weNEO2050+

Draft Long Range Plan

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NOACA
Northeast Ohio Areawide Coordinating Agency

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Coordinating Agency

Chapter 1: Envision the Future

Introduction

NOACA's long range plan*, weNEO2050+* continues to be a bold step forward for Northeast Ohio to advance the region's transportation systems so that all stakeholders have the opportunity for a more vibrant future. The framework of *weNEO2050+,* which is an update of its predecessor *eNEO2050*, aims to ensure that all people have access and mobility to enable them to actively participate in the economy and to enjoy the quality of life the region has to offer. The "we" is intended to reflect inclusivity while the "+" reflects the information updates. NOACA's vision statement identified in its Regional Strategic Plan, *Going Forward, Together*, adopted in 2015 states: NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE quality of life in Northeast Ohio.

It is clear that transportation investments and the physical location and type of transportation infrastructure have a profound potential to affect the region's future. It is more critical than ever, given the region's longstanding challenges with declining or flat population, to plan and develop such projects strategically in order to leverage public dollars to best reignite growth and the economic competitiveness of the region. However, w*eNEO2050+* goes beyond this necessity to challenge what NOACA must do to envision— and attain—a more inclusive future based on several potential future scenarios. These scenarios explore various approaches to transportation infrastructure investments within the context of workforce mobility and accessibility to the employment centers across the five counties that could make a real difference, especially to low-income and minority populations. NOACA explores the implications of prospective capital investments across each of these scenarios on a wide range of performance measures. Such measures naturally focus on the transportation network, but they also tap economic development, housing, environment, and land-use impacts of investment decisions as they are all intrinsically linked.

How is *weNEO2050+* Different from the Previous Plan?

The previous long range plan, *eNEO2050*, built upon the foundation of previous planning efforts led by NOACA, but incorporated a much more comprehensive approach. *eNEO2050* was developed as a "new" plan, with the adoption of scenario planning and performance measures and targets as part of its future outlook, which was not part of previous NOACA long-range plans (though it was part of a larger regional visioning effort known as Vibrant NEO 2040; see below and Chapter 2). The current plan, *weNEO2040+*, represents an update of the previous plan with added inclusivity, particularly for changes in the region as identified in the 2020 Census and the 2024 Household Travel Survey, as well as additions for recent regional and subregional studies.

NOACA has committed to maintaining the strength of the previous plan with the reflection of inclusivity in its broadest sense as highlighted by the "we" in the title. NOACA also engaged public stakeholders to revisit a comprehensive review of how past economic development, housing, land use, and environmental approaches created the current landscape, and identified ways to improve access to opportunity. Finally, NOACA did not propose the update with a simple, single future transportation plan for public consideration, but rather explored, modeled, and thoroughly vetted four comprehensive and distinct scenarios of how the region might invest in its transportation system differently, as it did in *eNEO2050*. NOACA built each scenario around the critical theme of workforce mobility and access, and both defined and calculated hundreds of performance measures to clarify the myriad of impacts of each scenario on what matters most.

Expectations (Federal Requirements)

Figure 1-1 identifies the requirements of the metropolitan planning process related to the transportation plan. These requirements were introduced by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (Pub. L. 109-59) and the Moving Ahead for Progress in the 21st Century (MAP-21) Act (Pub. L. 112-141); they continued under the Fixing America's Surface Transportation (FAST) Act (Pub. L. No. 114-94), and are current with Infrastructure Investment and Jobs Act (Pub. L. (117-58) as well as the Metropolitan Transportation Planning rule (23 CFR Parts 450 and 771) as contained in the Code of Federal Regulations (CFR). The table also indicates where in w*eNEO2050+* particular elements are contained.

Table 1-1. Federal Requirements and Status[1]

FEDERAL REQUIREMENTS	*weNEO2050+* REFERENCE
(a) The metropolitan transportation planning process shall include the development of a transportation plan addressing no less than a 20-year planning horizon as of the effective date. In formulating the transportation plan, the MPO shall consider factors described in § 450.306 as the factors relate to a minimum 20-year forecast period. In nonattainment and maintenance areas, the effective date of the transportation plan shall be the date of a conformity determination issued by the FHWA and the FTA. In attainment areas, the effective date of the transportation plan shall be its date of adoption by the MPO.	See Chapter 10 for projects and Chapter 11 for the fiscally constrained plan.
(b) The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.	See Chapter 11 for the fiscally constrained plan (other recommendations and actions in Chapters 5-8).
(c) The MPO shall review and update the transportation plan at least every 4 years in air quality nonattainment and maintenance areas and at least every 5 years in attainment areas to confirm the transportation plan's validity and consistency with current and forecasted transportation and land use conditions and trends and to extend the forecast period to at least a 20-year planning horizon. In addition, the MPO may revise the transportation plan at any time using the procedures in this section without a requirement to extend the horizon year. The MPO shall approve the transportation plan (and any revisions) and submit it for information purposes to the Governor. Copies of any updated or revised transportation plans must be provided to the FHWA and the FTA.	*weNEO2050+* meets the requirement. NOACA's last plan was adopted in June 2025 and was found to conform with the transportation conformity requirements in April 2025.
(d) In metropolitan areas that are in nonattainment for ozone or carbon monoxide, the MPO shall coordinate the	This update meets the requirement, with new SIP

[1] Based on 23 CFR § 450.324: Development and Content of the Metropolitan Transportation Plan [81 FR 34135, May 27, 2016, as amended at 81 FR 93473, Dec. 20, 2016; 82 FR 56544, Nov. 29, 2017]; https://www.law.cornell.edu/cfr/text/23/450.324 (accessed April 17, 2025)

development of the metropolitan transportation plan with the process for developing transportation control measures (TCMs) in a State Implementation Plan (SIP).	development occurring in 2022 and 2025.
(e) The MPO, the State(s), and the public transportation operator(s) shall validate data used in preparing other existing modal plans for providing input to the transportation plan. In updating the transportation plan, the MPO shall base the update on the latest available estimates and assumptions for population, land use, travel, employment, congestion, and economic activity. The MPO shall approve transportation plan contents and supporting analyses produced by a transportation plan update.	See Chapter 1 for recent population and employment trends. Chapter 9 provides projections and future transportation scenarios. NOACA's travel forecast model relies on this and other routinely updated data to project future transportation conditions in the region.
(f) The metropolitan transportation plan shall, at a minimum, include: (1) The current and projected transportation demand of persons and goods in the metropolitan planning area over the period of the transportation plan;	See Chapter 9 for current and projected conditions captured by NOACA's travel forecast model.
(f)(2) Existing and proposed transportation facilities (including major roadways, public transportation facilities, intercity bus facilities, multimodal and intermodal facilities, nonmotorized transportation facilities (e.g., pedestrian walkways and bicycle facilities), and intermodal connectors that should function as an integrated metropolitan transportation system, giving emphasis to those facilities that serve important national and regional transportation functions over the period of the transportation plan.	See Chapter 3 for the existing regional context. Chapter 9 provides future transportation scenarios. Chapter 11 includes projects within the fiscally constrained plan.
(f)(3) A description of the performance measures and performance targets used in assessing the performance of the transportation system in accordance with §450.306(d).	See Chapter 9 for performance measures and targets to analyze four transportation scenarios; Chapter 2 includes a summary of NOACA's past planning efforts.
(f)(4) A system performance report and subsequent updates evaluating the condition and performance of the transportation system with respect to the performance targets described in § 450.306(d), including (i) Progress achieved by the metropolitan planning organization in meeting the performance targets in comparison with system performance recorded in previous reports, including baseline data; and (ii) For metropolitan planning organizations that voluntarily elect to develop multiple scenarios, an analysis of how the preferred scenario has improved the conditions and performance of the transportation system and how changes in local policies and investments have impacted the costs necessary to achieve the identified performance targets.	See Chapter 9 for a full presentation of the future transportation scenarios.
(f)(5) Operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods;	See Chapter 11 for the fiscally constrained plan (other recommendations and actions in Chapters 5-8).
(f)(6) Consideration of the results of the congestion	See Chapter 11 for the Congestion

management process in TMAs that meet the requirements of this subpart, including the identification of SOV projects that result from a congestion management process in TMAs that are nonattainment for ozone or carbon monoxide.	Management Plan as part of the fiscally constrained plan and its projects.
(f)(7) Assessment of capital investment and other strategies to preserve the existing and projected future metropolitan transportation infrastructure, provide for multimodal capacity increases based on regional priorities and needs, and reduce the vulnerability of the existing transportation infrastructure to natural disasters. The metropolitan transportation plan may consider projects and strategies that address areas or corridors where current or projected congestion threatens the efficient functioning of key elements of the metropolitan area's transportation system.	See Chapters 9, 10, and 11.
(f)(8) Transportation and transit enhancement activities, including consideration of the role that intercity buses may play in reducing congestion, pollution, and energy consumption in a cost-effective manner and strategies and investments that preserve and enhance intercity bus systems, including systems that are privately owned and operated, and including transportation alternatives, as defined in 23 U.S.C. 101(a), and associated transit improvements, as described in 49 U.S.C. 5302(a), as appropriate;	See Chapters 9, 10, and 11.
(f)(9) Design concept and design scope descriptions of all existing and proposed transportation facilities in sufficient detail, regardless of funding source, in nonattainment and maintenance areas for conformity determinations under the EPA's transportation conformity regulations (40 CFR Part 93, subpart A). In all areas (regardless of air quality designation), all proposed improvements shall be described in sufficient detail to develop cost estimates;	See Chapters 10 and 11.
(f)(10) A discussion of types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the metropolitan transportation plan. The discussion may focus on policies, programs, or strategies, rather than at the project level. The MPO shall develop the discussion in consultation with applicable Federal, State, and Tribal land management, wildlife, and regulatory agencies. The MPO may establish reasonable timeframes for performing this consultation;	See Chapter 8.
(f)(11) A financial plan that demonstrates how the adopted transportation plan can be implemented. (i) For purposes of transportation system operations and maintenance, the financial plan shall contain system-level estimates of costs and revenue sources that are reasonably expected to be available to adequately operate and maintain the Federal- aid highways (as defined by 23 U.S.C. 101(a)(6)) and public transportation (as defined by title 49 U.S.C. Chapter 53).	See Chapter 10.

(f)(11)(ii) For the purpose of developing the metropolitan transportation plan, the MPO(s), public transportation operator(s), and State shall cooperatively develop estimates of funds that will be available to support metropolitan transportation plan implementation, as required under §450.314(a). All necessary financial resources from public and private sources that are reasonably expected to be made available to carry out the transportation plan shall be identified.	See Chapter 10.
(f)(11)(iii) The financial plan shall include recommendations on any additional financing strategies to fund projects and programs included in the metropolitan transportation plan. In the case of new funding sources, strategies for ensuring their availability shall be identified. The financial plan may include an assessment of the appropriateness of innovative finance techniques (for example, tolling, pricing, bonding, public private partnerships, or other strategies) as revenue sources for projects in the plan.	See Chapter 10.
(f)(11)(iv) In developing the financial plan, the MPO shall take into account all projects and strategies proposed for funding under title 23 U.S.C., title 49 U.S.C. Chapter 53 or with other Federal funds; State assistance; local sources; and private participation. Revenue and cost estimates that support the metropolitan transportation plan must use an inflation rate(s) to reflect "year of expenditure dollars," based on reasonable financial principles and information, developed cooperatively by the MPO, State(s), and public transportation operator(s).	See Chapter 10.
(f)(11)(v) For the outer years of the metropolitan transportation plan (i.e., beyond the first 10 years), the financial plan may reflect aggregate cost ranges/cost bands, as long as the future funding source(s) is reasonably expected to be available to support the projected cost ranges/cost bands.	See Chapter 10.
(f)(11)(vi) For nonattainment and maintenance areas, the financial plan shall address the specific financial strategies required to ensure the implementation of TCMs in the applicable SIP.	See Chapter 10.
(f)(11)(vii) For illustrative purposes, the financial plan may include additional projects that would be included in the adopted transportation plan if additional resources beyond those identified in the financial plan were to become available.	See Chapters 10 and 11.
(f)(11)(viii) In cases that the FHWA and the FTA find a metropolitan transportation plan to be fiscally constrained and a revenue source is subsequently removed or substantially reduced (i.e., by legislative or administrative actions), the FHWA and the FTA will not withdraw the original determination of fiscal constraint; however, in such cases, the FHWA and the FTA will not act on an updated or amended metropolitan transportation plan that does not reflect the changed revenue situation.	See Chapter 10.
(f)(12) Pedestrian walkway and bicycle transportation facilities in accordance with 23 U.S.C. 217(g).	See Chapter 3 for existing infrastructure, Chapter 9 for

	possible infrastructure scenarios, Chapter 10 for possible projects and the financial plan, and Chapter 11 for the *eNEO2050* final plan.
(g) The MPO shall consult, as appropriate, with State and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation concerning the development of the transportation plan. The consultation shall involve, as appropriate: (1) Comparison of transportation plans with State conservation plans or maps, if available; or (2) Comparison of transportation plans to inventories of natural or historic resources, if available.	See Chapter 8.
(h) The metropolitan transportation plan should integrate the priorities, goals, countermeasures, strategies, or projects for the metropolitan planning area contained in the HSIP, including the SHSP required under 23 U.S.C. 148, the Public Transportation Agency Safety Plan required under 49 U.S.C. 5329(d), or an Interim Agency Safety Plan in accordance with 49 CFR part 659, as in effect until completion of the Public Transportation Agency Safety Plan, and may incorporate or reference applicable emergency relief and disaster preparedness plans and strategies and policies that support homeland security, as appropriate, to safeguard the personal security of all motorized and non-motorized users.	See Chapters 1, 9 and 11.
(i) An MPO may, while fitting the needs and complexity of its community, voluntarily elect to develop multiple scenarios for consideration as part of the development of the metropolitan transportation plan. (1) An MPO that chooses to develop multiple scenarios under this paragraph (i) is encouraged to consider: (i) Potential regional investment strategies for the planning horizon;	See Chapter 9.
(i)(1)(ii) Assumed distribution of population and employment;	See Chapter 9.
(i)(1)(iii) A scenario that, to the maximum extent practicable, maintains baseline conditions for the performance areas identified in §450.306(d) and measures established under 23 CFR Part 490;	See Chapter 9.
(i)(1)(iv) A scenario that improves the baseline conditions for as many of the performance measures identified in §450.306(d) as possible;	See Chapter 9.
(i)(1)(v) Revenue constrained scenarios based on the total revenues expected to be available over the forecast period of the plan; and	See Chapters 9, 10, and 11.
(i)(1)(vi) Estimated costs and potential revenues available to support each scenario.	See Chapters 9, 10, and 11.
(i)(2) In addition to the performance areas identified in 23 U.S.C. 150(c), 49 U.S.C. 5326(c), and 5329(d), and the measures established under 23 CFR Part 490, MPOs may evaluate scenarios developed under this paragraph using	See Chapter 9.

locally developed measures.	
(j) The MPO shall provide individuals, affected public agencies, representatives of public transportation employees, public ports, freight shippers, providers of freight transportation services, private providers of transportation (including intercity bus operators, employer- based commuting programs, such as carpool program, vanpool program, transit benefit program, parking cashout program, shuttle program, or telework program), representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, and other interested parties with a reasonable opportunity to comment on the transportation plan using the participation plan developed under §450.316(a).	See Chapter 4.
(k) The MPO shall publish or otherwise make readily available the metropolitan transportation plan for public review, including (to the maximum extent practicable) in electronically accessible formats and means, such as the World Wide Web.	See Chapter 4.
(l) A State or MPO is not required to select any project from the illustrative list of additional projects included in the financial plan under paragraph (f)(11) of this section.	See Chapters 10 and 11.
(m) In nonattainment and maintenance areas for transportation-related pollutants, the MPO, as well as the FHWA and the FTA, must make a conformity determination on any updated or amended transportation plan in accordance with the Clean Air Act and the EPA transportation conformity regulations (40 CFR Part 93, subpart A). A 12-month conformity lapse grace period will be implemented when an area misses an applicable deadline, in accordance with the Clean Air Act and the transportation conformity regulations (40 CFR Part 93, subpart A). At the end of this 12-month grace period, the existing conformity determination will lapse. During a conformity lapse, MPOs can prepare an interim metropolitan transportation plan as a basis for advancing projects that are eligible to proceed under a conformity lapse. An interim metropolitan transportation plan consisting of eligible projects from, or consistent with, the most recent conforming transportation plan and TIP may proceed immediately without revisiting the requirements of this section, subject to interagency consultation defined in 40 CFR Part 93, subpart A. An interim metropolitan transportation plan containing eligible projects that are not from, or consistent with, the most recent conforming transportation plan and TIP must meet all the requirements of this section.	See Chapters 9, 10, and 11.

Vision, Goals and Objectives

State and Regional Goals and Objectives

The vision, goals, and objectives for w*eNEO2050+* incorporate and build upon those from the region's previous planning efforts including not only *eNEO2050* (2021), but also Vibrant NEO 2040 (2014),[2] Going Forward, Together (2015),[3] and Aim Forward 2040 (2017).[4] While Chapter 2 will provide more comprehensive details about the history of these efforts, it is critical to present their goals, objectives, recommendations, and strategies in an integrated way to help the reader understand common elements and relationships among previous and current plans.

weNEO2050+ advances the achievement of NOACA's vision, which incorporates the five goals of *Going Forward, Together*, NOACA's current regional strategic plan:

> *NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE quality of life in Northeast Ohio.*

In 2020, the Ohio Department of Transportation (ODOT) published Access Ohio 2045 (AO45),[5] the state's long range transportation plan. AO45 also identifies strategies and initiatives to guide, inform, and support long-term transportation investments for the next 25 years. This plan helps ODOT fulfill its mission to provide safe and easy movement of people and goods, while the agency prepares for future changes within transportation.

NOACA developed a set of 15 long-range transportation plan (LRTP) goals for *eNEO2050* that carry through *weNEO2050+*; Table 1-2 illustrates how NOACA's LRTP goals relate to the ODOT's AO45 goals.

Table 1-2. Relationship between Access Ohio 2045 Goals and w*eNEO2050+* Long Range Transportation Plan Goals

	***weNEO2050+* Long Range Transportation Plan Goals**														
Access Ohio 2045 Goals	**Enhance Multimodal Transportation System**	**Transit Access Improvement**	**Transit Travel Time Reduction**	**Increase Average Vehicle Occupancy**	**Highway Capacity Improvement**	**Highway Travel Time Reduction**	**Air Quality Improvement**	**Pavement & Bridge Preservation**	**Safety Improvement**	**Congestion Mitigation**	**Arterial Street System Restoration**	**Non-Traditional & Emerging Transportation Technology**	**Enhance Equity in Transportation**	**Economic Competitiveness**	**Improve Quality of Life**
Safety								x	x		x	x		x	x

[2] Northeast Ohio Sustainable Communities Consortium (NEOSCC), *Vibrant NEO 2040*, 2014 (accessed May 29, 2025 from https://vibrantneo.org/vibrantneo-2040/)
[3] Northeast Ohio Areawide Coordinating Agency (NOACA), *Going Forward, Together*, 2015 (accessed May 29, 2025 from https://www.noaca.org/regional-planning/major-planning-documents/regional-strategic-plan)
[4] NOACA, 2017. Aim Forward 2040 (accessed May 29, 2025 from https://www.noaca.org/regional-planning/major-planning-documents/aim-forward-2040)
[5] Ohio Department of Transportation (ODOT), *Access Ohio 2045*, 2020, amend. 2024, (accessed June 4, 2025 https://www.dot.state.oh.us/Documents/AO45/AO45_OhiosTransportationPlan_Final_UPDATED_110624.pdf)

Preservation							x	x			x			x	x	
Efficiency and Reliability	x		x	x	x	x		x	x	x	x	x		x	x	
Mobility and Accessibility	x	x	x	x	x	x		x		x		x	x	x	x	
Economic Competitiveness	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
Quality of Life	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Environmental Stewardship	x	x	x	x			x					x		x	x	

NOACA also coordinated w*eNEO2050+'s* LRTP goals with the recommendations and strategies of *Vibrant NEO 2040* and the goals and objectives of *Going Forward, Together*.[6] Table 1-3 is a matrix that illustrates not only the interconnections between the *Vibrant NEO 2040* and *Going Forward, Together* recommendations and goals, but also their relationships with the current LRTP goals. In Table 1-3, the column headers and subheaders are the *Vibrant NEO 2040* recommendations and strategies, respectively.

The row headers and subheaders are the *Going Forward, Together* goals and objectives, respectively. NOACA color-coordinated these headers and subheaders to identify whether they pertained to one of the areas of expanded scope in w*eNEO2050+*: economic development, housing, and land use. Each cell in the matrix represents a potential intersection of the goals from each of these previous plans. NOACA staff entered w*eNEO2050+* LRTP goals in the appropriate cells to illustrate how the goals from previous plans related to the w*eNEO2050+* LRTP goals, which are the same as the prior *eNEO2050*. The LRTP goals will also inform the performance measures and targets used to assess the future transportation scenarios introduced in Chapter 3 and detailed extensively in Chapter 9.

The key takeaway for the reader is that NOACA's planning efforts are connected to one another and to the State of Ohio's efforts, yet NOACA continues to strive for constant improvement in its planning process.

Table 1-3. Relationship between *Vibrant NEO 2040*; *Going Forward, Together*; and *weNEO2050+* LRTP Goals and Objectives

NOACA REGIONAL STRATEGIC PLAN (2015)		VIBRANT NEO 2040 (2014) (FULL RELATIONSHIP IN RECOMMENDATIONS MATRIX (p. 123))										
	ECONOMIC DEVELOPMENT; HOUSING; LAND USE	PROMOTE INVESTMENT IN OUR ESTABLISHED COMMUNITIES	ENHANCE OUR REGIONAL TRANSPORTATION NETWORK ("TransportationTech"); DEVELOP OUR REGIONAL ECONOMY WITH ACCESSIBLE EMPLOYMENT OPPORTUNITIES	DEVELOP OUR REGIONAL ECONOMY WITH ACCESSIBLE EMPLOYMENT OPPORTUNITIES	DEVELOP OUR REGIONAL ECONOMY WITH ACCESSIBLE EMPLOYMENT OPPORTUNITIES	ENHANCE OUR REGIONAL TRANSPORTATION NETWORK ("Transportation Tech")	ENHANCE OUR REGIONAL TRANSPORTATION NETWORK ("Transportation Tech")	PROTECT OUR SOIL, WATER, AIR AND ECOLOGICALLY SENSITIVE AREAS; EXPAND OUR PARKS AND OPEN SPACE NETWORK	PRESERVE AND VALUE OUR PRIME FARMLAND AS A REGIONAL ECONOMIC ASSET	IMPROVE OUR REGIONAL FISCAL HEALTH	CULTIVATE AND CELEBRATE OUR LOCAL ASSETS AND PLACES OF PUBLIC VALUE
GOALS ("Enhance Equity in Transportation")	OBJECTIVES	1. Focus new residential and commercial development on sites within established communities	2. Develop a robust network of regional job centers connected by multimodal transportation corridors between and within counties	3. Pursue the remediation, assembly, marketing, and redevelopment of abandoned properties at both the local and regional levels	4. Encourage a higher frequency of mixed-use development and a range of diverse, affordable housing options	5. Enhance and coordinate the region's rail and bus services	6. Enhance walking and cycling as transportation options to increase regional mobility and improve public health	7. Preserve our natural areas for future generations, provide outdoor recreation opportunities, and develop a regional approach to protecting air, water, and soil quality	8. Support sustainable agriculture and the local food system in Northeast Ohio	9. Increase collaboration among the region's government agencies to expand information sharing and find more cost-effective means of providing essential services	(Generally supports a regional approach to protect local assets and places of public value through land use and environmental planning)
STRENGTHEN REGIONAL COHESION	Foster collaboration on issues of transportation, air and water quality that will lead to greater regional cohesion on other regional issues.	Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Air Quality Improvement	Air Quality Improvement	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Transportation Tech	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Air Quality Improvement	Air Quality Improvement	Improve Quality of Life	Improve Quality of Life; Economic Competitiveness; Pavement and Bridge Restoration; Arterial Street System Restoration	Improve Quality of Life
	Work with governments in the region as well as state and federal authorities to remove barriers to joint development or maintenance of infrastructure.	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Arterial Street System Restoration							Pavement and Bridge Restoration; Arterial Street System Restoration	
	Work with governments in the region as well as state and federal authorities to promote cost sharing, purchasing coordination and consolidation of services.									Economic Competitiveness	
	Facilitate and promote the sharing of best practices for regional collaboration and cost sharing.								Economic Competitiveness	Economic Competitiveness	
	Ensure infrastructure investments are planned and implemented to maximize transportation benefits across all impacted communities.	Transit Access Improvement	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation; Transportation Tech			Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation; Transportation Tech	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Enhance Multimodal Transportation System; Transit Access Improvement; Highway Capacity Improvement; Pavement and Bridge Restoration; Arterial Street System Restoration	
	Promote infrastructure investments that enhance the inter-relationships of communities within the region.	Air Quality Improvement	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Air Quality Improvement; Congestion Mitigation; Transportation Tech	Air Quality Improvement	Air Quality Improvement	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation; Transportation Tech	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Air Quality Improvement; Congestion Mitigation	Air Quality Improvement	Improve Quality of Life; Economic Competitiveness	Enhance Multimodal Transportation System; Transit Access Improvement; Highway Capacity Improvement; Transit Travel Time Reduction; Highway Travel Time Reduction	
PRESERVE EXISTING INFRASTRUCTURE	Preserve or maintain existing infrastructure that serves currently developed areas of the region.	Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Air Quality Improvement	Air Quality Improvement		Air Quality Improvement	Air Quality Improvement	Improve Quality of Life	Pavement and Bridge Restoration; Arterial Street System Restoration	
	Facilitate improvements that connect existing activity centers and reinvigorate existing communities	Increase Average Vehicle Occupancy; Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Congestion Mitigation; Arterial Street System Restoration		Increase Average Vehicle Occupancy	Congestion Mitigation	Congestion Mitigation		Economic Competitiveness	Enhance Multimodal Transportation System; Transit Access Improvement; Highway Capacity Improvement; Transit Travel Time Reduction; Highway Travel Time Reduction	
	Facilitate development in higher density areas.	Air Quality Improvement	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement	Air Quality Improvement	Congestion Mitigation	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement	Economic Competitiveness		Improve Quality of Life
	Promote environmental sustainability.	Increase Average Vehicle Occupancy; Air Quality Improvement	Air Quality Improvement	Air Quality Improvement	Increase Average Vehicle Occupancy; Air Quality Improvement		Air Quality Improvement	Air Quality Improvement	Improve Quality of Life		Improve Quality of Life
	Devote approximately 90% of the region's transportation and infrastructure funding to maintain and preserve existing investments.	Increase Average Vehicle Occupancy; Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Arterial Street System Restoration		Increase Average Vehicle Occupancy					Economic Competitiveness; Pavement and Bridge Restoration; Arterial Street System Restoration	
	Monitor the condition of existing regional transportation assets and evaluate social equity/environmental justice impacts of investments.	Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Air Quality Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration	Air Quality Improvement	Air Quality Improvement		Air Quality Improvement	Air Quality Improvement		Enhance Equity in Transportation; Enhance Multimodal Transportation System; Pavement and Bridge Restoration; Arterial Street System Restoration	

[6] *Aim Forward 2040* and *eNEO2050*, the previous NOACA long range plans, used the regional strategic plan's goals and objectives as their framework.

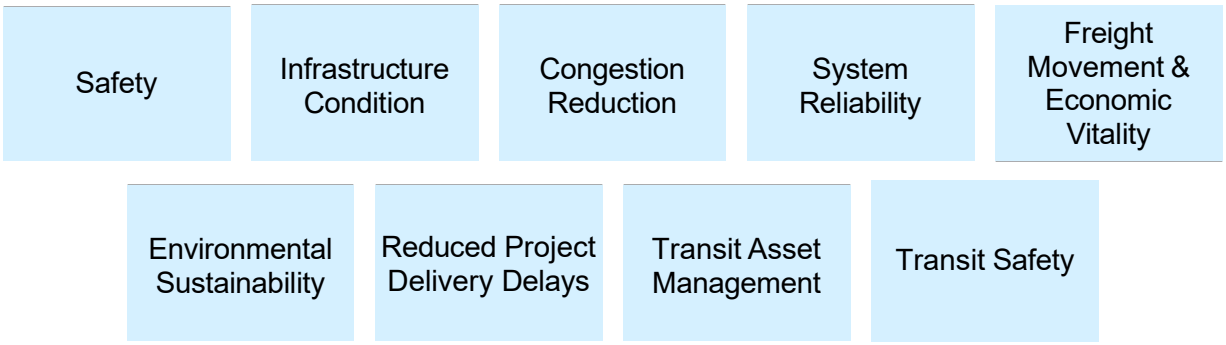
	Conduct benefit-cost analyses of all projects to insure that life cycle costs and regional fiscal sustainability are considered.									Economic Competitiveness; Improve Quality of Life	
BUILD SUSTAINABLE MULTIMODAL TRANSPORTATION SYSTEM	Enhance and improve coordination for public transit, rail, pedestrian and bicycle transportation		Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Enhance Multimodal Transportation System	
	Improve access to regional job centers, employment opportunities, and city centers	Increase Average Vehicle Occupancy	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation		Increase Average Vehicle Occupancy	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Transit Travel Time Reduction; Highway Travel Time Reduction	
	Facilitate intermodal transportation connections		Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction			Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction			Enhance Multimodal Transportation System	
	Reduce energy use and improve air quality	Increase Average Vehicle Occupancy; Air Quality Improvement	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement	Increase Average Vehicle Occupancy	Congestion Mitigation	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement		Improve Quality of Life	Improve Quality of Life
	Reduce greenhouse gas emissions	Increase Average Vehicle Occupancy; Air Quality Improvement	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement	Increase Average Vehicle Occupancy	Congestion Mitigation	Air Quality Improvement; Congestion Mitigation	Air Quality Improvement		Improve Quality of Life	
	Reduce reliance on auto travel	Increase Average Vehicle Occupancy	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation		Increase Average Vehicle Occupancy	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Enhance Multimodal Transportation System	
	Demonstrate an adequate long-term funding stream for operation and maintenance.	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Arterial Street System Restoration							Economic Competitiveness; Enhance Multimodal Transportation System; Pavement and Bridge Restoration; Arterial Street System Restoration	
	Integrate the control of stormwater, protection and improvement of water quality, and control of development in Floodplains										Improve Quality of Life
	Ensure and enhance safety		Safety Improvement; Pavement and Bridge Preservation; Arterial Street System Restoration		Safety Improvement	Safety Improvement	Safety Improvement			Safety Improvement	
	Assure the Regional Transportation Plan and TIP reflect commitment to a balanced multi-model system and NOACA's vision.		Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction			Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction				
	Encourage TOD in higher density urban corridors and other higher density areas and retrofit TO elements in appropriate lower density areas.		Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation			Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation				
	Consider strategic abandonment or alternative provision of service for infrastructure elements if underutilized or whose costs exceed benefit.										
	Achieve levels of infrastructure investment that do not exceed the region's financial capacity.									Economic Competitiveness; Improve Quality of Life	
SUPPORT ECONOMIC DEVELOPMENT ("Economic Competitiveness")	Provide for the movement of goods essential to the economic viability of the region	Highway Travel Time Reduction; Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Congestion Mitigation; Arterial Street System Restoration	Highway Travel Time Reduction	Highway Travel Time Reduction	Congestion Mitigation	Congestion Mitigation		Economic Competitiveness	Economic Competitiveness; Transit Travel Time Reduction; Highway Travel Time Reduction	
	Are consistent with state, regional and local economic development priorities, policies and strategies.									Economic Competitiveness; Improve Quality of Life	
	Support retention and expansion of Northeast Ohio businesses in areas with existing infrastructure and attract new businesses to Northeast Ohio.	Highway Travel Time Reduction; Pavement and Bridge Preservation; Arterial Street System Restoration	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Pavement and Bridge Preservation; Arterial Street System Restoration	Highway Travel Time Reduction	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction				Economic Competitiveness; Improve Quality of Life	
	Support development of NEO manufacturing base, health care system, and other areas of economic strength and economic development focus.	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction	Highway Travel Time Reduction	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction				Economic Competitiveness; Improve Quality of Life	
	Ensure NOACA's Board includes representatives of business, medicine, higher education, non-profit (Community and Business Advisory Councils).									Economic Competitiveness; Improve Quality of Life	
	Study and identify ways NOACA can direct investments and actions to create realistic opportunities (job retention and economic development).									Economic Competitiveness; Improve Quality of Life	
	Promote regional cooperation in the areas of economic development and job retention.	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction	Highway Travel Time Reduction	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction				Economic Competitiveness; Improve Quality of Life	
	Direct investments and actions to create realistic opportunities for job retention and economic development.	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction	Highway Travel Time Reduction	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction				Economic Competitiveness; Improve Quality of Life	
ENHANCE QUALITY OF LIFE ("Improve Quality of Life")	Promote the redevelopment of declining and abandoned areas	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Arterial Street System Restoration							Pavement and Bridge Restoration; Arterial Street System Restoration	
	Provide improved access to primary and secondary schools, colleges, universities and other educational opportunities	Highway Travel Time Reduction; Pavement and Bridge Preservation; Arterial Street System Restoration	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Pavement and Bridge Preservation; Congestion Mitigation; Arterial Street System Restoration	Highway Travel Time Reduction	Highway Travel Time Reduction	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation	Enhance Multimodal Transportation System; Transit Access Improvement; Transit Travel Time Reduction; Congestion Mitigation				
	Enhance the public's access to and enjoyment of the region's parks, cultural assets and recreational activities	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Congestion Mitigation; Arterial Street System Restoration			Congestion Mitigation	Enhance Multimodal Transportation System; Congestion Mitigation				
	Preserve agricultural lands, open space and important habitat areas, woodlands, and wetlands								Improve Quality of Life; Economic Competitiveness		Improve Quality of Life
	Promote healthy and active living	Air Quality Improvement	Air Quality Improvement	Air Quality Improvement	Air Quality Improvement		Enhance Multimodal Transportation System; Air Quality Improvement	Air Quality Improvement			Improve Quality of Life
	Make prudent and necessary infrastructure improvements to minimize the economic burden of transportation investments on the region's taxpayers	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Arterial Street System Restoration							Economic Competitiveness; Improve Quality of Life	
	Ensure that safety factors are considered in the development of regional infrastructure.	Pavement and Bridge Preservation; Arterial Street System Restoration	Pavement and Bridge Preservation; Safety Improvement; Arterial Street System Restoration		Safety Improvement	Safety Improvement	Safety Improvement			Safety Improvement	

Performance Measures and Targets

The MAP-21 Act and subsequent FAST Act emphasized the incorporation of performance management principles into the transportation planning and programming processes. In response, the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) established national performance goals and targets and required states, MPO's and public transit agencies to establish their own performance targets in support of the national goals.

Programmed projects within the NOACA TIP and Ohio STIP address transportation needs in one or more of these key areas below:

Figure 1-1. NOACA Key Transportation Project Areas



In December 2024, the NOACA Board of Directors approved Resolution 2024-049[7] entering into a Memorandum of Understanding with the Ohio Department of Transportation (ODOT) and the Cleveland UZA's Public Transit providers. The Agreement directs the development, design, and implementation of standard procedures of operations and coordination of efforts and responsibilities between the parties regarding the federal transportation performance management based planning process.

The NOACA Board of Directors has also approved the adoption of performance measures and applicable targets for inclusion in the NOACA long range plan and Transportation Improvement Program (TIP). These performance measures include:

- Infrastructure Condition - Pavement and Bridge
- Congestion Mitigation and Air Quality (CMAQ)
- Peak-hour Excessive Delay
- Non Single Occupancy Vehicle
- Mobile Emissions Reduction
- System Reliability
- Freight Movement & Economic Vitality
- Transit Asset Management
- Transit Safety

The section demonstrates that projects selected for funding and programmed in the NOACA 2021-2024 TIP advance Ohio and NOACA adopted performance targets, advancing federally established transportation performance measures.

Safety Performance Measures and Targets

Federal regulation 23 CFR. 490 requires states to establish five highway safety performance targets for those measures to demonstrate. In 2016, ODOT began to identify five statewide safety baselines through analysis of crash data in its Public Safety Crash Report System.

In accordance with federal legislation, Ohio used five-year rolling averages to calculate historic crash trends and identify statewide reduction targets. After reviewing historical crash trends, external factors, and through consultation with NOACA, ODOT adopted targets based on a 1% annual reduction across all five measures.

Safety Performance Management (Safety PM) is a part of the overall Transportation Performance Management (TPM) program, which FHWA defines as a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals. The Safety PM Final Rule supports the Highway Safety Improvement Program (HSIP), as it establishes safety performance measure requirements for the purpose of carrying out the HSIP and to assess fatalities and serious injuries on all public roads.

The Safety PM Final Rule establishes five performance measures as the 5-year rolling averages to include:

1. Number of fatalities
2. Rate of fatalities per 100 million vehicle miles traveled (VMT)

[7] NOACA Board of Directors Resolution 2024-049, https://www.noaca.org/board-committees/noaca-board-and-committees/board-resolutions

3. Number of serious injuries
4. Rate of serious injuries per 100 million VMT
5. Number of non-motorized fatalities and non-motorized serious injuries

The Safety PM Final Rule also instituted the process for ODOT and NOACA to establish and report their safety targets, and the process that FHWA will use to assess whether ODOT and NOACA have met or made significant progress toward meeting their safety targets.

After reviewing historical crash trends and external factors, ODOT and ODPS adopted a 2% percent annual reduction target across all five categories. This represents a more aggressive target based on the Governor's commitment and focus on safety. ODOT believes these initiatives will have a significant effect on reducing crashes in Ohio.

ODOT's 2% annual reduction rate reflects an aggressive approach toward reducing crashes, consistent with the 2% reductions recommended for emphasis areas in NOACA's adopted SAVE Plan[8]. However, NOACA has recently adopted a more stringent target of 3.8% reduction for calendar year 2025 using an Equal Annual Reduction (EAR) calculation based on the safety performance measure of the preceding year and "Vision Zero" in the year of 2050 targets for safety performance.[9]

Infrastructure Condition – Pavement Performance Measures and Targets

Federal Rule 23 CFR 490.307(a) (1-4) established four highway performance measures designed to provide information for the National Highway Performance Program (NHPP) on the condition, or state of good repair, of the area's road and bridges in support of the National Highway System (NHS).

In accordance with Section V of the Agreement, Pavement and Bridge Condition included within the agreement between the ODOT and NOACA, it was agreed that pavement condition would be analyzed using the Highway Performance Monitoring System (HPMS).

The four Pavement Performance Measures below include the performance measure baselines, ODOT's two and four year targets, and NOACA's 2- and 4-year targets (Table 1-4). The measures are:

1. Percentage of interstate pavement in good condition;
2. Percentage of interstate pavement in port condition;
3. Percentage of non-interstate NHS pavement in good condition; and
4. Percentage of non-interstate NHS pavement in poor condition.

Table 1-4. Pavement Performance Measures

Pavement Performance Measures	Baseline 8-Year Average	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
% of Interstate Pavement in Good Condition	39%	50%	50%	50%	50%
% of Interstate Pavement in Poor Condition	0.2%	1%	1%	1%	1%

[8] NOACA, *SAVE: NOACA's Plan for Transportation Safety*, May 2019; accessed June 4, 2025 from https://www.noaca.org/regional-planning/transportation-planning/regional-safety-program/transportation-safety-action-plan

[9] NOACA Board of Directors Resolution 2024-058, https://www.noaca.org/board-committees/noaca-board-and-committees/board-resolutions

% of Non-Interstate Pavement in Good Condition	21%	35%	35%	35%	35%
% of Non-Interstate Pavement in Poor Condition	2.1%	3%	3%	3%	3%

Infrastructure Condition – Bridges Performance Measures and Targets

Federal Rule 23 CFR 490.407(c)(1-2) established two bridge performance measures designed to provide information for the National Highway Performance Program (NHPP) on the condition of the area's bridges in support of the National Highway System (NHS).

In accordance with Section V of the Agreement, Pavement and Bridge Condition included within the agreement between the ODOT and NOACA, it was agreed that bridge conditions would be analyzed using the National Bridge Inventory (NBI) Database.

The two Bridge Performance Measures below include the performance measure baselines, ODOT's two and four year targets, and NOACA's 2 and 4 year targets (Table 1-5). The two Bridge Performance Measures are:

1. Percentage of NHS bridges classified as good condition; and
2. Percentage of NHS bridges classified as poor condition.

Table 1-5. Bridge Performance Measures

Bridge Performance Measures	Baseline	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
% of NHS Bridges in Good Condition	52%	50%	50%	50%	50%
% of NHS Bridges in Poor Condition	1.84%	5%	5%	5%	3%

NOACA's SFY 2026-2029 TIP was developed to ensure progress toward the accomplishment of the adopted pavement and bridge targets. To that end, NOACA plans and programs projects with a focus on how they contribute toward increasing and maintaining the percentage of pavements on the National Highway System (NHS) in good condition and reducing the percentage of pavement in the NHS in poor condition consistent with the adoption of these performance targets and measures.

The SFY 2026-2029 TIP contains 575 projects utilizing $1.8 billion in funding awarded through various pavement and bridge funding programs administered through the NOACA, Counties and ODOT. These investments contribute toward accomplishing the overall improvement of pavement and bridges in the NOACA region, including NHS Interstate and NHS Non-interstate facilities.

Through NOACA's robust transportation asset management planning, *weNEO2050+* continues to prioritize a state of good repair for pavements and bridges, consistent with the Board of Directors' policy that 90% of the region's resources be committed to preservation of existing assets. Therefore, NOACA promotes the achievement of performance measures associated with pavements and bridges on the interstate and non-interstate NHS.

System Reliability – Travel Time and Freight Movement Performance Measures and Targets

NOACA's Travel Time Reliability Performance plan for Interstate, Non-Interstate and Freight Movement are based on the performance measures established by 23 CFR 490.507(a)(1-2) and 23

CFR 490.607 (Tables 1-6 and 1-7).

Section VI.A. of the Agreement requires ODOT and NOACA to establish targets for the following two measures:

1. The percent of the person-miles traveled on the Interstate that are reliable [Interstate Time Travel Reliability (TTR 1)]; and
2. The percent of the person-miles traveled on the Non-Interstate National Highway System (NHS) that are reliable [Non-Interstate NHS Level of Time Travel Reliability (TTR Non 1)].

Table 1-6. Travel Time Reliability Performance Measures

Travel Time Reliability Performance Measures	NOACA Baseline	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
Interstate Level of Travel Time Reliability (TTR 1)	91.1% of system LOTTR < 1.50	85% of system LOTTR < 1.50	85% of system LOTTR < 1.50	85% of system LOTTR < 1.50	85% of system LOTTR < 1.50
Non-Interstate NHS Level of Travel Time Reliability (TTR Non 1)	84.7% of system LOTTR < 1.50	N/A	80% of system LOTTR < 1.50	N/A	80% of system LOTTR < 1.50

Table 1-7. Freight Movement Performance Measures

Freight Movement Performance Measure	NOACA Baseline	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
Interstate Truck Travel Time Index	TTTR = 1.03	TTTR < 1.50	TTTR < 1.50	TTTR < 1.50	TTTR < 1.50

The weNEO2050+ plan was developed to ensure the region continues to meet the adopted system reliability and freight movement targets. NOACA plans and programs projects with a focus on how they contribute toward improving the level of travel time reliability for person miles travelled on National Highway System (NHS) and freight movement on the interstate system consistent with the adoption of these performance targets and measures.

CMAQ Congestion and Air Quality Performance Measures and Targets

The NOACA Air Quality/CMAQ Performance plan is prepared as a component of the Ohio Department of Transportation (ODOT) statewide CMAQ Performance reports for the initial period in accordance with the requirements of 23 CFR 409.107(c) and 49 USC 149(1) in collaboration with the ODOT, FHWA, and stakeholders within the region. In specific, this section focuses on the performance measures established through the PM3 regulation Subpart G (Measures to Assess the CMAQ Program – Traffic Congestion) and Subpart H (Measures to Assess the CMAQ Program On-road Mobile Source Emissions).

The national performance measures to assess traffic congestion for the CMAQ program were established in 23 CFR 707 (a-b) and are referred to collectively as the CMAQ Traffic Congestion Measures. They are: (a) Annual Hours of Peak Hour Excessive Delay (PHED) per Person per Year (PHED Measure); and (b) Percent of Non-Single Occupancy Vehicle Travel (Non-SOV). Section VI of

the agreement establishes targets for each of the CMAQ Congestion and Air Quality measures.

Table 1-8 shows the baseline and four-year target peak hours of excessive delay (PHED) per person, per year for the Cleveland urbanized area. The information for this measure was developed from FHWA vehicle occupancy factors, HPMS traffic count data, and the NPMRDS travel time data set.

Table 1-8. Traffic Congestion Measure: Peak Hour Excessive Delay (PHED)

Measure	NOACA Baseline 4-Year Average	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
Cleveland UZA: Peak Hour Excessive Delay Per Capita	1.3 hours/year	N/A	< 10 hours/year	N/A	< 10 hours/year

Table 1-9 presents the baseline, two-year and four-year targets for Non-Single Occupancy Vehicle travel (Non-SOV) within the Cleveland urbanized area. The information for this metric was developed and analyzed using data from the American Community Survey (Table DP03).

Table 1-9. Traffic Congestion Measure: Non-Single Occupancy Vehicle (Non-SOV) Travel

Measure	NOACA Baseline 4-Year Average	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
Cleveland UZA: % of Non-SOV Travel	21%	≥ 18%	≥ 18.5%	≥ 18%	≥ 18.5%

The following CMAQ On-Road Mobile Source Emissions information included in Table 1-10 shows the on-road baseline, two-year, and four-year quantitative NOACA emissions targets for Volatile Organic Compounds (VOC), Nitrous Oxide (NOx), and Particulate Matter with a diameter of less than 2.5 micrometers (PM2.5). The baseline data was derived from the FHWA Congestion Mitigation and Air Quality (FHWA CMAQ) Public Access Database and aggregated by pollutant type for the years 2014-17. For the two- and four-year targets, the data was derived from obligated projects with quantified emissions benefits for the two years and the four-year projection includes programmed projects for those years

Table 1-10. On Road Mobile Source Emissions

Measures	NOACA Baseline	ODOT 2-Year Target	ODOT 4-Year Target	NOACA 2-Year Target	NOACA 4-Year Target
Volatile Organic Compounds Total Emissions Reduction (VOC kg/day)	4-year average 85.90 kg/day	69 kg/day	69 kg/day	16.16 kg/day	16.16 kg/day
Nitrous Oxide Total Emissions Reduction (NOx kg/day)	4-year average 671.31 kg/day	537 kg/day	537 kg/day	56.71 kg/day	56.71 kg/day

Particulate Matter at 2.5 Micrometers Total Emissions Reduction (PM2.5 kg/day)	4-year average 44.97 kg/day	36 kg/day	36 kg/day	3.96 kg/day	3.96 kg/day

Strategies and projects contained within *eNEO2050*, as well as *weNEO2050+*, place heavy emphasis on improving air quality. Through initiatives like our Gohio Commute platform, workforce mobility and accessibility tool, electric vehicle charging station siting, and STOP program, NOACA is aggressively planning to achieve goals related to non-SOV travel and reduction of on road mobile source emissions.

Transit Asset Management Performance Measures and Targets

The MAP-21 Act required the FTA to develop rules establishing a systematic process of operating, maintaining, and improving public transit capital assets through their entire life cycle. In response, the FTA published the Transit Asset Management (TAM) Final Rule, 49 CFR 625, designed to monitor and manage public transportation capital assets to:

1. Enhance safety;
2. Reduce maintenance costs;
3. Increase reliability; and
4. Improve performance.

Public transit agencies are required to establish performance targets in support of these national goals and, in turn Metropolitan Planning Organizations (MPOs) to establish regional performance targets encompassing the area's public transit agencies.

The Final TAM Rule established the general provisions for public transit TAM plans including performance management requirements, general capital asset categories and their associated asset classes, and the record keeping and reporting requirements for public transit agencies and MPOs. It defined the standards for measuring the condition of public transit capital assets and established four State of Good Repair (SGR) performance measures – the first two age-based, the third condition-based, and the last performance-based. These include:

1. **Rolling Stock/Revenue Fleet**: The percentage of revenue vehicles (by type) at or exceeding the useful life benchmark (ULB). ULB is defined by the FTA as the age at which the vehicles is no longer in a State of Good Repair (SGR).
2. **Equipment**: The percentage of non-revenue or service vehicles (by type) that exceed their ULB.
3. **Facilities**: The percentage of facilities (by group) that are rated less than 3.0 or a SGR on the Transit Economic Requirements Model (TERM).
4. **Infrastructure**: The percentage of track segments (by mode) that have performance restrictions. Track segments are measures to the nearest 0.01 of a mile.

In response, NOACA, the Ohio Department of Transportation (ODOT) and the region's Tier I and Tier II public transit agencies entered into the previously discussed Memorandum of Understanding referred to as the "Agreement" that defined the mutual responsibilities of each party in meeting their ongoing Transportation Performance Management - TAM Plan and Performance Management requirements.

Due to significant differences between the region's large and small urban and rural public transit providers, NOACA adopted Tiered TAM performance targets in March 2019 through Resolution 2019-

021.[10] This approach will help to better understand and track improvements in each transit provider's State of Good Repair (SGR) measures and will facilitate the future development of one unified set of TAM performance measure targets for the region (Table 1-11).

The four established Transit Agency Tiers along with the associated providers include:

- Tier I – Large Urban Provider: Greater Cleveland Regional Transit Authority
- Tier II – Small Urban Providers: Laketran, Medina County Public Transit, and Lorain County Transit
- Tier II – Rural Provider: Geauga County Transit (Established by the Ohio Department of Transportation
- Tier II – Section 5310 Open Door Sub-Recipients

NOACA will continue to coordinate with all transit providers to ensure timely, realistic targets are established and will monitor their progress towards achieving them in the future.

[10] NOACA Board of Directors Resolution 2019-021, https://www.noaca.org/board-committees/noaca-board-and-committees/board-resolutions

Table 1-11. Tiered Transit Asset Management (TAM) Performance Targets

TIERED TRANSIT ASSET MANAGEMENT (TAM) PERFORMANCE TARGETS

Tier I (GCRTA) TAM Performance Targets

Asset Category/Class	Sub-Group	Measure	% not to Exceed
Revenue Fleet (Useful Life Benchmark)	**Revenue Vehicles**	**8 - 31 years ULB**	**15&%**
	Bus 60-Ft	12 years ULB	10%
	Bus 40-Ft	12 years ULB	15%
	Trolley	13 years ULB	5%
	Over-the-road Bus	12 years ULB	5%
	Paratransit	8 - 10 years ULB	15%
	Train: Heavy & Light Rail	31 years ULB	25%
Equipment	Heavy Equipment	10 - 25 years ULB	25%
	Non-Revenue Vehicles	8 years ULB	25%
Facilities (State of Good Repair)	Facilities	TERM Rating below 3.0 SGR	10%
	Facility Assets	TERM Rating below 3.0 SGR	10%
Infrastructure	Track, Catenary, Signals, etc.	% of Rail system slow zones	2% during construction season
		% of Rail system slow zones	0.5% at year end

Tier II Urban (Laketran, MCPT, & LCT) TAM Performance Targets

Asset Category/Class	Sub-Group	Measure	% not to Exceed
Revenue Fleet (Useful Life Benchmark)	**Revenue Vehicles**	**8 - 12 years ULB**	**5%**
	Over-the-road Bus	12 years ULB	0%
	Bus - 35/40-Ft	12 years ULB	0%
	Cutaway Bus	5 - 7 years ULB	6%
	Mini-Vans	8 years ULB	0%
	Vans	5 years ULB	17%
Equipment	Non-Revenue/Service Auto	10 years ULB	17%
	Trucks & Rubber Tire Vehicles	8 - 10 years ULB	23%
	Maintenance	10 - 25 years ULB	N/A
	Operations	10 - 25 years ULB	N/A
Facilities (State of Good Repair)	Administration	TERM Rating below 3.0 SGR	0%
	Maintenance	TERM Rating below 3.0 SGR	0%
	Passenger Facilities	TERM Rating below 3.0 SGR	0%
Infrastructure	Track, Catenary, Signals, etc.	N/A	N/A
		N/A	N/A

TIERED TRANSIT ASSET MANAGEMENT (TAM) PERFORMANCE TARGETS

Tier II Rural (Geauga County Transit) TAM Performance Targets

Established by ODOT*

Asset Category/Class	Sub-Group	Measure	% not to Exceed
Revenue Fleet (Useful Life Benchmark)	**Revenue Vehicles**	**8 - 14 years ULB**	**N/A**
	Over-the-road Bus	N/A	N/A
	Bus - 35/40-Ft	14 years ULB	21%
	Cutaway Bus	10 years ULB	2%
	Mini-Vans	10 years ULB	10%
	Vans	8 years ULB	2%
Equipment	Non-Revenue/Service Auto	10 years ULB	0%
	Trucks & Rubber Tire Vehicles	N/A	N/A
	Maintenance	14 years ULB	0%
	Operations	10 years ULB	0%
Facilities (State of Good Repair)	Administration	TERM Rating below 3.0 SGR	38%
	Maintenance	TERM Rating below 3.0 SGR	22%
	Passenger Facilities	TERM Rating below 3.0 SGR	0%
Infrastructure	Track, Catenary, Signals, etc.	N/A	N/A
		N/A	N/A

Tier II Section 5310 Open Door Sub-Recipient Performance Targets

Asset Category/Class	Sub-Group	Measure	% not to Exceed
Revenue Fleet (Useful Life Benchmark)	**Revenue Vehicles**	**8 years ULB**	**45%**
	Over-the-road Bus	12 years ULB	N/A
	Bus - 35/40-Ft	12 years ULB	N/A
	Cutaway Bus	8 - 10 years ULB	N/A
	Mini-Vans	8 years ULB	N/A
	Vans/Automobile	8 years ULB	45%
Equipment	Non-Revenue/Service Auto	N/A	N/A
	Trucks & Rubber Tire Vehicles	N/A	N/A
	Maintenance	N/A	N/A
	Operations	N/A	N/A
Facilities (State of Good Repair)	Administration	TERM Rating below 3.0 SGR	N/A
	Maintenance	TERM Rating below 3.0 SGR	N/A
	Passenger Facilities	TERM Rating below 3.0 SGR	N/A
Infrastructure	Track, Catenary, Signals, etc.	N/A	N/A
		N/A	N/A

Over the four years of the SFY 2026-2029 TIP, more than 113 individual public transit agency projects, which can be consolidated into over 40 individual capital improvement programs for the area's large and small urban transit providers, utilize a combined $401 million towards maintaining and improving the State of Good Repair (SGR) of their capital assets in support of the TAM Performance Measures and Targets listed in Table 12.

Transit providers in the NOACA area utilize a variety of funding sources in support of their programmed projects. These awards include, but are not limited to, a number of FTA grant awards including the Section 5307 Urbanized Formula, Section 5337 State of Good Repair, Section 5339 Bus and Bus Facilities awards, and other FTA competitive discretionary awards, NOACA directed CMAQ funds, the State of Ohio from its Urban Transit Program (UTP) and from the Ohio Transit Preservation Partnership Program (OTPPP), local funds, other competitive discretionary awards, and 100 percent local funds.

In addition, NOACA is the direct recipient of the Cleveland UZA's annual FFY Section 5310 funds and, in turn, allocates a minimum of 60 percent of these funds to public transit agencies and a maximum of 40 percent to various sub-recipients, including local communities and non-profits, in the area through an annual application and evaluation process.

Strategies and projects contained within the *weNEO2050+* plan continue to prioritize as state of good repair for public transportation assets. NOACA coordinates with the region's transit agencies, and its 5310 providers, in the planning and programming of transit vehicles, non-vehicle capital, and other facilities that maintain efficient and effective levels of service for all that depend on public transportation to access the economy, recreation, shopping, and other aspects for improved quality of life.

Transit Safety Performance Measures and Targets

The FTA published the Public Transportation Agency Safety Plans (PTASP) Final Rule of 49 CFR 673 to ensure that public transportation systems are safe nationwide. The compliance date for transportation systems was December 31, 2020. MPOs were to establish their performance targets within 180 days, which was completed in June 2021.

The PTASP builds upon the FTA's April 15, 2016, State Safety Oversight (SSO) final rule which significantly strengthened an SSO Agency's authority to investigate accidents and oversee a rail transit agency's implementation of its safety rule. It required all eligible states to have an FTA approved and certified SSO program by April 15, 2019 and if an eligible state fails to meet the certification deadline by that date, under requirement U.S.C. Chapter 5329 (e) (3) the FTA must withhold all Chapter 53 funds from the entire State. The State of Ohio was one of the first in the nation to have its SSO programmed approved and certified by the FTA to avoid this issue. This program provides Federal support for State oversight of the transit agencies safety plans and, as such, establishes the necessary administrative oversight, support, and reporting structure for the upcoming Transit Safety Performance Measures and Targets.

Established in the final rule, public transportation providers and State Departments of Transportation (DOT) are required to establish safety performance targets (SPTs) to address the safety performance measures (SPMs) identified in the National Public Transportation Safety Plan (49 CFR 673.11(a)(3)). A safety performance measure is a quantifiable indicator of performance or condition that is used to establish targets related to safety management activities, and to assess progress toward meeting the established targets (§ 673.5). The final rule includes the following performance measures:

1. Fatalities,
2. Injuries,
3. Safety Events
4. System Reliability

A safety performance target is a quantifiable level of performance or condition expressed as a value for the measure related to safety management activities to be achieved within a set time period (§ 673.5). Transit providers may choose to establish additional targets for the purpose of safety performance monitoring and measurement. This requirement excludes transportation systems that only receive Federal financial assistance under 49 U.S.C. Chapter 53 Section 5310 or Section 5311.

The Final Rule requires safety targets be set by each transit provider and requires MPOs to include performance targets in their partner agreements, Transportation Improvement Program (TIP), State-wide Transportation Improvement Program (STIP), and Metropolitan Transportation Plans.

Greater Cleveland Regional Transit Authority, Laketran, Lorain County Transit, and Medina County Public Transit are all required to meet these requirements and have all provided NOACA with their PTASPs and STPs. Recommended STPs are included in Table 1-12 below and will be approved by the NOACA Board of Directors in June 2025, along with the *weNEO2050+.*

Table 1-12. Recommended NOACA Safety Performance Targets

Safety Performance Targets										
Agency	**Mode**	**TOS**	**Events**		**Fatalities**		**System Reliability**	**Injuries**		
			Total # of Safety Events*	**Rate per Vehicle Revenue Miles**	**Total # of Fatalities***	**Rate per Vehicle Revenue Miles**	**System Reliability** ***(Mean Distance between Failure)***	**Total # of Injuries***	**Rate per Vehicle Revenue Miles**	**Occupational Injuries** ***(GCRTA Only)***
Greater Cleveland Regional Transit Authority	HR/LR	DO	25.3	0.9	0	0	106,500	11.5	0.39	0.07
Greater Cleveland Regional Transit Authority	MB	DO	62	0.46	0	0	788,000	134	1	0.11
Laketran	CB	DO	0	0	0	0	64,121	0	0	
Laketran	DR	DO	1.31	0.07	0	0	42,004	1.31	0.07	
Laketran	MB	DO	0.33	0.04	0	0	10,768	0.33	0.04	
Lorain County Transit	DR	PT	0	0	0	0	0*	1	0.34	
Lorain County Transit	MB	PT	0	0	0	0	0*	1	0.83	
Medina County Public Transit	DR	DO	0.05	0.02	0	0	35,251	0.05	0.02	
Medina County Public Transit	MB	DO	0.04	0.02	0	0	24,015	0.04	0.02	

*Rounded to the nearest whole number

System Performance Report

Federal regulations require that the metropolitan transportation planning process shall provide for the establishment and use of a performance-based approach to transportation decision- making to support the national goals described in 23 U.S.C. 150(b) and the general purposes described in 49 U.S.C. 5301(c).The section above provides a detailed description of the established performance measures and performance targets used in assessing the performance of the transportation system in accordance with § 450.306(d).

Federal regulations also require the development and incorporation of a system performance report evaluating the condition and performance of the transportation system with respect to the performance targets.

ODOT, in coordination with NOACA and other statewide MPOs, have developed the system performance report contained within Appendix 1-1. This report contains the progress that NOACA and its partners have made in achieving the performance measures and targets described during the most recent 2-year reporting period.

MPOs that voluntarily elect to develop multiple scenarios, as NOACA has done in the development of *weNEO2050+,* the plan must include analysis of how the preferred scenario has improved the conditions and performance of the transportation system and how changes in local policies and investments have impacted the costs necessary to achieve the identified performance targets.

The *weNEO2050+* plan comprehensively addresses this requirement, demonstrating the potential regional investment strategies for the planning horizon; assumed distribution of population and employment; and demonstrated maintenance of baseline conditions for the performance areas identified in § 450.306(d) and measures established under 23 CFR 490.

Recommendations and Implementation Actions

While the goals help frame the potential future for Northeast Ohio, specific recommendations and implementation actions will help the region achieve it. Chapter 11 provides the w*eNEO2050+* Final Plan, with its associated projects based on fiscal constraint. Chapters 5-8 provide details about the steps NOACA can take to support this Final Plan to realize a more inclusive future across the spheres of transportation, economic development, employment, housing, environmental quality, climate change, and health.

Regional Demographic Trends

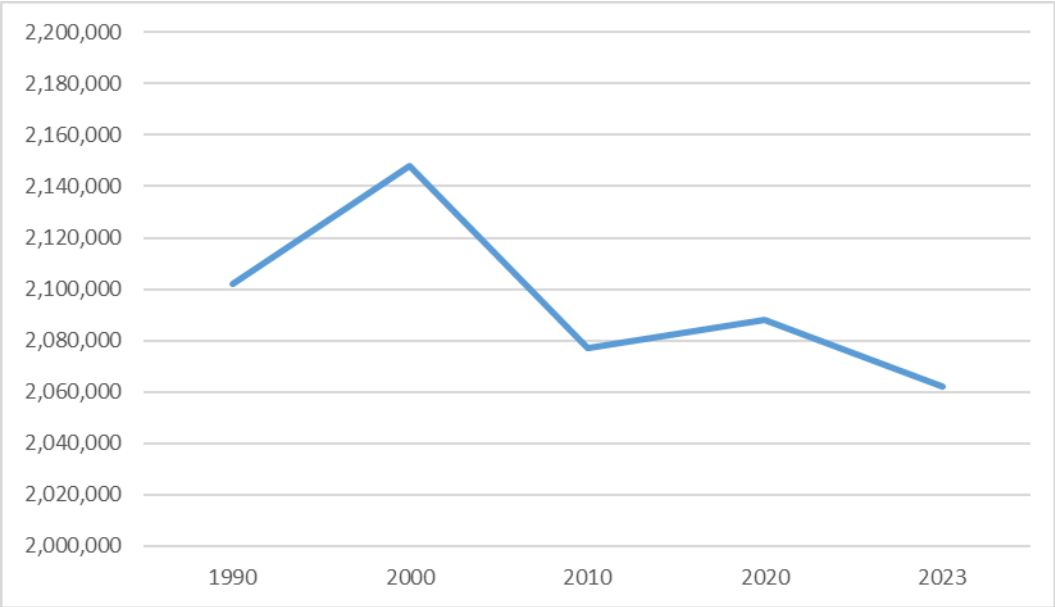
The following section presents how population and employment have changed in Northeast Ohio over the past 30 years. This initial discussion of past population and employment trends sets the tone for the rest of the document for the deeper discussion into the current transportation system (Chapter 3), the reasons for these changes, as well as their impacts (Chapters 5-8), and the projections for future changes (Chapter 9).

Population

NOACA's regional population has experienced a slight decline in the past three decades (see Figure 1-3). Overall, the regional population has hovered just over 2 million. Between 1990 and 2000, regional population increased only slightly at a rate of 2.2% to approximately 2.15 million. Between 2000 and 2010, the region's population dropped to just below 2.08 million. Between 2010 and 2020

the regional population rebounded slightly with an increase of around 11,000 to a total of about 2.09 million. Following 2020, the US Census estimates that the region has declined in population to 2.06 million in 2023.

Figure 1-3. Regional Population Change (1990-2023)[11]



Source: Decennial Censuses 1990-2020, US Census County Population Estimates 2023

Table 1-14. Population Change by County, City of Cleveland, and NOACA Region (1990-2023)[12]

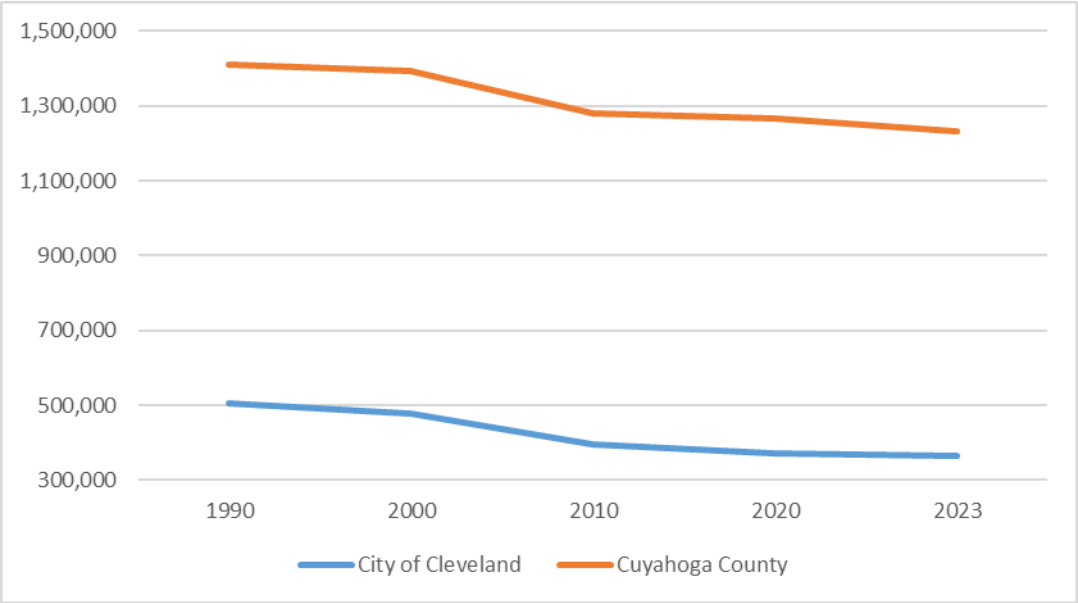
Geography	1990	2000	2010	2020	2023	Change 1990-2000	Change 2000-2010	Change 2010-2020	Change 2020-2023	Change 1990-2023	% Change 1990-2000	% Change 2000-2010	% Change 2010-2020	% Change 2020-2023	% Change 1990-2023
Cuyahoga County	1,412,140	1,393,978	1,280,122	1,264,775	1,233,088	-18,162	-113,856	-15,347	-31,687	-179,052	-1.3%	-8.2%	-1.2%	-2.5%	-12.7%
City of Cleveland	*505,616*	*478,403*	*396,815*	*372,596*	*362,656*	*-27,213*	*-81,588*	*-24,219*	*-9,940*	*-142,960*	*-5.4%*	*-17.1%*	*-6.1%*	*-2.7%*	*-28.3%*
Geauga County	81,129	90,895	93,389	95,433	95,407	9,766	2,494	2,044	-26	14,278	12.0%	2.7%	2.2%	0.0%	17.6%
Lake County	215,499	227,511	230,041	232,521	231,640	12,012	2,530	2,480	-881	16,141	5.6%	1.1%	1.1%	-0.4%	7.5%
Lorain County	271,126	284,664	301,356	312,956	317,910	13,538	16,692	11,600	4,954	46,784	5.0%	5.9%	3.8%	1.6%	17.3%
Medina County	122,354	151,095	172,332	182,475	184,042	28,741	21,237	10,143	1,567	61,688	23.5%	14.1%	5.9%	0.9%	50.4%
NOACA Region	2,102,248	2,148,143	2,077,240	2,088,160	2,062,087	45,895	-70,903	10,920	-26,073	-40,161	2.2%	-3.3%	0.5%	-1.2%	-1.9%

Source: Decennial Censuses 1990-2020, US Census County and City Population Estimates 2023

When NOACA examined the population figures by county (Table 1-14), a pattern of outward migration and suburbanization is revealed. The central and most populous county of the region, Cuyahoga County, has seen the greatest decline in population (nearly 13% from 1990 to 2023). This trend is driven primarily from losses experienced by Cuyahoga County's urban core communities, the largest being the City of Cleveland. Over the same period, the City of Cleveland lost approximately 28% of its population. Most of the population decline within Cuyahoga County and the City of Cleveland occurred between 2000 and 2010 (see Figure 1-4).

[11] Decennial Censuses 1990-2020, county and city population estimates 2023, https://data.census.gov (accessed August 16, 2024).
[12] Ibid.

Figure 1-4. Population Change for Cuyahoga County and City of Cleveland (1990-2023)[13]

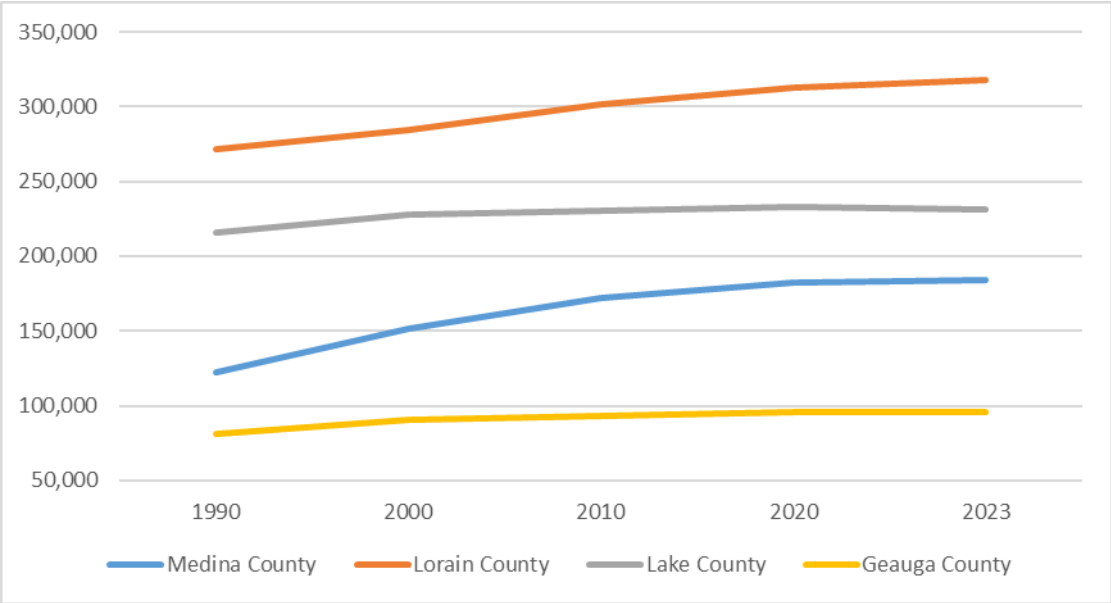


Source: Decennial Censuses 1990-2020, US Census County and City Population Estimates 2023

Because the City of Cleveland and Cuyahoga County account for the overall NOACA regional population loss, the collar counties of Geauga, Lake, Lorain, and Medina have experienced moderate to high levels of population growth, which has slowed considerably in recent years. This growth has somewhat tempered the region's population loss. Lake County saw the lowest level of growth (7% between 1990 and 2023). Lorain County and Geauga County grew at moderate rates of 17% and 18%, respectively, during the same period. Medina County experienced the highest level of growth out of all the counties in the region between 1990 and 2023 (50%).

[13] Ibid.

Figure 1-5. Population Change for Geauga, Lake, Lorain and Medina Counties (1990-2023)[14]

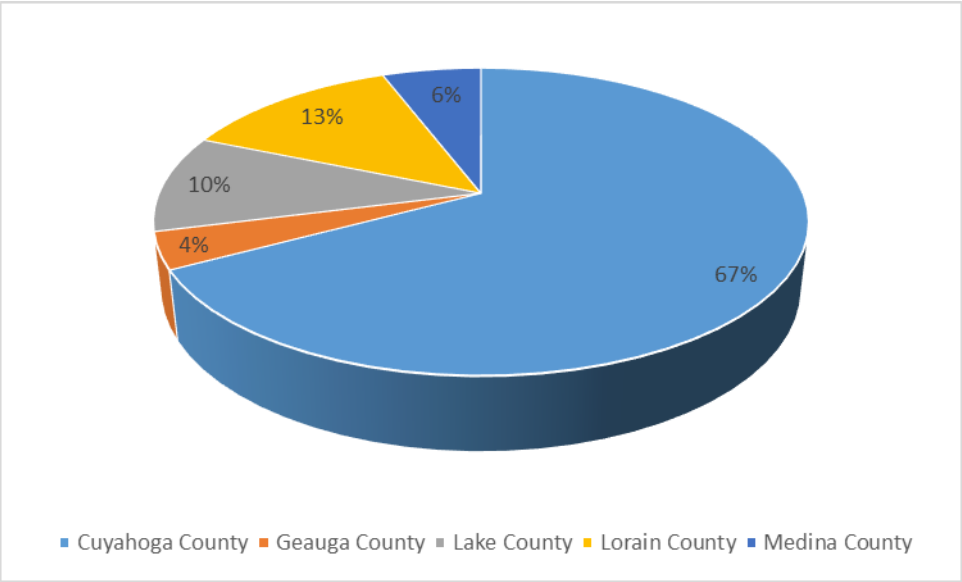


Source: Decennial Censuses 1990-2020, US Census County and City Population Estimates 2023

Much of the growth of the collar counties represents a shift or redistribution of population throughout the region that began in the 1960s. In 1990, Cuyahoga accounted for 67% of the regional population (Figure 1-5). In 2023, Cuyahoga's share dropped to 60% of the regional population (Figure 1-6). Much of the increase in regional population share occurred in Medina and Lorain counties, which experienced a 5% combined regional share increase (from 19% to 24%). Lake and Geauga counties also gained in their regional population share, but they experienced only a combined increase of 2%. Despite the high level of population redistribution throughout the region, the population gains of the collar counties do not account for all of the population losses of Cuyahoga County; therefore, the region's population has declined.

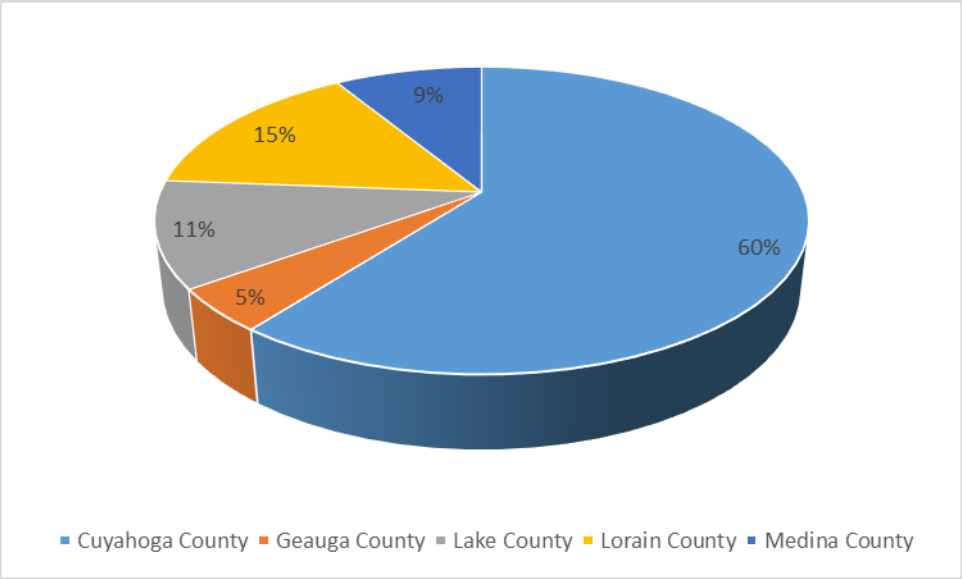
[14] Ibid.

Figure 1-6. County Share of Regional Population (1990)[15]



Source: Decennial Census 1990

Figure 1-7. County Share of Regional Population (2023)[16]



Source: American Community Survey

Despite the lack of regional growth from 1990-2023, the historic data indicates that the rate of decline for the region has slowed. For example, Cuyahoga County, the only county to experience a decrease, saw its decadal decline rate change from approximately 8% (2000-2010) to approximately 1% (2010-2020). On the opposite side of the spectrum, however, Medina County saw its decadal growth rate during the same periods decline from approximately 14% to about 6%. These historic trends seem to indicate that the rate of population sprawl in the NOACA region has slowed somewhat.

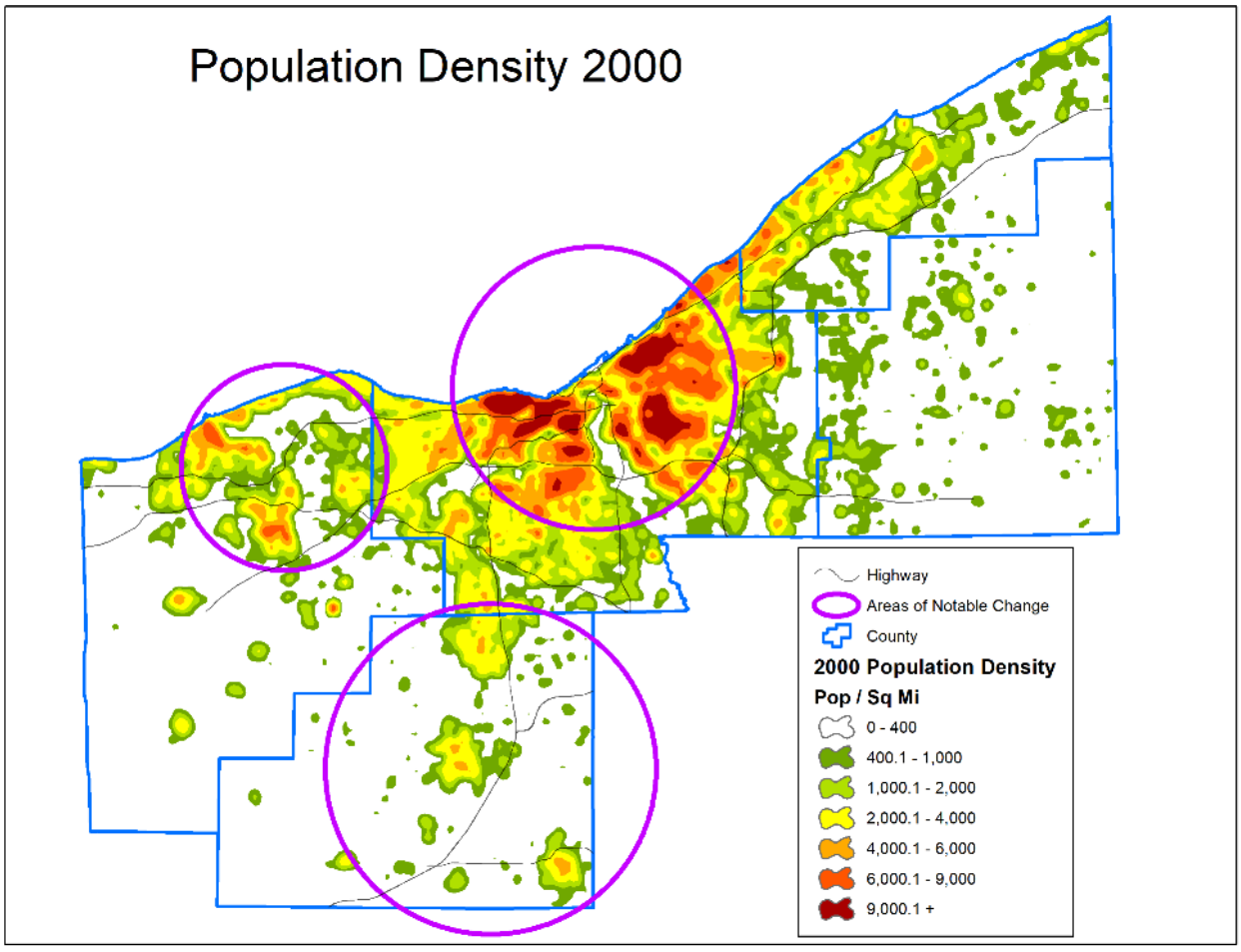
[15] Ibid.
[16] Ibid.

Population Density

NOACA also investigated population density levels, but only from 2000 to 2023 (Census block level data used to produce the following density maps is unavailable for 1990). This analysis showed regional patterns of sprawl at the sub-county level (see Figures 1-8 and 1-9). In Cuyahoga County, the density of the urban core declined dramatically on its eastern side, but not so much elsewhere. Therefore the conclusion is that much of the population loss in Cuyahoga County between 2000 and 2023 is attributed to the eastern half of the urban core. Downtown Cleveland and the near west side neighborhoods (e.g., Ohio City, Tremont) did not experience this same decline. Rather, from 2000 to 2023, there was a large increase in population density in these Cleveland neighborhoods. These areas account for the only noticeable increase in density within the urban core of Cuyahoga County.

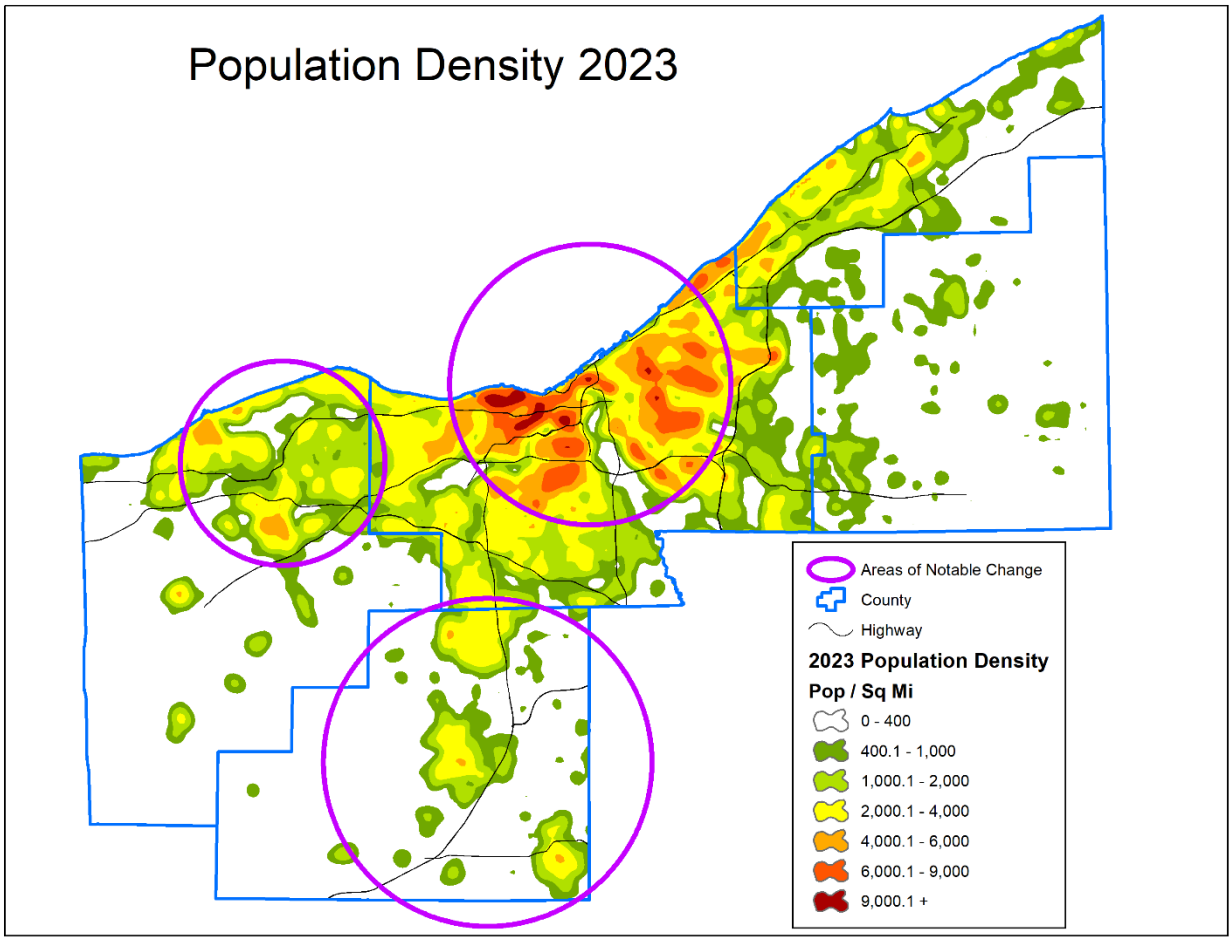
Lorain County experienced a substantial change in density levels between 2000 and 2023. Its urban core (the cities of Elyria and Lorain in the north-central part of the county) shows a moderate amount of density loss. In the northeast section of the county, mainly in the suburbs of Avon Lake, Avon, and North Ridgeville, there was a great increase in population density over that same period. Medina County also saw a slight amount of population density increase. The three largest cities of that county—Brunswick, Medina, and Wadsworth—all have experienced such increases.

Figure 1-8. Regional Population Density (2000)[17]



[17] NOACA analysis of Decennial Census 2000 (block geography); ibid.

Figure 1-9. Regional Population Density (2023)[18]



Employment

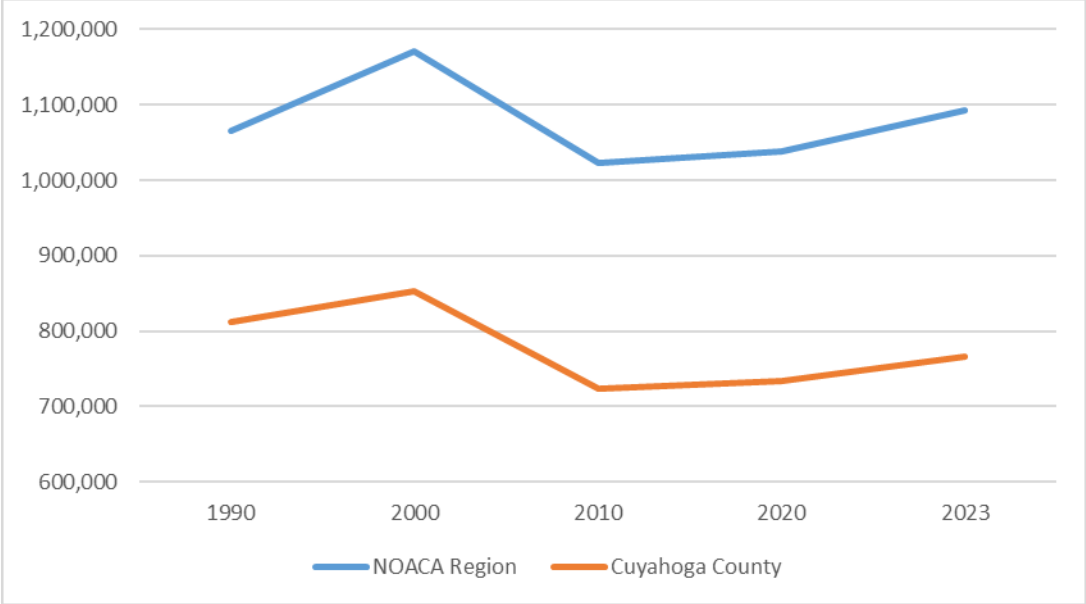
The total number of jobs in the region has moderately increased over the last three decades, fluctuating between 1.02 and 1.17 million. Unlike regional population trends, the total number of regional jobs tend to vary more dramatically, based on the health of the economy (Figure 1-10). For example, the region experienced a substantial level of job gains between 1990 and 2000 (more than 100,000 jobs at a 10% increase) but subsequently experienced a massive level of job losses between 2000 and 2010 (nearly 150,000 jobs at a 13% decrease) due to two recessions. Between 2010 and 2023, the economy recovered somewhat to end above the 1990 jobs level, but not enough to end above the 2000 jobs level. To be more precise, as a region of 2 million people, we have gained 26,000 jobs over the past 33 years.

Cuyahoga County followed a similar pattern as the NOACA region with regard to the change in total jobs from 1990 to 2023. There is a key difference, however. When the entire 33 years are taken as a whole, Cuyahoga County lost over 5% of its total jobs, while the NOACA region grew by more than 2%. Some of that regional growth can be attributed to the collar counties (Geauga, Lake, Lorain, and Medina) which experienced a positive trend (see Table 1-15 and Figure 1-11). Over the course of the

[18] NOACA analysis of forecasted Census block data using the Ohio Department of Development's (ODOD) county population forecasts (2023).

33 years, each collar county gained between 13,000 and 30,000 jobs, while Cuyahoga County lost nearly 45,000 jobs.

Figure 1-10. Employment Change for Cuyahoga County and NOACA Region (1990-2023)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

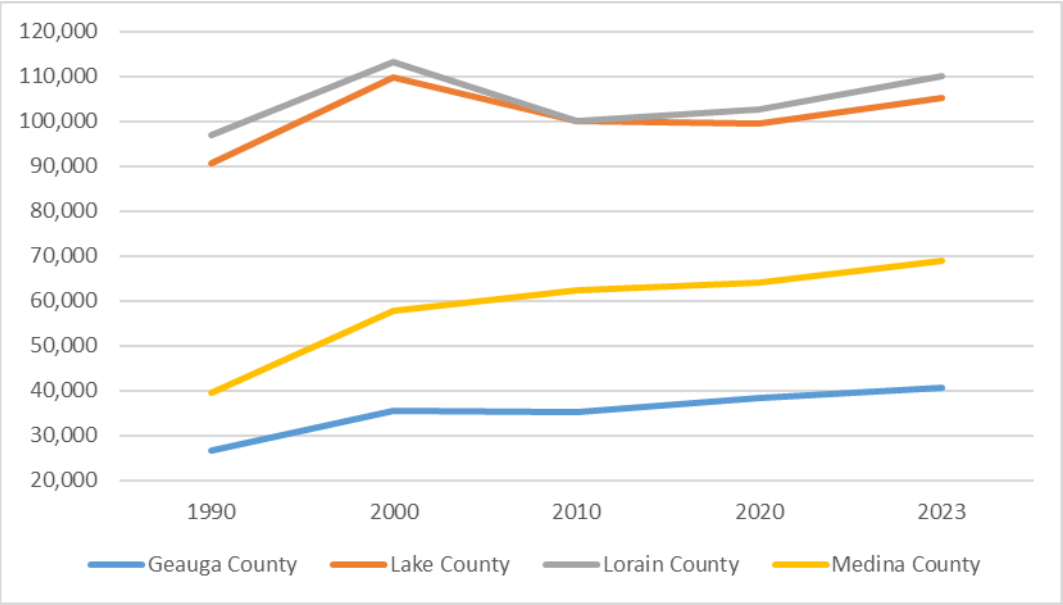
Nevertheless, this demonstrates the fairly stagnant job growth for a region hovering around 1 million jobs. In summary, Cuyahoga County has still not gotten back to its 1990 job levels and the jobs in the collar counties increased during the period; but overall, the NOACA region has not recovered from job losses that occurred during the 2000s.

Table 1-15. Total Employment Change by County and NOACA Region (1990-2023)

Geography	1990	2000	2010	2020	2023	Change 1990-2000	Change 2000-2010	Change 2010-2020	Change 2020-2023	Change 1990-2023	% Change 1990-2000	% Change 2000-2010	% Change 2010-2020	% Change 2020-2023	% Change 1990-2023
Cuyahoga County	811,551	853,451	724,528	733,066	766,856	41,900	-128,923	8,538	33,790	-44,695	**5.2%**	**-15.1%**	**1.2%**	**4.6%**	**-5.5%**
Geauga County	26,588	35,584	35,150	38,365	40,661	8,996	-434	3,215	2,296	14,073	**33.8%**	**-1.2%**	**9.1%**	**6.0%**	**52.9%**
Lake County	90,620	109,851	100,157	99,569	105,207	19,231	-9,694	-588	5,638	14,587	**21.2%**	**-8.8%**	**-0.6%**	**5.7%**	**16.1%**
Lorain County	97,020	113,316	100,181	102,727	110,186	16,296	-13,135	2,546	7,459	13,166	**16.8%**	**-11.6%**	**2.5%**	**7.3%**	**13.6%**
Medina County	39,556	57,803	62,312	63,996	68,871	18,247	4,509	1,684	4,875	29,315	**46.1%**	**7.8%**	**2.7%**	**7.6%**	**74.1%**
NOACA Region	1,065,335	1,170,005	1,022,328	1,037,723	1,091,781	104,670	-147,677	15,395	54,058	26,446	**9.8%**	**-12.6%**	**1.5%**	**5.2%**	**2.5%**

Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

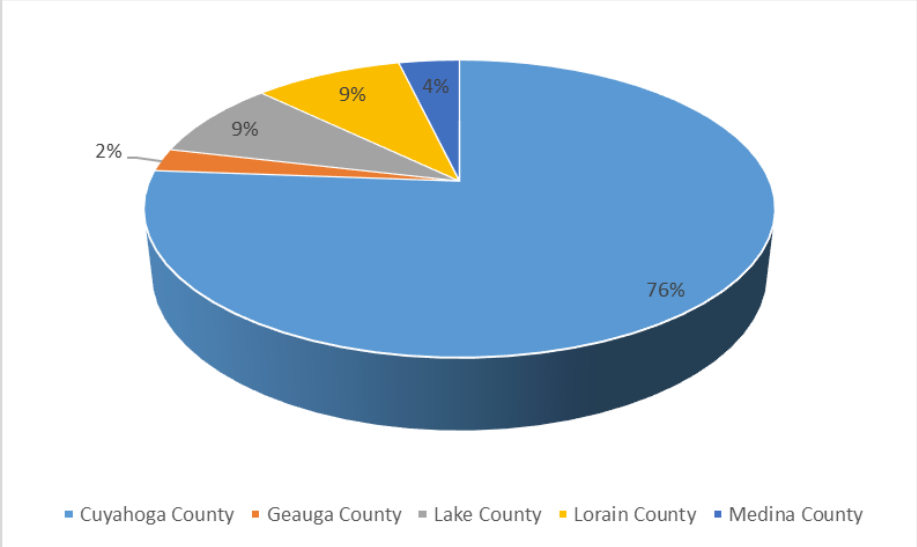
Figure 1-11. Employment Change for Geauga, Lake, Lorain and Medina counties (1990-2023)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

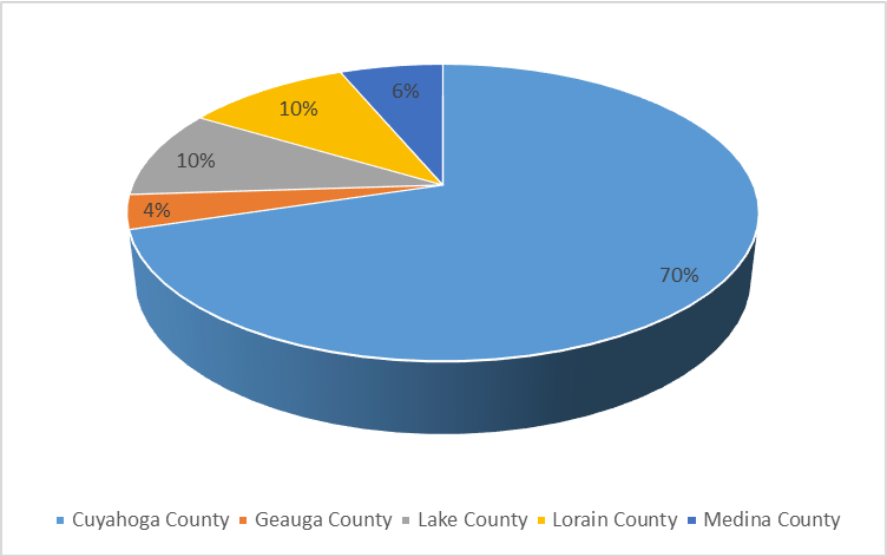
Similar to population, the geographic distribution of jobs throughout the region shows a pattern of outward migration and suburbanization. Unlike the population trends, though, the job gains in the collar counties have exceeded the job losses in Cuyahoga County, so the entire region has seen an increase in the number of jobs between 1990 and 2023. Jobs are now more widely distributed throughout the outer counties, and the overall job share of Cuyahoga County has declined (see Figures 1-12 and 1-13). In 1990, Cuyahoga County accounted for 76% of all jobs in the region. By 2023, Cuyahoga County's share had dropped to 70%. Nevertheless, looking at the job densities in the subsequent section indicates a variety in gains and losses within Cuyahoga County.

Figure 1-12. County Share of Regional Employment (1990)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Figure 1-13. County Share of Regional Employment (2023)

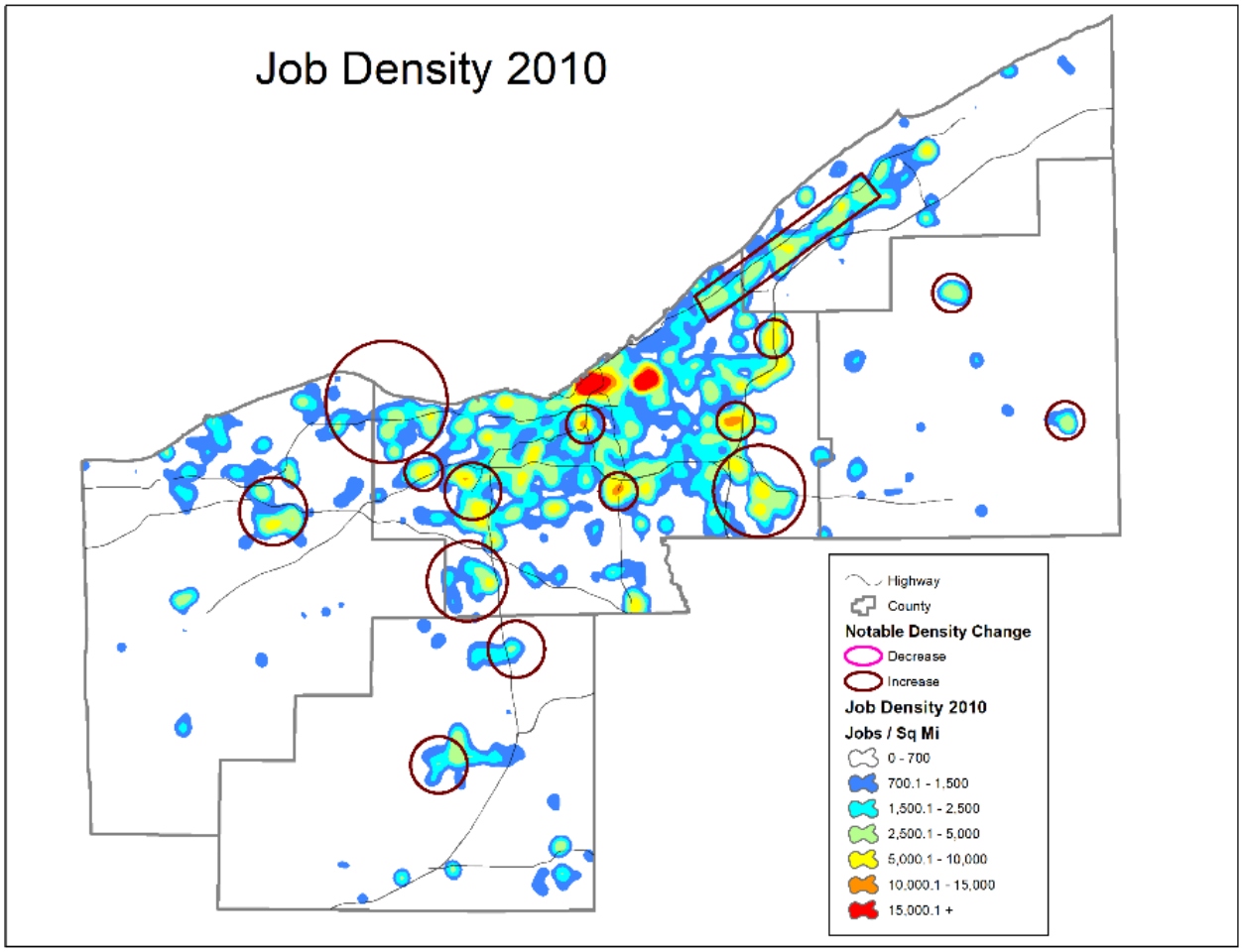


Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Employment Density

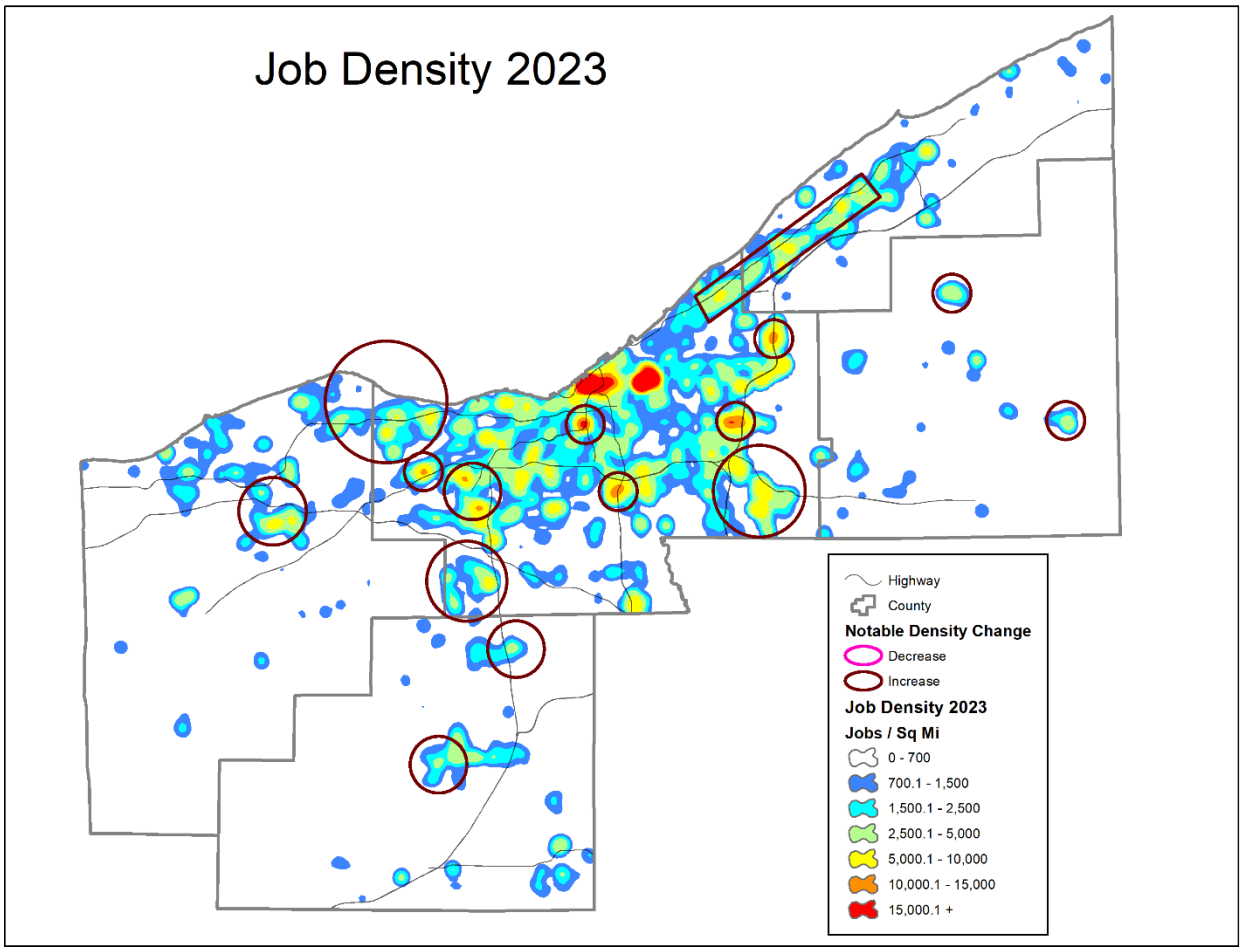
Job density levels (sub-county) between 2010 and 2023 show growth in the region after the economic downturn of 2008-2009 (employment data at the necessary scale to map job density is unavailable for years prior to 2010) (see Figures 1-14 and 1-15). Suburban cities outside of the inner-ring, such as Strongsville, Avon, and Mentor, all experienced notable increases in job density during the past decade. Areas with a high concentration of manufacturing jobs, such as the Cleveland Hopkins Airport area, Solon, and Elyria, all saw increases in density due to the rebound of the basic sector after the recessions of the 2000s (though the longer-term trend for manufacturing is still negative; see Chapter 5). Major employment centers, such as Independence and Chagrin Highlands, also saw their jobs increase, as did the job hubs in more rural areas like Medina County. Downtown Cleveland and University Circle, both in Cuyahoga County, maintained high levels of job density (above 15,000 employees per square mile) during the past decade to remain the two largest employment hubs of the NOACA region, in terms of both job density and total jobs.

Figure 1-14. Regional Job Density (2010)



Source: Quarterly Census of Employment and Wages (QCEW) 2010. Obtained via the Ohio Department of Transportation (ODOT) in 2012.

Figure 1-15. Regional Job Density (2023)



Source: NOACA-forecasted data based on the Quarterly Census of Employment and Wages (QCEW) 2010 and county forecasts by Moody's Economy.com. QCEW data obtained from the Ohio Department of Transportation (ODOT) in 2012 and Moody's Economy.com data obtained from Team NEO in August 2024.

Employment by Major Sector

When NOACA examined job types at a regional level, a trend emerged. There has been a shift from basic/industrial types of jobs to service types of jobs. For simplicity and transportation modeling purposes, NOACA classified jobs into three major categories:

1. Basic (Industrial)
2. Retail
3. Service

Figure 1-16 summarizes industries included in these three major classifications.

Figure 1-16. Industries included in Major Employment Sectors

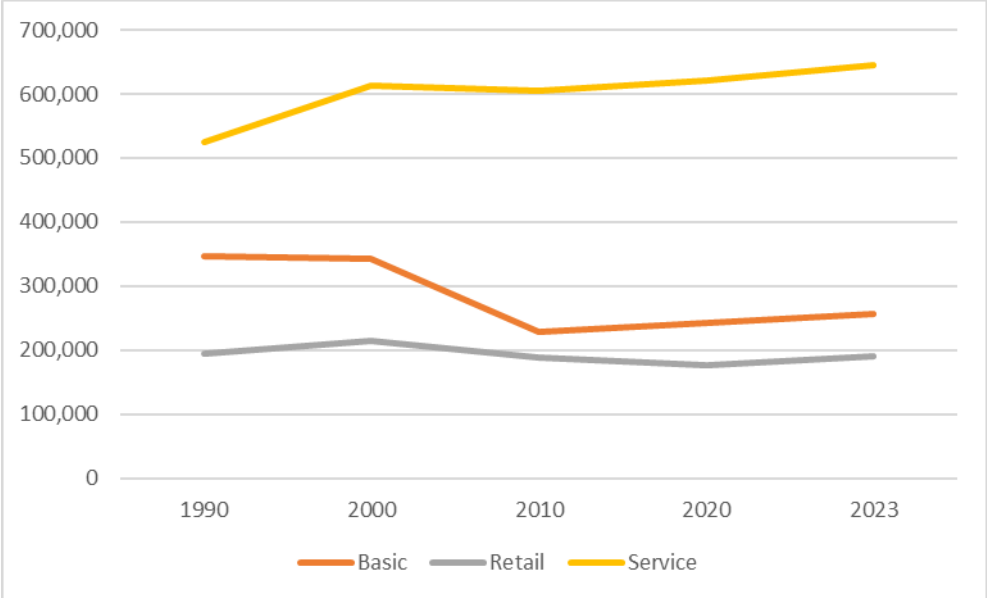
Basic:
- Agriculture, forestry, fishing, and hunting
- Mining, quarrying, and oil and gas extraction
- Utilities
- Construction
- Manufacturing
- Wholesale trade
- Transportation and warehousing

Retail:
- Retail trade
- Food services and drinking establishments

Service:
- Information
- Finance and insurance
- Real estate, rental, and leasing
- Professional, scientific, and technical service
- Management of companies and enterprises
- Administrative and support and waste management and remediation services
- Educational services
- Health care and social assistance
- Arts, entertainment and recreation
- Accommodations
- Public administration

NOACA, like other Midwestern regions, has experienced a decline in manufacturing and other industrial jobs. This decline in basic jobs has contributed to the low level of regional job growth over the past three decades. From 1990 to 2023, the region lost nearly 90,000 basic jobs. Most of these job losses in the Basic sector occurred during 2000-2010, where the region lost nearly 115,000 jobs. There was a modest increase in regional basic jobs between 2010 and 2023, around 29,000, but that was not enough to offset the job losses during 2000-2010. On the other end of the spectrum, service sector jobs experienced a major increase between 1990 and 2023 (see Figure 1-17 and Table 1-16). Overall, the service sector employment increased by more than 120,000 jobs (23%). Retail employment throughout the region has remained relatively flat. This is not surprising since retail jobs are highly tied to the population and the overall health of the economy. Since the regional population has slowly declined and the economy has experienced a few downturns during the period, it makes sense that retail sector jobs have not changed significantly.

Figure 1-17. Regional Employment Sector Change (1990-2023)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Table 1-16. Regional Employment by Sector (1990-2023)

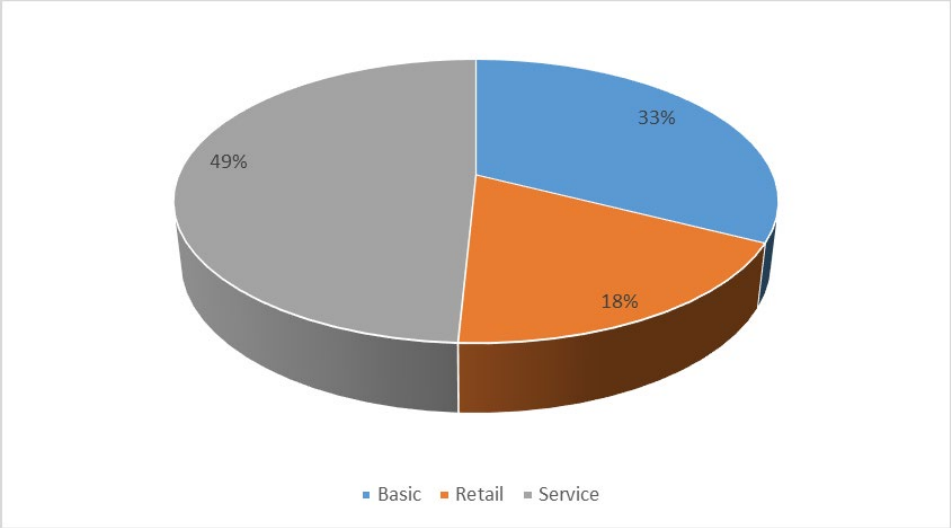
Job Type	1990	2000	2010	2020	2023	Change 1990-2000	Change 2000-2010	Change 2010-2020	Change 2020-2023	Change 1990-2023	% Change 1990-2000	% Change 2000-2010	% Change 2010-2020	% Change 2020-2023	% Change 1990-2023
Basic	346,736	343,396	228,410	241,759	257,265	-3,340	-114,986	13,349	15,506	-89,471	**-1.0%**	**-33.5%**	**5.8%**	**6.4%**	**-25.8%**
Retail	194,297	214,062	188,080	175,877	190,052	19,765	-25,982	-12,203	14,175	-4,245	**10.2%**	**-12.1%**	**-6.5%**	**8.1%**	**-2.2%**
Service	524,302	612,547	605,838	620,087	644,464	88,245	-6,709	14,249	24,377	120,162	**16.8%**	**-1.1%**	**2.4%**	**3.9%**	**22.9%**

Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

The regional job trends show the dichotomy between basic jobs and service jobs. While basic jobs declined at a rate of 26% between 1990 and 2023, service jobs increased at a similar rate of 23%. Because the service industry is larger than the basic industry, the 23% increase results in a net gain for the region in terms of total jobs. The dominant dynamic has been the replacement of basic jobs with service jobs.

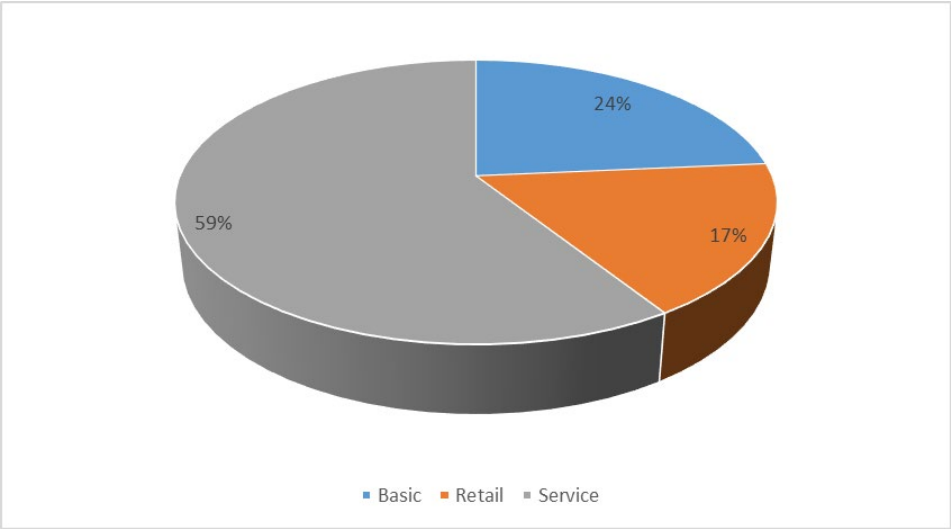
In 1990, the basic sector accounted for 33% of all the jobs in the NOACA region; by 2023, the basic sector share had dropped to 24% (see Figures 1-18 and 1-19). The service sector showed the opposite pattern: in 1990, 49% of the total jobs were in the service sector; by 2023, the service sector share had increased to 59%. Over the same period, the share of jobs in the retail sector stayed relatively constant. The transition from basic to service jobs reflects a trend throughout the United States for many years, especially in Midwestern regions like Northeast Ohio.

Figure 1-18. Employment Sector Share of Total Regional Jobs (1990)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Figure 1-19. Employment Sector Share of Total Regional Jobs (2023)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

These demographic and economic trends form the foundation of the considerations about transportation infrastructure needs in the region. The subsequent section provides a brief summary of each chapters. Each chapter contains a plethora of detail and nuances on the many facets of our regional development patterns that shape transportation needs.

Summary of Chapters

Chapter 2: Examine Current Plans

This chapter reflects how NOACA has built a foundation through the visioning and planning activities of the past decade to support its vision for 2050. Five major planning documents, *Vibrant NEO 2040*, *Moving Forward Together*, *Aim Forward 2040*, *eNEO2050*, and *weNEO2050+*, establish the importance of a more comprehensive approach to regional planning. These efforts link transportation, land use, housing, economic development, the environment, and public health. This chapter also explores the numerous planning efforts NOACA has successfully completed over the past several years on the varied topics of freight, safety, water quality, air quality, bicycle and pedestrian planning, and mobility for senior citizens and the disabled. This chapter also explores highlights of other metropolitan planning organizations' planning efforts to provide national context for NOACA.

Chapter 3: Explore Regional Context

Chapter 3 introduces the current state of transportation infrastructure in Northeast Ohio. This includes the various components of the current system, including roadways (arterials and highways), bridges, public transportation (buses, bus rapid transit, light rail and heavy rail), bicycle infrastructure, pedestrian infrastructure, passenger and freight rail, ports, and traffic control devices. This chapter defines access versus mobility, and presents a detailed discussion of each concept.

The discussion includes general access to different components of the current transportation system (arterial network, freeway system, transit network) and important destinations (land uses and jobs). This plan particularly emphasizes the importance of job accessibility as a way to increase inclusivity within the region. There is a significant presentation about jobs and job hubs (both major, minor and legacy job hubs), access to which form a core component for the current long-range plan.

The mobility discussion highlights elements of how easily people and goods move within the region's system. Traffic congestion is an important consideration, as delays can lengthen trips. This phenomenon results from bottlenecks at certain points in the transportation network. Delays and congestion ultimately result in costs that can negatively impact individuals and the region. Finally, this chapter introduces the concept of transportation scenario planning and its purpose for w*eNEO2050+*. A full discussion of future transportation scenarios for Northeast Ohio and performance measures to assess those scenarios against the baseline and one another are the theme of Chapter 9.

Chapter 4: Engage the Community

NOACA considers strategic stakeholder and public involvement outreach essential to the success of the w*eNEO2050+* plan. Through a broad process, NOACA established a defined and integrated approach to reaffirm the long-term strategies and vision of w*eNEO2050+* for public input. Chapter 4 outlines NOACA's approach through its public engagement process, strategies, outreach, and approaches. NOACA implemented four phases of engagement to parallel the w*eNEO2050+* plan's development: Visioning, Research, Preliminary Plan, and Final Plan. Some of the more innovative approaches employed by NOACA and consultants for the prior *eNEO2050* plan included a digital regional survey of a geographically and demographically representative sample of NOACA's adult population; a CrowdGauge tool used in a series of geographically focused remote interactive sessions; a comprehensive and dynamic web portal for all materials, activities, and updates related to the plan; a series of various events and products (podcasts, lunch-and-learns, videos, etc.) to attract different audiences through a spectrum of media; and education of NOACA's Board to become vocal champions for obtaining information and input among their constituencies and stakeholder groups. For *weNEO2050+*, we built upon these activities and integrated information from our decennial Household Travel Survey.

Chapter 5: Enable the Economy

Broadly defined, economic development refers to policy interventions that aim to improve the well-being of a community that is achieved through the creation or growth of businesses and jobs. Economic security is linked directly to quality of life for individuals and for society, which is often measured by income and tax base respectively, with income providing personal wealth and buying power and a tax base providing public services for all. The past 50 years mark a dramatic shift from the booming economic growth and expansion of Northeast Ohio prior to 1970, but there are signs that key sectors have emerged to help the region position itself for future opportunities. With that in mind, NOACA facilitated the development of a Comprehensive Economic Development Strategy (CEDS), which was adopted by the Board and accepted by the US Economic Development Administration. We have also applied to become an Economic Development District (EDD).

A regional economy needs to be inclusive, where all people and places prosper. Greater Cleveland has a growing healthcare sector as well as a manufacturing sector that remains strong, despite declines in employment. Decentralization of jobs and housing away from historical population centers, however, has created a spatial mismatch. This gap between where workers live and where employers locate is especially problematic for those who lack affordable and reliable access to jobs.

This chapter describes:

- The regional economy from past to present
- Geographic, income, and racial disparities
- Current conditions of key industries
- Economic development stakeholders

- Current NOACA programs, policies and projects
- Strategies and initiatives around Northeast Ohio used to address current and future economic development
- Highlights of potential threats and opportunities from climate change and pollution

This chapter details how transportation influences the development of Northeast Ohio's economy, particularly through NOACA's role to inform transportation policy decisions and fund projects. Finally, this chapter discusses potential future transportation scenarios (introduced in Chapter 3) and how they might impact regional economic development by the year 2050.

Chapter 6: Excellent Housing

In Northeast Ohio, housing planning and policy are inconsistent at a regional level; they are fragmented across local jurisdictions and viewed within smaller scopes, including counties, municipalities, neighborhoods, and developments. It is short-sighted, however, to neglect the impact that housing can have on the health of a region, particularly given the relationship between housing, land use, and transportation. In particular, transportation and housing are inextricably linked, as are their influence on quality of life in a region.

This chapter first presents the historical housing trends in the United States and Northeast Ohio over the past century and then evaluates the policies that have shaped the current landscape. Secondly, it addresses the demographic changes in recent years, current trends that affect housing in the region, and NOACA's existing efforts to support communities that are challenged by an aging housing stock, declining population, and disinvestment. Finally, the chapter explores strategies and initiatives around Northeast Ohio to address future housing needs in the region, particularly how NOACA might affect transportation policy decisions to improve housing, property values, and equity. Chapter 3 introduced the framework for these future transportation infrastructure investment scenarios.

Chapter 7: Efficient Land Use

This chapter focuses on the relationship between the same transportation network and the region's land use. Although NOACA does not hold a formal role in local land use policy (the domain of municipal government), the agency's regional responsibilities for both transportation and environmental planning influence land use change. Transportation planning and land use planning must operate in tandem for Northeast Ohio to leverage its resources more efficiently.

Land use and transportation infrastructure impact the quality of life experienced by the current and future population. Where and how development occurs impacts the functionality of the current transportation system, which in turn influences future land use decisions. The five- county NOACA region has continued to experience population loss since 1970, yet that smaller population has expanded its development footprint over a broader area. Incentives to expand transportation infrastructure, such as the interstate highway system, simultaneously upended established communities in urban areas, as well as rural ones, subsequently facilitating outward migration of people and jobs to more remote areas. The consequence is an inefficient transportation system required to support that pattern of land consumption, with excess capacity in some areas, while new infrastructure is built in others.

This pattern of land use, without the requisite regional population growth, has yielded a legacy of underutilized land and disinvestment in core, urban areas. Strategic investment in transportation infrastructure improvements can act as an effective counter measure to this legacy. Transportation projects should be more multi-modal with increased efficacy within existing communities.

Chapter 8: Environment and Health

In Chapters 5 through 7, NOACA illustrates how the evolution of the region's transportation network shaped the economy, employment opportunity, housing, and land use for Northeast Ohio.

Chapter 8 focuses on the relationships between the same transportation network and the region's land use, water quality, air quality, and resiliency. As NOACA serves the region for both transportation and environmental planning, this plan integrates transportation, air quality, and water quality in a manner consistent with the priorities of NOACA as an Areawide agency.[19]

Proposed future transportation scenarios will affect the region's air and water resources both directly and indirectly. Fundamental to environmental planning is clarity about the drivers of land use change within the region. Land use and transportation infrastructure affect the quality of life experienced by the current and future population.

Chapter 9: Equal Access Future Transportation Scenarios

Chapter 9 embraces future possibilities for the NOACA region; the major theme is what 2050 could look like in terms of population and employment growth, transportation, job access, land use, and environmental quality. This chapter first sets the table for NOACA's "look ahead" baseline demographic projections. Then, presents the foundation necessary to build the different scenarios for how the region may function in 2050: travel demand and supply side forecasting, highway capacity projects, bus/rail extensions, major transit hubs, innovative technology (including electric vehicle infrastructure), and active transportation facilities.

The four future transportation scenarios consist of population and employment forecasts and infrastructure investment priorities. MAINTAIN and CAR scenarios anticipate the baseline projections to remain the same, while the investment priorities are to take care of the existing system (MAINTAIN) and increase capacity of the arterial and highway network (CAR). The TOTAL and TRANSIT scenarios are different; they project population growth and employment growth above the baseline with expanded capacity of the region's public transportation network. This chapter presents each of these scenarios in detail, accompanied by performance measures that illustrate expected outcomes of these four different transportation investment priorities (including costs).

Chapter 10: Expected Financial Plan

Chapter 10 identifies and prioritizes projects and strategies to maintain, enhance, and expand the region's multimodal transportation network through 2050. The purpose of The Financial Plan is to demonstrate that NOACA can implement w*eNEO2050+* within specified fiscal constraints. This means

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[19] In 1975, the Northeast Ohio Lake Erie Basin (NEOLEB) organization was designated by the Governor of Ohio under provisions of the federal Clean Water Act to perform the areawide water quality management planning required under Section 208 of that Act. In 1990, the NOACA Board assumed the NEOLEB Board's areawide planning responsibilities for the five-county area. NOACA is organized under the Ohio Revised Code pursuant to the joint powers of County Government at ORC 307.14 et seq. Section 208 of the federal Clean Water Act sets forth requirements for water quality management plans (WQMPs) developed by areawide planning agencies (Areawides). In Ohio, the responsibilities for water quality management planning in urbanized areas are shared by Areawides and the Ohio Environmental Protection Agency (Ohio EPA). Authority for NOACA to perform the WQMP function is provided in state law at ORC 6111.02(A), 41-42. (accessed May 29, 2025 from https://www.noaca.org/regional-planning/water-quality-planning/areawide-water-quality-management-208-plan).

that projects and strategies contained in the w*eNEO2050+* Final Plan (see Chapter 11) cannot exceed the amount of funding "reasonably expected to be available" during the life of the plan. Chapter 10 identifies all necessary financial resources NOACA reasonably expects to be available to carry out the w*eNEO2050+* Final Plan.

The w*eNEO2050+* Final Plan also includes visionary (e.g., illustrative) projects that are cost prohibitive for adoption in the Financial Plan but are critical to achieve the vision of *weNEO2050+*. NOACA may advance these projects if the agency identifies available funding and determines that the projects align with NOACA planning requirements during the specific planning horizon. NOACA refers to this as the Illustrative Plan.

The Financial Plan consists of the following key components:

- Primary Transportation Revenue Sources
- Forecasted Revenue Scenarios
- Cost Assumptions
- Forecasted Projects

The Financial Plan also includes an evaluation and recommendation of financing strategies NOACA may pursue to fund additional or illustrative projects and programs. In the case of new funding sources, NOACA identify strategies to ensure their availability.

Chapter 10 also includes also the air quality conformity determination for the projects included in the Financial Plan, a required element to ensure that none of the planned projects to achieve the vision of the long-range plan will compromise the region's conformity to the National Ambient Air Quality Standards (NAAQS) through Ohio's State Implementation Plan (SIP).

Chapter 11: w*eNEO2050+* Final Plan

In Chapter 9, Scenario 4, "TOTAL" resulted in the best cost-benefit ratio compared to the other three scenarios analyzed. Chapter 11 illustrates the list of projects from Scenario 4 and their planned implementation decades for each project. The scenario effectiveness based on the selected performance measures is evaluated by comparing them with those of Scenario 1: MAINTAIN as the benchmark values. The evaluation results are then combined with the net present value of the total scenario-specific project costs, which produces an acceptable level of economic return indicator. The rest of this chapter introduces the new *weNEO2050+* projects with a succinct description.

Chapter 2: Examine Current Plans

Introduction

weNEO2025+ is a required four-year update to NOACA's existing long range plan, *eNEO2025*. NOACA has updated *eNEO2050* based on newly available data, emerging trends, and major project progress. weNEO2050+ builds on the strong foundation of *eNEO2050*, which is well-rooted in NOACA's major regional planning efforts, the state transportation plan, numerous NOACA local planning efforts, a cursory review of other metropolitan planning organizations' (MPOs) long-range plans, and NOACA staff visioning. Because *weNEO2050+* is a simple update to the substantial effort of *eNEO2050*, it is important that the premise of the latter is fully understood. As such, the major elements of eNEO2050 are discussed along with the new components of *weNEO2050+.*

NOACA and the other MPOs of Northeast Ohio collaborated to produce *Vibrant NEO 2040* (2014), a comprehensive regional vision framework for the future of a 12-county region.[1] This framework, the recipient of the 2015 Daniel Burnham Award for a Comprehensive Plan from the American Planning Association (APA), outlines recommendations, objectives, and strategies to help the region realize its preferred future scenario to do things differently in anticipation of little, if any, population growth over the next 25 years (2015-2040). The following year, NOACA's Board finalized *Going Forward, Together (2015)*, a regional strategic plan that captures and documents a vision, goals, and objectives that form the basis for NOACA's planning efforts.[2] *Going Forward, Together* identifies strategies for how to allocate resources—money, staffing, and Board and stakeholder activities—in pursuit of stated goals and objectives. *eNEO2025* was the agency's first comprehensive long range plan based on the goals, objectives, and strategies defined in *Going Forward, Together,* [3] now complimented with *weNEO2050+*. NOACA staff established *eNEO2050*'s long range transportation plan (LRTP) goals based on the goals and objectives from *Going Forward, Together*, *Vibrant NEO 2040*, and the state's transportation plan, *Access Ohio 2045 (AO45)*.[4] This foundation built upon critical regional plans has been carried over into the updated *weNEO2050+*.

These regional and state plans have inspired NOACA staff to develop additional plans that guide the work of NOACA's Board of Directors in transportation and environmental planning. During the same period, NOACA developed – and continues to develop – comprehensive plans and studies about the region's current transportation assets, bicycle infrastructure, public transportation and transit-oriented development opportunities, multimodal freight network, specialized mobility services, safety and intelligent transportation systems (ITS), and workforce accessibility and mobility.

NOACA also developed a water quality strategic plan, a comprehensive wastewater management and water quality plan, an air quality public education and outreach strategy, and an air quality communication plan. These topical plans help flesh out the broader scope of the larger scale

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[1] Northeast Ohio Sustainable Communities Consortium (NEOSCC) and Sasaki Assoc., *Vibrant NEO 2040* (Feb. 2014); https://vibrantneo.org/vibrantneo-2040/vneo-2040-full-report/

[2] Northeast Ohio Areawide Coordinating Agency (NOACA), *Going Forward, Together* (2015); https://www.noaca.org/regional-planning/major- planning-documents/regional-strategic-plan

[3] Northeast Ohio Areawide Coordinating Agency (NOACA), *Aim Forward 2040* (June 2017); https://www.noaca.org/regional-planning/major- planning-documents/aim-forward-2040

[4] Ohio Department of Transportation (ODOT), *Access Ohio 2045* (December 2020); https://www.dot.state.oh.us/Documents/AO45/AO45_OhiosTransportationPlan_Final_UPDATED_110624.pdf

regional and state plans to focus on specific needs to realize Northeast Ohio's desired future.

NOACA also looked outward and inward to gain a better perspective for *eNEO2050*. A cursory review of other MPOs' long range transportation plans was conducted to provide further guidance to *eNEO2050* development. The primary purpose was to understand how other regions adopted a more comprehensive scope to both the plan's content and the MPO's approach to public stakeholder engagement. Staff wanted to ensure its content thoroughly accounted for all the aspects of life in Northeast Ohio with a clear relationship to the region's transportation network.

Regional and State Plans

Vibrant NEO 2040 (2014)

Vibrant NEO 2040 is a regional visioning framework for 12 counties in Northeast Ohio (including the five counties of NOACA): Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, and Wayne. Its development began in 2010 and concluded in 2014. In 2009, the Northeast Ohio Sustainable Communities Consortium (NEOSCC), a small nonprofit established precisely for this effort, received a grant from the Partnership for Sustainable Communities, a joint effort of three cabinets of the federal government: the Environmental Protection Agency (US EPA), Housing and Urban Development (HUD), and Department of Transportation (US DOT). NEOSCC, a collaboration of 33 board member organizations, provided financial, facilities, and services support, with NOACA as lead agent.
Elected officials and stakeholders throughout these communities recognized the unifying issues of housing, transportation, environment, and economy. Many Northeast Ohio communities share assets and challenges, as well as future success or failure.

This process revealed important facts about the course of the region. If Northeast Ohio continued to experience modest population decline and modest employment growth while communities maintained their current approach to land use and infrastructure development, the region would face unprecedented challenges by 2040:

- Continued development at the edges of our metro areas on land that requires new infrastructure and public services.
- Abandonment of existing communities that already have infrastructure and public services.
- Increasing distance between people and their jobs.
- Limited transportation options other than our personal vehicles
- Increased fiscal stress on both households and local governments.

The *Vibrant NEO 2040* effort engaged hundreds of elected and appointed officials and more than 5,600 residents. Outputs included a Conditions & Trends web-based Platform; Regional Analysis of Impediments to Fair Housing Choice and Fair Housing Equity Assessment; regional parcel-level land-use and zoning maps; a public feedback library to make all public input visible; a tool kit and best practices; a policy framework; pilot projects; and metrics of future success.

NEOSCC coordinated five work stream committees: Economic Development, Environment, Housing and Communities, Transportation, and Quality Connected Places. These committees represented more than 120 organizations, facilitated 27 large public events throughout 2013, and coordinated with staff and consultants to conduct two statistically valid surveys (online and telephone). An interactive online tool called "Imagine My NEO" allowed participants to use CrowdGauge software to explore policy options, investments, and trade-offs to frame their

personal vision for the future.[5]

NEOSCC and consultants used all of this qualitative and quantitative data to generate four scenarios for what the future might hold (see Figure 2-1).

Figure 2-1. Vibrant NEO 2040 Future Scenarios[6]

NEOSCC compared the four scenarios across a variety of metrics, and Northeast Ohio public stakeholders overwhelmingly opted to pursue the "Do Things Differently" scenario. They made a bold statement that growth was not necessarily the answer, but rather an improved quality of life for the region lay in a different approach to the policies and practices that had driven the region outward from core communities to consume natural areas and farmland with low-density, auto-oriented development. NEOSCC and the consultants then developed recommendations, objectives, and strategies (see Table 1-3 in Chapter 1 *of eNEO2050*) to frame the vision for future implementation.

In 2015, the American Planning Association awarded NEOSCC and NOACA the Daniel Burnham Award, its highest honor for a comprehensive plan, for *Vibrant NEO 2040*. Even though there is no federal funding to support NEOSCC work to implement its recommendations, the group remains committed to the vision. NEOSCC still meets quarterly under the name

Vibrant NEO to educate stakeholders, share best practices, and inspire all residents to help realize a sustainable, vibrant, and equitable region.

In 2021, NOACA and Vibrant NEO entered a Memorandum of Agreement (MOA) to form the NOACA-Vibrant NEO Brownfield Coalition (Coalition) in order to apply for a Brownfields Revolving Loan Fund (RLF) grant from the US EPA. The Coalition was awarded $1,000,000 in 2022 to implement the RLF for brownfields remediation projects. A Brownfields Steering Committee was created to review application for loans/subgrants, conduct standard due diligence normally

[5] Sasaki Associates, "CrowdGauge," 2020, http://crowdgauge.org/
[6] NEOSCC and Sasaki, *Vibrant NEO 2040*, p. 44.

undertaken by lending entities, and recommend projects to the NOACA and Vibrant NEO Boards of Directors based on criteria developed by Vibrant NEO. Upon executing its first loan in 2024, the Coalition applied for supplemental funding from the US EPA and was awarded an additional $1,000,000 to grow the RLF. A total of four loans have been approved, in the amount of $1,508,000.

In 2023, the Vibrant NEO Board of Directors approved the Vibrant NEO Board Strategy: Background, Recommendations and Role. The following are recommended actions that track those in the Vibrant NEO report and are of critical importance to the region's future:

- Achieve Growth and Density in the Core of the Region with a Focus on Transit Oriented Development.
- Discourage Further Sprawl
- Consolidate Local Government Services
- Redevelop Land (i.e., reuse abandoned land, deteriorated sites and brownfields in a way that is consistent with the goals set out in the Vibrant NEO plan)
- Help Businesses and Jobs (i.e., revitalize the region's economy by helping existing businesses to expand and by bringing new businesses and jobs to the region)

Going Forward Together (2015)

The NOACA regional strategic plan is an organizational development document. Like *Vibrant NEO 2040*, its focus is the demographic and economic trends that will shape Northeast Ohio over the next 20 to 30 years. A strategic plan captures and documents the ultimate reasons that an agency does what it does, based on input from those who lead, operate, and are served by the organization. *Going Forward, Together* defines the agency's vision and goals, and identifies strategies for how to allocate resources — money, staffing, and Board and stakeholder activities— in pursuit of NOACA's vision and goals.

A vision statement received approval from the Board at its January 2014 meeting: *NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE quality of life in Northeast Ohio.*

The vision statement embodies the five goals of the strategic plan. Objectives were developed to support the goals based on input from the Board activities, visioning workshop, and external and internal scans. Final approval of the strategic plan was in January 2015. Table 1-3 in Chapter 1 *of eNEO2050* includes all of the goals and objectives in *Going Forward, Together* and illustrates how they relate to the recommendations and objectives in *Vibrant NEO 2040* and the *eNEO2050* LRTP goals.

Table 2-1. Summary of Key Steps in NOACA Strategic Planning Process[7]

June 2012	New Executive Director Grace Gallucci is appointed and identifies development of strategic plan as goal for the agency.
July 2012	Executive Director announces development of a strategic plan for the agency at first Board meeting.
July-December 2012	Executive Director meets one-on-one with Board members. The need for, and thoughts, ideas and opinions about, a strategic plan is among the topics of these meetings.
November 2012	NOACA conducts a staff retreat, with a strategic plan among the topics discussed.
December 2012	NOACA conducts a Principles and Goals Workshop with Board members.
January 2013	NOACA Staff and Board members draft a mission statement based on input from the Principles and Goals Workshop in December. The draft mission statement reads as follows: "NOACA will foster the success of communities with regard to quality of life and economic strength through targeted transportation investments that create a multimodal regional transportation system in the counties of Cuyahoga, Geauga, Lake, Lorain, and Medina." Using polling devices, Board members give the proposed mission statement a 70% rate of approval.
February 2013	NOACA holds a Board Retreat to kick off the Regional Strategic Planning effort. With the assistance of Cleveland State University, Input is collected that is later used to develop initial vision statement, goals and objectives.
March 2013	BVU is brought in to assist with evaluation of the board committee structure.
April-June 2013	Board receives results of polling exercise related to the vision statement elements from the retreat and the results of a Board survey related to the Code of Regulations.
July 2013	The consultant team of Parsons Brinckerhoff (PB) and Organizational Effectiveness (OE) Strategies is selected to assist NOACA in the development of the Strategic Plan.
October 2013	NOACA staff and the consultant team hold a Board Visioning Workshop in which Board members provide input on elements of a potential vision statement.
December 2013	Board members select and make minor wording modifications to a proposed vision statement from among three potential vision statements proposed by NOACA staff and the consultant team.
January 2014	Board approves the vision statement identified and developed in the December meeting. NOACA staff and the consultant team hold a Goals and Objectives Development Workshop to identify potential elements of a set of goals and objectives for the Strategic Plan.
February 2014	NOACA Staff, PB and OE Strategies engage in a series of strategies discussions with Board committees.
February-June 2014	NOACA staff and the consultant team, with the addition of Civic Commons at ideastream, solicit public input on the plan vision statement, goals, objectives and strategies at a series of online and in-person forums around Northeast Ohio, culminating in a community forum held at the Idea Center at Public Square on June 4.
July – October 2014	Board review and refining of goals and objectives and preliminary drafting of Strategic Plan Document.
October – December 2015	Final drafting of Strategic Plan Document
January 2015	Board approval of final NOACA Regional Strategic Plan

Access Ohio 2045 (AO45)

Ohio Department of Transportation's (ODOT) long range transportation plan, *Access Ohio 2045 (AO45)*, envisions the state "connected by a safe, smart, and collaborative transportation system

[7] NOACA, *Going Forward, Together.*

that moves people and freight efficiently and reliably and supports community visions."[8] The plan explores increasing population and commuter changes, and the infrastructure, bridges, sidewalks, and roads needed to accommodate the expected population and economic growth, as well as the innovation of new technology and efficient mobility options.

AO45 aims to expand transportation data sharing; address security risks to transportation assets, coordinate planning at both system and corridor levels, support more multimodal options, leverage emerging technologies, and advance sustainable transportation funding options. Furthermore, the plan emphasizes the importance of cooperation between ODOT and community stakeholders to accomplish these initiatives.

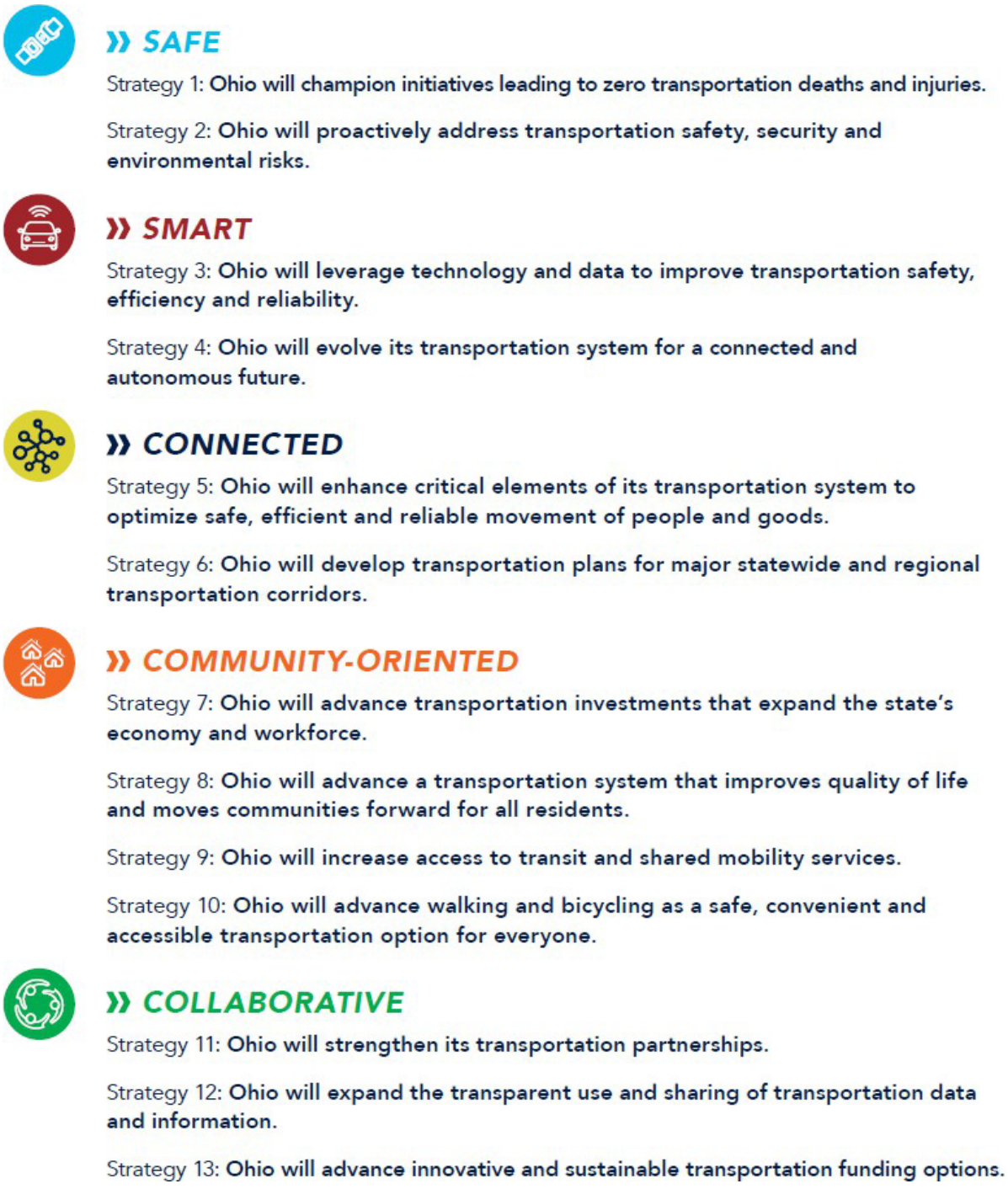
AO45 frames its objectives around seven goals (see Figure 2-3). Chapter 1 (Table 1-2) of *eNEO2050* illustrates the relationship between *AO45* goals and *eNEO2050* LRTP goals.

Figure 2-3. Access Ohio 2045 Goals and Objectives[9]

[8] ODOT, *Access Ohio 2045*
[9] Ibid.

To achieve these goals, *AO45* details 13 major strategies, categorized within 5 major themes that emphasize resiliency, equity, and sustainability (see Figure 2-4).

Figure 2-4. Access Ohio 2045 Themes and Strategies[10]



Additionally, *AO45* includes a transportation needs assessment, which outlines needs based on various future conditions. The assessment estimates total statewide transportation needs will cost $6.4-6.9 billion annually ($174-194 billion total) through 2045.

[10] Ibid.

Existing NOACA Plans

Overview

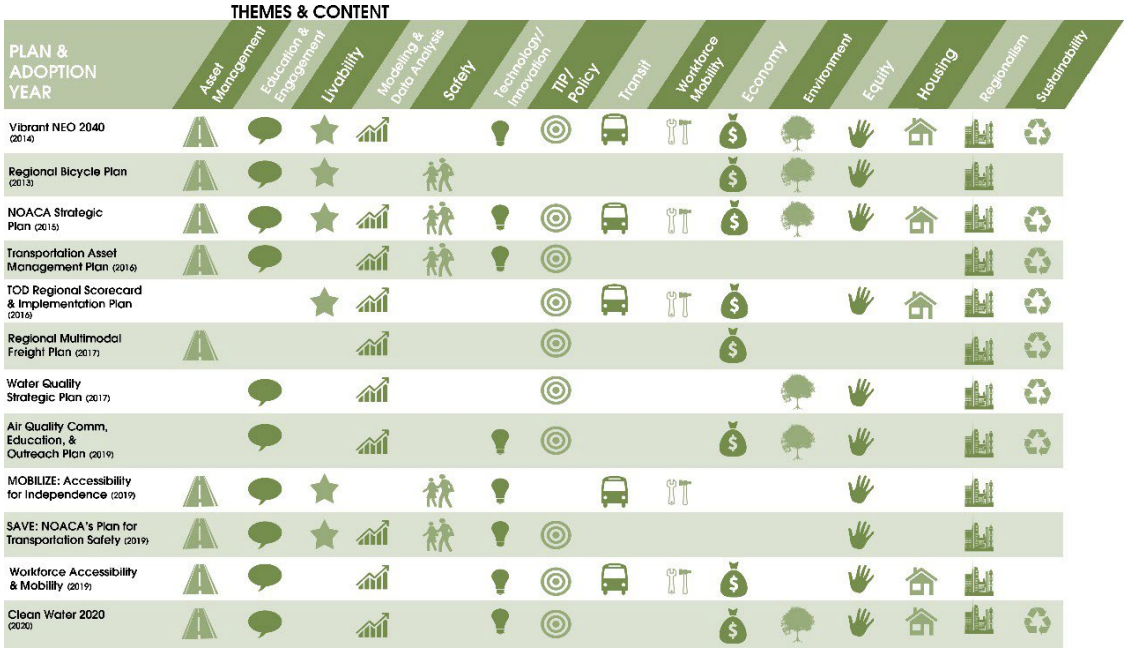
NOACA and Northeast Ohio are aligned with the regional and state plans described in the previous section, as well as several other recent NOACA planning efforts. These other efforts target specific topics and go into much greater detail than the broader regional plans. Yet, the more targeted plans still reflect NOACA's regional strategic plan and undergird its long range plan.

The following plans were developed with broad support from NOACA's Board and public stakeholders. The following presentation illustrates how each of these plans informs *eNEO2050*, and subsequently *weNEO2050+* which, in turn, capitalizes on each plan's advancement of recommendations and implementation actions to improve the region.

- Regional Bike Plan (2013) and ACTIVATE (2021)
- Transportation Asset Management Plan (TAMP) (2016)
- Regional Transit-Oriented Development (TOD) Scorecard and Implementation Plan (2016)
- Multimodal Regional Freight Plan (2017)
- Air Quality Public Education and Outreach Strategy & Communication Plan (2019)
- Intelligent Transportation Systems (ITS) Strategic Plan (2019)
- MOBILIZE: Accessibility for Independence, NOACA's Coordinated Public Transit-Human Services Transportation Plan for Northeast Ohio (2019)
- SAVE: NOACA's Plan for Transportation Safety (2019)
- Workforce Accessibility and Mobility (2019)
- Hyperloop Feasibility Study (2019)
- Clean Water 2020: A 208 Water Quality Plan (2020)
- Regional Strategic Transit Plan (2020)
- Water Quality Strategic Plan (2023)

Table 2-2 illustrates how each of the NOACA plans listed above corresponds to a series of plan themes and also how these plan themes relate to the 15 *eNEO2050* LRTP goals presented in Chapter 1, which are also used as the basis for *weNEO2050+.* It is noteworthy that two of the themes (Education & Engagement and Regional Cohesion) are connected to all the local plans listed as well as all of the *eNEO2050* LRTP goals. This makes sense, because all NOACA planning efforts are done in the spirit of transparency, education, and engagement for the benefit of public stakeholders to help build a more cohesive and collaborative Northeast Ohio.

Table 2-2. Local Plan Themes, Content and eNEO2050 LRTP Goals



Regional Bicycle Plan (2013) and ACTIVATE (2021)

Regional Bicycle Plan (2013)

NOACA's 2013 *Regional Bicycle Plan* maps highlight necessary improvements to make northeast Ohio more bicycle friendly; they serve as an update to the 2008 Regional Bicycle Transportation Plan.[11] The 2013 plan acknowledges the benefits of a bike-friendly region: a zero-emission mode of transportation to decrease air pollution; health benefits for users; less expensive modal infrastructure; and a safe, efficient form of transportation for those without access to a personal vehicle.

The 2013 plan reviews existing infrastructure, efforts to accomplish bicycling-related goals, and the effectiveness of those efforts. NOACA examined factors such as current bicycling rates, potential demand for bicycle facilities, and volumes and trends for crashes that involved bicyclists.

Building on the 2008 *Regional Bicycle Transportation Plan*, the 2013 plan includes the following goals:

1. Plan and implement bicycle facilities.
2. Create and support new or improved policies and programs related to bicycling.

To accomplish these goals, the 2013 *Regional Bicycle Plan* focuses on the Regional Priority Bikeway Network, a visionary system of interconnected routes throughout northeast Ohio that is both safe and convenient for bicyclists. The plan proposes a multitude of programs to complement infrastructure improvements. Each program includes a suggested lead agency, department, or organization, as well as suggested partners, and a list of priorities to achieve implementation.

[11] Northeast Ohio Areawide Coordinating Agency (NOACA), *Regional Bicycle Plan* (May 2013) https://www.noaca.org/regional-planning/transportation-planning/bicycle-pedestrian-planning.

ACTIVATE (2021)

ACTIVATE is NOACA's new pedestrian and bicycle plan and the first holistic study of pedestrian planning for the region.[12] ACTIVATE highlights how communities can plan and construct both short-term, low-cost safety measures and visionary plans for connected biking and walking networks. The verb "ACTIVATE" means to make something active or to convert an immobile object or substance into an active form. Walking and biking are referred to throughout this plan as active transportation, and the title of this plan refers to NOACA's vision to ACTIVATE Northeast Ohio in several key ways (see Figure 2-5).

Figure 2-5. ACTIVATE Plan Components

- ACTIVATE STREETS into networks for safe biking and walking
- ACTIVATE COMMUNITIES to plan with local tools and resources
- ACTIVATE PROGRAMS to respond to the demand for biking and walking by encouraging best practices
- Ultimately, ACTIVATE PEOPLE to try biking and walking and reap the physical, economic, and social benefits of active transportation

Early public and stakeholder activities provided significant inputs that coalesced into the themes shown below (Figure 2-6). These themes served to guide the development of the plan's analyses and recommendations.

Figure 2-6. ACTIVATE Themes

[12] Northeast Ohio Areawide Coordinating Agency (NOACA), *ACTIVATE* (2021), https://www.noaca.org/home/showpublisheddocument/28272/637931330003330000

NOACA also conducted a community survey and focus groups to gather valuable feedback from public stakeholders about Northeast Ohio's bicycle and pedestrian assets, as well as their user experiences. NOACA enjoyed a highly successful engagement effort and continues to develop the final plan to benefit all travelers in Northeast Ohio with the safety, welfare, and positive experience of cyclists and pedestrians as a very high priority. This effort is particularly important given the COVID-19 pandemic, which has emphasized the benefit of more physical activity and the need for more comprehensive multimodal transportation networks, especially those where the individual can be outside confined spaces.

Transportation Asset Management Plan (TAMP) (2016)

Introduction

The *NOACA Transportation Asset Management Plan* (*TAMP*) outlines the existing and planned state of transportation asset management (TAM) in NOACA's five counties.[13] It begins with an overview of TAM and why it is important for the region. The *TAMP* then discusses existing asset conditions and TAM processes. It presents objectives and measures for TAM in the region, discusses performance gaps, and summarizes risks. The *TAMP* includes an assessment of NOACA's financial picture for the next 10 years, along with potential investment strategies, and future TAM process enhancements.

Roadway infrastructure provides the backbone of America's transportation system. It sustains the economy and contributes to the competitiveness of both the United States and Northeast Ohio. Transportation agencies recognize the immense need to preserve transportation investments. Therefore, they turn to TAM strategies to maintain, improve, and ensure future generations' ability to travel safely and efficiently.

TAM approaches have gained favor over the past decade. The establishment of a new requirement to develop risk-based TAMPs, as part of the Moving Ahead for Progress in the 21st Century (MAP-21) Act, served as a major milestone. This approach carried forward as part of the Fixing America's Surface Transportation (FAST) Act. While state departments of transportation are the primary focus of the requirement, metropolitan planning organizations also find significant benefit from well-structured TAMPs. MPOs such as NOACA will gain from a forward-thinking preservation approach given the tremendous investment that infrastructure assets represent, and the demand for economic vitality in an era of limited funding.

Other factors driving TAM include an increased emphasis on transparent performance measures in transportation, particularly on roadway and bridge system-wide asset conditions, and pending requirements for targets at the state and metropolitan area levels.

Although TAM can include a variety of functions, activities, and decisions at the state, regional, and local levels, it most commonly comprises the following:

- Transportation investment policies;
- Institutional relationships between transportation agencies and public/private groups;
- Multimodal transportation planning;
- Program development for capital projects, operations, and maintenance;
- Real-time and periodic system monitoring; and
- Information technology (IT) support activities.

[13] Northeast Ohio Areawide Coordinating Agency (NOACA), *Transportation Asset Management Plan* (July 2016), https://www.noaca.org/home/showpublisheddocument/23052/636747889911230000

Agencies that implement TAM principles can reap many benefits, including lower long-term costs for infrastructure preservation, improved performance and service to customers, and better cost effectiveness and use of available resources. TAM's focus on performance and outcomes can ultimately result in improved credibility and accountability for decisions and expenditures.

Goals and Performance Measures

The broad goals for inclusion in the NOACA *TAMP* are drawn from the agency's vision statement: *NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE quality of life in Northeast Ohio.* All actions of the TAMP should support NOACA's vision and goals. Specific *TAMP* objectives focus on these goals:

- *STRENGTHEN REGIONAL COHESION*
  - Objective 1: Establish Transportation Asset Management as a regional priority
  - Objective 2: Serve as a liaison for NOACA members and partners such as ODOT and FHWA
- *PRESERVE EXISTING INFRASTRUCTURE*
  - Objective 3: Apply a "fix-it-first" mentality for projects that rely on NOACA funds
  - Objective 4: Achieve a state-of-good-repair for roadway assets
  - Objective 5: Promote a least-life-cycle cost approach to transportation infrastructure investment
- *BUILD A SUSTAINABLE MULTIMODAL TRANSPORTATION SYSTEM TO SUPPORT ECONOMIC DEVELOPMENT AND ENHANCE QUALITY OF LIFE*
  - Objective 6: Expand Transportation Asset Management program to other modes

NOACA also focuses on the measurement and improvement of the state of good repair for pavements and bridges in the region. ODOT developed Pavement Condition Ratings (PCRs) to monitor pavement conditions over time. The scorers give each pavement segment a numeric rating between 0 and 100; they start at 100 and deduct points for each observable distress according to guidance issued by ODOT. In its *TAMP*, NOACA sets a tentative target of at least 80 PCR for its average urban and local federal-aid system condition level. The *TAMP* also established a tentative target of 85 percent of the network at or above 55 PCR. NOACA will require further financial analysis to confirm these are sustainable expectations.

FHWA guidelines assign a condition rating of Good, Fair, or Poor based on the minimum National Bridge Inventory (NBI) condition rating of each bridge's deck, superstructure, or substructure (see Table 2-3). It is recommended that NOACA use percentage of the deck area of bridges that is good or fair based on NBI ratings (>4) to determine the state of good repair (SOGR) for bridges. As part of NOACA's commitment to maintain regional bridges in SOGR over the life of the *TAMP*, NOACA tentatively sets a target that meets the MAP-21 requirement and dictates that no more than 10% of the total NHS bridge deck area may be on poor, or structurally deficient, bridges.

Table 2-3. National Bridge Inventory (NBI) Ratings[14]

Bridge Condition Ratings

NBI Rating	Bridge Condition	Structural Classification
≥7	Good	Not Deficient
5 or 6	Fair	Not Deficient
≤4	Poor	Deficient

Regional TOD Scorecard and Implementation Plan (2016)

In response to one of *Going Forward, Together's* objectives, "encourage transit-oriented development in higher-density urban corridors and other higher-density areas of the region and retrofit transit-oriented elements in appropriate lower-density areas," NOACA developed the *Regional TOD Scorecard and Implementation Plan*.[15] The plan explores transit-oriented development (TOD): compact, walkable development integrally linked to public transportation, with the goals of increased transit ridership and removed barriers to new development.

The plan is divided into two phases: Phase 1 includes three tasks 1) the development of the TOD scorecard and typologies, 2) the design of a regional TOD program, and 3) the development of an Age in Place Strategy. Phase 2 consists of the development of an implementation plan for three pilot sites identified from work in Phase 1, which includes a strategy for public engagement.

In Phase 1, a key feature of NOACA's *TOD Scorecard and Implementation Plan* is the TOD Place Typology. The typology sorts the "universe of stations"—42 rail and bus rapid transit stations; 10 bus priority corridors organized into 99 segments; and 10 outlying town centers—into seven categories differentiated by location, connectivity, land use, urban form, and intensity:

- Metro Core
- Town Center
- Neighborhood Center
- Main Street
- Neighborhood Residential
- Industrial/Transitional
- Special Destination

A station's Typology category reflects its existing conditions as well as its future aspirational character. The Typology indicates the ultimate vision for a station area, regardless of current conditions, and is not expected to change unless the community's vision for a neighborhood or district fundamentally changes.

A second analytic framework, the Regional TOD Readiness Scorecard, measures how a station performs relative to the full TOD potential implied by its Place Typology category. There are four

[14] Federal Highway Administration (FHWA), *Bridge Preservation Guide: Maintaining a Resilient Infrastructure to Preserve Mobility* (Spring 2018), https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf

[15] AECOM, *NOACA Regional TOD Scorecard and Implementation Plan* (Nov. 2016), https://www.noaca.org/home/showpublisheddocument/19936/636590347755130000.

overall Readiness scores: Long-Term, Emerging, Ready, and Arrived. The purpose of the Readiness Scorecard is twofold: 1) to identify stations where high-priority investments are needed to support TOD; and 2) to set realistic expectations for the timeframe in which different stations are likely to blossom.

In Phase 2, a market analysis and implementation plan were developed for three pilot sites: West Boulevard Cudell Rapid Station, East 116th Rapid Station, and Broadway/Slavic Village Bus Corridor. NOACA can use the methods developed in the *Regional TOD Scorecard and Implementation Plan* as tools for evaluation purposes.

Multimodal Regional Freight Plan (2017)

Introduction

Northeast Ohio is a key hub for freight due to its robust multimodal shipping network and easy access to population centers in the United States and Canada. The region has five interstates, an international airport, two major railroad lines, and three Great Lakes port facilities, as well as a developed pipeline system to move liquid products. It is critical for NOACA and its stakeholders to plan and invest in transportation projects that make goods movement into, out of, and through the region as easy possible for all modes. Doing so will help existing businesses grow, encourage the start-up of new businesses, and facilitate relocation of businesses into the region from other parts of the country or world.

NOACA's *Multimodal Regional Freight Plan* provides extensive data on the current freight system and conditions, especially pavement, bridge, and congestion metrics.[16] Intermodal connectors; these are roads that connect air, water, and rail facilities with the highway network are highlighted. Intermodal connectors are vital pieces of the freight system because they enable the movement of goods between different modes for "first and last mile" delivery.

The plan describes each of the different freight modes. While all are viable shipping methods in the region, trucking accounts for roughly 80% of all freight by both volume and value, which closely mirrors the national average. NOACA expect trucking to remain the dominant mode of goods movement. Improved security and resiliency, reduced crashes, lower congestion, and minimal road damage should be objectives of every freight mode, however. Expansion of other modes will also improve air quality, because trucks create more air pollution than rail or water shipping per ton-mile of goods shipped. Redundancy in the system means mitigation of disruption to one mode, since coordinators can shift freight temporarily to other modes.

Different modes are used for different goods and by different types of businesses. Air cargo, due to the speed, is the most expensive option. Only high-value goods or very perishable items go by air (e.g., pharmaceutical products). Rail and water freight providers both serve businesses that ship large items that will not fit on trucks, items that are not time sensitive, and low-value commodity goods (e.g., iron ore, scrap metal, or shelf-stable grains). Trucks serve essentially all other goods, including most commercial and retail products. It is important for business retention and attraction that Northeast Ohio have all modes available.

A SWOT (strengths, weaknesses, opportunities, and threats) analysis for the freight system is illustrative for future planning. Despite the advantages of location and a strong multimodal system, there will be obstacles to growth in Greater Cleveland. Most pressingly, expenses outpace revenues for funding infrastructure. The existing system continues to age in older

[16] Northeast Ohio Areawide Coordinating Agency (NOACA), *Multimodal Regional Freight Plan* (2017); https://www.noaca.org/home/showpublisheddocument/21293/637249557653870000

communities, while it expands in newer communities; the current gas tax is insufficient to meet these maintenance and construction needs. A stable but moving regional population means shifting locations of people, businesses, and freight movement patterns. This creates winners and losers among individual communities but has no net benefit for the region. Several technological advancements may change the movement of people and freight (e.g., Hyperloop, autonomous vehicles, or aerial delivery by drone). These will have implications for future spending, particularly if funds remain limited.

Goals and Performance Measures

With these factors in mind, NOACA extensively engaged the freight community to develop the following goals and performance measures to meet the needs of freight stakeholders; improve the transportation system for all users; and increase safety, security, and resiliency.

The goals are:

- Prioritize maintenance over capacity additions.
- Facilitate all modes of shipping.
- Use targeted strategies to reduce congestion where it impedes freight movement.

These goals are in line with NOACA's vision statement as well as the *National Freight Strategic Plan* and *Ohio Department of Transportation Comprehensive Freight Plan*. Specific objectives and performance measures (see below) will help NOACA staff prioritize projects and track progress toward goals:

- Average Truck Travel Time Reliability Index on Interstates and the National Highway System
- Pavement condition on freight intermodal connectors
- Pavement condition on corridors where either average daily truck traffic (ADTT) is greater than 1,600 or trucks make up at least 8% of all vehicles
- Number of at-grade railroad crossings on National Highway System roads with at least 19 train crossings per 24 hours, which is the average number of trains per day for all regional crossings[17]

NOACA updates the *Multimodal Regional Freight Plan* every four years to coincide with NOACA's long range plan. Additionally, NOACA drafts a "State of Freight" memo annually to document project progress and ensure advancement of performance measures. The freight community is engaged throughout to ensure transportation spending reflects regional priorities. This plan therefore provides a blueprint for NOACA and its partners to make decisions that lead to a successful and efficient freight system that advances NOACA's vision and goals.

Air Quality Public Education and Outreach Strategy & Communication Plan (2019)

NOACA developed the *Air Quality Public Education and Outreach Strategy* & *Communication Plan*. These are internal documents NOACA staff use to guide its efforts to raise awareness about persistent air quality issues in Northeast Ohio and to develop strategies to educate public stakeholders about both the problem and potential solutions.

The mission for this strategy is:

"NOACA will educate the community about the region's air quality challenges and

[17] The NOACA Multimodal Regional Freight Plan was drafted in 2016-2017, and some of the data was several years old. With updated data and changing movement patterns, the average number of trains per day is now 13, not 19. The new figure applies to all current and future freight planning efforts.

> the linkages among air quality, transportation, land use, and public health. NOACA will empower individuals and organizations to improve air quality, in particular through increased use of alternate transportation modes. NOACA will advocate for public policies that provide greater transportation choice, reduce mobile emissions, benefit public health, create economic opportunity, and enhance the quality of life in Northeast Ohio."

The team fleshed out this mission statement into specific goals, attainable objectives, and actionable items to focus NOACA's efforts. The five goals are:

1. Increase awareness of the air quality challenge in Northeast Ohio.
2. Educate the community on the causes and potential solutions for the air quality challenge in Northeast Ohio.
3. Empower employers, health-care providers, and educational institutions with resources to be air quality champions.
4. Promote a culture at NOACA that better integrates air quality with other programs.
5. Promote strategies outside NOACA to change transportation and infrastructure policy and increase clean air funding.

The strategy identifies five major target audiences: 1) the general public; 2) businesses and organizations (employers, health-care providers, religious institutions, and educators); 3) the media; 4) NOACA staff, Board, Committee, Subcommittee, and Council members; and 5) government leaders and elected officials. Additionally, the team prioritized three media categories to interact best with those audiences:

1. Owned media (website, social media, content marketing, email campaigns)
2. Paid media (social media ads, radio, television, print, and outdoor)
3. Earned media (media relationships, lunch and learns, conferences and events, Gohio Commute promotions, search engine optimization)

A communication plan is a policy-driven approach to provide stakeholders with information. Less formally, this document is a roadmap to get NOACA's message out to the right people. NOACA's *Communication Plan* to accompany the *Air Quality Public Education and Outreach Strategy* formally defines to whom NOACA should give specific information, how NOACA should deliver that information, and what communication channels NOACA should use to deliver the information. The *Communication Plan* also includes three budget ranges and corresponding message impact based on the level of investment NOACA will make to educate and engage public stakeholders about Northeast Ohio air quality.

Intelligent Transportation Systems (ITS) Strategic Plan (2019)

NOACA developed the *Northeast Ohio Intelligent Transportation Systems (ITS) Strategic Plan* as part of the agency's effort to update the region's ITS Architecture.[18] An ITS Architecture is a structured plan that defines and integrates ITS technologies at a national, state, or regional level. The ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems.[19] An ITS Strategic Plan should clearly define the region's vision for ITS implementation, identify regional ITS gaps and needs, and present feasible ITS projects to consider for short, medium, and long-term implementation. An ITS Strategic Plan aligns closely with the ITS Architecture; it supports the identification and understanding of projects to be considered and included in the regional ITS Architecture.

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[18] Cambridge Systematics, Inc. and AECOM, *Northeast Ohio ITS Strategic Plan* (September 2019) https://noaca-its.aecomonline.net/NOACA_ITSStrategicPlan_2019-09.pdf

[19] U.S. Department of Transportation (U.S. DOT), Architecture Reference for Cooperative and Intelligent Transportation, https://www.arc-it.net/

US DOT describes ITS as a broad range of communications-based information and electronics technologies that, when integrated into the transportation system's infrastructure and in vehicles themselves, relieve congestion, improve safety and enhance productivity[20] ITS includes the planning, design, and implementation of technology on transportation infrastructure and services to meet transportation needs better and reduce negative externalities on the environment. ITS technologies encompass all modes, from pedestrian activities to freight movement. The goal of ITS implementation is to enhance the mobility and accessibility in a defined region and help users go where and when they want to go in an easier, and cleaner, manner.

The *Northeast Ohio ITS Strategic Plan* aligns with NOACA's regional strategic plan goals from *Going Forward, Together*. The ITS Strategic Plan vision is to develop a roadmap to encourage efficient technology deployment to use the region's infrastructure better; enhance communication across regional stakeholders; and position the region for emerging technology. To reach this vision, the Northeast Ohio ITS Strategic Plan includes five general objectives. Table 2-4 presents a summary of the ITS Strategic Plan objectives and maps these objectives to corresponding regional strategic plan goals.

Table 2-4. Northeast Ohio ITS Strategic Plan Objectives[21]

	Regional Strategic Plan Goals				
ITS Strategic Plan Objectives	STRENGTHEN regional cohesion	PRESERVE existing infrastructure	BUILD a sustainable, multi-modal transportation system	SUPPORT economic development	ENHANCE quality of life in Northeast Ohio
Develop a complete inventory of current ITS equipment and technology	✓	✓			
Collaborate with regional stakeholders to identify regional transportation gaps and needs	✓		✓		
Identify planned and proposed ITS projects to address regional needs and emerging technology	✓		✓	✓	✓
Update the region's ITS Architecture to incorporate ITS Strategic Plan			✓	✓	✓
Develop an initial assessment of projects and a proposed project implementation strategy			✓	✓	✓

One of the objectives in Figure 2-7 is "develop an initial assessment of projects and a proposed project implementation strategy." Such a strategy builds upon identified projects and their analysis to define a path toward implementation. The ITS projects NOACA staff and the consultants identified and described the *ITS Strategic Plan* respond to a variety of needs in Northeast Ohio, from short-term solutions to current problems to long-term visions. As such, projects may have different levels of detail in concept definition; it is a challenge to compare these projects to define an implementation path.

The *ITS Strategic Plan* implementation strategy is based on a project scoring analysis. To score

[20] U.S. DOT Intelligent Transportation System (ITS) Joint Program Office (JPO), About ITS Standards; https://www.standards.its.dot.gov/LearnAboutStandards/ITSStandardsBackground

[21] Cambridge Systematics, Inc., *Northeast Ohio ITS Strategic Plan*

the different types of projects fairly, it was important to identify scoring criteria that could be comparable among the different projects and their respective stages. Through this prioritization strategy, it was possible to score the projects and rank them in order of relevance and importance to develop the implementation strategy. Based on the results obtained from the project prioritization analysis, NOACA staff put forth recommendations to promote the implementation of projects according to their expected implementation time frame (Figure 2-7).

Figure 2-7. Northeast Ohio ITS Projects Implementation Strategy[22]

8.4.1 Short term implementation (1 to 3 years)

In a short term, the region could focus on more on local projects, with low cost projects such as Signal Timing Optimization Program and the Automated Traffic Signal Performance Measures projects scoring the highest in the region. There are also plenty of signal implementation projects that could benefit the region at a low cost and fast implementation.

At the State level, there are projects that can have significant impact in the region that may be considered as an expansion of current solutions, such as "ODOT Advanced Traffic Management System (ATMS)", "Expand Traveler Information Delivery Methods" and "Freeway Management System (FMS) Expansion" projects. These projects are already operating at the State level, and could be considered in the short term for the NOACA region.

At the regional level, it is important to continue promoting ITS solutions in public transportation services, promoting the implementation of projects such as CAD/AVL on GCRTA, Laketran, and other municipal transit agencies' vehicles.

8.4.2 Medium term implementation (3 to 6 years)

In the medium term implementation, the project with the highest score was the Regional Traffic Management Center (TMC). This project, although it could represent a significant investment, could help promote other ITS solutions in the region. A regional TMC would also enhance communication within regional agencies, and allow traffic operators to implement strategies to address recurrent and non-recurrent congestion in the region.

At the state level, the project with the highest score was the Transportation Systems Management and Operations (TSMO) project. This project is currently being implemented, and it is suggested to continue promoting its implementation to enhance coordination among regional stakeholder, and improve mobility in the region.

8.4.3 Long term implementation (6 to 9 years)

In the long term, the projects with the highest scores were all State projects. In a long term future, and considering that short and medium term projects have been implemented, it is possible to consider projects and strategies that rely heavily on new technology. These projects include the "Truck Parking Information Management System (TPIMS)", "Freeway Managed Lanes", and "Freeway Speed Harmonization.

SAVE: NOACA's Plan for Transportation Safety (2019)

The purpose of *SAVE: NOACA's Plan for Transportation Safety* (aka the *"SAVE" Plan*) is to save lives in the NOACA region through strategies and actions to reduce the most severe crashes that result in fatalities and serious injuries in Northeast Ohio.[23] The *SAVE Plan* is a localized

[22] Ibid.
[23] Northeast Ohio Areawide Coordinating Agency (NOACA), *SAVE: NOACA's Plan for Transportation Safety* (Cleveland: Northeast Ohio Areawide Coordinating Agency, May 2019); https://www.noaca.org/home/showpublisheddocument/23712/636928352508970000

companion document that supports ODOT's *Strategic Highway Safety Plan* (SHSP), which is the cornerstone of the federal Highway Safety Improvement Program (HSIP) in Ohio.

NOACA developed the *SAVE Plan* with the vision that traffic deaths and injuries are preventable with appropriate planning, policies, and programs. The long-term goal is to reduce the number of fatalities and serious injuries by 50% by the year 2040. Regional data from State of Safety reports helped NOACA identify emphasis areas to reflect regional safety priorities. NOACA, its member communities, and its partner agencies identified and quantified the magnitude of the problem in specific emphasis areas to focus the collective resources of the region on what is most critical to improve safety for all road users. These areas are where NOACA trends higher than the state average, as well as other key statewide areas. The 10 emphasis areas are Intersection, Roadway Departure, Young Driver, Speed, Impaired Driving, Older Driver, Distracted Driving, Pedestrian, Motorcycle, and Bicycle.

A safer transportation network requires stakeholders to address the interaction among the infrastructure, vehicles, and the skill and behavior of travelers. To this end, the strategies and actions recommended in the *SAVE Plan* incorporate a "6 E's" approach into the safety planning process: engineering, education, enforcement, emergency response, evaluation, and equity. All play a key role in the prevention of severe crashes and saving lives in the areas of greatest need. As an MPO, NOACA is well suited to take action on strategies related to "evaluation" and "engineering," given that a primary function of MPOs is to coordinate the planning and implementation of transportation infrastructure throughout the region.

Because technical analysis is one of NOACA's strengths, actions that support the strategies of the *SAVE Plan* tend to focus on the analysis and evaluation of crash data at the regional level. Perhaps the most important task staff perform in support of the *SAVE Plan* is to identify regional safety priority locations through evaluation of historical crash performance at intersections and along roadway corridors. Regional safety priority lists account for the total number of all crashes and the combined number of fatalities and serious injuries (FSIs) that have occurred at intersections or along one-mile defined-length corridors along *all* roads (not just numbered state routes like ODOT's HSIP lists) in the region's non-freeway network. Locations that experience FSIs received greater emphasis over the total count of all crashes to align regional priorities with the national emphasis outlined in the FAST Act.

NOACA has recently embarked on a safety initiative to develop a predictive method for urban and suburban arterial streets and intersections in all cities and villages in the region. This study has four objectives:

- Provide a structured methodology and develop predictive models to estimate the expected average crash frequency and crash severity
- Produce a separate safety report for each community in the NOACA region
- Prioritize the expected crash locations locally and regionally
- Recommend crash mitigation remedies to communities

This study applies the Highway Safety Manual methodology and uses the crash data for the calibration stage of the developed predictive models. The results will help cities and villages rank safety priorities on arterial streets and intersections within their jurisdictions for individual communities.

NOACA also recognizes the importance of other "E's," and can support partners to improve the "behavior" elements of transportation safety through its stature as a regional leader. NOACA can connect the planners, engineers, and officials at local governments with resources that support and promote actions directed toward "education," "enforcement," and "equity."

Workforce Access and Mobility Study (2019)

Transportation access for workers to jobs is important to the economic vitality of a region, as well as a social issue.. NOACA conducted its *Workforce Access and Mobility Study* to analyze the accessibility of job hubs in the region with a mathematical model, and to recommend strategies to improve access and mobility of workers.[24] The study examines both the number of available workers in an area and transportation (workforce information). The commute time during the morning peak period is the most important concern for workers (by personal vehicle and transit). The combination of travel time measure with workforce information provides a powerful transportation planning tool.

The *Workforce Access and Mobility Study* also presents annual benefits of travel time and congestion savings for each percent of the worker-employer mismatch reduction and recommends a number of transportation and land-use solutions to alleviate the overall strain to the transportation system these mismatches cause. To reduce mismatches and implement the study's recommendations, NOACA staff recommended the following transportation and land-use solutions:

- Transit Solutions
  - Schedule more frequent express and local buses to major regional job hubs
  - Implement low-cost traffic engineering solutions at identified arterial bottleneck locations on transit routes
  - Extend the transit network to/from major regional job hubs and intercounty transit services
  - Add more park-and-ride locations throughout the region
  - Dedicate highway lanes to express buses and car pools
  - Develop more bike lanes to access major transit stations
- Land-use Solutions
  - Encourage mixed-use development along existing major transit corridors
  - Encourage mixed-use development around job hubs
  - Support policies for housing development closer to job hubs
  - Encourage businesses to locate near existing transit services, particularly rail and bus rapid transit
- NOACA Policies
  - Support and prioritize transportation funding, especially transit expansion and enhancements around major regional job hubs
  - Support and prioritize funding for multimodal accessibility to job hubs and connections to transit services
  - Support a regionalized transit system—intercounty transit routes and expansion of park and ride systems
  - Encourage efficient mixed-use development
  - Implement a mobility-accessibility study for any current and potential employment centers

The *Workforce Access and Mobility Study* can encourage businesses and government organizations to consider siting their locations near the workforce during the planning and decision-making process to create shorter work commutes. Business site selection and housing incentive programs should attempt to match the industry sectors of existing employment centers with workers of a required skill set who reside within a shorter distance. Such approaches will

[24] Northeast Ohio Areawide Coordinating Agency (NOACA), *Workforce Access and Mobility Study* (Nov. 2019); https://www.noaca.org/home/showpublisheddocument/24551/637117481132970000

save commute time, alleviate traffic congestion, reduce accidents, and mitigate pollution to enhance quality of life.

Hyperloop Feasibility Study (2019)

On February 26, 2018, the Northeast Ohio Areawide Coordinating Agency (NOACA) and Hyperloop Transportation Technologies (HTT) entered into a public private partnership to complete a feasibility study for the technical analysis and evaluation of a Cleveland, Ohio to Chicago, Illinois and Pittsburgh, Pennsylvania corridor; known as the Great Lakes Hyperloop Feasibility Study. The project launched on July 1, 2018, with the feasibility study being completed December 2019. NOACA also conducted a peer review of the feasibility study with participants from Cleveland State University, Carnegie Mellon, The University of Illinois Chicago and Northwestern University to provide an independent review of the project framework, assumptions, and analysis approach. The project had many collaborating partners such as: Illinois Department of Transportation, Indiana Toll Road, Federal Highway Administration, NASA, Eastgate Regional Council of Governments, Erie Regional Planning Commission, Southwestern Pennsylvania Commission, Team NEO, and Toledo Metropolitan Area Council of Governments.

The feasibility study assessed the technical and financial feasibility for the environmental, financial, operational, and structural requirements to create a Hyperloop Transportation System. The feasibility study also addressed the requirements for building and achieving optimal alignment of the system, siting requirements for location of major structures, assessing the constraints on alignment of the system, integrating the Hyperloop transportation system with existing transportation infrastructure, and identifying issues with construction of the optimized system.

The Feasibility Study for the Great Lakes Hyperloop revealed positive financial and cost benefit results creating a strong case for developing the corridor connecting Chicago, Cleveland and Pittsburgh as a passenger and freight system. As a result of these positive findings the Preliminary Development phase becomes the next necessary step forward in the project development process.

Clean Water 2020 (2020)

NOACA is one of six Areawides designated by the Ohio governor to develop and implement wastewater management and water quality plans (208 plans) as required by Section 208 of the Clean Water Act (CWA). NOACA's 208 plan, *Clean Water 2020*, guides local water quality improvement efforts.[25] Within the plan, NOACA designate the management responsibilities for wastewater, point source, and nonpoint source pollution control within Northeast Ohio. *Clean Water 2020* is a comprehensive update of *Clean Water 2000* and serves as the region's wastewater management and water quality plan for the next 20 years.

Clean Water 2020 focuses on the protection and restoration of water resources in a region where the population has slowly declined while it has spread out over a larger area. This pattern of lower density and a larger development footprint results in higher funding demands from fewer people both to construct new infrastructure and to maintain existing, aging infrastructure. *Clean Water 2020* emphasizes the optimization of existing infrastructure; minimization of development impacts associated with sanitary sewer extensions; protection of regional water quality improvements; support for watershed planning, protection, and restoration of critical water resources; and support for efforts to manage stormwater runoff and on-site sewage treatment systems.

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[25] Northeast Ohio Areawide Coordinating Agency (NOACA), *Clean Water 2020* (Sept. 2020); https://www.noaca.org/home/showpublisheddocument/25346/637359378998830000

The following goals served as a framework for the development of *Clean Water 2020*:

1. Optimize investment in existing infrastructure to support existing and infill development and not encourage new development on greenfield sites.
2. Provide a framework for locally determined development density that mitigates water quality impacts.
3. Protect regional water quality gains and guide implementation measures to improve water resources that do not yet meet designated uses.
4. Support programs that address stormwater and sewage treatment systems management.
5. Protect and restore valuable water resource areas.
6. Support watershed planning activities that address point and nonpoint source pollution.
7. Educate local decision makers on regional water quality management issues.
8. Create a plan that can meet the future water quality needs of Northeast Ohio.
9. Educate and solicit support for implementation of *Clean Water 2020*.
10. Allow flexibility in the plan to adapt to changes in future water quality needs of Northeast Ohio.

Regional Strategic Transit Plan (2020)

In the last few decades, the NOACA region has experienced significant changes in population, land use, travel patterns, and funding mechanisms. These changes have led to population shifts from urban to suburban/exurban areas; employment shifts from the core cities to edge communities; and lower transit ridership. Several previous efforts have called for a more strategic and cohesive approach to regional transit: NOACA's *Going Forward, Together*; the 2014 *Ohio Statewide Transit Needs Study*, *Build Your Own Transit System*; and results from *CrowdGauge*.

The purpose of the recently completed *Regional Strategic Transit Plan* is to support the development of a cohesive and coordinated vision for public transit investment in the NOACA region. The five public transit agencies in the region are Greater Cleveland Regional Transit Authority (GCRTA), Laketran, Lorain County Transit (LCT), Medina County Public Transit (MCPT), and Geauga County Transit (GCT). This study sought to do the following:

1. Analyze current transit service, needs, gaps, and areas of potential improvement and enhancement; analyze the projected future population and service needs (regional); determine the transit options required to serve the NOACA region effectively as well as how to best connect the region over a 10-year horizon.
2. Develop a plan that supports the development of a cohesive, coordinated vision for investment in public transit on a regional scale; identify opportunities, advantages, disadvantages, and barriers to service enhancement or service expansion.
3. Improve coordination of the five current public transit agencies listed above and examine opportunities for enhanced regional coordination with neighboring public and private transit systems and providers.
4. Analyze current funding mechanisms and determine potential new sources of funding necessary to meet projected needs.
5. Prepare a strategic plan that identifies strategies to enhance mobility across the region (see Table 2-5).

Table 2-5. Summary of Recommended Action Strategies[26]

Short-Term Actions (1 to 5 Years)	Long-Term Actions (5 to 10 Years)	Aspirational Actions (5-to 10 Years with further investigation)
• Expansion of demand response service design to enhance intercounty service – Alignment of eligibility criteria – Development of cost-sharing for cross-boundary service where warranted for seamless transit	• Intercounty transit service – Commuter services to University Circle	• Regional high capacity transit – Explore additional connections: – Lorain/Elyria–Westlake-Rocky River-Lakewood-Cleveland – Cleveland-Solon
• Multi-jurisdictional procurement and support – Consider single procurement for service contractors – Advance existing NEORide initiatives for joint vehicle and equipment procurements – Consider centralized scheduling and dispatching for regional demand response transit – Continue to collaborate through active information technology (IT) planning on shared IT services	• Regional Service – Micro mobility, shared use mobility, active modes	• Connections to Areas Outside NOACA (High-Quality Transit/DR/MB) – Canton-Akron-Cleveland – Medina-Akron bus route – Existing plans for intercity transportation
• Unified regional transit information systems – Provide unified graphics and combined route maps to support cohesive regional transit – Provide regional transit information helpline or website. (e.g., 411 number)	• Support Functions – Shared administrative functions	• Regional Transit Funding – Allocation of benefit from cross boundary travel – Contributions from existing public assistance sources – Innovative plans for additional funding to capture regional synergies
• Coordinated regional fare policies – Encourage the use of existing unified fare collection systems – Coordinate regional fare structures	• Customer Interface – Fare policy alignment	

New and Updated Plans

Beyond the plans used as the basis for *eNEO250*, new and updated plans were introduced to support the foundation of *weNEO2050+.* Their descriptions and relevance are described below:

- eNEO2050 (2021)
- Community Safety Reports (2022 and 2025)
- Comprehensive Economic Development Strategy (2023)
- Brownfields Revolving Loan Fund Program (2023)
- Water Quality Strategic Plan (2023)
- Priority Climate Action Plan (2024)
- Coordinated Public Transit-Human Services Plan (2024)
- Freight Plan (2025)
- Congestion Management Plan (2025)
- Regional Metroparks Trails Connectivity Study (2025)

eNEO2050 (2021)

It is apparent that *eNEO2050* is the single most influential document undergirding *weNEO2050+*. This long range plan, completed in 2021, represented a major overhaul to the prior Long Range

[26] NOACA Regional Strategic Transit Plan (2021

Transportation Plans. Characterized by the significant public outreach and engagement, the plan took 18 months to complete and offered a more comprehensive approach to transportation planning. It stressed the interrelationships between transportation and land use, economic development, housing, health and the environment. It also utilized scenario planning for the first time, allowing stakeholders to view impacts of various transportation proposals. It was developed as two documents in one, with a resource document as the plan itself and the vision document as a synthesis of the plan in an easy to read format focused on visuals.

The documents can be found in Appendix 2-1 and 2-2.

Community Safety Reports (2022 and 2025)

NOACA has incorporated Systemic Safety and the Safe System Approach into ongoing safety programs to make a system that protects road users even after errors. This approach uses crash prediction models based on roadway and traffic characteristics to estimate the expected average crash frequency along arterials and significant intersections, along with examples of countermeasures and cost-benefit analyses. This process is taken from the Highway Safety Manual (HSM), produced by the American Association of State Highway and Transportation Officials (AASHTO). It provides predictive methods for estimating it by road network, facility, or individual site involving vehicles, motorcycles, bicycles, and pedestrians. Combining these expected future crash locations with observed crash history sites will result in safety improvement projects with higher efficacy. The predictive method may also be used without high-quality historical site-level crash data or where there is no history of reported crashes.

The NOACA systemic safety approach considers 1,047 centerline miles and 3,240 lane miles of arterial roadways within the region. This safety analysis separated the arterials by jurisdictional boundaries into 925 distinct segments and evaluated 512 major intersections based on their roadway and traffic characteristics.

The NOACA Systemic Safety Management approach is community-based, and specific Safety Performance Functions (SPFs) are being developed for each community based on road inventory, traffic volume, and crash data. This approach also uses the FHWA Crash Modification Factors (CMF) that indicate how much crash experience is expected to change following a design or traffic control modification. CMF is the ratio between the number of crashes per unit of time expected after a modification or measure is implemented and the number of crashes per unit of time estimated if the change does not take place.

The biannual Community Safety Reports help to prioritize transportation safety concerns. Each community receives a list of the most dangerous arterial segments and intersections of two arterials within their city limits, ranked by predicted average annual crashes using formulas from the Highway Safety Manual.

The current NOACA Community Safety Reports (CSR)[27] included a summary of the Federal Highway Administration's (FHWA's) Proven Safety Countermeasures (PSC). These community-based reports include a cost-benefit analysis of select PSCs to assist communities in making decisions about possible implementation.

The equipment cost component of the conducted cost-benefit analysis was derived from FHWA's PedBikeSafe database and inflated to 2024 dollars through Net Present Value (NPV) calculations. The benefit side of the analysis was calculated based on formulas from AASHTO's Highway Safety Manual for predicted crashes based on roadway configurations multiplied by the average

[27] https://www.noaca.org/community-assistance-center/planning-assistance/community-safety-reports

crash cost calculated through proportions of crashes of different severities with the human error percentage applied.

Comprehensive Economic Development Strategy (2023)

The U.S. Economic Development Administration (U.S. EDA) recommends a regional Comprehensive Economic Development Strategy (CEDS), a strategy-driven plan to bring together stakeholders and the general public to develop consensus around economic development goals and a strategy to meet them. NOACA's regional standing is directly attributed to its stakeholders and allows the stakeholders to engage in meaningful conversation on how economic growth should occur in the region. NOACA began development of its CEDS[28] in 2022 and it was approved by the U.S. EDA in the Spring of 2023. More than 20 regional agencies and partners came together to develop the CEDS which provides the foundation for stakeholders to align funding and create the proper environment for regional economic prosperity.

The CEDS Steering Committee and Working Group were the architects of the document which identified seventeen key topic areas from review of existing plans, statistical data, stakeholder input, surveys, and a Strength, Weakness, Opportunity and Threat (SWOT) analysis. The SWOT analysis process revealed the following key topic areas:

- Access to Broadband
- Aerospace / NASA Glenn
- Agriculture
- Cultural Amenities
- Education
- Equity
- Healthcare
- Housing
- Immigration
- Innovation and Entrepreneurship
- Institutions – Regional Collaboration, and Urban and Rural Connectivity
- Manufacturing
- Parks and Recreation
- Tourism
- Transportation
- Water Resources
- Workforce Development

The topics are interrelated areas to be addressed by the CEDS. Each topic area addresses strategies, outcomes, and potential partnerships. The CEDS also contains strategic direction and an action plan and should incorporate and be incorporated into other local and regional planning efforts. It is a document that requires implementation and maintenance.

Brownfields Revolving Loan Fund Program (2023)

In 2022, the US EPA awarded a $1,000,000 Brownfield Revolving Loan Fund (RLF) Grant to the NOACA and Vibrant NEO Coalition (the Coalition). The RLF supports the clean-up and subsequent redevelopment of brownfield sites through loans and sub-grants, depending on the reuse of the property. Grant funds are utilized to clean up both hazardous and petroleum substances at properties located in a 12-county region of Northeast Ohio (Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, and Wayne). Target

[28] https://www.noaca.org/home/showpublisheddocument/28754/637992811439130000

areas within these counties are Vibrant NEO-defined Strategic Reinvestment Areas, or Asset Risk Areas; these are areas with a high density of community assets and existing infrastructure to support redevelopment.

In March 2023 the NOACA Board of Directors approved a resolution that created a Brownfields Steering Committee to develop and implement the RLF grant. It consists of 29 members, 26 of whom are voting members, from the 12 counties within the Coalition area. Coalition representatives developed selection criteria, based on each site's potential:

- For sustainable, catalytic redevelopment;
- To mitigate a site's negative impact on the community (environment, public health, nuisance, and environmental justice);
- Location within the target areas;
- Opportunities to provide gap financing to encourage work on high-risk sites in vulnerable communities;
- Degree of community interest/concern in revitalizing the site;
- Conformance with local strategic plans; and
- Proximity to a waterbody or residential neighborhood.

The Brownfield Steering Committee reports as needed to the NOACA Board of Directors and Vibrant NEO Board of Directors, both of which meet quarterly. The NOACA Board of Directors consists of elected officials from five of the 12 counties. The Vibrant NEO Board of Directors contains elected officials, as well as representatives from the private and non-profit sectors, across the 12-county region. The Coalition retained a consultant as the Qualified Environmental Professional (QEP) to assist with site eligibility determination, environmental report reviews, and remediation oversight.

In March 2024, the Coalition applied to the US EPA for supplemental funding and was awarded an additional $1,000,000 in September 2024. As of December 31, 2024, four loans have been approved, totaling $1,508,000. As loans are repaid, the funds will be made available for additional remediation projects. NOACA staff continue to seek supplemental funding to further grow the RLF program.

Water Quality Strategic Plan (2023)

NOACA's *Water Quality Strategic Plan* (WQSP) was updated in 2023 and builds upon the updated, consensus-driven mission, goals, objectives, and strategies to guide the staff-supported work of the agency.[29] NOACA's WQSP guides the work of NOACA's water quality planning staff over a five-year planning period. Staff updated the 2023 WQSP Goals and Objectives in response to both ongoing and new regional water quality issues. Additionally, the 2023 WQSP reflects the changes in population and households as reported by the 2020 Census and summarized by NOACA's Census 2020 Technical Analysis Report.[30] The 2023 WQSP also considers land use trends associated with changes in population and households that affect water resources and infrastructure in both rural and urban communities.

As the designated "Areawide," NOACA is responsible for water quality and wastewater planning in Northeast Ohio and prepares a 208 Plan (see below) as required by the federal Clean Water Act.[31] While there has been marked improvement, there remains a widespread threat to water

[29] Northeast Ohio Areawide Coordinating Agency (NOACA), *Water Quality Strategic Plan* (December 2023); https://www.noaca.org/home/showpublisheddocument/30771/638385800419370000
[30] Northeast Ohio Areawide Coordinating Agency (NOACA), *Census 2020 Technical Analysis Report* (February 2022); https://www.noaca.org/home/showpublisheddocument/27763/637856175513800000
[31] Areawide Councils of Governments act as the lead planning agencies in 24 Ohio counties (those with

quality in Northeast Ohio from nonpoint source pollution carried by stormwater runoff from paved surfaces, rooftops, lawns, and farms.

In response to the water quality threats that persist, NOACA staff collaborated with members of NOACA's Water Quality Subcommittee to update and refine the WQSP's mission and goals:

Revised Water Quality Strategic Plan Mission Statement

"As a designated areawide planning agency and a metropolitan planning organization, NOACA will maintain and update the region's Water Quality Management (208) Plan. NOACA will support the restoration, protection, and sustainable use of water. NOACA will provide leadership, planning and technical assistance to advance Northeast Ohio's quality of life through the management of water as a valuable resource."

Revised Water Quality Strategic Plan Goals

The WQSP goals are intended to be broad and long range, and guide NOACA's water planning work.

1. Provide planning and technical support to protect and restore Lake Erie and the region's valuable water resources.
2. Protect the region's water quality/quantity to support regional economic competitiveness
3. Identify and inform communities & organizations about the impacts of local decisions on valuable regional water resources and infrastructure.
4. Advance the philosophy of "One Water" through NOACA's water planning work.
5. Within NOACA's internal structure, address potential water quality & quantity impacts related to climate change on the region's transportation and water infrastructure.

The 2023 WQSP also reevaluated, revised and updated the objectives and implementation strategies for each of the goals. Staff will need to review and update the WQSP in 2028 to ensure that it remains a dynamic, guiding document for NOACA's water quality planning and technical work.

Priority Climate Action Plan (2024)

The 1969 Cuyahoga River fire fanned a smoldering environmental movement into a roaring protest against the devastating impact of human pollution on the nation's waterways, air quality and natural ecosystems. The result was the United States Environmental Protection Agency (US EPA) and an unprecedented wave of federal regulation to counter polluters and protect our fragile environment. More than 50 years later, another daunting challenge to our global sustainability in the form of climate change has prompted the US EPA to take dramatic steps to spur regions, states, tribes, and territories across the nation to counter the climate challenge.

The Priority Climate Action Plan (PCAP)[32] represents the first key outcome in a major climate planning initiative for the entire Cleveland-Elyria Metropolitan Statistical Area (MSA). It builds on previous and ongoing climate action plans at the municipal and county level. The regional greenhouse gas inventory highlights the significant contribution of electricity generation and

large urban populations). These Areawide Agencies prepare and approve the 208 Plan in their counties. The State of Ohio prepares and maintains the 208 Plan applicable in the remaining 64 counties. The Governor then certifies the entire 208 Plan via submission to US EPA for their approval (https://www.epa.ohio.gov/dsw/mgmtplans/208index)

[32] Cleveland-Elyria Metropolitan Statistical Area Priority Climate Action Plan (March 2024) https://www.eneo2050.com/_files/ugd/2114d4_9aa04a96e04f43b4823270eb196196b6.pdf

transportation sources to climate change. Given the high contribution from these sources, the projected emissions reductions from the electricity, building efficiency, steel manufacturing and transportation priority measures (actions) exhibit relatively high impact toward emissions reductions. These are the greatest areas of opportunity to mitigate climate change in Northeast Ohio, while expansion of forests and restoration of tree canopy offer opportunity for carbon sequestration.

The Cleveland-Elyria MSA is an extremely diverse region and spans the full spectrum of legacy industrial, inner-ring suburban, contemporary exurban, and rural communities (including small villages and historical Western Reserve towns). The priority measures in the PCAP evolved from direct, multi-modal engagement with decision-making, technical, and public stakeholders. The measures comprise a menu of potential actions to reduce GHG emissions that provide communities with options to best fit their respective needs.

Section 60114 of the 2022 Inflation Reduction Act (IRA) appropriated $5 billion to US EPA for its CPRG efforts. This money will support states, territories, municipalities, tribes, and similar groups in their development and implementation of greenhouse gas (GHG) emission reduction plans. The total amount of appropriated funds goes toward the following:

- Phase I planning grants ($250 million for eligible entities to develop GHG emissions reduction plans); each of the 67 most populous MSAs received $1M to produce the following three deliverables during the award period (2023-2027)
    - Priority Climate Action Plan (PCAP): due March 1, 2024
    - Comprehensive Climate Action Plan (CCAP): due December 1, 2025
    - Status Report: due mid-2027
- Phase II implementation grants ($4.6075 billion for grants to GHG emissions reduction measures from funded plans)
- Administrative costs ($142.5 million)

The Northeast Ohio Areawide Coordinating Agency (NOACA) and the City of Cleveland partnered on a CPRG workplan and budget to help scale up established local climate action planning and pollution reduction efforts to the regional level.

The Cleveland-Elyria Metropolitan Statistical Area (MSA) Priority Climate Action Plan (PCAP), approved March 7, 2024, includes all the elements required by US EPA:

- GHG inventory
- GHG reduction (priority) measures
- Low Income/Disadvantaged Communities (LIDAC) benefits analysis
- Review of authority to implement for each measure

In addition to the required elements, the Cleveland-Elyria MSA PCAP also touches on benefits, costs, intersection with other funding availability, and workforce implications for each of the priority measures. The Cleveland-Elyria MSA CPRG Program planning team will reserve its analysis and presentation of GHG emissions projections, GHG reduction targets, and in-depth quantitative analysis of priority measures (benefits, costs, intersection of funding, and workforce planning) for the Comprehensive Climate Action Plan (CCAP), due December 1, 2025.

Coordinated Public Transit-Human Services Plan (2024)

NOACA's Coordinated Public Transit-Human Services Transportation Plan for Northeast Ohio Update (Coordinated Plan) [33] is a federally mandated coordinated transportation plan for

[33] Coordinated Public Transit-Human Services Transportation Plan for Northeast Ohio Update (Dec.

Cuyahoga, Geauga, Lake, Lorain, and Medina counties.[34] This coordinated plan serves as the required four-year update and builds upon NOACA's 2019 Coordinated Plan, "*Mobilize: Accessibility for Independence*." This Plan focuses on the transportation needs of seniors and persons with disabilities and barriers surrounding their mobility.

All projects that are selected for funding under the Federal Transit Administration's (FTA) Enhanced Mobility for Seniors and Individuals with Disabilities (49 U.S.C. Section 5310) program are required to be included in a Coordinated Plan. By law, coordinated plans must be "developed and approved through a process that includes participation by seniors, individuals with disabilities and representatives of public, private and non-profit transportation."

NOACA is the designated recipient of those federal funds for the Cleveland Urbanized Area (UZA), which includes Cuyahoga, Lake, and portions of Lorain and Medina Counties. NOACA began an update of its Coordinated Plan in the summer of 2024 by holding a series of public meetings and stakeholder and community events throughout the region. The process also included surveys to providers/stakeholders and clients/riders to collect more feedback and better identify transportation needs for seniors and individuals with disabilities. From this input, the Coordinated Public Transit-Human Services Transportation Plan for Northeast Ohio was crafted and adopted by the NOACA Board of Directors in December 2024. The next scheduled update period for the plan will begin in 2028.

The Coordinated Plan includes:

- An assessment of available transportation services that identifies current providers
- An assessment of transportation needs for target populations
- Strategies and activities to address identified gaps and redundancies in services
- Prioritization for implementation of strategies and activities based on resources, feasibility, and time
- Federal law requires that projects submitted under the Enhanced Mobility for Seniors and Individuals with Disabilities Program (Section 5310) be included in and consistent with the goals of the Coordinated Plan.

Freight Plan (2025)

The NOACA region, contributing approximately 20% of Ohio's Gross Domestic Product (GDP), ranks as one of the largest economies in Ohio state. This region's economy encompasses over two million residents, 900,000 households, one million workers, 1.4 million jobs, and 309,000 business establishments. This extensive economic activity creates a substantial demand for freight transportation planning to efficiently facilitate goods movement into, within, and out of the five-county region. The combination of trucks accounts for almost 8% of Vehicle Miles Traveled (VMT) on the region's highways and streets network.

Freight operations are generally evaluated by main performance measure categories of Travel time reliability, freight network condition, congestion, safety and environmental impacts, Freight demand, Freight parking, Freight efficiency, etc.

The NOACA region has five primary modes of freight transportation: Road, Air, Rail, Pipeline, and

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2024), https://www.noaca.org/home/showpublisheddocument/32409/638744366627900000

[34] Lorain County completed a local Coordinated Public Transit-Human Service Transportation Plan (HSTP) Update in 2023 for Lorain County. Since the majority of Lorain County is outside of the Cleveland Urbanized Area (UZA) and is included in the Lorain Urbanized Area, the Lorain County HSTP was developed by United Way of Lorain County. The inventory of services that was included in the Lorain County HSTP is referenced within NOACA's Coordinated Plan.

Water. Trucking is the predominant mode of freight transport. In 2024, there were over 2,300 crashes involving trucks in the NOACA region, which is over 9.8% of the total crashes. There were 115 fatal and 737 serious injuries; 10 of those deaths and 34 serious injuries were attributed to trucks.

Truck parking shortages are a national safety concern. The current number of truck spots in the NOACA Region is estimated at 1,688, which is about 10 and 47 spaces per each million dollars of GDP and 100,000 daily VMT, respectively. According to Jason's Law Truck Parking Survey results, it is required to add almost 30 truck parking spaces every year to achieve 2,500 truck parking spaces in 2050. The average truck parking space per 100,000 daily truck VMT will almost be 68 in 2050, a 40% increase.

Based on the calibrated and validated NOACA travel forecasting model, the truck VMT for the future planning year of 2050 increases by a few percentages, but the model outputs suggest that truck through traffic in the NOACA region is expected to increase by 1/3.

The Truck Travel Time Reliability System (TTTR) Index is a national performance measure that evaluates the consistency of commercial truck travel times on the Interstate system. An index value of 1.0 is the lowest (and optimal) possible score, representing perfectly uniform travel speeds. This index is currently around 1.10 for truck routes, highways, and arterials in the NOACA region and stays the same in the future planning year of 2050. For comparison, the ODOT target for the measure is 1.5, and the state index was at 1.22 in 2023.

There are 474 at-grade rail crossing intersections in the NOACA region. Effective management of rail crossings is critical for facilitating freight movement while ensuring the safety and efficiency of transportation networks. Chapter 5 discusses a prioritization approach for rail crossings based on their impact on freight traffic, identifying critical crossings that require immediate attention or improvement.

The final chapter introduces a few selected innovative freight topics that will most likely be adopted by freight companies for good movements in the next decades. The Connected and Automated Vehicle (CAV), drone, and Intelligent Transportation System (ITS) are the most plausible innovative technologies for good movements. The HAZMAT transportation and wildlife habitat considerations are the last discussed topics.

Congestion Management Plan (2025)

Congestion management is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods. A CMP, as defined in federal regulation, is an objective-driven and performance-based process that intends to integrate effective management and safe operation of the existing multimodal transportation facilities.

The CMP is intended to be an ongoing process and fully integrated into the updated LRTP. The CMP is continually evolving to improve transportation system performance measures, address concerns of communities and ultimately achieving NOACA objectives and goals.

The purpose of the NOACA congestion management plans is to:

- Identify the spatial and temporal characteristics of traffic congestion in the region,
- Measure the congestion severity, duration, extent, and variability, and
- Develop congestion mitigation strategies for enhancing the mobility of people and goods in the NOACA region.

In consonance with the FHWA's purposes, three of the regional strategic plan goals have been adopted as the main focus of the NOACA congestion management plans, and they are;

- System preservation,
- Provision of a safe and efficient multimodal transportation system for all travelers, and
- Advance the region's economic conditions and improve quality of life based on sustainable development.

The current planning demi-decade and future planning decades for the NOACA congestion management are 2025 -2030, 2031-2040, and 2041-2050 and each plan will be evaluated during the third and sixth years of its implementation.

Congestion management objectives define what the NOACA region intends to achieve regarding the traffic congestion management process every decade cycle. A set of Specific, Measurable, Agreed, Realistic, and Time-bound (SMART) objectives were established for each planning decade. These regional and local objectives of each planning decade are also the continuation of the prior planning decade's objectives, and the continuity will eventually fulfill the NOACA regional strategic goals. It should be noted that the congestion management objectives are a subset of the NOACA long-range objectives and goals and thus focus on providing a multimodal transportation system and strategies to alleviate traffic congestion.

During the third and sixth years of each decade cycle, a monitoring procedure will be invoked to evaluate the progress and effectiveness of the implementation of the congestion management plans, and adjust or update their objectives, if necessary.

The congestion management plan objectives have been developed based on the following guidelines:

- Reduce average delay per traveler during peak periods,
- Increase the percentage of Non-Single occupancy vehicles,
- Regulate the flow of traffic entering freeways,
- Increase the efficiency of interchanges,
- Increase capacity of non-freeway corridors,
- Increase transit accessibility, and
- Increase transit and non-motorized mode shares.

Regional Metroparks Trails Connectivity Study (2025)

The Regional Metroparks Trails Connectivity Study (RMTCS) provides substantial benefit to the NOACA region by laying out a plan to expand the region's trail network that serves users of all ages and abilities. When fully built out, this network will connect many parks, neighborhoods, schools, and employment & shopping destinations for recreation and utility. NOACA partnered with Cleveland Metroparks, Geauga Park District, Lake Metroparks, Lorain County Metro Parks, and the Medina County Park District to establish a framework for this region-wide multi-modal trail network expansion, which will be developed over the next 25 years and beyond.
Project goals were organized into three groups: Connectivity & Access, All Modes & All Purposes, and Environmental Impact. These goals provided clear direction throughout the process of developing the plan and informed the development of technical criteria applied in a phase-based approach which included analyses of existing conditions, trip potential, network alternatives, and proposed facility scoring.

Implementation of the proposed network is organized into short-, mid-, and long-term project priorities, based on park district and stakeholder needs, public input, recent facility development

efforts, and facility scoring, resulting in a network that addresses each county's opportunities and challenges. Building out the network will improve connectivity and access for non-motorized trips of all types, increase mode share for walking and biking, improve public health and safety, and reduce the region's carbon footprint. To realize and maximize these benefits, NOACA will continue to evolve the plan with the partnership of regional stakeholders, including trail users, member jurisdictions, counties, watershed conservancies, and park districts.

Review of Metropolitan Planning Organizations Long-Range Transportation Plans and Regional Transportation Plans

Very early in the NOACA visioning process for the scope of its baseline *eNEO2050* long range plan, NOACA staff conducted a review of metropolitan planning organizations' (MPO) long range transportation plans (LRTPs) and regional transportation plans (RTPs), along with associated documents. The review covered 11 such plans from peer MPOs during the first quarter of 2020. NOACA staff conducted a review of various plan elements and public participation plans. NOACA used this review to establish a framework for further *eNEO2050* thematic development. Table 2-6 lists the documents that NOACA staff reviewed.

Table 2-6. Long Range Transportation Plans and Regional Transportation Plans Included in NOACA Staff Review

MPO Agency	Location	Document Plan Name
Atlanta Regional Council (ARC)	Atlanta, GA	*The Atlanta Region's Plan 2050*
Chicago Metropolitan Agency for Planning (CMAP)	Chicago, IL	*On to 2050 Long-Range Plan*
Ohio-Kentucky-Indiana Council of Governments (OKI)	Cincinnati, OH	*2040 OKI Regional Transportation Plan*
The Mid-Ohio Regional Planning Commission(MORPC)	Columbus, OH	*2020-2050 Metropolitan Transportation Plan*
Denver Region Council of Governments (DRCOG)	Denver, CO	*Metro Vision 2050*
Houston-Galveston Council of Governments (HGAC)	Houston, TX	*HGAC 2045 Regional Transportation Plan*
Mid-America Regional Council (MARC)	Kansas City, MO	*Connected KC 2050*
South California Association of Governments (SCAG)	Los Angeles, CA	*SCAG 2012-2035 Sustainable Communities Strategy*
Southwest Pennsylvania Commission (SPC)	Pittsburgh, PA	*SmartMoves for a Changing Region 2050*
Wasatch Front Regional Council (WFRC)	Salt Lake City, UT	*Explore. Choose. Prioritize. Implement. 2050 Regional Plan*
The San Diego Association of Governments (SANDAG)	San Diego, CA	*SANDAG 2050 Regional Plan*

NOACA staff learned that the majority of reviewed documents dated to within the past five years and used a 30-year planning horizon. This makes sense because FHWA requires MPOs to update their LRTPs every four years and use a minimum 20-year planning horizon. During its review process, NOACA staff discovered commonalities among the 30+ plan elements included in these 11 plans. Many of these themes were consistent across all the MPO plans NOACA staff reviewed. Figure 2-9 shows a word cloud NOACA staff created to highlight the themes that appeared most frequently across the plan elements. For readers who may not be familiar with the term, a word cloud is an electronic image that shows words used in a particular piece of electronic

text or series of texts. The words are different sizes according to how often they are used in the text.[35]

Figure 2-8 portrays several themes quite prominently, which became central to *eNEO2050* and subsequently *weNEO2050+*:

- Transportation Choices
- Placemaking
- Livability
- Mobility
- Vitality
- Environmental Justice

Figure 2.8: Summary of Plan Element Themes

NOACA staff also reviewed the MPOs' public participation plans for ideas on how to elevate the regional transportation conversation to diverse audiences in multiple formats. Many of the MPOs' plans illustrated engagement in various formats. These formats ranged from traditional, "in-person" community meetings and workshops to innovative "YouTube" videos. Below is a summary of the different approaches to public engagement NOACA staff uncovered in the reviewed plans:

- Traditional in-person community meetings
- In-person, off-site community workshops
- Facebook Live and other social media platforms
- Video series posted on various outlets (e.g., YouTube) about important regional topics
- Pop-up engagements at regional destinations, events, and major gatherings
- Interactive iPad kiosks with questionnaires
- Online surveys and interactive online games
- Advisory panels and mailing lists to target environmental social communities and youth

[35] Cambridge Dictionary, Definition of "word cloud," 2021, https://dictionary.cambridge.org/us/dictionary/english/word-cloud

stakeholders (ages 14-18)

NOACA staff considered a combination of many of these approaches, but due to the COVID-19 pandemic, a different engagement plan was necessary for *eNEO2050*. NOACA developed a creative and entrepreneurial approach that did not involve a mass gathering of residents and stakeholders but still had the ability to reach a critical mass of the population. The learned strategies were nevertheless carried forward to *weNEO2050+.* For more information on NOACA's public engagement process, please see Chapter 4.

NOACA Staff Visioning Session

NOACA launched the *eNEO2050* long range plan process in January 2020 with a significant media event; one of the early follow-ups to that event was a staff-wide visioning session held on March 12, 2020, just days before NOACA and most other employers instituted COVID-19 remote work policies. Such policies ended in 2022, after the approval of *eNEO2050* in June 2021. NOACA staff collaborated during the four-hour session that focused on the agency's five strategic goals:

1. STRENGTHEN regional cohesion
2. PRESERVE existing infrastructure
3. BUILD a sustainable, multimodal transportation system
4. SUPPORT economic development
5. ENHANCE quality of life in Northeast Ohio

NOACA's senior management team randomly assigned staff to one of five stations (5-7 persons per station), each focused on one of the NOACA goals. With questions to prompt discussion (see below) and the directive to "think big and outside the box," the groups spent 20 minutes per session in collaborative brainstorming while volunteer scribes jotted notes on large flip charts. At the end of each session, scribes "reported out" the ideas generated at their particular station to the whole. This process continued until all staff members had the opportunity to participate in the five stations (e.g., five sessions).

The visioning session concluded with flip chart sheets displayed throughout the room, and staff members asked to vote for their favorite ideas via sticky labels of different colors. Select NOACA staff recorded all feedback and votes from these flip chart sheets and captured them in a Visioning Session matrix (see Table 2-7).

Table 2-7. NOACA Staff Visioning Session Feedback Matrix and Plan Focus Areas/Themes

NOACA STAFF VISIONING SESSION: MARCH 12, 2020 FEEDBACK MATRIX & PLAN FOCUS AREAS/THEMES				
NOACA GOALS	**VISIONING PROMPTS**			
	What does this goal mean to you?	What are the top 3 challenges?	What are visionary ways to achieve this goal?	How does this goal translate
STRENGTHEN regional cohesion	**regional identity (1)** efficiency collaboration regional scale and scope larger than just NOACA's 5 counties common goals (we're in this together)	**income segregation (1)** * urban, suburban, exurban, rural fragmentation competing interests competition for resources desire for local autonomy/Home Rule	* **regional corridor improvements (revitalize arterials) (5)** **one-region government (7 counties) (4)** **accessible, multi-modal transportation network (3)** **cost-sharing, collaboration (1)** **regional conference for decision-makers (2)** **welcome immigrants (2)** **school funding overhaul (1)** consolidate regional services and systems revenue sharing	**expand NEOSCC framework (2)** **MPO collaboration (4)** **MSA project (1)** **Lake Erie protection (3)** **Regional bike map (3)** * **no investment in infrastructure on projec sprawl (1)** **working groups and relationship- buildin** **poverty reduction strategies through lan** **awards/recognition of local organization** **target funds through scoring level (1)** **score regionally-significant projects high** regional plans: transit, bike/ped, safety, TLC
PRESERVE existing infrastructure	* **maintain existing infrastructure "fix it first" (1)** * **investigate communities' expansion in a shrinking region (1)** prioritize useful life benchmarks new projects should not encourage sprawl * maximize current capacity before expansion * reuse where possible (brown fields/gray fields, facilities)	* **priorities: 1) what to maintain, 2) what NOT to maintain, 3) what to repurpose (7)** funding * no incentives for developers to redevelop/reinvest vs. build on green fields * policies and philosophies on growth and sprawl * lack of regional growth policies among municipalities (Home Rule)	* **reduce VMT (work from home, encourage public transit) (3)** * **uniform asset management program across municipalities (1)** **one regional entity manage wastewater/sewer (1)** **innovation (1)** **incentivize developers to reuse land/facilities (1)** * **new technologies and methods to preserve infrastructure (1)** **focus on whole systems (not portions) (2)** **educate decision-makers with NOACA data (1)** * **more bike and transit options to take stress off roads (1)**	* **outreach/education on importance of iss** **regional conversation (1)** **broaden definition of preservation (1)** **climate change (1)** **preserve shoreline (1)** **interactive website for paving reports (4)** * **demonstrate regional impact of local dec negative) (1)** better coordination across municipalities, or

			make transit a viable transportation option (2) * **evaluate existing systems, do some portions no longer make sense? (1)**	
BUILD a sustainable multimodal transportation system	* options for all (affordable, many modes, accessible) * interconnected, modes coexist and work together * cost-effective and able to be maintained financially for longevity	funding is siloed and lack of funding access redevelop/reinvest vs. build on green fields * need for collaboration among entities, municipalities * regional growth patterns, current system is built for and prioritizes automobiles	**rail network connections (1)** * **true regional wide (5-7 counties) transit agency/plan together (4)/(4)** **smarter infrastructure (1)** * **build D.C.-style metro/rail system to connect Akron, Canton, Sandusky, Youngstown (2)** **solar rail cars (1)** * **identify smart tech corridors and green infrastructure corridors (2)** **establish mode shift goals (1)** comprehensive complete streets safe access across modes (transit, bike, pedestrian) * prioritize alternative modes and their systems (transit, bike, pedestrian)	**transit strategic plan, regional study and policy to encourage TOD (1)** * incorporate goals from existing plans and pr mobility, ACTIVATE, TAM and TAMP, SAVE, 5310, TLCI) innovation and technology
	* **attract and retain residents and businesses (1)** * **access to opportunity (training, education, jobs) (1)** growth of high-quality jobs	**declining population (1)** population loss and spread out workforce education * communities competing for businesses/poaching	**embrace innovation, technology, trades (1)** **prioritize projects and support smart growth (1)** **workforce planning (2)** promote brown and gray field development decline of manufacturing sector	**review of existing policies + develop new Downtown Cleveland/Lakefront Master P** * **prioritize practical improvement for Dow Lakefront + bikeway, green space, shoppi** **encourage jurisdictions to follow best pr**

Conclusion

NOACA's major regional planning efforts, the state transportation plan, numerous NOACA local planning efforts, inspiration from other MPOs, and NOACA staff visioning contributed to a strong foundation for *eNEO2050 and subsequently weNEO2050+*. NOACA's plans, in particular, showcase the agency's initiative to improve constantly upon each long-range plan and move the region closer to its envisioned goals. This perpetually evolving process reflects the dynamic nature of a diverse region.

Chapter 3: Evaluate Regional Context

Introduction

Transportation infrastructure is a foundational structure and system for transporting people and goods. This system supports the economy and directly impacts the competitiveness of the nation and the NOACA region. Over the years, the United States has built one of the world's most extensive transportation systems, representing trillions of dollars of public investment. The transportation system is made up of many individual elements, which, ideally, should be connected to provide ease of movement for all users. These individual elements are roads, bridges, sidewalks, bikeways, transit, rail, waterways, airports, and intermodal connectors. These individual systems are described in this chapter, as well as how each provides an equally important role in providing access and mobility for the NOACA region.

State of Transportation Infrastructure

Roadway Network

Similar to other metropolitan areas with urban and rural configurations, the road network in the NOACA region is the most extensive transportation mode, connecting all land uses, i.e., activity locations in communities, to each other. This network is also an essential part of supporting the local and regional economy and residents' movements for work, social, educational, and other trip purposes. The NOACA region contains a significant portion of Ohio's interstate total lane miles with local Interstate routes, including IR-71, IR-77, IR-80, IR-90, IR-271, IR-480, and IR-490.

Typically, the interstate and freeway systems carry the highest volume of traffic in the region, requiring more travel lanes. Much of the Interstate system was built in the late 1950s and early 1960s and is now 60+ years old.

Table 3-1 displays the lane miles of the road system except local streets by facility type. The data is based on the 2024 highway network of the NOACA travel forecasting model.

Table 3-1. Road Lengths by Facility Type[1]

Facility Type	Lane Miles	Percent of Total
Freeway / Expressway	1,890	21%
Highway Ramp	316	4%
Major Road (Arterial)	3,898	44%
Minor Road (Collector)	2,762	31%
Total	**8,866**	**100%**

The Federal-aid Highway Program supports state highway systems by providing financial assistance for the construction, maintenance, and operations of the nation's 3.9-million-mile highway network, including the Interstate Highway System, primary highways, and secondary

[1]The 2021 road network data contained errors in which many local roads were classified as "Collectors." In 2024, NOACA performed a systematic and region-wide update to the facility type data in our master road network. This update greatly reduced the amount of collector lane mileage on the NOACA road network and improved the accuracy of the lane mile values.

local roads. The Federal Highway Administration (FHWA) is charged with implementing the Federal-aid Highway Program in cooperation with the state and local governments.[2]

Local government–primarily counties, cities and towns, or local Public Agencies (LPAs)–own and operate about 75 percent, or roughly 2.9 million miles, of the nation's highway network. LPAs build and maintain this network using a variety of funding sources, including the Federal-Aid Highway Program. An estimated 7,000 LPAs manage about $7 billion annually in federal aid projects, or roughly 15 percent of the total program.[3]

Federal-aid System in the NOACA region includes Interstate Routes (IR), US Routes, State Routes (SR), and County Routes (CR). It should be noted that the Ohio Department of Transportation (ODOT) maintains roads such as Interstates, Freeways, and State Routes outside of municipal boundaries, which are excluded from the Federal Aid column of Table 3-2. Table 3-2 illustrates the road and Federal-aid system lengths by County.

Table 3-2. Road Lengths by County[4]

County	Lane Miles	Federal-aid Lane Miles	County Percent of Federal-aid Lane Miles
Cuyahoga	4,442	3,155	71.0%
Geauga	700	255	36.4%
Lake	1,091	575	52.7%
Lorain	1,578	747	47.3%
Medina	1,055	353	33.5%
NOACA Region	**8,866**	**5,085**	**57.4%**

Transit Network

Mobility choices are vital to the health and vibrancy of a region. Public transit options reduce congestion, personal transportation costs, and carbon output. A robust public transit system presents residents with a choice to travel within the region. Public transit is a form of alternative transportation for those with automobiles, as well as a primary service for those who do not have other options, primarily lower-income households, the elderly, the young, and people with disabilities. Public transit provides access to employment, healthcare, entertainment, and educational facilities, among other daily activities and destinations.

Similarly to single-occupancy vehicles, public transportation vehicles also operate on the road network. Furthermore, the transit system includes limited miles of a railway network, but the rail system is not comparable in scale to the road network; thus, the bus service is more expansive.

[2] U.S. Department of Transportation Federal Highway Administration, Federal-aid Highway Program https://www.fhwa.dot.gov/federal-aidessentials/federalaid.cfm. Accessed June 5, 2025.
[3] Ibid.
[4] The 2021 road network data contained errors in which many local roads were classified as “Collectors.” In 2024, NOACA performed a systematic and region-wide update to the facility type data in our master road network. This update greatly reduced the amount of collector lane mileage on the NOACA road network and improved the accuracy of the lane mile values.

Transit Services

There are five different transit agencies operating within the NOACA region: Geauga County Transit (GCT), the Greater Cleveland Regional Transit Authority (GCRTA), Laketran, Lorain County Transit (LTC), and Medina County Public Transit (MCPT). The additional agencies, the Portage Area Regional Transportation Authority (PARTA), the Akron Metro Regional Transit Authority (Akron METRO), and the Stark Area Regional Transit Authority (SARTA), also operate in the NOACA region. As the region's population density has declined and the population expanded outward into previously rural areas, serving within the shifting land use patterns has been a challenge. NOACA and the region's transit systems will need to continue to plan accordingly to meet the needs of the region's population. It will be necessary to prioritize limited transportation funding. The region must balance transit needs with demands, determining where to expand or reduce service and where to strengthen core service.

Transit Infrastructure

In the NOACA region, bus services, including local, premium, and Bus Rapid Transit (BRT), run through the existing highways and street networks with thousands of bus stops at different levels of passenger comfort. Additionally, rapid transit access is ensured through a network of light and heavy rail operated by the Greater Cleveland Regional Transit Authority (RTA) for passenger services and regional freight rail companies. The passenger rail services comprise three lines: the Red Line, Blue Line, and Green Line.

In addition to the existing highway and rail infrastructure for the bus and rail services, there are currently 36 park-and-ride facilities in the NOACA region. The majority of these intermodal facilities are in Cuyahoga County (27), which are at rail stations (20), premium bus stations (2), shared BRT and Rail stations (2), and BRT stations (3). The other park-and-ride facilities are in Lake (8) and Medina (1) counties and are for premium bus services.

Figures 3-1 and 3-2 show the existing transit services and the locations of the current intermodal facilities in the NOACA region.

Figure 3-1. The Current Transit Network

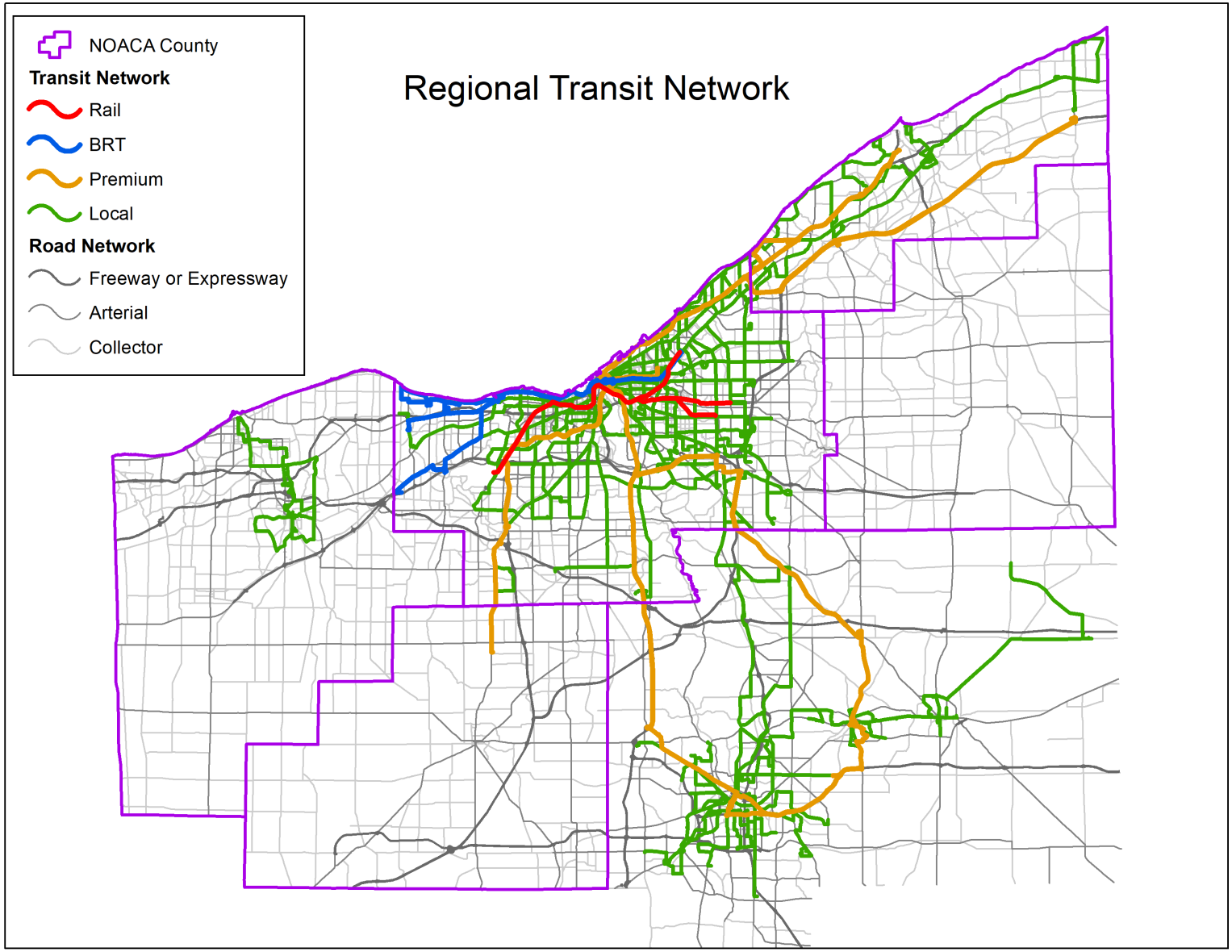
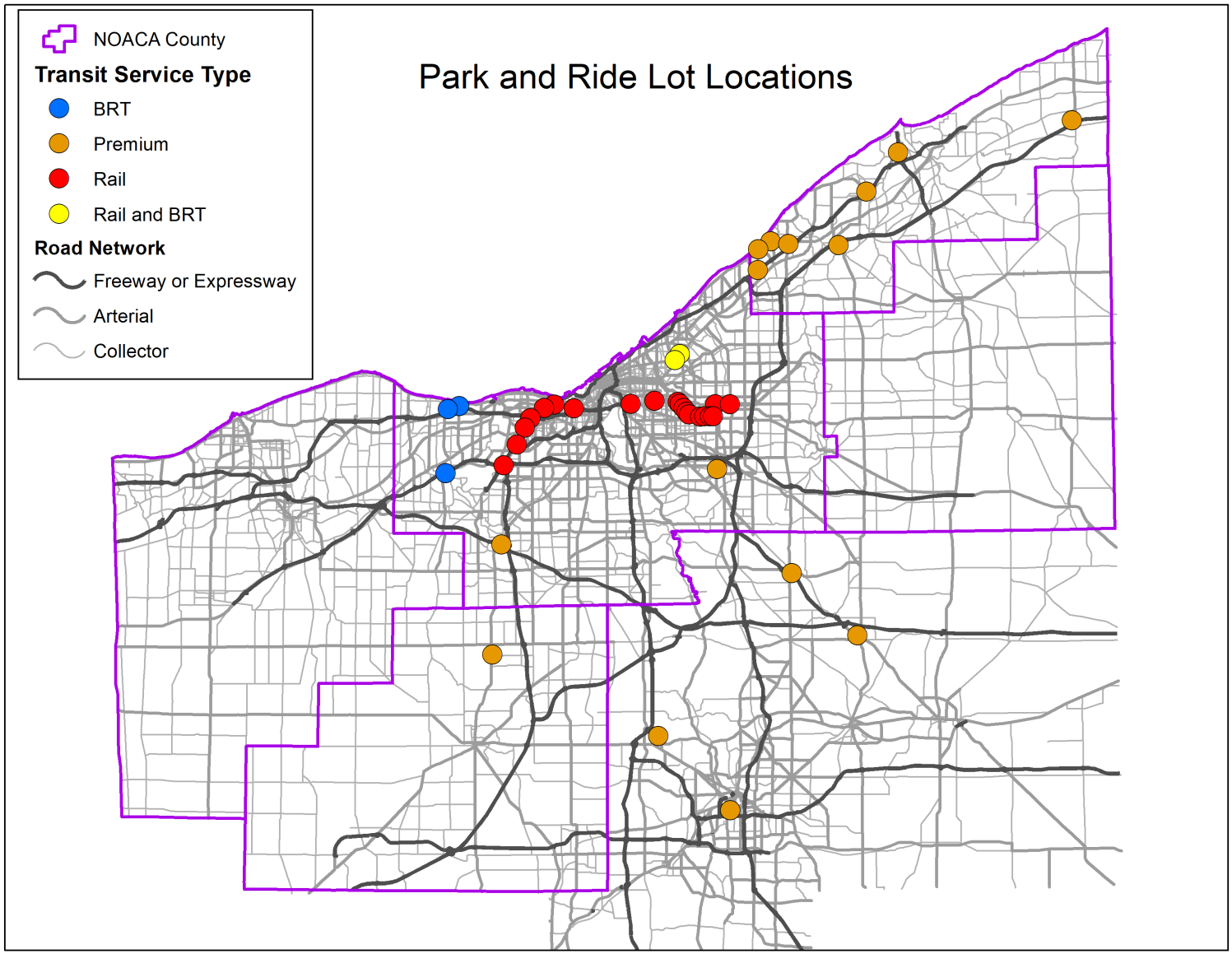


Figure 3-2. The Locations of the Current Intermodal Facilities



A central aspect of transit planning is improving the way that we move around the region and providing access to support development through transportation infrastructure. Choice means increasing both the number of easily accessible destinations and the mode of access to arrive at those destinations. All the region's transit systems plan to maintain and possibly expand their respective systems to accommodate these conditions better.

Expanding public transit requires significant capital investment, however, the potential advantages of a well-planned project are often greater than the costs. Public transit benefits include:[5]

- Connecting people and jobs
- Improving mobility for people of all ages
- Stimulating and focusing new development on sites near transit
- Creating and supporting jobs by providing a reliable alternative to driving
- Moving more people in the same amount of road space
- Improving air quality and reducing greenhouse gas emissions
- Reducing household transportation costs

Non-Motorized Transportation

Non-motorized transportation or active transportation refers to being physically active for the purpose of transportation (typically biking and walking) and is distinct from being physically active for recreation. NOACA has been formally planning at the regional level for bicycling as a means of transportation since 1978, with the release of Phase I of a four-phase bicycle planning process that spanned from 1977 to 1989. The NOACA Regional Bicycle Plan has been updated in 1997, 2008, and 2013. A new bicycle and pedestrian plan, ACTIVATE, was developed from 2019-2022. This plan provides a vision for increasing the use of bikeways and walkways for transportation and commuting and also serves as a guide for future bicycle and pedestrian improvements. This plan also includes a prioritization model based on a Connectivity Scoring Quantitative System (CSQS) for investing in non-motorized facilities for accessing the transit network.

Planning for bicycling and walking as modes of transportation is important for a variety of reasons. Improving travel safety is always important, but improving the safety of bicycling and walking is especially important because these road users are most vulnerable to fatality and severe injury in a crash. Furthermore, the perceived safety of these modes has a direct effect on how many people are willing to choose biking and walking. With limited federal and state transportation funding, encouraging mode shifts to biking and walking is an important and underused travel demand management strategy that can alleviate traffic congestion. Biking and walking are forms of exercise, so increasing these activities can improve the mode users' health. In addition, because biking and walking are zero-emission modes of transportation, shifting trips to these modes can improve public health more generally by improving air quality. Specifically, biking and walking are ideal modes for replacing short trips (three miles or less), which are more polluting and less efficient per mile by car than longer trips.[6] Moreover, a significant percentage of the population in Northeast Ohio does not have access to a car, and providing viable transportation options is vital.

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[5] Northeast Ohio Sustainable Communities Consortium (NEOSCC), *Vibrant NEO2040*, http://vibrantneo.org/wp-content/uploads/2014/04/Vibrant-NEO-Final-Report_3-31-14_lowres_ALL.pdf. Accessed May 22, 2025.

[6] M.L. Grabow, S.N. Spak, T. Holloway, B. Stone, Jr., A.C., Mednick, and J.A. Patz, "Air Quality and Exercise-Related Health Benefits from Reduced Car Travel in the Midwestern United States," National Center for Biotechnology Information Resources, https://www.ncbi.nlm.nih.gov/pubmed/22049372. Accessed May 22, 2025.

Planning for bicycle and pedestrian travel has also been established as a priority by the federal government. The United States Code requires that bicyclists and pedestrians be given due consideration in the comprehensive transportation plans developed by each metropolitan planning organization and state, in accordance with sections 134 and 135, respectively. Bicycle transportation facilities and pedestrian walkways are to be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation facilities, except where bicycle and pedestrian uses are not permitted. Transportation plans and projects must also provide due consideration for safety and contiguous routes for bicyclists and pedestrians.

Bicycle and Pedestrian Infrastructure

Bicycling is an important component of the transportation system. It is an important travel demand strategy that can alleviate traffic congestion and reduce emissions. Improving or increasing the bicycle infrastructure is important to the NOACA region, but especially for the population that does not have access to a personal vehicle.
NOACA, in coordination with partner agencies, maintains an inventory of 821 miles of existing bicycle facilities in all five counties. These facilities can be defined as separated and shared types:

Separated
- All Purpose Trails: Open to bicyclists and are fully separated from the roadways.
- Separated Bike Lanes: On-street bike lanes that are vertically separated from traffic by posts or other barriers.
- Buffered Bike Lanes: are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking.

Shared
- Bike Lanes: on-street bike lanes that are marked with a painted line and accompanying signage.
- Bike Routes: on-street, typically marked with sharrows and/or signs.

Table 3-3 summarizes the bike lane lengths by type and county.

Table 3-3. The Bike Lane Facilities Lengths by Type and County

COUNTY	ALL PURPOSE TRAIL	SEPARATED BIKE LANE	BUFFERED BIKE LANE	BIKE LANE	BIKE ROUTES*	TOTAL
Cuyahoga	279.4	0.9	8.3	83.9	116.8	489.3
Geauga	29.2				0.2	29.4
Lake	62.7			19.4	5.3	87.4
Lorain	97.3			27.3	53.6	178.2
Medina	36.7					36.7
NOACA Region	**505.3**	**0.9**	**8.3**	**130.6**	**175.9**	**821**

Source: NOACA Regional Bike Network, *Routes are typically marked with sharrows and/or signs

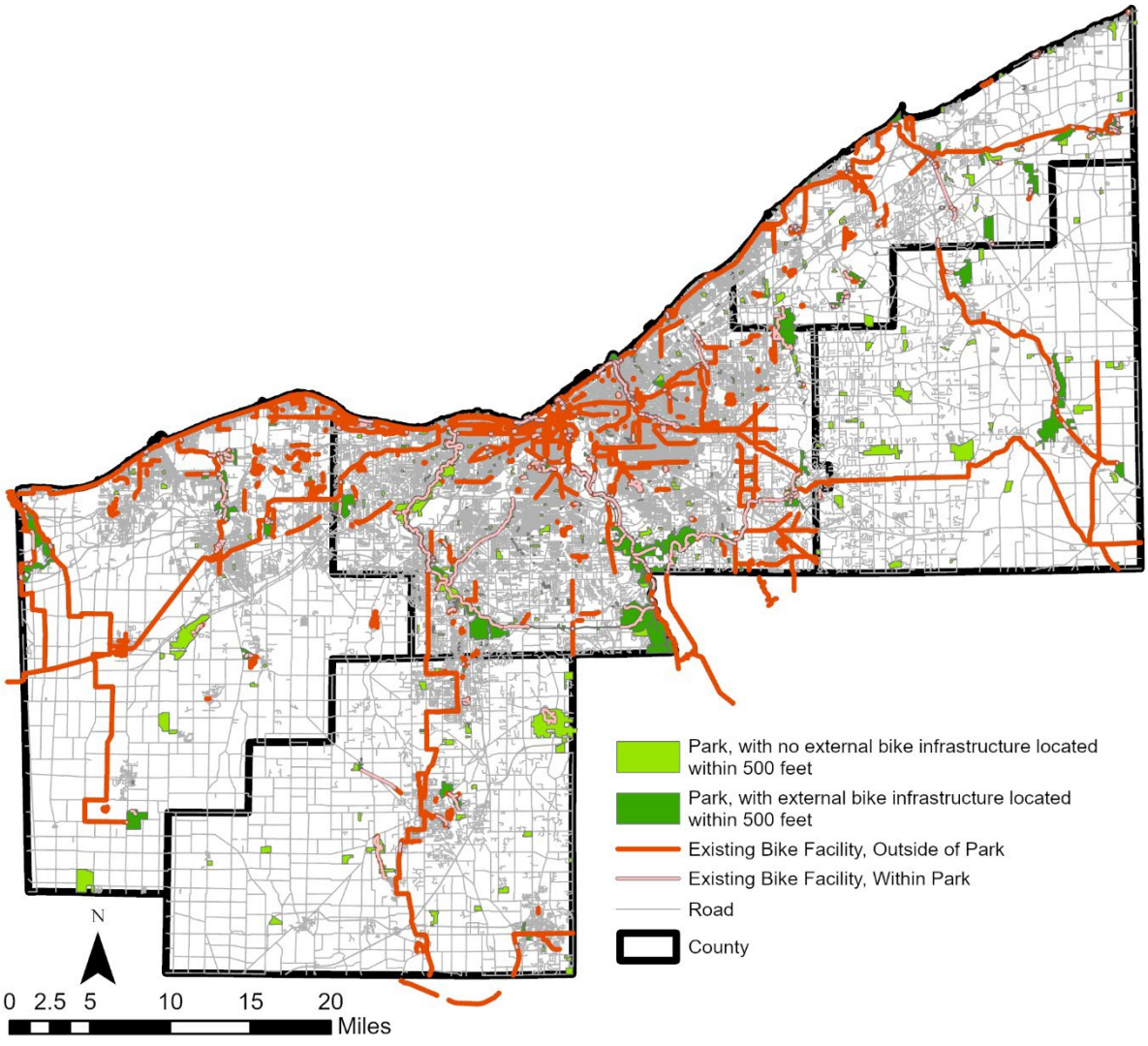
Bicycle Facility and Park Access

Northeast Ohio is home to many recreational biking trails within park facilities, such as the Big Creek Parkway, the Towpath Trail, and the Black River Trail in Elyria. Recreational trails can become transportation assets when they are maintained throughout the year, have adequate

lighting, and connect to other bike infrastructure. However, many of the region's parks do not have bike infrastructure within 500 feet of the park's boundary, which limits access to the park's interior trails and amenities from being used to support active transportation. These same parks often have significant trail infrastructure inside the park itself, such as the Valley Parkway and Rocky River Reservation.

Very few parks in the rural areas of the NOACA region appear to have bike facilities within 500 feet of the park boundary. In total, 231 (41%) of the region's 566 parks have bike facilities located within 500 feet of the park boundary. Figure 3-3 shows the parks in the region according to whether bike facilities are within 500 feet of the boundary of the park.

Figure 3-3. Bike Facilities and Park Access



NOACA conducts bicycle and pedestrian counts throughout the agency's five-county region to gauge regional and local levels of bicycling and walking, identify trends to aid in the planning and design of transportation infrastructure and programming, and calibrate walk and bike modes in the NOACA Travel Forecasting Model.

Manual counts have been conducted biannually since September 2011, and 240 different locations have been counted at least once through 2024. Counts have been conducted along a variety of roadway and bicycle facility types, including bike lanes, all-purpose trails, and roadways without bicycle infrastructure or sidewalks. The majority of counts have been conducted in more populated areas of the region within Cuyahoga County, but counts were also done in smaller towns and rural areas throughout all five counties in the NOACA region. In addition to overall numbers of pedestrians and cyclists, the counts also tracked the number of cyclists by helmet usage, sidewalk usage, and weather conditions.

Automated Bicycle and Pedestrian Counts

NOACA collects data from permanently installed bike and pedestrian counters throughout the region (see Table 3-4). Sixteen counters use Miovision video-based technology, and two counters use EcoCounter infrared and under-pavement loop technology.
NOACA purchased the Miovision counter equipment using an ODOT Active Transportation grant. It was installed and calibrated to collect data in 2020 and has been properly maintained since.

The Miovision counter equipment utilizes a 360-degree view to conduct turning movement counts at intersections, including motor vehicles, bikes, and pedestrians. The counters may also count specific bike and pedestrian-focused zones, including bike lanes and all-purpose trails where a full turning movement count is not possible or desired.

The EcoCounter equipment offers more targeted bike/pedestrian-only counts of specific trails or bike lanes, including a heavily used bridge trail in Downtown Cleveland and a bike lane near Case Western Reserve University.

Data is being collected continuously at these locations, covering a variety of roadway classifications and bike facility types.

Table 3-4. Permanent Automated Counter Equipment

ID	Counter Type	Location	City
1	Miovision TrafficLink	Lake Shore Blvd. and E. 149th St.	Cleveland
2	Miovision TrafficLink	Superior Ave. and E. 21st St.	Cleveland
3	Miovision TrafficLink	E. 105th St. and Euclid Ave.	Cleveland
4	Miovision TrafficLink	Detroit Ave. and W. 65th St.	Cleveland
5	Miovision TrafficLink	Detroit Ave. and W. 25th St.	Cleveland
6	Miovision TrafficLink	Superior Ave. and Huron Rd.	Cleveland
7	Miovision TrafficLink	Overlook Rd. and Cedar Glen Pkwy.	Cleveland Heights
8	Miovision TrafficLink	Madison Ave. and Victoria Ave.	Lakewood
9	Miovision TrafficLink	Hilliard Blvd. and Clague Rd.	Westlake
10	Miovision TrafficLink	Main St. and Wright St.	Wadsworth

11	Miovision TrafficLink	Munson Rd. and Center S.	Mentor
12	Miovision TrafficLink	Lake Rd. west of Shields Rd.	Avon Lake
13	Miovision TrafficLink	South Main St. and Edison St. (North Coast Inland Trail)	Oberlin
14	Miovision TrafficLink	South St. and Maple Highlands Trail	Chardon
15	Miovision TrafficLink	E. 79th St. and Kinsman Rd.	Cleveland
16	Miovision TrafficLink	E. 71st St. and Kinsman Rd.	Cleveland
17	Eco Counter Zelt Loop	Lorain-Carnegie Bridge All Purpose Trail	Cleveland
18	Eco Counter Urban Post	Edgehill Rd. Bike Lane	Cleveland Heights

Level of Traffic Stress (LTS)

Level of Traffic Stress (LTS) is a relatively new means of assessing who may feel comfortable biking on a particular road. LTS seeks to measure the traffic stress present on a roadway and identify the type of bicyclist who is likely comfortable biking on that road. When applied to a community or a region, it can result in a number of analysis tools that can assess the overall connectivity and prevalence of low-stress biking facilities.

NOACA has been developing a regional Level of Traffic Stress analysis as part of its bicycle transportation maps since 2018. The regional analysis was completed for the ACTIVATE plan. The bike maps remain a natural complement to this work, as they seek to make cycling easier and less intimidating by providing information on where there are bike facilities and low-stress routes.

LTS is based on the premise that most people will generally avoid cycling on roads that they perceive are stressful and that traffic (speed, volume, and distance from cyclists) is the key factor in determining cyclist stress. The main source of bicyclist stress changes throughout the day, alternating between volume (during AM and PM peak) and speed (when volumes are low). Researchers have developed a set of measures to broadly capture a road's stress level by classifying it in one of four levels of traffic stress from low to high. LTS was first developed by the Mineta Transportation Institute in 2012 for the U.S. Department of Transportation in California. NOACA created a customized version of the LTS methodology that fits the region's characteristics with data that was easier to verify and gather. It also added a fifth LTS, a level to indicate roads that should be avoided by even expert-level cyclists.

Bicycle and Pedestrian Crash Data

The most recent analysis of crashes in the NOACA region (NOACA's 2024-2025 Community Safety Reports) uses data for only the two-year period from 2022-2023 to exclude COVID-era abnormalities. Due to how the Highway Safety Manual predictive formulas are set up, the same grouping of segments is expected for the highest pedestrian-vehicle and bicycle-vehicle collisions. Therefore, the tables have been combined to show both groups of data in the same table. Tables 3-5 through 3-7 show the top ten expected vehicle-pedestrian and vehicle-bicycle collision arterial segments and pedestrian and bicycle arterial intersections for the NOACA region.

Table 3-5. Top Ten Highest Predicted Pedestrian and Bicycle Arterial Segments

Road Name	From	To	Expected Annual Vehicle-Pedestrian Collisions	Expected Annual Vehicle-Bicycle Collisions	County	City
Bagley Road	Pleasant Avenue	Pearl Road (US 42)	0.86	0.45	Cuyahoga	Middleburg Heights
US 6 (Superior Avenue)	East 55th Street	East 125th Street	0.77	0.40	Cuyahoga	Cleveland
US 42 (Pearl Road)	West 130th Street	Wesley Drive	0.71	0.37	Cuyahoga	Parma Heights
US 20 (Center Ridge Road)	Elyria ECL	Jaycox Road	0.69	0.36	Lorain	North Ridgeville
Carnegie Avenue SE	East 55th Street	Cedar Glen Parkway	0.65	0.34	Cuyahoga	Cleveland
West 150th Street	Puritas Avenue	Lorain Road (SR 10)	0.64	0.33	Cuyahoga	Cleveland
SR 91 (Som Center Road)	S of Maplegrove Road	Euclid Avenue (US 20)	0.60	0.31	Lake	Willoughby
US 20 (Euclid Avenue)	East 214th Street	Cuyahoga County ECL	0.60	0.31	Cuyahoga	Euclid
Cedar Road	Fenway Drive	I-271 Southbound Entrance Ramp	0.60	0.31	Cuyahoga	Beachwood
US 42 (Pearl Road)	Lucerne Drive	West 130th Street	0.58	0.30	Cuyahoga	Middleburg Heights

Table 3-6. Top Ten Highest Predicted Pedestrian Arterial Intersections

Major Road	Minor Road	Expected Annual Vehicle-Pedestrian	County	City
US 20 (W CLIFTON BLVD/SLOANE AVE)	US 6 (CLIFTON BLVD)	0.4710	Cuyahoga	Lakewood
US 20 (CENTER RIDGE RD)	ROOT RD	0.4645	Lorain	North Ridgeville
SR 611 (COLORADO AVE)	LAKE BREEZE RD	0.4628	Lorain	Sheffield
US 20 (EUCLID AVE)	EDDY RD	0.4627	Cuyahoga	East Cleveland
SR 283 (LAKESHORE BLVD)	HEISLEY RD	0.4623	Lake	Mentor
US 6 (CLIFTON BLVD)	WARREN RD	0.4619	Cuyahoga	Lakewood
US 42 (PEARL RD)	MEMPHIS AVE	0.4617	Cuyahoga	Cleveland
CEDAR AVE	CARNEGIE AVE SE	0.4615	Cuyahoga	Cleveland
US 20 (EUCLID AVE)	LEE RD	0.4614	Cuyahoga	East Cleveland
MILES RD	BRAINARD RD	0.4610	Cuyahoga	Orange

Table 3-7. Top Ten Highest Predicted Bicycle Arterial Intersections

Major Road	Minor Road	Expected Annual Vehicle-Bicycle Collisions	County	City
US 422 (Chagrin Boulevard)	SR 87 (Richmond Road)	0.241	Cuyahoga	Beachwood
SR 94 (State Road)	SR 17 (Brookpark Road)	0.237	Cuyahoga	Cleveland
Ridge Road	SR 17 (Brookpark Road)	0.210	Cuyahoga	Cleveland
SR 611 (Colorado Avenue)	Chester Road	0.209	Lorain	Avon
US 322 (Mayfield Road)	SR 91 (Som Center Road)	0.193	Cuyahoga	Mayfield Heights
West 130th Street	SR 17 (Brookpark Road)	0.187	Cuyahoga	Brook Park
West Bagley Road	North Rocky River Drive	0.183	Cuyahoga	Berea
SR 91 (Som Center Road)	Solon Road	0.177	Cuyahoga	Solon
Cedar Glen Parkway	Cedar Road	0.174	Cuyahoga	Cleveland Heights
East 9th Street	Prospect Avenue	0.172	Cuyahoga	Cleveland

Traffic Control Devices

Traffic is the movement of a large number of individual drivers, cyclists, and pedestrians through highways, streets, sidewalks, and transit networks from their origins to their destinations for completing their journeys. A traffic control system manages those journeys through physical networks based on two principles of safety and efficiency and utilizes physical devices such as signs, road markings, traffic signals, etc. See Table 3-8 for the number of signalized intersections by county in the NOACA region.

Table 3-8. Number of Signalized Intersections by County

County	Number of Signalized Intersections	Percent of Region
Cuyahoga	2,621	76%
Lorain	340	10%
Lake	281	8%
Medina	147	4%
Geauga	67	2%
NOACA Region	**3,456**	**100%**

Transportation Safety and Operations

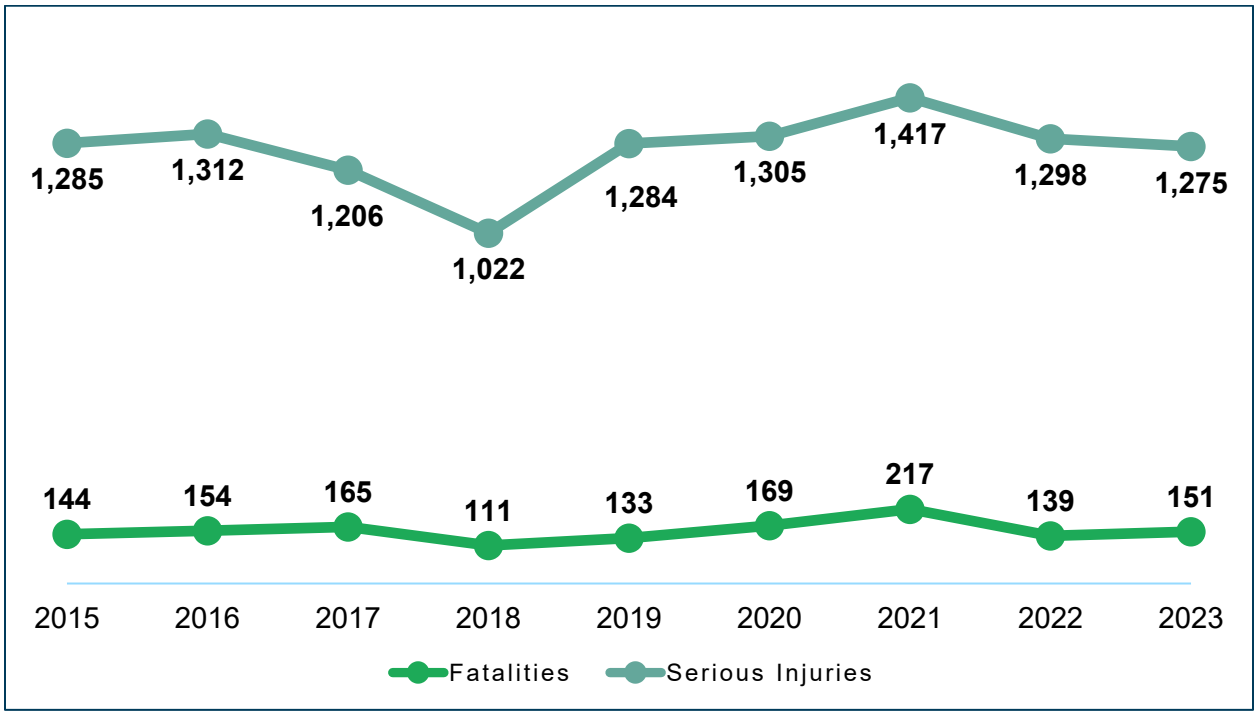
Introduction

One of NOACA's transportation planning goals is to preserve and improve the efficiency and safety of the existing transportation system, prioritize its elements, and ensure it serves homeland security.

In 2023, there were 41,230 roadway crashes in the region, which resulted in 151 fatalities and 1,275 serious injuries (see Figure 3-4 and Tables 3-9 and 3-10). These are the number of fatalities and serious injuries noted by the Ohio Department of Public Safety or ODOT personnel at the scene; they are not adjusted with hospital data. They do account for crashes where more than one person was seriously hurt or killed. Both fatalities and serious injuries rose gradually after a low in 2018 before significantly increasing during the COVID-19 pandemic, but have begun coming down again, although 2023 fatalities increased from 2022.

- A total of twelve more fatalities occurred in 2023, an 8.6% increase from 2022 but a 30.4% decrease since 2021. This is still a 36% increase from the low of 111 fatalities in 2018, however.
- Twenty-three fewer serious injuries occurred in 2023, a 1.8% decrease from 2022 but a 10% decrease from the high in 2021. However, this is still a 24.8% increase from the low of 1,022 serious injuries in 2018.

Figure 3-4. Fatalities and Serious Injuries in the NOACA Region (2015-2023)



NOACA's Safety and Operations Council (SOC) serves as an advisory group on safety planning and provides recommendations regarding regional safety and operations programs to NOACA's Transportation Subcommittee. The SOC comprises local planning and engineering staff, law enforcement, emergency responders, the Ohio Department of Transportation, the Federal Highway Administration, the Greater Cleveland Rapid Transit Authority, the Ohio Traffic Safety Office, and community members.

Table 3-9. All Crashes by County Per Year, with Averages

Year	Cuyahoga	Geauga	Lake	Lorain	Medina	NOACA Region Annual Total
2019	33,990	1,954	4,535	6,176	3,483	50,138
2020	28,661	1,603	3,736	5,501	2,764	42,265
2021	30,711	1,665	4,080	6,136	2,925	45,517
2022	30,840	1,577	4,248	6,020	3,097	45,782
2023	26,867	1,656	3,982	5,665	3,060	41,230
Average	**30,214**	**1,691**	**4,116**	**5,900**	**3,066**	**44,986**

Table 3-10 is based on the number of *crashes* in which injuries were present (or not present). This table does *not* represent the number of fatalities or serious injuries that occurred since a single crash can cause more than one. It only represents the number of crashes where more than one (or none) fatality or serious injury was present.

Table 3-10. Crashes by Selected Severities (2019-2023)

Year	Fatal Crashes	Fatal Percent of All Crashes	Serious Injury Suspected Crashes	Serious Injury Percent of All Crashes	Property Damage Only Crashes	Property Damage Percent of All Crashes	All Crashes for the NOACA Region
2019	123	0.25%	1,071	2.14%	36,247	72.29%	50,138
2020	161	0.38%	1,084	2.56%	30,271	71.62%	42,265
2021	200	0.44%	1,154	2.54%	32,628	71.68%	45,517
2022	134	0.29%	1,085	2.37%	33,432	73.02%	45,782
2023	146	0.35%	1,002	2.43%	29,810	72.30%	41,230
Total	**764**	**0.34%**	**5,396**	**2.40%**	**162,388**	**72.19%**	**224,932**

The biannual Community Safety Reports help to prioritize transportation safety concerns. Each community receives a list of the most dangerous arterial segments and intersections of two arterials within their city limits, ranked by predicted average annual crashes using formulas from the Highway Safety Manual. Tables 3-11 and 3-12 show the top high predicted crash corridors and intersections based on 2022-2023 crash data. Years of data were limited to exclude COVID-era abnormalities but will be expanded to more years of data in the next update.

Table 3-11. Arterial Corridors with More than Fifty Predicted Crashes

Road Name	From	To	Average Predicted Crashes per Year	Average Recorded Crashes (2022 & 2023)	County	City	Regional Rank
US 6 (SUPERIOR AVE)	E 55TH ST	E 125TH ST	83.56	146.50	Cuyahoga	Cleveland	1
SR 91 (SOM CENTER RD)	S OF MAPLEGROVE RD	EUCLID AVE (US-20)	83.10	58.00	Lake	Willoughby	2
US 20 (CENTER RIDGE RD)	ELYRIA ECL	JAYCOX RD	77.13	50.00	Lorain	North Ridgeville	3
SR 10	0.15 MI N OF I-80	LORAIN/CUYAHOGA COUNTY LINE	76.04	50.50	Lorain	North Ridgeville	4
CARNEGIE AVE SE	E 55TH ST	CEDAR GLEN PKWY	71.27	119.50	Cuyahoga	Cleveland	5
BAGLEY RD	PLEASANT AVE	PEARL RD (US-42)	71.27	88.00	Cuyahoga	Middleburg Heights	6
W 150TH ST	PURITAS AVE	LORAIN RD (SR-10)	69.53	73.50	Cuyahoga	Cleveland	7
SNOW RD	RIDGE RD (SR-3)	BROADVIEW RD (SR-176)	66.28	53.00	Cuyahoga	Parma	8
SR 94 (STATE RD)	RIDGEWOOD DR	BROOKPARK RD (SR-17)	62.32	52.50	Cuyahoga	Parma	9
SR 3 (RIDGE RD)	RIDGEWOOD DR	PEARL RD (US-42)	62.31	40.50	Cuyahoga	Parma	10
SR 611 (COLORADO AVE)	LORAIN ECL	ABBE RD (SR-301)	61.20	38.00	Lorain	Sheffield	11
SR 306 (REYNOLDS RD/BROADMOOR RD)	ADKINS RD	LAKESHORE BLVD	60.59	29.00	Lake	Mentor	12
US 42 (PEARL RD)	W 130TH ST	WESLEY DR	58.33	77.00	Cuyahoga	Parma Heights	13
BRAINARD RD	CEDAR RD	RIDGEBURY BLVD	57.36	33.00	Cuyahoga	Lyndhurst	14
SR 611 (COLORADO AVE)	SHEFFIELD ECL	0.14 MILES WEST OF MOORE RD	56.82	50.50	Lorain	Avon	15
SR 57	LORAIN BLVD / SR-113	0.22 MI N OF I-90	56.47	91.00	Lorain	Elyria	16
W 117TH ST	BELLAIRE RD	TRISKETT RD	56.15	72.00	Cuyahoga	Cleveland	17
SR 17 (BROOKPARK RD)	W 130TH ST	W 78TH ST	53.55	74.00	Cuyahoga	Parma	18
PLEASANT VALLEY RD	0.12 MI W OF YORK RD	E OF STATE RD (SR-94)	51.40	34.50	Cuyahoga	Parma	19
US 20 (EUCLID AVE)	E 214TH ST	CUYAHOGA COUNTY ECL	51.14	51.50	Cuyahoga	Euclid	20
CEDAR RD	FENWAY DR	I-271 SOUTHBOUND ENTRANCE RAMP	50.87	89.00	Cuyahoga	Beachwood	21

Table 3-12. Arterial Intersections with More than Twenty-four Predicted Crashes

MAJOR RD	MINOR RD	AVERAGE CRASHES PER YEAR	County	City	Regional Rank
SR 94 (STATE RD)	SR 17 (BROOKPARK RD)	39.50	Cuyahoga	Cleveland	1
SR 611 (COLORADO AVE)	CHESTER RD	35.50	Lorain	Avon	2
RIDGE RD	SR 17 (BROOKPARK RD)	35.09	Cuyahoga	Cleveland	3
US 422 (CHAGRIN BLVD)	SR 87 (RICHMOND RD)	31.28	Cuyahoga	Beachwood	4
SR 306 (REYNOLDS RD/BROADMOOR RD)	SR 84 (JOHNNYCAKE RIDGE RD)	31.06	Lake	Mentor	5
E 9TH ST	PROSPECT AVE	28.75	Cuyahoga	Cleveland	6
E 105TH ST	CARNEGIE AVE SE	28.28	Cuyahoga	Cleveland	7
SR 91 (SOM CENTER RD)	SR 84 (RIDGE RD)	27.77	Lake	Willoughby	8
SR 91 (SOM CENTER RD)	US 20 (EUCLID AVE)	26.64	Lake	Willoughby	9
SR 611 (COLORADO AVE)	SR 301 (ABBE RD N)	26.00	Lorain	Sheffield	10
US 20 (EUCLID AVE)	US 322 (CHESTER AVE)	25.93	Cuyahoga	Cleveland	11
US 20 (EUCLID AVE)	MARTIN LUTHER KING JR DR	25.46	Cuyahoga	Cleveland	12
LORAIN BLVD	SR 57	25.28	Lorain	Elyria	13
SR 306 (REYNOLDS RD/BROADMOOR RD)	US 20 (MENTOR AVE)	25.05	Lake	Mentor	14
SR 306 (REYNOLDS RD/BROADMOOR RD)	TYLER BLVD	24.57	Lake	Mentor	15
SR 14 (BROADWAY AVE)	CARNEGIE AVE SE	24.44	Cuyahoga	Cleveland	16
US 322 (MAYFIELD RD)	SR 91 (SOM CENTER RD)	24.32	Cuyahoga	Mayfield Heights	17

Strategies to Improve Safety

A roadway crash is caused by one or more contributing factors encompassing driver behavior, vehicle faults, or environmental circumstances. A driver could be distracted, the road could have an engineering flaw, the speed limit may be too high, there may be a blinding glare, or countless other factors. Achieving safety on the roads will require a coordinated effort between all aspects of the transportation system. The strategies established in NOACA's SAVE Plan use a comprehensive approach to address safety on the roads by including strategies from all of the six "Es" of transportation safety: Education, Enforcement, Engineering, Evaluation, Emergency Medical Services, and Equity.

The SAVE Plan identifies multiple strategies to reduce crashes in each of the ten emphasis areas:

- Intersection
- Roadway Departure
- Young Driver
- Speed
- Impaired Driving
- Older Driver
- Motorcycle
- Pedestrian
- Distracted Driving
- Bicycle

NOACA utilizes Systemic Safety Management in ongoing safety programs to make a system that protects road users even after mistakes are made. This approach uses crash prediction models based on roadway and traffic characteristics to estimate the expected average crash frequency along arterials and major intersections of arterials. This process is taken from the Highway Safety Manual (HSM), produced by the American Association of State Highway and Transportation Officials (AASHTO). It provides predictive methods for estimating it by road network, facility, or individual site involving vehicles, motorcycles, bicycles, and pedestrians.

Emphasizing the Safe System Approach encourages NOACA to be more proactive about upstream causes of crashes rather than solely focusing on individualistic methods such as driver education. According to the National Highway Traffic Safety Administration, most crashes are caused by human error, but it's only the last failure in the causal chain of events leading to a collision. That doesn't mean it's the driver's fault, but it means that the roads, vehicles, speeds, people, and post-crash care have all failed to protect vulnerable human bodies using the transportation system. Rather than releasing communities from the responsibility of building safer and more forgiving roads, it is even more crucial that we fix system design errors, make our streets slower, and separate users of different modes by space and time. Engineers' focus must be on safety first and vehicle throughput second. Making a mistake shouldn't cost any roadway user their life. Instead, factors like lane widths, lighting, corner radii, and signal timing must be designed and calibrated to provide multiple redundant levels of protection so that someone is seriously hurt or killed only when everything fails. If just one layer fails, the roadway users will still escape with their lives.

NOACA has a Safe Routes to School (SRTS) Assistance Program to provide jurisdictions and school districts with SRTS planning and implementation support. Safe Routes to School (SRTS) is a program focused on making it safe, convenient, and fun for kids and families, including those with disabilities, to walk or bicycle to school and in everyday life. The planning framework is safety-

based, following the 6 E's of SRTS: Education, Encouragement, Enforcement, Evaluation, Engineering, and Equity.

Implementation Action

NOACA partners with ODOT, regional safety organizations, and local communities throughout the region to provide information on low-cost countermeasures, strategies to promote safe driving behavior, and educational resources for different audiences. NOACA engages in various efforts to promote safe road-user behavior, including educational campaigns and the support of new legislation to achieve the region's safety targets. Currently, NOACA is working with statewide transportation safety organizations to seek a more flexible and context-sensitive approach to setting speed limits within municipalities to provide greater local control and improved safety.

Additionally, the five-year rolling averages for the following five safety performance measures continue to be tracked as required since the FAST Act:

- Number of fatal crashes.
- Number of serious injury crashes.
- Rate of fatalities per 100 million vehicle miles traveled.
- Rate of serious injuries per 100 million vehicle miles traveled.
- Number of nonmotorized fatal and serious injury crashes.

They are calculated based on the averages of the previous five years, and reductions are chosen through the equal annual reduction method to reach zero by 2050.

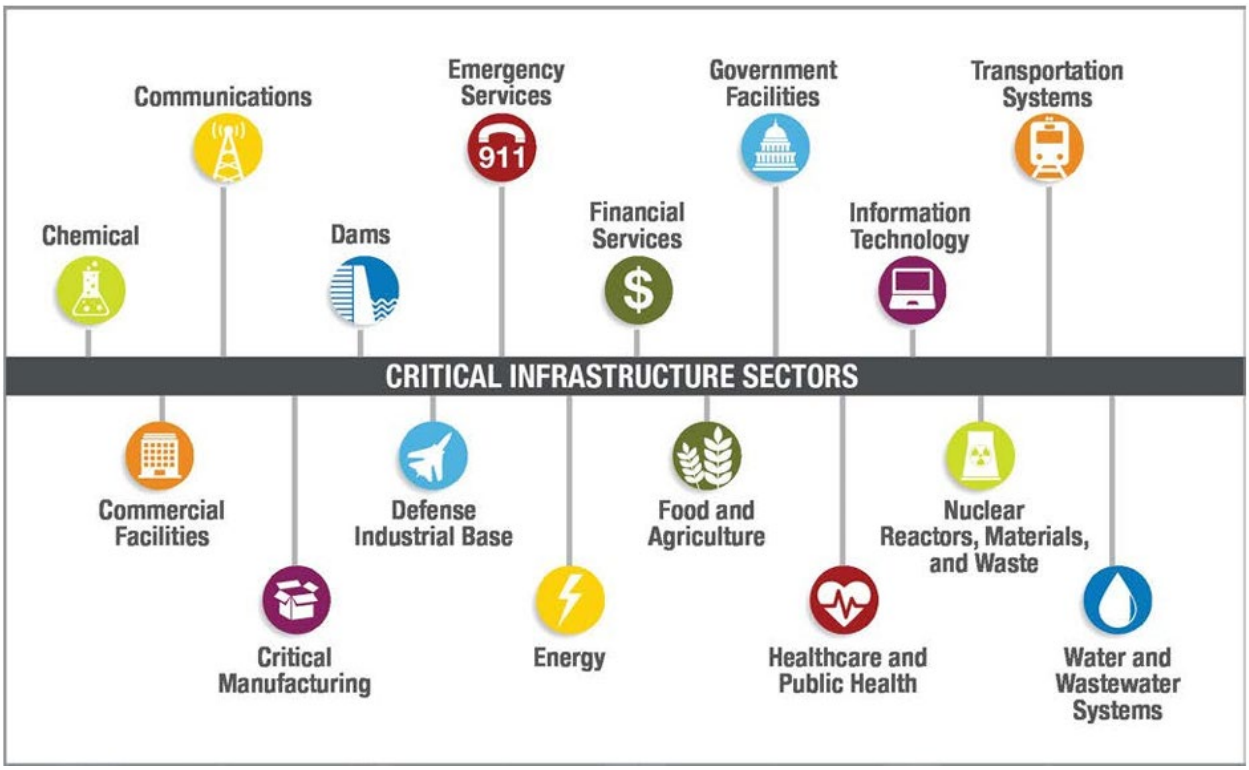
Security

The transportation system touches everyone in some way: personal mobility, the movement of raw materials or manufactured materials, and the delivery of agriculture and food products are just a few ways the nation depends on transportation for its livelihood and economic stability. So much so that the Transportation Systems Sector is one of the 16 Critical Infrastructure Sectors identified by the National Coordinator for Critical Infrastructure Security and Resilience (CISA) (See Figure 3-5.)[7] Critical Infrastructure Sectors are defined as "sectors whose assets, systems, and networks, whether physical or virtual, are considered so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof."

The Department of Homeland Security has developed a National Infrastructure Protection Plan (NIPP) that sets forth a comprehensive risk management framework and clearly defines critical infrastructure protection roles and responsibilities for the Department of Homeland Security, Federal Sector-Specific Agencies (SSAs), and other Federal, State, local, tribal, and private sector security partners. The NIPP provides a coordinated approach that will be used to establish national priorities, goals, and requirements for infrastructure protection so that funding and resources are applied in the most effective manner.

[7] The National Coordinator for Critical Infrastructure Security and Resilience (CISA). Critical Infrastructure Sectors. https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors Accessed June 6, 2025

Figure 3-5. Critical Infrastructure Sectors



Protecting and ensuring the continuity of the critical infrastructure and key resources (CI/KR) of the United States is essential to the Nation's security, public health and safety, economic vitality, and way of life. CI/KR includes physical or virtual assets, systems, and networks so vital to the United States that the incapacity or destruction of such assets, systems, or networks would have a debilitating impact on security, national economic security, public health or safety, or any combination of those matters. The National Infrastructure Protection Plan (NIPP) provides a coordinated approach that is used to establish national priorities, goals, and requirements for CI/KR protection so that Federal resources are applied in the most effective and efficient manner to reduce vulnerability, deter threats, and minimize the consequences of attacks and other incidents. It establishes the overarching concepts relevant to all CIKR sectors identified under the authority of Homeland Security Presidential Directive 7 and addresses the physical, cyber, and human considerations required for the effective implementation of protective programs and resiliency strategies.[8]

Northeast Ohio is susceptible to many threats, such as severe winter storms, flooding, tornados, and severe thunderstorms. The region must also prepare for other risks, such as terrorism. The unexpected and complex nature of these incidents requires extensive coordination, collaboration, and flexibility among all the agencies and organizations involved in planning, mitigation, response, and recovery. Regional coordination is critical to security and emergency preparedness. The region's many individual municipalities, villages, and townships, as well as extensive roadways and bridges, wide-ranging mass transit systems, rail, airports, and shipping ports, present significant challenges to coordinating and implementing effective security programs.

[8] https://www.dhs.gov/xlibrary/assets/NIPP_Overview.pdf Accessed May 22, 2025.

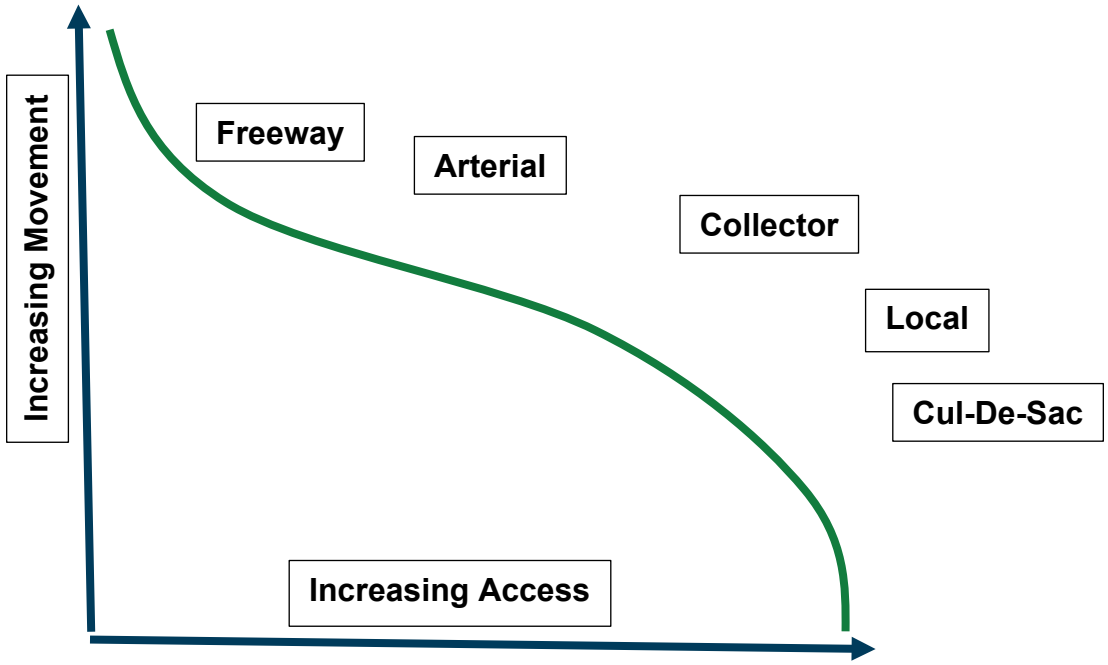
Definition of Access and Mobility

Some transportation modes, such as air transportation, have a clear separation between access and mobility. Access to an aircraft begins with passengers boarding, and once the cabin doors are closed, the aircraft is transferred from an access function to a mobility function. For the highway mode, access and mobility do not have such clear boundaries. Road and street functional classifications attempt to define these boundaries by grouping roads, streets, and highways in a hierarchy based on the type of highway service they provide.

Generally, how closely a highway or street functions compared to the defined service plays a crucial role in reducing congestion, promoting safety, and increasing transportation system efficiency. Streets and highways are part of an interconnected network, and each one moves traffic throughout the system by a specified degree of access and a level of movement.

Figure 3-6 indicates the degree to which different road functional classes should accommodate movement and access. The curve in this figure illustrates the defined relation between access and mobility for each road function class.

Figure 3-6. Relationship between Access and Movement Functions of Roads & Streets



In recent years, travel behavior has substantially changed. Journeys with a single purpose, such as work, shopping, or returning home, have been replaced by trip chains. These new characteristics of travel demand have led to the widespread use of private cars. Combining private motorized vehicle usage with trip chain behavior has affected transportation mode choice and made the access and mobility relationship more complex for road function class.

In the following sections, access to the existing highway and transit systems and the level of mobility through these networks are evaluated as benchmarks for shifting travel demand from a mainly single mode, i.e., private motorized vehicles, to other mode choices in a more equitable transportation system.

Access

People travel from an origin to a destination for the primary purposes of economic, social, recreational, and other activities. Although the physical act of traveling is a secondary function, it is necessary for conducting the primary functions. Traveling is possible if travelers have safe, timely, and affordable access to the existing transportation infrastructure components. Without access to the transportation platform, trips may not be made in a safe and efficient manner.
The following sections attempt to analyze the state of access in the NOACA region. A critical question is who has access to which part of the transportation system. This section summarizes the existing access to the current transportation system in the NOACA region, which will be a benchmark for planning and investing in equitable transportation infrastructure in the next three decades.

Access to Freeway System

In the NOACA road network, highways with controlled access, such as Interstate 71, Interstate 77, Interstate 480, etc., provide a connectivity platform for mainly long regional and inter-county vehicular traffic at a high speed. The controlled access to interstate highways is designed by on-ramps or off-ramps and interchanges. The ramp and interchange spacing is critically important in the origins and destinations of trips traveling through those highways, mobility role, safety, and traffic management.

An excessive number of access facilities, such as interchanges in a freeway network, diverts many short trips from the arterial and collector street network to the freeway system. This diversion has two negative impacts:

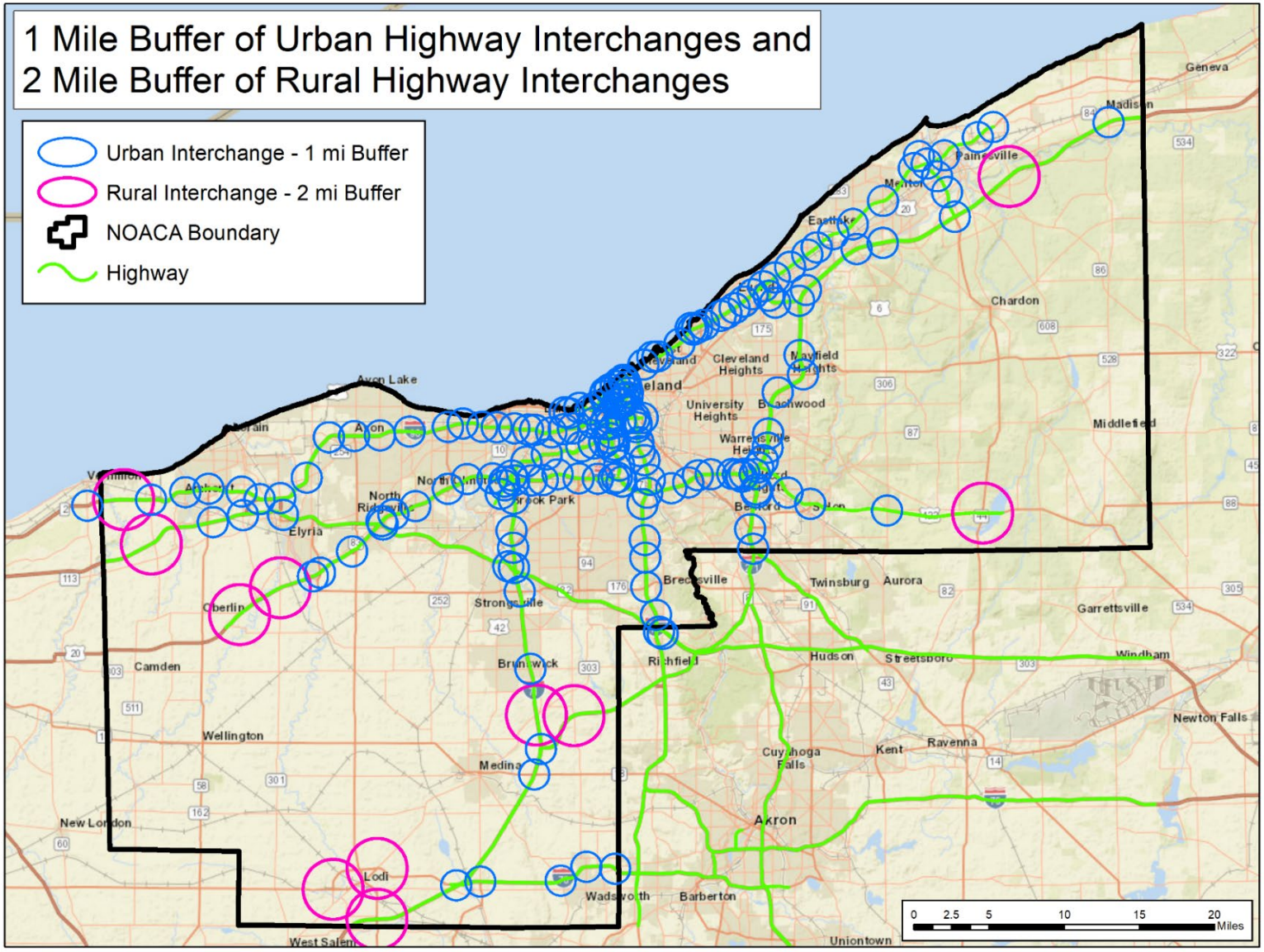
- Freeways will be congested by short vehicular trips entering from one interchange and leaving the freeway system at the next interchange,
- Reduces street network throughput, and streets operate under capacity and consequently seem over-invested.

The AASHTO's design guidelines (Green Book) recommend the following passage regarding interchange spacing:

> "In areas of concentrated urban development, proper spacing usually is difficult to attain because of traffic demand for frequent access. Minimum spacing of arterial interchange (distance between intersecting streets with ramps) is determined by interchange form, lane configuration, weaving volumes, signing, signal progression, and lengths of speed-change lanes. A general rule of thumb for minimum interchange spacing is 1 mi [1.5 km] in urban areas and 2 mi [3.0 km] in rural areas. In urban areas, spacing of less than 1 mi [1.5 km] may be developed by grade-separated ramps or by adding collector-distributor roads."

In response to the trip chain travel demand over the last decades and the implications of the above guideline, as illustrated in Figure 3-7, the existing interchange locations in the NOACA region indicate that there may have been overinvestments in providing access to the freeways rather than paying attention to their mobility purposes.

Figure 3-7. Existing Interchange Spacing in the NOACA Region



In the literature, transportation accessibility is mainly measured by three components: trip coverage, spatial coverage, and temporal coverage. In this section, each facility access point is measured by a circular buffer with a specific radius to identify its existing coverage area and analyze the future requirements for a transportation facility.

Figures 3-8 and 3-9 depict the five-mile travel distance coverage for each freeway access point and access coverage in relation to the urban area.

Figure 3-8. Access to Highway System

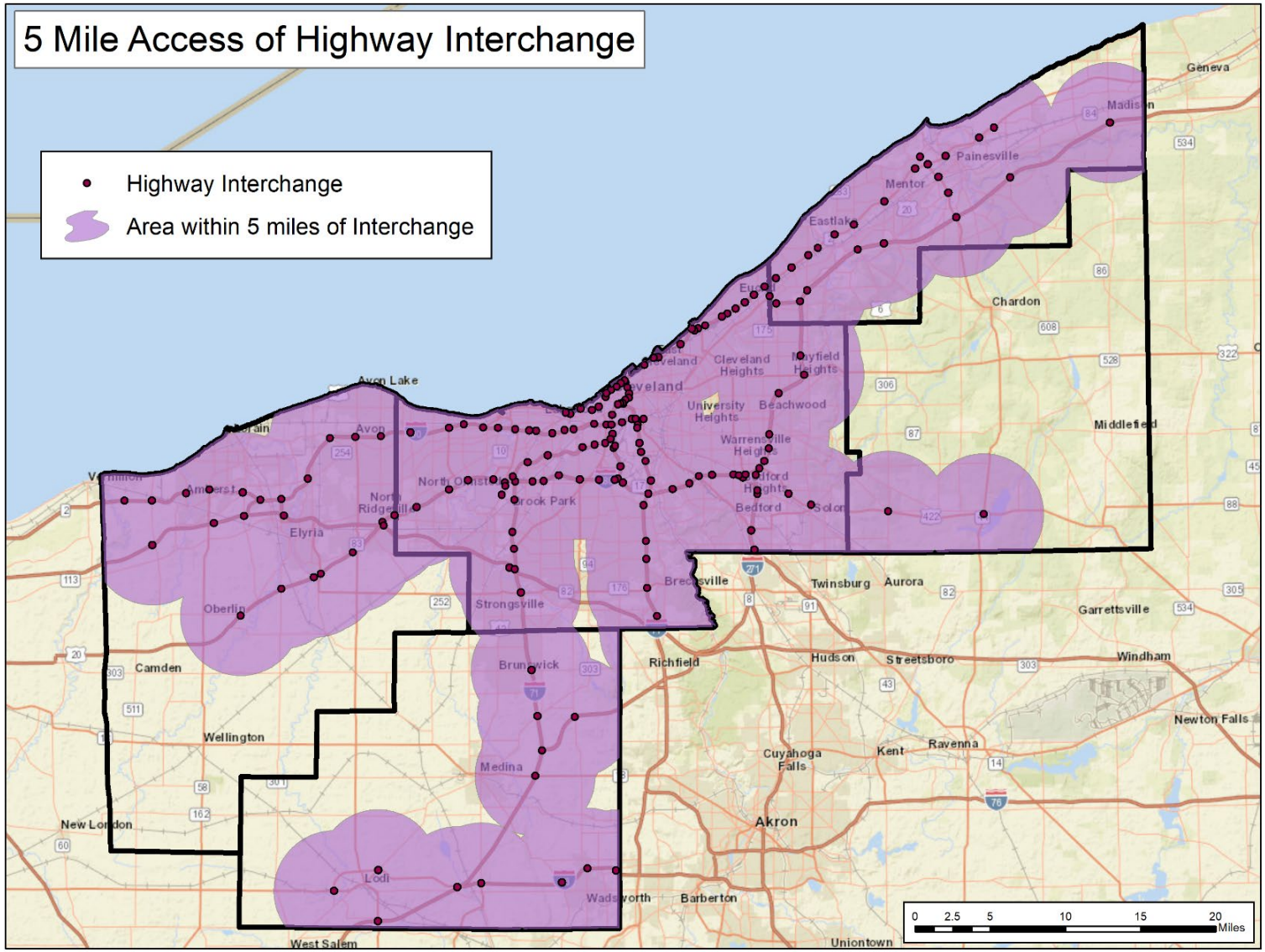
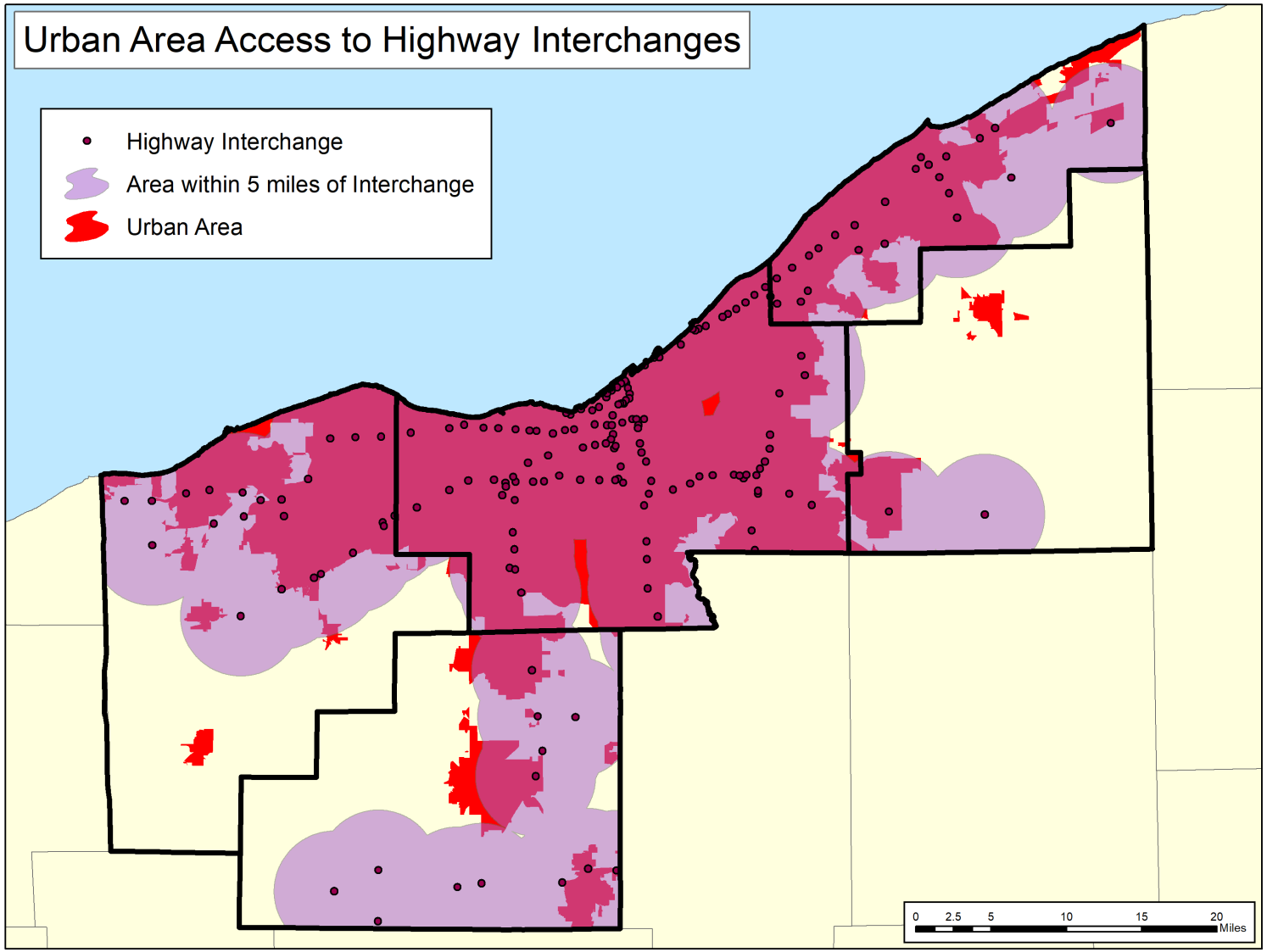


Figure 3-9. Urban Area Access to Highway System



As illustrated, most of the urban area has quick access to the freeway system. The overlapping areas of the 5-mile circles may be assumed to indicate excessive access and overinvestments. Currently, over 1.8 million of the total NOACA region population reside within a 5-mile driving distance of an interchange. This is over 90 percent of the residents, and it indicates that the freeway network is accessible within a short distance regardless of one's neighborhood.

Arterial Network Accessibility

The arterial network consists of major (or principal) and minor arterials. The major arterial network consists of roads and streets that serve large amounts of traffic traveling relatively long distances at higher speeds. Considering its function class, this network may play an alternative role to the freeway network in reducing traffic congestion. Arterials generally connect residential areas to many employment centers and intersect with freeways.
Major arterials are usually congested, and the Level of Service (LOS) measure indicates overcapacity and is calculated as:

$$\frac{\text{Volume}}{\text{Capacity}} > 1$$

This means that the traffic volume is higher than the road capacity, and improvement strategies generally aim to improve the capacity (i.e., increase the denominator) to alleviate congestion.
On the contrary, the LOS measures for the exiting arterial corridors in the NOACA region are generally under capacity.

$$\frac{\text{Volume}}{\text{Capacity}} < 1$$

Capacity-improving strategies, such as signal timing optimization, attempt to increase capacity, not to reduce the ratio above, but to attract more through traffic. This would increase the use of the road and restore it as an alternative to congested highways.

Generally, the arterial corridors are radial (originating from the center of Cleveland) or tangential (running “around” the periphery of downtown Cleveland at increasingly distant intervals). At further distances, the radial and tangential corridors tend to intersect with the centers of other large communities in the NOACA region.

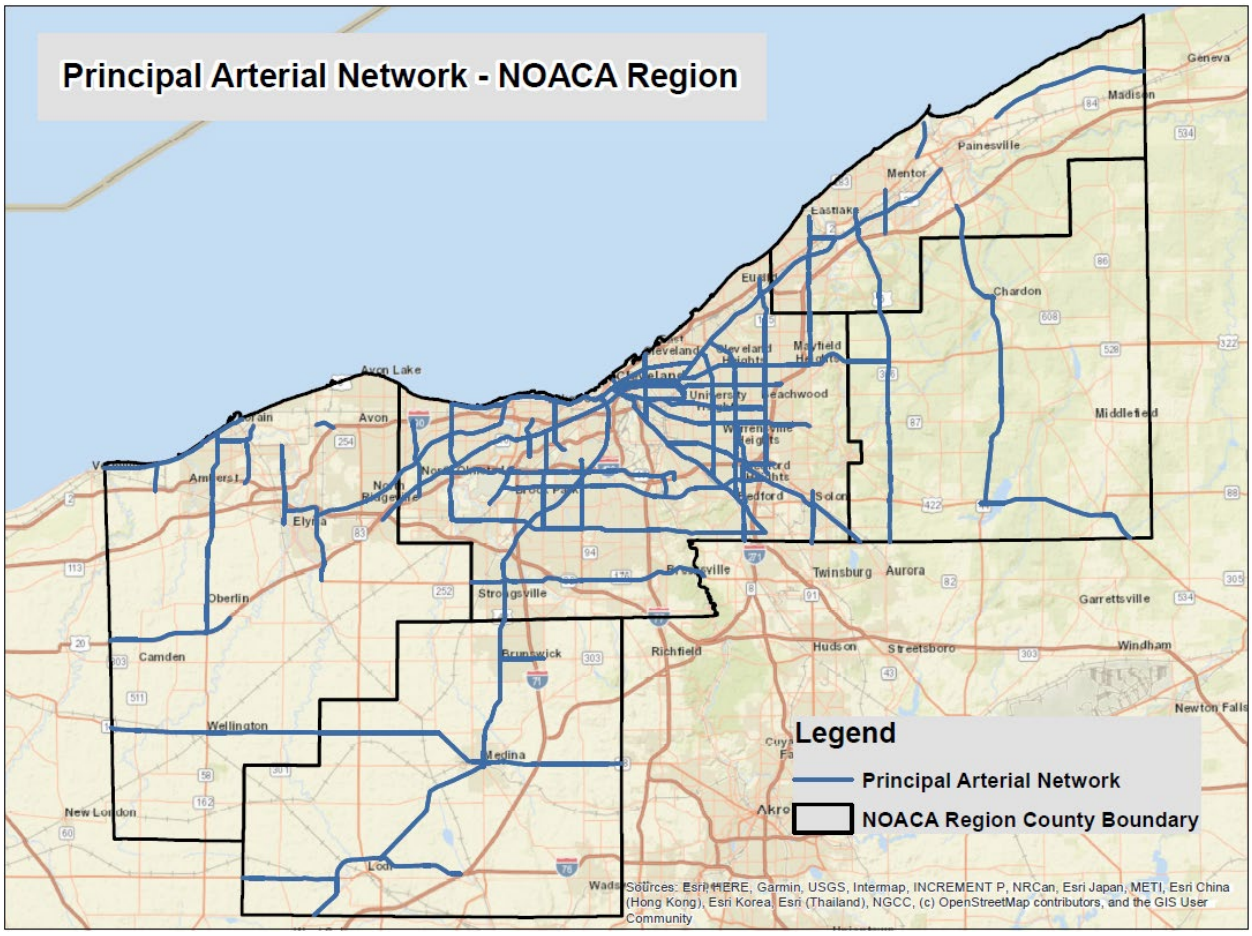
Transit riders are often divided into two categories: “choice” riders (individuals who own cars but choose to ride transit) and “captive” riders (individuals who do not own cars and must use transit). In these corridors, transit routes operate through the arterial network, providing an alternative travel mode for passenger vehicles for residents’ daily commutes. Some of these corridors run through the neighborhoods traditionally underserved by existing transportation systems, such as low-income and minority households, which are likely to have a high concentration of zero-vehicle households. Therefore, public transportation along these corridors is a travel necessity for some of the residents.

Most travelers are concerned about the length of their travel time on the major arterial network, which is generally affected by intersection delays and posted speed limits. However, higher accessibility of these corridors has the potential to attract more motorists to travel through the

arterial network as an alternative to the existing congested freeways during the morning and afternoon peak periods. This would benefit the businesses along these corridors and also reduce traffic congestion on freeways.

Figure 3-10 displays the major arterial network in the NOACA region.

Figure 3-10. Major Arterial Network in the NOACA Region



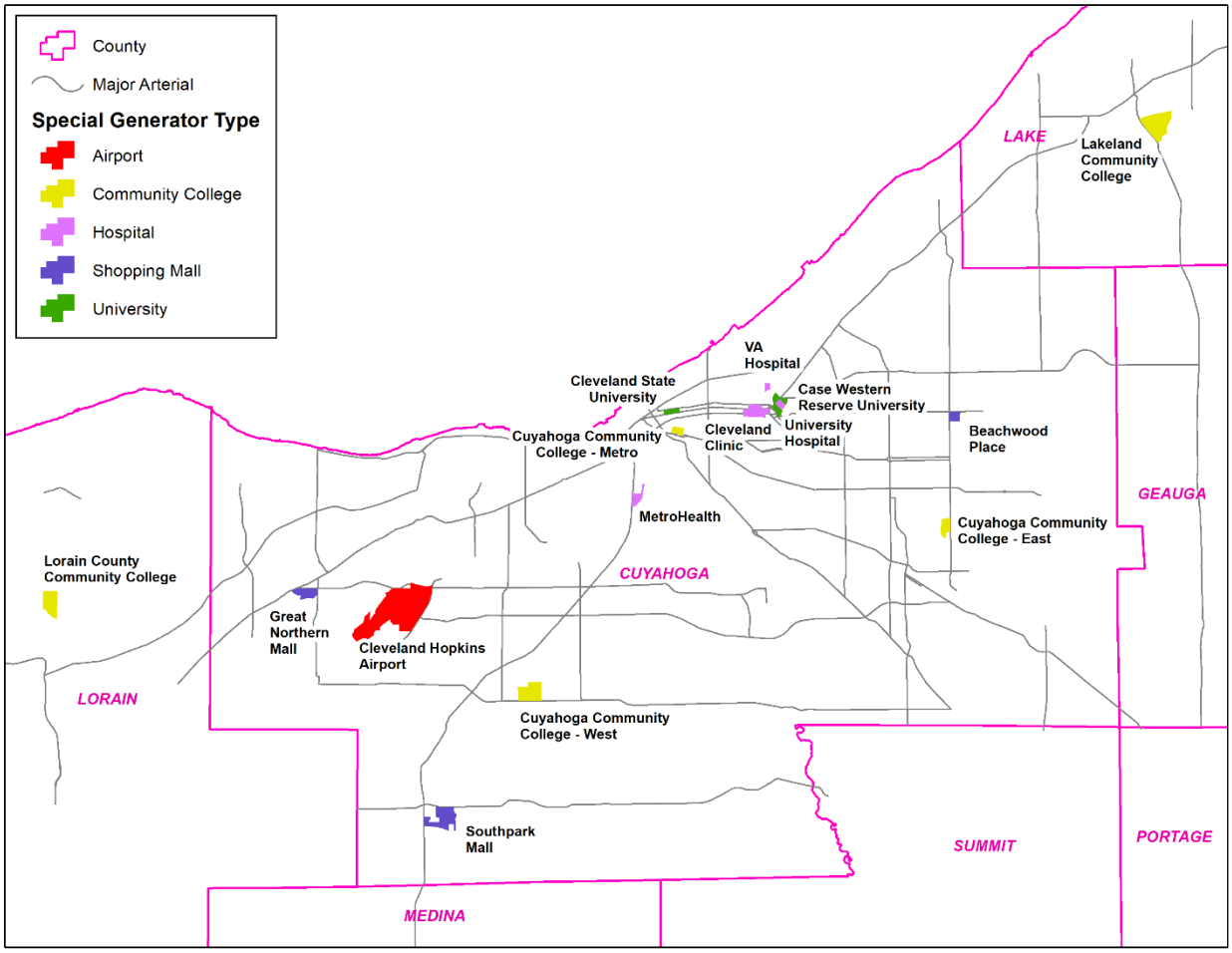
Access to Important Trip Generators

Access to regionally significant origins/ destinations, such as healthcare, education, and shopping, is highly dependent upon the major arterial network. Many of the regionally significant locations for healthcare, education, and shopping are found along major arterials. As previously discussed, arterials are used for both mobility and access. Therefore, it makes sense that many regionally significant trip generators would be located on major arterials, as these roadways provide transportation assets for residents traveling from near or far.

The NOACA travel forecasting model takes into account all different types of land uses, and those that are regionally significant in terms of employment and person trips have been identified as “Special Generators”. These locations are unique in the fact that they attract and generate many more trips from much farther distances compared to other similar land uses. Almost all the special generators fall into the major trip generator categories of healthcare, education, and shopping (with Cleveland Hopkins Airport being the lone exception). As can be seen in Figure 3-11, all of

the special generators are located on or near a major arterial, with many being located near the intersection of two major arterials. Therefore, the reinvigoration of the arterial network is important for accessing the major and minor activity locations.

Figure 3-11. Special Generators and the Major Arterial Network



Access to Transit Network

Bicycle and pedestrian access to transit is an important aspect of a cohesive, multimodal transportation network. These connections to the transit network are often referred to as “first mile-last mile trips,” those short trips that get commuters from their homes to a bus or train or from the bus or train to their place of work. Because bus routes and rail stations cannot pick all riders up right at their front doors, most people must travel some distance before boarding a bus or train. Riders should be able to safely and conveniently get to and from transit stops and stations via a well-connected system of pedestrian and bicycle infrastructure.

The potential connectivity of residents and commuters to the regional transit network via walking and biking can be gauged by the presence and prevalence of quantifiable characteristics. For example, intersection density is an established indicator of walkability and connectivity. Grid pattern development with many intersecting perpendicular streets usually offers multiple routes between origins and destinations, while cul-de-sac developments or areas with fewer roadways and intersections can hinder direct shortest-distance movement. Similarly, a high density of low-

stress roadways offers pedestrians and cyclists a greater number of safer and more comfortable opportunities to move along roadways and through intersections, while a greater proportion of higher-stress roadways may discourage pedestrian and cyclist travel.

Measuring the quality and quantity of access to transit services is important in evaluating existing transit services, travel demand, allocating transportation investments, and making decisions on land use development. In this regard, the ability to walk to transit is important for access to jobs and vital services, like education and healthcare, especially for those who do not have access to a car. To measure accessibility, a distance of three-quarters of a mile or equivalent to 15 minutes of walking time (assuming 3 miles per hour as walking speed) is often utilized to represent a reasonable walking distance/time to reach a transit stop.

Currently the walk accessibility to transit is not evenly distributed throughout the five counties of the NOACA region. In many counties, access to transit by walking is scarce and very limited. Geauga County has no fixed-route transit and, as a result, none of its population is within a reasonable walking distance. When the entire NOACA region is considered, just over two-thirds of the regional population is within a reasonable walking distance of a transit stop.

Lorain and Medina counties only have a few transit lines within their counties and thus have a small percentage of their population within a reasonable walking distance, coming in at approximately 28% and 10%, respectively. Lake County has more transit lines within its large population centers, and that results in around two-thirds of its population being within a 15-minute walking distance of a transit stop (71%). Cuyahoga County has the most extensive transit network covering most of the county and thus has a large majority of its population (87%) within a reasonable walk to transit.

Table 3-14 displays the existing transit stop coverage by numbers and percentages of people living within a 15-minute walking distance from transit stops.

Table 3-14. Transit Walk Accessibility Measure by County

County	Population within a 15-Minute Walk to Transit Stop	Walk Accessibility to Transit Percentage
Cuyahoga	1,074,218	87%
Geauga	0	0%
Lake	163,284	71%
Lorain	88,043	28%
Medina	18,189	10%
NOACA Region	**1,343,734**	**66%**

Figures 3-12 and 3-13 display the current regional and zero-car-household transit walk accessibility. In these maps, neighborhoods are considered Traffic Analysis Zones (TAZ).

Figure 3-12. Transit Walk Accessibility in the NOACA Region

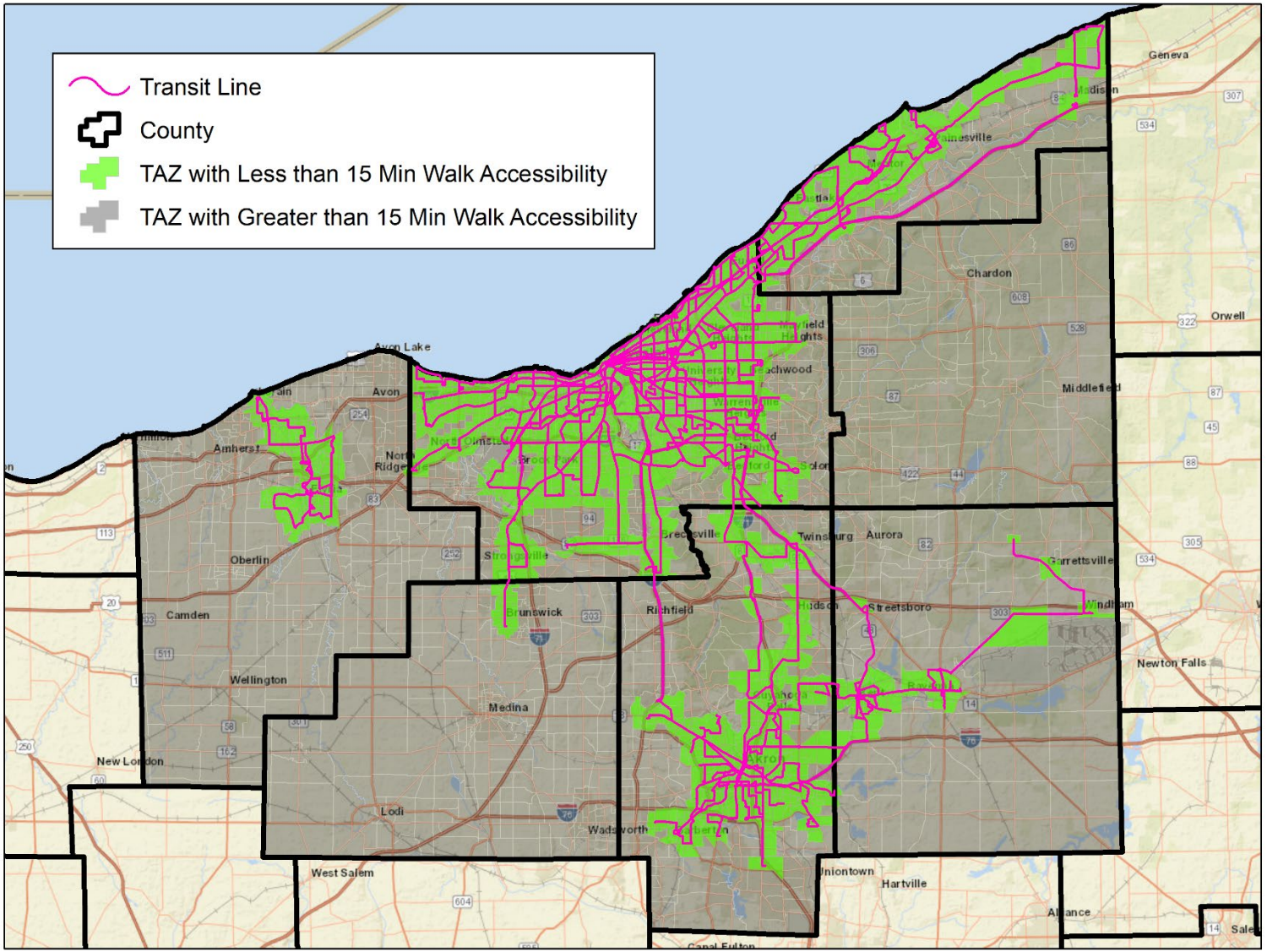
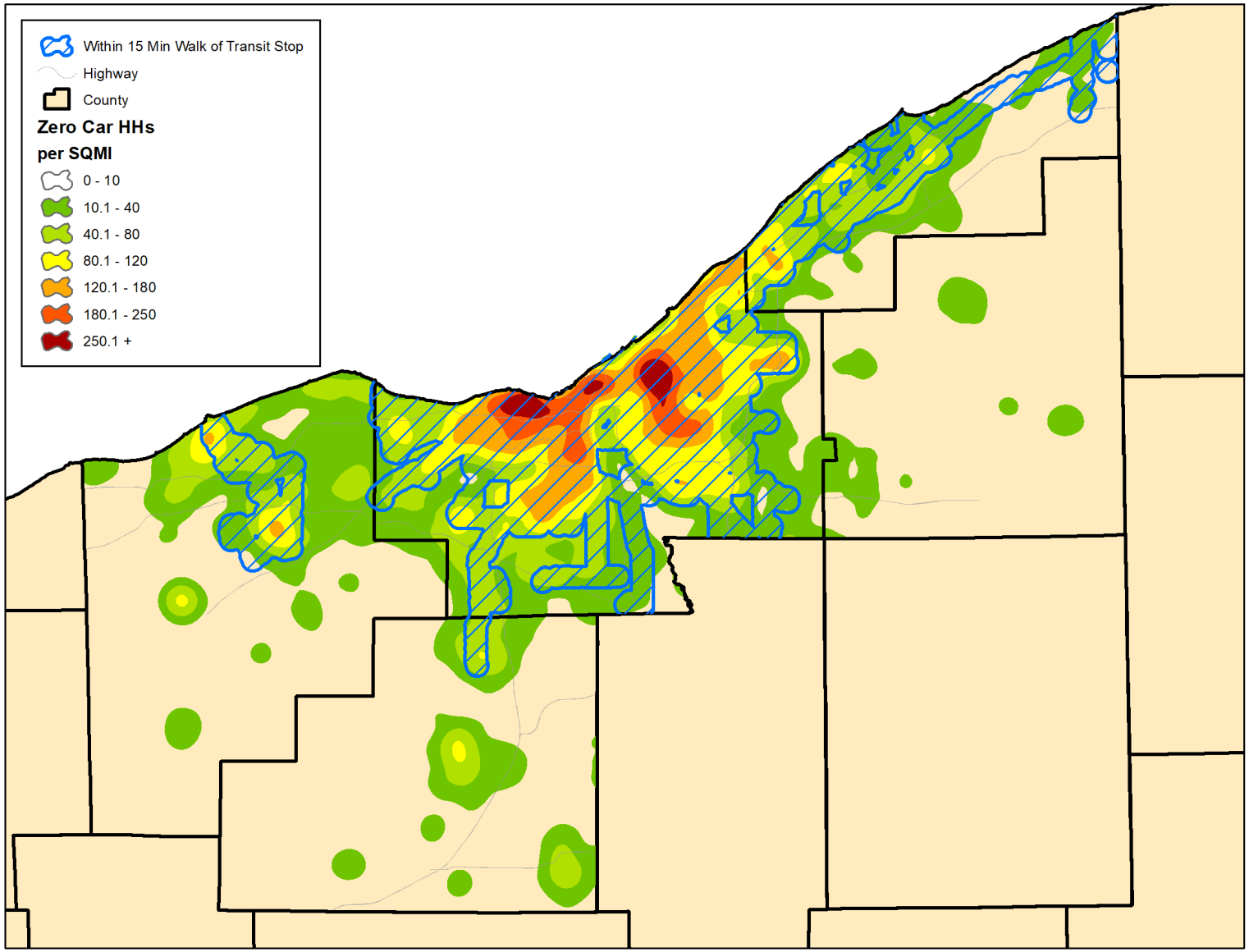


Figure 3-13. Zero Car Household Walk Accessibility to Transit Stops



The Location Quotient (LQ) method is a useful quantitative screening tool for assessing the potentially disparate impacts of indicators associated with particular geographic areas, such as zero-car households.

The LQ for the zero-car households within a 15-minute walking distance from a transit stop is calculated by applying the following formula:

$$LQ = \frac{\frac{Zero\ Car\ HHs\ within\ \ 15\ min\ Walking\ Distance\ from\ a\ Transit\ Stop}{All\ HHs\ within\ \ 15\ min\ Walking\ Distance\ from\ a\ Transit\ Stop}}{\frac{Total\ Zero\ Car\ HHs\ in\ the\ NOACA\ Region}{Total\ HHs\ in\ the\ NOACA\ Region}}$$

The LQ for zero-car households within a short walking distance of a transit stop is 1.09, which indicates that the concentration of zero-car households in the 15-minute transit coverage area is slightly higher relative to the entire population in the NOACA region.

Table 3-15 summarizes LQ values for the zero-care households and access to two different types of transit stations.

Table 3-15. LQ Values for Zero Car Households

Access Type	Zero Car Households
15 Minutes Walking Distance to any Transit Stop	1.09
15 Minutes Walking Distance to a Rail Station	1.25

All the rail stations are in Cuyahoga County, as is the highest concentration of zero-car households. As indicated in Table 3.15, zero-car households that are within a short walking distance of rail stations are overrepresented relative to the total zero-car households in the NOACA region.

However, a high concentration of zero-car households around a transit station does not guarantee a reasonable work commute time by transit. The long commute time is due to low transit service frequencies and, consequently, long waiting and transfer times for riders. The next section will illustrate the long transit commute times to job hubs.

Access to Jobs

In a region, trips are categorized by their purposes: work trips, school trips, shopping trips, social trips, etc. The work trip category includes the most important mandatory trips, and reducing work commute time from workers' residences to employment locations is a major transportation planning challenge. A region's economic vitality is an important factor in the current competitive global economy, and providing access to jobs for workers at any income level improves the entire region socially and economically.

In order to measure the current job accessibility in the NOACA region, six major job hubs were identified based on a research brief produced by NOACA in 2016 entitled "Major Employment Hubs in the Cleveland MSA." These employment areas have the highest employment density compared to other areas in the region, and they are:

1. Downtown/Near East Side
2. University Circle, including Midtown between E. 105th Street and E. 83rd Street
3. Solon Cochran Corridor
4. Chagrin Highlands
5. I-77 and Rockside Road Area
6. Hopkins Airport Area

The regional characteristics of a job hub, including the number of jobs and its centralized or decentralized location, are important factors in the accessibility measure. There are many local job centers, as well as jobs not within any hub or center throughout the region, but the regional job hubs account for 30% of the jobs in the region. The six major job hubs include about one-quarter (25%) of current jobs in the region. Workers commute to these regional job hubs from various distances: short, medium, and long distances from across the region. The majority of work trips to local and minor job hubs are generally only short trips, and generally, trip time data to these job hubs are biased. Therefore, this section discusses work commute times to the major regional job hubs as representative of all the work trip times. A pilot analysis for legacy and minor job hubs was completed for Medina County at the same time as the regional hubs, with an analysis for the remaining three counties still underway but yet to be completed. To summarize, Figure 3-14 shows the locations of the regional job hubs (major, minor, and legacy) in the NOACA region. In addition to regional job hubs, there are also local job centers that have been considered but cannot be reliably modeled for various transportation analyses due to their disjointed characteristics and, therefore, not included in this work.

Figure 3-14. Regional Job Hubs Map

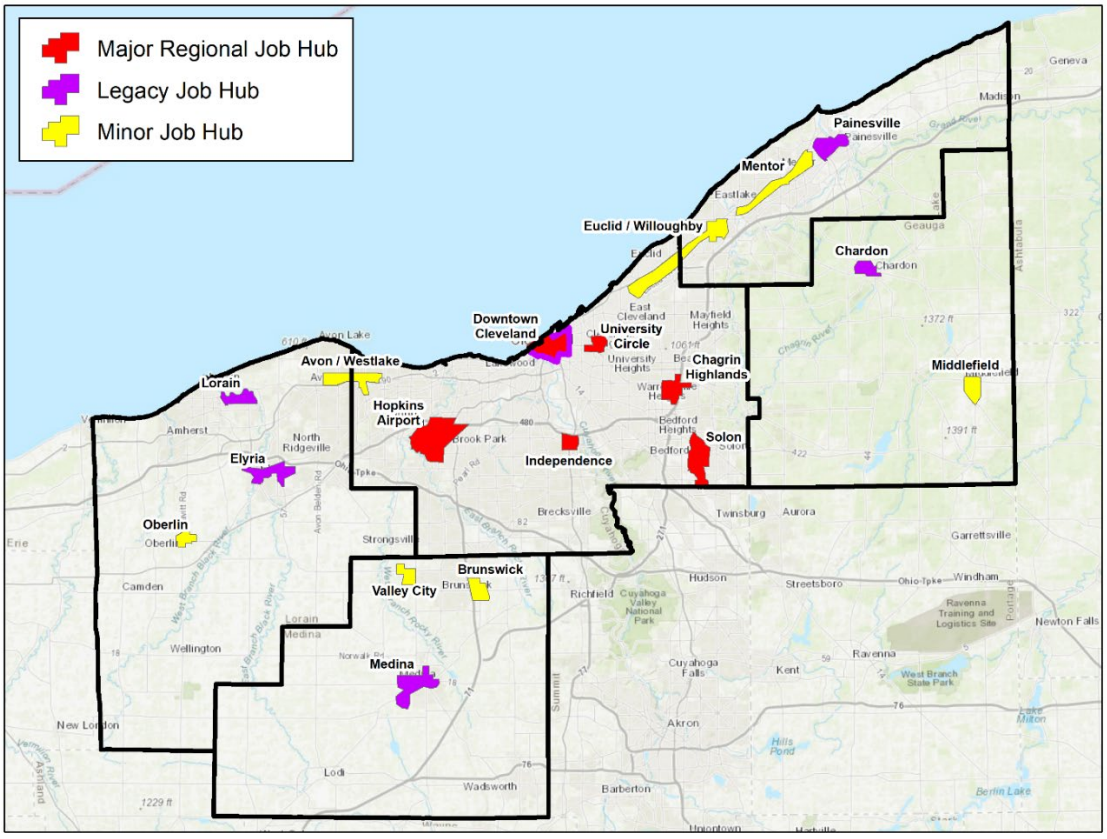


Table 3-16 illustrates the minimum, maximum, and average commute times of the current work trips during the morning peak period of a typical day from workers' homes to the major regional job hubs by auto and transit.

Table 3-16. Regional Statistical Values of Morning Work Commute Times by Auto and Transit

Auto & Transit Work Commute Times During 2024 AM Peak Period		Origin					
		Region					
		Morning Work Commute Time by Transit (Minutes)			Morning Work Commute Time by Auto (Minutes)		
Destination	Major Job Hub	Min	Average	Max	Min	Average	Max
	Cleveland Downtown	16	73	245	3.3	31	87
	University Circle	16	68	264	2.7	37	93
	Solon	28	107	315	3.4	36	79
	Chagrin Highlands	28	86	288	3.0	32	76
	Independence	41	99	301	2.0	29	77
	Hopkins Airport Area	38	98	309	4.0	31	85

Source: NOACA Travel Forecasting Model

As discussed previously, the transit system has an acceptable level of coverage in Cuyahoga County. However, due to the low frequency of transit services, low speed on the arterial streets, and long waiting and transfer times, work commute time is still much higher than that of the auto mode. All the statistical values of the minimum, average, and maximum of the transit mode are more than twice those of the auto mode.

Most people seem to enjoy a certain amount of personal travel, about 30 minutes a day, and dislike devoting more than about 90 minutes a day. Adding the travel times of the return home trips similar to the average transit travel time shown in the above table results in daily work trip travel time outside an acceptable range for most residents in the NOACA region. Therefore, high transit travel time is a critical factor in choosing private vehicle mode for daily work trips. The implications of this analysis are far-reaching. On the workforce development side, the analysis and data could be used to identify undersupplies of worker types residing in areas with good accessibility to major job hubs. In order to reduce the worker and employer locations mismatch in this region, more frequent transit services to the major job hubs, more park-and-ride locations throughout the region, implementation of low-cost traffic engineering to remove arterial bottlenecks, and more bike facilities to access major transit stations.

Mobility

Typically, the interstate and freeway systems carry the highest volume of traffic in the region, requiring more travel lanes. In the NOACA region, the lane-miles length of the existing freeway/expressway system is about 2,200 miles, which is about 25% of total roadway lane-miles.

Vehicle Miles Traveled (VMT) is a measure used extensively in transportation planning for various purposes. It is the leading measure of both personal and commercial vehicle travel demand. VMT data are also useful in policy decisions for infrastructure investment. Since VMT measures travel demand, it is useful in determining where resources are most needed, and it is an important measure to monitor and forecast.

The current VMT percent of the freeway/expressway system is about 56 based on the typical daily vehicle trips in the NOACA region, based on the NOACA Travel Forecasting Model.

The VMT per capita illustrates the relationship between population growth and the length of travel in the NOACA region. The current annual personal VMT estimate per capita is about 6,600, and the annual commercial VMT per capita is about one-tenth of that.

Comparing the lane-miles percentages of the freeway/expressway system with the major arterial, shown in Table 3-17, indicates that although the total lane miles are less, the VMT percent of the freeway network is over 60% more than that of the major arterial network. This is additional evidence to reinforce the argument that the major arterial network, as a mobility alternative to the freeway system, is currently underutilized in the NOACA region.

Table 3-17. Percentages of Lane Miles, VMT, and Delay by Facility Type[9]

Facility Type	Main Function	Lane Miles Percent	Personal & Commercial Vehicles VMT Percent	Daily Delay Percent
Freeway/ Expressway/Ramp	Mobility	25%	56.2%	31.7%
Major Road (Arterial)	Mobility & Access	44%	33.5%	49.2%
Minor Road (Collector)	Access	31%	10.3%	19.1%

Traffic Congestion

Following access to the transportation facilities, a journey begins from an origin to a destination. The journey may be measured qualitatively and quantitatively by various travel attributes: travel time, delays due to routine or unexpected congestion, travel mode, journey route, safety, trip quality, etc.

It is expected that large numbers of people are all trying to reach their destinations at the same time, usually during peak hours, which causes congestion and delay. If congestion and delay are a daily routine, most travelers accept and plan for them. However, unexpected delays are less

[9] The 2021 road network data contained errors in which many local roads were classified as “Collectors.” In 2024, NOACA performed a systematic and region-wide update to the facility type data in our master road network. This update greatly reduced the amount of collector lane mileage on the NOACA road network and improved the accuracy of the lane mile values.

tolerated. Delay is a quantity that indicates where the problems are, what the solutions might be, and how beneficial the investment will be.

Transportation authorities continuously take actions to benefit travelers by balancing land use access and mobility and reducing travel time. On the contrary, actions in pursuit of other goals, such as improving safety, may also have the unintended or unavoidable consequence of slowing travel. The purpose of this section is to evaluate reductions or increases in passenger and goods travel time that result from such actions.

As discussed in previous sections, accessibility, mobility, and congestion are the main measures for evaluating the performance of the highway system in terms of how efficiently users can traverse it. Mobility and congestion represent similar concepts, and the same metrics, such as travel time, may be used to measure them.

Congestion describes the travel conditions on facilities, and the Federal Highway Administration (FHWA) defines seven sources for traffic congestion and unreliable travel time:

- Category 1: Traffic Influencing Events
  - Traffic incidents,
  - Work zones,
  - Weather
- Category 2: Traffic demand
  - Fluctuation in normal traffic
  - Special events
- Category 3: Physical Highway Features
  - Traffic control devices
  - Physical bottleneck (“Capacity”)

Congestion spreads in time and space. In some areas of the NOACA region, congestion now lasts longer than the traditional morning and evening peak hours, and queues from physical bottlenecks are extended to a mile or two. The following section documents the existing recurring freeway, interchange, and intersection bottlenecks in the NOACA region as sources of congestion and ranks them based on their localized congestion severity. This discussion also examines the relationship between the demand and supply sides of the highway system.

Bottlenecks

FHWA offers the following definitions for a traffic bottleneck:

- A critical point of traffic congestion evidenced by queues upstream and free-flowing traffic downstream
- A location of a highway where there is a loss of physical capacity, surges in traffic volumes, or both
- A point where traffic demand exceeds the normal capacity
- A location where demand for usage of a highway section periodically exceeds the section’s physical ability to handle it and is independent of traffic-distributing events that can occur on the roadway

The highway network in the NOACA region was assessed by using the NOACA travel forecasting model and the following congestion criteria to identify the bottleneck locations. Only “over capacity” freeway segments (a volume over capacity (V/C) ratio above 1) were considered when identifying highway bottleneck locations.

Congestion Criteria

Volume-over-Capacity Ratio (V/C)
The volume-over-capacity ratio during peak periods is one of the primary criteria for evaluating traffic congestion characteristics. The Highway Capacity Manual (HCM) provides different measures for various road classifications and intersection control types; however, these measures are generally divided into six ranges and assigned a Level-Of-Service (LOS) category A through F, with LOS F being indicative of severe congestion. LOS is a qualitative measure used to relate the quality of traffic service. Table 3-18 shows highway LOS ranges that have been used to locate the intensity of traffic congestion.

Table 3-18. Volume over Capacity Ranges

Volume over Capacity Ratio (V/C)	LOS	Description
V/C < 0.3	A	Free Flow Condition
V/C < 0.5	B	Reasonably Free Flow Condition
V/C < 0.7	C	Under Capacity
V/C < 0.85	D	Near Capacity
V/C = < 1	E	At Capacity
V/C > 1	F	Over Capacity

Travel Time Index (TTI)
The Travel Time Index (TTI) is one of the primary metrics used to measure congestion. It is the ratio of the actual travel time divided by the travel time under free-flow conditions. A TTI of 1.2 means that a trip takes 20 percent longer than it would under ideal conditions.

Speed and Travel Time
Speed is the distance traveled per unit of time. In traffic operations, two measures of average speed are Space Mean Speed (SMS) and Time Mean Speed (TMS). SMS is the average speed of all vehicles occupying a defined section of roadway at a point in time. TMS is the average speed of all vehicles passing a point on a roadway for a defined period of time.

NOACA Congestion Assessment

Figures 3-14 and 3-15 present the existing freeway bottleneck locations during the AM and PM peak periods.

Figure 3-14. Existing Freeway Bottleneck Locations during the AM Peak Period

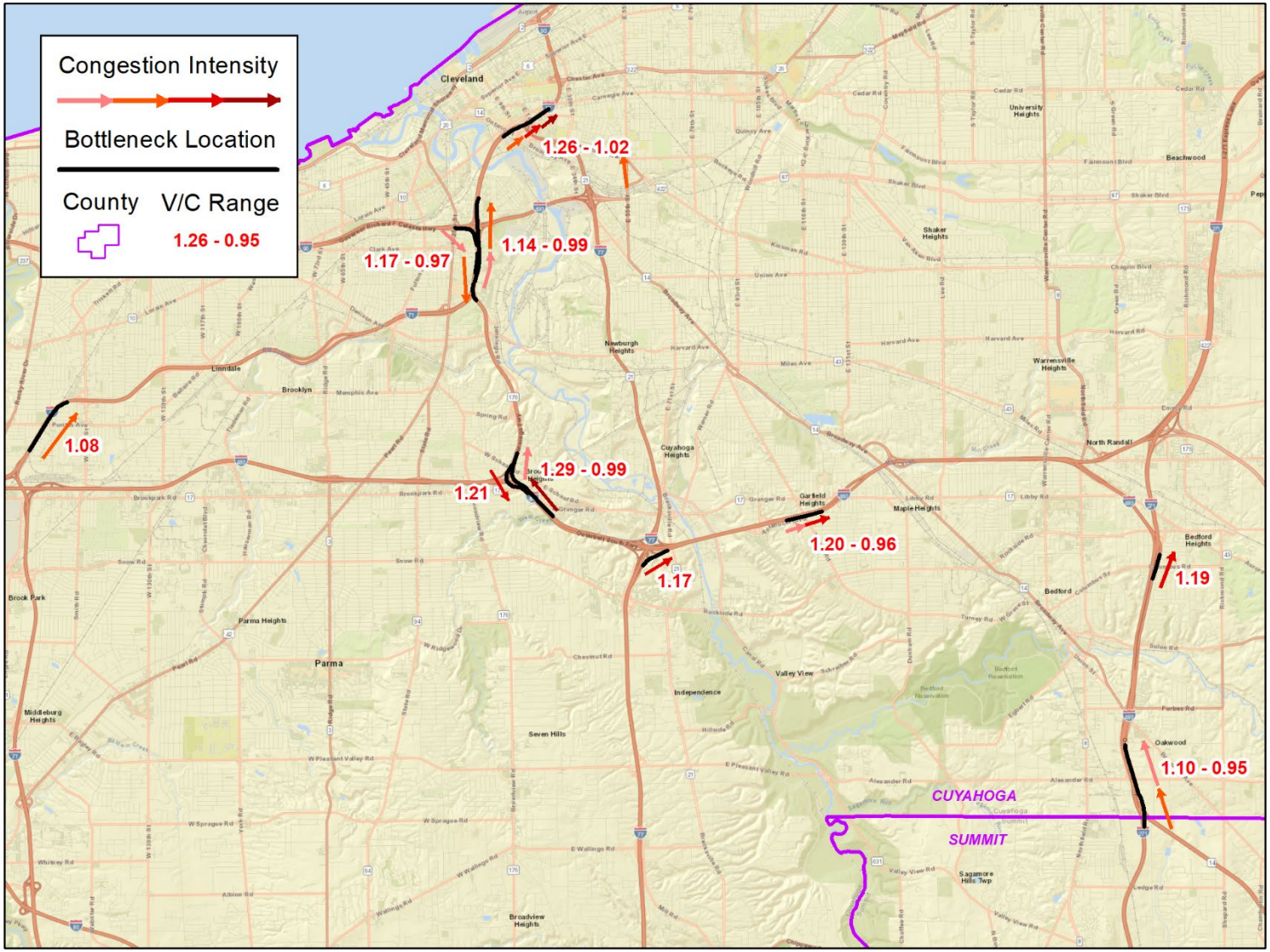
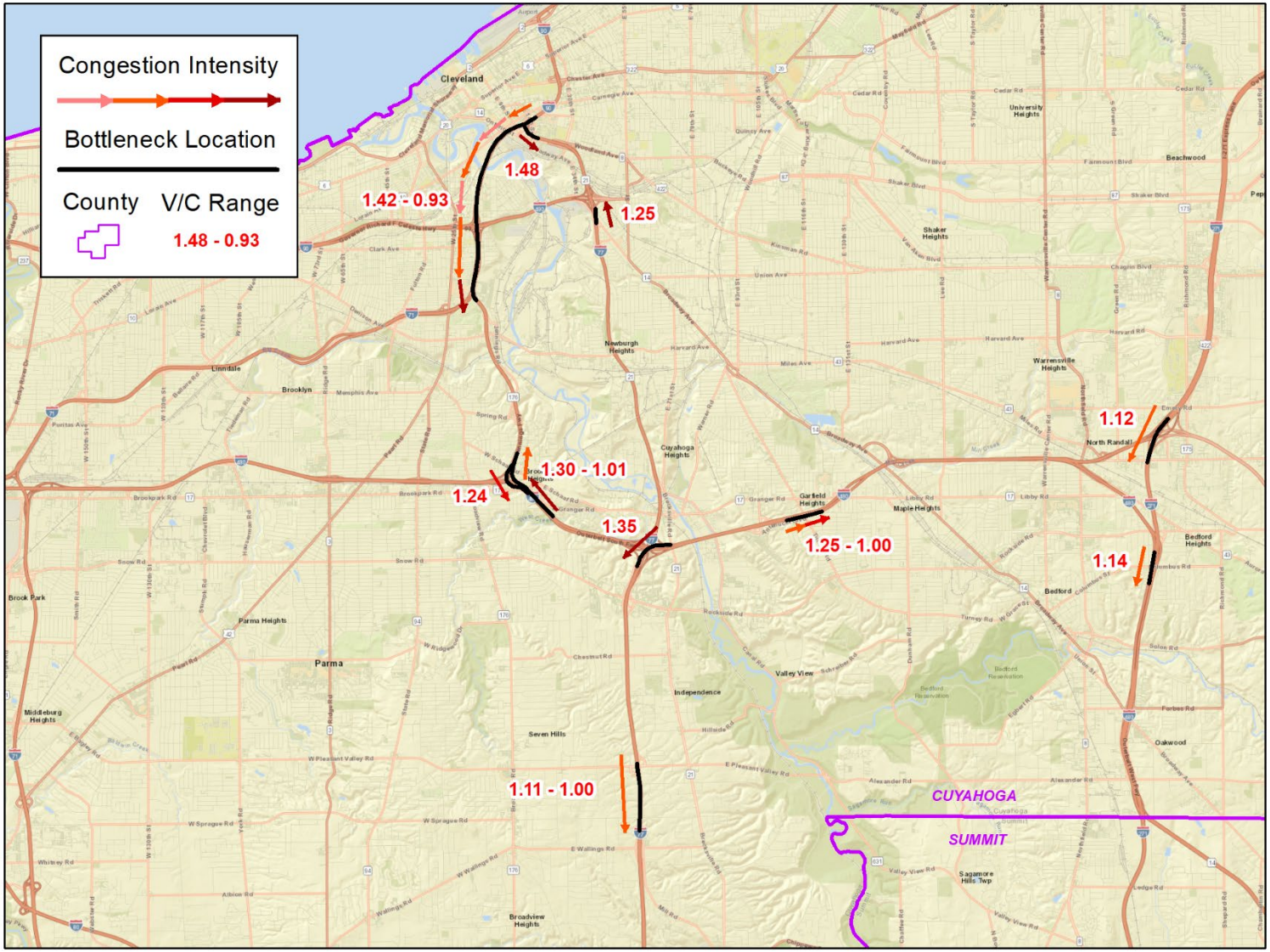


Figure 3-15. Existing Freeway Bottleneck Locations during the PM Peak Period



Tables 3-19 and 3-20 present the V/C, TTI, and speed ranges for the identified freeway bottleneck locations during the AM and PM peak periods.

Table 3-19. Existing Freeway Bottleneck during the AM Peak period

No.	Freeway	Direction	From	To	V/C Range	TTI Range	Actual Speed (mph) Range
1	I-480 Ramp to SR-176	WB / NB	E. Granger Rd. Exit Ramp	SR-176 NB	0.99 - 1.29	1.18 - 2.57	18 - 39
2	I-90	EB	Carnegie Ave. Exit Ramp	Ontario St. Exit Ramp	1.02 - 1.26	1.23 - 2.25	22 - 41
3	SR-176 Ramp to I-480	SB / EB	I-480 WB Ramp	Tuxedo Ave. Bridge	1.21	1.93	24
4	I-480	EB	Transportation Blvd. Entrance Ramp	Granger Rd. Exit Ramp	0.96 - 1.20	1.43 - 4.00	16 - 45
5	I-480	WB	I-271 Split	Rockside Rd. Exit Ramp	1.19	1.8	26
6	I-77 Ramp to I-480	NB / EB	Ramp from I-77 NB to I-480 WB	Ramp from I-77 SB to I-480 EB	1.17	1.69	28
7	I-90 Ramp / I-71 / SR-176 Ramp	EB / SB	Ramp from I-90 EB to I-71 SB	Ramp to SR-176 SB	0.97 - 1.17	1.16 - 1.68	23 - 36
8	I-71	NB	Ramp to W. 14th St.	I-90 Merge	0.99 - 1.14	1.37 - 1.89	23 - 45
9	I-271 / I-480	NB / WB	I-271 / I-480 Merge	Fairoaks Rd. / Broadway Ave. Exit Ramp	0.95 - 1.10	1.27 - 1.92	32 - 49
10	I-71	NB	Ramp from I-480 EB / SR-237 NB	W. 150th St. Exit Ramp	1.08	2.23	28

Note: NB: Northbound, SB: Southbound, WB: Westbound, and EB: Eastbound

Table 3-20. Existing Freeway Bottleneck during the PM Peak period

No.	Freeway	Direction	From	To	V/C Range	TTI Range	Actual Speed (mph) Range
1	I-90 Ramp to I-77	WB / SB	E. 14th St. Entrance Ramp	Bridge over E. 22nd St.	1.48	5.71	6
2	I-90 / I-71	WB / SB	I-77	SR-176	0.93 - 1.42	1.11 - 4.21	11 - 47
3	I-480 Ramp to I-77	WB / SB	Ramp from I-480 WB to I-77 NB	Ramp from I-480 EB to I-77 SB	1.35	3.23	18
4	I-480 Ramp to SR-176	WB / NB	E. Granger Rd. Exit Ramp	SR-176 NB	1.01 - 1.30	1.21 - 2.68	17 - 38
5	I-77 Ramp to I-490	NB	Broadway Ave. Bridge	I-490 EB and WB Ramps	1.25	2.23	16
6	I-480	EB	Transportation Blvd. Entrance Ramp	Granger Rd. Exit Ramp	1.00 - 1.25	1.60 - 5.47	12 - 41
7	SR-176 Ramp to I-480	SB / EB	I-480 WB Ramp	Tuxedo Ave. Bridge	1.24	2.12	22
8	I-480	EB	Rockside Rd. Entrance Ramp	I-271 Merge	1.14	1.56	30
9	I-271	SB	I-271 Express Lane Merge	Ramp from I-480 WB	1.12	2.06	29
10	I-77	SB	Pleasant Valley Rd. Exit Ramp	Wallings Rd. Exit Ramp	1.00 - 1.11	1.39 - 2.00	31 - 45

Note: NB: Northbound, SB: Southbound, WB: Westbound, and EB: Eastbound

In order to identify the top interchange and intersection bottleneck locations, a calculation based on the following equation, was performed to average the volume over capacity (V/C) values for all approaches of a given interchange or intersection.

$$WVC = \frac{\sum_{i=1}^{n} VOL_i \times (V/C)_i}{\sum_{i=1}^{n} VOL_i}$$

Where:
WVC = Weighted V/C values
n = Number of approaches
VOL = Approach traffic volume (weighting factor)

For example, a four-legged intersection has four approaches, each with its own V/C value. A weighted average of each approach's V/C value was calculated, using the total volume of each approach as the weighting factor. Weighting was used to give a more heavily traveled roadway's congestion level more influence over the intersection's final calculated value. The locations with the highest weighted V/C values were then identified as the top bottleneck interchanges and intersections in the region.

A number of the bottleneck locations were grouped together based on their proximity and interactions with each other. For example, in Medina County, three bottleneck locations were identified along the SR-94 corridor (Ridge Rd.). Since these locations are located along the same corridor, congestion at one location leads to increased congestion at a nearby location. It was determined that these locations should be grouped together and discussed as one due to these inter-relationships. Similar groupings can be seen on the map (indicated with black circles), showing bottleneck locations that have some relationship with each other, such as neighboring interchanges along the same freeway and intersections in a similar geographic area, like downtown Cleveland.

Figures 3-16 and 3-17 present the existing interchange and intersection bottleneck locations during the AM and PM peak periods.

Figure 3-16. Existing Interchange/Intersection Bottleneck Locations during the AM Peak Period

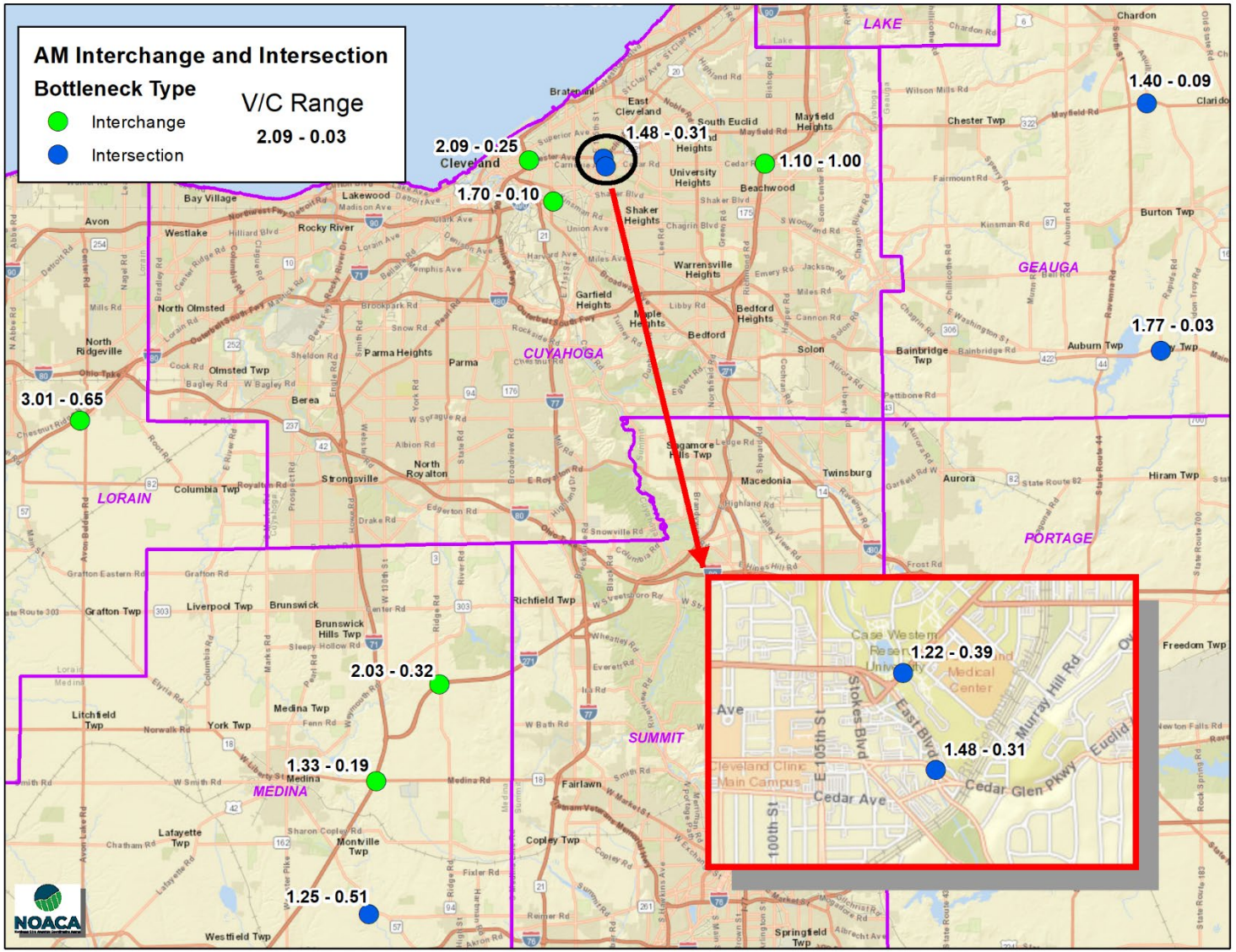
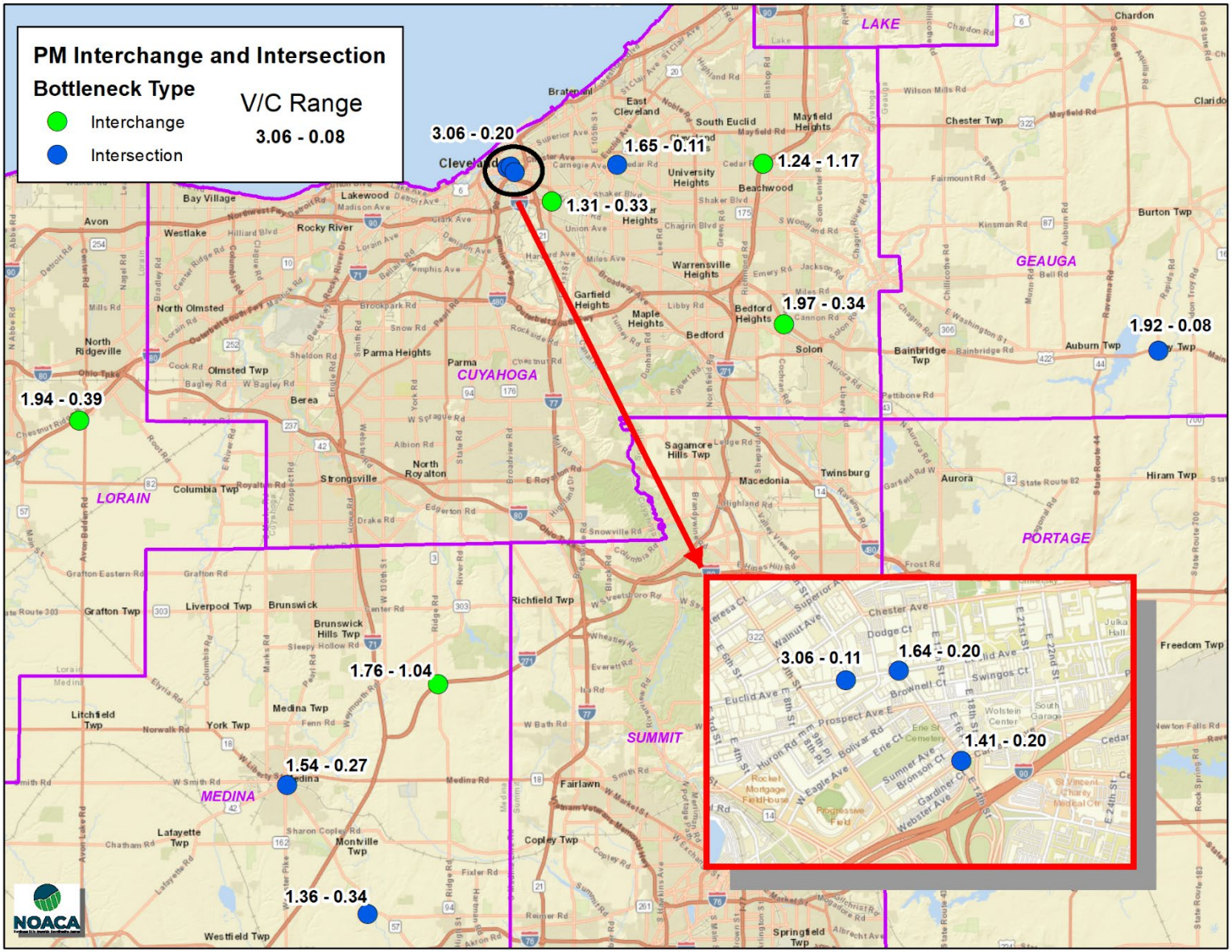


Figure 3-17. Existing Interchange/ Intersection Bottleneck Locations during the PM Peak Period



Tables 3-21 and 3-22 present the V/C values for the identified interchanges and intersection bottleneck locations during the AM and PM peak periods.

Table 3-21. Existing Interchange/Intersection Bottleneck during the AM Peak Period

No.	Location	County	Type	AM Peak Period (6AM - 9AM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
1	**SR-10 NB Ramps / Butternut Ridge Rd. / Chestnut Ridge Rd.**	**Lorain**	**Interchange**	**1.78**	**3.01 - 0.65**	**2**
2	**I-90 EB Exit / Chester Ave. (US-322)**	**Cuyahoga**	**Interchange**	**1.67**	**2.09 - 0.25**	**1**
3	**I-271 SB Ramps / Ridge Rd. (SR-94)**	**Medina**	**Interchange**	**1.47**	**2.03 - 0.32**	**1**
4	**I-490 / Opportunity Corridor (SR-10) / E. 55th St.**	**Cuyahoga**	**Interchange**	**1.46**	**1.70 - 0.10**	**2**
5	**Main Market Rd. (US-422) / Rapids Rd.**	**Geauga**	**Intersection**	**1.44**	**1.77 - 0.03**	**2**
6	**I-71 NB Ramps / Medina Rd. (SR-18)**	**Medina**	**Interchange**	**1.12**	**1.33 - 0.19**	**2**
7	**University Circle Area**	**Cuyahoga**	**Intersection**	**1.08 - 1.07**	**1.48 - 0.31**	**4**
-	*MLK Jr. Dr. / Carnegie Ave.*	*Cuyahoga*	*Intersection*	*1.08*	*1.48 - 0.31*	*2*
-	*Euclid Ave. (US-20) / East Blvd.*	*Cuyahoga*	*Intersection*	*1.07*	*1.22 - 0.39*	*2*

Table 3-21 Continued. Existing Interchange/Intersection Bottleneck during the AM Peak Period

No.	Location	County	Type	AM Peak Period (6AM - 9AM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
8	Mayfield Rd. (US-322) / Aquilla Rd.	Geauga	Intersection	1.06	1.40 - 0.09	1
9	I-271 SB Ramp / Cedar Rd.	Cuyahoga	Interchange	1.05	1.10 - 1.00	2
10	Wadsworth Rd (SR-57) / Styx Hill Rd. / River Styx Rd.	Medina	Intersection	1.03	1.25 - 0.51	3

Table 3-22. Existing Interchange/Intersection Bottleneck during the PM Peak period

No.	Location	County	Type	PM Peak Period (3PM - 7PM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
1	**Downtown Cleveland Area**	**Cuyahoga**	**Intersection**	**1.86 - 1.15**	**3.06 - 0.20**	**5**
-	*Euclid Ave. (US-20) / E. 12th St.*	*Cuyahoga*	*Intersection*	*1.86*	*3.06 - 0.11*	*1*
-	*Euclid Ave. (US-20) / E. 14th St.*	*Cuyahoga*	*Intersection*	*1.28*	*1.64 - 0.20*	*1*
-	*Carnegie Ave. / E. 14th St.*	*Cuyahoga*	*Intersection*	*1.15*	*1.41 - 0.20*	*3*
2	**Main Market Rd. (US-422) / Rapids Rd.**	**Geauga**	**Intersection**	**1.58**	**1.92 - 0.08**	**2**
3	**I-271 SB Ramps / Ridge Rd. (SR-94)**	**Medina**	**Interchange**	**1.37**	**1.76 - 1.04**	**3**
4	**Cedar Glen Pkwy. / Cedar Rd. / Euclid Heights Blvd**	**Cuyahoga**	**Intersection**	**1.28**	**1.65 - 0.11**	**1**
5	**I-271 SB Ramp / Cedar Rd.**	**Cuyahoga**	**Interchange**	**1.20**	**1.24 - 1.17**	**2**
6	**US-422 / Harper Rd.**	**Cuyahoga**	**Interchange**	**1.20**	**1.97 - 0.34**	**1**

Table 3-22 Continued. Existing Interchange/Intersection Bottleneck during the PM Peak period

No.	Location	County	Type	PM Peak Period (3PM - 7PM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
7	SR-10 NB Ramps / Butternut Ridge Rd. / Chestnut Ridge Rd.	Lorain	Interchange	1.19	1.94 - 0.39	2
8	Wadsworth Rd. (SR-57) / S Broadway St. / Lafayette Rd.	Medina	Intersection	1.16	1.54 - 0.27	2
9	I-490 / Opportunity Corridor (SR-10) / E. 55th St.	Cuyahoga	Interchange	1.15	1.31 - 0.33	2
10	Wadsworth Rd (SR-57) / Styx Hill Rd. / River Styx Rd.	Medina	Intersection	1.14	1.36 - 0.34	3

The following paragraphs discuss the identified freeway, interchanges, and intersection bottleneck locations and their congestion severity.

Freeway Bottlenecks

I-90/I-77 Interchange Area
Many trips heading to downtown Cleveland, as well as through traffic from west to east and vice-versa, travel along I-90 through the central interchange area where I-77 and I-90 meet. These two major interstates meeting near a downtown area creates many congested segments in the immediate area, with one of the top congested segments in the AM peak period being I-90 EB from Carnegie Ave. to Ontario St. This segment's AM peak period V/C ratio ranges from 1.02 to 1.26, a TTI range from 1.23 to 2.25, and an actual speed range of 22 to 41 mph. In the PM peak period, traffic wanting to exit to I-77 from I-90 WB creates a bottleneck situation at this southbound ramp. This segment's PM peak period V/C ratio is 1.48, its TTI is 5.71, and the actual speed is 6 mph.

I-90/I-71/SR-176 Interchange Area
The I-90/I-71/SR-176 interchange area is a highly traveled corridor leading to and from downtown Cleveland. In particular, I-71 and SR-176, heading northbound, feed into I-90, heading towards downtown Cleveland, creating a bottleneck situation in the AM peak period. Conversely, in the PM peak period, traffic heading towards these two freeways creates a lot of congestion upstream before splitting into their separate directions. In the AM peak period, the I-71 NB segment between W. 14th St. and I-90 EB has a V/C ration range of 0.99 to 1.14, a TTI range of 1.37 to 1.89, and an actual speed range of 23 to 45 mph. Also, in the AM peak period, the opposite direction along I-71 SB from I-90 EB to SR-176 SB has a V/C range of 0.97 to 1.17, a TTI range from 1.16 to 1.68 and an actual speed range of 23 to 36 mph. In the PM peak period, this southbound section of I-71 is also congested and actually begins upstream along I-90 WB, starting at the I-77 interchange. This segment has a V/C ratio range of 0.93 to 1.42, a TTI range of 1.11 to 4.21, and an actual speed range of 11 to 47 mph.

I-480/SR-176 Interchange Area
The ramps between I-480 and SR-176 are used by many commuters during both the AM and PM peak periods to travel to downtown Cleveland, as well as the job hubs along I-480, such as the Hopkins Airport area and Independence. More specifically, the ramps from I-480 WB to SR-176 NB and SR-176 SB to I-480 EB are the most congested during both peak periods. In the AM peak period, the I-480 WB Ramp to SR-176 NB has a V/C ratio ranging from 0.99 to 1.29, a TTI range from 1.18 to 2.57, and an actual speed range from 18 to 39 mph. In the PM peak period, this same segment is also congested with a V/C ratio range of 1.01 to 1.30, a TTI range of 1.21 to 2.68, and an actual speed range of 17 to 38 mph. The ramp in the opposite direction, from SR-176 SB to I-480 EB, is congested in both the AM and PM peak periods. In the AM peak period, the V/C ratio is 1.21, the TTI is 1.93, and the actual speed is 24 mph. In the PM peak period, the V/C ratio is 1.24, the TTI is 2.12, and the actual speed is 22 mph.

I-71/I-480 Interchange Area
Many trips destined for downtown Cleveland travel along I-71 and transfer from I-480 or SR-237, creating a lot of congestion where these three highways meet. In particular, the segment along I-71 NB just north of I-480 to W. 150th St. is quite congested because all traffic from I-71, I-480, and SR-237 converge on an NB path to downtown Cleveland. In the AM peak period, this segment has a V/C ratio of 1.08, a TTI of 2.23, and an actual speed of 28 mph.

I-77 between I-480 and I-80
I-77 between I-480 and I-80 is a busy portion of the interstate system, with many trips traveling NB to job hubs such as Independence and downtown Cleveland or heading SB to the I-80 turnpike and points outside the NOACA region. In particular, the SB segment of I-77 between Pleasant Valley Rd. and Wallings Rd. is quite congested in the PM peak period. It has a V/C ratio range of 1.00 to 1.11, a TTI range of 1.39 to 2.00, and an actual speed range of 31 to 45 mph.

I-480 between I-77 and I-271
I-480, between I-77 and I-271, is a highly traveled east-west highway corridor connecting eastern and western suburbs to nearby job hubs, such as Independence, Chagrin Highlands, and Solon. In the AM peak period, the ramp from I-77 NB to I-480 EB is congested with a V/C ratio of 1.17, a TTI of 1.69, and an actual speed of 28 mph. Not far to the east, there is another highly congested segment in the AM peak period along I-480 EB, specifically between Transportation Blvd. and Granger Rd. This segment has a VC ratio range of 0.96 to 1.20, a TTI range of 1.43 to 4.00, and an actual speed range of 16 to 45 mph. This same segment is also congested in the PM peak period with a V/C ratio range of 1.00 to 1.25, a TTI range of 1.60 to 5.47, and an actual speed range of 12 to 41 mph. Traveling back westward to the I-480 / I-77 interchange, the ramp from I-480 WB to I-77 SB is congested, with a V/C ratio of 1.35, a TTI of 3.23, and an actual speed range of 18 mph.

I-480/I-271 Corridor Area
I-480 and I-271 merge in southeastern Cuyahoga County to form one combined highway corridor for about a 4-mile stretch. Due to the convergence of these two major and highly-traveled highways, this area has many congested segments in both the AM and PM peak periods. In the AM peak period, the NB/WB segment between the I-480/I-271 merge and Broadway Ave. has a V/C range ratio of 0.95 to 1.10, a TTI range of 1.27 to 1.92, and an actual speed range of 32 to 49 mph. A few miles to the north, I-480 WB between the I-271 split and Rockside Rd. is also congested. This segment has a V/C ratio of 1.19, a TTI of 1.8, and an actual speed of 26 mph. In the PM peak periods, the SB/EB sections of this corridor become more congested. In particular, I-271 SB between the express lanes and the ramp from I-480 WB has a V/C ratio of 1.12, a TTI of 2.06, and an actual speed of 29. A short distance to the south, the I-480 EB segment between Rockside Rd. and I-271 merge is congested, with a V/C ratio of 1.14, a TTI of 1.56, and an actual speed of 30 mph.

I-77/I-490 Area
The I-77/I-490 interchange area is just south of the I-90/I-77 interchange area near downtown Cleveland. As a result, this area has many trips that lead to and from the downtown interchanges to the north. There are other trips that are seeking destinations to the east and west, such as points along the Opportunity Corridor to the east or I-490 to the west. In the PM peak period, the ramp from I-77 NB to the I-490 EB and WB ramps is quite congested. This segment has a VC ratio of 1.25, a TTI of 2.23, and an actual speed of 16 mph.

Interchange/Intersection Bottlenecks

Downtown Cleveland Area
Downtown Cleveland is the largest job hub in the NOACA region. With many workers traveling to and from the area in the AM and PM, as well as a growing residential population, traffic congestion is present at peak travel times. One such area of downtown Cleveland that has higher levels of congestion during peak times is the area near Playhouse Square and Cleveland State University on the eastern side of downtown Cleveland. In particular, four signalized intersections have high levels of congestion: two located on the city's traffic grid and two on the innerbelt freeway. The

intersection of E 12th St and Euclid Ave is congested in the PM peak period with one approach, southbound E. 12th St., having a V/C ratio value of above 3. In the AM peak period, none of the approaches are congested at this intersection. Just to the east, the intersection at E. 14th St. and Euclid Ave. is also congested in the PM peak period, with the eastbound approach having a V/C ratio of above 1.5. In the AM peak period, none of the approaches are congested at this intersection. Just to the south and adjacent to ramps leading to/from the innerbelt freeway, the intersection at E. 14th St. and Carnegie Ave is congested in the AM and PM peak periods. In the AM peak period, the northbound approach along E 14th St has a V/C ratio value of above 1.25. In the PM peak period, three approaches at this intersection have V/C ratio values above 1: northbound on E. 14th St., southbound on E. 14th St., and westbound on Carnegie Ave. On the eastern edge of downtown, the intersection of the eastbound I-90 exit ramp and Chester Ave. is also congested in both the AM and PM peak periods. In the AM peak period, the eastbound exit ramp has a V/C ratio above 2. In the PM peak period, this same ramp has a V/C ratio above 1.

University Circle Area

Like Downtown Cleveland, the University Circle area is one of the region's largest job hubs, and with that distinction comes traffic congestion during peak travel times. In particular, two signalized intersections are quite congested in the AM peak period: MLK Jr. Dr./Carnegie Ave. and Euclid Ave./East Blvd. At the MLK Jr. Dr./Carnegie Ave. intersection, two approaches are congested with V/C ratios above 1, specifically westbound Carnegie Ave. and northbound MLK Jr. Dr. At the Euclid Ave./East Blvd. intersection, two approaches are congested with V/C ratios above 0.85, specifically westbound Euclid Ave and eastbound Euclid Ave. In the PM peak period, one of the main entry points into the University Circle area, the Cedar Glen Pkwy./Cedar Rd./Euclid Heights Blvd. intersection, is congested. This signalized intersection has one approach with a V/C ratio above 0.85, specifically Cedar Glen Pkwy. eastbound. In the AM peak period at this intersection, Euclid Heights Blvd. westbound is congested, with a V/C value of 0.88.

I-271/Cedar Rd. Interchange

The I-271/Cedar Interchange is located along the border of the cities of Lyndhurst and Beachwood in eastern Cuyahoga County. This interchange is near large retail areas to the west, such as Beachwood Place and Legacy Village, as well as large office parks to the east. In the AM and PM peak periods, the signalized intersection at Cedar and the southbound ramp to I-271 is congested. In both time periods, both the eastbound and westbound approaches on Cedar Rd have V/C values above 0.85.

I-490/Opportunity Corridor/E. 55th St. Interchange

I-490 terminates at E. 55th St. in the City of Cleveland. At this location east-west highway turns into the Opportunity Corridor that leads to and from the University Circle job hub. In both the AM and PM peak periods, the signalized intersection of I-490/Opportunity Corridor/ramp to E. 55th St. is congested. Specifically, both the eastbound and westbound approaches along I-490 and Opportunity Corridor have V/C values above 0.85.

US-422/Harper Rd. Interchange

The US-422/Harper Rd. interchange, located in the City of Solon in southeastern Cuyahoga County, is the main entry point from the highway system to the Solon job hub along the Harper Rd./Cochran Rd. corridor. Large employers, such as Nestle, are located in close proximity to the interchange, which creates traffic congestion conditions. The signalized intersection where Harper Rd. meets the eastbound ramps is particularly congested in the PM peak period. Specifically, the northbound approach on Harper Rd has a V/C value of 1.97, indicating high levels of congestion. In the AM peak period, one approach has a V/C value above 0.85, specifically the

eastbound exit ramp, and one approach has a V/C value close to 0.85, specifically northbound Harper Rd. at 0.81.

US-422/Rapids Rd Intersection
The US-422/Rapids Rd intersection is located in Troy Township in southern Geauga Twp. This intersection is near where US-422 changes from a 4-lane divided highway to a 2-lane roadway. In both the AM and PM peak periods, this intersection is congested, with 2 approaches having high levels of congestion. Specifically, in both time periods, the eastbound and westbound approaches on US-422 have V/C values above 0.85.

US-322/Aquilla Rd Intersection
The US-422/Rapids Rd. intersection is located in Claridon Township in northern Geauga Twp. This is a signalized intersection where two one-lane roads meet in a rural area. In the AM peak period, this intersection has 1 congested approach, which is US-322 westbound. None of the approaches are congested in the PM peak period.

I-271/Ridge Rd. Interchange
The I-271 / Ridge Rd. Interchange is located in northeastern Medina County in Granger Township. This interchange mostly serves rural areas of the county, being located a few miles away from the largest urban areas in the county, such as the cities of Brunswick and Medina. In both the AM and PM peak periods, the intersection at the southbound exit ramp has congestion issues. In the AM peak period, the southbound approach on Ridge Rd. has a V/C ratio value above 2, which indicates an extremely congested situation during that time frame. In the PM peak period, all three approaches have V/C ratios above 1 (southbound and northbound on Ridge Rd. and the southbound exit ramp from I-271).

I-71/SR-18 Interchange
The I-71/SR-18 interchange is located in central Medina County along the Medina Township and Montville Township border, just east of the City of Medina. This interchange is one of the main access points to and from the City of Medina and thus has high traffic volumes along its ramps and along SR-18. In particular, the intersection at the northbound exit ramp is congested in both the AM and PM peak periods. In the AM peak period, this signalized intersection has two approaches with V/C ratios above 0.95, both on SR-18. The same two approaches are also congested in the PM peak period, with V/C ratio values above 1.

SR-10 /Butternut Ridge Rd./Chestnut Ridge Rd. Interchange
The SR-10/Butternut Ridge Rd./Chestnut Ridge Rd. interchange is located in southeastern Lorain County near the border of North Ridgeville and Eaton Township. Butternut Ridge Rd. and Chestnut Ridge Rd. run parallel to SR-10, with an access road connecting the interchange ramps to the two roadways. The unsignalized intersection of the eastbound ramps and the access road is congested in both the AM and PM peak periods. In the AM peak period, two approaches (the eastbound exit ramp and northbound access road) have V/C values above 0.85. The same two approaches have V/C values above 0.85 in the PM peak period as well.

SR-57/Styx Hill Rd./River Styx Rd. Intersection
The SR-57/Styx Hill Rd./River Styx Rd. Intersection is located in Guilford Township in southern Medina County, just northwest of the City of Wadsworth. This location is a 4-way intersection with multiple congested approaches in both the AM and PM peak periods. In the AM peak period, three out of four approaches have V/C values above 0.85 (SR-57 westbound, River Styx southbound, and River Styx northbound). In the PM peak period, traffic congestion is worse, with the same three approaches having V/C values above 1.

SR-57/S. Broadway St./Lafayette Rd.
The SR-57/S. Broadway St./Lafayette Rd. intersection is a 4-way stop located in the City of Medina, just south of Medina's historic square. In the PM peak period, two approaches have V/C values above 0.85 and 1 approach just below 0.78. The two congested approaches are Lafayette Rd. eastbound and Broadway St. southbound, and the approach at near congested levels is SR-57 westbound. In the AM peak period, the situation is somewhat improved but still congested, with only one approach, SR-57 westbound, having a V/C value of over 0.85.

Fuel, Delay, and Congestion Costs

As demand approaches the capacity of a freeway (or of the interchanges along the highway), extreme traffic congestion sets in. Traffic congestion impacts the operation and performance of the freeway, causing longer trip times, slower speeds, and increased delays. As traffic engineering and financial performance indicators, the combination of travel delay and wasted fuel due to congestion is considered the congestion cost.

This combined measure was calculated based on the following;

- Average fuel cost per gallon; this measure may be considered as the quotient of total daily Vehicle Miles Traveled (VMT) divided by total daily gasoline consumption.
- Median value of time per hour: According to the US Department of Transportation and other sources, the value of time measure is 30 to 60 percent of average earnings.
- Average Auto occupancy during peak and off-peak periods of a day.

Congestion Cost Estimation Procedure

The following steps are used to calculate the total congestion cost for the road segments in the influence subarea being considered.

- The ***average road segment delay*** is the difference between the estimated travel time under actual (often congested) conditions and uncongested conditions.

$$Average\ Road\ Segment\ Delay\ (hr) = \frac{Length\ of\ the\ road\ Segment\ (miles)}{Road\ Segment\ congestedspeed\ (mph)} - \frac{Length\ of\ the\ road\ Segment\ (miles)}{Free\ Flow\ Speed\ (mph)}$$

- The ***total delay on a road segment*** is the product of the average delay and total vehicles traveling this segment.

$$Road\ Segment\ Delay\ (hr) = Average\ Road\ Segment\ Delay\ \times Total\ Traffic\ Volume$$

- The ***road segment delay cost*** is calculated by multiplying the estimated road segment delay by the average passenger car occupancy and the occupants' average value of time.

$$Road\ Segment\ Delay\ Cost\ (\$) = Road\ Segment\ Delay\ \times Average\ auto\ occupancy\ \times Average\ Value\ of\ time$$

- Vehicles waste additional fuel when they are in congested conditions. The ***additional fuel consumed cost*** can be estimated using the delay and auto operating cost calculated below.

$$Road\ Segment\ Fuel\ Cost\ (\$) = Road\ Segment\ Delay \times Road\ Segment\ Congested\ Speed \times auto\ Operating\ cost$$

- The ***average auto operating cost*** is estimated by dividing the fuel cost per gallon by the average miles a vehicle can travel on one gallon of fuel.

$$Average\ Auto\ Operating\ Cost\ (\$) = \frac{Fuel\ Cost\ per\ gallon}{Average\ miles\ a\ vehicle\ can\ travel\ on\ one\ gallon\ of\ fuel}$$

- Finally, the ***total road segment congestion cost*** comprises two elements: delay cost and fuel cost.

$$Road\ Segment\ Congestion\ Cost\ (\$) = Road\ Segment\ Delay\ Cost + Road\ Segment\ Fuel\ Cost$$

Table 3-23 displays the estimated 2024 daily and annual congestion costs.

Table 3-23. Estimated 2024 Daily and Annual Congestion Costs

Cost Item	Unit	Estimated 2024 Value
Daily Wasted Fuel	Gallon	79,000
Daily Wasted Fuel Cost	2024$	223,000
Total Daily Delay	Hour	74,000
Total Daily Delay Cost	2024$	1,445,000
Total Daily Congestion Cost	2024$	1,668,000
Total Annual Congestion Cost	2024$	485,273,000

Assumptions
Fuel Cost per Gallon (2024$): 2.83
Average Traveled Miles per Gallon: 20.65
Average Values of Time (2024$): 15.50

Chapter 4: Engage the Community

Introduction

weNEO2050+ is the "people's plan" for making equitable decisions and implementing initiatives for community impact. The primary focus is actively involving community members in planning and ensuring all voices and perspectives are heard and considered throughout the development of the planning updates. This is the foundation of an inclusive engagement process— creating active involvement with diverse community members, ensuring everyone feels welcome, and allowing everyone to contribute their perspectives and ideas to lead toward a more equitable and impactful outcome.

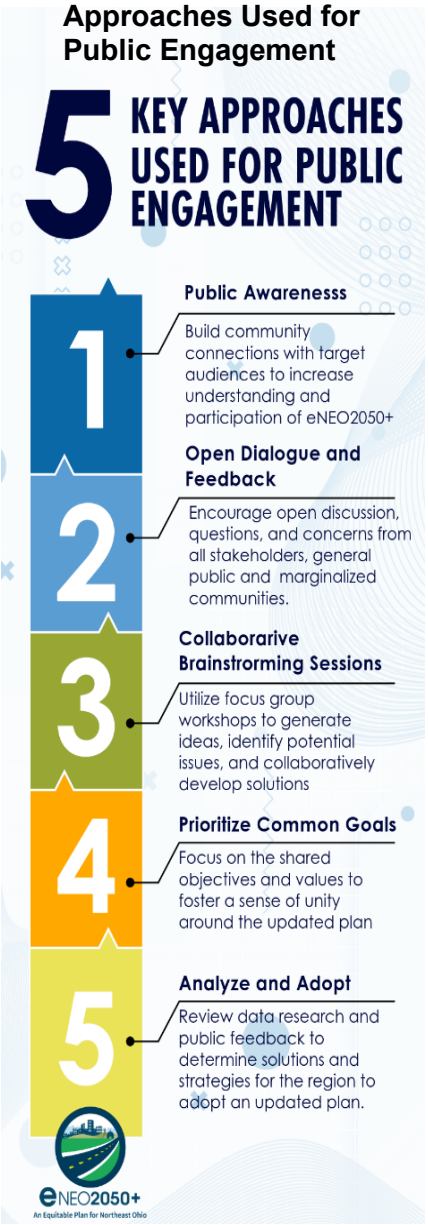
While developing w*eNEO2050+*, NOACA actively created key methods and approaches to build collaborative efforts with regional stakeholders, especially underserved populations, to encourage participation and feedback (See Figure 4.1)

These approaches were developed to bridge opportunities for capacity building with key stakeholders early in the process by hosting collaborative brainstorming sessions to update audiences on scenario planning, household travel surveys, population/demographic trends, and work commute patterns. Discussions on innovative technologies like autonomous vehicles, electric vehicle charging stations, and types of imagined infrastructure investments were also introduced to ultimately build an understanding of how to identify community needs and prioritize common goals for the future of Northeast Ohio

NOACA convened stakeholders and the public for discussions around topics of regional significance and those of community-based local interest to employ a broad spectrum of appropriate approaches. Activities reflected the wider goals, strategies, and tactics of NOACA's *Public Participation Plan*[1] to provide opportunities to learn about what projects and initiatives have been planned and implemented since adoption of *eNEO2050* in June 2021.

NOACA staff posted these engagement opportunities online and communicated widely throughout each county service area—Cuyahoga, Geauga, Lake, Lorain, and Medina—to clarify how and when the public could participate. As part of the process, NOACA utilized foundational planning documents (including the current Long Range Plan, *eNEO2050: An Equitable Future for Northeast Ohio*) to reflect lessons learned through those engagement strategies and what further input is needed in the decision-making process.

Figure 4-1. Five Key Approaches Used for Public Engagement



[1] NOACA, *Public Participation Plan*, September 2024, https://www.noaca.org/home/showpublisheddocument/32141/638694442356130000

NOACA staff created a comprehensive content marketing distribution process around the transportation scenarios to gain perspective on whether views were different since the scenarios were developed in 2021. Marketing assets and community surveys were distributed online, through interactive kiosks, and Survey Monkey, via a subscriber list. Written surveys were also made available at the December 2024 public meetings and May 2025 Open Houses. Postcards were placed at 52 locations and posted online at 27 local public libraries to clarify how and when the public could participate (See Figure 4-2). Throughout the development of *weNEO2050+* NOACA:

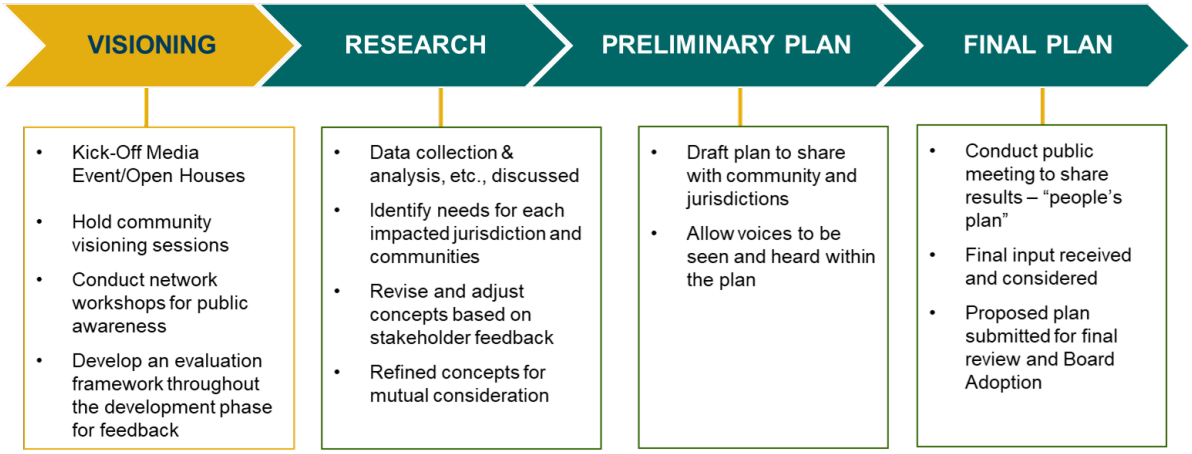
1. Utilize the eNEO2050 website (eneo2050.com) as a central communication tool for project and plan updates
2. Posted social media and traditional outreach formats
3. Offered listening sessions, forums, and workshops
4. Designed and deployed interactive techniques and tools
5. Commissioned a statistically significant Regional Questionnaire
6. Provided traditional participation by connecting with regional leaders, the general public, NOACA Board, Committees, Subcommittees and Councils

Public Participation Process and Strategies

NOACA engaged stakeholders and the general public through four phases:

1. Visioning
2. Research
3. Preliminary Plan
4. Final Plan

Figure 4-2. Public Engagement Process



During each phase, NOACA:

1. Provided stakeholders and the general public with multiple opportunities for feedback during the plan's development:
2. Created activities and approaches that align with the agency's mission and vision to communicate a clear, coordinated, and comprehensive public message
3. Updated the public through various avenues influenced by community experts represented by the NOACA Board, Committees, Councils, and stakeholders
4. Identified and contacted new and previously hard-to-reach communities and residents in underserved communities.

NOACA strategically approached all public participation with meaningful dialogue throughout the initial and current engagement processes to meet the needs of the region. It was important to reach out to stakeholders from all backgrounds and perspectives to have conscientious plans that benefit everyone. NOACA developed public participation activities with a comprehensive approach to equity, collaboration, and inclusion.

Partners in local and state government, advocacy groups, and stakeholders each play a key role in helping to shape the work of the agency. NOACA targeted select groups at each engagement phase, especially to help plan and shape messages and participation methods. Specific constituencies included:

- Historically underrepresented areas within regional planning efforts (communities of color, cultural communities, the disability community)
- Regional residents and their mobility behaviors, including drivers, cyclists, pedestrians, and transit users
- Elected officials and staff of counties, cities, the state, and other relevant public agencies
- Freight interests (including ports, shippers, freight transportation service providers)
- Business interests (employers and employees; central business district representatives within each service area)
- Organizations that represent public transportation employees, private transportation, and commuting programs (carpooling, vanpooling, parking and transit benefit programs, telework, etc.)

NOACA engaged agencies that represented the diverse geography of the region, such as rural parts of the region and urban core centers, and agencies with expertise in areas such as land use and multimodal solutions.

NOACA also endeavored to reach communities that historically have not been engaged in policy and decision making with NOACA. Staff developed a robust and strategic outreach model to encourage underrepresented communities to provide feedback. Specific tactics included, but were not limited to, the following:

- Paid advertisements for online and mail community canvasing (three campaigns)
- Increased volume of flyers, postcards, and bullet cards handed out at various community engagements and outlets (2,200)
- Inclusion of sign interpreters and other language materials (i.e., Spanish, Mandarin) for meetings (one public meeting, three material releases)
- Neighborhood drop-in centers for distribution (127)

NOACA presented various information and messages to these groups and conducted targeted outreach methods to allow for more participation as well as leverage new relationships to cultivate long-lasting connections.

Public Participation Outreach Engagement and Approaches

Throughout the public engagement planning efforts, staff provided opportunities for stakeholders and the general public to participate in the plan's development to ensure all voices were heard, valued, and considered. NOACA built on its long history of engagement activities to strengthen its comprehensive planning efforts.

Outreach and public involvement are valuable activities that can engage stakeholders, underrepresented constituencies, and newer audiences to shape region-wide planning. Approaches included:

1. Creating background information to post on websites and for use in fact sheets, handouts, and other materials.
2. Convening stakeholders for discussion around large topics of regional scale.
3. Sponsored listening sessions, workshops, and virtual webinars to feature policy aspects and promote topic-based policy discussions on plan content.
4. Using social media to connect constituencies to planning efforts and promote involvement—both for two-way discussion and one-way push marketing.
5. Utilizing interactive techniques (such as crowdsourcing and visual mapping) to gather data and facilitate feedback.
6. Designing and disseminating informal surveys—using social media, electronic mailing lists, idea-gathering platforms, and websites to ask questions and promote discussion spaces.
7. Using online interactive engagement tools with the ability to crowdsource or generate surveys, interactive online maps and visualization (supported features such as layering), videos, create markers and provide feedback (related to social media and web-based methods).
8. Offering forums, including online forums, to elicit stakeholders' and communities' ideas and perspectives on regional issues, projects, and initiatives.
9. Offering open opportunities to learn about projects, through open houses, meetings/virtual meetings, receptions specific to locations that interest the public, or other experiences in order to highlight an initiative, infrastructure project, or investment.
10. Soliciting in-depth information by hosting focus groups or small-group discussions about issues, activities, or public perceptions from stakeholders in nontraditional locations.
11. Updating existing foundational planning documents (including the current long range plan, eNEO2050) to reflect lessons learned through engagement strategies.
12. Creating a web portal to access and download resources for public comment.

NOACA used a combination of several or all of these strategies in every effort and, as appropriate, for specific audiences. Activities reflected the broader goals, strategies, and tactics of NOACA's *Public Participation Plan*. NOACA staff posted these activities online and communicated widely to clarify how and when the public could participate.

External Communications

NOACA facilitated access to w*eNEO2050+* information to help residents understand, follow, and engage in the development process. NOACA used in-person, website content, emails, social media, and other electronic means for external communications. Staff shared collateral materials at community meetings, events, and drop-off center locations. Staff also used community calendars and stakeholder distribution of information to notify a vast audience network.

Electronic Notifications

NOACA notified a broad range of stakeholders about w*eNEO2050+* milestones and participation opportunities through complementary modes of communication:

1. **Emails:** Subscribers to the NOACA email list can opt in or out of communications about meetings, engagement opportunities, transportation equity updates, and notices. Emails are NOACA's primary method to notify interested parties about opportunities for engagement.
2. **Social Media:** NOACA used its social media platforms followed by transportation advocates, community groups, other government agencies, and interested members of the public. Staff routinely scheduled postings of events, campaigns, and public participation opportunities throughout w*eNEO2050+* development. Links to the long range plan website gave viewers easy access to information. Social media postings

complemented the use of all email and collateral material communications.

3. **Social Media Kits:** NOACA sent quarterly social media kits to Board members, committees, and partners to share and distribute pertinent information about w*eNEO2050+*, which included public awareness campaigns, activities, and comment periods.
4. **NOACA Homepage Banners:** NOACA used large, inviting banner graphics with prominent “action buttons” to alert visitors to the NOACA website regarding important announcements and opportunities. The action buttons redirected visitors to the long range plan website, which hosts all plan development information.
5. **NOACA Website Calendar/Announcements:** NOACA added public involvement events to the webpage calendar and announcements under the News Section as information became available.

Public Comments

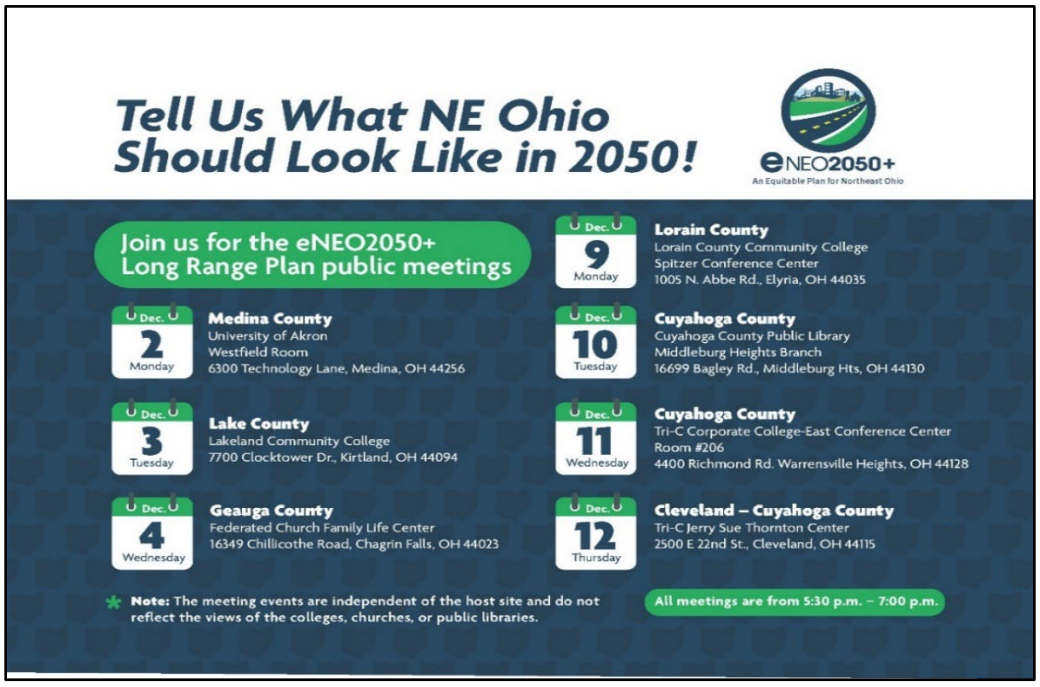
NOACA targeted select groups at each engagement phase to help shape the plan with feedback and public comments. Public comments were compiled from surveys, hotline phone calls, emails, meeting notes, online portals such as Mindmixer, and focus group discussions. The following constituencies participated in the plan update:

- Historically underrepresented populations within regional planning efforts (communities of color, cultural and ethnic communities, the disability community)
- Regional residents with diverse mobility behaviors, including drivers, cyclists, pedestrians, and transit users
- Elected officials and staff of counties, cities, the state, and other relevant public agencies
- Logistics providers (including ports, shippers, freight transportation service providers)
- Business interests (employers and employees; central business district representatives within each service area)
- Organizations that represent public transportation employees, private transportation, and commuting programs
- (carpooling, vanpooling, parking and transit benefit programs, telework, etc.)
- Agencies that represent rural parts of the region, urban core centers, and those with expertise in areas such as land use and multimodal solutions

Figures 4-3 through 4-6 show different external communication materials that provided information on opportunities for public engagement and feedback as well as directly solicited public comment.

See Appendix 4-9 for compilation of public comments throughout the feedback period.

Figure 4-3. Postcards for Long Range Plan Public Meetings and Open Houses



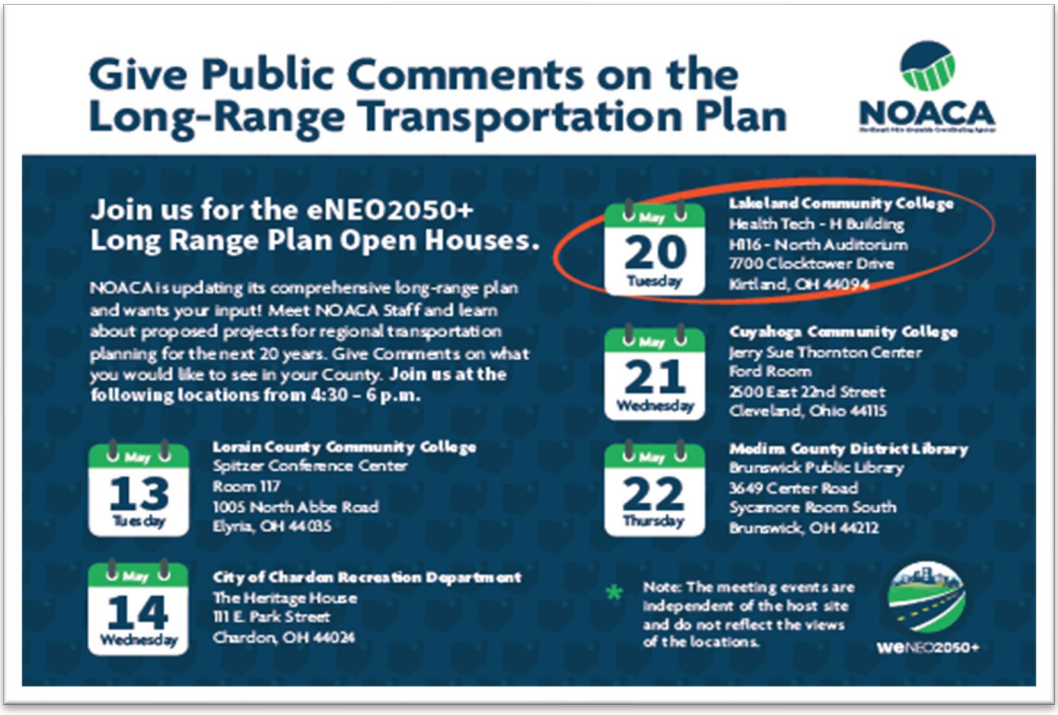


Figure 4-4. Front and Back of Postcards for Long Range Plan Public Comment

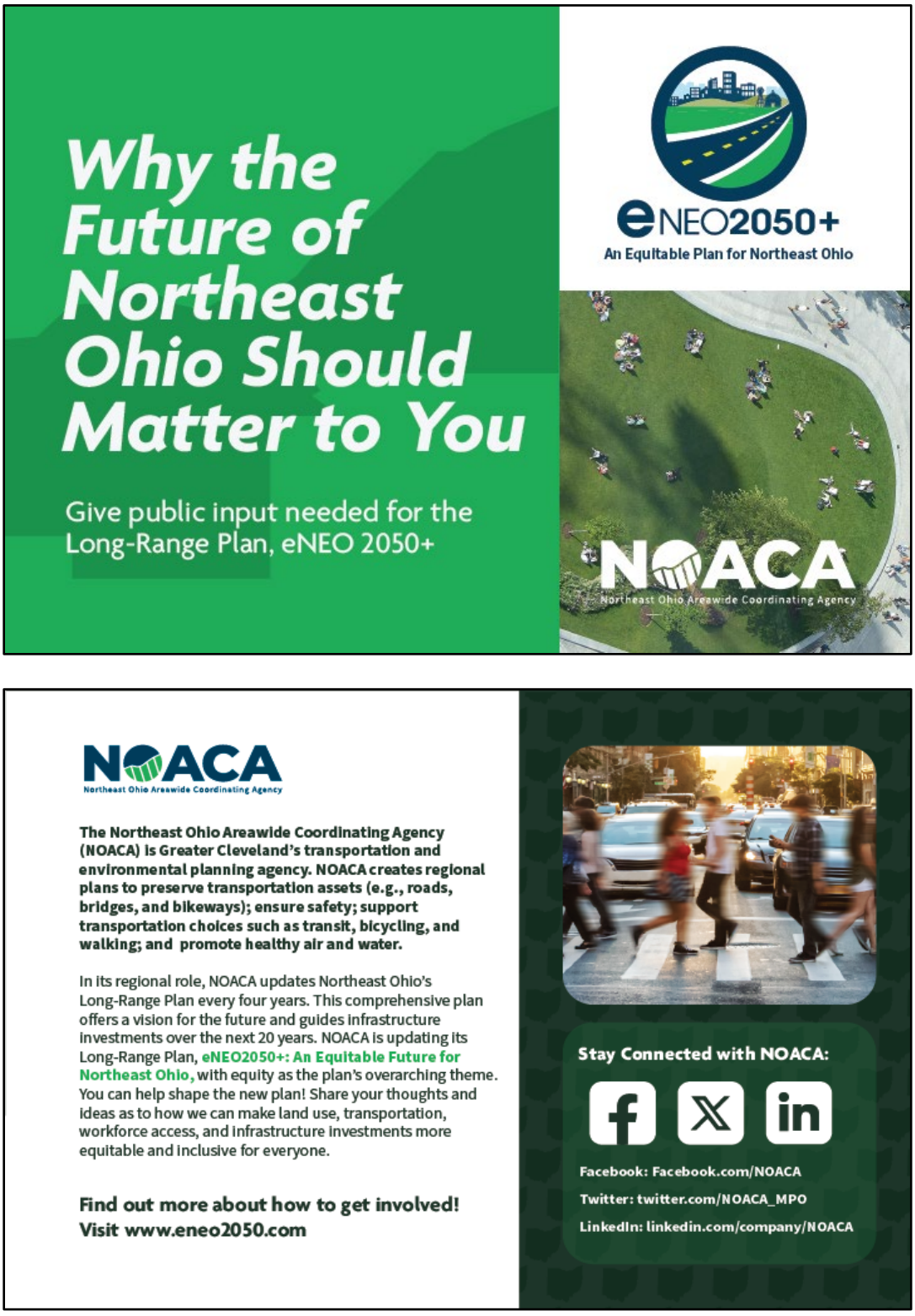
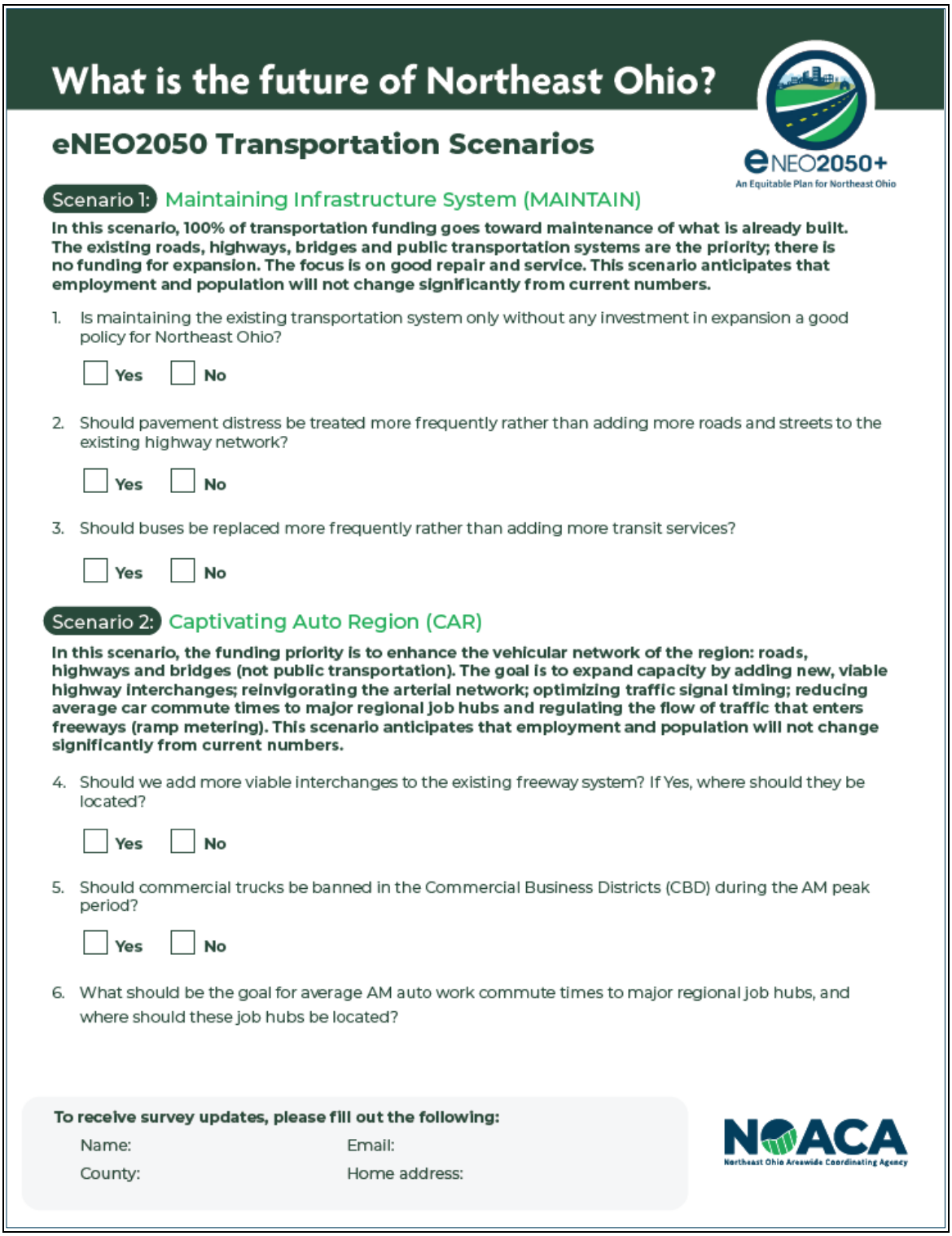


Figure 4-5. Postcards for Long Range Plan Public Comment

Figure 4-6. Online Platform Solicitation – Constant Contact (8948 Long Range Plan Subscribers)

Figure 4-7. Social Media and Online Platform Digital Outreach Images

Figure 4-8. Transportation Scenario Survey (Part 1 and 2)



What is the future of Northeast Ohio?

eNEO2050 Transportation Scenarios

eNEO2050+
An Equitable Plan for Northeast Ohio

Scenario 1: Maintaining Infrastructure System (MAINTAIN)

In this scenario, 100% of transportation funding goes toward maintenance of what is already built. The existing roads, highways, bridges and public transportation systems are the priority; there is no funding for expansion. The focus is on good repair and service. This scenario anticipates that employment and population will not change significantly from current numbers.

1. Is maintaining the existing transportation system only without any investment in expansion a good policy for Northeast Ohio?

   ☐ **Yes** ☐ **No**

2. Should pavement distress be treated more frequently rather than adding more roads and streets to the existing highway network?

   ☐ **Yes** ☐ **No**

3. Should buses be replaced more frequently rather than adding more transit services?

   ☐ **Yes** ☐ **No**

Scenario 2: Captivating Auto Region (CAR)

In this scenario, the funding priority is to enhance the vehicular network of the region: roads, highways and bridges (not public transportation). The goal is to expand capacity by adding new, viable highway interchanges; reinvigorating the arterial network; optimizing traffic signal timing; reducing average car commute times to major regional job hubs and regulating the flow of traffic that enters freeways (ramp metering). This scenario anticipates that employment and population will not change significantly from current numbers.

4. Should we add more viable interchanges to the existing freeway system? If Yes, where should they be located?

   ☐ **Yes** ☐ **No**

5. Should commercial trucks be banned in the Commercial Business Districts (CBD) during the AM peak period?

   ☐ **Yes** ☐ **No**

6. What should be the goal for average AM auto work commute times to major regional job hubs, and where should these job hubs be located?

To receive survey updates, please fill out the following:

Name: Email:

County: Home address:

NOACA
Northeast Ohio Areawide Coordinating Agency

eNEO2050 Transportation Scenarios (Continued)

Scenario 3: TRANSportation System with Improved Transit (TRANSIT)

This scenario is nearly the flipside of CAR; it's all about expansion of public transportation service in Northeast Ohio. This scenario adds autonomous shuttle routes from transit hubs to major job hubs. This scenario includes new pedestrian and bike connections from major transit hubs to major job hubs. In addition to rail expansion, this scenario would include expanded bus and bus rapid transit routes and more frequent service to Environmental Justice Areas. This scenario anticipates slight employment and population growth as outlined in the scenario matrix.

7. Is the expansion of the rail network a good idea for Northeast Ohio?

   ☐ **Yes** ☐ **No**

8. Should other modes of transit, like local bus or Bus-Rapid Transit (BRT), be prioritized instead of rail?

   ☐ **Yes** ☐ **No**

9. Are autonomous shuttle buses a good idea for Northeast Ohio?

   ☐ **Yes** ☐ **No**

10. Are autonomous shuttlebus routes, which serve the major regional job hubs, located in the most optimal locations?

    ☐ **Yes** ☐ **No**

11. Do high occupancy vehicles (HOV) lanes make sense for Northeast Ohio? If so, what roads or highways should include them?

    ☐ **Yes** ☐ **No**

12. Should housing development be prioritized around existing job hubs and rail stations? If yes, is an increase of 1% of the regional workforce in those areas a reasonable goal?

    ☐ **Yes** ☐ **No**

Scenario 4: Transportation with Optimal Technology and Access (TOTAL)

The TOTAL scenario essentially includes all anticipated projects in the CAR and TRANSIT scenarios, except for the addition of new highway interchanges. Other projects in this scenario include designated smart freeway and arterial lanes for autonomous cars and trucks, installation of electric vehicle (EV) charging ports, and construction of the hyperloop station. This scenario anticipates more substantial employment and population growth as outlined in the scenario matrix.

13. Is the expansion of the transit and highway networks simultaneously a good idea for Northeast Ohio?

    ☐ **Yes** ☐ **No**

14. Are autonomous shuttle buses routes, serving the major regional job hubs, located in the most optimal locations? If so, what roads or highways should include them?

    ☐ **Yes** ☐ **No**

15. If housing development is prioritized around job hubs, rail and Park & Ride stations, what percent of the regional workforce should live around those areas?

    ☐ **Yes** ☐ **No**

16. Should the goal for the percent of the regional workforce living around job hubs, rail, and Park & Ride stations be 1%, 2% or higher?

    ☐ **1%** ☐ **2%** ☐ **Higher**

eNEO2050 Regional Survey

Overview

A major component of *eNEO2050* was a regional survey conducted in 2020. NOACA sought public input from a geographically and demographically representative sample of its adult population. The survey covered topics beyond transportation with the goal of achieving a sample size large enough to ensure the results would be statistically significant at desired levels of confidence and error. The questionnaire for was designed to maximize the number of survey respondents through an engaging, online experience. Reporting documents included data subsets, recommendations, presentations, advocacy, follow-up, and ongoing support. Because of the size and scope of this survey, and that the administration occurred post-COVID outbreak and post-2020 Census, the results have also been used in this update.

Additionally, the Agency conducted its decennial regional Household Travel Survey, with the main survey running from February 2024 to October 2024. The Household Travel Survey provides a detailed picture of the daily travel patterns of people in Northeast Ohio. In addition to analyzing travel trends for key planning and programming activities, this survey is utilized for calibrating and validating the NOACA travel forecasting model and updating its socioeconomic parameter values. The regional air quality conformity analysis and Long Range Transportation Plan are based on the calibrated and validated NOACA travel forecasting model. Therefore, completion and incorporation of the Household Travel Survey and associated data was prioritized over updating the 2021 regional survey.

Sampling Methodology

NOACA determined a sample size of at least 2,400 would ensure overall results at a “medium” confidence level of 95%, within a ±2% “low-medium” margin of error. Figure 4-6 displays the formula used to calculate sample size based on specified parameters [sample proportion (p) value assumed to be 0.5 to maximize sample size].

Figure 4-9. Formula used to calculate sample size[2]

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

NOTE: (N) represents population size at a specified confidence level (z-score), margin of error (e) and sample proportion value (p)

The actual sample size was a bit higher (2,464) than 2400, which translates to a confidence level between 95% and 96%. An adjustment model probability sampling (controlled for outcome variables) was utilized where the 2018 American Community Survey (ACS) provided benchmark

[2] SurveyMonkey, Sample Size Calculator, 2020, https://www.surveymonkey.com/mp/sample-size-calculator/ (retrieved May 11, 2020).

demographics for quota sampling data (specifically age and race) from a large frame population over age 18. The final survey (see Appendix 4-2) included a total of 36 questions designed not only to reveal information about the respondents, but also to provide information to NOACA staff that would support efforts to model the four future transportation scenarios introduced earlier and referenced throughout the remaining chapters of this document.

Collection of Responses

A total of 2,464 respondents completed the survey. The URLs experienced 3,980 hits with 3,028 qualified respondents (based on county and age questions) initially posted. A high number of respondents (2,534) continued to post answers past Q8 (jobs and economic growth); 2,416 continued to post until Q18 (increase riding public transportation); and 2,249 posted all demographic answers through the final question about race (optional). NOACA's Regional Survey completion rate (the percentage of qualified respondents who answered all questions) was 77%. Many questions prefaced that respondents should answer to reflect the time before or after the COVID-19 pandemic (Note: During data collection, the U.S. economy went from lockdown to reopening).

Data collection began June 26 and mostly concluded in four weeks (by July 24). The last week of data collection focused exclusively on black respondents and, later, representative quota compliance in Lorain County.

Figure 4-10 and Table 4-1 illustrate the distribution of the sample across NOACA's geography. Appendix 4-3 provides a comprehensive report of survey results.

Figure 4-10. Map of respondents across the NOACA region by county and concentration*

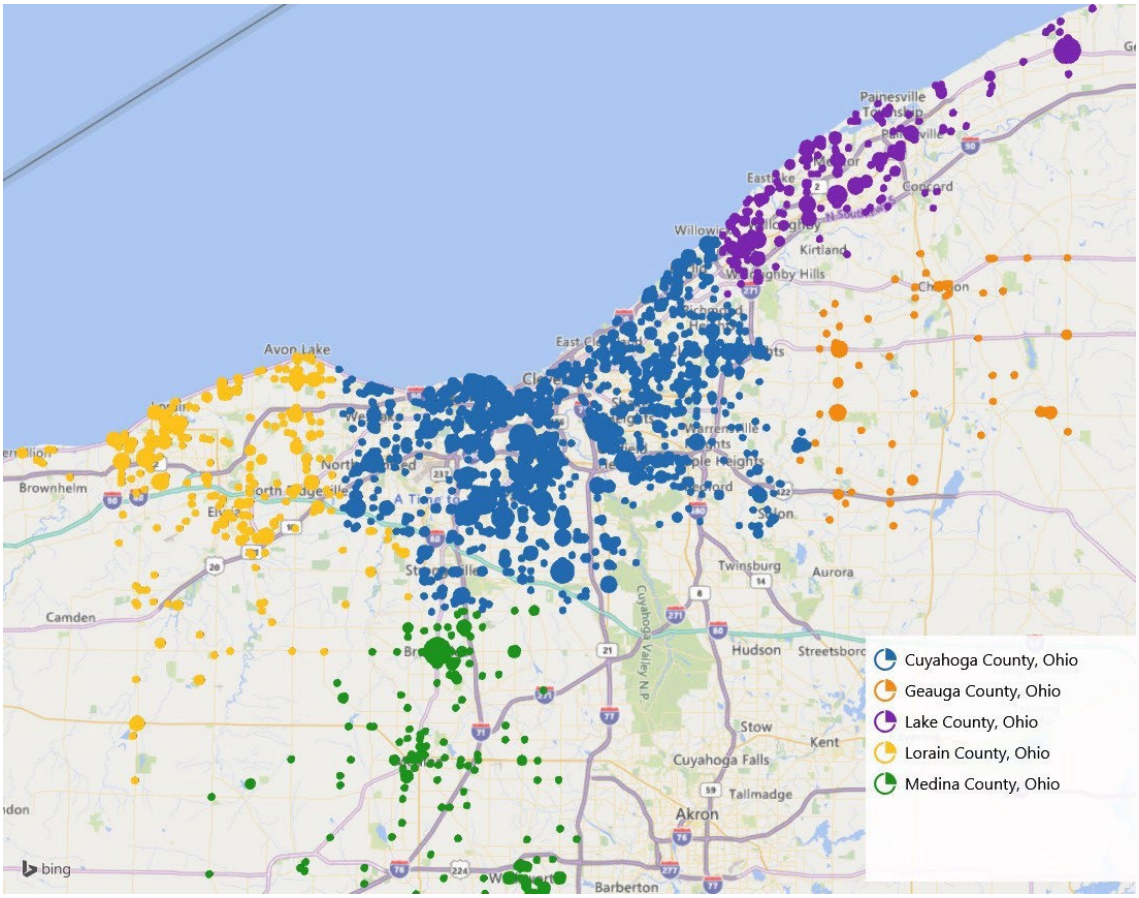


Table 4-1. Distribution of respondents by income/race category across NOACA geographies

		Cleveland and Counties	
	NOACA Survey Base	NOACA Survey	American Community Survey Population >18
Goodness of Sample	**2,464**	**%**	**%**
Cleveland	446	18	19
Cuyahoga	1,087	44	42
Lorain	362	15	15
Lake	271	11	11
Medina	207	8	9
Geauga	91	4	4

Gender

Tables 4-2 and 4-3 (below) illustrate the distribution of respondents (total respondents labeled "BASE") by gender, in comparison to regional and local gender distribution across the population. These tables suggest possible undersampling of males and oversampling of females, but it is also important for the reader to note that 217 respondents (9%) did not answer the gender question, so the possible under/oversampling may simply be an artifact of nonresponse.

Table 4-2. Distribution of Regional Survey Sample by Gender

	Gender						
	NOACA Region	Cleveland	Cuyahoga (no Cleveland)	Lorain	Lake	Medina	Geauga
BASE	**2,247**	**380**	**1,013**	**326**	**253**	**194**	**81**
	%	%	%	%	%	%	%
Female	61.59	60.53	62.88	60.12	63.24	58.76	58.02
Male	37.83	38.95	36.43	39.88	35.57	41.24	40.74
Nonbinary	0.58	0.53	0.69	-	1.19	-	1.23

Table 4-3. Distribution of Regional Population by Gender

	ACS Gender 2018: ACS 1-Year Estimates Subject Tables					
	Cleveland	Cuyahoga (no Cleveland)	Lorain	Lake	Medina	Geauga
BASE: Population >18	**301,081**	**684,949**	**241,198**	**184,304**	**138,890**	**72,713**
	%	%	%	%	%	%
Female	51.23%	54.00%	51.41%	51.65%	51.10%	50.62%
Male	48.77%	46.00%	48.59%	48.35%	48.90%	49.38%

Age

Table 4-4 (below) breaks down the distribution of respondents by both geography and age. The numbers in the rows marked "ACS" represent the targeted subsample sizes from a particular geography within a particular age cohort. These numbers make up a sample distribution based

on the actual percentage of the adult population that falls within that particular geography and age range. The numbers in the rows marked “Survey” represent the actual subsample sizes based sampling methodology. For most geography/age subsamples, the Survey numbers and ACS numbers are quite similar. See Appendix 4-4 for a comprehensive breakdown of the full Regional Survey results by age.

Table 4.4 Distribution of respondents across age cohorts (sample versus ACS)

		Age Cohort						
County	**Source**	**18-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65+**	**Total**
Cleveland	ACS	60	93	63	68	82	81	447
	Survey	81	87	83	62	75	58	446
Cuyahoga	ACS	102	168	149	161	182	254	1,016
	Survey	106	158	162	180	244	237	1,087
Lorain	ACS	41	49	55	61	66	84	356
	Survey	57	43	53	49	70	90	362
Lake	ACS	25	40	40	47	52	68	272
	Survey	33	39	39	40	58	62	271
Medina	ACS	19	29	33	38	38	47	204
	Survey	23	29	49	49	32	25	207
Geauga	ACS	12	12	14	19	21	29	107
	Survey	13	8	10	17	25	18	91
Target total (ACS) = 2,400; Total respondents final (Survey) = 2,464								

Race and Ethnicity

Tables 4-5 and Table 4-6 show the distribution within the sample by geography and race and by geography and ethnicity. Please note that the NOACA region base count in Table 4-8 is lower because some respondents elected not to answer the race questions. Also, percentages may exceed 100% because some residents indicated that their identity included two races.

Table 4-5. Distribution of respondents (number and percentage) by race across geographic units

	Race						
Race	**NOACA Region**	**Cleveland**	**Cuyahoga**	**Lorain**	**Lake**	**Medina**	**Geauga**
BASE	**2,249**	**383**	**1,011**	**328**	**253**	**193**	**81**
White	**79.90**	53.52	80.61	87.50	92.49	93.78	92.59
African American or Black	**15.03**	38.64	13.75	8.84	4.74	4.15	2.47
Asian	**2.98**	3.92	3.46	1.83	1.98	2.07	2.47
American Indian and Alaska Native	**1.16**	2.35	1.19	-	1.58	-	1.23
Other(s)	**2.49**	3.92	2.47	2.74	1.19	0.52	3.70

Table 4-6. Distribution of respondents (number and percentage) by Hispanic/Latino ethnicity across geographic units

	Ethnicity						
Hispanic or Latino	NOACA Region	Cleveland	Cuyahoga	Lorain	Lake	Medina	Geauga
BASE	**2,235**	**378**	**1,004**	**326**	**253**	**193**	**81**
Hispanic/Latino	**5.23**	7.94	4.98	7.98	1.98	2.59	1.23
Not Hispanic/Latino	**94.77**	92.06	95.02	92.02	98.02	97.41	98.77

Tables 4-7 and 4-8 provide a more detailed summary of racial and ethnic distribution among survey respondents in comparison to racial and ethnic distribution among the NOACA adult population based on the 2018 U.S. Census Bureau American Community Survey.

Table 4-7. Population and Sample Distribution by Race and Geography

NOACA Region	Total Population (2,057,009)		White	Black	Native	Asian	All other	TOTAL
Cleveland	19%	ACS Population	173,202	197,208	6,830	14,238	14,100	405,578
		ACS % population	43%	49%	2%	4%	3%	100%
		ACS # for survey	191	217	8	16	16	448
		NOACA Survey	205	148	9	15	15	392
		NOACA %	52%	38%	2%	4%	4%	100%
Cuyahoga (no CLE)	42%	ACS Population	642,342	196,455	5,777	36,201	7,010	887,785
		ACS % population	72%	22%	1%	4%	1%	100%
		ACS # for survey	736	225	7	41	8	1,017
		NOACA Survey	815	139	12	35	25	1,026
		NOACA %	79%	14%	1%	3%	2%	100%
Lorain	15%	ACS Population	274,543	32,511	2,645	5,325	4,461	319,485
		ACS % population	86%	10%	1%	2%	1%	100%
		ACS # for survey	306	36	3	6	5	356
		NOACA Survey	287	29	-	6	9	331
		NOACA %	87%	9%	-	2%	3%	100%
Lake	11%	ACS Population	213,368	13,674	1,418	4,361	3,229	236,050
		ACS % population	90%	6%	1%	2%	1%	100%
		ACS # for survey	246	16	2	5	4	273
		NOACA Survey	234	12	4	5	3	258
		NOACA %	91%	5%	2%	2%	1%	100%
Medina	9%	ACS Population	173,724	3,941	1,087	2,818	1,377	182,947
		ACS % population	95%	2%	1%	2%	1%	100%
		ACS # for survey	195	4	1	3	2	205
		NOACA Survey	181	8	-	4	1	194
		NOACA %	93%	4%	-	2%	0%	100%
Geauga	4%	ACS Population	91,720	1,377	311	881	0	94,289
		ACS % population	97%	1%	-	1%	-	100%
		ACS # for survey	104	2	-	1	-	107

	NOACA Survey	75	2	1	2	3	83
	NOACA %	90%	3%	1%	3%	4%	100%

Table 4-8. Population and Sample Distribution by Ethnicity and Geography

NOACA Region	Total Population (2,057,009)		Hispanic or Latino	Not Hispanic or Latino	TOTAL
Cleveland	19%	ACS Population	47,144	336,637	383,781
		ACS % population	12%	88%	100%
		ACS # for survey	55	392	447
		NOACA Survey	30	348	378
		NOACA %	8%	92%	100%
Cuyahoga (no CLE)	42%	ACS Population	29,588	830,488	860,076
		ACS % population	3%	97%	100%
		ACS # for survey	35	982	1,017
		NOACA Survey	50	954	1,004
		NOACA %	5%	95%	100%
Lorain	15%	ACS Population	31,642	277,819	309,461
		ACS % population	10%	90%	100%
		ACS # for survey	36	320	356
		NOACA Survey	26	300	326
		NOACA %	8%	92%	100%
Lake	11%	ACS Population	10,738	219,776	230,514
		ACS % population	5%	95%	100%
		ACS # for survey	13	259	272
		NOACA Survey	5	248	253
		NOACA %	2%	98%	100%
Medina	9%	ACS Population	3,823	175,323	179,146
		ACS % population	2%	98%	100%
		ACS # for survey	4	201	205
		NOACA Survey	5	188	193
		NOACA %	3%	97%	100%
Geauga	4%	ACS Population	1,509	92,522	94,031
		ACS % population	2%	98%	100%
		ACS # for survey	2	105	107
		NOACA Survey	1	80	81
		NOACA %	1%	99%	100%

Table 4-7 shows ACS race for the total population and NOACA's survey sample. These numbers suggest possible undersampling of nonwhites and Hispanics. Both tables also suggest possible undersampling of certain geographies (e.g., City of Cleveland) and certain racial and ethnic groups where highly concentrated (e.g., blacks in Cleveland and suburban Cuyahoga County and Hispanics in Cleveland and Lorain County). However, because 9% of the respondents did not answer the race question or the ethnicity question, the apparent undersampling may simply be an artifact of nonresponse.

Income

The 2020 *eNEO2050* Regional Survey respondents were segmented into "Higher- Income" and "Lower-Income" groups by a threshold set at 200% of the Federal Poverty Level (FPL) (see Table 4-9).[3]

- Higher-income
  - $25,000 - $34,999+ and a one-person household
  - $35,000 - $49,999+ and a household with two people
  - $50,000 - $74,999+ and a household with up to three people
  - $75,000 - $200,000+ and four or more people in a household
- Lower-income
  - $10,000 - $24,999 or less and a one-person household
  - $25,000 - $34,999 or less and two or more people in a household
  - $35,000 - $49,999 or less and three or more people in a household
  - $50,000 - $74,999 or less and four or more people in a household

Table 4-9. Distribution of respondents by income across geographic units

	Annual Household Income						
	NOACA Region	Cleveland	Cuyahoga	Lorain	Lake	Medina	Geauga
BASE	**2,220**	**376**	**1,000**	**323**	**252**	**192**	**77**
	%	%	%	%	%	%	%
Less than $10,000	**6.85**	14.10	5.00	8.05	4.37	5.21	2.60
$10,000 - $14,999	**3.60**	9.57	1.60	5.26	3.57	1.04	-
$15,000 - $24,999	**8.29**	15.69	6.90	4.33	9.13	7.29	6.49
$25,000 - $34,999	**11.35**	15.16	10.10	11.46	13.49	10.42	3.90
$35,000 - $49,999	**12.30**	13.83	11.80	12.07	13.89	13.02	5.19
$50,000 - $74,999	**19.41**	15.16	21.00	17.03	22.62	17.71	23.38
$75,000 - $99,999	**14.05**	6.91	15.80	15.48	13.49	15.10	19.48
$100,000 - $149,999	**14.73**	5.59	16.50	19.81	12.30	18.23	14.29
$150,000 – $199,999	**5.27**	1.86	6.50	4.64	2.78	6.25	14.29
$200,000 or more	**4.14**	2.13	4.80	1.86	4.37	5.73	10.39

And then cross-tabulated "higher-income" and "lower-income" filters by race ("White" and "Nonwhite") (see Figure 4-12 and Table 4-10).

- White (1,755 respondents)
- Nonwhite[4] (459 respondents)

[3] United States Department of Health and Human Services, (1.17.2020). "Annual Update of the HHS Poverty Guidelines," Jan. 17, 2020, https://www.federalregister.gov/documents/2020/01/17/2020-00858/annual-update-of-the-hhs-poverty-guidelines (accessed June 24,2020). Up to $25,520 for one-person household Up to $34,480 for two-person household Up to $43,440 for three-person household Up to $52,400 for four-person household Up to $61,360 for five-person household Up to $70,320 for six-person household Up to $79,280 for seven-person household Up to $88,240 for eight-person household

[4] Some respondents identified as multiple races. For this report, any nonwhite identification was included in the nonwhite group.

Inclusion in the income/race groups (and subsequent analysis) required respondents to answer both the income and race questions. Some, however, chose to skip one or both questions.

Figure 4-12. Distribution of Regional Survey respondents across NOACA by income/race category

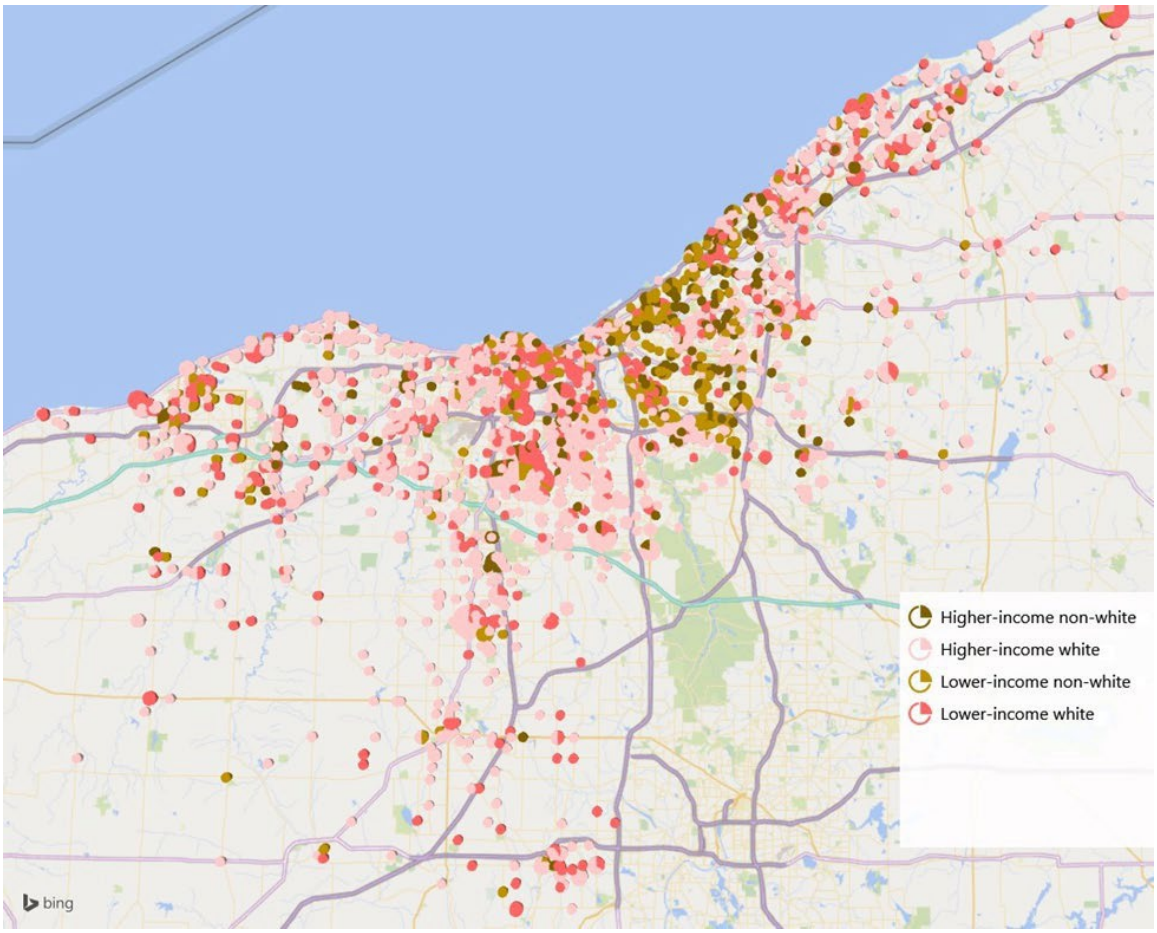


Table 4-10. Distribution of respondents by income/race category across NOACA geographies

		Race and Income Disparity for each NOACA county/county subset			
	NOACA Region	Higher-income white	Lower-income white	Higher-income Non-white	Lower-income Non-white
BASE	**2,453**	**1,215**	**536**	**219**	**237**
Cuyahoga Westside	25.72%	33.74%	22.95%	19.18%	6.33%
Cleveland Westside	8.97%	5.35%	15.11%	10.05%	12.66%
Cleveland Eastside	8.56%	2.39%	4.48%	21.92%	30.80%
Cuyahoga Eastside	18.14%	16.21%	11.75%	33.79%	29.54%
Lorain County	14.76%	15.56%	17.35%	8.22%	10.13%
Lake County	10.84%	11.85%	15.86%	4.11%	5.06%
Medina County	8.40%	9.96%	10.63%	1.37%	4.22%
Geauga County	3.55%	4.77%	1.49%	1.37%	1.27%

As previously mentioned, not all respondents answered the race or income questions in NOACA's Regional Survey; thus, the individual income/race classification group counts in Table 4-10 (above) do not add up to the base count of 2,453. Please see Appendix 4-5 for a comprehensive breakdown of Regional Survey results by income/racial group.

Environmental Justice Areas

The data file was also divided into respondents from Environmental Justice (EJ) and non-EJ areas[5]. Figure 4-13 and Tables 4-11 through 4-14 illustrate the intersection between EJ/non-EJ areas by geographic and demographic variables. Please see Appendix 4-6 for a comprehensive breakdown of Regional Survey results by Environmental Justice area status.

[5] In January 2025, President Trump signed an Executive Order (EO) revoking all prior EOs that had served as the foundations for environmental justice (EJ) initiatives by the federal government. Since EJ initiatives and definitions were in place at the time of the survey, the results of which remain incorporated, the terminology has not been changed.

Figure 4-13. NOACA Environmental Justice Areas

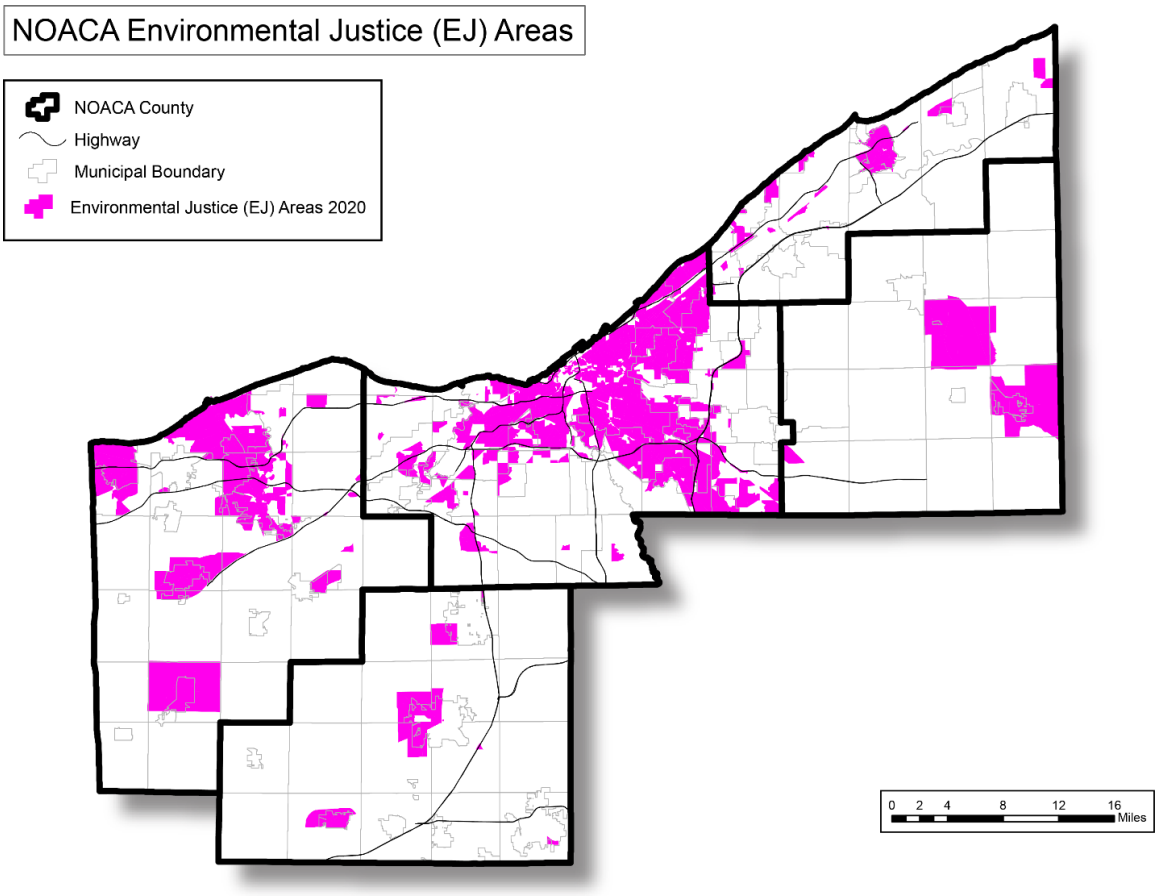


Table 4-11. Percent of counties and county subsets inside and outside Environmental Justice areas[6]

	BASE	NOACA Environmental Justice areas	Non-EJ	
Cuyahoga Westside	631	34.39%	65.61%	*100%*
Cleveland Westside	220	86.82%	13.18%	*100%*
Cleveland Eastside	210	95.71%	4.29%	*100%*
Cuyahoga Eastside	445	67.87%	32.13%	*100%*
Lorain County	356	35.96%	64.04%	*100%*
Lake County	263	24.71%	75.29%	*100%*
Medina County	203	27.09%	72.91%	*100%*
Geauga County	84	19.05%	80.95%	***100%***

[6] Includes the answer to “In which county of Northeast Ohio do you currently live?” and ZIP codes.

Table 4-12. NOACA Environmental Justice area respondents by each county/county subset

	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,453**[7]	**1,175**	**1,237**
Cuyahoga Westside	25.72%	18.47%	33.47%
Cleveland Westside	8.97%	16.26%	2.34%
Cleveland Eastside	8.56%	17.11%	0.73%
Cuyahoga Eastside	18.14%	25.70%	11.56%
Lorain County	14.76%	10.89%	18.43%
Lake County	10.84%	5.53%	16.01%
Medina County	8.40%	4.68%	11.96%
Geauga County	3.55%	1.36%	5.50%
		100%	*100%*

Table 4-13. NOACA Environmental Justice area respondents by race

	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,284**	**1,104**	**1,172**
White	78.68%	66.58%	89.93%
African American or Black	14.80%	25.45%	4.86%
Asian	2.93%	3.08%	2.82%
American Indian and Alaska Native	1.14%	1.45%	0.85%
Other(s)	2.45%	3.44%	1.54%
	100%	*100%*	*100%*

Table 4-14. NOACA Environmental Justice area respondents by income group

	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,220**	**1,066**	**1,146**
Less than $10,000	6.85%	9.85%	3.93%
$10,000 - $14,999	3.60%	5.63%	1.75%
$15,000 - $24,999	8.29%	10.32%	6.37%
$25,000 - $34,999	11.35%	14.26%	8.64%
$35,000 - $49,999	12.30%	12.85%	11.87%
$50,000 - $74,999	19.41%	19.98%	18.94%
$75,000 - $99,999	14.05%	11.35%	16.67%
$100,000 - $149,999	14.73%	10.32%	18.76%
$150,000 - $199,999	5.27%	3.00%	7.33%
$200,000 or more	4.14%	2.44%	5.76%
	100%	*100%*	*100%*

[7] Researchers would not fully verify whether 41 respondents lived in an Environmental Justice area. Therefore, the base for row percentages is 2,412 and the base for columns is 2,453.

Employment

Finally, the NOACA Regional Survey was segmented into responses by respondents' employment status, which was a multiple-choice question. For this analysis, researchers created a single employment status for the 261 respondents (10.6% of the sample) who provided multiple responses (see Table 4-15). Please see Appendix 4-7 for a comprehensive breakdown of Regional Survey results by employment status.

Table 4-15. Employment status of respondents across NOACA Region

	Total	Cuyahoga Westside	Cleveland Westside	Cleveland Eastside	Cuyahoga Eastside	Lorain	Lake	Medina	Geauga
BASE	**2,250**	**599**	**200**	**178**	**412**	**330**	**251**	**194**	**75**
	%	%	%	%	%	%	%	%	%
Employed full-time	38.27	39.57	34.50	36.52	40.29	30.61	39.84	43.81	45.33
Retired	22.36	27.05	19.50	12.36	17.23	27.27	30.28	13.40	20.00
Not currently employed	9.78	9.02	12.50	16.29	7.52	10.00	6.37	13.40	5.33
Part-time (one job)	5.87	4.67	2.00	8.43	5.58	7.88	6.77	8.76	2.67
Part-time (multiple jobs)	2.22	1.84	2.00	2.81	2.91	2.42	1.20	3.09	1.33
Furloughed (COVID-19)	5.51	5.34	7.50	10.11	6.55	5.45	1.59	3.61	4.00
Student	5.38	3.84	5.50	5.06	7.28	5.45	6.77	3.61	6.67
Self-employed	4.49	2.84	6.00	3.37	6.07	4.24	3.59	5.67	6.67
Work from home	3.73	3.51	5.50	3.37	3.64	3.33	2.79	4.12	6.67
Disabled[8]	1.73	1.34	4.50	1.12	2.67	2.12	0.80	-	-
Homemaker[9]	0.67	1.00	0.50	0.56	0.24	1.21	-	0.52	1.33
	100%	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

Analysis and Reports

A series of reports that focused on the overall results of the survey, as well as specific elements were produced. While each of these reports is too lengthy to include (see Appendices 4-2 through 4-7), data and analysis from these reports helped inform the content

[8] Disabled was a verbatim response (additional respondents might have selected disability if prompted). It is included in the tables but not in the charts.

[9] Homemaker was a verbatim response. It is only included on this table and not in any further part of the analysis.

included here. This section provides and discusses some of the overall results of the Regional Survey, while other results are shared in subsequent chapters that focus on corresponding topics.

One of the most poignant sets of questions posed to respondents was Question 12:
Please indicate how much of your personal income you would be willing to invest, each month, for the following concepts in the future. Respondents then reviewed items pertaining to concepts (future transportation projects, environmental protection, existing road maintenance, etc.) and selected from an array of dollar amounts that reflected the monthly outlay they would be willing to pay personally in support of each concept or project: $(0, 1, 5, 10, 25, 50, 100). The following tables illustrate the breakdown of respondents' willingness to pay broken down by geography, EJ area, income, race, and age.

Each of the four tables shown (Tables 4-16 through 4-19) includes a list of the 13 concepts on the left side, one per row, ordered from top to bottom according to respondents' average monthly willingness to pay. The columns reflect a particular demographic or socioeconomic characteristic of respondents, in no specific order. Each cell contains the average monthly willingness to pay for a unique concept by a unique subgroup and exhibits a color that corresponds to a range of monetary value indicated in the legend below each table.

The order of concepts in each table indicates an overall pattern. Repair and maintenance of existing roads received the highest average monthly allocation ($14.40), followed generally by a number of environmental protection initiatives, then innovative transportation projects or technologies. The overall takeaway from these tables is that Northeast Ohio residents are willing to pay most for improved and maintained roads, but they also want climate change impact reduction and a clean environment. There is a willingness to pay for innovations such as Hyperloop, commuter rail along Interstate 480, and smart crosswalks, but they are comparatively lower priority. It is noteworthy that the lowest priority item (smart crosswalks) still earned a monthly average willingness-to-pay value of $7.24, so all of the listed concepts have value among the respondents.

Table 4-16. Willingness to Pay across Entire NOACA Region and by Geography

	NOACA Region	Cleveland	Cuyahoga County (no CLE)	Lorain	Lake	Medina	Geauga
Road repair and maintenance	$14.40	$20.37	$13.17	$11.88	$14.69	$13.84	$10.78
Reduce climate change impacts	$14.15	$20.57	$13.11	$13.05	$13.48	$11.17	$9.02
Cleaner rivers and lakes	$13.57	$19.78	$12.63	$12.84	$10.88	$12.26	$9.00
Cleaner drinking water	$13.56	$21.82	$12.12	$11.79	$11.17	$12.47	$7.65
Hyperloop CLEVELAND-CHICAGO	$12.78	$15.38	$12.39	$12.48	$12.39	$11.87	$9.49
Cleaner air	$12.73	$20.47	$11.40	$11.01	$10.38	$11.42	$8.25

V2I (vehicle-to-infrastructure comm)	$10.81	$15.91	$9.50	$9.68	$10.36	$10.48	$8.59
Hyperloop CLEVELAND-PITTSBURGH	$10.77	$14.77	$9.82	$9.43	$10.97	$11.07	$6.91
Transportation hub	$10.16	$13.69	$9.39	$9.19	$8.20	$11.48	$9.30
Commuter rail I-480 route	$8.07	$12.87	$7.87	$6.46	$5.03	$6.54	$6.39
Brownfield cleanup & redevelop	$8.03	$13.05	$7.02	$6.47	$5.94	$8.72	$7.01
Improve movement of goods	$7.93	$13.38	$6.61	$7.26	$6.37	$6.54	$8.25
Smart crosswalks	$7.24	$13.50	$5.33	$6.32	$6.33	$7.12	$6.91

$13.50+	**$11.50-13.49**	**$9.50-11.49**	**$7.50-9.49**	**<$7.50**

Table 4-16 illustrates how willingness to pay varies across the geographic location of the respondents. The colors help illustrate this pattern as well. City of Cleveland respondents generally demonstrated the highest willingness to pay, with cleaner drinking water at the top ($21.82 per month). None of the suburban respondents expressed an average willingness to pay of even $15 per month for any of the listed concepts. Road repair and maintenance garnered the highest amount of support from respondents in Lake (14.69), Medina ($13.84) and Geauga ($10.78) counties, as well as suburban Cuyahoga (13.70) county; and the third highest in Lorain County ($11.88). The other significant observation in Table 4-16 is that Geauga County respondents are the least willing to pay for most of these concepts; all monthly averages are below $10 per month except for road repair and maintenance ($10.78) commuter rail route). The lowest overall monthly commitment was by Lake County respondents for I-480 commuter rail ($5.03).

Table 4-17. Willingness to Pay Across Entire NOACA Region and by EJ Area

	NOACA Region	Inside EJ Area	Outside EJ Area
Road repair and maintenance	$14.40	$16.06	$12.25
Reduce climate change impacts	$14.15	$15.68	$12.34
Cleaner rivers and lakes	$13.57	$15.49	$11.30
Cleaner drinking water	$13.56	$15.93	$10.88
Hyperloop CLEVELAND-CHICAGO	$12.78	$12.98	$12.29
Cleaner air	$12.73	$14.84	$10.32
V2I (vehicle-to-infrastructure comm)	$10.81	$11.78	$9.60
Hyperloop CLEVELAND-PITTSBURGH	$10.77	$11.50	$9.76
Transportation hub	$10.16	$10.97	$9.07
Commuter rail I-480 route	$8.07	$9.49	$6.52
Brownfield cleanup & redevelop	$8.03	$9.50	$6.23
Improve movement of goods	$7.93	$9.52	$6.10
Smart crosswalks	$7.24	$9.01	$5.43

$13.50+ **$11.50-13.49** **$9.50-11.49** **$7.50-9.49** **<$7.50**

The pattern in Table 4-17 is fairly clear: respondents inside EJ areas demonstrate a higher willingness to pay than respondents outside EJ Areas. Professed monthly allocations for EJ area respondents are generally higher than the region as a whole, with priority given to road repair and maintenance ($16.06) and environmental protection; the lowest priority is smart crosswalks ($9.01 per month). Among non-EJ area respondents, the three highest priorities are climate change impact reduction, Hyperloop to Chicago, and road repair and maintenance, but all under $12.50 per month. The lowest priority is smart crosswalks, but at a much lower amount ($5.43) per month than respondents in EJ areas.

Table 4-18. Willingness to Pay across Entire NOACA Region and by Income/Race Group

	NOACA Region	Higher-income Whites	Lower-income Whites	Higher-income Non-whites	Lower income Non-whites
Road repair and maintenance	$14.40	$12.58	$12.92	$16.13	$22.29
Reduce climate change impacts	$14.15	$11.38	$13.39	$18.17	$20.56
Cleaner rivers and lakes	$13.57	$10.39	$12.45	$17.77	$22.91
Cleaner drinking water	$13.56	$10.12	$13.03	$19.45	$22.74
Hyperloop CLEVELAND-CHICAGO	$12.78	$13.08	$9.48	$14.93	$14.71
Cleaner air	$12.73	$9.29	$11.99	$19.78	$21.55
V2I (vehicle-to-infrastructure comm)	$10.81	$10.13	$8.03	$14.49	$16.28
Hyperloop CLEVELAND-PITTSBURGH	$10.77	$9.87	$8.54	$13.57	$13.70
Transportation hub	$10.16	$9.75	$6.91	$12.31	$14.90
Commuter rail I-480 route	$8.07	$6.99	$6.13	$9.64	$14.32
Brownfield cleanup & redevelop	$8.03	$5.83	$6.78	$9.51	$16.68
Improve movement of goods	$7.93	$5.95	$6.52	$10.30	$15.55
Smart crosswalks	$7.24	$4.75	$7.05	$10.01	$15.54

$13.50+ **$11.50-13.49** **$9.50-11.49** **$7.50-9.49** **<$7.50**

The pattern in Table 4-18 is also fairly clear: nonwhite respondents demonstrate higher willingness to pay for the listed concepts than white respondents and, among nonwhites, lower-income respondents demonstrate higher willingness to pay than higher-income respondents. Among all whites, willingness to pay does not extend much beyond $13 per month. Highest priorities for higher-income white respondents are the Hyperloop to Chicago, and road repair and maintenance. Lower-income white respondents do not prioritize Hyperloop as much; they are most willing to pay for climate change impact reduction and cleaner drinking water. Highest priorities for higher-income nonwhites are cleaner air and cleaner drinking water (each between $19 and $20 per month). Lower-income nonwhites prioritize these as well, but also road repair and maintenance, and cleaner rivers and lakes (highest, at nearly $23 per month).

Table 4-19. Willingness to Pay across Entire NOACA Region and by Age Cohort

		AGE					
	NOACA Region	18-24	25-34	35-44	45-54	55-64	65+
Road repair and maintenance	$14.40	$22.78	$15.85	$13.90	$13.69	$12.70	$10.80
Reduce climate change impacts	$14.15	$25.93	$18.18	$13.88	$13.50	$10.37	$8.47
Cleaner rivers and lakes	$13.57	$25.56	$16.57	$12.85	$12.84	$10.47	$8.23
Cleaner drinking water	$13.56	$22.71	$19.00	$14.53	$12.82	$10.18	$7.07
Hyperloop CLEVELAND-CHICAGO	$12.78	$17.63	$16.51	$14.51	$12.79	$10.38	$8.05
Cleaner air	$12.73	$22.02	$16.46	$13.07	$13.06	$9.28	$7.15
V2I (vehicle-to-infrastructure comm)	$10.81	$16.20	$14.31	$10.50	$10.38	$8.45	$7.86
Hyperloop CLEVELAND-PITTSBURGH	$10.77	$18.06	$13.74	$11.79	$10.33	$8.73	$5.62
Transportation hub	$10.16	$17.93	$12.43	$10.04	$9.16	$7.78	$6.97
Commuter rail I-480 route	$8.07	$12.60	$11.11	$8.24	$7.72	$6.35	$4.88
Brownfield cleanup & redevelop	$8.03	$16.69	$9.21	$8.35	$7.25	$5.39	$4.81
Improve movement of goods	$7.93	$15.20	$9.83	$8.38	$7.35	$5.28	$4.77
Smart crosswalks	$7.24	$14.10	$10.36	$7.35	$6.49	$5.42	$3.00

$13.50+ **$11.50-13.49** **$9.50-11.49** **$7.50-9.49** **<$7.50**

Table 4-19 displays perhaps the sharpest pattern of all, with younger respondents more willing to pay for listed concepts than older respondents. Interestingly enough, the younger cohorts demonstrate a higher willingness to pay for certain concepts than any other subgroup, and the older cohorts demonstrate a lower willingness to pay for certain concepts than any other subgroup. For example, respondents aged 18-24 are willing to spend more than $25 per month on both climate change impact reduction, and cleaner rivers and lakes; the lowest they'll spend is $12.60 per month on the I-480 commuter rail. Respondents aged 65 years and older are not even willing to spend $5 per month on the I-480 commuter rail, brownfield cleanup and redevelopment, or improved goods movement. The oldest cohort of respondents is only willing to spend $3 per month on smart crosswalks. The most interesting observation here is that older respondents, who reflect those in positions of greater power, influence, and authority, have very different priorities than the younger respondents for whom *eNEO2050* will shape their adult lives as they move into those positions.

Presentation and Webinar

NOACA presented highlights of the Regional Survey results to the NOACA Board of Directors on December 11, 2020. At the Board's request, NOACA staff also presented highlights of the regional survey results at a webinar on January 15, 2021. Board members and stakeholders within their respective networks were eligible to attend. Appendix 4-8 includes the webinar presentation, with all information presented to the Board on December 11, as well as some additional refinements and information based on Board member feedback.

CrowdGauge Tool

NOACA continued its robust public engagement process for *eNEO2050* by using CrowdGauge software. NOACA had previously used CrowdGauge for both *Vibrant NEO 2040*, a regional visioning framework for a 12-county region in Northeast Ohio (including the five-county NOACA region), and *AIM Forward 2040*. CrowdGauge is described as an open-source framework for creating educational online games. It first asks users to rank a set of priorities, then demonstrates how a series of actions and policies might impact those priorities. The third part of the sequence gives users a limited number of coins, asking them to put that money towards the actions they support most.[10]

NOACA's intent with CrowdGauge was to supplement its Regional Survey with a more focused effort to target input from certain stakeholders and especially from persons within Environmental Justice areas. NOACA sought input from low-income and minority populations that historically have been less engaged or not engaged with the planning process, and hoped the tool would facilitate that engagement. This was particularly important given NOACA's strong emphasis on equity in the new long-range plan and staff desire to articulate a more equitable future for the region. The following paragraphs will describe development of the CrowdGauge tool; an outreach strategy to engage all persons, but particularly those from EJ Areas; regional workshops held to engage the diverse geographic areas of the NOACA region; and analysis of participant responses.

Tool Development

A comprehensive, three-phase tool was developed, which was beta-launched at NOACA's annual Transportation Day on July 24, 2020. Feedback was incorporated from this event into the first of several regional workshops that began on August 3, 2020, and continued through the months of August and September. The tool itself, made available through NOACA's long-range plan website, stayed open for anyone to access through October 31, 2020.[11]

The CrowdGauge tool involves three phases, or steps: priorities (or values), project and policy impacts, and project and policy choices. And although most of the items related directly to areas that NOACA could influence in its role as a transportation and environmental planning agency, some were intentionally placed outside of its jurisdiction in order to gauge broad priorities in comparison to its own responsibilities. A title page preceded these three steps; it provided not only details about the tool itself and its intended purpose, but also the opportunity for participants to provide some basic demographic information to help NOACA better understand the characteristics of the sample, including user location.

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[10] Sasaki and Associates, CrowdGauge.

[11] Northeast Ohio Areawide Coordinating Agency (NOACA), "CrowdGauge," eNEO2050: An equitable future for northeast Ohio, https://www.eneo2050.com/crowdgauge (accessed Feb. 3, 2021)

Step 1: Priorities
NOACA developed a list of 15 present-tense statements that describe attributes related to numerous subjects, such as mobility, jobs, housing, health, and the environment. The tool required users to identify their priorities for the future through these statements. Users considered each statement from the perspective of either a desire to preserve a current attribute of the system or to describe an ideal future condition. Users assigned zero to five stars to each statement as a reflection of relative value to the individual; however, each user only had 40 stars to assign. Therefore, it was not possible for a user to rate all 15 statements as a top priority (five stars); users had to make choices and trade-offs. A dynamic display of icons shifted with the user's scoring of each statement, which yielded a composite, icon-based visualization of their individual priorities.

Step 2: Project and Policy Impacts
Once users had established priorities, they could click through different options of projects and policies to see how these would affect their priorities. NOACA generated examples of projects and policies that reflected not only areas where NOACA has a direct influence, such as transportation and the environment, but also areas strongly connected to transportation, such as land use, housing, and economic development. As was the case in the Priorities step, users' clicks through the options influenced the size and color of the icons to represent positive or negative impact by the selected projects and policies. The selected options highlighted the three greatest impacts based on the users' priorities.

NOACA also developed explanations of why and how the impacts occur, to facilitate the users' understanding. It is noteworthy that, in Step 2, there was no direct action by the user. Step 2 was an opportunity for users to learn more about how realistic project and policy options might affect their priorities. Step 3 involved actual decision-making.

Step 3: Project and Policy Choices
With stated priorities and information about impacts on those priorities in hand, users advanced to choose specific projects and policies. NOACA developed 29 project group categories, each of which contained a mix of specific projects and policies. Users spent money on projects and voted on policies based on the potential impacts they would have on the user's priorities. As with the stars in Step 1, users had a limited budget of coins (50) they could spend on projects. As users selected projects and policies, the sizes and colors of the priority icons changed to reflect the impacts of a given choice. When the user clicked on the icon, a written explanation of how the project or policy affected that specific priority appeared. This "pop-up" explanation provided an opportunity for the user to learn about the consequences of their choices. The user's selection of priorities, projects, and policies collectively indicated their overall attitudes and choices regarding regional transportation planning and investment trade-offs.

Analysis and Reports

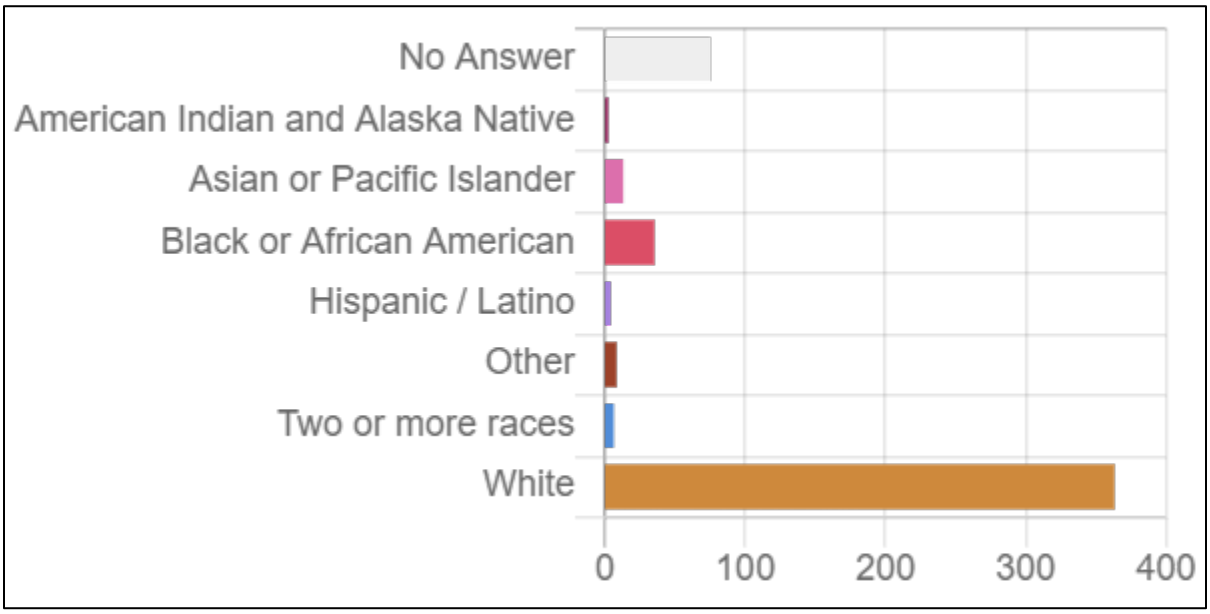
Sample
A total of 506 stakeholders participated in the CrowdGauge exercise. This was much lower than expected, and NOACA attribute the lower participation rate to the COVID-19 pandemic. It was not possible to engage stakeholders in person. Virtual gatherings and remote distribution of information did not realize the same levels of participation as in-person engagement activities. NOACA presented the full results from the CrowdGauge tool exercise at a virtual roundtable for *eNEO2050* on November 6, 2020.

Among the 506 respondents, more than half came from Cuyahoga County (270). This was to be expected given that Cuyahoga County represents more than half of the total population in the

NOACA region (see Chapter 1). The second largest group of participants came from Medina County (132). Although this may seem unusual as it is not proportional to population, it can be attributed to interest in engagement by the Medina County Economic Development Corporation who facilitated a special workshop on the CrowdGauge tool during the participation period The remaining counties had a lower participation rate: Lorain (31), Lake (16) and Geauga County (8). There was also a smattering of participants from other counties outside the NOACA region.

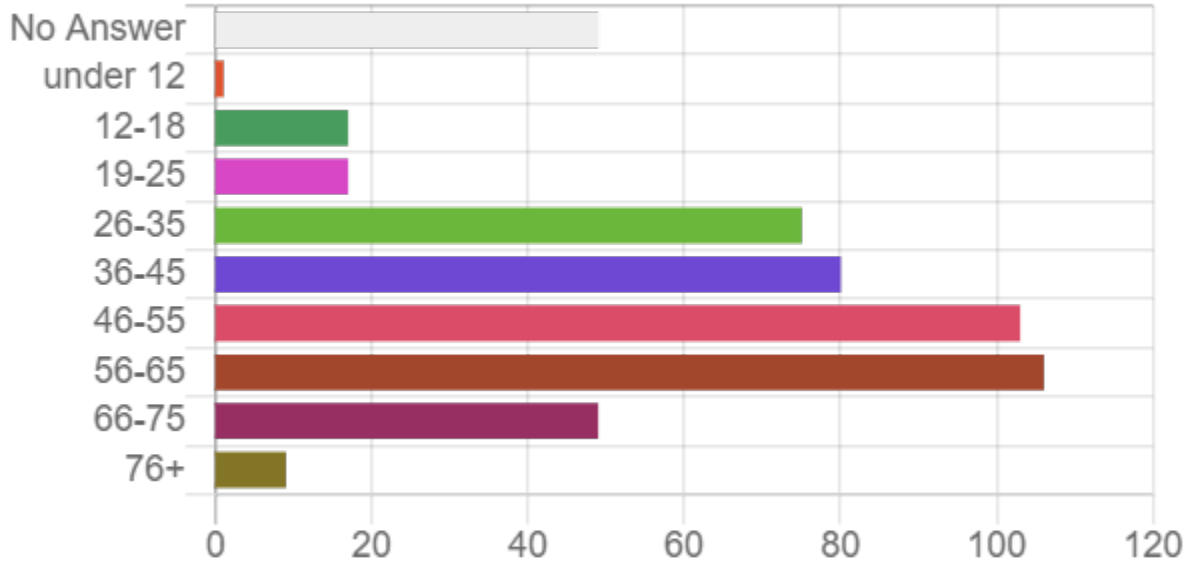
The racial breakdown of participants was overwhelming white (see Figure 4-13 below). Among the 431 respondents who reported race, more than 84% (363) identified as white. Only 35 (8%) of the respondents who reported race identified as black, which is less than the percentage of blacks from the entire NOACA regional population (15%) and certainly far below the over-representative sample NOACA staff had hoped to obtain.

Figure 4-13. Distribution of CrowdGauge Participants across Racial/Ethnic Groups



While there was roughly equal gender representation among the participants (48% women versus 52% men), that was not the case with regard to age. Figure 4-14 below shows two prominent peaks in terms of the age cohorts represented in the bar graph (46-55 and 56-65). Of the 457 respondents who reported their age, nearly half (46%) were ages 46-65. By comparison, the number of respondents ages 19-35 made up only 20% of all reporting respondents. Not only did the COVID-19 pandemic prove challenging to reach nonwhite stakeholders, but it was also more difficult to secure broader participation among younger adults, particularly high school and college students, whom were identified as a target audience. *eNEO2050* is really a plan for the youth today who will mature personally and professionally over the next 30 years. Their engagement is critical to the region's future success.

Figure 4-14. Distribution of CrowdGauge Tool Users by Age



Priorities Results

A major theme emerged from the priorities rankings: priority to live in a clean environment, with access to recreation and parks, healthy food, and health care. Based on all respondents, the top five (of 15) priorities ranked in the CrowdGauge tool were as follows (each priority averaged a score of at least three stars; total stars assigned per priority are provided in parentheses):

1. I live in an environment with clean water (1,678)
2. I live in an environment with clean air (1,601)
3. I can easily get to fresh food and healthcare (1,568)
4. I live in a home/neighborhood free from toxins and pollutants (1,510)
5. I can easily get to recreation spaces and parks (1,448)

Priorities by county varied. Cuyahoga, Lorain, and Medina counties each had the overall top priority, “I live in an environment with clean water,” as their top priority as well. Respondents from Cuyahoga and Medina counties each had the overall second priority, “I live in an environment with clean air,” as their second priority. Respondents from Lorain County had the overall fourth priority, “I live in a home/neighborhood free from toxins and pollutants,” as their second priority. Lake and Geauga counties were somewhat different, although it is critical to note that very few individuals from each and of these counties actually participated. Lake County had the overall third priority, “I can easily get to fresh food and healthcare,” as its top priority and the overall sixth priority, “I can access a good job to ensure my financial stability,” as its second priority. Geauga County had the overall ninth priority, “I am proud to live in my neighborhood,” as its top priority and the overall top priority (clean water) as its second priority.

Policies Results

Most of the policies received positive reactions, with one exception. The only policy response that received more negative reactions than positive reactions was “only implement new High-Occupancy Vehicle (HOV) lanes as additions to, not in replacement of, existing highway lanes.” Three of the top five positive policy responses were in support of NOACA’s commitment to greater community leaders’ involvement and prioritization of racial equity and diversity.

1. Involve more community leaders in NOACA project review and decision making that will impact their communities (255 “for,” 14 “against”).

2. Support ongoing maintenance and upgrades to wastewater treatment facilities (253 “for,” 4 “against”).
3. NOACA uses traffic calming solutions to achieve more livable communities (252 “for,” 19 “against”).
4. NOACA Commitment to Racial Equity in Planning (2020): “NOACA will commit to creating a subcommittee of the Policy Committee and develop a plan to ensure racial equity is embedded in all of our work” (249 “for,” 19 “against”).
5. Increase racial and ethnic diversity on advisory councils that corresponds to specific planning areas (245 “for,” 17 “against”).

Four of the top five policies most voted against still received (by far) more positive votes overall. Here are the five policies with the most “against” votes (total votes):

1. Only implement new High-Occupancy Vehicle (HOV) lanes as additions to, not replacement of, existing highway lanes (129 “against,” 79 “for”).
2. Require developers or communities to share in the cost of new road construction for their projects for which they receive direct benefit (74 “against,” 188 “for”).
3. Require local governments to increase housing density, commercial and retail uses in specific areas to enable more convenient walking, biking and transit to reduce car dependency (37 “against,” 188 “for”).
4. Prioritize investment in new or upgraded transit before building new roads (35 “against,” 232 “for”).
5. Improve road infrastructure to attract or facilitate the relocation of companies to places where most workers live (34 “against,” 185 “for”).

Projects Results

NOACA summarized the top specific projects by the number of coins given and the number of times selected to provide a more comprehensive view that accounts for preference as well as cost.

The top five most coins awarded to specific projects included redevelopment and clean-up of brownfield sites (a relatively expensive project, but also one that fulfilled numerous priorities) as well as projects that focused on regional transportation, clean water, and the construction of new parks. The top five most coins awarded to specific projects (total coins) aligns very well with the top five project categories in terms of focus on issues of mobility and the environment.

1. Redevelop 200 acres of brownfields (contaminated sites that require environmental clean-up/remediation, such as former factories, gas stations, dry cleaners, and junkyards) to attract new employers with 1,000 jobs (1,260).
2. Add 10 new miles of cross-county intercity commuter rail (1,050).
3. Invest in upgrades to 50 wastewater treatment facilities and grey infrastructure (e.g., tunnels, conduits, sewer pipes) (1,044).
4. Add bike lanes to 10% of local roads; improve sidewalks on 10% of local roads (812).
5. Build new roads and utilities (water, sewer, etc.) to facilitate development of 10,000 new homes on previously undeveloped land (680).

When ranked by the number of times selected, the top five specific projects are still primarily focused on mobility-related issues, with traffic calming the most selected, followed by restoration of recently cut bus service, provision of free transit passes, and senior shuttle services. These projects also align with the preferences identified within the broader project categories, but also likely received many selections due to their relatively low cost compared to other projects. The fifth-most selected specific project was the demolition of 1,000 currently vacant housing units, and planting trees as part of a neighborhood beautification effort. The popularity of this specific project

supports the broader project group category of decayed building renovation or demolition, which ranked third overall based on number of total policies and projects selected.

1. Traffic calming measures at 500 intersections, such as curb extensions, traffic circles, raised crosswalks, speed tables, pedestrian signals, etc. (203).
2. Restore recently cut bus and rapid transit services (172).
3. Provide free transit passes to 5,000 households that make less than 80% of the area median income to maintain the affordability of their housing units (169).
4. Provide funding for purchasing up to 400 neighborhood shuttles for seniors (148).
5. Demolish 1,000 currently vacant housing units, add fencing, plant trees, and maintain for 30 years to beautify the lot (137).

eNEO2050 Scenario and Plan Development

eNEO2050 was the first NOACA long range plan to adopt scenario planning and associated performance measures and targets as part of its future outlook. Since *weNEO2050+* is an update of the previous plan, it builds on these same scenarios, which were developed utilizing two core components: 1) public outreach to gather input on transportation needs from people across the region, and 2) analysis of data on transportation services and infrastructure to identify existing gaps for opportunities and improvements.

Preliminary Plan and Scenario Development

During the Preliminary Plan Phase, outreach approaches and messages conveyed how NOACA used the results from public comments to shape analyses of several proposed alternatives. The results of these analyses were part of a scenario planning exercise and development of associated performance measurements. NOACA used various outreach methods to raise awareness about these results, starting with the identification of four possible future scenarios for Northeast Ohio's transportation system. These announcements were issued through various outreach formats and included press releases to various news outlets, which included instructions on how stakeholders could provide input; direct email and newsletter announcements; electronic material to reach vast audiences; website alerts; social media; and presentations of the findings at 12 NOACA Board, Committee, and Advisory Council meetings. These various outreach approaches allowed for continuous public comments at these meetings and through the online portal.

The social media analytics provided reach to all five counties served with more than 185,000 impressions combined from Facebook, LinkedIn, and Twitter, along with an increase of 421 frequent monthly website users between January 1 and March 30, 2021. Although comments were minimal from the digital outlets, likes and shares of the public awareness campaign held steady at 15%, a slight 2.1% increase from the 2020 public awareness campaign. This indicates that NOACA retained public interest and frequent users to the website, along with other digital formats during this three-month outreach process.

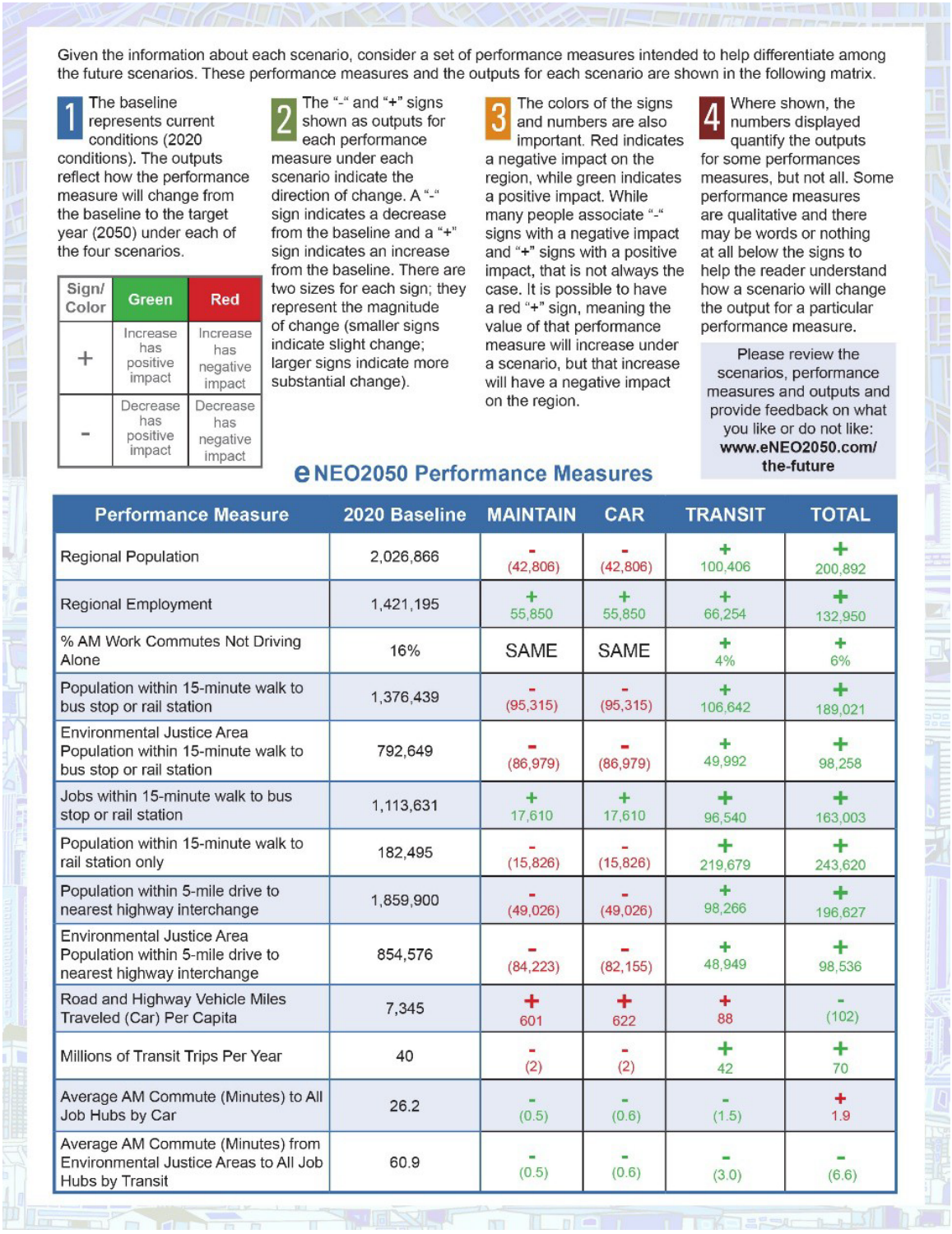
Neither the website portal nor the agency website generated any public comments. Most of the comments from this outreach campaign came directly from targeted stakeholders through meetings and advisory councils of Northeast Ohio representatives.

NOACA developed a matrix to outline the performance measures as they aligned with the four scenarios. NOACA presented this matrix to the general public and stakeholders. NOACA staff distributed this information to more than 1,100 regional residents as part of the project email list (see Figure 4-12). The *eNEO2050* website hosted the matrix. NOACA also sent it to NOACA's

Board of Directors, Committees, Subcommittees, and Advisory Councils to maximize audience reach. Two stakeholder meetings that targeted the Ohio Department of Transportation (ODOT), planners, engineers, economic developers, and other transportation professionals from five-county NOACA region took place on March 5 and March 18, 2021. NOACA received direct comments and questions from these professionals regarding the scenarios and performance measures to guide and advise staff on revisions and next steps.

Figure 4-15. Public Posting of Future Transportation Scenarios and Performance Measures

Figure 4-16. Public Posting of Future Transportation Scenarios and Performance Measures (cont.)



Given the information about each scenario, consider a set of performance measures intended to help differentiate among the future scenarios. These performance measures and the outputs for each scenario are shown in the following matrix.

1 The baseline represents current conditions (2020 conditions). The outputs reflect how the performance measure will change from the baseline to the target year (2050) under each of the four scenarios.

Sign/ Color	Green	Red
+	Increase has positive impact	Increase has negative impact
-	Decrease has positive impact	Decrease has negative impact

2 The "-" and "+" signs shown as outputs for each performance measure under each scenario indicate the direction of change. A "-" sign indicates a decrease from the baseline and a "+" sign indicates an increase from the baseline. There are two sizes for each sign; they represent the magnitude of change (smaller signs indicate slight change; larger signs indicate more substantial change).

3 The colors of the signs and numbers are also important. Red indicates a negative impact on the region, while green indicates a positive impact. While many people associate "-" signs with a negative impact and "+" signs with a positive impact, that is not always the case. It is possible to have a red "+" sign, meaning the value of that performance measure will increase under a scenario, but that increase will have a negative impact on the region.

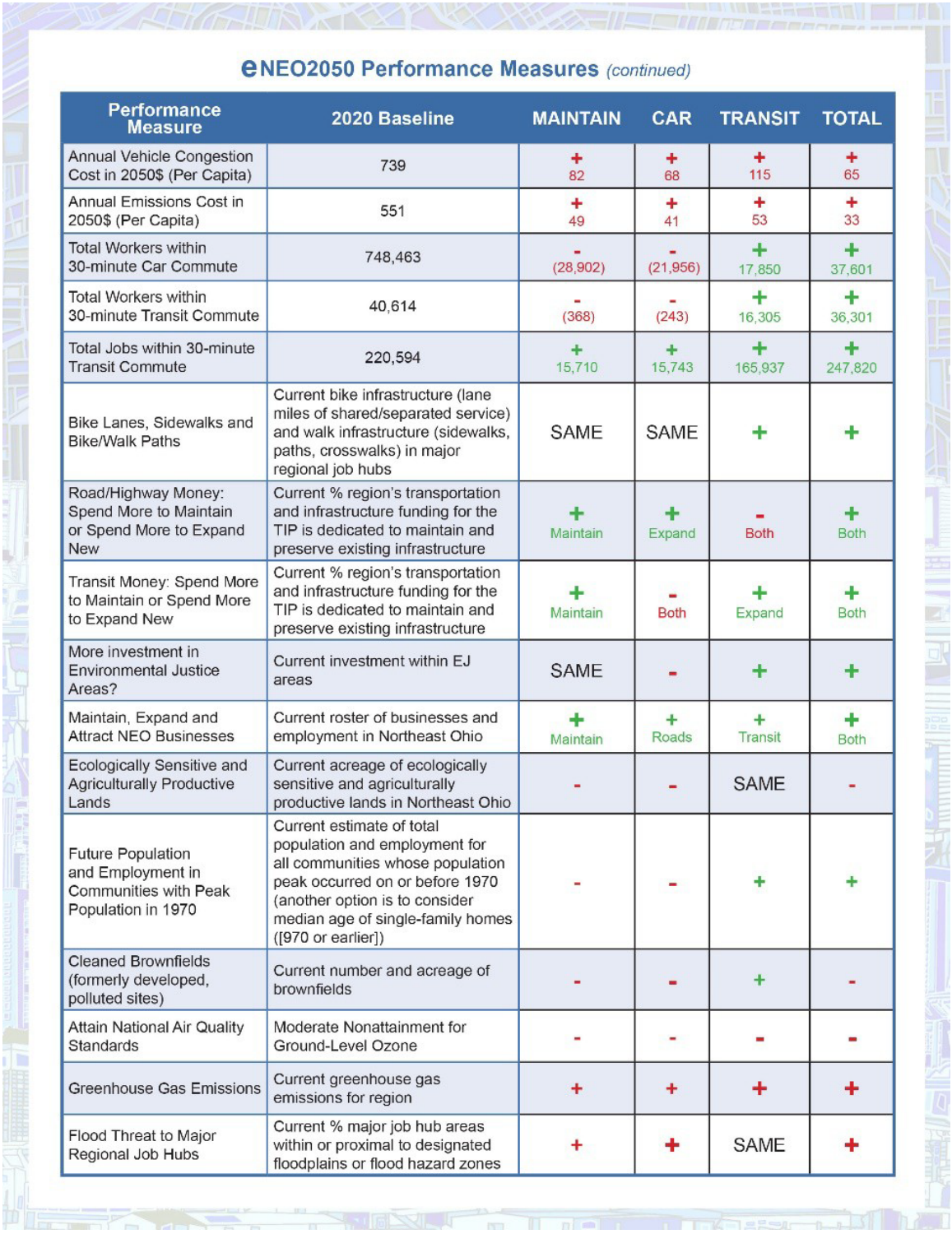
4 Where shown, the numbers displayed quantify the outputs for some performances measures, but not all. Some performance measures are qualitative and there may be words or nothing at all below the signs to help the reader understand how a scenario will change the output for a particular performance measure.

Please review the scenarios, performance measures and outputs and provide feedback on what you like or do not like: **www.eNEO2050.com/the-future**

eNEO2050 Performance Measures

Performance Measure	2020 Baseline	MAINTAIN	CAR	TRANSIT	TOTAL
Regional Population	2,026,866	- (42,806)	- (42,806)	+ 100,406	+ 200,892
Regional Employment	1,421,195	+ 55,850	+ 55,850	+ 66,254	+ 132,950
% AM Work Commutes Not Driving Alone	16%	SAME	SAME	+ 4%	+ 6%
Population within 15-minute walk to bus stop or rail station	1,376,439	- (95,315)	- (95,315)	+ 106,642	+ 189,021
Environmental Justice Area Population within 15-minute walk to bus stop or rail station	792,649	- (86,979)	- (86,979)	+ 49,992	+ 98,258
Jobs within 15-minute walk to bus stop or rail station	1,113,631	+ 17,610	+ 17,610	+ 96,540	+ 163,003
Population within 15-minute walk to rail station only	182,495	- (15,826)	- (15,826)	+ 219,679	+ 243,620
Population within 5-mile drive to nearest highway interchange	1,859,900	- (49,026)	- (49,026)	+ 98,266	+ 196,627
Environmental Justice Area Population within 5-mile drive to nearest highway interchange	854,576	- (84,223)	- (82,155)	+ 48,949	+ 98,536
Road and Highway Vehicle Miles Traveled (Car) Per Capita	7,345	+ 601	+ 622	+ 88	- (102)
Millions of Transit Trips Per Year	40	- (2)	- (2)	+ 42	+ 70
Average AM Commute (Minutes) to All Job Hubs by Car	26.2	- (0.5)	- (0.6)	- (1.5)	+ 1.9
Average AM Commute (Minutes) from Environmental Justice Areas to All Job Hubs by Transit	60.9	- (0.5)	- (0.6)	- (3.0)	- (6.6)

Figure 4-17. Public Posting of Future Transportation Scenarios and Performance Measures (cont.)



eNEO2050 Performance Measures *(continued)*

Performance Measure	2020 Baseline	MAINTAIN	CAR	TRANSIT	TOTAL
Annual Vehicle Congestion Cost in 2050$ (Per Capita)	739	+ 82	+ 68	+ 115	+ 65
Annual Emissions Cost in 2050$ (Per Capita)	551	+ 49	+ 41	+ 53	+ 33
Total Workers within 30-minute Car Commute	748,463	- (28,902)	- (21,956)	+ 17,850	+ 37,601
Total Workers within 30-minute Transit Commute	40,614	- (368)	- (243)	+ 16,305	+ 36,301
Total Jobs within 30-minute Transit Commute	220,594	+ 15,710	+ 15,743	+ 165,937	+ 247,820
Bike Lanes, Sidewalks and Bike/Walk Paths	Current bike infrastructure (lane miles of shared/separated service) and walk infrastructure (sidewalks, paths, crosswalks) in major regional job hubs	SAME	SAME	+	+
Road/Highway Money: Spend More to Maintain or Spend More to Expand New	Current % region's transportation and infrastructure funding for the TIP is dedicated to maintain and preserve existing infrastructure	+ Maintain	+ Expand	- Both	+ Both
Transit Money: Spend More to Maintain or Spend More to Expand New	Current % region's transportation and infrastructure funding for the TIP is dedicated to maintain and preserve existing infrastructure	+ Maintain	- Both	+ Expand	+ Both
More investment in Environmental Justice Areas?	Current investment within EJ areas	SAME	-	+	+
Maintain, Expand and Attract NEO Businesses	Current roster of businesses and employment in Northeast Ohio	+ Maintain	+ Roads	+ Transit	+ Both
Ecologically Sensitive and Agriculturally Productive Lands	Current acreage of ecologically sensitive and agriculturally productive lands in Northeast Ohio	-	-	SAME	-
Future Population and Employment in Communities with Peak Population in 1970	Current estimate of total population and employment for all communities whose population peak occurred on or before 1970 (another option is to consider median age of single-family homes ([970 or earlier])	-	-	+	+
Cleaned Brownfields (formerly developed, polluted sites)	Current number and acreage of brownfields	-	-	+	-
Attain National Air Quality Standards	Moderate Nonattainment for Ground-Level Ozone	-	-	-	-
Greenhouse Gas Emissions	Current greenhouse gas emissions for region	+	+	+	+
Flood Threat to Major Regional Job Hubs	Current % major job hub areas within or proximal to designated floodplains or flood hazard zones	+	+	SAME	+

eNEO2050 Final Plan

NOACA staff consulted with stakeholders and the public throughout the entire development of *eNEO2050*. From the discovery phase's needs assessment, public awareness campaigns, CrowdGauge Tool, and Regional Survey to the analysis of alternative transportation scenarios and performance measures, NOACA's previous long range plan reflected public input during each phase of planning.

The final *eNEO2050* public comment period for the draft plan ran began May 3, 2021 and continued for 30 days, providing the public a last opportunity to review and comment on the recommended plan and the entire *eNEO2050* development process before finalization for NOACA Board review and approval at its June 11, 2021, meeting.

NOACA notified the public of the plan's availability for review on the *eNEO2050* website through email, social media, and news media, and throughout the stakeholder network. NOACA created both print and digital materials to disseminate throughout the region, including drop-off centers, hard-to-reach population areas, and in-person events as allowed during shifting COVID pandemic rules for social distancing.

Due to the COVID pandemic, NOACA conducted a public meeting through a webinar digital format on May 3, 2021. This information was included in the print and digital material released. Because the webinar platform was limited to 500 attendees, NOACA used a Live YouTube feed to ensure more residents could view the meeting. For those without technology resources, NOACA made a printed summary and audio available for post-meeting consumption.

NOACA shared the final, Board-approved plan with the Northeast Ohio community, including organizational leaders and local elected officials. The agency also provided the last episode of its podcast, "The NOACA Report," to summarize *eNEO2050* and the next steps for NOACA staff to implement actions and recommendations outlined in the document.

NOACA Household Travel Survey (2024)

Overview

In December 2022, NOACA released a request for proposal (RFP) seeking travel survey data to support an update to the Greater Cleveland travel demand model covering the seven counties of Cuyahoga, Lorain, Lake, Medina, Geauga, Summit, and Portage. The previous survey had been conducted in 2012 and covered five counties (Cuyahoga, Geauga, Lake, Lorain, and Medina). Compared to the last survey conducted over 10 years ago, the current survey will provide NOACA with more detailed and updated data, replace personal wearable data logger technology with smartphone-based data collection technology, and utilize more advanced communication tools for respondents. NOACA awarded this travel survey in July 2023, after a competitive bidding process, to the team led by Westat.

The survey collected socio-demographic data and a one-day (24-hour) period of weekday (Tuesday, Wednesday, and Thursday) household travel behavior. The original goal was to collect data from 9,000 households across NOACA's transportation planning region. The geographic area surveyed consisted of the entire geographic area of Cuyahoga, Lorain, Lake, Medina, and Geauga counties and portions of Portage and Summit counties.

The dataset was weighted and expanded to the American Community Survey 5-Year estimates and the results of the data match those control totals.

Summary of Key Findings

Overall survey results show a representative snapshot of regional travel behavior. First, regarding the mode share distribution, Table 4-20 shows the majority of trips were made using private vehicles, either as the driver or passenger. This includes the proportion of both unweighted and weighted trips by mode. This outcome was expected and aligns with prior household travel survey outcomes across the U.S.

Table 4-20. Overall Trips by Mode

Mode	N	Unweighted	Weighted	MOE (95%)
Walk/Bike	5,815	9.39%	9.35%	0.52%
Driver	39,645	64.03%	63.34%	0.71%
Passenger	13,003	21.00%	20.98%	0.86%
Carpool/Vanpool	511	0.83%	0.82%	0.18%
School bus	1,093	1.77%	1.98%	0.23%
Public transit	1,163	1.88%	2.21%	0.30%
Something else	690	1.11%	1.33%	0.32%
Total	**61,920**	**100%**	**100%**	**0%**

There are 158 “Not Ascertained” values for variable Mode. These missing variables are not included in the above table.

Trip rates obtained in the survey were reasonable and as expected. Table 4-21 shows the average number of trips captured at the household level by mode of survey participation (i.e., smartphone app or web/CATI). On average, households reported more trips per household through the smartphone app than those reporting through online or phone. Note that trip rate correction factors, based on smartphone app use, were not applied to the trip rate results.

Table 4-21. Overall Household Trip Rates by Retrieval Mode

Retrieval Mode	N	Unweighted	Weighted	MOE (95%)
Smartphone App	41,670	8.59	8.98	0.23
Web / CATI	20,250	6.26	6.38	0.20
Total	**61,920**	**7.66**	**7.92**	**0.13**

Similarly, Table 4-22 shows that the number of trips captured at the person level collected via the smartphone app was higher than trips reported per person via web or CATI.

Table 4-22. Overall Person Trip Rates by Retrieval Mode

Retrieval Mode	N	Unweighted	Weighted	MOE (95%)
Smartphone App	28,926	4.58	4.57	0.09
Web / CATI	32,994	2.79	2.76	0.06
Total	**61,920**	**3.42**	**3.38**	**0.05**

Households throughout the survey area showed a similar amount of interest and participation with overall response rates fairly consistent at the county level, as shown in Table 4-23.

Table 4.23. Response Rates for Recruit and Retrieval by County

County	Sample Count	Complete Recruit Count	Recruitment Rate	Complete Retrieval Count	Retrieval Rate	Response Rate
Cuyahoga	415,581	10,233	2.46%	5,141	50.24%	1.24%
Geauga	26,445	610	2.31%	295	48.36%	1.12%
Lake	68,004	1,551	2.28%	699	45.07%	1.03%
Lorain	94,082	2,085	2.22%	955	45.80%	1.02%
Medina	53,940	1,300	2.41%	643	49.46%	1.19%
Portage	5,289	139	2.63%	72	51.80%	1.36%
Summit	21,092	558	2.65%	281	50.36%	1.33%
Total	**684,433**	**16,476**	**2.41%**	**8,086**	**49.08%**	**1.18%**

Finally, the following are the key survey results:

- Overall, 684,433 randomly selected households were invited to participate in the survey. Each of these households was mailed an invitation letter.
- Of those households, 16,476 households recruited themselves into the study (2.4 percent of all invited households), and 8,086 households completed the travel reporting survey, resulting in a retrieval rate of 49.1 percent and an overall response rate of 1.2 percent.
- The survey results contain information for 8,086 households, 18,122 persons, 14,308 vehicles, 61,920 trips, and 61,673 activities representing 957,074 households, 2,242,770 persons, 1,599,598 vehicles, and 1,182,835,016 trips throughout the entire study area.
- Households reported an average of 1.87 vehicles, including 6 percent zero-vehicle households.
- Households reported or captured an average of 7.92 daily household trips and 3.38 daily person trips.
- Overall, 84 percent of all trips were made by private vehicles as drivers or passengers, 9 percent were by non-motorized modes including walking and biking, 2 percent were by public transportation, and 4 percent were by other transportation modes including school bus and carpools/vanpools.
- Overall, the average one-way trip duration was 20.68 minutes, ranging from 19.80 minutes for Lake and Lorain counties to 21.45 minutes for Geauga County.

Chapter 5: Enable the Economy

Introduction

Broadly defined, economic development refers to policy interventions that aim to improve the well-being of a community that is achieved through the creation or growth of businesses and jobs. Economic security is linked directly to quality of life for individuals and for society, which is often measured by income and tax base respectively, with income providing personal wealth and buying power and a tax base providing public services for all. The past 50 years mark a dramatic shift from the booming economic growth and expansion of Northeast Ohio prior to 1970, but there are signs that key sectors have emerged to help the region position itself for future opportunities. To do so, it is necessary to understand where the Northeast Ohio economy is currently and how it reached this point.

A regional economy needs to be inclusive, where all people and places prosper. Greater Cleveland has a growing healthcare sector as well as a manufacturing sector that remains strong, despite declines in employment. Decentralization of jobs and housing away from historical population centers, however, has created a spatial mismatch. This gap between where workers live and where employers locate is especially problematic for low-income and minority workers who lack affordable and reliable access to jobs.

This chapter describes:

- The regional economy from past to present
- Geographic, income and racial disparities
- Current conditions of key industries
- Economic development stakeholders
- Current NOACA programs, policies and projects
- Strategies and initiatives around Northeast Ohio used to address current and future economic development
- Highlights of potential threats and opportunities from climate change and pollution

This chapter also integrates how transportation influences the development of Northeast Ohio's economy, particularly through NOACA's role to inform transportation policy decisions and fund projects.

What Role Can NOACA Play?

In 2015, the NOACA Board of Directors developed a Regional Strategic Plan with a vision statement that comprises five goals (see Chapter 1). One of those goals is to "support economic development." The Board outlined several objectives to undergird this goal, largely based on NOACA scoring criteria. NOACA prioritizes projects that:

1. Provide for the movement of goods essential to the economic viability of the region;
2. Are consistent with state, regional and local economic development priorities, policies and strategies;
3. Support the retention and expansion of Cleveland-area businesses or attract new businesses to areas served by existing infrastructure;
4. Support the development of the region's manufacturing base, healthcare system, and other areas of regional economic strength and economic development focus;
5. Create realistic opportunities for job retention and economic development.

NOACA's Board also seeks to ensure it includes the expertise of business, medical, higher education and nonprofit sector representatives through the Business, Community, Emerging Leaders and Rural Advisory Councils. The primary mission of the councils is to provide input into the NOACA planning process and connect with the community. In addition to participating in the development of strategies to prioritize projects, they facilitate regional cooperation in the areas of economic development and job retention as it relates to transportation.

NOACA's primary role as a transportation planning agency positions it well to leverage opportunities through improved workforce accessibility. NOACA should continue to explore how to better connect workers to jobs through greater transportation choice. This is one of NOACA's best tools to coordinate a more cohesive regional approach toward equity.

Where Have We Been?

Pre-World War II

After a long period of Native American habitation, Europeans began to settle Northeast Ohio in the late 18th century. Lake Erie and its major tributaries provided easy access to the most viable transportation option at the time: shipping. The completion of the Ohio and Erie Canal in 1830 connected the region to the population centers of the East Coast and the Gulf of Mexico to facilitate further growth. Over the next 30 years, railroads connected the region overland to the East Coast and eventually the southern and western United States. The advent of the automobile by the turn of the 20th century brought both local and federal roads. This robust infrastructure system enabled rapid growth, primarily in manufacturing. Key industries at the time not only took advantage of these modes of transportation, but also facilitated their expansion: iron and steel, shipbuilding, automobile, electrical equipment and light, and telegraph were the predominant employers. These industries attracted workers from around the country and from overseas.[1] By 1910, Cleveland's population had grown to make the city the fifth largest in the United States.[2] Neighboring cities, such as Lorain and Elyria, also enjoyed robust growth in the shipbuilding, steel, and auto industries. Regional growth continued after World War I, predominantly from migrants who moved from Appalachia and Eastern Europe, as well as a significant number of African Americans from the South (e.g., The First Wave of the Great Migration).[3]

Post-World War II (1945-1970)

During and after World War II, the regional population continued to grow, primarily due to increased birth rates (the Baby Boom) and the Second Wave of the Great Migration, as African Americans continued to leave the South in search of relief from poverty and Jim Crow regulations. However, discriminatory practices such as redlining concentrated African American residents in specific neighborhoods limited their economic opportunities (see Chapter 6). A 2019 paper from the National Bureau of Economic Research recognizes that "recent scholarship has also highlighted the role of discriminatory government policies in supporting residential segregation by race and disadvantaging black wealth accumulation through home ownership…there is clear consensus that real estate markets and housing policy were integral in fostering the disadvantage."[4] Population and jobs began to depart the city shortly after the war, and the City of

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[1] Northeast Ohio Sustainable Communities Consortium (NEOSCC), *Vibrant NEO 2040: A Vision, Framework, and Action Products for Our Future* (Cleveland: NEOSCC, 2014), pp. 16-17, https://vibrantneo.org/vibrantneo-2040/vneo-2040-full-report/ (accessed May 29, 2025)

[2] Case Western Reserve University, *Encyclopedia of Cleveland History*, https://case.edu/ech/timeline

[3] NEOSCC, *Vibrant NEO 2040*, pp. 16-17

[4] Prottoy A. Akbar, Sijie Li, Allison Shertzer, and Randall P. Walsh, "Racial Segregation in Housing Markets and the Erosion of Black Wealth," Working Paper 25805 (Cambridge, MA: National Bureau of

Cleveland began to decline from its 1950 population peak. Initial decline and decentralization of legacy industrial cities such as Cleveland and Lorain was small at first, and the growth of suburban and exurban areas of Northeast Ohio continued to foster regional growth in the 1950s and 1960s; however, decline accelerated and expanded beyond the urban core by the 1970s and the region as a whole entered a period of population decline.

The "Rust Belt" (Post-1970)

After 1970, the region as a whole lost people and jobs, and the decline of both in Cleveland accelerated. This was partially driven by an exodus of manufacturing businesses to southern states or overseas. Additionally, technological advances over the decades meant that even if businesses remained in the region, they did not need to employ as many workers, which led many former manufacturing sector workers to leave Northeast Ohio in search of new jobs. This trend in population loss subsided briefly in the 1990s and early 2000s but resumed with the Great Recession and housing crisis in 2008.

For the past decade, the NOACA region has seen pockets of development, and even a resurgence of downtown Cleveland, but this has been a shifting of people from one community to another rather than broader growth. Furthermore, the pockets of recovery have not benefited all groups equally; minority populations suffered a disproportionate share of loss during the Great Recession (see Chapter 6). This is important because the region's arterial and highway network was built in anticipation of a far greater population than ever materialized. The envisioned public transportation system, however, has not been fully built, which disproportionately strands low-income and minority populations who struggle to access employment opportunities. The loss of population and the tax revenues they would have generated exacerbate the region's struggles with infrastructure maintenance, including funding, and raises the prospect of tax increases to compensate. Both crumbling infrastructure and higher taxes discourage economic development and sharpen inequality, so it is critical that stakeholders manage a more efficient, multimodal transportation system to support strategic economic development to benefit as many residents of the region as possible.

Where Are We Now?

This section provides an overview of the economy as measured by gross domestic product (GDP), a widely used metric for economic activity. To address some of the causes of economic inequity, the discussion turns to key economic sectors that drive Northeast Ohio's economy, so that low-income and minority residents can not only find jobs but also access them. NOACA can play a significant role in workforce mobility through the efforts of its Board and staff, so this is a topic of keen focus.

Gross Domestic Product

Greater Cleveland represents nearly 20% of Ohio's GDP. GDP is a comprehensive measure of economic activity that measures the value of all the final goods and services produced. The U.S. Bureau of Economic Analysis states that changes in GDP are the most popular indicator of the nation's overall economic health.[5] It is important to note, however, that GDP, does not capture everything. The Organization for Economic Cooperation and Development (OECD) notes that several measures of well-being are unrelated to GDP growth, including income inequality, housing

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Economic Research, May 2019), JEL No. J15, N12, R31.2; https://www.nber.org/system/files/working_papers/w25805/w25805.pdf (accessed May 29, 2025)

[5] U.S. Bureau of Economic Analysis, Gross Domestic Product, https://www.bea.gov/data/gdp/gross-domestic-product (accessed May 29, 2025)

affordability, gender wage differences, air pollution, life expectancy, household debt, and others. The OECD does note that GDP growth is significantly related to several other quality of life metrics, such as higher household incomes and employment rates.[6] For these reasons, it is important to track GDP as one of several measures for regional quality of life.

Table 5-1 shows the GDP of the NOACA counties and their rank in Ohio. In 2022, Franklin County (Columbus) surpassed Cuyahoga County as the leading economy in the state. Cuyahoga is now second (within 2.88%) followed by Hamilton County (Cincinnati), the third largest economy in Ohio, about 20% behind Cuyahoga County. Summit (Akron) and Montgomery (Dayton) round out the top five Ohio counties, with each GDP only about one-third that of Cuyahoga. Given that Summit County borders the NOACA region, this may mean there are greater opportunities for collaboration between the two counties to leverage their combined economies rather than act independently.

Table 5-1. 2022 Gross Domestic Product (GDP) by Northeast Ohio County[7]

County	2022 Real GDP (in thousands of dollars)	State Rank
Cuyahoga	$104,557,644	2
Lake	$11,720,868	11
Lorain	$11,051,315	12
Medina	$7,655,024	19
Geauga	$4,195,488	29

Source: U.S. Bureau of Economic Analysis

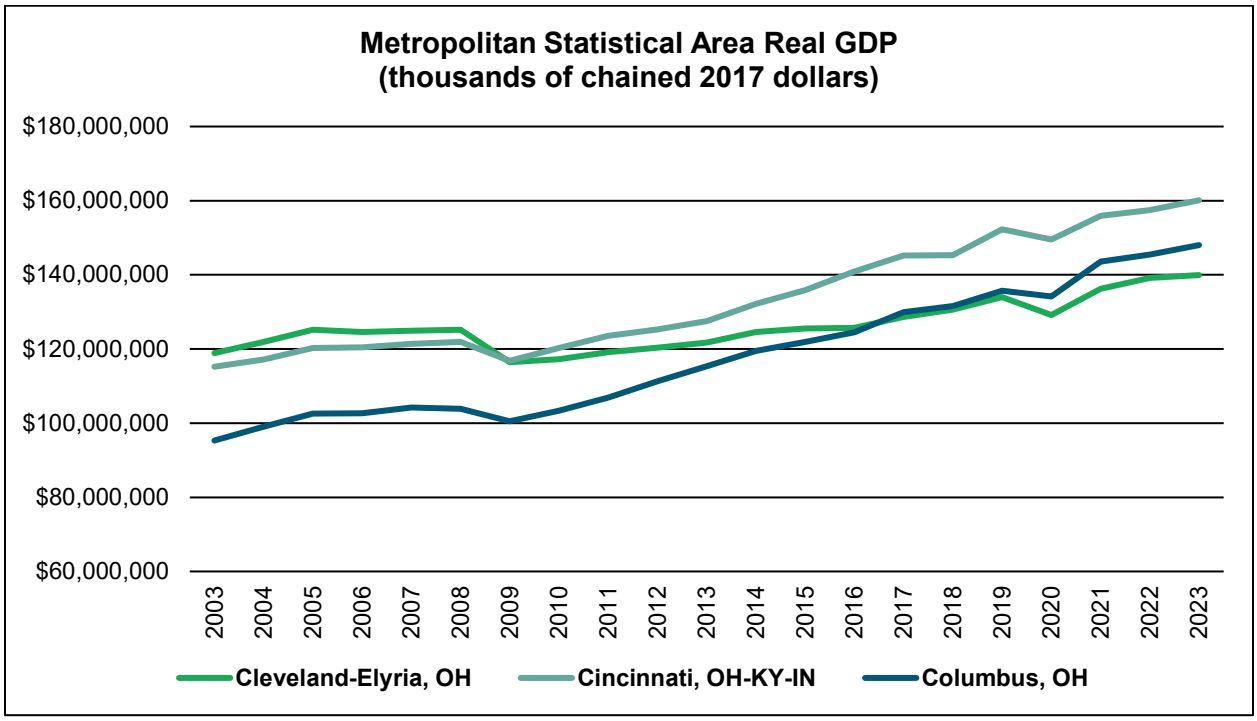
The Great Recession, combined with continued population loss, has negatively affected Greater Cleveland relative to Ohio's other two largest metropolitan areas: Cincinnati and Columbus.

Figure 5-1 shows GDP trends for all three regions over the past 20 years. The previous paragraph noted that Franklin County's GDP is larger than Hamilton County's GDP; however, the Greater Cincinnati metropolitan area has the largest economy of any metropolitan region in the State of Ohio. While the Greater Cleveland GDP remains second, it does so by only a very slim margin. Greater Columbus has nearly surpassed the Cleveland-Elyria metropolitan area due to robust growth since the end of the Great Recession in 2009.

[6] Organization for Economic Cooperation and Development (OECD), *How's Life? 2020: Measuring Well-being* (Paris: OECD Publishing, 2020), Chapter 1, 54; https://doi.org/10.1787/9870c393-en (Accessed May 29, 2025)

[7] U.S. Bureau of Economic Analysis, County and MSA gross domestic product (GDP) summary, 2022, https://apps.bea.gov/itable/index.html?appid=70&stepnum=40&Major_Area=4&State=39000&Area=XX&TableId=533&Statistic=1&Year=2022&YearBegin=-1&Year_End=-1&Unit_Of_Measure=Levels&Rank=1&Drill=1&nRange=5 (Accessed May 29, 2025)

Figure 5-1. Peer Region GDP by Year[8]



Source: U.S. Bureau of Economic Analysis

GDP alone does not tell the full story, though. It is also important to compare the population of each region, which then enables us to see the GDP per capita (see Table 5-2). Greater Cleveland fares slightly better by this metric, but Greater Cincinnati is still first, while Greater Columbus is a close third behind Greater Cleveland.

Table 5-2. 2022 Peer Region Population and GDP per Capita[9]

Metropolitan Area	2022 Population	2022 GDP per Capita
Cincinnati	2,268,393	$69,405
Cleveland-Elyria*	2,063,132	$67,441
Columbus	2,161,511	$67,292

Source: U.S. Census Bureau. The Per Capita GDP calculation is GDP divided by Population.

Furthermore, GDP's real value is really the extent to which it reflects quality of life (e.g., higher GDP corresponds to higher quality of life). This is not always the case. For example, an investment of one billion dollars to rebuild a damaged community after a tornado or a flood increases GDP within that region by that amount, but the storm itself may have cost lives, property damage, and severe hardship. For this reason, another important metric is wealth distribution throughout the population.

[8] U.S. Bureau of Economic Analysis, Gross Domestic Product Summary by County and Metropolitan Statistical Area, https://apps.bea.gov/regional/downloadzip.htm (accessed April 17, 2025)
[9] U.S. Census Bureau, 2022 American Community Survey, 1-year, Demographic and Housing Estimates, Table DP05; https://data.census.gov/table/ACSDP1Y2022.DP05?g=310XX00US17140,17460,18140&y=2022&d=ACS+1-Year+Estimates+Data+Profiles (accessed May 29, 2025)

Income and Poverty

GDP measures the size of the economy, but it does not necessarily translate into how much money individuals have to provide for themselves. What matters more to people is their ability to pay bills and meet daily needs. This subsection provides data on income, poverty, and inequality, and explains how these factors are related to other important variables (e.g., geographic location, race, gender, etc.).

Table 5-3 shows per capita income in the NOACA region compared to peers. It is the lowest of the three regions and lower than that of the United States, although higher than that of Ohio. Lower incomes typically also mean higher poverty. Table 5-4 shows that Greater Cleveland has the highest overall poverty rate and child poverty rate relative to peers, the state, and country.

Table 5-3. 2022 Peer Region Per Capita Income[10]

Geography	Per Capita Income
Cincinnati MSA	$41,698
Cleveland-Elyria MSA	$40,750
Columbus MSA	$42,395
Ohio	$37,932
United States	$41,804

Source: U.S. Census Bureau

Table 5-4. 2022 Peer Region Poverty and Under-18 Child Poverty[11][12]

Geography	Poverty Rate	Child Poverty Rate	Percent of Population Under 18
Cincinnati MSA	11.8%	13.6%	22.8%
Cleveland-Elyria MSA	13.7%	19.7%	20.5%
Columbus MSA	12.4%	16.5%	23.0%
Ohio	13.4%	17.7%	21.8%
United States	12.6%	16.3%	21.7%

Source: U.S. Census Bureau

While this data may describe a serious situation in Northeast Ohio, it is important to note that many households in the region are financially prosperous. Table 5-5 shows that more than one-quarter of area households have incomes greater than $100,000, although this rate is lower than that of peers, state, and country. Table 5-5 shows that the region has far more households at the lowest end of the income distribution as well, compared with peers, state, and country.

[10] U.S. Census Bureau. 2022 American Community Survey, 1-year, Demographic and Housing Estimates, Selected Economic Characteristics, Table DP03; https://data.census.gov/table/ACSDP1Y2022.DP03?q=per+capita+income&g=010XX00US_040XX00US39_310XX00US17140,17460,18140&y=2022 (accessed May 29, 2025)

[11] Ibid.

[12] U.S. Census Bureau, 2022 American Community Survey, 1-year, Age and Sex, Table S0101; https://data.census.gov/table/ACSST1Y2022.S1701?q=Income+and+Poverty&g=010XX00US_040XX00US39_310XX00US17140,17460,18140&y=2022 (accessed May 29, 2025)

Table 5-5. 2022 Peer Region Population by Household Income Bracket[13]

Geography	<$10,000	$10,000 to $14,999	$15,000 to $24,999	Total <$25,000	≥$100,000
Cincinnati MSA	5.6%	4.0%	5.7%	15.3%	36.5%
Cleveland- Elyria MSA	6.4%	4.8%	7.8%	19.0%	32.3%
Columbus MSA	4.8%	3.5%	5.8%	14.1%	37.6%
Ohio	5.9%	4.4%	7.5%	17.8%	31.1%
United States	5.5%	3.7%	6.8%	16.0%	37.1%

Source: U.S. Census Bureau

Table 5-5 suggests that Northeast Ohio has substantial income inequality (51.3% of its households make less than $25,000 or at least $100,000). This statistic trails the State of Ohio (nearly 49%); however, its peers (Columbus, 51.7%, and Cincinnati, 51.8%) and the United States (53.1%) are slightly higher. One way to measure income inequality is the Average to Median Income Ratio (see Table 5-6), which compares the average income to the median income. A higher ratio of average income to median income indicates skewness in the income distribution (i.e., a relatively smaller number of very wealthy households skew the results for the whole region). Table 5-6 shows that Cleveland's number is higher than its peers, the state, and the United States.

Table 5-6. 2022 Peer Region Average to Median Income Ratio[14]

Geography	Ratio
Cincinnati MSA	1.362
Cleveland-Elyria MSA	1.423
Columbus MSA	1.377
Ohio	1.287
United States	1.412

Source: NOACA Calculation of U.S. Census Bureau

Evidence of income inequality in Northeast Ohio receives further support by an analysis in Table 5-7 conducted by the Economic Policy Institute (EPI), a Washington, D.C.-based think tank. In 2018, researchers used individual tax returns (2015) from the IRS to determine the average individual income of the wealthiest 1% of each area's (region, state, country, etc.) residents and the average individual income of the remaining residents.[15] A higher ratio indicates greater inequality. Once again, Greater Cleveland's ratio is higher than those of its peers and the State of Ohio, but not as high as the United States ratio (also worth noting that the average individual income of Cleveland's wealthiest 1% is higher than that of its peers and the State of Ohio).

[13] U.S. Census Bureau, 2022 American Community Survey, 1-year, Income in the Past 12 Months (in 2019 Inflation-Adjusted Dollars), Table S1901; https://data.census.gov/table?q=population+by+income&g=010XX00US_040XX00US39_310XX00US17140,17460,18140&y=2022 (accessed May 29, 2025)

[14] Ibid.

[15] Estelle Sommeiller and Mark Price, "The New Gilded Age: Income Inequality in the U.S. by State, Metropolitan Area, and County" (Washington, DC: Economic Policy Institute, 2018); https://www.epi.org/publication/the-new-gilded-age-income-inequality-in-the-u-s-by-state-metropolitan-area-and-county/ (accessed May 29, 2025)

Table 5-7. 2015 Peer Region Individual Income of Highest Earners

Geography	Average Income of Top 1%	Average Income of Remaining 99%	Ratio
Cincinnati MSA	$1,028,180	$55,087	18.7
Cleveland-Elyria MSA	$1,038,532	$48,257	21.5
Columbus MSA	$989,323	$54,097	18.3
Ohio	$858,965	$46,157	18.6
United States	$1,316,985	$56,107	26.3

Source: Economic Policy Institute analysis of IRS data

While these two independent analyses corroborate each other, a third supporting study comes from Bloomberg. Its analysis of 2018 Census data found Cleveland was the fifth most unequal city in the country when the income of the top 5% of earners was compared to the bottom 50% of earners, among cities with at least 250,000 people.[16] Each of these three studies suggests that income inequality is sharper in Greater Cleveland than in peer metros such as Columbus and Cincinnati. This inequality can be seen within the NOACA region as well (Table 5-8) through disparate average household incomes and poverty rates by county.

Table 5-8. 2023 Household Income and Poverty by County[17]

County	Median Household Income	Poverty Rate
Cuyahoga	$62,823	16.0%
Geauga	$100,783	6.3%
Lake	$77,952	10.1%
Lorain	$70,693	11.0%
Medina	$92,660	7.6%

Source: U.S. Census Bureau

Table 5-8 indicates Cuyahoga County has the highest poverty rate in the NOACA region, but the situation in the City of Cleveland is worse. Census estimates show that Cleveland became the poorest large city in the nation in 2019. The nonprofit Center for Community Solutions notes that, additionally, Cleveland's senior citizens had the second-highest poverty rate and its children the highest poverty rate among large cities in the United States.[18] Cleveland is the largest city in the region and the anchor of the regional economy. Improved economic conditions in the City of Cleveland could have a tremendous positive effect on all of Northeast Ohio.

The nonpartisan Center on Budget and Policy Priorities uses data from the Census Bureau, IRS, Federal Reserve, and Congressional Budget Office to determine national income and wealth inequality. All these different sources and methodologies indicate national inequality continues to increase over time as well.[19] As with GDP, income inequality is just one metric among many. The

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[16] "Cleveland Moves to the No. 5 Spot in Bloomberg's City Inequality Ranking," *Crain's Cleveland Business*, Nov. 21, 2019; https://www.crainscleveland.com/economic-outlook/cleveland-moves-no-5-spot-bloombergs-city-inequality-ranking (accessed May 29, 2025)

[17] U.S. Census Bureau, Median households income (in 2023 dollars), 2019-2023; Persons in poverty, percent https://www.census.gov/quickfacts (accessed May 29, 2025)

[18] Emily Campbell, "Cleveland Is Now the Poorest Big City in the Country," Center for Community Solutions, Sept. 21, 2020; https://www.communitysolutions.com/cleveland-now-poorest-big-city-country/ (accessed May 29, 2025)

[19] Chad Stone, Danilo Trisi, Arloc Sherman, and Jennifer Beltran, "A Guide to Statistics on Historical Trends in Income Inequality," Washington, D.C.: Center on Budget and Policy Priorities, 2020); https://www.cbpp.org/research/poverty-and-inequality/a-guide-to-statistics-on-historical-trends-in-income-inequality (accessed May 29, 2025)

upshot for NOACA is that there is the potential to boost economic development through increased access to opportunity that may lift low-income residents out of poverty.

Racial Inequality

Table 5-9 shows the poverty levels of black, and Hispanic/Latino residents in the region are each more than two times higher than the poverty level for Non-Hispanic/Latino white residents.

Table 5-9. 2023 Regional Poverty Rate by Race/Ethnicity[20][21]

Race/Ethnicity	MSA Poverty Rate
White, Not Hispanic/Latino	8.9%
Asian	14.2%
Black/African American	27.3%
Hispanic/Latino	20.7%

Source: U.S. Census Bureau, American Community Survey (ACS) 2023

Most minority residents in the region live in Cuyahoga County. Table 5-10 shows that Cuyahoga County has the most minorities both in absolute terms and as a percentage of the population.

This is partly a result of past housing and transportation policies. In particular, the robust investment in building the highway system, combined with the lack of similar investment in expanding public transit, which is disproportionately used by low income and minority populations, contributed to this outcome. In recent decades, NOACA has made and continues to make transportation investments to achieve a more equitable transportation system relative to access and mobility.

Table 5-10. 2023 Race/Ethnicity by County[22]

County	Total Population	White		Non-White[23]		Asian	Black/ African American	American Indian	Hispanic/ Latino*
		#	%	#	%				
Cuyahoga	1,249,418	733,835	58.7%	515,583	41.3%	40,588	362,015	2,632	84,864
Geauga	95,479	89,461	93.7%	6,018	6.3%	502	898	36	1,775
Lake	232,101	201,733	86.9%	30,368	13.1%	3,314	11,339	302	11,833
Lorain	314,588	250,254	79.5%	64,334	20.5%	4,148	23,588	654	33,992
Medina	183,049	169,696	92.7%	13,353	7.3%	1,803	2,368	167	4,803

Source: U.S. Census Bureau, American Community Survey (ACS) 2023
*Hispanic or Latino people may identify as any race.

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[20] U.S. Census Bureau, 2023 American Community Survey, 1-year, Poverty Status in the Past 12 Months for the Cleveland Metropolitan Statistical Area (MSA), Table S1701; https://data.census.gov/table/ACSST1Y2023.S1701?q=poverty&g=310XX00US17410 (accessed May 29, 2025)

[21] Poverty data for Native Americans in the Cleveland MSA (which was included in eNEO2050) was not available in the 2023 dataset.

[22] U.S. Census Bureau, 2023 American Community Survey, 5-year, Demographic and Housing Estimates, Table B03002; https://data.census.gov/table/ACSDT5Y2023.B03002?q=Race+and+Ethnicity&g=050XX00US39035,39055,39085,39093,39103 (accessed May 29, 2025)

[23] In order to get to 100% of the total population, Non-White means regardless of Hispanic ethnicity. Hispanic/Latino ethnicity is still included at the end of the table with the asterisk.

For the past few years, the idea of a "spatial mismatch" or "disconnect" between jobs and workers has moved to the forefront of economic development discussions. Put simply, this means businesses and workers are located far apart. The term, "spatial mismatch," was originally coined in 1968 and referred specifically to housing segregation that reduced job opportunities and increased unemployment for black people. Recent research published by the National Bureau of Economic Research combines the spatial mismatch theory with racial disparities in employer hiring practices. The authors show that black job seekers have fewer job openings available near them, and that discrimination in hiring becomes greater for black people as the community where the job is located becomes less black.[24]

Chapter 3 introduced this concept of "spatial mismatch" as it manifests itself in Northeast Ohio through workforce mobility and access. As a transportation planning agency, NOACA has been engaged in efforts to better connect people and jobs, particularly for poor and minority residents. Chapter 9 describes four possible future scenarios for transportation infrastructure investment, including performance measures and targets to illustrate how different priorities for transportation infrastructure investment in each scenario will impact low-income and minority populations differently. Improved regional mobility, particularly within and between job hubs and communities traditionally underserved by existing transportation systems, such as low-income and minority households who may face challenges accessing employment,[25] is one way NOACA can help achieve equality in Northeast Ohio.

Access to Job Hubs

Areas traditionally underserved by existing transportation systems, such as low-income and minority households, who may face challenges accessing employment are target areas to improve accessibility to jobs. Although such populations are not all low-income or all minority (or both), they are areas characterized by substantial low-income and minority representation and a high concentration of zero-vehicle households. Their accessibility to major regional job hubs is critical for the future economic success of Northeast Ohio.

Table 5-11 illustrates the minimum, maximum, and average commute times of the current work trips during the morning peak period of a typical day from workers' homes to the major regional job hubs by auto and transit.

Table 5-11. Regional Statistical Values of Morning Work Commute Times by Auto and Transit

Auto & Transit Work Commute Times During 2024 AM Peak Period		Origin					
		Region					
		Morning Work Commute Time by Transit (Minutes)			Morning Work Commute Time by Auto (Minutes)		
Destination	Major Job Hub	Min	Average	Max	Min	Average	Max

[24] Amanda Y. Agan and Sonja B. Starr, "Employer Neighborhoods and Racial Discrimination," Working Paper 28153 (Cambridge, MA: National Bureau of Economic Research, 2020), JEL No. J23, J71, R23; https://www.nber.org/system/files/working_papers/w28153/w28153.pdf (accessed May 29, 2025)
[25] 23 CFR 450.316(1)(vii)

	Cleveland Downtown	16	73	245	3.3	31	87
	University Circle	16	68	264	2.7	37	93
	Solon	28	107	315	3.4	36	79
	Chagrin Highlands	28	86	288	3.0	32	76
	Independence	41	99	301	2.0	29	77
	Hopkins Airport Area	38	98	309	4.0	31	85

NOACA's Regional Survey revealed a lower level of vehicle ownership among respondents (total number of respondents referenced as "base") from Environmental Justice Areas (Table 5-12). When broken down by income/race groups, the contrast becomes even more striking (Table 5-13). The fact that lower-income/nonwhite respondents report an average of one vehicle per household compared with an average of two vehicles per household reported by higher-income/white households illustrates the lack of access to private vehicles by lower-income, minority populations.

Table 5-12. Average Number of Vehicles per Household: Environmental Justice Area

	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,448**	**1,169**	**1,239**
Vehicles	1.67	1.45	1.88
Bicycles	1.11	0.97	1.24
Hybrid vehicles	0.09	0.09	0.08
Electric vehicles	0.07	0.10	0.07

Table 5-13. Average Number of Vehicles per Household: Income/Race Group

	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,448**	**1,218**	**531**	**218**	**233**
Vehicles	1.67	1.94	1.39	1.52	1.03
Bicycles	1.11	1.25	0.91	1.03	0.85
Hybrid vehicles	0.10	0.07	0.06	0.14	0.18
Electric vehicles	0.08	0.06	0.03	0.12	0.15

The lack of access to private vehicles by lower-income/nonwhite households becomes even clearer when you consider that these respondents reported higher household sizes than higher-income/white households (Table 5.14). Given an average of 1.03 vehicles per average household size of 2.93, the per-capital vehicle ownership among lower-income/nonwhite respondents is only 0.35 (0.49 for lower-income/white respondents). Compare this to the per-capita vehicle ownership among higher-income/white respondents (0.83). This means that the per-capita vehicle ownership rate for higher-income/white respondents is nearly 2.5 times the rate for lower-income/nonwhite respondents.

Table 5-14. Average Household Size: Income/Race Group

	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,244**	**1,217**	**536**	**220**	**237**
# of people in household	2.50	2.35	2.85	2.10	2.93
# under 18 years of age	0.54	0.39	0.71	0.49	0.93

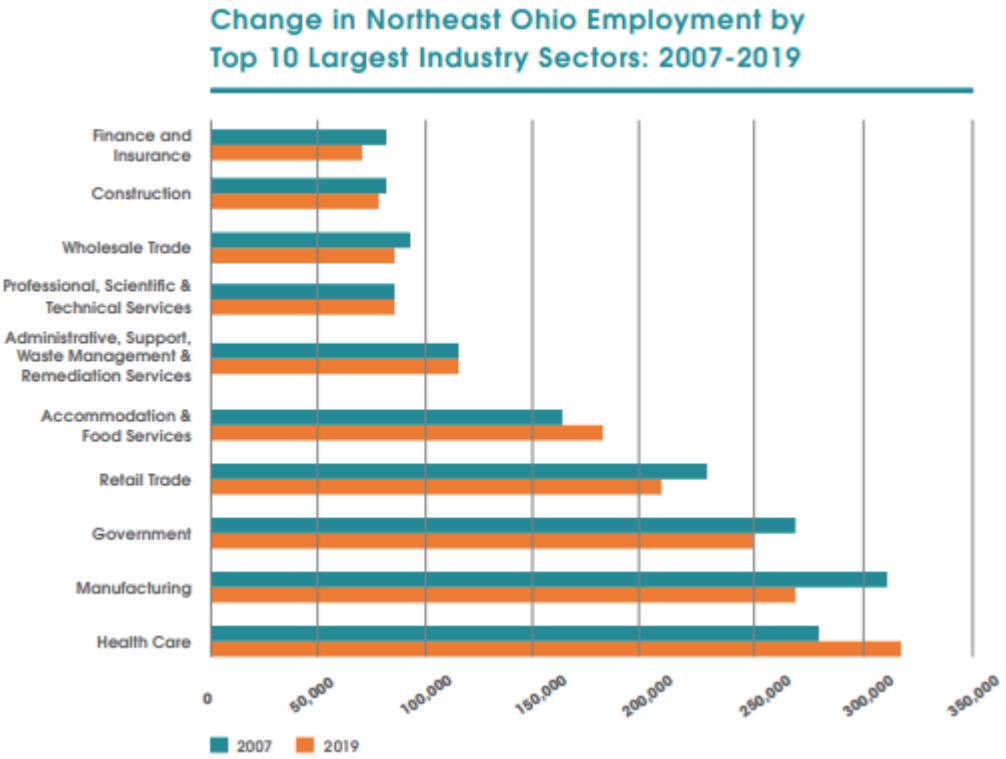
The lower access to private vehicles among lower-income/nonwhite households emphasizes the importance of the non-single occupant vehicle commute for the areas defined by substantial low-income or minority populations. A look back at Table 5.11 illustrates the dramatic difference in auto versus transit commute times from Environmental Justice Areas to Northeast Ohio's major regional job hubs, especially job hubs located outside the City of Cleveland. Individuals that lack access to private vehicles must rely on transit and daily commute times that average three hours are simply untenable to lift up low-income, minority households and boost the regional economy. In this respect, NOACA's goal to "build a sustainable, multimodal transportation system" directly links to NOACA's goal to "support economic development." Chapter 9 illustrates various scenarios for future transportation infrastructure investment and outline performance measures and targets. This data will help the agency identify investments that may close the commute gap and boost access to employment opportunities for populations struggling the most from income and racial inequality.

Key Industries

Northeast Ohio economic development has historically meant manufacturing. For decades, this sector employed more area residents than any other sector, particularly until the Great Recession (2007-2009). As shown in Figure 5-2, it remains the second largest employer today, trailing the rapidly growing healthcare sector.[26]

[26] Team NEO, "NEO since the Great Recession," (Cleveland, OH: TeamNEO, 2019); https://northeastohioregion.com/wp-content/uploads/2022/03/northeast-ohio-since-great-recession-2019-qer.pdf Figure 5-3 includes the entire 16-county Team NEO region, while Table 5- 13 shows the five NOACA counties follow the same relative pattern of jobs by employment sector (accessed May 29, 2025)

Figure 5-2. Change in Employment by Industry, 2007-2019[27]



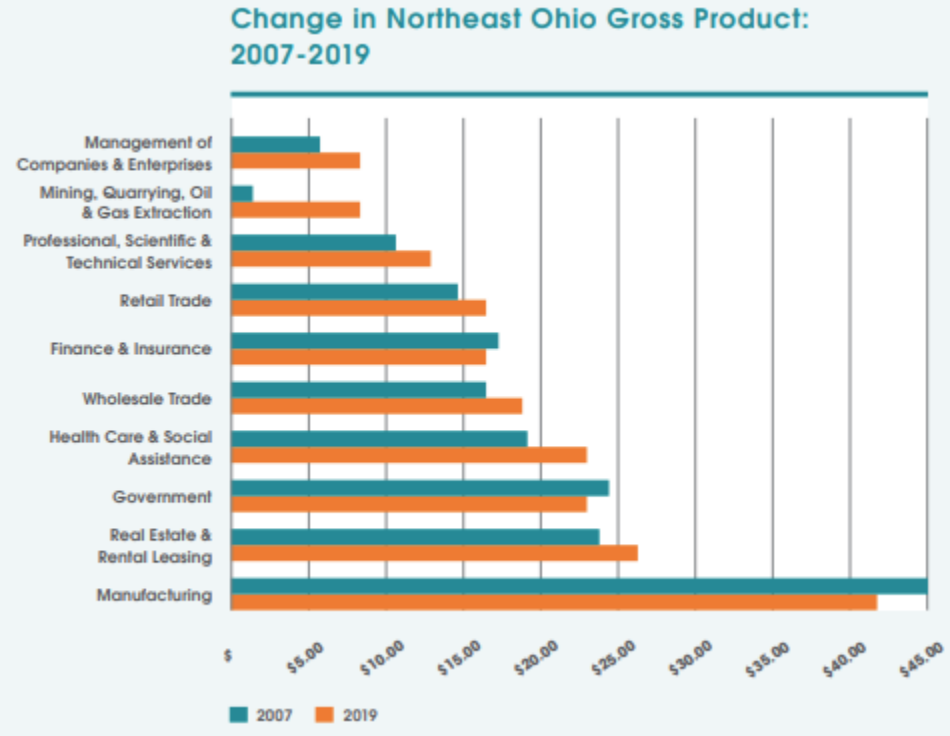
Source: Team NEO

Current employment still remains below pre-recession levels. This is increasingly true in manufacturing, where advancements in automation and robotics mean fewer people are needed to do the same amount of work. Workforce development (i.e., provide skills to area residents so they can find and maintain well-paying jobs) will play a greater role in economic development to increase employment. This section explores some of the industries that may offer such jobs.

While not meant to be exhaustive, this section describes a few key industries and how economic developers can facilitate their growth to have regional benefits. For transportation analysis purposes introduced in Chapter 3 and explored more deeply in Chapter 9, jobs fall into three categories: basic, retail, and service. Put simply, basic jobs produce goods, retail jobs sell goods, and service jobs support basic and retail jobs. From a transportation standpoint, this categorization allows for the modeling of traffic patterns, particularly within and between the regional job hubs and undeserved areas. NOACA knows locations of the regional job hubs (Chapter 3) and the types of jobs in them and knows the locations of underserved (Chapter 1) and the jobs those residents hold. From an economic development standpoint, however, it is critical to examine subsectors of these very broad categories to facilitate economic development and job growth. Figure 5-3 shows the top sectors by GDP and how they have changed since the Great Recession.

[27] Ibid.

Figure 5-3. Change in GDP by Industry (in billions of dollars), 2007-2019[28]



Source: Team NEO

This section illustrates representative examples from each category: two in basic, one in service, and one that cuts across service and retail. The selected industries demonstrate significant employment levels, contribution to gross domestic product, ability to grow, and importance for regional economic resilience. Despite the diversity of Northeast Ohio, from dense urban centers to small rural villages, the economies of each of the five counties share many similarities (see Tables 5-15 through 5-17).

In terms of sales or revenue, Table 5-15 shows the top five categories in each county fall within one of the following: manufacturing; wholesale trade, retail trade, professional scientific and technical services, administrative and support and waste management, and healthcare and social assistance. Interestingly, manufacturing leads every county except Cuyahoga, where healthcare is the top industry. As previously discussed, Cuyahoga County, which includes Cleveland, was originally established as an international manufacturing hub. The fact that manufacturing is no longer the largest sector (it now ranks third) shows both the rapid growth of the healthcare industry in Cuyahoga County as well as the relocation of manufacturing jobs to the "sunshine" states and overseas.

Table 5-15. 2022 Sales or Revenue by Industry in NOACA Counties ($1000s)[29]

Industry	Cuyahoga	Geauga	Lake	Lorain	Medina
Utilities	1,104,356	24,239	588,169	N/A	N/A

[28] Ibid.
[29] U.S. Census Bureau, Economic Census, All Sectors: Summary Statistics for the U.S., States, and Selected Geographies, 2022, Table EC2200BASIC; https://data.census.gov/table/ECNBASIC2022.EC2200BASIC?q=EC2200BASIC:+All+Sectors:+Summary+Statistics+for+the+U.S.,+States,+and+Selected+Geographies: (accessed May 29, 2025)

Manufacturing	26,605,408	4,104,856	7,225,536	7,541,544	3,757,530
Wholesale Trade	27,719,322	762,112	1,553,131	3,247,707	3,260,444
Retail Trade	23,832,596	1,846,918	4,773,957	5,716,525	4,354,854
Transportation & Warehousing	6,461,556	199,061	302,963	299,370	482,944
Information	6,473,949	39,798	201,909	191,553	138,355
Finance & Insurance	38,471,530	169,942	384,461	453,142	2,371,488
Real Estate & Rental & Leasing	4,591,359	56,373	261,433	169,031	146,363
Professional, Scientific, & Technical Services	11,601,080	317,546	662,334	414,883	408,420
Administrative & Support & Waste Mgmt.	5,907,694	299,916	728,397	942,695	589,413
Educational Services	243,761	20,139	36,259	28,651	22,105
Healthcare & Social Assistance	21,306,107	587,106	1,356,973	1,955,531	694,448
Arts, Entertainment, & Recreation	2,681,298	34,783	86,343	88,123	59,075
Accommodation & Food Services	4,048,217	156,263	577,084	584,801	359,890
Other Services (except Public Admin)	2,729,139	133,717	372,875	291,807	218,321
Agriculture*	9,261	38,896	97,729	170,982	92,790
Construction**	9,880,533	N/A	553,810	N/A	1,500,722

Source: U.S. Census Bureau
*Agriculture is the Market Value of Goods Sold from the U.S. Department of Agriculture[30]
**Source: U.S. Census Bureau[31]

Table 5-16 shows manufacturing and healthcare are also two of the largest industries by payroll.

Table 5-16. 2022 Payroll by Industry in NOACA Counties ($1000s)[32]

Industry	Cuyahoga	Geauga	Lake	Lorain	Medina
Utilities	175,074	4,758	85,205	32,241	13,350
Manufacturing	4,389,318	452,253	1,316,109	940,853	575,628
Wholesale Trade	2,173,987	71,881	182,305	209,251	185,427
Retail Trade	2,776,116	159,356	404,417	447,714	336,551

[30] U.S. Department of Agriculture, Natural Agricultural Statistical Service, 2022 Census of Agriculture; https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Ohio/ (accessed May 29, 2025)
[31] U.S. Census Bureau, Annual Economic Surveys, Annual Business Survey: Statistics for Employer Firms by Industry, Sex, Ethnicity, Race, and Veteran Status for the U.S., States, and Selected Geographies, 2022, Table AB2200CSA01; https://data.census.gov/table?q=AB2200CSA01&g=050XX00US39035,39055,39085,39093,39103 (accessed May 29, 2025)
[32] U.S. Census Bureau, Economic Census, All Sectors: Summary Statistics for the U.S., States, and Selected Geographies, 2022, Table EC2200BASIC; https://data.census.gov/table?q=EC2200BASIC:+All+Sectors:+Summary+Statistics+for+the+U.S.,+States,+and+Selected+Geographies:+2022&g=050XX00US39035,39055,39085,39093,39103 (accessed May 29, 2025)

Transportation & Warehousing	1,320,492	53,887	81,342	89,254	116,660
Information	1,731,655	10,648	30,712	31,787	21,359
Finance & Insurance	4,971,879	50,585	90,125	109,238	300,308
Real Estate & Rental & Leasing	831,132	12,110	40,518	32,253	25,989
Professional, Scientific, & Technical Services	N/A	88,793	N/A	N/A	169,310
Administrative & Support & Waste Mgmt.	2,564,337	100,128	553,954	311,670	335,990
Educational Services	82,007	6,345	7,782	10,647	7,893
Healthcare & Social Assistance	8,927,811	219,767	512,183	770,115	293,600
Arts, Entertainment, & Recreation	1,128,253	11,842	26,873	28,080	16,802
Accommodation & Food Services	1,187,934	47,290	165,502	165,465	105,044
Other Services (except Public Admin)	713,416	44,339	108,167	81,404	67,381
Construction*	1,948,945	140,874	259,419	227,681	261,386

Source: U.S. Census Bureau. Agriculture data not available.
*Source: U.S. Census Bureau.[33]

Large payrolls are partly driven by large numbers of employees. Table 5-17 shows all five counties exhibit similar dominance by manufacturing and heath care by numbers of employees.[34]

Table 5-17. 2022 Number of Employees by Industry in NOACA Counties[35]

Industry	Cuyahoga	Geauga	Lake	Lorain	Medina
Utilities	1,646	52	883	327	118
Manufacturing	63,374	7,794	20,545	15,846	9,411
Wholesale Trade	28,602	959	2,468	2,648	2,696
Retail Trade	80,239	4,509	11,954	13,948	9,601
Transportation & Warehousing	22,959	766	1,574	1,771	2,070
Information	26,200	197	606	704	427
Finance & Insurance	47,488	672	1,244	1,710	3,416
Real Estate & Rental & Leasing	13,380	274	824	789	556
Professional, Scientific, & Technical Services	48,963	1,346	3,875	4,038	2,640

[33] U.S. Census Bureau, Annual Economic Surveys, All Sectors: County Business Patterns by Legal Form of Organization and Employment Class Size for U.S., States, and Selected Geographies, 2022, Table CB2200CBP; https://data.census.gov/table?q=CB2200CBP&g=050XX00US39093,39085,39035,39055,39103 (accessed May 29, 2025)
[34] This is complicated somewhat by the fact that farm data comes from different sources and many farm owners have other off-farm jobs. If all farmland owners and all farmworkers are combined in a single category, this would become the fifth largest industry by employment in Geauga County
[35] U.S. Census Bureau, Annual Economic Surveys, All Sectors: County Business Patterns by Legal Form of Organization and Employment Class Size for U.S., States, and Selected Geographies, 2022, Table CB2200CBP.

Administrative & Support & Waste Mgmt.	53,213	2,163	8,374	7,170	7,086
Educational Services	2,852	200	376	398	338
Healthcare & Social Assistance	136,856	4,231	10,454	15,041	6,518
Arts, Entertainment, & Recreation	12,484	525	1,138	1,202	872
Accommodation & Food Services	56,407	2,565	9,039	9,266	6,178
Other Services (except Public Admin)	17,144	1,262	2,808	2,493	1,905
Public Administration*	22,388	1,246	5,180	8,928	3,714
Construction †	24,191	2,066	3,650	3,892	3,611
Agriculture; Forestry; Fishing & Hunting; Mining*	1,762	268	559	756	947
Farm Producers (primary owner of land)‡	187	2,067	416	1,588	1,806

Source: U.S. Census Bureau
*Source: U.S. Census Bureau, but based on where the employee lives; all other rows are based on place of employment.[36]
† Source: U.S. Census Bureau[37]
‡Source: U.S. Department of Agriculture.[38] Many of these producers may have a different primary occupation that falls into another row here as well.

Healthcare

The largest employment sector in Northeast Ohio is the healthcare industry. World-renowned institutions include the Cleveland Clinic, Metrohealth, and University Hospitals (UH), as well as research institutions such as Case Western Reserve University (CWRU) and Cleveland State University. With the Clinic, UH, and CWRU all in close proximity, University Circle has become a major regional job hub and economic engine for Northeast Ohio and the entire state. NOACA identified job hubs such as University Circle to prioritize transportation and infrastructure spending to better connect the regional workforce, particularly low-income and minority populations, to these hubs.

Northeast Ohio has seen multiple businesses launch to commercialize academic research and take advantage of the huge talent pool provided by its healthcare institutions. Data from the U.S. Patent and Trademark Office shows that healthcare was the most innovative sector in the region between 2013 and 2018, and likely still is today. CWRU is the top patent generator in the region, and the Cleveland Clinic ranks second.[39] This is important because research from CSU

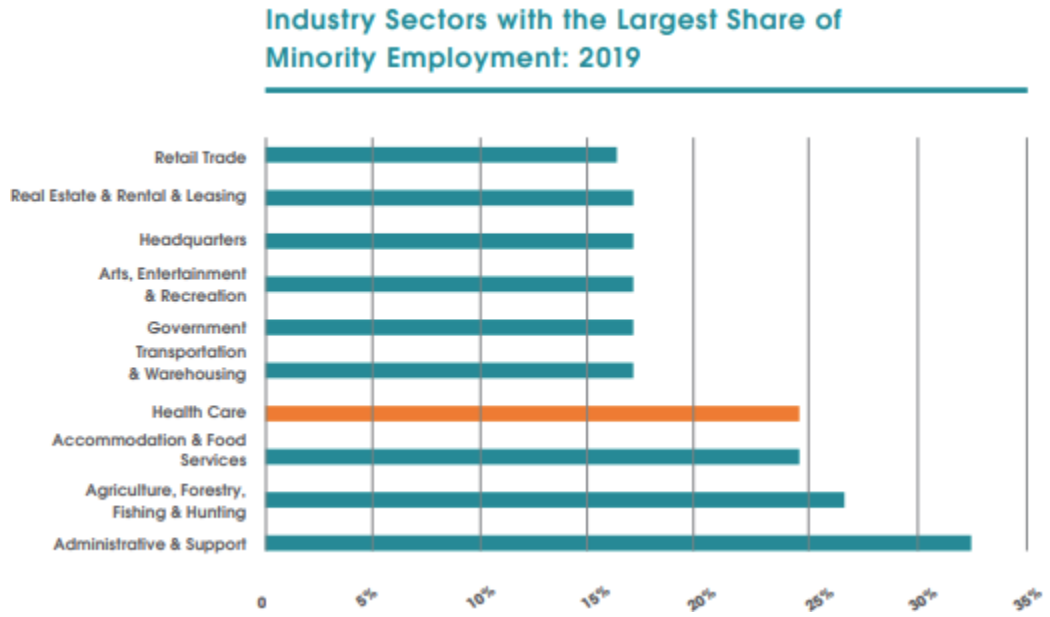
[36] U.S. Census Bureau, 2023 American Community Survey, 1-year, Industry by Occupation for the Civilian Population 16 Years and Over, Table S2405; https://data.census.gov/table?q=S2405:+INDUSTRY+BY+OCCUPATION+FOR+THE+CIVILIAN+EMPLOYED+POPULATION+16+YEARS+AND+OVER&g=050XX00US39035,39055,39085,39093,39103 (accessed May 29, 2025)
[37] U.S. Census Bureau, Annual Economic Surveys, All Sectors: County Business Patterns by Legal Form of Organization and Employment Class Size for U.S., States, and Selected Geographies, 2022, Table CB2200CBP; https://data.census.gov/table?q=CB2200CBP&g=050XX00US39093,39085,39035,39055,39103 (accessed May 29, 2025)
[38] U.S. Department of Agriculture, Natural Agricultural Statistical Service, 2022 Census of Agriculture; https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Ohio/ (accessed May 29, 2025)
[39] CBRE, "Cleveland Viewpoint February 2019, The New Industrial Revolution" https://f.tlcollect.com/fr2/719/20937/Cleveland_ViewPoint_-_The_New_Industrial_Revolution_-

shows innovation and talent are important factors for metropolitan area growth.[40]

Healthcare matters not just for the jobs it provides, but also its function. The national population continues to increase and age, so demand for quality healthcare continues to rise. Nationally recognized healthcare institutions can help attract and retain residents. Furthermore, healthcare organizations cannot easily automate or outsource many jobs, even though numerous doctor's appointments have gone virtual due to the coronavirus. Healthcare providers still rely on human interaction for tests and treatments.

Healthcare jobs also require a broad array of tasks, skills, and supportive training and education. In addition to doctors and nurses with advanced degrees, the healthcare sector provides numerous opportunities for workers without formal degrees. Many of these positions may be a point of entry into the healthcare sector by low-income and underrepresented minority populations. Figure 5-4 shows nearly 25% of healthcare workers come from minority groups.[41]

Figure 5-4. Minority Employment by Industry[42]



Source: Team NEO

For the reasons stated above, regional economic development stakeholders should continue to facilitate growth in the healthcare sector. Stakeholders could support growth through

_February_2019.pdf (accessed May 29, 2025)

[40] Iryna Lendel, Merissa Piazza, Molly Schnoke, Jinhee Yun, Nora Walsh, "Moving Cleveland Above the Trend: Benchmarking Regional Performance (Report)" (Cleveland: Cleveland State University, Sept. 25, 2020), *Urban Publications. 0 1 2 3 1677.* 4*;* https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?article=2670&context=urban_facpub. (accessed May 29, 2025)

[41] Team NEO, "NEO Since the Great Recession." Because the figure comes from Team NEO, it shows all 16 counties of the region Team NEO covers; however, healthcare is the largest employment sector in Cuyahoga County (Table 5-17), Cuyahoga is the largest county in the region, Cuyahoga has a large minority (nonwhite) population (Table 5-10), and the NOACA region is the largest metro area within Team NEO's coverage. These factors combined mean Figure 5-17 may understate minority employment in healthcare in the five NOACA counties.

[42] Ibid.

transportation, particularly robust multimodal workforce mobility. This is important for all job hubs, but especially for hubs such as University Circle and Chagrin Highlands where healthcare sector jobs make up a substantial portion of total jobs (see Table 5-18)

Table 5-18. Percentage of Healthcare Sector Jobs in Six Major Regional Job Hubs for Northeast Ohio

Job Hub	Healthcare
Airport	1.5%
Chagrin Highlands	18.4%
Downtown	11.1%
Independence	8.3%
Solon	2.9%
University Circle	78.0%

Source: NOACA Travel Forecasting Model, 2024

Access to hubs with significant healthcare jobs, especially by transit and paratransit, is important not just for workers, but also low-income, minority, and disabled individuals who need access to medical appointments and other services. Chapter 4 showcased results from the Crowd Gauge Tool, where respondents chose "I can easily get to fresh food and healthcare" as the third-highest priority out of 15 options. Table 5-19 contains NOACA Regional Survey results, which show nearly one-third of lower-income, nonwhite respondents do not agree that their community provides access to hospitals and healthcare (double the same response across the entire region). As an example of how to remedy this, the Greater Cleveland Regional Transit Authority (GCRTA) announced in January 2021 that it will provide free transit passes to new and expecting mothers in three Cleveland-area zip codes.[43] GCRTA also announced in March 2021 that it will provide free transit service to those who need to reach the Cleveland State University Wolstein Center COVID-19 mass vaccination site and other vaccination sites throughout Cuyahoga County. GCRTA will use a $773,000 grant from the Ohio Department of Transportation to partner with Cuyahoga County and the City of Cleveland to distribute free, all- day passes through hundreds of social service agencies and community centers. The Wolstein Center is strategically adjacent to the Stephanie Tubbs Jones Transportation Center, a major bus hub on the east side of downtown Cleveland served by GCRTA.[44]

Table 5-19. NOACA Regional Survey Results on Access to Healthcare

	My community provides me with access to hospitals and healthcare				
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,463**	**1,217**	**537**	**220**	**239**

[43] Courtney Astolfi, "New, Expectant Mothers to Get Free RTA Passes under Program Aimed at Reducing Infant Mortality," *cleveland.com*, Jan. 19, 2021; https://www.cleveland.com/news/2021/01/new-expectant-mothers-to-get-free-rta-passes-under-program-aimed-at-reducing-infant-mortality.html (accessed May 29, 2025)

[44] Kim Palmer, "RTA will provide free rides to COVID-19 vaccination sites," *Crain's Cleveland Business*, March 15, 2021; https://www.crainscleveland.com/government/rta-will-provide-free-rides-covid-19-vaccination-sites (accessed May 29, 2025)

Strongly Agree (5)	54.41%	60.97%	51.40%	49.55%	37.66%
Somewhat Agree (4)	29.68%	27.86%	31.28%	31.82%	30.54%
Neutral (3)	10.80%	7.72%	11.73%	12.27%	22.18%
Somewhat Disagree (2)	3.86%	2.96%	4.28%	4.09%	6.28%
Strongly Disagree (1)	1.26%	0.49%	1.30%	2.27%	3.35%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	**4.32**	**4.46**	**4.27**	**4.22**	**3.93**

Manufacturing

As mentioned earlier, Northeast Ohio has historically been a manufacturing powerhouse. Proximity to Lake Erie provided an abundance of fresh water, which is often needed for manufacturing processes. It also allowed for inexpensive and easy shipping of goods through the Great Lakes, particularly before the interstate highway system. Even with declines over time, manufacturing is still the second-largest employment sector in the region and by far the greatest contributor to regional gross domestic product, as seen earlier in Figure 5-3.[45]

Although manufacturing no longer employs as many workers, Table 5-20 shows the manufacturing sector still thrives in Northeast Ohio. This is particularly important for high-school graduates without college degrees, because the Ohio Department of Jobs and Family Services notes that many manufacturing jobs are available to this segment of the population.[46]

Table 5-20. 2023 Manufacturing Earnings Compared to Median Earnings for the Entire Region and Adults without a High School Diploma[47]

Group of Workers	Median Wages
All Workers in Cleveland-Elyria MSA	$46,890
Manufacturing Workers in the MSA	$56,537
Residents with High School Diploma as Highest Educational Level in the MSA*	$37,395

Source: U.S. Census Bureau
*Source: U.S. Census Bureau[48]

[45] Team NEO, "NEO Since the Great Recession.
[46] Ohio Department of Jobs and Family Services, "2026 Job Outlook: Cleveland-Elyria Metropolitan Statistical Area" (Columbus: July 2019); https://ohiolmi.com/portals/206/proj/MSA/Cleveland.pdf (accessed May 29, 2025)
[47] U.S. Census Bureau, 2023 American Community Survey, 1-year, Industry by Sex and Median Earnings in the Past 12 Months (in 2023 Inflation-adjusted Dollars), Table S2413; https://data.census.gov/cedsci/table?q=s2413&g=310M300US17460&tid=ACSST1Y2019.S2413&hidePreview=false (accessed May 29, 2025)
[48] U.S. Census Bureau, 2023 American Community Survey, 1-year, Median Earnings in the Past 12 Months (in 2023 Inflation-adjusted Dollars) by Sex by Educational Attainment for the Population 25 Years and Over, Table B20004; https://data.census.gov/table/ACSST1Y2023.S2413?q=S2413:+Industry+by+Sex+and+Median+Earnings+in+the+Past+12+Months+(in+2023+Inflation-Adjusted+Dollars)+for+the+Civilian+Employed+Population+16+Years+and+Over&g=310XX00US17410 (accessed May 29, 2025)

As noted in the discussion about healthcare jobs, innovation is the leading metric for regional economic growth. Manufacturing remains an incredibly innovative sector, which is partly why jobs have decreased even as productivity has grown. Manufacturing simply means “to make a good.” If Northeast Ohio does not make things, it will have to import them. If it does make things, it can be an exporter for the country and the world, which will help increase jobs.

Manufacturing is especially reliant on robust transportation infrastructure, which means there are two ways to facilitate growth: 1) ensure a robust multimodal passenger transportation system to connect available workers with jobs, and 2) ensure a robust intermodal freight transportation system so businesses can easily ship by truck, rail, air, or water. Two of the major regional job hubs are also two of the largest manufacturing centers in the region: Solon and Cleveland Hopkins International Airport (see Table 5-21). Hopkins Airport is also one of six NOACA freight hubs. Freight hubs are areas where large volumes of freight shift from one transportation mode to another (e.g., airplane to truck). These “intermodal” facilities are critical to support a wide variety of businesses. NOACA workforce mobility efforts that connect workers with these job and freight hubs through multimodal transportation can help strengthen the regional economy and create a more equitable future, particularly if focused on workers from undeserved areas.

Table 5-21. Percentage of Manufacturing Sector Jobs in Six Major Regional Job Hubs for Northeast Ohio

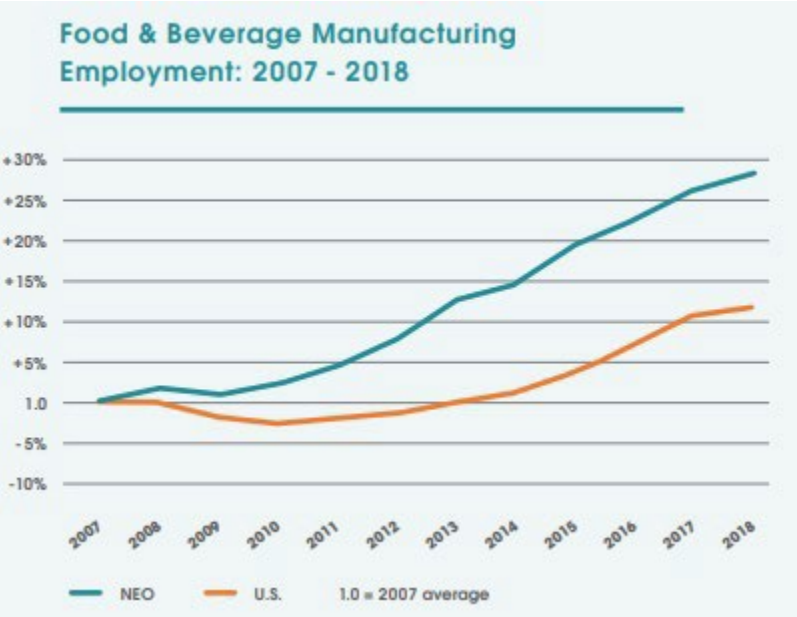
Job Hub	Manufacturing
Airport	15.1%
Chagrin Highlands	3.1%
Downtown	2.7%
Independence	1.6%
Solon	43.5%
University Circle	0.2%

Source: NOACA Travel Forecasting Model, 2024

Agriculture

Although farming itself does not provide many jobs in Northeast Ohio, it is critical to three of the NOACA counties that have a substantial rural population (Geauga, Lorain and Medina). Moreover, the entire agricultural ecosystem (food processing, preparation, and distribution) does provide a significant number of jobs to the region. Furthermore, Figure 5-5 shows that food processing and manufacturing is one of the only subsectors of manufacturing that has increased employment and should continue to do so. In fact, it is growing faster in Northeast Ohio than in the rest of the United States. This suggests our region has a competitive advantage in that sector, so it can be a key job creator and exporter. The region has this competitive advantage because agriculture is based on climate, soil, and water; Northeast Ohio has a good mix of these factors that support a variety and abundance of crops and livestock.

Figure 5-5. Change in Food and Beverage Manufacturing Employment, 2007-2018[49]



Source: Team NEO

Agriculture is also important from a resilience standpoint—food is necessary for survival. The coronavirus pandemic has shown how disruptions to national and global supply chains can cause food shortages and hardship; growth and processing of food locally for local consumption means the region is less subject to shocks.

Vibrant NEO 2040 (Chapter 1) lists "Supporting sustainable agriculture and the local food system in Northeast Ohio" as one of its nine key recommendations. It is an important enough industry across the region that it is the only one that *Vibrant NEO 2040* specifically highlights among nine recommendations and 41 initiatives. One analysis concluded that if Northeast Ohio residents obtained 25% of their food from local farms (currently only 1-2%), it would create 27,664 new jobs, increase regional output by $4.2 billion, and increase state and local tax collections by $126 million.[50]

Table 5-22 shows that more than one-third of lower-income, nonwhite residents do not agree that they have access to stores and services, including grocery stores (more than double the same response across the entire region). Improved multimodal transportation access from Environmental Justice Areas to stores and services, including groceries, will provide greater equity and stimulate this sector of the regional economy. This again fits with the third-highest preference from the Crowd Gauge Tool: "I can easily get to fresh food and healthcare."

[49] TeamNEO, Across Northeast Ohio: Food and Beverage Manufacturing, June 2019; https://teamneo.org/wp-content/uploads/2019/07/quarterly-economic-review-june-2019.pdf (accessed May 29. 2025)

[50] Masi, Brad, Leslie Schaller, Michael H. Shuman, "The 25% Shift: The Benefits of Food Localization for Northeast Ohio & How to Realize Them," December 2010; https://farmlandinfo.org/publications/the-25-shift-the-benefits-of-food-localization-in-northeast-ohio-and-how-to-realize-them.

Table 5-22. NOACA Regional Survey Results on Access to Stores and Services, Including Fresh Food/Grocery

	My community provides me with access to stores and services (including fresh food/grocery)				
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,463**	**1,217**	**537**	**220**	**239**
Strongly Agree (5)	49.78%	55.22%	46.74%	44.55%	34.31%
Somewhat Agree (4)	33.13%	32.95%	34.64%	32.73%	31.38%
Neutral (3)	11.21%	8.63%	13.22%	13.18%	19.67%
Somewhat Disagree (2)	4.10%	2.71%	3.72%	5.91%	10.04%
Strongly Disagree (1)	1.79%	0.49%	1.68%	3.64%	4.60%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	**4.25**	**4.40**	**4.21**	**4.09**	**3.81**

Local agricultural sector growth has benefits across counties, as rural areas produce the food consumed by the population centers. The benefits are not limited to those large urban areas. Geauga and Lake Counties present a great example with their wineries. Because they produce a good, they house "manufacturers." Because these counties also grow the fruit to make the wine, they house "farmers." Because people from across the region and state visit their wineries, these counties also serve as destinations for travelers and tourists. Support for local agriculture, therefore, cuts across economic sectors and can contribute to shared, regional economic growth.

Travel & Tourism

While not the largest sector, travel and tourism can (under normal conditions) play a substantial role because it attracts visitors and spending from outside the region. In a way, the region itself can be thought of as a key export because it is something that is sold to people from other places. Additionally, tourism has the potential to turn tourists into residents, who then grow the regional economy through the purchase of houses and other products and services, some of which may also lead to additional tax payments. Most businesses that engage in travel and tourism fall under the retail trade industry, which is one of the largest industries in terms of revenues, employees, and payroll.

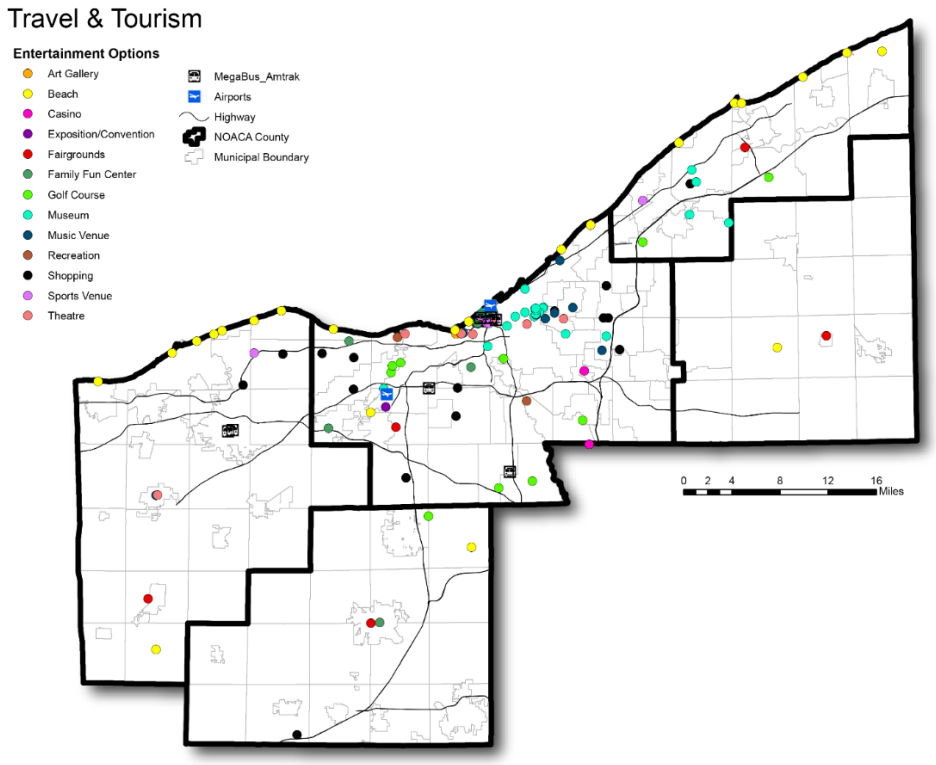
In 2018, Cuyahoga County attracted 19.2 million visitors, an increase of 720,000 visitors (4%) from 2017.[51] In 2019 about $12.2 billion in tourism sales occurred in the five-county NOACA region, the largest of any region in Ohio. This industry supports 97,389 jobs in the region, with a total of $3.3 billion in direct and indirect income in 2019.[52] Tourism supports between 5% and 10% of jobs in each NOACA county. To retain a robust tourism sector, the region must ensure the multimodal transportation system is accessible, easy to navigate, well-maintained, and resilient.

[51] Destination Cleveland, "Harnessing the Power of the Visitor," *2018 Convention & Leisure Tourism: Metrics Report* (Cleveland: Destination Cleveland, 2018); https://www.thisiscleveland.com/ThisIsCleveland/media/Documents/Tourism%20Metric%20Reports/2018-convention-leisure-tourism-metrics-report.pdf?quality=75&cache=3.0 (accessed May 29, 2025)

[52] Lake County Visitors Bureau, "Economic Impact of Tourism in Lake County, Ohio 2019." Prepared by Tourism Economics.

Travel and tourism is an important economic sector because it extends across the region, from professional sports stadiums in downtown Cleveland to wineries in Lake County to Amish villages in Geauga County (see Figure 5-6). Additionally, Lake Erie attracts people from around the country primarily for fishing, but also sailing, swimming, and other recreation. According to the Ohio State University Stone Laboratory, scientists estimate Lake Erie contains 50% of all fish in the Great Lakes system, despite only having 2% of the water.[53] A robust park system in all five counties provides more outdoor opportunities, as well as connections and access to the lake and its tributaries for fishing, boating, and kayaking.

Figure 5-6. Key Regional Attractions



Transportation infrastructure also plays an important role in the travel and tourism sector. Visitors who travel to key attractions or events in the region (via plane, regional bus, Amtrak, personal vehicle, etc.) should experience strong connections with sufficient signage to other travel modes so they can reach their destinations safely and quickly. Many of these trips involve two or more modes.

The NOACA Regional Survey asked respondents to identify all the various travel modes they use for errands, social visits, and fun times in Northeast Ohio (Table 5-23). Although not tourists, the diverse array of responses (more than half of respondents in every county reported walking; more than one-third reported cycling; one-third of Cleveland respondents used public transportation) suggest that visitors to Northeast Ohio may also likely use different transportation modes, and possibly more so, given that they don't live in the region and may not have as ready access to a private vehicle. A robust multimodal transportation system is vital for leisure and recreational travel within the region, whether by residents or visitors.

[53] Mark Brush, "Lake Erie Has 2% of the Water in the Great Lakes, but 50% of the Fish," *Michigan Public*, Nov. 5, 2013; https://www.michiganpublic.org/environment-science/2013-11-05/lake-erie-has-2-of-the-water-in-the-great-lakes-but-50-of-the-fish (accessed May 29, 2025)

Table 5-23. NOACA Regional Survey Results on Modes of Transportation Used for Non-Work Trips

	Popularity of travel options for errands, social visits, and fun trips in Northeast Ohio						
	NOACA Region	**Cleveland**	**Cuyahoga**	**Lorain**	**Lake**	**Medina**	**Geauga**
BASE	**2,447***	**444**	**1,083**	**359**	**269**	**204**	**88**
	%	**%**	**%**	**%**	**%**	**%**	**%**
Personal vehicle	79.12	63.96**	82.55	83.57	83.27	79.41	81.82
Walk	55.25	59.01	55.49	50.97	56.13	53.92	51.14
Bicycle	39.03	43.47	38.60	39.55	34.94	34.80	42.05
Uber, Lyft	23.70	33.33	24.01	19.22	18.59	17.16	20.45
Public transportation	17.90	32.43	16.53	11.98	15.24	11.27	9.09
Carpool or vanpool	17.70	24.55	15.24	17.83	15.24	18.14	19.32
Airplane	13.12	15.99	13.02	13.09	11.52	10.78	10.23
Motorcycle	12.63	15.54	9.51	14.76	14.87	13.73	18.18
Scooter	10.91	19.37	8.13	11.14	10.78	6.37	12.50
Taxi	10.13	16.67	8.68	9.19	8.18	7.35	11.36
Telecommute	9.69	14.41	8.31	8.08	10.78	8.82	7.95
Greyhound	7.11	12.84	5.54	6.96	5.95	4.9	6.82
Charter bus	7.07	12.61	5.26	5.29	7.81	5.39	10.23
Amtrak rail	6.70	11.26	5.54	5.57	5.95	4.90	9.09

*All residents provided their travel options for errands, social, and fun trips.
**We can be 99% confident that fewer people in Cleveland, compared with people in suburban areas, drive themselves to errands, social, and fun trips.

Current and Projected Employment

According to NOACA's Regional Survey, residents are only in slight agreement that the economy is headed in the right direction and provides good job opportunities (see Table 5-24).

Table 5-24. Survey Respondent Opinions on the State of the Economy

	Agreement with statements about Northeast Ohio (NEO)		
5 = Highest 1 = Lowest **BASE = 2,454**	**NEO's economy is headed in the right direction**	**NEO is a good place for employment opportunities**	**It's easy to find affordable housing in NEO**
Cleveland	3.20	3.36	3.27
Cuyahoga	3.22	3.46	3.59
Lorain	3.19	3.32	3.51
Lake	3.36	3.66	3.53
Medina	3.25	3.49	3.50

Geauga	3.43	3.55	3.53
NOACA Region	**3.24**	**3.45**	**3.51**

In Chapter 1, the data showed that the region lost population yet still expanded its development footprint. Having fewer people spread out over more space consumes greater resources per capita to maintain services and amenities, including infrastructure. Table 5-25 shows this trend may continue, with job totals in Cuyahoga County essentially stagnant while every other county seeing a double-digit percentage increase; total regional employment will only grow by 7% over the next 30 years. It will be critical to ensure growth happens in places already serviced by infrastructure. Continued outward migration will further stress the region and its counties (both financially and environmentally).

Table 5-25. NOACA Region Employment Projections[54]

	Employment		Employment Projection	Employment Change (%)	Projected Employment Change (%)
County	**2010**	**2020**	**2050**	**2010-2020**	**2020-2050**
Cuyahoga	724,529	733,065	722,199	1.2	-1.5
Geauga	35,150	38,365	41,903	9.1	9.2
Lake	100,158	99,568	106,994	-0.6	7.5
Lorain	100,181	102,727	126,333	2.5	23.0
Medina	62,312	63,996	78,546	2.7	22.7
NOACA	1,022,330	1,037,721	1,075,975	1.5	3.7

Source: Team NEO, Moody's Analytics, 2024

Studies demonstrate that "proximity promotes agglomeration, helping to grow industries and regional economies. Research continually finds that urban economies benefit when workers and firms locate near one another (or cluster), saving travel time and promoting greater knowledge exchanges."[55] In other words, clusters of housing (for workers), jobs, and businesses are better for the regional economy. This is an important driver of NOACA's effort to improve workforce mobility and access to the region's job hubs. Development of neighborhoods (urban, suburban and rural) already served by existing infrastructure is the best way to do this. Improved transportation system linkages and modal choice can further facilitate clusters and make more jobs accessible to more people within a shorter commute time. This is especially important for communities with . Many such areas contain ample infrastructure that remains underused; these are prime parcels for revitalization.

Economic Development Stakeholders

Several agencies and organizations already work on economic development across all levels of government. Economic growth can provide jobs for residents and increase tax revenue to help provide services and amenities. The involvement of regional and local stakeholders is critical because they best understand local conditions and have the greatest stake in local growth. The federal government provides funding and technical assistance to state and local entities that it hopes will lead to an improved national economy. The state government likewise provides funding

[54] TeamNEO, Moody's Analytics, February 2020

[55] Adie Tomer, Joseph W. Kane, and Lara Fishbane, "Connecting People by Proximity: A Better way to Plan Metro Areas," *Brookings Metropolitan Policy Program,* June 21, 2019; https://www.brookings.edu/blog/the-avenue/2019/06/21/connecting-people-by-proximity-a-better-way-to-plan-metro-areas/ (accessed May 29, 2025)

and assistance to improve the state economy. This section, while not meant to be comprehensive, describes stakeholders at all of these levels and how they interact.

Federal

The federal government typically adopts nationwide policies, while place-based economic development is under the purview of entities that exist within a particular geographic area. The federal government also provides funding to state or local entities for these purposes. The Economic Development Administration (EDA), within the Department of Commerce, is the main stakeholder at the federal level. Its mission is to promote innovation and competitiveness to prepare communities for success in the global economy. To do so, the EDA offers grants for planning, technical assistance, and infrastructure construction. The NOACA region falls under the Chicago Regional Office, which then works with regional and local stakeholders to build economic development knowledge and capacity.

An important, but often overlooked stakeholder, is the U.S. Commercial Service (USCS), also within the Department of Commerce under its International Trade Administration. The USCS promotes the export of goods and services, particularly by small- and mid-sized businesses, to help them grow. It can be a key player to help small or new businesses scale, which will create jobs. The USCS provides international market research, counseling and advocacy, and training programs to help businesses determine if, when, and where it is beneficial to export. It also provides programs to introduce businesses to qualified buyers and distributors in overseas markets.

State

Similar to the federal level, the state sets the framework for economic development through laws, regulations, and programs, while county or local jurisdictions handle the details. The main state-level stakeholders are JobsOhio and the Ohio Development Services Agency (ODSA).

JobsOhio is a private, nonprofit corporation with a mission of job retention, creation, and attraction. JobsOhio drives much of the business attraction and investment from outside the state, assisting with site selection and tax incentives. JobsOhio primarily focuses on 14 industries that it has identified as key to economic growth at the state level. It then defers to designated regional partners to identify those industries important in their given region and that partner drives most of the efforts to secure business investment. In Northeast Ohio, the regional partner is Team NEO (discussed below). Table 5-26 lists the 14 key industries identified by JobsOhio[56] and the 12 key industries identified by Team NEO.

Table 5-26: Key Industries[57]

Jobs Ohio	Team NEO
Advanced Manufacturing	Advanced Manufacturing
Additive Manufacturing	Aerospace and Aviation
Aerospace and Aviation	Automotive
Automotive	Financial Services
Advanced Mobility	Food Processing
Cybersecurity	Headquarters & Professional Services
Energy and Chemicals	Healthcare & Biotechnology

[56] JobsOhio, https://www.jobsohio.com/industries (accessed May 29, 2025)
[57] Team NEO, https://northeastohioregion.com/grow-your-business-here/key-industries/ (accessed May 29, 2025)

Financial Services	Information Technology
Food and Agribusiness	Logistics
Healthcare	Metal Production & Fabrication
Insurtech	Polymers & Materials
Logistics and Distribution	Semiconductors
Military and Federal	
Technology	

The ODSA is a fully public department of the state government, committed to job creation and community development while it ensures accountability for taxpayer money. Although JobsOhio and Team NEO may offer tax incentives to businesses, in concurrence with the local jurisdiction, ODSA administers the tax incentive programs for both business and housing development.

Regional and Local

Economic development agencies at regional and local levels regularly collaborate on attracting and retaining businesses. They often work in partnership as a result of the federal and state organizations and funding sources. Table 5-27 is just a partial list of regional and local stakeholders, grouped together by the geographic scale at which they operate.

Table 5-27. Regional Economic Development Stakeholders

Regional	County	City or Neighborhood
Bioenterprise	County Chambers of Commerce	City Chambers of Commerce
Cleveland Foundation	County Economic Development Departments	City Economic Development Departments
Educational Institutions	County Jobs & Family Services	Community Development Corporations
Federal Reserve Bank of Cleveland	County Land Banks	Community Improvement Corporations
Gund Foundation	County Port Authorities	Main Street Organizations
Jumpstart	Greater Cleveland Partnership	
MAGNET		
NOACA		
Team NEO		
Vibrant NEO		

Team NEO is the state-designated agency for business retention, attraction, and expansion. Every county and most of the mid-to-large-size cities have their own economic development departments, which often work in conjunction with Team NEO. Chambers of commerce such as the Greater Cleveland Partnership, the Lorain County Chamber of Commerce and the Geauga Growth Partnership are private business organizations that also play a role and, again, most counties and even some cities have chambers of commerce. Foundations and like organizations such as the Cleveland Foundation and Fund for Our Economic Future are also heavily involved. They provide research, grant funding, or other services. Some nonprofits focus on specific economic sectors, such as Bioenterprise (biomedical) or MAGNET (manufacturing). Many neighborhoods have Community Development Corporations (e.g., Detroit-Shoreway, Ohio City, University Circle, St. Clair-Superior), and some have Main Street organizations (e.g., Chardon, Medina, Wellington). All of these work with businesses and developers in their neighborhoods to help them grow. Every county also has a workforce development agency through the state-level Ohio Means Jobs program. These agencies complement business stakeholders through job training and other skills development for unemployed or underemployed residents. The

educational system, from K-12 to joint vocational schools to community colleges to universities, also plays a critical role. Educational institutions provide a wide variety of training and skills for diverse career paths.

Several of these organizations have representatives on NOACA's various Advisory Councils. Team NEO and some chambers of commerce are also on the NOACA Business Advisory Council (BAC), which is chartered to represent business interests in the transportation planning process. The BAC both informs NOACA planning efforts and helps share those efforts with the business community.

NOACA Efforts to Increasing Workforce Mobility

Current Challenges

NOACA plays a significant role in economic development through its planning and distribution of transportation funding. The authors of *Vibrant NEO 2040* recognized the role of transportation in equitable economic growth; they made "Increasing Transportation Choice" one of its four key themes. NOACA can play an especially important role because, as Table 5-28 shows, a higher percentage of Northeast Ohio residents lack personal vehicles than elsewhere in the state and country; transportation choice is critical. The City of Cleveland fares even worse; more than one-fifth of households are without a personal vehicle.

Vehicles are a huge upfront expense, with ongoing payments for insurance, gas, and repairs; many residents cannot afford vehicles or don't want to own them. This creates a paradox, however, where a car is often needed to access jobs, but jobs are needed to afford cars. The problem is further compounded by exclusionary zoning practices in many suburban or rural areas that make it difficult or even impossible for low-income or minority residents to move closer to jobs (see Chapter 6). Additionally, housing insecurity is known to result in job loss and reduced employment prospects.[58]

This means transit, cycling, and walking improvements, all core functions of NOACA, are particularly relevant in Northeast Ohio to help connect workers and jobs. These multimodal transportation efforts are especially necessary to improve racial equity because low-income, minority residents are more likely to depend on alternative modes.

Table 5-28. 2023 Percentage of Households without a Personal Vehicle[59]

Location	Percent of Households without a Vehicle
Cincinnati MSA	6.6%
Cleveland-Elyria MSA	9.3%
Columbus MSA	6.5%
Ohio	7.6%
United States	8.4%
City of Cleveland	22.1%

[58] Matthew Desmond and Carl Gershenson, "Housing and Employment Insecurity among the Working Poor," *Social Problems* 0, 1-22 (Oxford, U.K.: Oxford University Press, 2016); https://scholar.harvard.edu/files/mdesmond/files/desmondgershenson.sp2016.pdf?m=1452638824 (accessed May 29, 2025)

[59] U.S. Census Bureau, "2023 American Community Survey, 1-year, Selected Housing Characteristics, Table DP04"; https://data.census.gov/table?q=DP04:+Selected+Housing+Characteristics&g=010XX00US_040XX00US39_160XX00US3916000_310XX00US17140,17410,18140 (accessed May 29, 2025)

Source: U.S. Census Bureau

Despite lack of private vehicle ownership, results from NOACA's Regional Survey show general agreement that vehicles are necessary to reach work (see Table 5-29). Cleveland respondents, with the highest percentage of no-vehicle households but several transit routes, offered the lowest levels of agreement, while Geauga and Medina County residents expressed the strongest agreement. This data supports the need for NOACA and transit agencies to ensure a robust and reliable transit system.

Table 5-29. NOACA Regional Survey Respondents Agreement that Vehicles are Necessary

	In Northeast Ohio, people have to have a vehicle to get to work	
5 = Highest 1 = Lowest	**All Respondents**	**Respondents employed full- or part-time**
BASE	**2,2463**	**1,194**
Cleveland	3.39	3.40
Cuyahoga	3.59	3.60
Lorain	3.96	3.99
Lake	3.69	3.73
Medina	3.96	3.95
Geauga	4.10	4.21
NOACA Region	**3.67**	**3.69**

Transportation planning is also critical because workers commute widely throughout the region to access jobs. According to Table 5-25, 70% of jobs are in Cuyahoga County. Table 5-30 shows that Cuyahoga County is the top place of work for residents of every county except Lake, where it is a close second. Based on job densities and commute patterns, NOACA has identified six major regional job hubs in the region, all of which happen to be in Cuyahoga County (see Chapter 3). NOACA must provide multimodal opportunities for workers to access these job hubs and other sub-regional job centers and corridors to facilitate upward economic mobility for low-income households.

Table 5-30. 2022 NOACA Residents Place of Home and Work[60]

		Work In				
		Cuyahoga	**Geauga**	**Lake**	**Lorain**	**Medina**
Live In	**Cuyahoga**	401,300	4,745	16,059	14,845	7,902
	Geauga	16,578	9,850	5,258	279	192
	Lake	42,529	3,812	46,239	725	476
	Lorain	51,662	430	1,454	52,166	3,684
	Medina	28,472	312	696	3,075	23,867

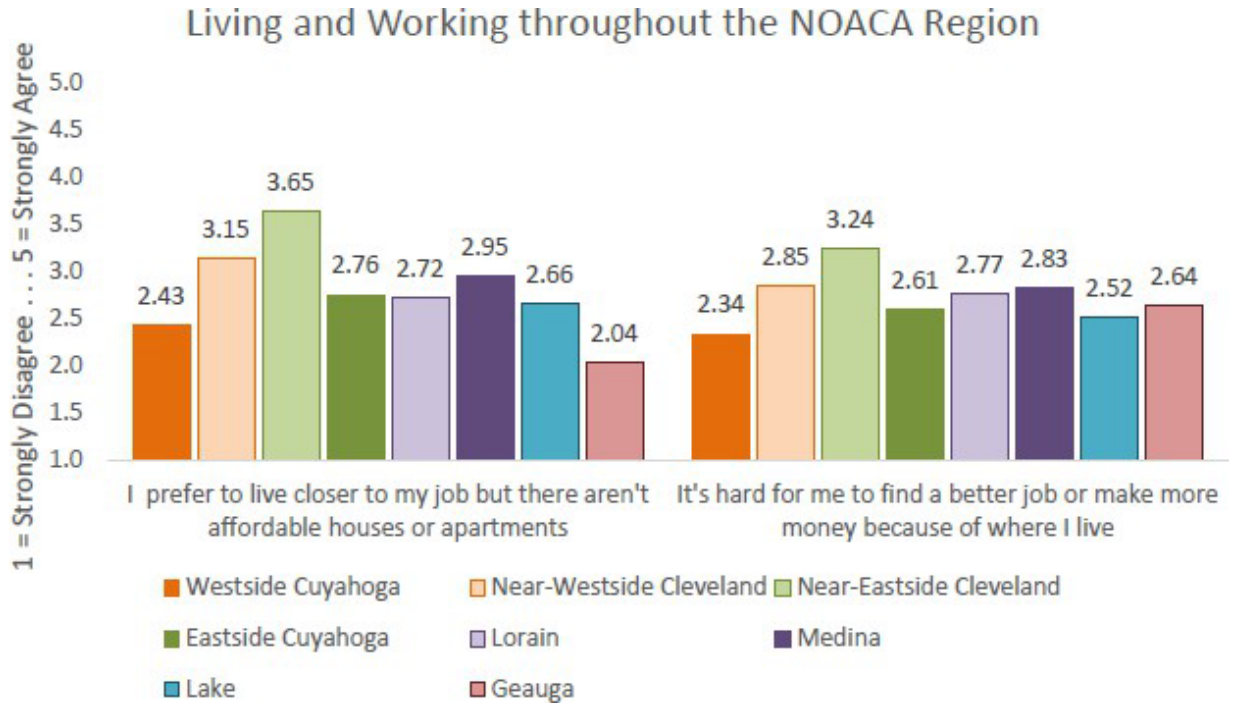
Source: U.S. Census Bureau

NOACA's Regional Survey included two statements posed to respondents about the jobs-

[60] U.S. Census Bureau, "LEHD Origin-Destination Employment Statistics (2002-2022)" [computer file], LODES 8.3 [version] (Washington, DC: U.S. Census Bureau, Longitudinal-Employer Household Dynamics Program [distributor], 2025), https://onthemap.ces.census.gov

housing disconnect (see also Chapter 6). First, respondents were asked to state the extent to which they agreed or disagreed that they would prefer to live closer to their job but there isn't affordable housing. Second, respondents were asked the extent to which they agreed or disagreed that it was hard for them to find a better job or make more money because of where they lived. Figure 5-7 shows the responses, which vary significantly by location. Cleveland residents indicated the highest level of agreement with both statements; they agree that lack of affordable housing keeps them from living closer to work, and they agree that their current residential location limits their job prospects and earning potential. Suburban respondents generally disagreed with both statements.

Figure 5-7. NOACA Regional Survey: Respondent Preferences for Living and Working Arrangements



Several NOACA programs facilitate better multimodal transportation access to employment opportunities. This is particularly true for residents of Areas, who may not be able to afford a personal vehicle. The following sections provide further details.

NOACA's Board of Directors outlined specific goals in its 2015 Regional Strategic Plan, including "support economic development" and "improve quality of life" with several supporting objectives.[61] These goals and objectives explicitly demonstrate NOACA's commitment to promote transportation system infrastructure projects and investment that will also expand economic opportunity across the region to improve stakeholders' lives. NOACA's Business, Community, Emerging Leaders and Rural Advisory Councils work toward these goals through the regional leaders who make up their memberships. These council members act as a conduit from NOACA to their communities to inform NOACA Board decision making and provide feedback on NOACA

[61] Northeast Ohio Areawide Coordinating Agency, *NOACA Strategic Plan: Going Forward, Together* (Cleveland: NOACA, 2015); https://www.noaca.org/home/showpublisheddocument?id=6639 (accessed May 29, 2025)

staff efforts.

The NOACA plans, programs, policies, and projects described below can positively influence economic development in Northeast Ohio, particularly through enhanced mobility and access. This is important because research from Cleveland State University (CSU) indicates that location of jobs near population centers is more effective to improve the transport of workers to jobs. Improved workforce accessibility fosters growth and reduces unemployment. These researchers found that manufacturing and retail businesses have been the most likely to leave the urban core for exurban areas, while available workers for those industries remain in the core, and that "it may not be prudent to advocate for limited transportation funding in the creation of transit connections to disparate areas."[62] Similarly, the Federal Reserve Bank of Cleveland states "longer commute distances have also been found to negatively impact the economic mobility of low-income households from one generation to the next."[63] The transportation scenarios introduced in Chapter 3, summarized at the end of this chapter, and described more fully in Chapter 9 address different ways NOACA and stakeholders can best prioritize infrastructure spending. Infrastructure investment can help low-income or minority workers surmount these mobility hurdles, especially those workers in areas traditionally underserved by existing transportation systems.

In 2015, the Brookings Institution analyzed studies from around the country and found that "people who live closer to jobs are more likely to work. They face shorter job searches and spells of joblessness" and that "black, female, and older workers tend to be more sensitive to job accessibility…For poor residents, living closer to jobs increases the likelihood of working and leaving welfare."[64] Brookings then conducted additional analysis that found Greater Cleveland had the largest percent drop nationwide in the number of jobs accessible to the average resident between 2000 and 2012. This means people and jobs have spread farther apart. While 2020 Census data may reveal a shift in this trend, the challenge for workers to live closer to jobs to improve their economic outcomes remains real.

A recent study from the Journal of Urban Economics demonstrates the jobs-housing disconnect impact on metropolitan area growth. As mentioned previously, innovation is the number one determinant of metro area growth. The study found that every 6.2-mile increase in commute distance leads to a 5% decline in the number of patents generated by an inventor and a 7% decrease in patent quality. In other words, a metro region where jobs and people are spread farther apart will be less innovative and experience less growth. The authors conclude that their "findings support the importance of density in urban planning policy" because "increasing zoning and other land-use restrictions on multifamily construction have an unintended efficiency cost" through increased commute distances.[65]

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[62] Richey Piiparinen and Jim Russell, "Center for Population Dynamics Quarterly Brief January 2017: Transportation's Role in the Economic Restructuring of Cleveland," *Urban Publications* 0 1 2 3 1427 (Cleveland: Cleveland State University, January 2017); https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?article=2431&context=urban_facpub. (accessed May 29, 2025)

[63] Brett Barkley and Alexandre Gomes-Pereira, "A Long Ride to Work: Job Access and Public Transportation in Northeast Ohio," A Look Behind the Numbers 6, no. 1. 1 (2015), The Federal Reserve Bank of Cleveland; https://www.clevelandfed.org/newsroom-and-events/publications/a-look-behind-thenumbers/albtn-20151123-a-long-ride-to-work-job-access-and-public-transportation-in-northeast-ohio.aspx (accessed May 29, 2025)

[64] Elizabeth Kneebone and Natalie Holmes, "The Growing Distance between People and Jobs in Metropolitan America," *The Brookings Metropolitan Policy Program* 2 (March 2015); https://www.brookings.edu/wp-content/uploads/2016/07/srvy_jobsproximity.pdf (accessed May 25, 2025)

[65] Hong Yu Xiao, Andy Wu, Jaeho Kim, "Commuting and Innovation: Are Closer Inventors More Productive?" *Journal of Urban Economics* 121 (Jan. 2021), 26; https://doi.org/10.1016/j.jue.2020.103300 (accessed May 29, 2025)

As a transportation agency, NOACA is best suited to improve transportation options, which is one important way to reduce poverty and increase productivity. Land use is the other side of the coin, however, and local jurisdictions control their own land use. The programs, policies, and projects described in the next section are ways that NOACA can help shape transportation and related development decisions that may ultimately influence local land-use priorities and best connect workers with jobs.

NOACA Programs

NOACA's transportation planning programs embody the agency's goal to "support economic development"; it is typically central to their intended purpose. A business may struggle to achieve success in a location without reliable workforce accessibility. Transportation infrastructure is necessary (even if not sufficient) for business expansion and job growth. NOACA, therefore, promotes a variety of programs to optimize transportation investments to support Northeast Ohio's economy.

Workforce Mobility

NOACA workforce mobility efforts seek to close the gap between workers and jobs so that all residents can safely and reliably access job sites through multiple transportation options. This can help reduce their overall housing and transportation cost burden, as described in Chapter 6, which will help increase housing security.

As Northeast Ohio population and employment have decentralized from its legacy cities and towns, the distance between businesses and their workers has grown. This is especially harmful for low-income and minority residents, who disproportionately live in historic core communities. Reliable personal vehicles may be cost- prohibitive or unattainable due to disability; transit is often not viable or very infrequent in less dense areas; and distances are too great to walk or bike to work. Table 5-31 provides data from the Brookings Institute study, which shows that, compared to peers, Greater Cleveland fares worse across several jobs-housing connection metrics.

Table 5-31. Percentage Change in Number of Jobs near Residents from 2000 to 2012[66]

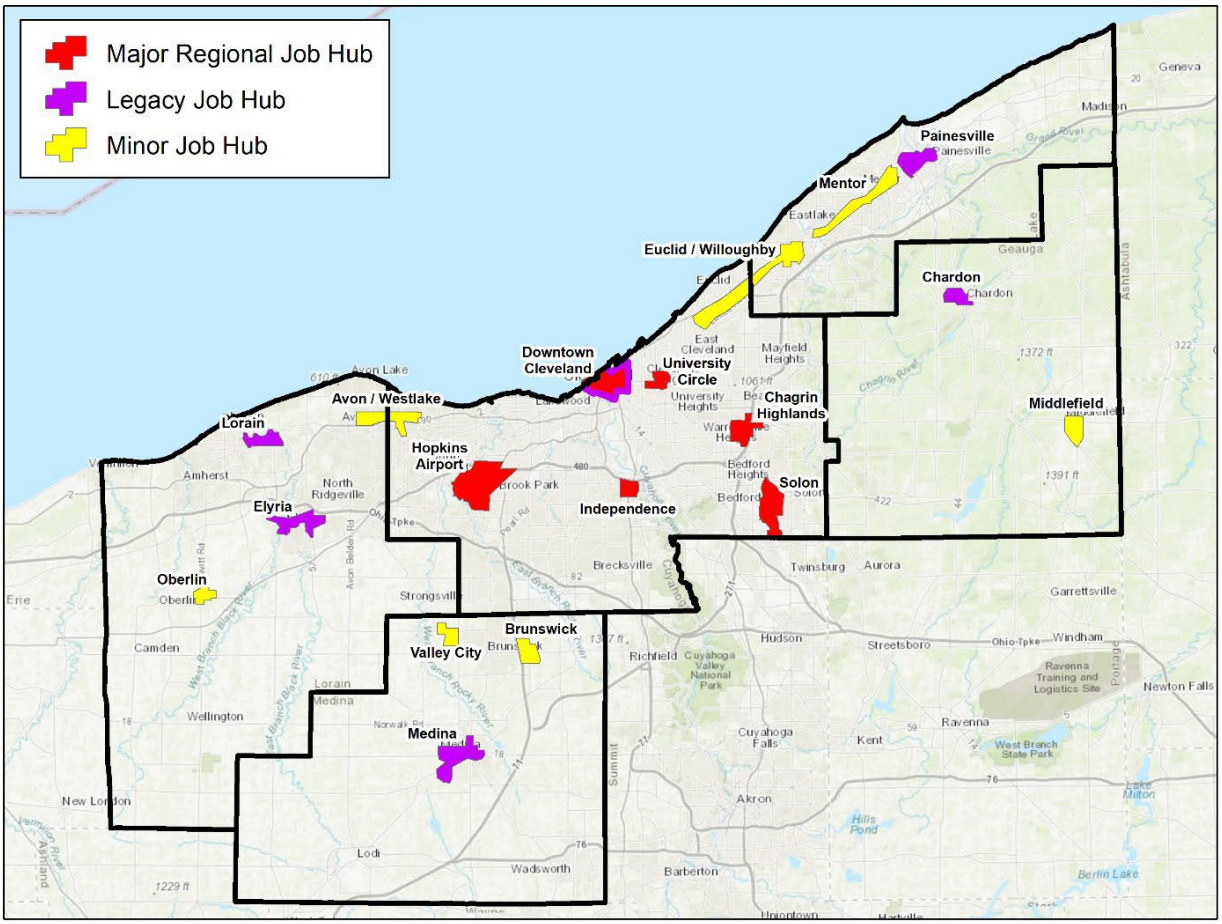
Location	% Change in Average # of Jobs Near a Resident	% Change in # of Jobs Near High-Poverty Neighborhoods	% Change in # of Jobs Near Majority-Minority Neighborhoods
Cincinnati MSA	-14.5%	-28.3%	-17.0%
Cleveland-Elyria MSA	-26.5%	-35.0%	-28.0%
Columbus MSA	-7.9%	-26.5%	-13.9%

Source: Brookings Metropolitan Policy Program, 2015

NOACA has identified regional job hubs, shown in Figure 5-8 (see also Chapter 3). Each is a dense node of at least 10,000 employees or a legacy job hub that has seen significant infrastructure investments over the past decades. These are the areas where transportation spending can best connect businesses within the hubs and employees to the hubs through a multimodal transportation system.

[66] Interactive map and table found at https://www.brookings.edu/research/the-growing-distance-between-people-and-jobs-in-metropolitan-america/ (accessed May 29, 2025)

Figure 5-8. Regional Job Hubs Map



NOACA has developed workforce mobility strategies and analysis for job hubs. The current work has focused on the six major regional job hubs, which are located in Cuyahoga County, and three legacy and minor job hubs located in one of the collar counties, Medina. NOACA will also extend the detailed study to the remaining legacy and minor job hubs across the region to complete the work. The analysis identifies the predominant jobs in the hubs (for example, healthcare workers in University Circle), where workers with those skills live, and how long it takes them to access the job hub by personal vehicle or public transit. NOACA continues to develop a public tool to inform users about the locations of workers with certain skills, among other features Economic developers and businesses will be able to use the tool to make better siting decisions (e.g., ideally, to locate near their current and prospective employees). Please see the "Where do We Go from Here?" section at the end of this chapter for more information on how NOACA modeled future transportation infrastructure investment scenarios around access to the major regional job hubs shown in Figure 5-8.

Transit Planning

NOACA's *Regional Transit Strategic Plan* likewise has a heavy emphasis on how to connect residents to job hubs and other important places in the region through public transit in each county. As described throughout this chapter, transit connections to jobs are particularly important from an equity standpoint. Low-income, minority, and disabled populations are more likely to depend on transit to reach jobs. Older residents may also increasingly turn to transit if their driving abilities diminish. Younger generations have also expressed a greater interest in transit, in part

due to environmental concerns and due to the high cost of vehicle ownership.[67] These groups combine to form a large share of the population interested in transit, whether captive (ride out of necessity) or choice. NOACA must ensure a robust transit network for Northeast Ohio to ensure its businesses can attract and retain these people.

Transit Oriented Development (TOD) incorporates these needs through its design. TOD emphasizes dense residential and commercial nodes around transit stations, particularly rail lines. This is especially important for minority and low-income populations because these groups are more dependent on transit. TOD can help these populations more fully participate in the economy by affordably accessing jobs, although there is also the risk of gentrification and rising housing costs within TODs. NOACA conducted a thorough analysis of TOD potential for every rail station, as described in Chapter 2. Through this analysis, NOACA created a *TOD Scorecard and Implementation Plan,* with goals to increase ridership and promote development in and around rail stations and high performing bus corridors.[68] It grouped all stations into one of seven place typologies based on several characteristics of the surrounding community. NOACA staff then identified TOD "readiness" to identify stations where high-priority investments are needed to support TOD and set timeframes in which development is likely to occur. The Scorecard will help the NOACA Board and local stakeholders make the most efficient use of funding to promote development around transit stations (see also Chapter 7).

Transportation for Livable Communities Initiative (TLCI)

The Transportation for Livable Communities Initiative (TLCI) also fosters economic development and mobility. NOACA's TLCI program[69] provides assistance to communities and public agencies for integrated transportation and land-use planning and projects that strengthen community livability. TLCI advances the goals of NOACA's Regional Strategic Plan[70] through the following objectives:

- Develop transportation projects that provide more travel options through complete streets and context sensitive solutions to increase user safety and support positive public health impacts
- Promote reinvestment in underutilized or vacant/abandoned properties through development concepts supported by multimodal transportation systems
- Support economic development through place-based transportation and land use recommendations, and connect these proposals with existing assets and investments
- Ensure that the benefits of growth and change are available to all members of a community by integrating principles of accessibility into projects
- Enhance regional cohesion through collaboration between regional and community partners
- Provide people with safe and reliable transportation choices that enhance their quality of life

The TLCI program consists of two components: (1) planning and (2) implementation.

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[67] Northeast Ohio Areawide Coordinating Agency (NOACA), "Transit Planning" https://www.noaca.org/regional-planning/transportation-planning/transit-planning-tod/transit-planning (Accessed May 29, 2025)
[68] Ibid.
[69] Northeast Ohio Areawide Coordinating Agency (NOACA), "Transportation for Livable Communities Initiative (TLCI)", 2021, https://www.noaca.org/community-assistance-center/funding-programs/transportation-for-livable-communities-initiative-tlci (accessed May 29, 2025)
[70] Northeast Ohio Areawide Coordinating Agency (NOACA), "Regional Strategic Plan", 2021, https://www.noaca.org/regional-planning/major-planning-documents/regional-strategic-plan (accessed May 29, 2025)

1. Planning awards help fund planning studies that can lead to improvements in transportation systems and the neighborhoods they support.
2. Implementation awards help communities move forward with the development and installation of infrastructure from past completed livability studies.

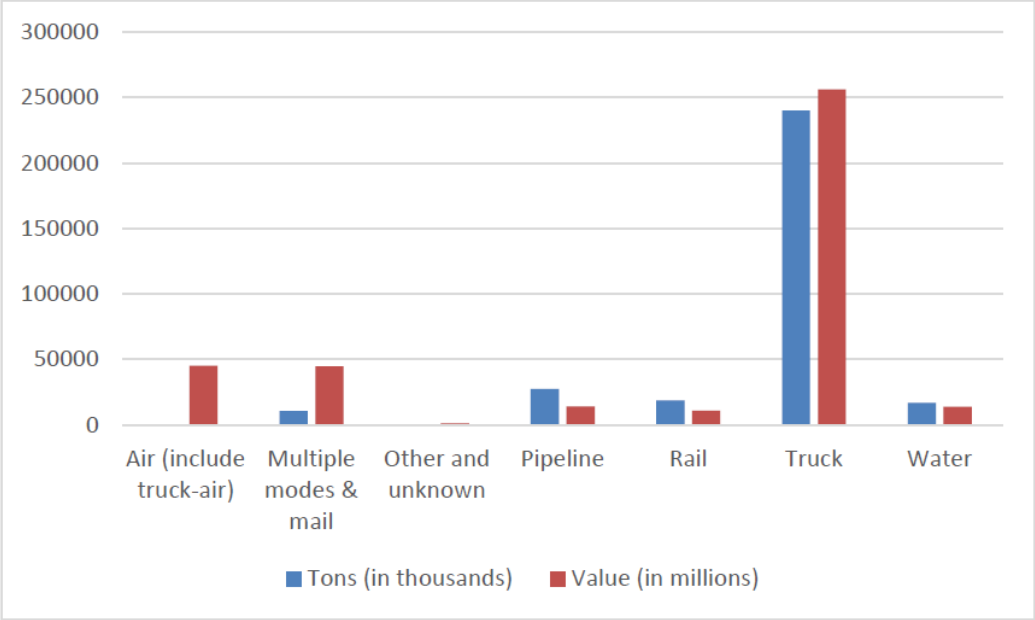
Through TLCI, NOACA has planned or funded several projects around the region that increase worker mobility and advanced economic development. The multimodal focus of the program works to ensure that all residents, regardless of income, race, or other status, have more options to reach more places of employment and that economic development reaches all communities. An evaluation of the program completed by NOACA in 2013 demonstrated that that for every dollar spent by NOACA on the development of TLCI plans, $114.70 is generated in transportation and land use improvements. More precisely, $5.1 million spent on the studies, spurred $176.1 million for 31 transportation projects and $472.5 million for 54 land use projects. The resulting transportation projects were primarily multimodal, while the land use projects included commercial, residential, greenspace and mixed use. A majority of the projects (77%) were located in the urban areas representing communities with higher densities, existing infrastructure, transit services, mixed land uses and large 23 CFR 450.316(1)(vii) populations, while 23% were in more suburban and ex-urban areas with needs for primary multi-modal connections. Project sponsors reported that the TLCI program is particularly valuable as a unique means to promote reinvestment in urban core communities as it is truly a catalyst for economic development in that environment.[71]

Freight Planning

In addition to increased mobility for people, NOACA strives to increase mobility for goods through its freight planning efforts, such as the *NOACA Multimodal Regional Freight Plan*. Chapter 2 described this plan, including the goals and performance measures for the freight system developed with extensive stakeholder input. One of the key themes is resilience: businesses, shippers, and other logistics stakeholders must have multimodal shipping options in case of disaster or other hardship. The coronavirus pandemic has only further stressed the importance of a robust system, showing how plans, schedules, and needs can quickly change. Figure 5-9 shows that trucking dominates regional freight mode share, but other modes play crucial roles as well. A robust intermodal system is therefore a form of economic development because it can lay the groundwork for new or existing businesses to grow.

[71] Northeast Ohio Areawide Coordinating Agency (NOACA), "Transportation for Livable Communities Initiative (TLCI)", 2021, https://www.noaca.org/community-assistance-center/funding-programs/transportation-for-livable-communities-initiative-tlci (accessed May 29, 2025)

Figure 5-9. Freight Tonnage and Value in the NOACA Region[72]



Because shipping by truck plays such a critical role, NOACA has developed a regional freight network, shown in Figure 5-10. NOACA developed the network through analysis of truck volumes, trucks as a percentage of all vehicles on the road, and the location of intermodal connectors. Importantly, the network extends beyond interstates to include many arterials and other key roads. Interstates are critical for cross-country movement of goods, which helps businesses that import or export goods over long distances. However, businesses are not located on interstates, which by definition are limited access. The regional freight network, therefore, covers locations that include dense concentrations of manufacturers, wholesalers, and retailers that generate large numbers of truck trips. The network helps NOACA prioritize projects for its TIP that will have the biggest impacts on freight movement.

[72] Northeast Ohio Areawide Coordinating Agency (NOACA), *Multimodal Regional Freight Plan* (Cleveland: Northeast Ohio Areawide Coordinating Agency, 2017); https://www.noaca.org/home/showpublisheddocument/21293/637249557653870000 (accessed May 29, 2025) NOACA Analysis of Federal Highway Administration 'Freight Analysis Framework (FAF) 4.0 data. FHWA FAF5.0 data is being released throughout 2021 and contains more recent data, but it is not yet available as of the writing of this plan

Figure 5-10. NOACA Freight Network

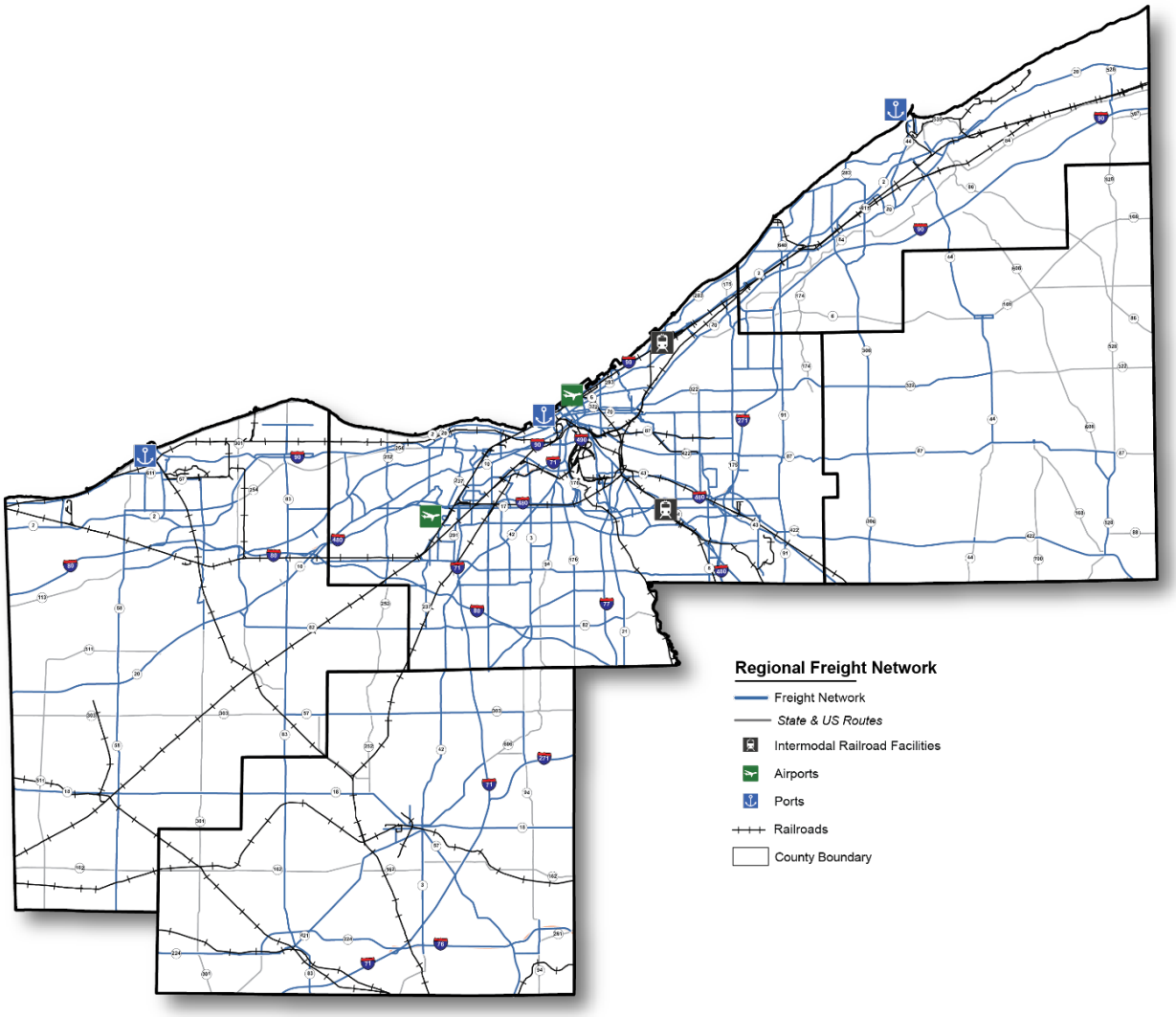


Figure 5-11 shows that NOACA expect both tonnage and value to grow over the timeframe of eNEO2050. This will be true even if the regional population does not grow, or grows slowly, because state, national, and global population will likely continue to grow at a faster rate than the population of Northeast Ohio. This means more freight will pass through the region, and the region will generate more freight, through manufacturing, agriculture, and other key industries. If NOACA's population increases robustly (as shown in some of the projected scenarios), freight tonnage and value may increase even more.

Figure 5-11. Freight Tonnage and Value Projections[73]

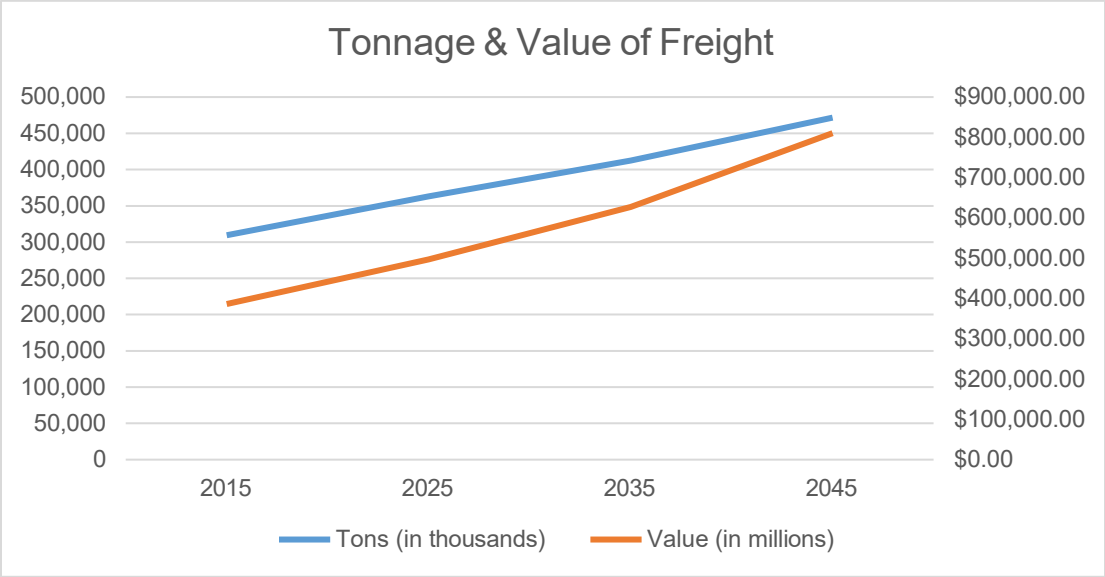


Table 5-32 shows that growth is expected across almost all modes of transportation for both imports and exports; the only exceptions are a slight decline in the value of products shipped via pipeline and a decline in the tonnage of goods exported via rail. When exports and imports are combined, though, all modes see tonnage and value increases.

Table 5-32. Imports and Exports via Freight Mode[74]

Mode	2015 Tonnage (in thousands)	2015 Value (in millions)	2045 Tonnage (in thousands)	2045 Value (in millions)	Tonnage Increase	Value Increase
Air	405	$45,129	1,479	$193,731	265%	329%
Multiple Modes & Mail	10,748	$44,886	15,248	$84,010	42%	87%
Other & Unknown	53	$1,216	202	$4,884	283%	302%
Pipe	27,316	$13,990	37,711	$15,504	38%	11%
Rail	18,775	$10,966	21,323	$19,537	14%	78%
Truck	239,714	$256,040	370,218	$445,348	54%	74%
Water	16,840	$13,727	25,449	$47,276	51%	244%

Additionally, nearly all individual commodity classes are expected to grow. Out of 42 commodity classes, only building stone, coal, crude petroleum, fuel oils, gasoline, logs, tobacco products, and wood products are projected to contract in either tonnage or value. Tables 5-33 and 5-34 show the 10 exports and imports, respectively, expected to grow the fastest in tonnage as well as their absolute tonnage. Transportation projects can facilitate this expected growth through identification of business locations, good access, and conditions. Economic developers often choose to focus on exported goods because they have a larger possible market, which means more potential for growth.

[73] Ibid.
[74] Ibid.

Table 5-33. Top 10 Exports by Tonnage in 2045[75]

Exports	2045 Tonnage (in thousands)	% Increase
Transportation Equipment	847	311%
Precision Instruments	213	226%
Electronics	1,603	185%
Machinery	4,987	125%
Meat/Seafood	392	120%
Chemical products	5,728	114%
Pharmaceuticals	113	111%
Furniture	1,580	93%
Misc. Manufacturing Products	1,304	90%
Alcoholic Beverages	1,377	88%

Table 5-34. Top 10 Imports by Tonnage in 2045[76]

Imports	2045 Tonnage (in thousands)	% Increase
Precision Instruments	256	257%
Electronics	2,133	177%
Machinery	5,646	163%
Furniture	2,144	141%
Pharmaceuticals	451	126%
Transportation Equipment	97	103%
Chemical Products	2,373	99%
Plastics/Rubber	8,164	97%
Animal Feed	1,169	95%
Printed Products	4,438	94%

The tables above reflect some of the key industries described earlier in this chapter. Tables 5- 15 through 5-17 noted that manufacturing, healthcare, and retail are three of the five largest industries in each NOACA county, whether measured by revenues, payroll, or employment.

That discussion further noted that agriculture is the ninth largest sector in the state by GDP. All the commodities in the above tables, except for meat/seafood, are manufactured goods. They are all sold at retail outlets. Pharmaceuticals are critical for the healthcare industry. Meat/seafood, alcoholic beverages, and animal feed are all part of the agriculture industry. It is therefore critical for the regional economy that NOACA and other stakeholders facilitate the movement of these products.

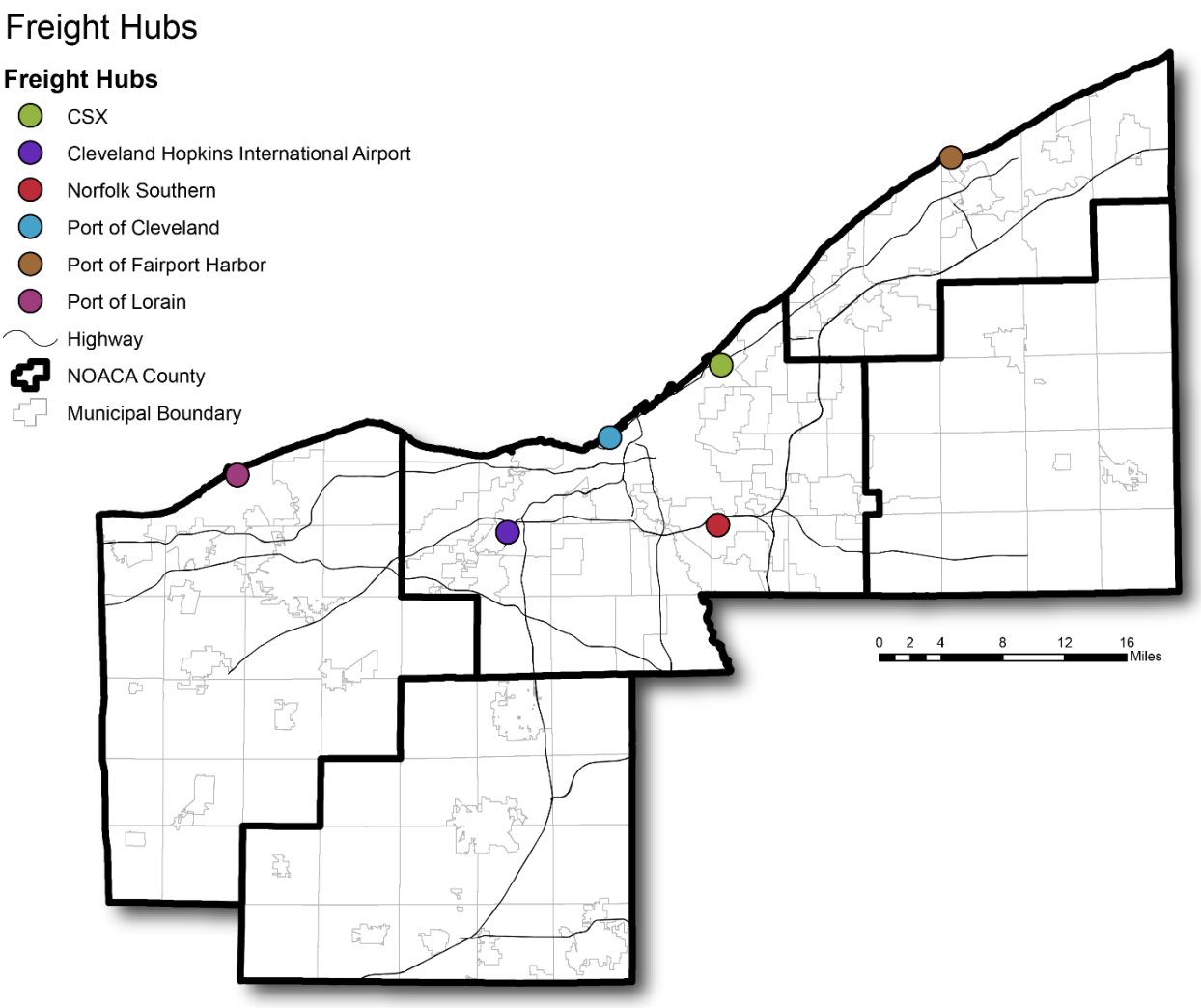
One key freight planning effort that NOACA has undertaken is the development of freight hubs. Like major regional job hubs, a freight hub is a dense concentration of key freight stakeholders. NOACA has focused on intermodal facilities such as hubs (see Figure 5-11).

Intermodal facilities include airports, water ports, and railyards. NOACA's efforts to ensure businesses have all these transportation modes at their disposal facilitates economic

[75] Ibid.
[76] Ibid.

development. Depending on the type and volume of goods, different businesses have different needs for shipping speeds and cost. Business owners will want to locate where they can access multimodal shipping options. Workforce mobility, to ensure people can access freight hub jobs, will further support economic growth within the hub.

Figure 5-12. NOACA Region Freight Hubs



Since freight stakeholders identified freight hub development as a top priority in 2017, NOACA has completed studies for Hopkins International Airport[77] and the Norfolk-Southern railyard.[78] The studies analyze several metrics for infrastructure around the intermodal facility and adjacent industrially zoned properties, which are likely to contain shippers and manufacturers that use the facility. The studies compare pavement and bridge conditions, congestion, and safety in the freight hub with those same measures in the region. In this way, NOACA can determine if hubs

[77] Northeast Ohio Areawide Coordinating Agency (NOACA), *Hopkins International Airport Freight Hub Study,* (Cleveland: NOACA, January 2020), https://www.noaca.org/home/showpublisheddocument/24850/637183182592170000

[78] Northeast Ohio Areawide Coordinating Agency (NOACA), *Norfolk Southern Freight Hub Study,* (Cleveland: NOACA, January 2020), https://www.noaca.org/home/showpublisheddocument/24852/637183182599130000 (accessed May 29, 2025)

fall behind in needed repairs and improvements, which could hurt business retention, expansion, and attraction.

Next, the freight hub studies describe the tonnage and value of goods shipped via the intermodal facility and their projected growth, the main origins and destinations for the goods, and key businesses in the hub engaged in sectors that use these goods (primarily manufacturers). NOACA can ensure that businesses are able to easily access the intermodal facilities and facilitate the projected growth in goods movement.

These businesses cannot thrive without an available workforce. The freight hub studies therefore show Census data on educational attainment and fields of degrees for workers in the hub. This data, combined with the information on businesses and goods in the hub, will allow economic and workforce development agencies to best provide training and other services.

Such training and services will ensure that existing and potential businesses have the workers they need to thrive. NOACA also analyzes Census data to show the home Census tracts of employees in the hub and how they commute to work. This data can address gaps in the multimodal transportation system that create disparities in job access, particularly for residents of underserved communities.

NOACA combines all this data to identify any shortfalls in freight or commuting patterns. Examples include freight bottlenecks, intermodal connectors not in a state of good repair, or gaps in transit coverage that prevent worker access to dense job nodes. NOACA suggests potential projects to remedy these conditions. NOACA improves both intermodal mobility for freight and multimodal mobility for workers, which helps to spur regional economic development and job growth.

NOACA Policies

NOACA has, and continues to develop, policies to help shape economic development within Northeast Ohio. The region has not enjoyed a growing tax base to support expansion of its development and infrastructure footprint, particularly since road and sewer extensions have merely shifted development from one location to another. NOACA's Board and Committees have developed and approved the following policies to facilitate transportation and environmental planning.

Transportation Asset Management Policy

The *Transportation Asset Management Policy* created the Transportation Asset Management Program (TAMP), which ensures efficient and effective maintenance of transportation infrastructure for Northeast Ohio's present and future needs.[79] Although not directly related to economic development, this policy still matters because a region with inadequate infrastructure may not be able to retain and attract businesses or residents.

Regional Transportation Investment Policy

Similarly, the *Regional Transportation Investment Policy* also helps prioritize infrastructure funding for the best possible use.[80] It explains how potential projects must meet NOACA's vision

[79] Northeast Ohio Areawide Coordinating Agency (NOACA), *Transportation Asset Management Policy,* (Cleveland: NOACA, 2016), https://www.noaca.org/home/showpublisheddocument?id=21285 (accessed May 29, 2025)
[80] Northeast Ohio Areawide Coordinating Agency (NOACA), *Regional Transportation Investment Policy,*

statement, goals and objectives, including “support economic development” and “improve quality of life.” The policy describes exactly what it means for a project to meet this vision, helping NOACA staff, committees, and the Board prioritize projects in light of fixed funds.

New or Modified Highway Interchange Projects Policy

In December 2020, NOACA adopted a *New or Modified Highway Interchange Projects Policy*.[81] NOACA developed the policy in response to numerous requests from communities for new or expanded highway interchange projects to accommodate potential imminent development or spur potential future economic development. The NOACA policy requires that any new interchange must undergo a thorough review, based on both transportation planning and local/regional impacts criteria to outline an interchange project’s potential effect (locally and regionally, short-term and long-term). These criteria, articulated in the policy as rubrics for evaluation, are crucially important for Board review and consideration of a proposed project given the history of transportation planning decisions on Northeast Ohio communities.

As expected, to ensure the highest and best use of the region’s resources, a cost-benefit analysis is required for each alternative considered, including a no-build alternative in the Feasibility Study. The total construction and operation and maintenance costs are considered as the total cost of the project and the congestion, safety and emission cost savings are the project benefits. In the analysis, NOACA utilizes United States Department of Transportation (USDOT) guidelines for its “Benefits/Cost Analysis” for major transportation infrastructure projects, including approach, methods, standards, values, etc.

Furthermore, the first step of the “Local and Regional Impact Criteria” is a good example of the more comprehensive scope of the policy is: “NOACA will analyze the proposal through a set of rubrics to demonstrate whether the new or modified highway interchange maximizes transportation-related benefits across all impacted communities.” In accordance, NOACA will:

1. Identify the impacted communities for either positive or negative impact.
    a. The community in which the new or modified highway interchange will exist, but also its immediate neighbors. These are the communities that may experience new transportation impacts and new development, or land use impacts, because of the new or modified highway interchange.
    b. There are other communities within the region, possibly not within the vicinity of the new interchange, which may experience a loss of existing or potential development or a gain of such development because of the new interchange. Some communities may realize these gains/losses immediately based on development driving the new or modified highway interchange (e.g., the relocation of an existing company within the region). Some communities may realize gains/losses at a future time. Losses are particularly critical to the analysis if regional population growth remains stagnant. In this scenario, the new interchange may create development opportunities within its vicinity that were not previously available or as desirable. Such opportunities may draw development from communities where it currently exists or entice future development to locate near the new interchange versus another community where that development may have occurred if the new interchange were not built.

(Cleveland: NOACA, April 2019), https://www.noaca.org/home/showpublisheddocument?id=13137 (accessed May 29, 2025)

[81] Northeast Ohio Areawide Coordinating Agency (NOACA), *New or Modified Highway Interchange Projects Policy,* (Cleveland: NOACA, 2020), https://www.noaca.org/home/showpublisheddocument?id=25793 (accessed May 25, 2025)

2. Identify the benefits/costs to the impacted communities (including the condition of existing regional transportation assets, social equity impacts, and cost of development incentives packages at local, regional and state level as well as cost of capital infrastructure investment).
    a. Community within which the new interchange will exist.
    b. Communities in close proximity to the new interchange.
    c. Communities potentially far from the new interchange that may experience impacts from existing and future development shifts from their locations to the vicinity of the new interchange.

NOACA Projects

The programs and policies described above have also led to the implementation of key projects with important economic development components. While not an exhaustive list, this section describes a few recent efforts.

Irishtown Bend

Irishtown Bend is a sharp turn in the Cuyahoga River near downtown Cleveland. This section of the Cuyahoga River is a major shipping corridor for the steel industry, among others. Shipping through the channel supports 23,758 jobs and $7.1 billion in yearly economic activity across the region, according to an economic analysis presented within a report prepared for the Ohio Department of Transportation (ODOT): "Ohio Maritime Plan Working Paper 4: Economic Impacts of the Ohio Maritime System."[82] Along the riverbank, support systems known as bulkheads prevent erosion of the hillside into the river. The bulkheads are decades old and degraded, which threatens bank stability and risks a catastrophic landslide. Such an event would completely shut down shipping, threatening jobs and economic activity. NOACA worked to secure more than $9 million in federal funding to reconstruct the bulkheads, and the agency has also committed another $7.5 million to support this effort. Several other partners, including the Port of Cleveland, Northeast Ohio Regional Sewer District (NEORSD), and the City of Cleveland will contribute additional financial support. Construction of the slope stabilization project began in July of 2023 and is estimated to be completed by December of 2025. After reconstruction, there are plans for a hillside park to benefit current Ohio City stakeholders, as well as future businesses and residents.

Hyperloop

NOACA entered into a public-private partnership with Hyperloop Transportation Technologies (HyperloopTT) to conduct a Hyperloop feasibility study. Hyperloop TT is developing a transportation system that brings airplane speeds to the ground safely, efficiently, and sustainably. Passenger and cargo capsules levitate above a track inside a tube through electromagnetic technology, with a linear electric motor for propulsion. Hyperloop will move passengers and goods between cities in minutes, rather than hours (see also Chapter 9).[83] The completion of a feasibility study places Greater Cleveland in a good position to capitalize on the creation of this high-speed and zero emission transportation system that will transform how regions are defined. The "Great Lakes Hyperloop" as the corridor originating from Cleveland to Chicago (with stations in Sandusky, Toledo and South Bend) and Cleveland to Pittsburgh (with a

[82] Martin Associates, Ohio Maritime Plan Working Paper 4: Economic Impacts of the Ohio Maritime System https://www.clevelandmetroparks.com/getmedia/75132924-5347-4a3b-8c76-851a08175927/Ohio-Maritime-System-Economic-Impacts-Working-Paper-4.pdf
[83] NOACA, "Great Lakes Hyperloop: What is Hyperloop?" 2019, https://www.glhyperloopoutreach.com/

station in Youngstown) is identified, presents an opportunity to capitalize on the assets of the largest mega region in the country containing nearly a third of the nation's economic activity, Hyperloop will open up these new metro regions as potential places of employment for Greater Cleveland residents in realistic commute times of less than 45 minutes. Furthermore, with spurs connecting to Pittsburg, Detroit, Toronto, Milwaukee, Buffalo and ultimately connecting to the northeast corridor (Boston, New York, Philadelphia, Washington DC), Cleveland is perfectly positioned between the east coast with nation's largest city, New York and the nation's capital, Washington DC, and the Midwest, with the third largest city in the United States, Chicago.

Air cargo is the fastest growing mode of freight movement, and it delivers the highest-value goods, such as pharmaceutical and biomedical products that are especially important in the healthcare sector. Further, the fastest growing segment of goods shipped is parcel service, which describes packages shipped by USPS, FedEx, UPS, etc. Hyperloop, if realized, will be faster than airplanes and several times faster than trucks, making it well-suited to capture air cargo and parcel delivery in a faster and more environmentally friendly way. With Hyperloop utilized both for passenger transport as well as freight, the regional economic benefits are substantial (see Table 5-35).

Table 5-35. Hyperloop Regional Economic Benefits (2025-2050)

Regional Economic Benefits 2025-2050						
Station Name	Income	Property Value	Employment	Property Tax	Local Tax	Income Tax
Unit	$millions	$millions	person year	$millions	$millions	$millions
Chicago, IL	21,555	34,045	425,628	570	919	4,225
South Bend, IN	3,503	5,457	67,755	95	150	682
Toledo, OH	3,189	5,169	64,306	85	136	650
Hopkins Airport, OH	1,946	3,037	37,928	52	82	392
Cleveland, OH	7,890	12,257	153,169	214	336	1,575
Youngstown, OH	1,888	2,994	36,592	50	79	373
Pittsburgh, PA	7,605	11,882	146,367	206	319	1,505
Total	**47,577**	**74,842**	**931,745**	**1,273**	**2,021**	**9,401**

NOACA continues to work with HyperloopTT and the U.S. Department of Transportation on the development, safety, and regulation of this potentially transformative mode of travel.[84]

Electric Vehicle (EV) Charging Stations

NOACA plans to install dozens of publicly available electric vehicle (EV) charging stations across the region. Electric vehicles have become more popular in recent years, and that trend is expected only to grow as businesses and consumers become increasingly conscientious about climate change. Similar to roads, sewers, broadband, and other utilities, EV charging stations will be a necessary infrastructure component to keep and attract businesses and residents.

NOACA plans to site these stations equitably, so they are accessible for historically underserved areas of low-income and minority residents.

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[84] Transportation Economics and Management Systems in Cooperation with Hyperloop Transportation Technologies, "Great Lakes Hyperloop Feasibility Study," Prepared for NOACA, 2019; https://df8e02a7-c9d7-45bc-89b0-ebfa2d7bf712.filesusr.com/ugd/96eba3_e0b8f11c5e4548f9b4fdc6e1cdd00d6d.pdf (accessed May 29, 2025)

Comprehensive Economic Development Strategy (CEDS)

The U.S. Economic Development Administration (EDA) recommends a regional Comprehensive Economic Development Strategy (CEDS), a strategy-driven plan to bring together stakeholders and the general public to develop consensus around economic development goals and a strategy to meet them.[85] NOACA's regional standing is directly attributed to its stakeholders and allows the stakeholders to engage in meaningful conversation on how economic growth should occur in the region. NOACA began development of its CEDS in 2022, and it was approved by the U.S. Economic Development Administration (EDA) in the Spring of 2023. More than 20 regional agencies and partners came together to develop the CEDS which provides the foundation for stakeholders to align funding and create the proper environment for regional economic prosperity

The CEDS Steering Committee and Working Group were the architects of the document which identified seventeen key topic areas from review of existing plans, statistical data, stakeholder input, surveys, and a Strength, Weakness, Opportunity and Threat (SWOT) analysis. The SWOT analysis process revealed the following key topic areas:

- Access to Broadband
- Aerospace / NASA Glenn
- Agriculture
- Cultural Amenities
- Education
- Equity
- Healthcare
- Housing
- Immigration
- Innovation and Entrepreneurship
- Institutions – Regional Collaboration, and Urban and Rural Connectivity
- Manufacturing
- Parks and Recreation
- Tourism
- Transportation
- Water Resources
- Workforce Development

The topics are interrelated areas to be addressed by the CEDS. Each topic area addresses strategies, outcomes, and potential partnerships. The CEDS also contains strategic direction and an action plan and should incorporate and be incorporated into other local and regional planning efforts. It is a document that requires implementation and maintenance.

NOACA's formation of the Economic Development Subcommittee and its role as the MPO responsible for multimodal transportation planning indicates a commitment to implement and maintain the CEDS. In January 2024, NOACA requested EDA approval to be designated as an economic development district (EDD). An EDD regulates regional economic development. Moreover, an EDD receives planning funding to maintain and implement the CEDS process.

Integration of Land Use and Transportation

Economic growth depends on linking land use and transportation which is key to sustainable

[85] U.S. Economic Development Administration, "Comprehensive Economic Development Strategy (CEDS): CEDS Content Guidelines"; https://www.eda.gov/ceds/ (accessed May 29, 2025)

infrastructure and development. Successful integration of land use and transportation involves thorough analyses of communities to determine the transportation needs of residents and assessing results with land use patterns to tailor transportation infrastructure investments to each community.

NOACA is well-suited because of the role transportation plays in economic growth (see previous sections on NOACA programs and policies). The nonprofit Center for Neighborhood Technology (CNT) has an Urban Opportunity Agenda scorecard that analyzes a variety of poverty reduction strategies to spur equitable growth. It found that job access and transportation would have the single largest impact of any metric studied, followed by workforce development.[86]

Transportation planners, in collaboration with economic development stakeholders, can best position Northeast Ohio to realize these economic and quality of life improvements.

The results of NOACA's Regional Survey demonstrate how stakeholders perceive the relationship between transportation mode and future job growth and economic development (see Table 5-36). Personal vehicles, public transportation, walking and working closer to home received the highest average scores across the region. When respondents are separated by geography, the reader can also see that airplanes received a very high score among Cuyahoga County respondents and personal vehicles received the highest score among Geauga County respondents. The fact that public transit, walking, and working closer to home all received very high scores suggests TOD may hold considerable promise as a development strategy in Northeast Ohio. Co-locating dense clusters of residents and jobs around transit stations should be a high priority. Conversely, autonomous vehicles, which have not yet entered the mainstream transportation system, received the lowest scores important for future job growth and economic development.

Table 5-36. NOACA Regional Survey Respondents Ranking of Travel Modes for Future Economic Development

	Importance of Travel Options for Job Growth and Economic Development						
Ratings for Future Travel Options *5 = Highest* *1 = Lowest*	**NOACA Region**	**Cleveland**	**Cuyahoga**	**Lorain**	**Lake**	**Medina**	**Geauga**
BASE	**2,459**	**445**	**1,084**	**362**	**271**	**207**	**91**
Personal vehicle	**4.45**	4.35	4.45	4.44	4.57	4.48	4.75
Public transportation	**4.04**	4.07	4.14	3.99	4.00	3.80	3.67
Walking	**3.98**	4.16	3.96	3.94	3.97	3.80	3.97
Working closer to home[87]	**3.97**	4.16	3.93	3.96	3.97	3.80	3.86
Airplanes	**3.92**	3.90	4.04	3.85	3.84	3.68	3.45
Telecommuting	**3.67**	3.58	3.75	3.64	3.61	3.50	3.77
Bicycles	**3.55**	3.74	3.53	3.54	3.52	3.40	3.40
Uber, Lyft	**3.50**	3.63	3.53	3.44	3.39	3.32	3.36
Carpools or vanpools	**3.40**	3.47	3.40	3.43	3.39	3.25	3.21
Amtrak rail	**3.32**	3.50	3.37	3.28	3.19	3.04	3.02

[86] Center for Neighborhood Technology, "Cleveland, Ohio: Urban Opportunity Agenda Summary Report," https://uoa.cnt.org/location.php?addr=Cleveland,%20Ohio#report (accessed May 29, 2025)
[87] People working closer to home

Connected vehicles[88]	**3.21**	3.28	3.20	3.25	3.19	3.07	3.13
Greyhound buses	**3.20**	3.44	3.20	3.13	3.18	2.93	2.91
Taxis	**3.09**	3.25	3.06	3.05	3.03	3.06	3.09
Charter buses	**3.07**	3.30	3.07	2.99	3.03	2.85	2.95
Scooters[89]	**2.93**	3.15	2.88	2.86	2.99	2.82	2.79
Motorcycles	**2.89**	2.98	2.82	2.92	3.03	2.81	3.01
Service autonomous vehicle	**2.88**	3.06	2.87	2.80	2.79	2.91	2.75
Personal autonomous vehicle	**2.88**	3.05	2.85	2.88	2.84	2.85	2.79
Commercial autonomous vehicle	**2.85**	3.03	2.82	2.81	2.83	2.81	2.68

Other Economic Development Strategies

Additional strategies and tactics by other organizations also merit discussion as ways to enable employment; some have been around for decades to foster business and job growth. The following is not meant be an exhaustive list, but it describes several well-known and frequently used strategies and places them in regional context. It is important to note that NOACA does not actually provide these strategies, such as tax incentives. However, NOACA does acknowledge these strategies as economic development tools; thus, consideration is given to their relationship to transportation and environmental planning.

Tax Incentives

Tax incentives are possibly the most widely known method of economic development. It is important to understand tax structures and why they matter, which also explains why economic development matters. Tax incentives are designed to incentivize or encourage a particular economic activity with the goal of raising the overall economic welfare of individuals through increasing economic growth. Tax incentives can have both positive and negative impacts on the economy, however. Among the positive benefits, if implemented and designed properly, tax incentives can draw investment to a region, mostly through business attraction and retention, resulting in higher levels of employment, population growth and a stronger tax base, and ultimately an improved quality of life. If tax incentives are not properly structured and executed, they can result in intra-regional competition that is not in the best interest of a long term strategy for a thriving region. They can also have the unintended consequence of weakening certain components of a tax base, such as funding for schools, and result in an inequitable distribution of the tax burden between residents and businesses.

Brownfield Redevelopment

Brownfields are vacant or abandoned properties that, based on previous uses, are known or expected to have some type of pollutant on site.[90] Businesses often avoid them because they are then legally liable for cleanup, which can be cost prohibitive. The business that polluted the site typically has no legal responsibility because it either no longer exists or produced the pollutants so long ago that relevant laws and regulations were not in place.

Brownfield cleanup and redevelopment is a priority for economic development in the region.

[88] Connected vehicles to enable crash avoidance Popup: also called V2V - vehicles (not drivers) communicate and alert drivers to upcoming danger, hazards, and potential crashes
[89] Scooters (electric, mobility)
[90] U.S. Environmental Protection Agency, "Overview of EPA's Brownfields Program," https://www.epa.gov/brownfields/about (accessed May 29, 2025)

NOACA's CrowdGauge Tool (see Chapter 4) showed that "redevelop 200 acres of brownfields to attract new employers with 1,000 jobs" was the number one choice by respondents on how to spend regional economic development dollars. Additionally, "I live in an environment with clean water" was the top priority overall and ranked highest in four of five counties. NOACA's Regional Survey results were a bit more mixed (Chapter 4): investment in brownfield cleanup and redevelopment was one of the lowest "willingness-to-spend" priorities across the region, but reduce climate change impacts, cleaner rivers and lakes, and clean drinking water were some of the highest. U.S. EPA data show that brownfield remediation investment has large benefits for climate change impacts, water quality, and air quality. Brownfield remediation also reduces the need for road expansion, which means more available money for maintenance.[91]

Many cities or counties in the region already have robust brownfield cleanup programs to enable redevelopment. Communities typically work with stakeholders such as chambers of commerce and land banks to identify potential sites based on what is known about the previous use.

Importantly, there is no requirement for a brownfield declaration to a public entity such as Ohio EPA, which has funding programs and maintains a brownfield database; it is voluntary. The community, sometimes in partnership with an interested developer, will then conduct soil and water testing for the presence of hazardous substances. If found, the community and developer (if there is one) will then attempt to obtain funding.

In December of 2022, the NOACA Board of Directors approved a Memorandum of Agreement (MOA) with Vibrant NEO to form the NOACA-Vibrant NEO Brownfield Coalition (Coalition). The Coalition received a $1,000,000 grant from the US EPA to create a revolving loan fund (RLF) for brownfields remediation projects across 12 Northeast Ohio counties: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, and Wayne. Target areas within these counties are Vibrant NEO-defined Strategic Reinvestment Areas or Asset Risk Areas; these are areas with a high density of community assets and existing infrastructure to support redevelopment.

The funding from the RLF is strictly for cleanup activities, so environmental assessments and demolition are not eligible. 9Funds from the NOACA-Vibrant NEO Brownfields RLF can be used towards ODOD's 25% match requirement of grant recipients, making the RLF a valuable resource in gap funding for remediation projects.

In March of 2023 the NOACA Board of Directors approved a resolution that created a Brownfields Steering Committee to develop and implement the RLF grant. The Steering Committee consists of elected officials and subject matter experts identified by the three participating regional planning agencies of Vibrant NEO – Eastgate Regional Council of Governments (Eastgate), Northeast Ohio Four County Regional Planning and Development Organization (NEFCO), and Northeast Ohio Areawide Coordinating Agency (NOACA). It consists of 29 members, 26 of whom are voting members. Several of the subject matter experts include county land banks, who are responsible for ODOD Brownfield Remediation Program fund administration. These members bring tremendous value to the Coalition as their familiarity with state-funded projects presents opportunities for the RLF to add support.

The Steering Committee helps the Coalition to:

- Review applications that request RLF money for brownfield remediation through the objective selection criteria agreed upon in the NOACA-Vibrant NEO Brownfields MOA
- Conduct due diligence and underwriting of loan applicants

[91] U.S. Environmental Protection Agency, "Brownfields Program Environmental and Economic Benefits," https://www.epa.gov/brownfields/brownfields-program-environmental-and-economic-benefits

- Draft loan/subgrant agreements, including (but not limited to): determination of loan or subgrant, dollar amount, interest rate, payback period, etc.
- Recommend projects and funding to the NOACA and Vibrant NEO Boards of Directors or their appropriate committees and present to those bodies as needed
- Other tasks as necessary

NOACA retains a Qualified Environmental Professional (QEP) to assist staff with ensuring that the brownfields sites are remediated to the standard necessary for redevelopment. The QEP assists NOACA staff with U.S. EPA compliance, as that individual:

- Prepares all documentation related to site remediation required by US EPA, including the Eligibility Determination, Analysis of Brownfields Cleanup Alternatives (ABCA), and Community Involvement Plan (CIP)
- Oversees remediation activities
- Provides site contamination and remediation to residents to allow for feedback related to cleanup alternatives

NOACA staff developed a NOACA-Vibrant NEO Brownfields Revolving Loan Fund Application, available on NOACA's website. Staff utilized the vast network of members from the Brownfields Steering Committee and Vibrant NEO Board of Directors to market the program and solicit applications. In the first round of funding consideration, NOACA received four applications, but only deemed one eligible.

The Brownfields Steering Committee met in October of 2023 to review its first application, and made a recommendation to offer a loan to the City of Middleburg Heights (Cuyahoga County) in the amount of $500,000; the Steering Committee also recommended general terms and conditions for loans made from the RLF:

- 0% interest
- 10-year repayment
- Recipient's contribution: 20%
- Fees: 0.5% (maximum of $2,000)

The Boards of Directors of NOACA and Vibrant NEO approved the recommendations, and upon execution of the loan with Middleburg Heights, the Coalition became eligible to apply for US EPA supplemental funding.

The Coalition received an additional $1,000,000 from US EPA in 2024, which allowed more loans. As of December 31, 2024, the Boards of Directors had approved four projects, totaling $1,508,000, for remediation.

PROJECT #1: Former Sears and Sears Auto Site
Recipient: City of Middleburg Heights, Cuyahoga County; $500,000
18.79 acres
Asbestos remediation prior to demolition of former Sears and Sears Auto
Planned reuse: Mixed-use, commercial/residential
400 temporary jobs expected: $30-50/hour wages
270 permanent jobs expected: $18-24/hour wages

PROJECT #2: MLK Plaza Site
Recipient: NREUV MLK Plaza, LLC, Cuyahoga County; $300,000
4.65 acres
400 yards from Doan Brook
Vibrant NEO Asset Risk Area

Environmental Justice Community
Planned reuse: Affordable multi-family housing with mixed-use retail
150-300 temporary jobs expected: $16.20/hour wage
25-30 permanent jobs expected: $20/hour wage to $70,000 salary

PROJECT #3: Firestone Park Site
Recipient: City of Akron, Summit County; $500,000
33 acres
Asbestos remediation prior to demolition
Vibrant NEO Strategic Reinvestment Area
Environmental Justice Community
Planned reuse: Industrial polymer technology manufacturing
150 temporary jobs expected: $20/hour wage
100 permanent jobs expected: $20/hour wage

PROJECT #4: Laisy Avenue-East 93rd Street Site
Recipient: Cuyahoga County Land Reutilization Corporation, Cuyahoga County; $208,000
11.75 acres
Subsurface remediation of hazardous substances; closure and removal of petroleum Underground Storage Tanks (UST)
Vibrant NEO Strategic Reinvestment Area
Environmental Justice Community
Planned reuse: Industrial manufacturing
65 temporary jobs expected: $20/hour wage
100 permanent jobs expected: $20/hour wage

These projects will provide the communities with prime opportunities for redevelopment and employment (765 temporary construction jobs and 500 permanent jobs). As recipients repay loans, funds will become available for new projects. The Coalition anticipates that it will qualify for more supplemental funding in 2025, if available.

Greyfield Redevelopment

Greyfields are former commercial shopping centers or strip malls that are now abandoned.[92] Unlike brownfields, there is no known or expected risk of pollutants on a greyfield. There are also no funding mechanisms specific to greyfields; however, they are similar to brownfields in that redevelopment is often more expensive than new construction. For this reason, the tax incentives may be good options for greyfield redevelopment, especially if it is around transit stations.

Infrastructure Investment

Infrastructure is essential for place-based development. It is important to describe the types of infrastructure, and the best location and time for both maintenance and expansion to foster equitable economic growth.

Transportation

Transportation is often used as an incentive for economic development because it serves as a critical mechanism for commerce. Whether promoting an existing rich transportation system or providing new transportation infrastructure such as building a new interchange, widening roads,

[92] Delaware Valley Regional Planning Commission, "Brownfields/Greyfields," https://www.noaca.org/home/showpublisheddocument?id=6639 (accessed

or extending transit service, transportation serves as the conduit to getting people to jobs and product to the market.

NOACA's recently approved New or Modified Highway Interchange Projects Policy will help guide staff review of the proposed interchange for, and the Board's deliberation of, its impacts. Asset management tools such as NOACA's TAMP policy, described earlier, can also help the Board weigh expansion of existing capacity against repair of existing infrastructure and make the best use of limited funding.

Water and Sewers

Water infrastructure investment is similarly a key incentive for economic development. Existing water and sewer lines allow for continued development or re-development to proceed without much cost or regulatory concerns, while new infrastructure comes with a cost and may require the expansion or modification of Facility Planning Areas as a prerequisite for development, with the latter generating the need for financial incentives.

Utilities

Other infrastructure is critical to business siting and success as well; most electric and natural gas utilities have economic development departments that work with local officials and businesses to expand these services, particularly into industrial parks that have large demands. As with roads and sewers, investment in utility infrastructure can sway business-siting decisions. Utilities often extend services in greenfields, particularly in more newly developed communities that seek to attract businesses and the accompanying tax benefits.

Internet

Broadband internet access has become increasingly important for all businesses to access and share information quickly and easily. Private internet service providers may also have economic development departments to facilitate high-speed internet access. However, the private sector is sometimes unwilling or unable to take on the cost.

Internet access is especially important from an equity perspective to ensure access to education, jobs, healthcare and more. Table 5-37 includes Census data that shows the entire metropolitan region has improved regarding internet access and is less likely to have internet access than the nation. Internet access in Cuyahoga and Geauga counties, and the City of Cleveland has improved, but still trails the state and the nation.

Table 5-37. 2023 NOACA Region Households without Internet Access[93]

Location	Percent of Households with No Internet Access
Cuyahoga County	9.4%
Geauga County	11.9%
Lake County	5.9%
Lorain County	7.7%

[93] U.S. Census Bureau, "2023 American Community Survey, Types of Computers and Internet Subscriptions, Table S2801," https://data.census.gov/table?q=S2801:+Types+of+Computers+and+Internet+Subscriptions&g=010XX00US_040XX00US39_050XX00US39035,39055,39085,39093,39103_160XX00US3916000_310XX00US17410

Medina County	5.4%
Cleveland-Elyria MSA	8.6%
City of Cleveland	14.6%
Ohio	8.7%
United States	7.8%

Source: U.S. Census Bureau

A nonprofit organization analyzed 2019 Census data not just for internet access, but also for the extent to which households are actually connected to high-speed internet in every city in the country with at least 65,000 residents.[94] It found Cleveland ranked last in both the state and the nation; the City of Lorain ranks second-to-last in the state.[95] More than 30% of Cleveland households didn't have fast internet, and without considering phone-based access, 46% of households had no internet at all. The Greater Cleveland economy will compete for businesses and residents as high-speed internet access is available for all.

Joint Economic District (JEDD) and Cooperative Economic Development Agreement (CEDA)

JEDD and CEDA are tools to foster collaboration between cities and their surrounding townships that were designed by the Ohio legislature to expand infrastructure, yet alleviate the concerns about the creation of winners and losers. *Vibrant NEO 2040* has a special research section devoted to them.[96] Both programs attempt to extend infrastructure and municipal services from a city into a township to promote development that both parties agree is beneficial. In the case of a JEDD, the city can collect income taxes from the township.

The programs have successfully fostered cooperation where the parties used to be in conflict around development. Townships receive increased property tax revenues from additional development, while cities receive increased revenues from: 1) water or sewer service provision, city residents employed by new businesses within the boundaries of the JEDD or CEDA, or new income taxes (in the case of JEDD).

An example from 2020 illustrates the risk and rewards. A certain business announced plans to open a major retail outlet in a township in the NOACA region. With 400 projected jobs and a payroll of $13 million, it will be one of the largest employers in the township and provide increased tax revenues for services and amenities. The state provided a Job Creation Tax Credit for this reason; TIF is also planned. The Ohio Department of Transportation will provide another incentive through its Jobs and Commerce Division to redesign a nearby intersection and signal system. Because the site is in a township, it lacked some necessary infrastructure to provide certain services for a business of this magnitude. To provide it, the township entered into agreements with nearby cities that will then share in the benefits of the project through tax- revenue sharing or service payments for utilities. This is a good example of regional collaboration that creates benefits for multiple communities.

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[94] National Digital Inclusion Alliance, "Worst Connected Cities 2019," 2020, https://www.digitalinclusion.org/worst-connected-cities-2019/

[95] Emily Bamforth, "Cleveland Ranks as Worst-Connected Large City for Internet in 2019," *Cleveland.com*, Sept. 23, 2020; https://www.cleveland.com/news/2020/09/cleveland-ranks-as-worst-connected-large-city-for-internet-in-2019.html (Accessed May 29, 2025)

[96] Northeast Ohio Sustainable Communities Consortium and Sasaki, *Vibrant NEO 2040: A Vision, Framework, and Action Products for Our Future,* (February 2014). , 115; https://vibrantneo.org/wp-content/uploads/2014/03/Outward_MigrationsBarriers_Redevelopment.pdf (accessed May 29, 2025)

Conversely, the financial incentives for this project also result in the expansion of infrastructure that creates long-term infrastructure maintenance obligations as well as risk of increased water pollution and flood risk due to the impervious surfaces. As legacy industrial cities, the nearby cities have vacant or abandoned properties that are already well served by road and sewer systems. Unfortunately, these sites did not meet the company's requirements. Additionally, the business will compete with others in a region with stagnant population, so 400 new jobs at this location does not necessarily mean a net increase of 400 jobs for the region.

Special Improvement Districts (SIDs) and Community Development Corporations (CDCs)

The same *Vibrant NEO 2040* special research section that addressed JEDD and CEDA also describes SIDs and CDCs, which have both increased rapidly through the region with the creation of supportive state legislation.

A Special Improvement District (SID) stems from most property owners in a given geographical area (for example, a downtown business district), who agree to impose a special assessment to voluntarily increase their own taxes, with the funds targeted exclusively within the SID boundary to fund improvements, such as infrastructure maintenance or improvements, including transportation. Their success and popularity even led the state to create an additional form, known as an Energy SID, or ESID, that uses the special assessment to install renewable energy infrastructure or energy efficiency upgrades.

Community Development Corporations (CDCs) often take the lead to secure business owner support for a SID. CDCs are nonprofit organizations that provide a variety of programs and services to support both business and housing development within their boundaries.

CDCs cover the entire City of Cleveland, as shown in Table 5-37, but are not found elsewhere in the region. This is likely because the city provides funding to CDCs through its Community Development Block Grant (CDBG) program. There is no official tax identification or government certification to qualify as a CDC, however; many other organizations in different parts of Northeast Ohio may play similar roles without this specific label.

Table 5-38. Cleveland Community Development Corporations[97]

East	West	Downtown
Burten, Bell, Carr Development	Jefferson-Puritas West Park Community Development Corporation	Campus District, Inc.
Greater Collinwood Development Corporation	Northwest Neighborhoods Community Development Corporation	Downtown Cleveland Alliance
Fairfax Renaissance Development Corporation	Ohio City, Inc.	Historic Gateway Neighborhood Corporation
Famicos Foundation	Old Brooklyn Community Development Corporation	Historic Warehouse District Development Corporation
Harvard Community Services Center	Metro West Community Development	Flats Forward
Little Italy Redevelopment Corporation	Tremont West Development Corporation	
Midtown Cleveland, Inc.	Westown Community Development Corporation	
Mt. Pleasant NOW Development Corporation		

[97] Cleveland Neighborhood Progress, "Cleveland CDCs," http://www.clevelandnp.org/cleveland-cdcs/

Slavic Village Development		
St. Clair-Superior Development Corporation		
NuPoint Community Development Organization		
University Circle, Inc.		

Source: Cleveland Neighborhood Progress

CDCs and SIDs focus on redevelopment and revitalization and regularly work with city officials and other government entities; they are examples of successful public-private partnerships.

CDCs regularly collaborate with the City of Cleveland to apply for many NOACA grants that spur transportation improvements and enhance quality of life. Because the area CDCs are all in Cleveland, these partnerships are a great way to foster infill and transit-oriented development to make the best use of existing infrastructure and improve equity.

Education and Medicine (Eds and Meds)

The Education and Medicine (Eds and Meds) economic development strategy builds on a place-based approach; educational and healthcare institutions are local and regional anchors tied to a given place. Residents will always need these services, and the institutions that provide them cannot easily move to a different region of the country or overseas. These industries are also difficult to automate. As noted earlier in this chapter, healthcare is also the most innovative industry, which supports further business and job creation. These are all reasons that University Circle, home to multiple educational and healthcare institutions, is one of the major regional job hubs of Greater Cleveland. Healthcare and social assistance is also the largest sector in the Chagrin Highlands job hub.

A robust healthcare system is critical not just for the jobs it creates, but also for the care it provides. Public health interventions significantly impact economic development when people live healthier and longer lives. David Bloom, a professor of Economics and Demography at Harvard University, summarized research that shows public health interventions often have significant positive impacts on economic growth, in an interview with Boston-based journalist and author Michael Blanding.[98] Healthcare providers and public health departments should therefore be considered critical economic development stakeholders. Connection of underserved communities to healthcare through multimodal transportation should be a critical task.

Climate Change and Pollution

As described in detail in Chapter 8, the release of greenhouses gases into the atmosphere from a variety of sources (e.g., transportation and electricity generation) can cause climate change.[99] This means that the development of Northeast Ohio's economy—where and how it occurs—will either mitigate or exacerbate the negative impacts of climate change and environmental pollution. Much will depend on increased or decreased energy and transportation demands. The implementation of strategies identified in eNEO2050, such as workforce mobility efforts to improve the special mismatch between jobs and housing, will reduce congestion, commute times, and vehicle miles traveled, which will benefit air quality and reduce the threat of climate change. TOD

[98] Michael Blanding, "Public Health and the U.S. Economy," *Harvard T.H. Chan School of Public Health*, Fall 2012 https://www.hsph.harvard.edu/news/magazine/public-health-economy-; election/#bloom
[99] U.S. Environmental Protection Agency, Climate Change Indicators: Greenhouse Gases," https://www.epa.gov/climate-indicators/greenhouse-gases (accessed May 29, 2025)

and nonmotorized forms of transportation within and between job hubs and freight hubs will further facilitate a reduction in single occupancy vehicles and mobile emissions.

Regional stakeholders should therefore prioritize multimodal infill for residential, commercial, and industrial development to the greatest extent possible. As described throughout this chapter, this is the best strategy for both economic development and to mitigate climate change and environmental degradation. This is important from an economic standpoint because several key pieces of the regional economy face high exposure to climate risks. Major industries, as well as human health, depend on clean air, water, and soil, and predictable weather patterns. Please see Chapter 8 for more details about the causes of, and potential impacts from, climate change and environmental pollution.

Where Do We Go From Here?

The Northeast Ohio development footprint has expanded, despite stagnant population over the past 50 years. Infrastructure investment in roads, highways, and interchanges has facilitated this spread, often accompanied by tax incentives that shifted economic activity within the region. The same level of investment has not occurred in public transportation. As a result, low-income and minority populations, many of whom live in zero-care households and/or communities traditionally underserved by existing transportation systems, have reduced levels of accessibility to jobs as the gap between housing and jobs increased. It takes a combination of land use and transportation changes to shrink this gap, and the four future transportation scenarios outlined in this long-range plan detail different paths NOACA can take to address this disconnect. The more successfully NOACA can knit housing and jobs together through multimodal transportation choice, the more likely the region will experience the type of economic development and job growth that benefits everyone, especially low-income and minority stakeholders.

An expanded footprint with a declining population also costs more, as infrastructure investments for anticipated population growth that never materialized place a heavier maintenance burden on fewer people. This results in deficient infrastructure and/or higher taxes, often both. Poor and minority residents are disproportionately affected, and the combination of poor infrastructure and high taxes may also deter business retention, expansion, and attraction.

Future Development Scenarios

Between 2021 and 2050, there are several different, potential paths for the NOACA region to follow. Each path leads to a different future—what planners call a “future scenario” (see Chapter 3). Future scenarios are predictions of how the region will evolve by 2050 and what will happen over the next 30 years. NOACA developed four scenarios based on different priorities

and investment levels for transportation infrastructure, with particular focus on worker accessibility to jobs. Chapter 9 presents, analyzes, and compares these four future scenarios (MAINTAIN, CAR, TRANSIT, and TOTAL) in great detail; however, brief summaries of these future scenarios, the measures used to compare them, and their implications for NOACA recommendations and implementation plan actions follow below, with particularly emphasis on economic development and employment growth.

Scenario 1: MAINTAIN – State of Good Repair

Scenario 1 focuses solely on maintenance of the existing transportation system, with no expansion of roads, bridges, highways, or public transit. The scenario assumes decreasing population and employment.

While the population of the region and total households will both decrease, slight new housing starts and demand for new housing will likely remain as NOACA will prioritize projects to maintain roads and highways with good access to job hubs. An emphasis on maintenance will likely encourage continued outward migration of the region and continued deconcentration of development in the urban core. Average commute times will likely decline slightly, but so will the number of people and jobs within a 15-minute (3/4-mile) walk of a transit (rail or bus) station. Modal choice will not expand under the MAINTAIN scenario; it's all about a state of good repair with regard to what the region currently has, not new investment.

Given the continued outward spread of people and jobs, there will be only limited demand for more multi-family, urban housing and continued demand for single-family, suburban housing. Regardless, the existing population of aging Baby Boomers will create demand for accessible, affordable housing of all types (independent living through skilled nursing levels). A demand for housing that allows individuals to "age in place" could be part of some developments and could grant access to transit, dining, entertainment, shopping, healthcare resources, and other essential needs.

Limited redevelopment and revitalization in traditional urban core communities and inner-ring suburbs is expected with population loss; however, some urban infill projects may persist where professionals and retirees demand housing (high-end, workforce type mix) in urban areas.
Increased transportation costs from more driving and less transit may strain household budgets a bit, but the improved state of existing roads may reduce vehicle maintenance needs and insurance premiums.

MAINTAIN will continue the housing trends of the past few decades; there will be little to no change.

Scenario 2: Captivating Auto Region (CAR) – Single Occupancy Vehicles

In Scenario 2, road capacity expansion is the priority. This includes new and improved infrastructure (roads, highways, bridges, interchanges), shorter travel times through traffic signal timing optimization, reduction of highway bottlenecks, ramp metering,[100] and reduced commutes to job hubs. Like Scenario 1 (MAINTAIN), CAR assumes modest decrease in population, households, and employment by the year 2050.

Despite the expected loss of population and total households in the CAR scenario, improved and expanded highways will accelerate existing migration of people and jobs to peripheral areas of the region. Moderate to high new housing starts should occur in more rural and exurban areas, even outside NOACA entirely, due to fast and easy access to job hubs. New highway access points will continue to incentivize greenfield development while disincentivize greyfield and brownfield redevelopment. There will be less motivation for urban core infill and revitalization since a centralized location won't mean as much. Average commute times by car will likely decrease given the anticipated improvements and even greater capacity in the arterial and highway network.

The CAR scenario promises an expanded, efficient transportation system for drivers, likely decreasing the demand for housing near job hubs as workers can live anywhere in the region,

[100] Ramp meters are signal systems near the end of entrance ramps onto limited-access highways. The meters detect speed and occupancy of mainline lanes, allowing cars to enter the highway from the ramp at appropriate times to promote the most efficient flow of mainline traffic (retrieved 5.29.2025 from https://www.transportation.ohio.gov/programs/traffic-operations/its/02-its

provided they have access to a private, reliable vehicle. Job hubs may even see increased demand for parking since there will likely be an increase in the number of workers incentivized to drive. Though the emphasis on personal, single-occupancy vehicles will lower demand for multi-family, urban housing, it will continue to be a useful development strategy for seniors who need accessible, affordable housing of all types (independent living through skilled nursing levels). Such units will also be necessary for low-income individuals and families who may not be able to afford personal vehicles or single-family, suburban homes. Unfortunately for these groups, overall demand for transit will likely decline and transit investment will be an even lower priority for investments of transportation dollars. These groups will still need a mix of workforce and low-income housing, but it is unclear whether such housing can find a home in closer proximity to a major regional job hub.

CAR may slightly exaggerate the housing trends of the past few decades; there will be increased spread from the urban core and from major regional job hubs.

Scenario 3: TRANsportation System with Improved Transit (TRANSIT) – Multimodal Transportation System

Scenario 3, TRANSIT, is essentially the opposite of CAR (Scenario 2). TRANSIT expands all transit agencies in the region through implementation of BRT. TRANSIT also includes connections between transit stops and job hubs with autonomous shuttles and new pedestrian and bike routes. In Scenario 3, the projected 2050 population and employment is based on the same NOACA forecasts used in the MAINTAIN and CAR scenarios, plus reduced decreases.

The expanded BRT may increase the demand for TOD so people and employers can take advantage of greater modal choice, including transit, biking, and walking. More workforce housing in transit-accessible locations or near job hubs will be necessary. Housing demand, particularly demand for revitalized or repurposed housing in existing urban areas, may increase slightly. There will continue to be a need for accessible, affordable housing of all types for the aging population, and improved transit will increase options for dining, entertainment, shopping, healthcare resources, and other essential needs.

While TRANSIT does not necessarily help drivers, individuals who cannot afford personal vehicles will have greater mobility and can more easily access jobs. A transit mobile workforce should encourage companies and other employers to focus on and prioritize proximity to transit when they make location decisions.

Scenario 4: Transportation with Optimal Technology and Access for All (TOTAL) – Advanced Multimodal Transportation System

The fourth scenario, TOTAL, incorporates all projects in the CAR (save highway interchanges) and TRANSIT scenarios. Additionally, the TOTAL scenario includes technological advances such as elected smart freeway lanes to autonomous cars and trucks; extra electric vehicle charging ports; and autonomous shuttle buses to improve workers' accessibility to the regional major job hubs and transit hubs. The projected 2050 population and employment in TOTAL is about half the decreases of the MAINTAIN and CAR scenarios.

An expanded BRT network that connects regional job hubs of the NOACA region means the additional population (relative to MAINTAIN and CAR) is targeted for residential areas with easy and convenient access to these new transportation options and major job locations. How and if these denser, mixed-use transit connected neighborhoods materialize is certainly primary within the decision-making realm of local governments. Potentially, all five counties can benefit from this additional population if counties pursue transit investment and land use changes.

Scenario 4 should mean less stress on the transportation network with more workers on public transit and with shorter commutes due to workers who live closer to jobs and major transit stations. Scenarios 3 and 4 assume reduced population decline will occur in areas within five miles of the major regional job hubs and transit stops of the expanded BRT network. The five-mile radius encompasses both persons who would access the major regional job hubs and transit system via car, as well as those who might access these same locations through active transportation (biking, walking, etc.).

Performance Measures and Targets

Although Chapter 9 will present a much more detailed discussion and analysis of the four future scenarios mentioned above, this section details performance measures to assess progress toward economic development and employment growth. The performance measures are variables used to assess the scenarios comparatively against each other. There are two important values associated with each performance measure: the baseline and the target. The baseline is the value of the performance measure in the current state (2020). The target is the value of the performance measure in the future state (2050). One of the four future scenarios will be the preferred scenario, and its performance measures will be the target values NOACA will use to assess the region's progress from the current state to the preferred future state.

Table 5-35 illustrates the performance measures and targets focused on economic development and employment growth.

The outputs are presented in a specific way to help the reader digest the information clearly and concisely with the following guidelines:

1. The baseline represents current conditions (2020 conditions). The outputs reflect how the performance measure will change from the baseline to the target year (2050) under each of the four scenarios.
2. The "-" and "+" (minus and plus) signs shown as outputs for each performance measure under each scenario indicate the direction of change. A "-" (minus) sign indicates a decrease from the baseline and a "+" (plus) sign indicates an increase from the baseline. There are two sizes for each sign; they represent the magnitude of change (smaller signs indicate slight change; larger signs indicate more substantial change).
3. The colors of the signs and numbers for each output are also important. Red color indicates a negative impact on the region, while green indicates a positive impact on the region. While many people commonly associate "-" signs with a negative impact and "+" signs with a positive impact, that is not always the case. It is possible to have a red "+" sign, meaning the value of that performance measure will increase under a scenario, but that increase is a negative impact on the region.
4. Many of the performance measures in Table 5-39 are qualitative. To help the reader interpret the differences across scenarios, consider the performance measure, "more investment in 23 CFR 450.316(1)(vii) areas?"
    a. MAINTAIN: Maintenance of the status quo will likely yield similar investment in 23 CFR 450.316(1)(vii) areas as exists now.
    b. CAR: Prioritization of arterial and highway infrastructure expansion will likely yield a substantial decline in 23 CFR 450.316(1)(vii) Areas in favor of new growth.
    c. TRANSIT: Investment in expansion of transit lines and stations instead of road/highway capacity will substantially benefit developed urban core areas.
    d. TOTAL: Investment in transit and road capacity expansion will benefit all areas.

Table 5-39. Performance Measures and Targets (Economic Development and Employment Growth)

Performance Measure	Scenario 1 MAINTAIN	Scenario 2 CAR	Scenario 3 TRANSIT	Scenario 4 TOTAL	2020 Base
Regional Population	- (42,806)	- (42,806)	+ 100,406	+ 200,892	2,026,866
Regional Employment	EXPAN + 55,850	+ 55,850	+ 66,254	+ 132,950	1,421,195
Road/Highway Money: Spend More to Maintain or Spend More to Expand New	(100,406 + MAINTAIN	+ EXPAND	- BOTH	+ BOTH	current % region's transportation and infrastructure funding for the TIP is dedicated to maintain and preserve existing infrastructure
Transit Money: Spend More to Maintain or Spend More to Expand New	+ MAINTAIN	- BOTH	+ EXPAND	+ BOTH	current % region's transportation and infrastructure funding for the TIP is dedicated to maintain and preserve existing infrastructure
More investment in 23 CFR 450.316(1)(vii)areas?	EXPAN SAME	-	+	+	Current investment within EJ areas
State of Ohio Priority	+ MAINTAIN	+	-	+ ROADS	Greater emphasis on arterial and highway infrastructure investment; particularly maintenance.
Maintain Existing NEO Businesses	+	+	+	+	Current NEO businesses
Expand Existing NEO Businesses	+	+	+	+	Current NEO businesses
Attract New NEO Businesses	+	+	+	+	Current NEO businesses
Cleaned Brownfields (formerly developed, polluted sites)	-	-	+	-	Current number and acreage of brownfields

Principal Considerations for Transportation in the Context of Economic Development

There are several positive efforts NOACA and collaborative partners can support over the next four years, regardless of what scenario receives preference. Below are key statements regarding the relationship between transportation and economic development; the next section will list specific implementation actions to bring these recommendations to fruition:

1. Economic development supports the quality of life in communities throughout the region. Economic development ensures that communities can maintain their existing character and ensure a high quality of life for their residents.

2. Balancing the needs of the region with local and county needs is critical for regional economic development. NOACA acknowledges that economic development is characterized by issues of regional, county, and local significance.
3. Regional economic development will work to strengthen the urban, suburban and rural economies in Northeast Ohio.
4. One issue of regional significance includes the designation of regional job hubs such as major, minor and legacy job hubs, which have evolved.
5. Regional job hubs and freight hubs should be accessible through multimodal options that reduce vehicle miles traveled and commute times.
6. Communities should collaborate on development, not compete through incentives.
7. Communities should also work to retain residents and businesses, and attract new ones, through quality-of-life improvements.
8. Workforce development needs to benefit all residents, including prioritizing low- income and minority residents.
9. NOACA counties demonstrate a diversity in complementary key industries that support the regional economy, and leveraging them as strengths will help increase the economic competitiveness of the region.
10. Economic development needs to be place-based and context sensitive by supporting the unique needs of urban, suburban and rural areas.

Implementation Actions

NOACA should implement specific actions to move the region toward a more equitable future. Here are actions targeted toward regional economic development and employment growth.

1. NOACA will work with its Business, Community, Rural, and Emerging Leaders Advisory Councils to better understand best practices for economic development in Northeast Ohio across all community types (urban, suburban, exurban, rural).
2. NOACA staff will implement an interactive map-based tool to use on its ongoing workforce mobility/job hub efforts.
3. NOACA will refine its transportation model with new data from the 2020 Census once it becomes available. The new model runs will enable NOACA to update its performance measures and targets, particularly those related to job accessibility, economic development, and employment growth.
4. NOACA will implement recommendations and outcomes from its CEDS effort.
5. NOACA will implement the New or Modified Highway Interchange Projects Policy to review proposed projects, especially those associated with potential development proposals.
6. NOACA will continue to produce its annual State of Freight Report and quinquennial Regional Freight Plan.
7. NOACA will further study the connection to major, minor and legacy job hubs across the region, with particular attention to 23 CFR 450.316(1)(vii) areas. This will extend the workforce mobility study and analysis of scenarios presented for the major job hubs.
8. NOACA will focus on 23 CFR 450.316(1)(vii) areas as an opportunity for economic development professionals to come together and develop efforts to attract companies to those locations in a proactive approach to increase development.

Chapter 6: Excellent Housing

Introduction

Overview

Transportation and housing are inextricably linked, as are their influence on equity and quality of life in a region. This chapter reviews the historical housing trends in the United States and Northeast Ohio over the past century and highlights the policies that have shaped the current development patterns. Secondly, the chapter addresses the demographic changes in recent years, current trends that affect housing in the region, and NOACA's existing efforts to support communities that are challenged by an aging housing stock, declining population, and disinvestment. Finally, the chapter explores strategies and initiatives by other organizations in Northeast Ohio to address future housing needs in the region, followed by a discussion on how NOACA might affect transportation policy decisions to improve housing, property values, and equity.

What Role can NOACA Play?

NOACA has not traditionally held a significant role in the housing realm across the five counties of Greater Cleveland; its primary responsibilities have focused on transportation and environmental planning. As the lead agency for the Northeast Ohio Sustainable Communities Consortium (NEOSCC) during 2011-2014, NOACA did oversee the development of a housing study as a companion piece to *Vibrant NEO 2040*, the regional visioning framework for Northeast Ohio. This effort elevated the important relationship between housing, economy, land use, and transportation in NOACA's Regional Strategic Plan (2015). Current NOACA policies such as the ones that address Environmental Justice (EJ) areas, Urban Core Communities and Disadvantaged Communities refer specifically to locations characterized by elements such as federally-designated criteria related to low-income or minority households (EJ), as well as other characteristics including housing stock and population density (see Chapter 5). The NOACA Board's official Commitment to Racial Equity acknowledges the detrimental impact of past practices in transportation investment on minority neighborhoods, and its New or Modified Highway Interchange Projects Policy calls specific attention to the regional impacts of proposed highway interchanges on development patterns in both urban core and exurban communities. However, these policies are now under review given the recent Executive Orders from the current federal administration.

NOACA will continue to advance its role as the primary regional planning agency for infrastructure (roads, highways, bridges, transit, sewer) through data analysis, policies, programs, and facilitation of collaborative discussions and educational events to highlight the impact of infrastructure planning on patterns of future residential development and redevelopment. This is an exciting opportunity for NOACA to become a stronger partner with leading housing agencies and the housing development community during the next 25 years.

Where Have We Been?

This chapter briefly summarizes the past policies and practices that have shaped the housing market in Northeast Ohio over the last century, particularly as related to transportation and water infrastructure development. While there are myriad factors that have contributed to the housing patterns that one can observe today, including schools and income levels, the following section focuses on the public and private sector policies that formed the basis of infrastructure investments that significantly contributed to racial discrimination and segregation. Learning from

the past, NOACA is committed to racial equity in planning and is vigilant about potential racial implications of its policies.

In the first part of the 20th century, zoning was used, in part, across the United States to racially segregate neighborhoods.[1] This was perpetuated by the practice of restrictive covenants and redlining in the 1930s and 1940s. Redlining was initiated by the insurance and loan companies which downgraded entire neighborhoods as "red districts" in which home loans were harder to obtain.[2] Even today, districts redlined 85 years ago still experience the impacts of the lack of private investment.[3] Minority and low-income populations tend to be clustered in the previously redlined districts and evictions remain high today.

In response to the lack of private investment, federal urban policy (1930s-1960s) attempted to make funding available for low-income housing. Hence, the 1949 and 1954 Housing Acts directed funding toward urban renewal. While program authors aimed to facilitate redevelopment and new construction after the demolition of distressed structures, 90% of demolished housing was not replaced.[4] Furthermore, the federal staff applied the program in a way that disproportionately displaced black neighborhoods. Metropolitan areas across the United States, including the NOACA region, experienced an unprecedented displacement of people and businesses (primarily low-income and minority).

Actions under the so-called urban renewal program quite literally "paved the way" for the massive interstate highway system established, funded, and built in the decades after World War II. In the years after the Second World War, highways served as a mechanism for growth and prosperity: move people and goods, spur neighborhood development and land use change, and increase property values. The planning and construction of these highways mirrored the effects of urban renewal. Expansion of the highway network meant the demise of many established minority and low-income neighborhoods.[5] New housing was built on the fringe of the urbanized area which was more attractive to those who could access it. At the same time, older housing stock and public infrastructure lacked reinvestment.

In 1964, the Civil Rights Act called for an end to discrimination based on race, religion, sex, or national origin. Coupled with the Title 8 Fair Housing Act in 1968, more minorities moved into homes and neighborhoods that were once prohibited.[6] Several communities transitioned from white to predominately African American, but the dwindling population and loss of jobs during the decline in the industrial sector left a diminished tax base and significant disinvestment. Migration of blacks to previously white neighborhoods compelled residents to leave the city; patterns of outward migration by race ultimately depreciated property values across an increasing percentage of the urban core while suburban property values appreciated.

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[1] Reece, Jason, Matt Martin, et al., *History Matters: Understanding the Role of Policy, Race, and Real Estate in Today's Geography of Health Equity and Opportunity in Cuyahoga County,* Columbus, OH: The Ohio State University Kirwin Institute of Race and Ethnicity, February 2015, https://www.nationalcollaborative.org/publication/cuyahoga-county-place-matters-history-matters-understanding-the-role-of-policy-race-and-real-estate-in-todays-geography-of-health-equity-and-opportunity/ (accessed June 6, 2025)

[2] Nelson, Robert K., LaDale Winling, et al., "Mapping Inequality," *American Panorama*, ed. Robert K. Nelson and Edward L. Ayers; https://dsl.richmond.edu/panorama/redlining/ (accessed May 28, 2025)

[3] U.S. Federal Reserve-Community Reinvestment Act; https://www.federalreserve.gov/consumerscommunities/cra_resources.htm (accessed April 23, 2025).

[4] Reece, et al., *History Matters*.

[5] Mark Rose, "Highways," *Case Western Reserve University Encyclopedia of Cleveland History*; https://case.edu/ech/articles/h/highways (accessed April 23, 2025).

[6] Reece et al., "History Matters."

Across the five-county region, each county has legacy cities that have experienced a lack of reinvestment in their older housing stock coupled with disinvestment in public infrastructure such as roads and sewers. The lack of investment has disproportionately affected low-income and minority populations. Due to the availability of inexpensive land and highway access to it, there has been a tendency for new public and private investment to occur on greenfields on the fringes of the region, not just in Northeast Ohio but across most United States metropolitan areas. However, the outward sprawl of industries, services, and housing investments is more problematic for the NOACA region since the regional population has declined over the past several decades.

Housing in America: A History of Inequality

The built environment of regions, cities and neighborhoods reflects historic housing policy and planning in America; the NOACA region is no exception. Recognition of the foundation of housing as it relates to the current landscape in the United States is crucial to understand its overarching impacts on transportation, land use, economics, and equity, and vice versa. It is especially important to review policies and legislation that may have been detrimental to large portions of the population.

Zoning, Restrictive Covenants, and Redlining

The roots of early housing opportunity and exclusion began with the founding of the National Association of Real Estate Exchanges (NAREE) in 1908, which became the National Association of Real Estate Boards (NAREB) and, later, the National Association of Realtors (NAR).[7] These associations influenced racial exclusion through housing and prohibitions against "race mixing."

The early decades of the 20th century, prior to the Great Depression, featured tremendous influx of both foreign immigrants and domestic migrants into industrial cities like Cleveland, St. Louis, Detroit, Chicago, and others. In 1920, Cleveland's population had reached nearly 800,000[8] and by 1930 had passed 900,000.[9] During the same decade, the black population of the City of Cleveland had more than doubled by the first wave of the Great Migration, from just over 34,000 in 1920 to nearly 72,000 in 1930. The combination of foreign and minority influx, along with rapid industrial development, may have motivated early stages of outmigration by some of Cleveland's native, white residents (around the time of World War I) and became more significant after the 1920s. Census data shows the City of Cleveland's total population actually changed very little during the 1930s and 1940s, most likely due to a combination of in- and out-migration.[10] [11]

America's long history of racial inequity is based on the social ideology of "keeping order between racial groups."[12] In terms of housing, the real estate profession presented several methods to

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[7] Reece, et al., *History Matters*.
[8] United States Census Bureau, 1920 Population of the United States – Ohio (US Census Bureau, 1922), https://www.census.gov/programs-surveys/decennial-census/decade/decennial-publications.1920.html (accessed April 23, 2025).
[9] United States Census Bureau, 1930 Population of the United States – Ohio (US Census Bureau, 1932), https://www.census.gov/programs-surveys/decennial-census/decade/decennial-publications.1930.html (accessed April 23, 2025).
[10] United States Census Bureau, 1940 Population of the United States – Ohio (US Census Bureau, 1942), https://www.census.gov/programs-surveys/decennial-census/decade/decennial-publications.1940.html (accessed April 23, 2025).
[11] United States Census Bureau, 1950 Population of the United States – Ohio (US Census Bureau, 1952), https://www.census.gov/programs-surveys/decennial-census/decade/decennial-publications.1950.html (accessed April 23, 2025).
[12] Reece, et al., *History Matters*.

"keep order" through restrictions on where people could live (both in the large cities that experienced significant population increase and demographic change and in the new streetcar suburbs that began to develop in the 1910s and 1920s). The most notable examples included zoning, restrictive covenants, and redlining. Together these policies hampered minority home ownership and the subsequent potential of building of equity and personal wealth through the 1960s.[13] The cumulative effects are still measurable more than 100 years later.

Zoning

Zoning based on race began in Baltimore in 1911 but quickly spread to other cities in the United States. Although struck down as unconstitutional in 1917, zoning ordinances persisted, all under the guise of "protecting property values." While zoning ordinances did not explicitly state that races, ethnicities, and incomes were not allowed, specific "detrimental uses" such as heavy industry and toxic waste were relegated to minority neighborhoods. Conversely, diverse and affordable housing types were restricted in white, upper-income neighborhoods. These codes generally went unchallenged by those negatively affected, as low-income and minority populations had little to no political capital.[14]

Restrictive Covenants

The second policy tool, the restrictive covenant, was tied to the deed of a property and indicated which races could and could not live there. Additionally, covenants could dictate who was permitted to purchase the property or relied on approval from the developer or neighbors before a sale. In 1914, the National Association for the Advancement of Colored People (NAACP) found "a noticeable tendency toward inserting clauses in real estate deeds restricting the transfer of property to colored people, Jews, and foreigners generally."[15] These restrictive policies were even used as a marketing tool within neighborhood associations; they warned of "undesirable neighbors" and promised "your neighbors are people with tastes like yours."[16] In his book, *Housing Dynamics in Northeast Ohio: Setting the Stage for Resurgence,* Dr. Thomas Bier shares an advertisement that touted Shaker Heights in 1921:

"From even the finest home communities [that is, neighborhoods] about Cleveland, old families have been forced away because undesirable buildings, features, neighbors could not be kept out. But not in Shaker Heights. Protective restrictions operate for 78 years to come. We created it – we sell it."[17]

Redlining

The third, and perhaps the most damaging, tool in the legacy of restrictive housing policy is redlining. The Federal Housing Administration's early urban development policies followed the underlying theories of "neighborhood life cycles" postulated by Homer Hoyt and Frederick Babcock at the end of the Great Depression.[18] The National Commission of Neighborhoods also adopted the theory that declining neighborhoods were tied to minority and low-income residents.

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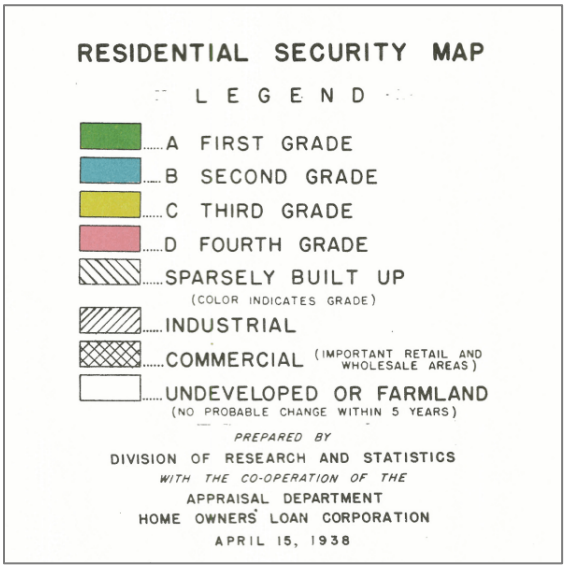
[13] Ibid.
[14] Ibid.
[15] Ibid, 6.
[16] Ibid,
[17] Thomas E. Bier, *Housing Dynamics in Northeast Ohio: Setting the Stage for Resurgence*, (Cleveland: MSL Academic Endeavors eBooks, 2017) accessed from https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?article=1003&context=msl_ae_ebooks on May 28, 2025
[18] Reece, et al., *History Matters*.

They used this as a basis for appraisal, lending, and underwriting of mortgages and ultimately as justification for redlining practices.

In 1933, the United States Congress created the Home Owners Loan Corporation (HOLC) in response to increased foreclosures during the Great Depression. The HOLC existed to help refinance home loans and thus created "Residential Security Maps" for 239 cities to rate financial security for real estate investment. Through a ranking system demarcated by color, areas designated Type A were green ("best"), Type B areas were blue ("still desirable"), Type C areas were yellow ("definitely declining"), and Type D areas were red ("hazardous"), as shown in Figure 6-1.[19] These rankings indicated levels of approval for federal mortgage backing (green areas received up to 80% backing, while red areas received no backing, hence the term "redlining"). Predictably, those areas in yellow and red were largely home to people of color, laborers, immigrants, and Jews.[20]

Figure 6-1. Example of Residential Security Map Legend[21]



These maps and rankings further widened and effectively institutionalized inequality in cities. Redlining was openly discriminatory; it used race, ethnicity, and social class to gauge security risk. The real estate industry used residential security maps to shape neighborhoods and minority economic progress over 40 years. However, in 1976, a federal lawsuit [US vs. American Institute of Real Estate Appraisers (AIREA)] struck down the use of race as a factor to appraise property and underwriting.[22]

In Ohio, 14 cities and counties had Residential Security Maps, including Cuyahoga County and the City of Lorain (see Figures 6-2 and 6-3). The Ohio State University (OSU) Libraries note that the maps were usually hand drawn/colored and not published. In 2012, OSU Libraries purchased digital copies of the maps from the National Archives so the public could view and download them.[23]

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[19] Nelson, et al., "Mapping Inequality."
[20] Reece, et al., *History Matters*.
[21] Nelson, et al., "Mapping Inequality."
[22] Reece, et al., *History Matters*.
[23] The Ohio State University Libraries, "Federal HOLC 'Redlining' Maps for Ohio Cities," *Research Guides*, 2013; https://guides.osu.edu/maps/redlining (accessed May 28, 2025)

Figure 6-2. Cuyahoga County HOLC Residential Security Map (1940)[24]

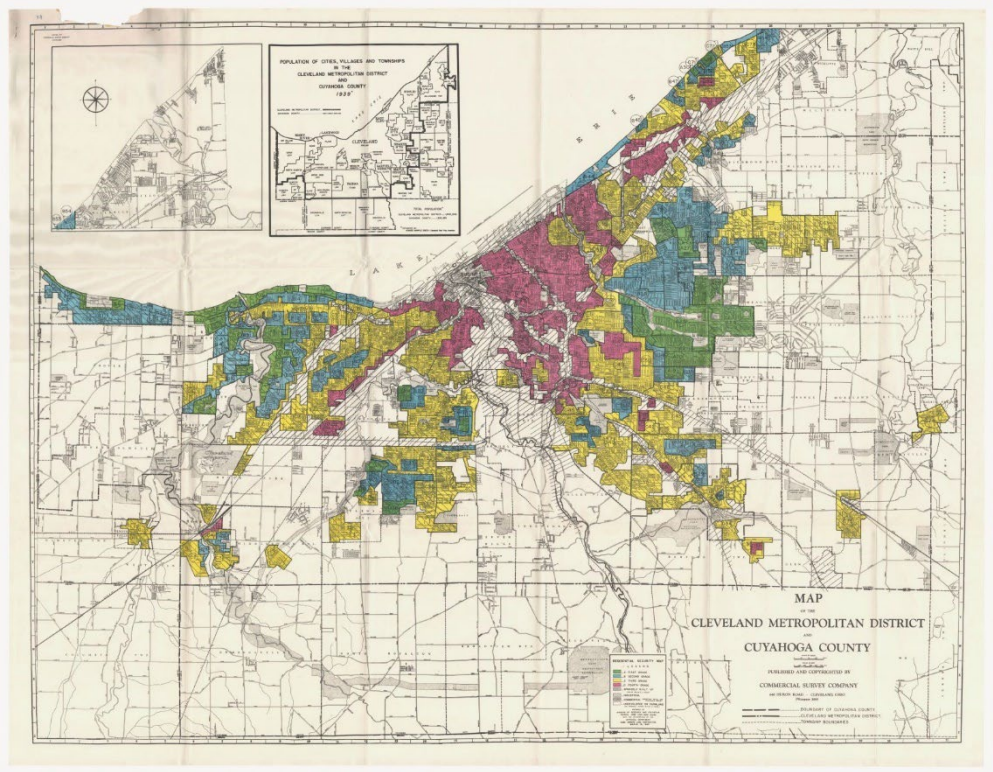
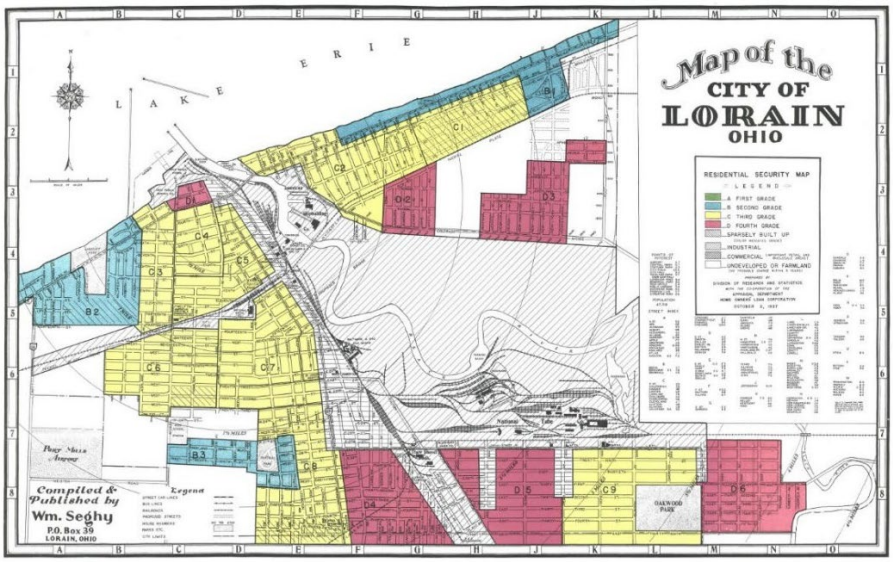


Figure 6-3. Lorain County HOLC Residential Security Map (1937)[25]



The lasting impacts of redlining persist in neighborhoods throughout the United States. A 2018 study by the National Community Reinvestment Coalition (NCRC) compared historic redlining

[24] The Ohio State University Libraries. Redlining Maps: Cuyahoga County, Ohio 1940, https://guides.osu.edu/maps/redlining (accessed April 23, 2025).
[25] The Ohio State University Libraries, Redlining Maps: City of Lorain, Ohio 1937, https://guides.osu.edu/maps/redlining (accessed April 23, 2025).

maps and their A-D ratings with current neighborhood characteristics. The current statuses are defined by economic data: low-to-moderate income (LMI) or middle-to-upper income (MUI), and demographic data: majority non-Hispanic white or majority-minority. The data indicates that, after more than 80 years, neighborhoods rated highly on HOLC maps continue to have the highest percentages of middle-to-upper income and non-Hispanic white residents (Tables 6-1 and 6-2). Data grouped by region shows the Midwest has a high percentage of low-to-moderate income individuals who live in neighborhoods deemed "hazardous" according to HOLC maps (Table 6-3 highlighted in yellow).[26]

Table 6-1. Percentage of areas by HOLC

Grades/Income	LMI	MUI
A Best	8.61%	91.39%
B Desirable	27.27%	72.73%
C Declining	53.94%	46.06%
D Hazardous	74.40%	25.60%

Table 6-2. Percentage of areas by HOLC grade currently LMI versus MUI nationally currently non-Hispanic white versus majority-minority nationally.

Grades/Minority	White	Minority
A Best	85.82%	14.18%
B Desirable	71.57%	28.43%
C Declining	54.91%	45.09%
D Hazardous	35.16%	63.84%

Table 6-3. Regional HOLC grades and current economic status.

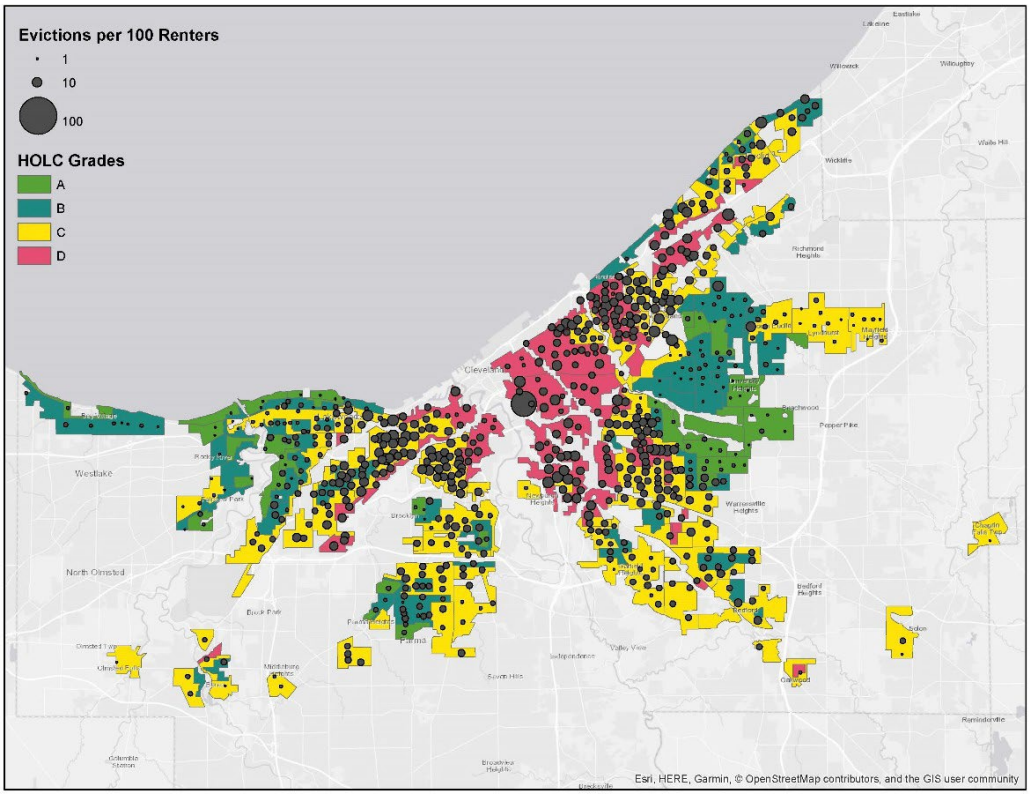
	Northeast		Midwest		South		West	
Grades/Income	LMI	MUI	LMI	MUI	LMI	MUI	LMI	MUI
A Best	5.42%	86.58%	9.34%	84.28%	6.03%	90.64%	5.09%	94.91%
B Desirable	28.19%	71.81%	37.36%	62.64%	28.58%	71.42%	20.28%	79.72%
C Declining	51.39%	48.61%	67.24%	32.76%	59.20%	37.47%	37.47%	48.23%
D Hazardous	74.75%	25.25%	81.22%	18.78%	80.41%	19.59%	19.59%	31.74%

A study from the Ohio Housing Finance Agency compared redlining maps and evictions. Figure 6-4 shows evictions per 100 Cleveland-area renters during 2002-2016, transposed over the HOLC map. The map very clearly demonstrates that higher numbers of evictions are clustered in

[26] The study methodology defined the median family income (low-to-moderate, or middle-to-upper) based on Federal Financial Institutions Examination Council 2016 criteria and Community Reinvestment Act definitions, adjusted by the median family income of the MSA each city. Low-to-Moderate Income (LMI) is defined as less than 80% of area median income (low < 50%, medium 50-80%). Middle-to-Upper Income (MUI) is defined as 80% or more of area median income (middle 80-120%, upper more than 120%). U.S. Federal Reserve-Community Reinvestment Act, https://www.federalreserve.gov/consumerscommunities/cra_resources.htm. The study methodology defined racial composition of census tracts by taking non-Hispanic white population into consideration, then determining if a census tract was "majority white" or "majority minority."

locations with historic yellow and red HOLC designations, versus locations with historic green and blue HOLC designations.[27]

Figure 6-4. Evictions per 100 Renters transposed over HOLC Security Map, Cleveland Area (2002-2016)[28]



NOACA references historically racist policies such as zoning, restrictive covenants, and redlining in its Board Resolution 2020-2029 (Commitment to Racial Equity in Planning), adopted in June 2020:

> "The NOACA Board of Directors is aware of the consequences of historic racism and its legacy that has resulted in systemic racism, which is defined as a form of racism, intentional or unintentional, that is embedded as normal practice within society. Consistent with NOACA's guiding mission and values, we are committed to doing our part to eradicate racism in our region and across the country. We unequivocally condemn racism, injustice and inequality."[29]

Subsequent sections of this chapter will highlight the legacy of transportation infrastructure investment that took advantage of the real estate profession's effective devaluation of property in communities they characterized as "low-income" and "minority," as well as NOACA's efforts to counter such practices as the region envisions a more equitable future for Northeast Ohio.

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[27] Devin Keithley, "Predicting Evictions: A Look Back on Redlining in Ohio," *Ohio Housing Finance Agency,* October 3, 2018; https://ohiohome.org/news/blog/october-2018/predictingevictions.aspx (accessed May 28, 2025)

[28] Ibid.

[29] NOACA, NOACA Board of Directors Resolution 2020-29: Commitment to Racial Equity in Planning, June 2020; https://www.noaca.org/home/showpublisheddocument?id=25175 (accessed May 28, 2025)

Blight, Urban Renewal, and Public Housing

After the Great Depression and World War II, housing became a top priority of political and policy leaders in the United States. Born of the Public Works Administration and President Franklin Delano Roosevelt's New Deal, the Housing Act of 1937 helped to accelerate public housing construction.[30] Techwood Homes, the inaugural federal public housing project, was built in Atlanta in 1935.[31] That same year, the Cuyahoga Metropolitan Housing Authority (CMHA) became the first public housing authority (PHA) in the United States (see Figure 6-5), and remains one of the 10 largest in the nation.[32]

Figure 6-5. WPA Poster advertising Cleveland Metropolitan Housing Authority Apartments on E. 30th Street (1936)[33]

[30] "Public Housing History," *National Low Income Housing Coalition,* October 2019, https://nlihc.org/resource/public-housing-history (accessed April 17, 2025).
[31] Ibid.
[32] Healy, Lenore and Michael Lepley, "Housing Voucher Mobility in Cuyahoga County," *The Housing Center: Housing Research and Advocacy Center*, February 2016; https://www.thehousingcenter.org/wp-content/uploads/2016/02/Cuyahoga-County-Voucher-Mobility-Report.pdf (accessed April 17, 2025)
[33] Works Progress Administration, "Your children like these low rent homes Cedar-Central Apt., East 30th Street," Library of Congress, between 1936 and 1940; https://clevelandhistorical.org/files/show/10599 (accessed June 6, 2025)

After World War II, the United States faced a housing shortage caused by a significant slowing of homebuilding during the Great Depression and war, and lack of modern updating to some existing stock. In his 1946 report to President Truman, Wilson Wyatt, Housing Expediter for the Office of War Mobilization, stated that there was "an urgent need for some 3,000,000 moderately and low-priced homes and apartments during the next two years." [34]

In response, Congress passed the Veterans' Emergency Housing Act in May 1946 to create the Veterans' Emergency Housing Program. Supported by the Federal Government, veterans were assured new homes with no down payment and low-interest mortgages, thus creating a boon of new-build housing on vacant land. In the 1950s, 85% of the 120,000 new homes built in Cuyahoga County were located in suburban communities. By the 1960s, very little new construction occurred in Cleveland; there was practically no vacant land left.[35]

The most referenced of new suburban housing developments in the United States is Levittown, a planned community built on Long Island, New York, by the Levitt family of developers. They streamlined the homebuilding process, with a home completed "every 16 minutes," and positioned on winding, non-grid streets. However, the Levitts only sold their new homes to white buyers and, by 1953, Levittown reached 70,000 residents, none of them black. Eventually this type of racial discrimination was found unconstitutional, but not before scores of white families moved to the suburban developments from urban neighborhoods.[36]

The 1949 Housing Act expanded federal public housing and also directed funding toward rebuilding and revitalizing urban neighborhoods. During this time, the Urban Land Institute, in collaboration with the National Association of Real Estate Brokers, identified areas of "blight" in 221 cities across the country. The Act encouraged demolition of distressed structures and aimed for construction and redevelopment; however, 90% of demolished housing was not replaced.[37]

The Housing Act of 1954 amended the 1949 bill. The term "urban renewal" described "slum" clearance in the name of revitalization.[38] In the core areas of downtown Cleveland, these federal funds helped to clear "blighted" neighborhoods for the development of modern office buildings. This clearance ultimately displaced predominately black residents, relocating them to high-density, low-income housing. Clearance eradicated established black communities and decimated gains in black economic independence.[39] In *The Death and Life of Great American Cities*, Jane Jacobs wrote of new, high-rise public housing: "Low-income projects that become worse centers of delinquency, vandalism, and general social hopelessness than the slums they were supposed to replace...this is not the rebuilding of cities."[40]

This brief history on urban renewal and public housing is important from a transportation planning perspective because such actions quite literally "paved the way" for the massive interstate highway system established, funded, and built in the decades after World War II. Metropolitan areas across the United States, including the NOACA region, experienced an unprecedented displacement of people and businesses (primarily low-income and minority) facilitated by federal

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[34] Wilson, Wyatt. *The Veteran's Emergency Housing Program, A Report to The President from The Housing Expediter*, https://fraser.stlouisfed.org/files/docs/historical/eccles/029_11_0004.pdf (accessed June 6, 2025).
[35] Bier, *Housing Dynamics in Northeast Ohio*.
[36] Crystal Galyean, "Levittown: The imperfect rise of the suburbs." US History Scene. https://ushistoryscene.com/article/levittown/. (accessed May 28, 2025).
[37] Reece et al., "History Matters."
[38] Ibid.
[39] Ibid.
[40] Jacobs, Jane. *The Death and Life of Great American Cities* (Random House: New York, 1961), p. 6

housing policy and accelerated by high-speed, limited-access highways and freeways that replaced streetcars and trolleys. As housing policy encouraged new, lower-density construction outside of cities, the interstate highways simultaneously displaced urban neighborhoods and made it easier for people to live further from employment, shopping and entertainment. As the next section describes, the practice of bulldozing low-income and minority neighborhoods followed the devaluation of these areas by the national real estate profession; these became the paths of least resistance due to lack of affluence and influence.

Interstate Highway System, White Flight, and Civil Rights

Just as housing and renewal were factors in the rapidly changing urban landscape, so, too, was the birth and growth of the U.S. Interstate Highway System. In the years after the Second World War, highways served as a mechanism for growth and prosperity: move people and goods, spur neighborhood development and land use, and increase property values. The transportation network became crowded and created conflict between users as personal vehicles became more attainable by the public.

In 1944, President Roosevelt and the U.S. Congress established the National Highway System.[41] Anticipation of future expressways became a tool for urban renewal and revitalization of downtowns. Ten years later, the 1954 Federal-Aid Highway Act enabled federal and state governments through a federal gas tax to provide the funds necessary to construct the National System of Interstate and Defense Highways.[42] Lane miles of concrete and asphalt replaced brick streets and streetcar tracks to make way for the purportedly more efficient movement of people and goods.

The planning and construction of these highways mirrored the effects of urban renewal. Expansion of the highway network meant the demise of many established immigrant, minority and low-income neighborhoods.[43] In Cuyahoga County, Engineer Albert Porter designed an extensive east-side freeway network (Figure 6-6). One such road, the Clark Freeway, would connect Interstates 271 and 490 and replace 300 homes in Cleveland and 80 homes in Shaker Heights, as well as a large swath of park space set aside as a respite for city-dwellers.[44] Concerned citizens of Shaker Heights, led by 30 garden club advocates, pressed officials to stop construction.[45] One outcome of their efforts became The Nature Center at Shaker Lakes. Eventually Ohio Governor James Rhodes removed the Clark Freeway from a list of state-approved projects in 1970.[46] The success of this group of white, wealthy, and politically influential residents was, however, a stark outlier to the many low-income, ethnic, and minority communities unable to prevent new freeways in Cleveland and other U.S. cities; they simply lost their homes and, in many cases, their livelihoods.

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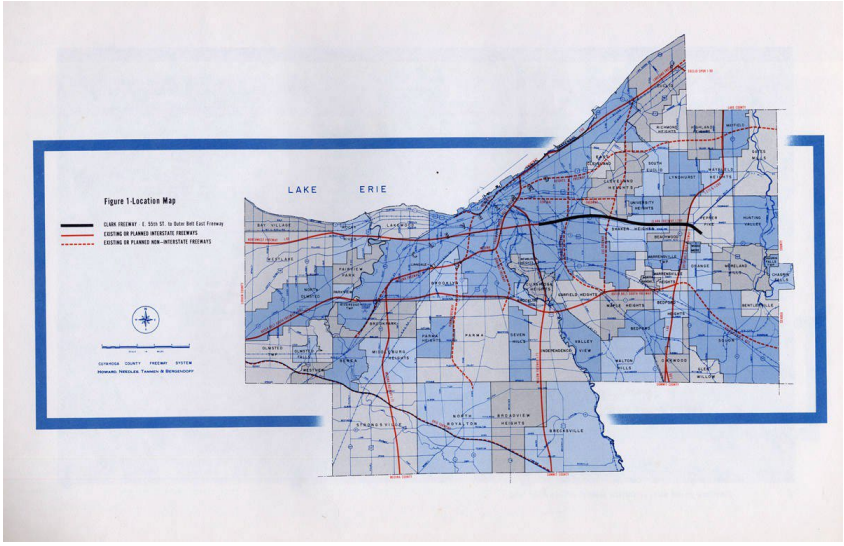
[41] Reece et al., “History Matters.”
[42] Ibid.
[43] Mark Rose, “Highways,” *Case Western Reserve University Encyclopedia of Cleveland History*; https://case.edu/ech/articles/h/highways (accessed May 28, 2025)
[44] https://www.ideastream.org/community/2017-11-17/the-clark-freeway-fight-offered-a-lesson-on-what-it-takes-to-protect-a-neighborhood (accessed May 28, 2025)
[45] Ibid.
[46] Ibid.

Figure 6-6. Proposed Location of Clark Freeway from Highway Route Planning Study 1966[47]



Although engineers, economists, and politicians touted highways as the tool to revitalize cities and encourage redevelopment, the results varied. Many white residents and business owners, now with increased mobility, moved out to the suburbs. Although Cleveland's population had fluctuated around 900,000 between 1930 and 1950, it dropped from 915,000 to 876,000 between 1950 and 1960, driven by a sharp decline in white population (from 765,000 to 623,000). The white population had declined 4.1% and 3.5% in the 1930s and 1940s, respectively, but it declined nearly 19% in the 1950s.[48] These declines would accelerate in the 1960s and 1970s as growing social ills (crime, poverty, racial discord, lower educational quality, municipal fiscal distress) made newer, farther suburbs more attractive to white residents and, by the 1970s, black residents as well.

In 1964, the Civil Rights Act called for an end to discrimination based on race, religion, sex, or national origin. Coupled with the Title 8 Fair Housing Act in 1968, more minorities moved outward into homes and neighborhoods that were once prohibited.[49] In Cleveland, Hough and Glenville transitioned from white to predominately black neighborhoods, but the dwindling population and loss of jobs during the decline in the industrial sector left a diminished tax base and significant disinvestment. Patterns of outward migration by race ultimately drove down property values across an increasing percentage of the urban core while suburban values escalated.

By the 1970s, the Civil Rights movement had spread beyond lunch counter sit-ins and marches for voting rights to combat de facto segregation of public schools, whose racial composition reflected the segregated neighborhoods they served. Although the 1954 United States Supreme Court Decision of *Brown v. Board of Education* (1954)[50] declared racial segregation in schools unconstitutional, many public schools remained segregated because of housing inequality. The Civil Rights Act of 1964 included school busing as an option to achieve racial integration in schools and the 1971 United States Supreme Court Decision of *Swann v. Charlotte-Mecklenburg Board*

[47] Howard, Needles, Tammen & Bergendoff. Route Location Studies: Lee Freeway, Outer Belt South Freeway to Clark Freeway. 1966. https://clevelandmemory.contentdm.oclc.org/digital/collection/urbanohio/id/2080/

[48] United States Census Bureau, The Population of the United States – Ohio General Characteristics (US Census Bureau, 1962), https://www2.census.gov/library/publications/decennial/1950/population-volume-2/37783896v2p35ch3.pdf (accessed April 17, 2025).

[49] Reece et al., "History Matters."

[50] Brown v. Board of Education of Topeka, 347 U.S. 483 (1954)

of Education[51] declared that federal judges could use busing as a tool to achieve racial balance in public schools.

In 1973, the Cleveland chapter of the National Association for the Advancement of Colored People (NAACP) filed a lawsuit against the Cleveland Municipal School District (CMSD). On August 31, 1976, federal judge Frank Battisti ruled, in *Reed v. Rhodes*,[52] that the CMSD Board was guilty of de facto and de jure segregation of black students in Cleveland schools.[53] Judge Battisti issued a remedial order (among others) in 1978 that the CMSD use busing to achieve racial quotas in city schools,[54] where blacks students would bus from eastside Cleveland neighborhoods to westside schools and white students would bus from westside Cleveland neighborhoods to eastside schools. That same year, voters overwhelmingly rejected a school levy request to remedy school deficits and CMSD had to obtain a $20M loan from Ohio's Emergency School Assistance Fund. The busing program began districtwide in 1979. The late 1970s and early 1980s were a time of changing leadership, oversight by the State of Ohio due to poor student performance, teacher strikes, financial problems, and legal challenges in CMSD.

NOACA also references the impact of past transportation infrastructure planning on low-income and minority populations in its region as part of Board Resolution 2020-2029 (Commitment to Racial Equity in Planning). In the resolution, NOACA recognizes:

The historically inequitable results of transportation planning in Northeast Ohio and throughout the country, particularly the development of the highway system, which have facilitated and heightened racially segregated communities and disparate outcomes relative to mobility and access to opportunity. We are aware that there are still inequity implications across the region and the nation.[55]

An Era of Demographic Change

By 1970, the combined population of NOACA's five counties peaked at 2.32 million (see Chapter 3) and began to fall, following the trend of other Rust-Belt metropolitan areas. From its peak in 1969 to the early 1980s, the City of Cleveland lost nearly a third of the high-paying, unionized manufacturing jobs that had been so vital to the region's growth.[56] Political, economic, and social change significantly affected the demographic landscape of Northeast Ohio, patterns reflected in other Rust-Belt cities as well. Cleveland, Pittsburgh, Buffalo, and Detroit collectively lost 50% of their residents during this period (1970-2020), but the decline was not uniform across all neighborhoods and Buffalo actually experienced a modest increase of 6.5% between 2010 and 2020.[57] The onset of regional population decline was simultaneous with full development and implementation of the arterial and highway network presented in NOACA's first long-range transportation plan, *A Framework for Action*. However, by the 1970s decline had become entrenched for the City of Cleveland, Cuyahoga County, and the region.

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[51] Swann v. Charlotte-Mecklenburg Board of Education, 402 U.S. 1 (1971)
[52] *Reed v. Rhodes,* 422 F. Supp. 708 (N.D. Ohio 1976)
[53] Case Western Reserve University, Encyclopedia of Cleveland History: Battisti, Frank Joseph (CWRU: Cleveland), https://case.edu/ech/articles/b/battisti-frank-joseph (accessed May 29, 2025)
[54] Case Western Reserve University, Encyclopedia of Cleveland History: Cleveland Public Schools (CWRU: Cleveland), https://case.edu/ech/articles/c/cleveland-public-schools (accessed May 29, 2025)
[55] NOACA, Resolution 2020-29
[56] David C. Hammack, "Economy," *Case Western Reserve University Encyclopedia of Cleveland History*; https://case.edu/ech/articles/e/economy (accessed June 6, 2025).
[57] *Commentary*, No. 2013-06, May 20, 2013, https://www.clevelandfed.org/publications/economic-commentary/2013/ec-201306-urban-decline-in-rust-belt-cities (accessed May 29, 2025). UPDATE: U.S. Census Bureau, *City and Town Population Totals 2020-2023*, https://www.census.gov/data/tables/time-series/demo/popest/2020s-total-cities-and-towns.html (accessed February 3, 2025)

Furthermore, the violent crime rate in the United States rose 270 percent from 1960, peaking in 1991 at 758 violent offenses per 100,000 people. Public perception and fear of crime was at an all-time high and, coupled with the crack cocaine epidemic, contributed to residents moving out of urban communities.

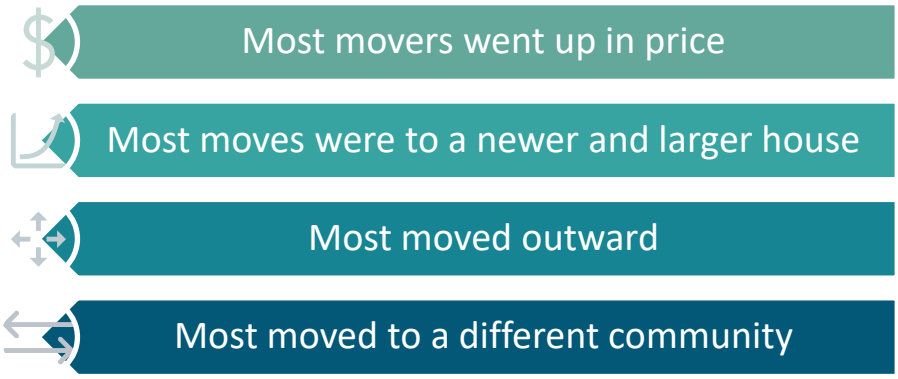
In response, President Ronald Reagan waged a "War on Drugs" and signed the Anti-Drug Abuse Act of 1986. The Act increased law enforcement and penalties for drug cases.

Additionally, President Bill Clinton signed the Violent Crime Control and Law Enforcement Act of 1994 (known as the 1994 Crime Bill), adding the possibility of the death penalty to several crimes and a "three strikes, you're out" provision to felony repeat offenders. The Act also called for banning of several types of semi-automatic weapons, and instituted sex offender registries and the Violence Against Women Act. The 1994 Crime Bill was supported by the Congressional Black Caucus (CBC) and, notably, black mayors from 10 urban cities, including Cleveland.[58]

Since the 1960s, the gradual outward movement of Greater Cleveland's population has created concentric rings of development, leaving a hollowed-out core with deteriorated infrastructure, loss of investment, and socioeconomic struggles. In the 1970s, home prices were lowest in neighborhoods closest to the center of Cleveland and gradually rose in communities farther out. Dr. Thomas Bier posits that when individuals move, they want to move up, but lack of redevelopment and renewal in aging neighborhoods forced them also to move out in search of better options and diverse housing types; the buildout of the region's highway network facilitated this outward movement in the 1950s, while increasing urban social problems hastened the phenomenon in the 1960s and 1970s, which further added to urban and inner-ring suburban decline.[59]

Dr. Bier studied home sales during the 1980s and 1990s to better understand where people moved and why. Through deed transfers and recorded property sale price, year built, and size, Dr. Bier noted the main findings shown in Figure 6-7 for sellers in Cuyahoga County.[60]

Figure 6-7. Cuyahoga County Real Estate Study Survey Results[61]

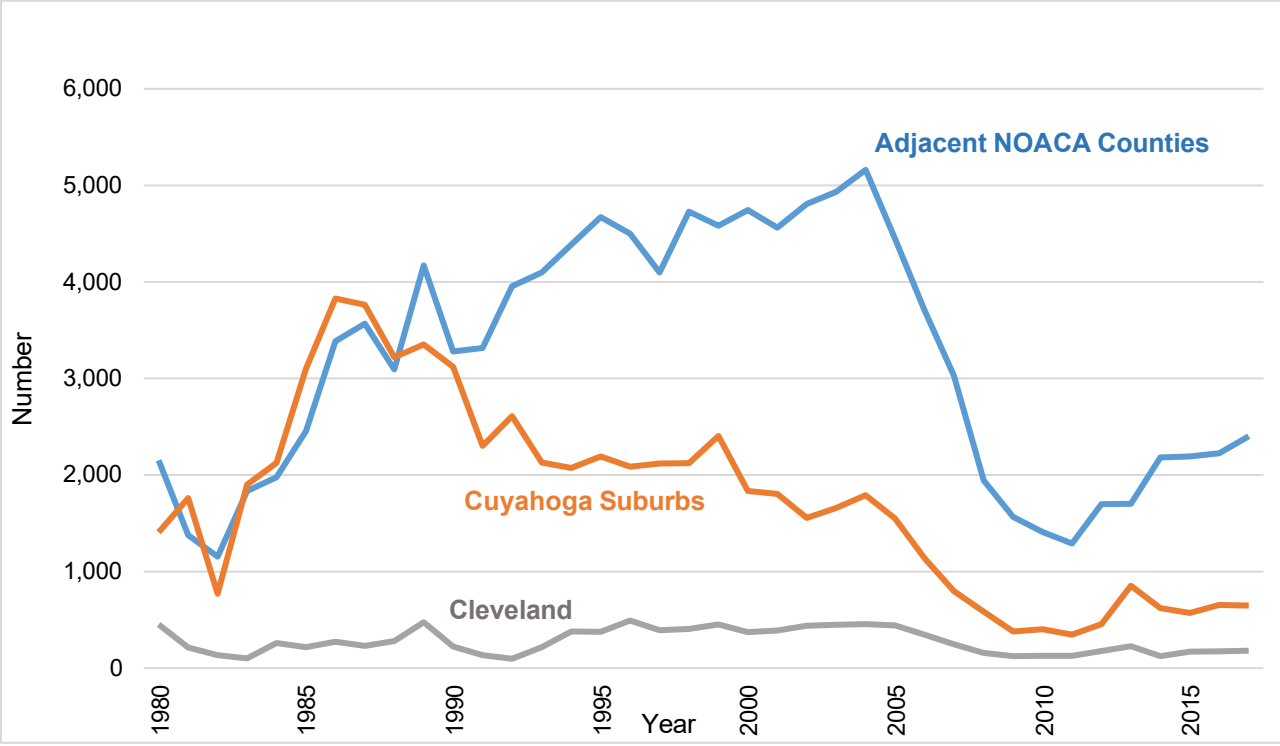


[58] Eisen, Lauren-Brook. "The 1994 Crime Bill and Beyond: How Federal Funding Shapes the Criminal Justice System." Brennen Center for Justice, September 9, 2010. https://www.brennancenter.org/our-work/analysis-opinion/1994-crime-bill-and-beyond-how-federal-funding-shapes-criminal-justice (Accessed May 29, 2025)
[59] Bier, *Housing Dynamics in Northeast Ohio.*
[60] Ibid.
[61] Ibid, p. 28.

The study also found that movers already in suburbs moved further out into exurban areas when they could afford a bigger, better home on a larger land parcel. This movement created more opportunities for city residents also to move outward. Dr. Bier noted that "healthy functioning of the suburban housing market requires that Cleveland residents leave the city for the suburbs."[62] An excess of capacity on area highways and freeways (built for a once-growing population now in decline) made this possible, so commute times remained reasonably low. This period witnessed the outward migration of jobs as well (see Chapter 5).

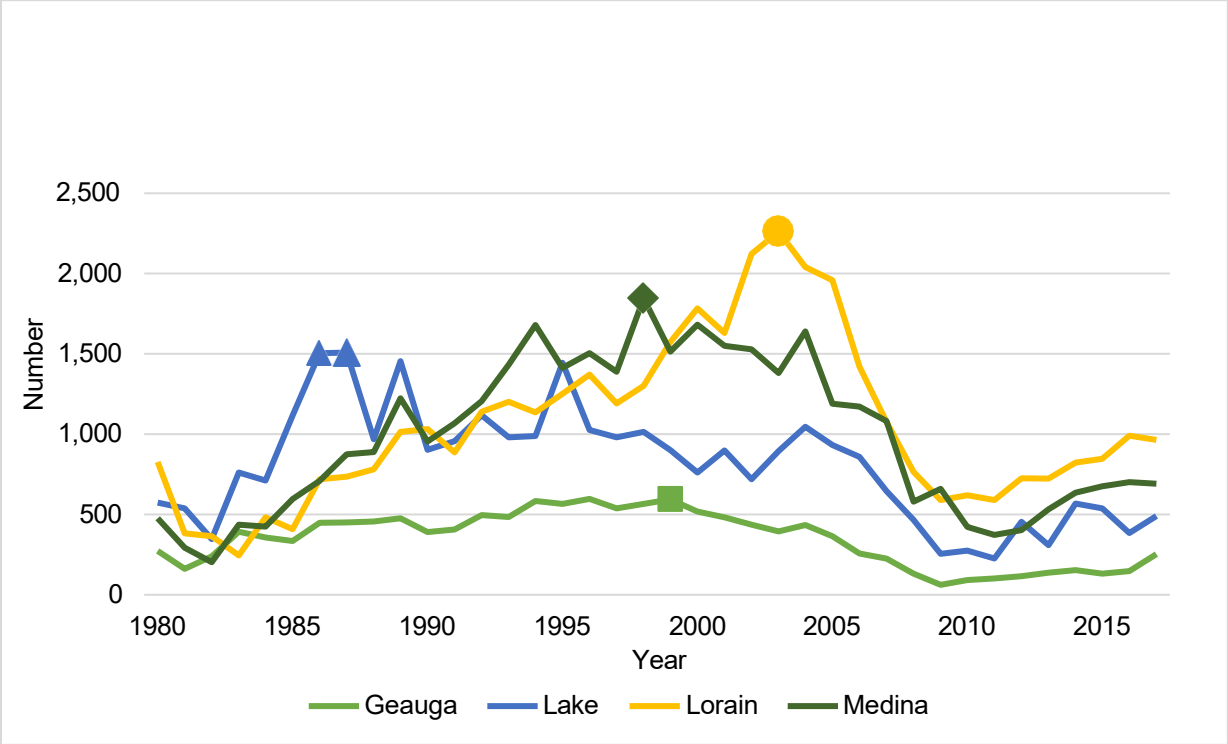
The outward shift of a declining population in the region resulted in concentrations of vacant properties in urban and inner-ring suburban areas that were no longer desirable. Of the approximately 287,000 homes abandoned and demolished between 1960 and 2010 in the seven-county Northeast Ohio housing market, 150,000 were in the City of Cleveland and 8,000 were in East Cleveland. While only 33,000 units of housing were built to replace the 150,000 homes demolished in Cleveland, 232,000 new homes were built outside the City of Cleveland.[63] Figure 6-8 shows the difference between residential permits in three geographic areas: City of Cleveland, Cuyahoga County suburbs, and the four adjacent NOACA counties over a 37-year span. Breaking out the aggregated four counties, Figure 6-9 indicates the residential permits in each county (peak years noted with symbols).

Figure 6-8. Number of Residential Permits (single and multi-family): City of Cleveland, Cuyahoga Suburbs, Collar Counties, 1980-2017[64]



[62] Ibid.
[63] Ibid.
[64] Cleveland State University, "Residential Building Permits, Tables, and Charts," Northeast *Ohio Metropolitan Data Resource*; http://levin.urban.csuohio.edu/neomdr/permits_tables.html. NOACA staff contacted Mark Salling and Joanna Ganning at Cleveland State University (February 3, 2025) to obtain updated information. However, Dr. Salling responded: "These data have not been updated on the college's web site since Charlie Post left. As noted on the web page, one can get more current data at https://www.census.gov/construction/bps/index.html, which can then take you to

Figure 6-9. Number of Residential Permits (single and multifamily): Collar Counties, 1980-2017[65]



In a 2020 study commissioned by Cleveland.com journalist Steven Litt, researchers from Cleveland State University compiled assessed values (adjusted for inflation) of residential, commercial, and industrial properties in 226 communities across seven Northeast Ohio counties (1960-2018). The researchers used this data to measure change in property values and community tax bases over time (see Figure 6-10).[66] The results show how the slow decline of Northeast Ohio's population, combined with highway capacity expansion, created a clear dichotomy of the region's property values as reflected in the "green" and "red".

https://www2.census.gov/econ/bps/. From there you can get county (and place) data by month. While there is also documentation, the data are in text format and would require research staff at CSU to update the graphics.

[65] Ibid.

[66] Steven Litt, "Highways turned Northeast Ohio communities into winners and losers. Can rules of the game change?" *Cleveland.com,* October 18, 2020; https://www.cleveland.com/news/2020/10/highways-turned-northeast-ohio-communities-into-winners-and-losers-can-rules-of-the-game-change.html

Figure 6-10. Percent change in total property value, 1960-2018

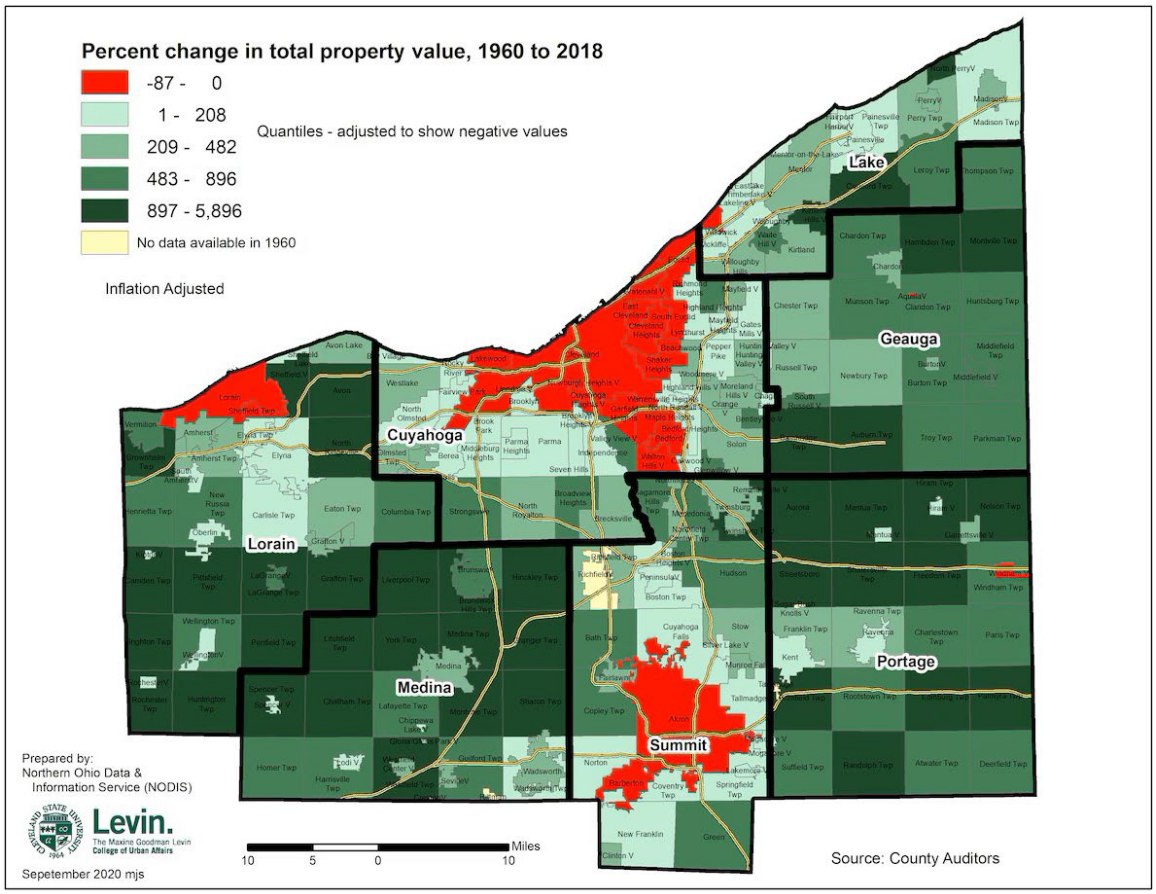
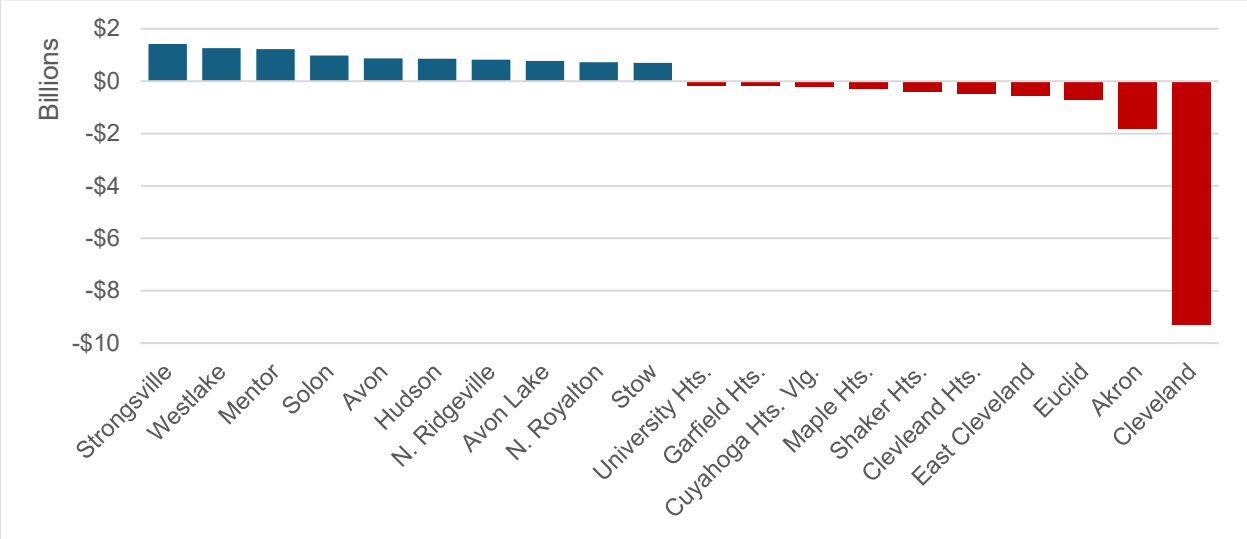


Figure 6-11 quantifies the magnitude of the valuation changes experienced by those communities, reflecting positive in blue and negative in red. Cleveland lost more than $9 billion in tax base revenue during this period. Inner-ring suburbs such as Euclid, East Cleveland, Cleveland Heights, and Shaker Heights also saw losses, while outer-ring suburbs such as Strongsville, Westlake, Solon, and Avon saw tax base revenue gains.[67] Although the regional tax base grew by nearly 48%, the gains were in the collar counties, with an overall loss in Cuyahoga County (see Figure 6-12).[68] This data demonstrates the impact of significant investment in the transportation network for vehicular traffic on the region, compared with the lack of equivalent investment in transit to serve older communities in the core.

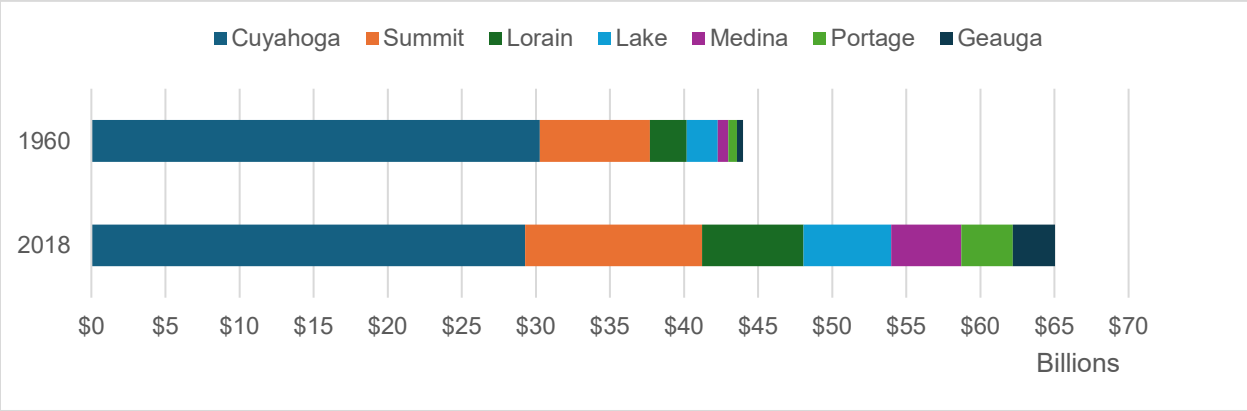
[67] Ibid.
[68] Ibid.

Figure 6-11. Ten Northeast Ohio communities with the biggest gains (red) in property tax base and biggest losses (ed), 1960-2018



Source: County auditors; research by Northern Ohio Data & Information Service (NODIS), Cleveland State University

Figure 6-12. Total Tax inflation-adjusted tax base[69]



Source: Cleveland State University

NOACA's Urban Core Communities Policy seeks to foster reinvestment in defined urban core areas and simultaneously minimize the rising regional infrastructure costs.[70] The policy defines specific criteria to measure the extent to which the current infrastructure network serves the population at a cost-effective density to support a multimodal network. These criteria include the age of a community's housing stock: "Median year of housing structures built is on or prior to 1970, the year that the region's population peaked."[71]

The Northeast Ohio Sustainable Communities Consortium's report *Vibrant NEO 2040* identifies "exogenous and endogenous barriers" to infill and redevelopment that contribute to outmigration

[69] Ibid.
[70] NOACA, Urban Core Communities Policy, September 2015, 27, included in NOACA, Diversity & Inclusion Policy (Cleveland: NOACA, December 2020); https://www.noaca.org/home/showpublisheddocument?id=21248 (accessed May 29, 2025)
[71] Ibid.

and exurban development. Exogenous barriers are external impacts, namely incentivized greenfield development, with much of those incentives in the form of subsidized vehicular transportation infrastructure investment. Endogenous barriers are internal impacts, which include high costs for redevelopment and urban infill. Extensive approvals, environmental remediation, and special improvement costs discourage some investors and developers from projects in core urban neighborhoods. Additionally, such projects may require layered financing, use of public funds, and support funding from private capital.[72]

Recognizing the role that transportation and environmental policy decisions had on past development patterns, have on current valuations, and will have on future growth, the NOACA Board stated the following in its Commitment to Racial Equity and Planning:

> "Seek to better understand the root causes of racial disparities linked to transportation and the environment, such as development patterns, and promote a deeper awareness of their correlations, with the goal of eliminating them. We will be more comprehensive in our planning scope, focusing on the relationship of transportation and environmental planning to housing, land use, economic development and health outcomes."[73]

Where Are We Now?

NOACA Regional Survey: Housing and Accessibility

NOACA conducted a Regional Survey in 2020[74] (see Chapter 4) to understand present perceptions toward a number of issues (transportation, housing, economy, quality of life, future outlook) from a representative sample of the region's adult population. The following discussion focuses on those questions and responses specific to housing, community and accessibility.

Proximity of Employment Opportunities and Affordable Housing

Chapter 5 featured responses to survey questions that focused on employment within Northeast Ohio. A pair of those questions featured statements about both the availability of affordable housing near work and the potential limitations a respondent's place of residence puts on their ability to find a better job or make more money (see Figure 6-13). This figure illustrates that, when broken down by geography, both issues resonate most with City of Cleveland respondents.

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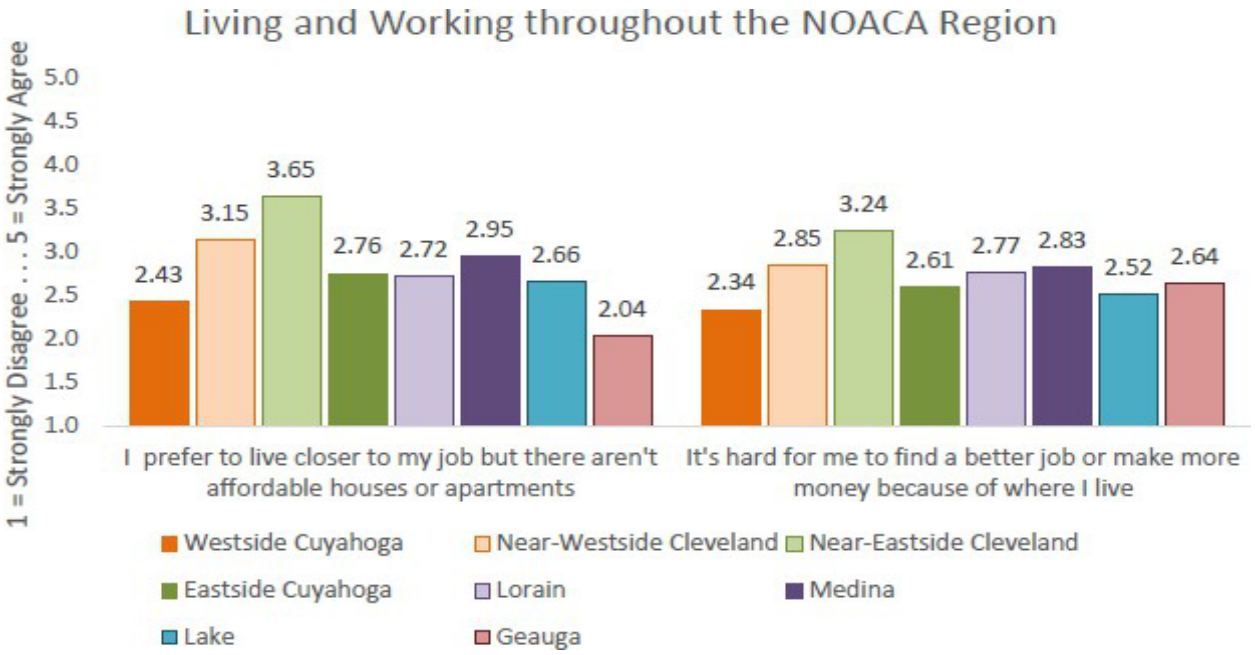
[72] NEOSCC and SASAKI, *Vibrant NEO 2040: A Vision, Framework and Action Products for our Future*, February 2014; https://vibrantneo.org

[73] NOACA, Resolution 2020-29.

[74] This is the most recent such survey undertaken by NOACA staff. Given survey administration occurred post-COVID outbreak and post-2020 Census, staff employed the results in this update of the Long Range Plan.

Figure 6-13. NOACA Regional Survey: Preferences for Living and Working Arrangements



The NOACA Regional Survey also organized responses by other variables (age, Environmental Justice area status, income race, employment status, etc.). A review of those results reveal that income/race classification highlights the biggest differences in response to the two statements. More specifically, Table 6-4 shows that lower-income, nonwhite respondents agree most strongly with the statement, "I prefer to live closer to my job but there aren't affordable houses or apartments." White respondents disagree, regardless of income (respondents shown as "BASE" in the table).

Table 6-4. NOACA Regional Survey Results: Affordable Housing Near Jobs

		I prefer to live closer to my job but there aren't affordable houses or apartments			
	NOACA Region	**Higher-income white**	**Lower-income white**	**Higher-income Nonwhite**	**Lower-income Nonwhite**
BASE	**1,326**	**768**	**253**	**148**	**133**
Strongly Agree (5)	14.48%	9.51%	13.83%	24.3%	30.83%
Somewhat Agree (4)	17.12%	15.449%	18.97%	16.22%	26.32%
Neutral (3)	25.57%	24.87%	26.48%	26.35%	25.56%
Somewhat Disagree (2)	15.16%	17.71%	12.65%	14.86%	6.77%
Strongly Disagree (1)	27.68%	32.42%	28.06%	18.24%	10.53%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	2.76	2.52	2.78	3.14	3.60

Table 6-5 shows that lower-income, nonwhite respondents also agree with the statement, "It's hard for me to find a better job or make more money because of where I live." The other income/race groups disagree.

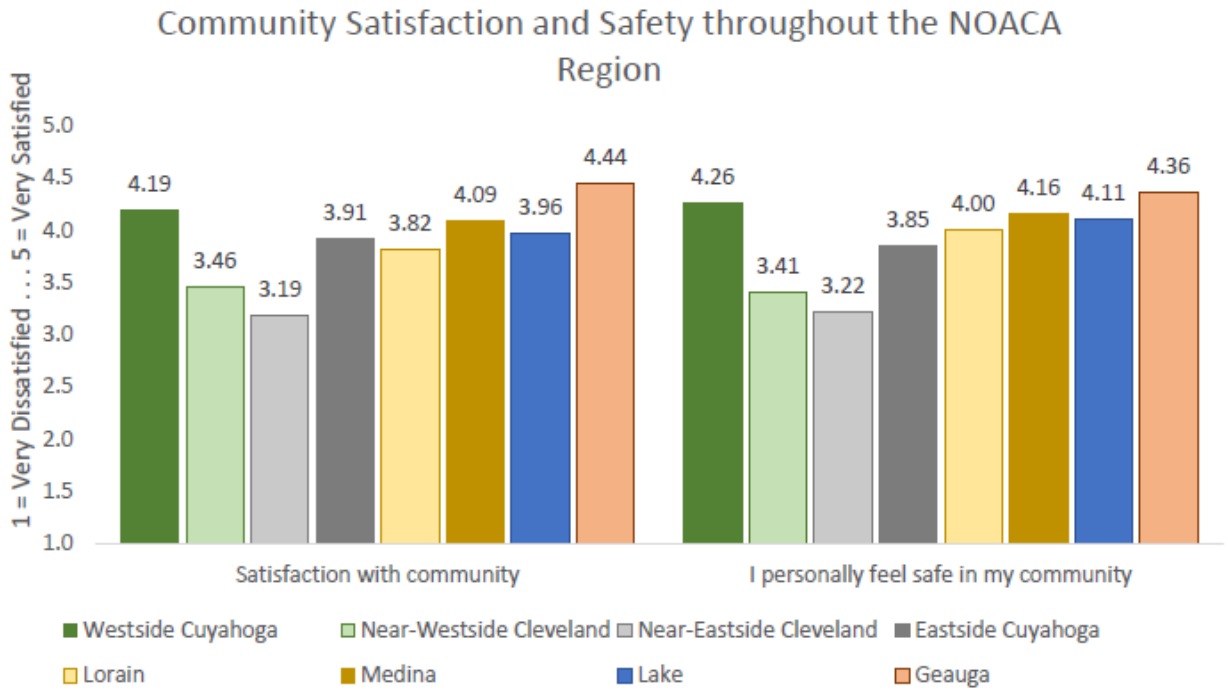
Table 6-5. NOACA Regional Survey: No Jobs Near Home

		It's hard for me to find a better job or make more money because of where I live			
	NOACA Region	Higher-income white	Lower-income white	Higher-income Nonwhite	Lower-income Nonwhite
BASE	1,326	768	253	148	133
Strongly Agree (5)	11.69%	8.46%	11.86%	14.86%	24.06%
Somewhat Agree (4)	16.44%	13.80%	22.53%	18.24%	20.30%
Neutral (3)	26.02%	25.13%	29.25%	23.65%	27.07%
Somewhat Disagree (2)	16.82%	19.27%	11.07%	16.89%	12.03%
Strongly Disagree (1)	29.03%	33.33%	25.30%	26.35%	16.54%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	2.65	2.45	2.85	2.78	3.23

Satisfaction with Community, Safety and Home

The survey also included statements for respondents to indicate how satisfied they were, generally, with their community and whether they personally felt safe in their community. Figure 6-14 shows responses by geographic location. The results are very similar to those received for the "living and working" statements. Respondents from the City of Cleveland are least satisfied; the respondents from suburban Cuyahoga County and the four collar counties are much more satisfied.

Figure 6-14. NOACA Regional Survey: Community Satisfaction and Safety



Tables 6-6 and 6-7 show that, among income/race groups, lower-income nonwhites are the least satisfied with their communities overall and feel the least safe in their communities.

Table 6-6. NOACA Regional Survey: Satisfaction with Community Overall

		Satisfaction with community overall			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	2,461	1,218	536	219	239
Very Satisfied (5)	32.26%	36.12%	27.43%	31.05%	23.01%
Somewhat Satisfied (4)	39.66%	44.58%	38.81%	35.62%	24.69%
Neutral (3)	17.43%	12.73%	21.27%	19.63%	32.22%
Somewhat Dissatisfied (2)	7.23%	4.93%	8.40%	10.96%	12.13%
Very Dissatisfied (1)	3.41%	1.64%	4.10%	2.74%	7.95%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.90	4.09	3.77	3.81	3.43

Table 6-7. NOACA Regional Survey: Feelings of Personal Safety

		I personally feel safe in my community			
	NOACA Region	Higher-income white	Lower-income white	Higher-income Nonwhite	Lower-income Nonwhite
BASE	2,461	1,218	537	220	239
Strongly Agree (5)	36.16%	42.45%	27.93%	30.91%	23.85%
Somewhat Agree (4)	37.51%	40.23%	39.48%	35.91%	26.78%
Neutral (3)	16.01%	11.82%	20.48%	18.64%	28.03%
Somewhat Disagree (2)	6.75%	4.19%	8.38%	8.18%	11.30%
Strongly Disagree (1)	3.58%	1.31%	3.72%	6.36%	10.04%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.96	4.18	3.80	3.77	3.43

For purposes of comparison, Table 6-8 shows satisfaction with respondents' homes and surrounding homes, as well as satisfaction with their communities overall. The same pattern of lower satisfaction from urban (City of Cleveland) respondents and higher satisfaction from suburban respondents exists here. When broken out by income/race group, higher-income whites are the most satisfied with their homes (4.27) and surrounding homes (4.15), while lower-income, nonwhites are the least satisfied with their homes (3.60) and surrounding homes (3.64). That being said, it's worth noting that all respondents, on average, are satisfied.

Table 6-8. NOACA Regional Survey: Home and Community Ratings ("How satisfied are you with the condition of the following?")

		Satisfaction		
Home and Community Ratings *5 = Highest* *1 = Lowest*	BASE	Home	Homes near home	Community overall
Cleveland	446	3.75	3.56	3.32
Cuyahoga	1,087	4.15	4.14	4.06
Lorain	362	4.17	4.03	3.84
Lake	271	4.10	3.98	3.97
Medina	207	4.17	4.06	4.09

Geauga	91	4.43	4.29	4.44
NOACA Region	2,462	4.09	4.00	3.90

Community Access to Products and Services

A final set of statements that respondents considered for the 2020 NOACA Regional Survey pertained to whether they agreed that their home community provided good access to products and services. Table 6-9 shows several types of products and services and average response scores across geographic areas. There was strongest agreement (average scores 4.00 and higher) on accessibility to services such as health care, retail stores, recreation, and entertainment. Agreement was less strong (scores below 4.00) on accessibility to education, affordable housing, jobs, and public transportation. The lowest average scores for education and affordable housing were from City of Cleveland respondents. while the Lorain County respondents averaged lower scores on accessibility to job opportunities, and all of the suburban respondents averaged lower on accessibility to public transportation (especially Lorain and Geauga counties).

Table 6-9. NOACA Regional Survey: Community Access to Products and Services

	Agreement										
Community Access Ratings *5 = Highest* *1 = Lowest*	**BASE**	**Hospitals & healthcare**	**Stores & grocery ***	**Recreation ****	**Entertainment & restaurants**	**Education & training*****	**Affordable housing**	**Job opportunities**	**Job opportunities (FTEs)**	**Public transportation**	**Public transportation (if ride weekly+)**
Cleveland	446	4.20	3.91	3.82	3.84	3.59	3.47	3.39	3.62	3.80	3.83
Cuyahoga	1,086	4.44	4.38	4.20	4.19	3.88	3.67	3.55	3.65	3.62	3.84
Lorain	362	4.19	4.19	3.93	3.80	3.79	3.61	3.32	3.44	2.68	3.19
Lake	271	4.31	4.36	4.18	4.14	3.82	3.74	3.72	3.86	3.61	3.93
Medina	207	4.19	4.20	4.13	3.99	3.80	3.53	3.63	3.74	3.14	3.45
Geauga	91	4.40	4.37	4.23	4.00	4.05	3.71	3.67	3.71	2.82	3.24
NOACA Region	2,463	4.32	4.25	4.08	4.04	3.81	3.62	3.52	3.66	3.44	3.83

*Stores and services (including fresh food/grocery)
** Recreational activities including parks, playgrounds, and swimming pools
*** Educational training opportunities

When broken out by income/race groups, access scores were lowest among low-income, non-whites and highest for high-income whites (except public transportation).

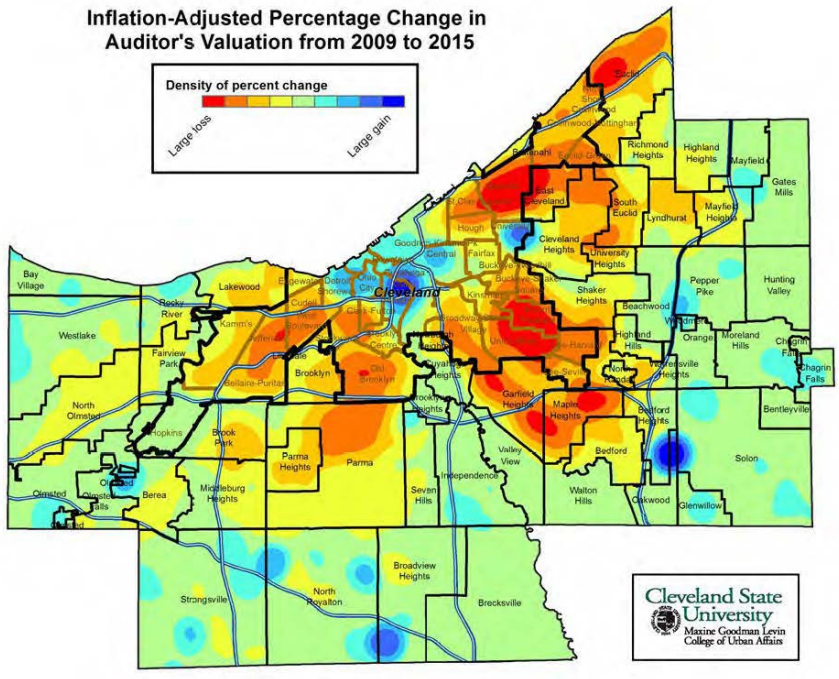
While respondents indicated they were generally satisfied with their residences, neighboring properties, communities, and access, significant challenges (aging infrastructure, disinvestment, outward migration, and lack of diverse transportation options) confront multiple entities in Northeast Ohio, including NOACA. Urban core and low-income, nonwhite respondents were least satisfied with their homes, communities, and accessibility. The needs expressed by low- income, minority respondents in core areas suggest opportunities for NOACA to focus its transportation infrastructure investment efforts more equitably to benefit existing communities and improve accessibility for the marginalized.

Current Conditions and Response to Disinvestment and Abandonment

Nascent Urban Development and Increasing Values

Urban neighborhoods in the NOACA region have shown signs of repopulation and redevelopment in the past decade, though not uniformly. Between 2009 and 2015, Cuyahoga County property valuations were generally static; however there was growth in the urban core, its surrounding neighborhoods, University Circle, and small pockets in outer suburbs (see Figure 6-15). Conversely, losses were concentrated in urban neighborhoods on the east side of Cleveland, and inner eastern suburbs such as Euclid, Garfield Heights, and Maple Heights.[75] A snapshot of the City of Cleveland housing market from 2019-2020, however, shows that most neighborhoods saw increased single-family home sale prices, save for a few on the east side (see Figure 6-16).[76] A Bloomberg Report noted that, in 2020, home values in urban areas of Cleveland grew by 16.5%, while suburban values increased by 10.1%.[77] Cuyahoga County Fiscal Office residential sales between 2016 and 2020 show a dramatic increase in "high-end" transactions (+$300,000) in the City of Cleveland, although they are primarily concentrated in just a few neighborhoods. Table 6-10 reveals more than 80% of all "high-end" residential sales occurred in just four neighborhoods during this period: Detroit-Shoreway, Downtown/Flats, Ohio City/Duck Island, and Tremont.

Figure 6-15. Heat Map of Change in Residential Property Valuations, 2009-2015

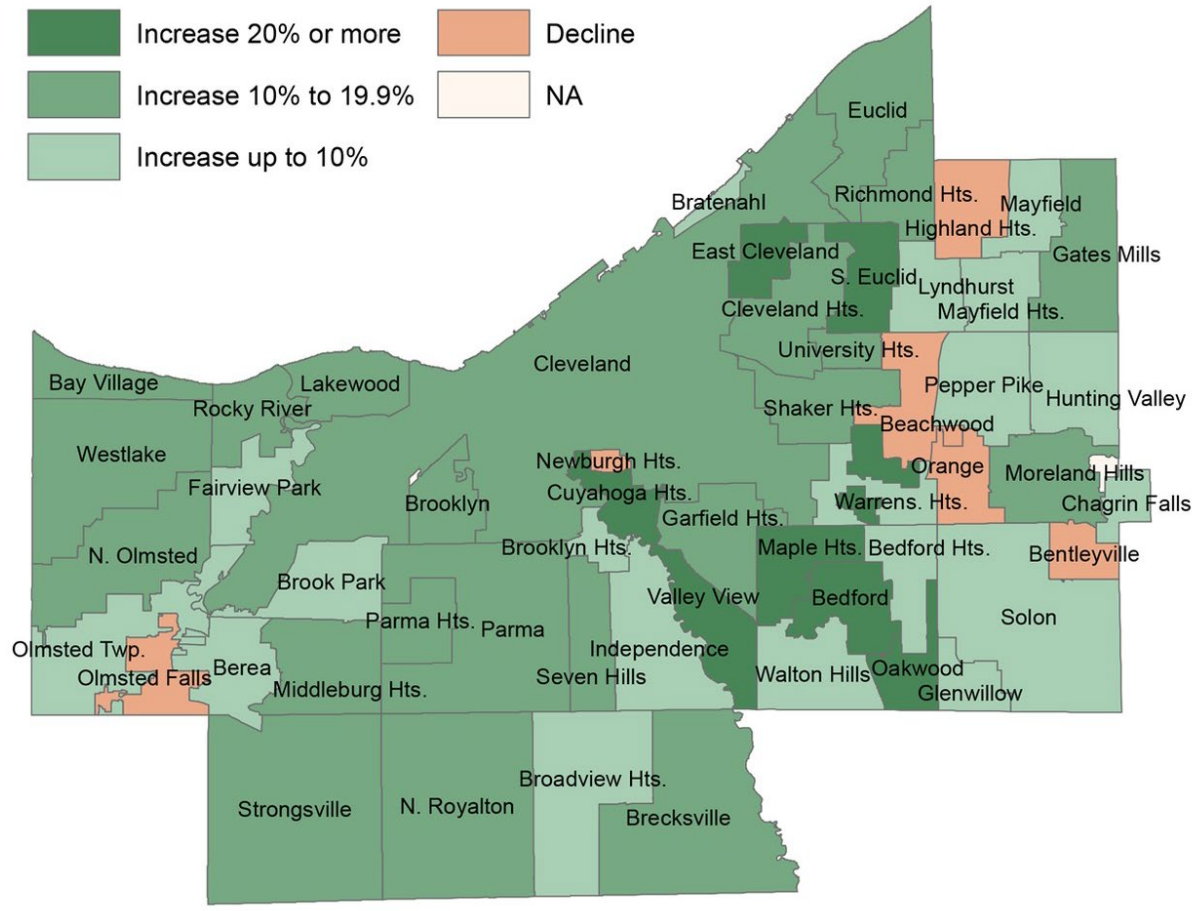


[75] Richey Piiparinen; Kyle Fee; Charlie Post; Jim Russell; Mark J. Salling, PhD, GISP; and Thomas Bier, "Preparing for Growth: An Emerging Neighborhood Market Analysis Commissioned by Mayor Frank G. Jackson for the City of Cleveland," *Urban Publications* (Cleveland: Cleveland State University 2017); https://engagedscholarship.csuohio.edu/urban_facpub/1469 (accessed June 6, 2025)

[76] Richard Exner, "Cuyahoga County home prices in 2020 up more sharply than at any time since the housing bust," https://www.cleveland.com/datacentral/2021/01/cuyahoga-county-home-prices-in-2020-up-more-sharply-than-at-any-time-since-the-housing-bust-see-details-for-each-town-thats-rich.html (accessed April 17, 2025).

[77] Noah Buhayar, "U.S. Homebuyers want to live in cities just as much as suburbs," February 4, 2021, https://www.bloomberg.com/news/articles/2021-02-04/u-s-homebuyers-want-to-live-in-cities-just-as-much-as-suburbs, Bloomberg, (accessed May 29, 2025)

Figure 6-16. Median Home Sales Price Change in Cleveland Neighborhoods, 2019-2020[78]



Trends are less reliable where there are few sales; there were fewer than 20 sales in Chagrin Falls Twp., Cuyahoga Hts., Glenwillow, Highland Hills, Hunting Valley, Linndale, N. Randall and Woodmere.

RICH EXNER/CLEVELAND.COM

Table 6-10. Number of "High-End" Sales by Cleveland Neighborhood, 2016-2020[79]

	YEAR					2016-2020	
NEIGHBORHOOD	**2016**	**2017**	**2018**	**2019**	**2020**	**#**	**%**
Detroit Shoreway	17	21	54	96	77	265	29.2%
Ohio City/Duck Island	17	18	44	53	58	190	21.0%
Tremont	24	40	24	44	49	181	20.0%
Downtown/Flats	13	17	19	20	28	97	10.7%
University Circle/Little Italy	13	12	10	22	21	78	8.6%
Clifton/Edgewater	2	4	14	15	16	51	5.6%
Shaker Square	3	4	5	3	6	21	2.3%
West Park/Kamm's Corners	3	2	4	1	5	15	1.7%
Midtown	0	0	0	1	2	3	0.3%

[78] Exner, "Cuyahoga County home prices in 2020."
[79] Rich Exner, "Find Cuyahoga County property sales and transfers with this searchable database," Last updated May 9, 2025; retrieved 2016-2020 from https://www.cleveland.com/datacentral/2009/06/find_cuyahoga_county_property.html. Michael Chambers, "Cuyahoga County Fiscal Officer: Real Property Information," 2021; retrieved 2016-2020 from https://fiscalofficer.cuyahogacounty.us/

North Collinwood	0	0	0	1	1	2	0.2%
Old Brooklyn/South Hills	0	0	0	1	1	2	0.2%
Glenville	0	0	1	0	0	1	0.1%
TOTAL	**92**	**118**	**175**	**257**	**264**	**906**	**100%**

Downtown Cleveland has shown an increase in population that began in the early 2000s; it grew 102% during 2000-2017 and reflected the millennial generation's preference for urban living and close proximity to dining, culture, entertainment, and sporting venues. In 2015, the number of downtown residents reached 15,000, with a goal set by the Downtown Cleveland Alliance (DCA) of 20,000 by the end of 2020.[80] As of its 2020 annual report, the DCA reported a downtown population of 19,645 residents (see Figure 6-17), and 21,000 by 2024.[81]

Figure 6-17. Housing and Population in Downtown Cleveland (2020)

FOR SALE MARKET	2020	2019
Total Sales	71	76
Average Sales Price	$310,338	$248,731
Average Price PSF	$215.86	$187.49

RENTAL MARKET	2020	2019
Occupancy	84.1%	90.0%
Rent PSF	$1.57	$1.58
Market Rate Units	8,797	7,520

Since *eNEO2050* and the end of the COVID pandemic shutdown, price valuation recovery in urban and inner suburban areas has continued. If we adjust the 2016 "high-end" baseline of $300,000 for inflation in the years 2021-2024[82], then we can still a spike in "high-end" sales within the same concentration of Cleveland neighborhoods (see Table 6-11).

[80] Karen Connelly Rice, "Population boom: Downtown Cleveland will see 20k residents by year end as DCA sets new goal of 30k," *Fresh Water,* February 18, 2020; https://www.freshwatercleveland.com/breaking-ground/DowntownGrowth021820.aspx (accessed May 29, 2025)

[81] Downtown Cleveland Alliance Data Dashboard, https://www.downtowncleveland.com/data-dashboard (Accessed February 3, 2025)

[82] Bureau of Labor Statistics, Consumer Price Index (CPI) Inflation Calculator, https://data.bls.gov/cgi-bin/cpicalc.pl?cost1=300%2C000.00&year1=201601&year2=202401 (accessed February 19, 2025)

Table 6-11. Number of Inflation-Adjusted "High-End" Sales by Cleveland Neighborhood, 2021-2024[83]

	YEAR				2021-2024	
NEIGHBORHOOD	2021	2022	2023	2024	#	%
Detroit Shoreway	83	81	59	54	277	26.4%
Ohio City/Duck Island	62	67	59	42	230	21.9%
Tremont	82	67	42	34	225	21.4%
University Circle/Little Italy	38	30	18	13	99	9.4%
Downtown/Flats	22	23	11	15	71	6.8%
Clifton/Edgewater	18	18	15	12	63	6.0%
Shaker Square/Larchmere/Fairhill	4	11	11	10	36	3.4%
Kamm's Corners/West Park	5	4	6	4	19	1.8%
Clark Metro	3	2	0	2	7	0.7%
West Boulevard/Cudell	1	1	1	3	6	0.6%
Midtown	2	2	0	1	5	0.5%
Fairfax	0	1	1	1	3	0.3%
Shore Acres	0	1	0	1	2	0.2%
Wildwood Park	0	2	0	0	2	0.2%
Asiatown	0	1	0	0	1	0.1%
Hough	1	0	0	0	1	0.1%
Puritas	1	0	0	0	1	0.1%
Triskett	0	1	0	0	1	0.1%
TOTAL	**322**	**312**	**223**	**192**	**1049**	**100%**

Inflation-adjusted "high-end" thresholds by year: 2021 ($331,000); 2022 ($356,000); 2023 ($379,000); 2024 ($391,000)

A comparison of Tables 6-10 and 6-11 shows the number of "high-end" sales in the City of Cleveland has continued to rise, despite the adjustment for inflation; nearly 100 more such homes sold during 2021-2024 than during 2016-2020 (year-over-year decline from 2021 peak due to higher thresholds for "high-end" and lower inventory due to increased mortgage interest rates). Most "high-end" sales are still concentrated in just a few neighborhoods (76% in the Downtown and Near West Side neighborhoods during 2021-2024). As a result, the City of Cleveland tailored its residential property tax abatement policy to reflect growing market demand in certain neighborhoods. Areas with high concentrations of investment (e.g., Downtown, Near West Side, and University Circle) are now "Market Rate" neighborhoods.[84] New legislation passed in July 2022 and effective January 1, 2024 redefined the amount of tax abatement available to both investors and purchasers:

In areas of Cleveland classified as Market Rate, the 15-year tax abatement for market rate for single family new construction (3 units or less) will be for 85 percent of the property taxes assessed. (This includes market rate areas that are designated in neighborhoods such as Tremont, Ohio City and Detroit Shoreway.) The abatement will be capped at $350,000. So,

[83] Rich Exner, "Find Cuyahoga County property sales and transfers with this searchable database," Last updated February 11, 2025; retrieved 2021-2024 from https://www.cleveland.com/datacentral/2009/06/find_cuyahoga_county_property.html. Michael Chambers, "Cuyahoga County Fiscal Officer: Real Property Information," 2025; retrieved 2021-2024 from https://fiscalofficer.cuyahogacounty.us/)

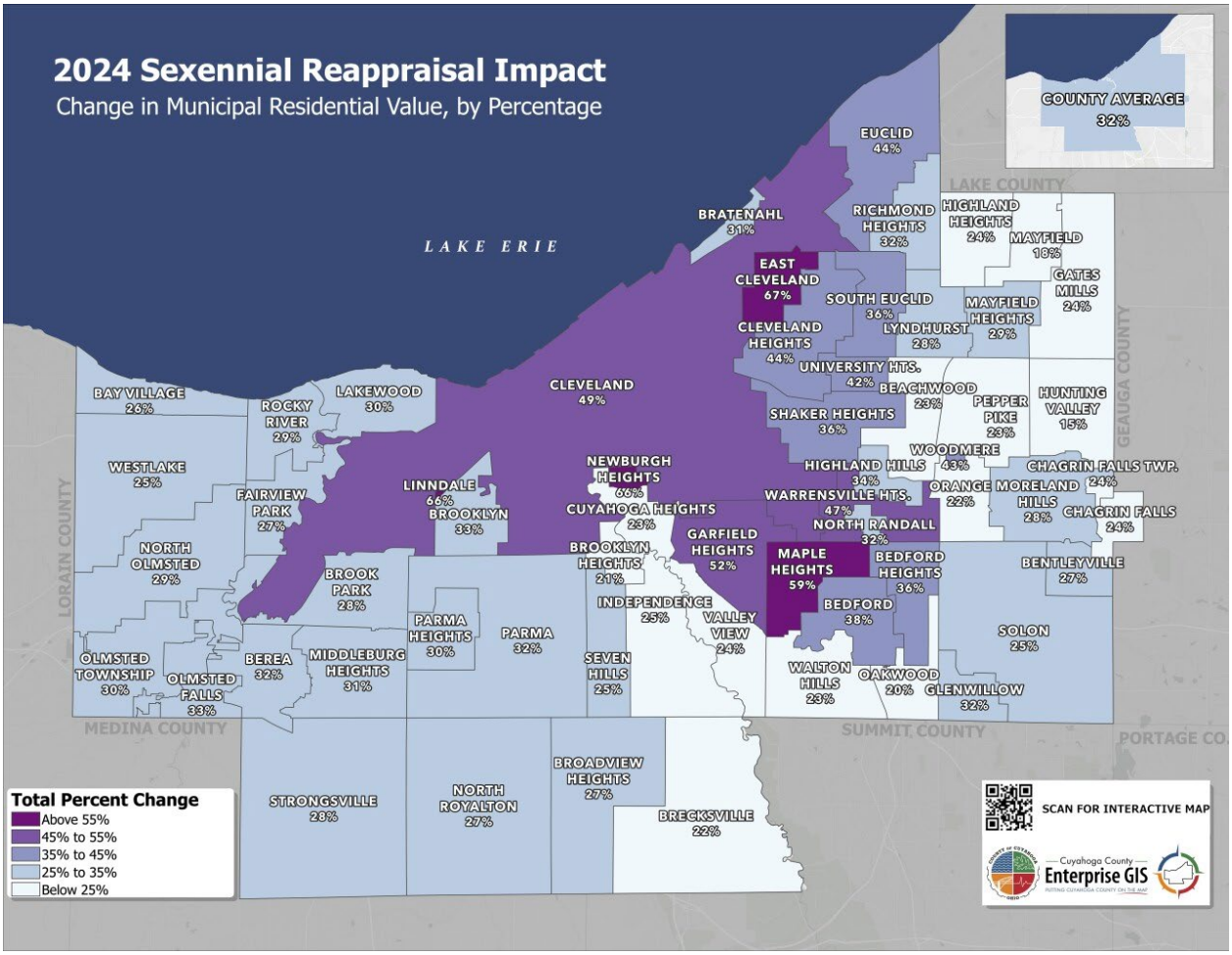
[84] City of Cleveland Community Development GIS Team, "Residential Tax Abatement: City of Cleveland, Ohio,https://clevelandgis.maps.arcgis.com/apps/webappviewer/index.html?id=03c32cde01ec4316bfdb9ce2fba83a2c (accessed February 25, 2025)

property owners will be tax exempt on 85 percent of the property tax and will pay 15 percent of the property tax for the value of the new construction up to $350,000. If their property is appraised at over $350,000, the owner will pay the full rate of property tax on the dollar value that is above $350,000.

In areas of Cleveland determined to be Middle Markets or Opportunity Markets, residential single family new construction will receive 100 percent 15-year tax abatements. In the Middle Market areas, the tax abatements will be capped at $400,000. In the Opportunity Markets the abatements will be capped at $450,000.[85]

Figure 6-18 shows the most recent property valuation change data for Cuyahoga County and a very clear pattern of valuation recovery, especially in core urban areas like Cleveland and its inner suburbs. The significant increase in prices over the past three years reflects lower baseline valuations (shadows of the Great Recession) and much tighter housing supply due to lack of new home construction and higher interest rates (many homeowners locked in at lower rates have been unwilling to list).

Figure 6-18. Property Valuation Change in Cuyahoga County (2021-2024)



[85] Plain Press (7.4.2022), "Cleveland City Council Passes New Tax Abatement Legislation," https://plainpress.blog/2022/07/04/cleveland-city-council-passes-new-tax-abatement-legislation/ (accessed February 25, 2025)

Neighborhood Stabilization and Land Reutilization

The 1977 Community Reinvestment Act (CRA) sought to directly address the decades of institutionalized discrimination, encouraging banks and thrift institutions to "serve the convenience and needs of the communities in which they are chartered to do business," including low- and moderate-income (LMI) communities, and to do so in a manner "consistent with the safe and sound operation of such institutions." While research suggests the CRA has increased lending and investment in LMI communities, critics argue that the scale of impact is marginal at best and may have contributed to the subprime mortgage crisis in the late 1990s and throughout the 2000s.

One of the tools utilized in the revitalization efforts of Cleveland's urban core is the United States Department of Housing and Urban Development (HUD)'s, Neighborhood Stabilization Program (NSP). The NSP offered grants to state and local governments to fund the purchase of foreclosed and abandoned properties for the purpose of rehabilitation, redevelopment, or demolition when warranted, to stabilize urban communities and neighborhoods affected by the foreclosure crisis. The Housing and Economic Recovery Act of 2008 authorized two rounds of funding, and a third became available by formula grant through the Dodd-Frank Wall Street Reform Act in 2010.[86]

In Ohio, Senate Bill 353 helped establish Land Reutilization Corporations and expanded the impact of traditional land banks to combat against vacant and deteriorated properties. The Cuyahoga County Land Reutilization Corporation (CCLRC) became the first authorized Land Reutilization Corporation in 2008, officially opening for operations in 2009. In 2010, counties with populations greater than 60,000 were authorized to create their own Land Reutilization Corporations. By 2015, all counties in Ohio were eligible to establish land banks and access funds allocated to them.[87] In the NOACA region, Lake and Lorain counties also have land banks, and Medina County has considered a land bank to address vacant properties.[88] According to its recent report, the CCLRC:

- Demolished nearly 10,000 properties, which increased surrounding property values by nearly $1.5 billion.
- Renovated and returned to the housing market more than 2,600 homes, creating a total impact of nearly $950 million in increased property values.
- Constructed nearly 250 new homes, which contributed approximately $143 million in property value increases.
- Restored more than $48 million in property tax revenue for local governments between 2009 and 2023 through return of vacant and abandoned properties to productive use.
- Created opportunities for large-scale private investments that drive economic growth through land assembly; title clearance; and development preparation. These actions sparked more than $395 million in private investment.
- Generated a total economic output of $632.7 million in the local economy through $330 million spent on demolitions, renovations, new constructions and other activities.[89]

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[86] United States Department of Housing and Urban Development, Office of Policy Development and Research, "Neighborhood Stabilization Program Data"; www.huduser.gov (accessed May 29, 2025)
[87] James Rokakis, 2020. *The Land Bank Revolution*. Presentation, Cleveland.
[88] Lake County Land Bank, https://lakecountylandbank.org/ (accessed May 29, 2025). Lorain County Land Bank. https://www.loraincountyohio.gov/728/Lorain-County-Land-Bank (accessed May 29, 2025)
[89] Cuyahoga Land Bank, "A Decade and a Half of Impact: Cuyahoga Land Bank Celebrates 15 Years," November 2024; https://cuyahogalandbank.org/blog/a-decade-and-a-half-of-impact-cuyahoga-land-bank-celebrates-15-years/ (accessed May 25, 2025).

The study also found that CCLRC's efforts resulted in a $3.6 billion positive impact on taxes, property values, and local economic indicators.

In 2011, the Western Reserve Land Conservancy, a collaborative organization that encompasses land trusts from 17 counties, established the Thriving Communities Institute. Now known simply as Thriving Communities, the program initially supported the creation of land banks across Ohio and expanded to five priorities (see Figure 6-19). According to the Western Reserve Land Conservancy website:

> "Land banks are an essential tool for stabilizing our fragile cities. They give our counties the much-needed ability to quickly acquire a distressed property, safely hold it, clean its title and prepare it for a better day. The goal is to secure vacant properties — which would otherwise attract crime, lower neighboring home values and incur public services costs — so they can be put to better use in the future. County land banks are powerful tools in the fight against blight."[90]

Figure 6-19. Thriving Communities Five Program Priorities

Tax Abatements: Encourage Investment or Reinvestment

Another driver of revitalization efforts in the region has been use of property tax abatements. Tax abatement is a temporary halt on property taxes, targeting either commercial or residential property or both. The most prominent example in the NOACA region has been the use of tax abatement in the City of Cleveland, which began in the mid-1980's by Mayor George Voinovich and the Cleveland City Council to set the stage for redevelopment through new home construction. Cleveland experienced a 20% increase in permits during the 1980s and 1990s while

[90] Western Reserve Land Conservancy, "Thriving Communities"; https://wrlandconservancy.org/western-reserve-land-conservancy-bids-farewell-to-jim-rokakis-welcomes-councilman-matt-zone-to-the-team/ (accessed May 29, 2025)

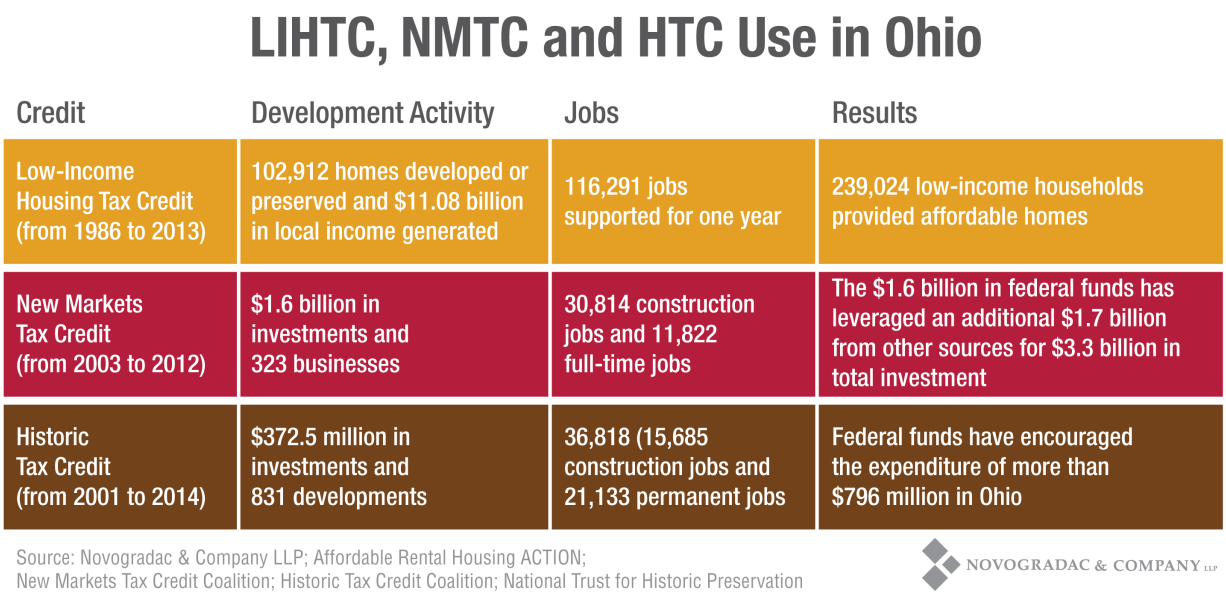
permits in suburban Cuyahoga County saw a decrease of 8%.[91]

Dr. Thomas Bier surveyed Cleveland homebuyers (of those moving within the region) nine times between 1982 and 1995. Results showed 40% of those who purchased homes in the city came from the suburbs where they had rented, while the remaining 60% had been renters in Cleveland. He also noted that 30% of city homebuyers had earned college degrees, while another 30% had some college experience. Dr. Bier noted a similar trend years later (2006- 2013), when Cleveland's college-educated young adult population doubled, from 7,536 to 15,057.[92]

Affordable Revitalization: Workforce Housing

In response to the abundant development of high-end homes, apartments, condominiums, and townhomes in the region, housing and equity advocates have called for more affordable options. Low and middle income workers do not earn enough to live in the communities in which they work. This is especially true for teachers, fire-fighters and healthcare workers, as well as hospitality staff and light manufacturing employees. The Urban Land Institute describes workforce housing as "affordable to households earning between 60 to 120 percent of area median income (AMI). Households who need workforce housing may not qualify for housing subsidized through the Low-Income Housing Tax Credit (LIHTC) program or the Housing Choice Vouchers program, which are two major programs in place for addressing affordable housing needs."[93] Figure 6-20 illustrates the impact of LIHTC in Ohio, along with two other housing tax credit programs: New Markets Tax Credit and Historic Tax Credit.

Figure 6-20. LIHTC, NMTC and HTC Use in Ohio[94]

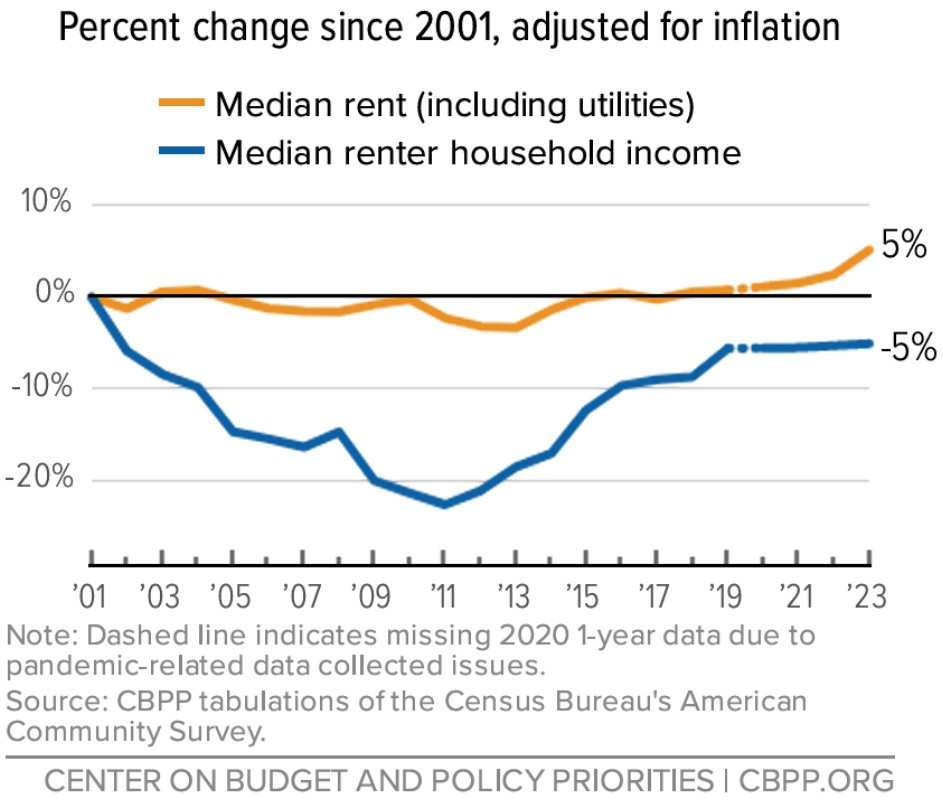


[91] Bier, *Housing Dynamics in Northeast Ohio.*
[92] Ibid.
[93] University of North Carolina (UNC) School of Government, "What Exactly is Workforce Housing and why is it important?" July 12, 2018 https://ced.sog.unc.edu/what-exactly-is-workforce-housing-and-why-is-it-important/ (accessed May 29, 2025)
[94] Novogradac & Company LLC. "Primary Season State Profile: Ohio," novoco.com March 16, 2016,

More Affordable Revitalization: Public Housing and Assistance

For individuals who have very low incomes, as well as seniors and people with disabilities, even workforce housing may be out of reach. Median incomes have not kept up with rising housing costs in the U.S., as shown in Figure 6-21.[95] Since 2001, the gap between median rent and median renter income has fluctuated (10% as of 2023).[96] While the federal government considers housing costs that exceed 30% of income to be "unaffordable," the Center on Budget and Policy Priorities reports that approximately 358,000 low-income households in Ohio pay more than half of their income toward housing.[97]

Figure 6-21. Percentage Gap between Median Rent and Median Renter Household Income since 2001, adjusted for inflation



In response to these needs, there are several types of assistance programs for seniors, individuals with disabilities, very low-income households, and unique or emergency housing situations. Figure 6-22 (HUD programs) highlights three main HUD programs to provide safe and healthy housing for those who need it most.

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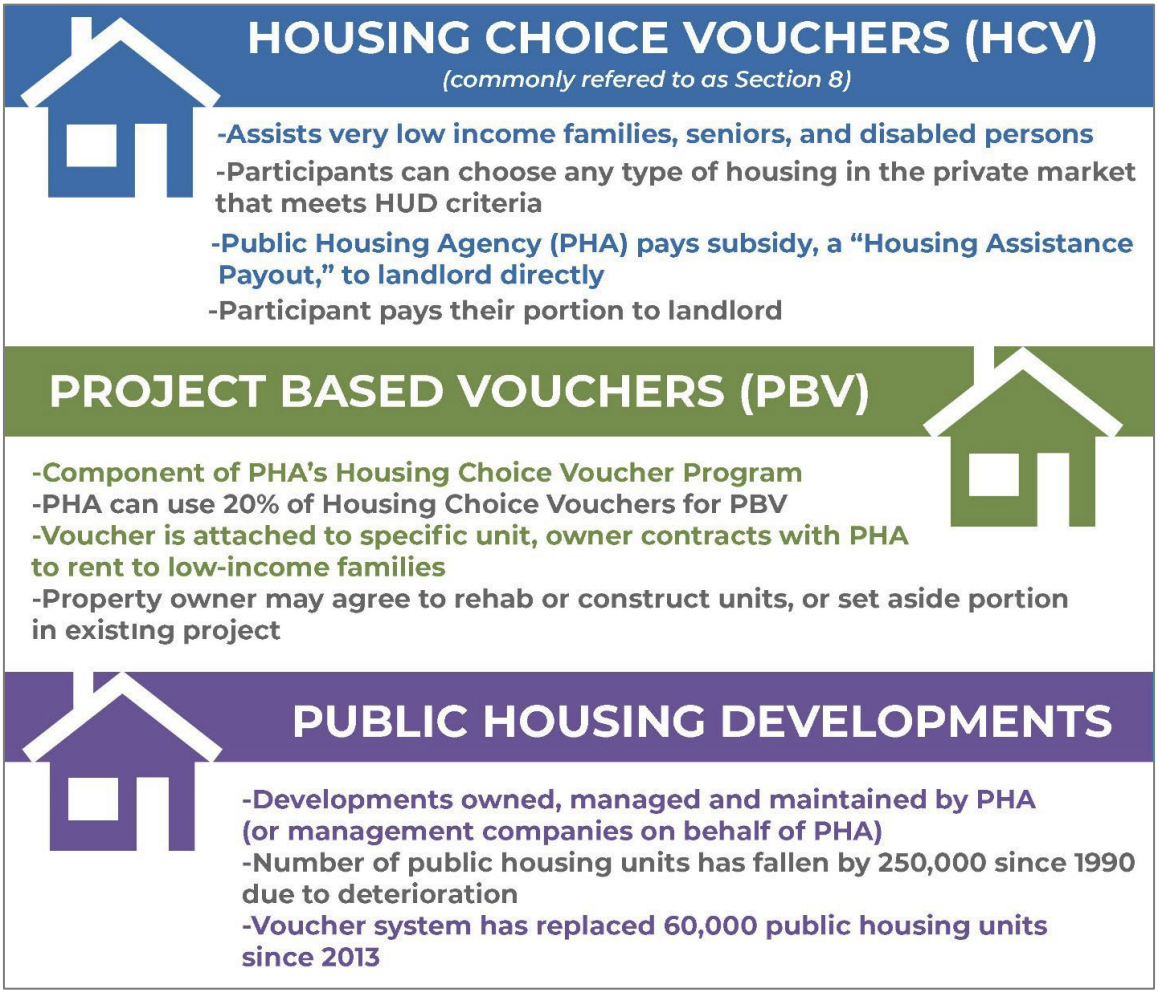
https://www.novoco.com/notes-from-novogradac/primary-season-state-profile-ohio (accessed June 6, 2025)

[95] Center on Budget and Policy Priorities, "Ohio Federal Rental Assistance Fact Sheet," January 2025; https://www.cbpp.org/sites/default/files/atoms/files/12-10-19hous-factsheet-oh.pdf (accessed May 25, 2025).

[96] Ibid.

[97] Ibid.

Figure 6-22. HUD Primary Housing Assistance Programs (2021)



In the NOACA region, there are nine Public Housing Agencies (PHAs) that administer federal housing assistance. As of a 2021 NOACA staff study, these nine agencies managed 13,545 affordable housing units (2020) and administered 20,520 housing choice vouchers of more than $128 million.[98]

The Metropolitan Housing Authorities for each of NOACA's five counties all own and manage public housing developments and smaller scale properties (Table 6-12), in addition to federal housing vouchers. The City of Parma manages a federally funded rental assistance program, as do Cleveland-based nonprofits Emerald Development & Economic Network (EDEN) and New Avenues to Independence. EDEN and New Avenues to Independence both focus their services on people with disabilities, namely those with low-incomes or who experience homelessness.[99]

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[98] Cuyahoga Metropolitan Housing Authority: https://www.cmha.net; Geauga Metropolitan Housing Authority: http://www.geaugamha.org/; Lake Metropolitan Housing Authority: https://lakehousing.org; Lorain Metropolitan Housing Authority: http://www.lmha.org; Medina Metropolitan Housing Authority: http://www.mmha.org; Parma Public Housing Agency: https://cityofparma-oh.gov/193/North-Coast-Housing-Connections; Eden, Inc: https://www.edeninc.org/housing-programs-applications; New Avenues to Independence: https://www.newavenues.net/residential

[99] Healy and Lepley, "Housing Voucher Mobility in Cuyahoga County."

Table 6-12. Public Housing Statistics in NOACA Region

Geographic Entity	Public Housing Agency (PHA)	Developments/ Properties (Jan 2021 Statistic)	Managed Units (Jan 2021 Statistic)	Housing Choice Vouchers: Quantity (Q4 2017 Statistic)	Housing Choice Vouchers: Funding (Annual 2017 Statistic)
Cuyahoga	Cuyahoga Metropolitan Housing Authority	60	10,000	15,275	$92,367,397
Geauga	Geauga Metropolitan Housing Authority	5	243	171	$877,043
Lake	Lake Metropolitan Housing Authority	4	280	1,457	$8,817,094
Lorain	Lorain Metropolitan Housing Authority	14	1627	3,109	$18,332,217
Medina	Medina Metropolitan Housing Authority	10	461	669	$3,017,848
Parma	Parma Public Housing Agency	1	60	742	$4,344,966
Cuyahoga, Lake, Lorain, Medina	Eden, Inc	87	867	125	$546,722
Cuyahoga, Lake	New Avenues to Independence	7	7	50	$262,340
TOTAL		**188**	**13,545**	**21,598**	**$ 128,565,627**

Where Will We Go?

Future Development Scenarios

Looking forward to 2050, there are a number of different possible paths for the NOACA region to realize its future. The following four scenarios serve as predictions for what could be, based on levels and types of transportation investment. There will be particular focus on worker accessibility to jobs and equity. The scenarios—MAINTAIN, CAR, TRANSIT and TOTAL—are discussed in relation to impacts on housing in the region. Chapter 9 provides a more detailed presentation of the scenarios, their components, and performance measures used for scenario comparison and selection.

Scenario 1: MAINTAIN-State of Good Repair

Scenario 1 focuses solely on maintenance of the existing transportation system, with no expansion of roads, bridges, highways, or public transit. The scenario assumes decreasing population and employment.

While the population of the region and total households will both decrease, slight new housing starts and demand for new housing will likely remain as NOACA will prioritize projects to maintain roads and highways with good access to job hubs. An emphasis on maintenance will likely encourage continued outward migration of the region and continued deconcentration of development in the urban core. Average commute times will likely decline slightly, but so will the number of people and jobs within a 15-minute (3/4-mile) walk of a transit (rail or bus) station. Modal choice will not expand under the MAINTAIN scenario; it's all about a state of good repair with regard to what the region currently has, not new investment.

Given the continued outward spread of people and jobs, there will be only limited demand for more multi-family, urban housing and continued demand for single-family, suburban housing. Regardless, the existing population of aging Baby Boomers will create demand for accessible, affordable housing of all types (independent living through skilled nursing levels). A demand for

housing that allows individuals to “age in place” could be part of some developments and could grant access to transit, dining, entertainment, shopping, healthcare resources, and other essential needs.

Limited redevelopment and revitalization in traditional urban core communities and inner-ring suburbs is expected with population loss; however, some urban infill projects may persist where professionals and retirees demand housing (high-end, workforce type mix) in urban areas. Increased transportation costs from more driving and less transit may strain household budgets a bit, but the improved state of existing roads may reduce vehicle maintenance needs and insurance premiums.

MAINTAIN will continue the housing trends of the past few decades; there will be little to no change.

Scenario 2: Captivating Auto Region (CAR)-Single Occupancy Vehicles

In Scenario 2, road capacity expansion is the priority. This includes new and improved infrastructure (roads, highways, bridges, interchanges), shorter travel times through traffic signal timing optimization, reduction of highway bottlenecks, ramp metering,[100] and reduced commutes to job hubs. Like Scenario 1 (MAINTAIN), CAR assumes modest decrease in population, households, and employment by the year 2050.

Despite the expected loss of population and total households in the CAR scenario, improved and expanded highways will accelerate existing migration of people and jobs to peripheral areas of the region. Moderate to high new housing starts should occur in more rural and exurban areas, even outside NOACA entirely, due to fast and easy access to job hubs. New highway access points will continue to incentivize greenfield development while disincentivize greyfield and brownfield redevelopment. There will be less motivation for urban core infill and revitalization since a centralized location won’t mean as much. Average commute times by car will likely decrease given the anticipated improvements and even greater capacity in the arterial and highway network.

The CAR scenario promises an expanded, efficient transportation system for drivers, likely decreasing the demand for housing near job hubs as workers can live anywhere in the region, provided they have access to a private, reliable vehicle. Job hubs may even see increased demand for parking since there will likely be an increase in the number of workers incentivized to drive. Though the emphasis on personal, single-occupancy vehicles will lower demand for multi-family, urban housing, it will continue to be a useful development strategy for seniors who need accessible, affordable housing of all types (independent living through skilled nursing levels). Such units will also be necessary for low-income individuals and families who may not be able to afford personal vehicles or single-family, suburban homes. Unfortunately for these groups, overall demand for transit will likely decline and transit investment will be an even lower priority for investments of transportation dollars. These groups will still need a mix of workforce and low-income housing, but it is unclear whether such housing can find a home in closer proximity to a major regional job hub.

CAR may slightly exaggerate the housing trends of the past few decades; there will be increased

[100] Ramp meters are signal systems near the end of entrance ramps onto limited-access highways. The meters detect speed and occupancy of mainline lanes, allowing cars to enter the highway from the ramp at appropriate times to promote the most efficient flow of mainline traffic (retrieved 5.29.2025 from https://www.transportation.ohio.gov/programs/traffic-operations/its/02-its

spread from the urban core and from major regional job hubs.

Scenario 3: TRANsportation System with Improved Transit (TRANSIT)-Multimodal Transportation System

Scenario 3, TRANSIT, is essentially the opposite of CAR (Scenario 2). TRANSIT expands all transit agencies in the region through implementation of BRT. TRANSIT also includes connections between transit stops and job hubs with autonomous shuttles and new pedestrian and bike routes. In Scenario 3, the projected 2050 population and employment is based on the same NOACA forecasts used in the MAINTAIN and CAR scenarios, plus reduced decreases.

The expanded BRT may increase the demand for TOD so people and employers can take advantage of greater modal choice, including transit, biking, and walking. More workforce housing in transit-accessible locations or near job hubs will be necessary. Housing demand, particularly demand for revitalized or repurposed housing in existing urban areas, may increase slightly. There will continue to be a need for accessible, affordable housing of all types for the aging population, and improved transit will increase options for dining, entertainment, shopping, healthcare resources, and other essential needs.

While TRANSIT does not necessarily help drivers (expect increased costs from lack of roadway maintenance), individuals who cannot afford personal vehicles will have greater mobility and can more easily access jobs. A transit mobile workforce may encourage companies and other employers to focus on, and prioritize proximity to, transit/BRT during location decisions.

Scenario 4: Transportation with Optimal Technology and Access for All (TOTAL)-Advanced Multimodal Transportation System

The fourth scenario, TOTAL, incorporates all projects in the CAR (save highway interchanges) and TRANSIT scenarios. Additionally, the TOTAL scenario includes technological advances such as elected smart freeway lanes to autonomous cars and trucks; extra electric vehicle charging ports; and autonomous shuttle buses to improve workers' accessibility to the regional major job hubs and transit hubs. The projected 2050 population and employment in TOTAL is about half the decreases of the MAINTAIN and CAR scenarios.

An expanded BRT network that connects regional job hubs of the NOACA region means the additional population (relative to MAINTAIN and CAR) is targeted for residential areas with easy and convenient access to these new transportation options and major job locations. How and if these denser, mixed-use transit connected neighborhoods materialize is certainly primary within the decision-making realm of local governments. Potentially, all five counties can benefit from this additional population if counties pursue transit investment and land use changes.

Scenario 4 should mean less stress on the transportation network with more workers on public transit and with shorter commutes due to workers who live closer to jobs and major transit stations. Scenarios 3 and 4 assume reduced population decline will occur in areas within five miles of the major regional job hubs and transit stops of the expanded BRT network. The five-mile radius encompasses both persons who would access the major regional job hubs and transit system via car, as well as those who might access these same locations through active transportation (biking, walking, etc.).

Performance Measures and Targets

While Chapter 9 presents a much more detailed discussion and analysis of the four future

scenarios mentioned above, this section details performance measures to assess progress toward more efficient land use. The performance measures are variables used to assess the scenarios comparatively against each other. There are two important values associated with each performance measure: the baseline and the target. The baseline is the value of the performance measure in the current state (2024). The target is the value of the performance measure in the future state (2050). One of the four future scenarios will be the preferred scenario and its performance measures will be the target values NOACA will use to assess the region's progress from the current state to the preferred future state. Table 6-13 illustrates the performance measures and targets focused on efficient land use.

The outputs are presented in a specific way to help the reader digest the information clearly and concisely with the following guidelines:

1. The baseline represents current conditions (2024 conditions). The outputs reflect how the performance measure will change from the baseline to the target year (2050) under each of the four scenarios.
2. The "-" and "+" signs shown as outputs for each performance measure under each scenario indicate the direction of change. A "-" sign indicates a decrease from the baseline and a "+" sign indicates an increase from the baseline. There are two sizes for each sign; they represent the magnitude of change (smaller signs indicate slight change; larger signs indicate more substantial change).
3. The colors of the signs and numbers for each output are also important. Red color indicates a negative impact on the region, while green indicates a positive impact on the region. While many people commonly associate "-" signs with a negative impact and "+" signs with a positive impact, that is not always the case. It is possible to have a red "+" sign, meaning the value of that performance measure will increase under a scenario, but that increase will have a negative impact on the region.
4. Some of the performance measures in Table 6-13 are qualitative. To help the reader interpret the differences across scenarios, consider the performance measure, "future population and employment in communities with peak population in 1970."
    a. MAINTAIN: Maintenance of the status quo will likely yield moderate decline of population in those communities whose population peaked in 1970, the same year the region's population peaked. These communities make up the region's peak population development footprint; after 1970, all growth essentially came at the expense of older, urban core neighborhoods that experienced decline, disinvestment, abandonment, and demolition.
    b. CAR: Prioritization of arterial and highway infrastructure expansion will likely yield moderate decline in the population and employment of the 1970 development footprint.
    c. TRANSIT: Investment in expansion of transit lines and stations instead of road/highway capacity will reduce some of the decline of the population and employment within the 1970 development footprint.
    d. TOTAL: Investment in both transit and road capacity expansion will reduce population and employment even further (about half that of the MAINTAIN and CAR scenarios) within the 1970 development footprint.

Table 6-13. Performance Measures and Targets (Housing)

Performance Measure	Scenario 1 MAINTAIN	Scenario 2 CAR	Scenario 3 TRANSIT	Scenario 4 TOTAL	2020 Baseline
Regional Population	- (235,000)	- (235,000)	- (174,000)	- (114,000)	2,068,546
Regional Employment	- (113,000)	- (113,000)	- (83,000)	- (54,000)	1,188,488
Future Population and Employment in Communities with Peak Population in 1970	-	-	-	-	Current estimate of total population and employment for all communities whose population peak occurred on or before 1970 [another option is to consider median age of single-family homes (1970 or earlier)]

Principal Considerations for Transportation in the Context of Excellent Housing

As NOACA and Northeast Ohio plan for the next three decades, here are some key considerations that may help create more equitable housing opportunity for residents of Northeast Ohio:

Diverse housing options closer to public transportation networks to provide greater transportation choice and employment opportunities.

In-depth understanding of regional housing dynamics improves the efficiency of transportation investments, and collaboration with the real estate industry, as well as public and workforce housing providers will increase knowledge of housing trends and patterns, and transportation needs for workforce accessibility.

Regional data sharing about projects and programs that embody approaches to more equitable housing allow communities to learn from one another and replicate success stories across multiple jurisdictions.

Implementation Actions

Looking forward to 2050, NOACA should implement the following actions to move the region toward a more empowered future:

1. Gather and maintain a portfolio of “best practices in housing and transportation” from each of the five NOACA counties to share with members and the public to improve knowledge of local success stories that may be replicated or “scaled up” to benefit the region.
2. Gather regional information on Northeast Ohio housing and transportation access data.
3. Create a comprehensive housing and transportation strategy for the five-county region including affordable housing efforts for interested counties in cooperation with Ohio Housing Finance Agency, and US-HUD.
4. Reinvigorate the Vibrant NEO Board of Directors across all 12 of its counties to probe housing challenges, opportunities, and success stories to share.

Chapter 7: Efficient Land Use

Introduction

Overview

In the past two chapters, NOACA illustrated how the evolution of the region's transportation network shaped the economy and housing for Northeast Ohio. This chapter focuses on the relationship between the same transportation network and the region's land use. Although NOACA does not hold a formal role in local land use policy (the domain of municipal government), the agency's regional responsibilities for both transportation and environmental planning influence land use change. Transportation planning and land use planning must operate in tandem for Northeast Ohio to leverage its resources more efficiently.

Land use and transportation infrastructure impact the quality of life experienced by the current and future population. Where and how development occurs impacts the functionality of the current transportation system, which in turn influences future land use decisions. Chapter 1 already demonstrated that the five-county NOACA region has continued to experience population loss since 1970, yet that smaller population has expanded its development footprint over a broader area. The consequence is an inefficient transportation system with excess capacity in some areas, while new infrastructure is built in others. This pattern of land use, without the requisite regional population growth, has resulted in a legacy of underutilized, abandoned, and disinvested land generally in core, urban areas. Strategic investment in transportation infrastructure improvements can act as an effective counter measure to this legacy. Transportation projects should be more multi-modal with increased efficacy within existing communities, particularly in Environmental Justice areas.

What Role Can NOACA Play?

The goals specified in NOACA's Regional Strategic Plan vision statement encompass a host of objectives, some of which speak directly to land use and provide direction on how NOACA should prioritize projects to influence development patterns and protect valuable resources:

- GOAL: PRESERVE EXISTING INFRASTRUCTURE
  - preserve or maintain existing infrastructure that serves currently developed areas of the region
  - facilitate improvements that connect existing activity centers and reinvigorate existing communities
  - facilitate development in higher density areas
- GOAL: SUSTAINABLE MULTIMODAL TRANSPORTATION SYSTEM
  - Encourage transit-oriented development in higher density urban corridors and other higher density areas of the region and retrofit transit-oriented elements in appropriate lower density areas
- GOAL: ENHANCE QUALITY OF LIFE
  - promote the redevelopment of declining and abandoned areas
  - preserve agricultural lands, open space and important habitat areas, woodlands, and wetlands

NOACA strives to fulfill its vision through attainment of these objectives. Recognizing that land use is a local issue, NOACA does not, and cannot, regulate land use decisions within or across jurisdictions within its region. It must, however, consider the impacts of land use in its transportation and environmental planning processes. Land use decisions inform the development of such plans which, in turn, inform land use decisions; they must be addressed

concurrently to be effective. This is especially important given the significant relationships introduced in previous chapters.

Environmental Justice and Land Use

Environmental justice embodies the need for equity among communities; all stakeholders require involvement to help make decisions, especially when they bear the impacts that result from policies, programs, and projects. Negative impacts of development, industry, and natural processes disproportionately harm select communities, which result in reduced quality of life across income levels and ethnicities. While this chapter focuses on land use related to transportation infrastructure investment decisions, environmental justice reflects equity on a broader scale and is central to the entire LRP.

Local government needs and priorities drive land-use decisions in Northeast Ohio. A regional perspective reveals how land cover and development patterns change over time. The population of the entire NOACA region has slowly declined during the past 50 years (see Chapter 1) yet simultaneously spread outward over a much larger footprint. This pattern is inefficient and expensive. It strains both growing and declining areas because of simultaneous demands for new infrastructure and services in growing areas and expensive maintenance of existing infrastructure and services in declining areas. Moreover, many urban areas and older communities that have suffered disproportionate losses in population increasingly experience concentrations of low-income and minority residents who are unable to relocate. These are too often the redlined neighborhoods of the past (see Chapter 6), which have now become the Environmental Justice areas of today (see Chapter 1). The remaining population in declining areas must shoulder the increased burden to maintain (i.e., finance) the underutilized infrastructure of an aging community. Furthermore, utilities may focus investments in growing areas, which can yield lower service quality and degraded operations in declining areas.

Chapter 6 articulated how the post-World War II development pattern shifted Northeast Ohio's population into increasingly segregated neighborhoods and communities by income and race. Too often, community land-use policies and zoning regulations restricted or prevented low-income and minority populations. These groups, by default, concentrated in areas considered less desirable and, subsequently, less valuable. Stakeholders in these communities frequently lacked the power and influence to prevent land use decisions that negatively impacted their health, safety, and welfare. The result is many low-income and minority communities experienced reduced quality of life.

Regional Land Use Planning

Introduction

The State of Ohio is known as a "home rule" state, which means that municipalities (including incorporated cities and villages) have the power to govern themselves locally.[1] The Ohio Constitution empowers these local governments to enact land use decisions and zoning regulations; they do not have to coordinate with each other, nor with the county or region in which they are located:[2]

> *Whenever the planning commission of any municipal corporation or any board or officer with city planning powers, whether such commission, board, or officer is*

[1] Ohio Department of Health, "Zoning 101: Frequently Asked Questions," https://odh.ohio.gov/know-our-programs/health-promotion/resources/zoning-101-fact-sheet (accessed April 17, 2025).
[2] Ohio Rev. Code §713.07, https://codes.ohio.gov/ohio-revised-code/section-713.07 (accessed April 17, 2025).

created by statute or municipal charter, certifies to the legislative authority of the municipal corporation any plan for the districting or zoning thereof according to the uses of buildings and other structures and of premises, such legislative authority, in the interest of the promotion of the public health, safety, convenience, comfort, prosperity, or general welfare, may regulate and restrict the location of buildings and other structures and of premises to be used for trade, industry, residence, or other specified uses, and for such purposes may divide the municipal corporation into districts of such number, shape, and area as are best suited to carry out the purposes of this section. Regulations may be imposed for each of such districts, designating the kinds or classes of trades, industries, residences, or other purposes for which buildings or other structures or premises may be permitted to be erected, altered, or used subject to special regulations.

Unlike municipalities, counties and townships in Ohio do not receive home rule authority under the Ohio Constitution; their authority cannot deviate from state statute. Any zoning in unincorporated areas must be in accordance with a comprehensive plan. However, certain townships have Limited Home Rule Authority, which affords certain rights.[3]

Given the power and provision of home rule, NOACA has no jurisdiction over the regulation of land use within individual communities in its region. Cities and villages have constitutional authority to plan and zone themselves, while other areas (including counties as a whole) must subscribe to a comprehensive plan in line with state statute[4] This limitation is important to emphasize because, even though NOACA may advocate for particular programs, policies or projects, the agency can never dictate land use decision-making over any of its members or other geographic district within its region. MPOs must respect the autonomy of the local governments and their land use decisions.

NOACA can certainly inform decision-making; convene collaborative discussions about land use issues with multi-jurisdictional (or regional) impact; and prioritize projects that support the goals and objectives approved in NOACA's Regional Strategic Plan. Even though local municipalities have the authority to decide their own land use patterns, the reality is that the communities of Northeast Ohio operate within a region linked by many common interests and systems, including transportation, economy and natural resources. Coordination and collaboration are communities' best interests. NOACA's role is to educate and facilitate the vision its members articulate for themselves as a cohesive region becomes their future reality.

Zoning and Transportation

Land use within a region evolves through local zoning and regulations, both influenced by population, housing demands, employment opportunities, and infrastructure investments in utilities and transportation. Earlier chapters discussed the trends of these influences and the context within which land use planning occurs in Northeast Ohio.

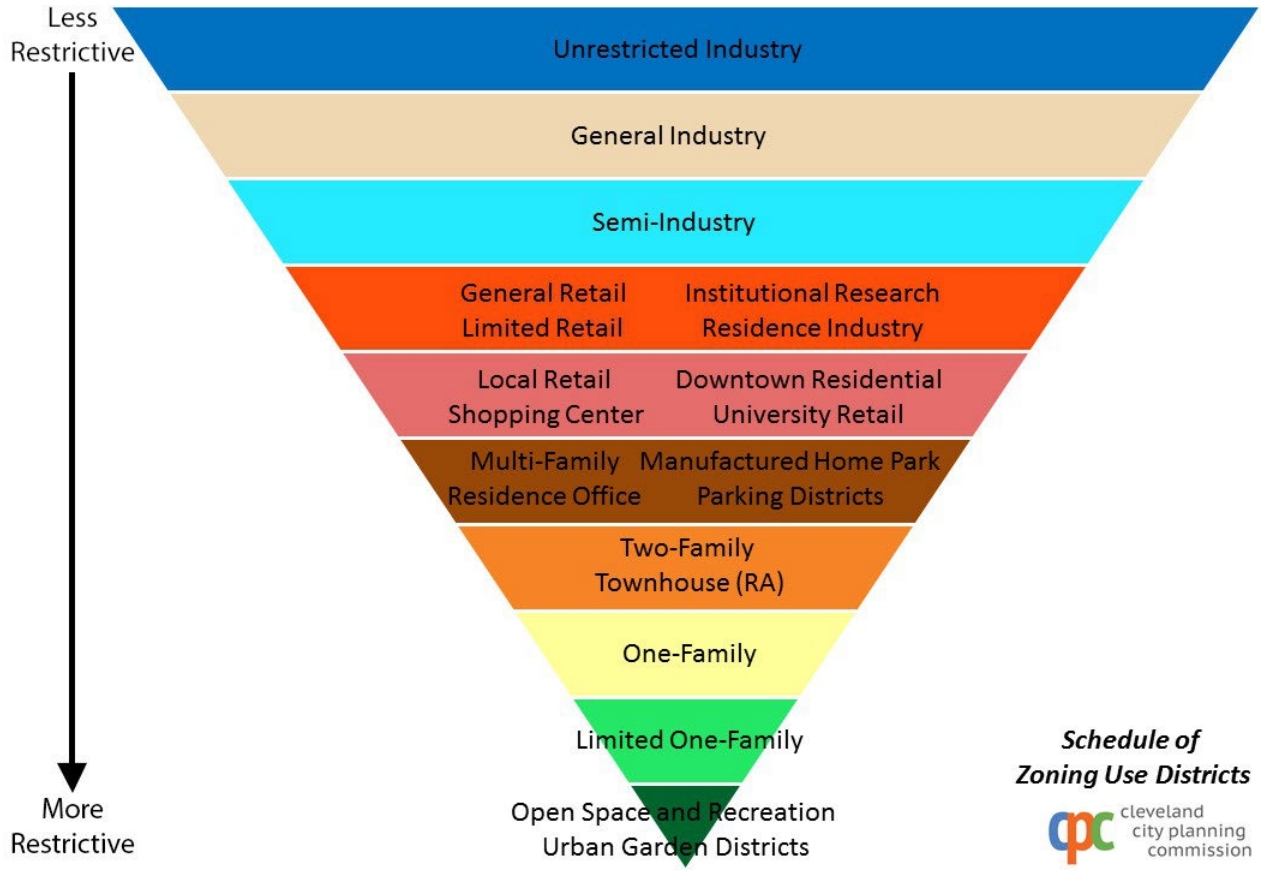
Traditional land use planning and zoning establishes land uses for areas based on location within a community, uses of adjacent areas, and community preference. The 1926 U.S. Supreme Court decision *Village of Euclid v. Ambler Realty Co.* upheld the constitutional rights of cities, villages,

[3] Ohio Legislative Service Commission, Dec. 8, 2021, "Ohio General Assembly Members Brief: Limited Home Rule Townships (accessed Oct. 22, 2024 from https://www.lsc.ohio.gov/assets/organizations/legislative-service-commission/files/members-briefs-volume-134-limited-home-rule-townships.pdf)

[4] State of Ohio, 5.22.2024, "Local Government," (accessed Feb. 11, 2025 from https://ohio.gov/government/resources/local-government-rosters.

and townships to separate land uses in their communities into specific zones.[5] The term "Euclidian Zoning" came into the lexicon to describe this approach, which often uses a hierarchy of zones to separate residential, commercial, and industrial uses from one another within the physical footprint of a community. The Euclidean hierarchy generally allows less restrictive uses (e.g., commercial and residential) within zones designated for more restrictive uses (e.g., industrial) but not vice versa (see Figure 7-1). While the intent of Euclidean Zoning began as a mechanism to prohibit potentially harmful industrial and commercial uses adjacent to residential neighborhoods, many municipalities have co-opted zoning practices to restrict land uses (e.g., multifamily residential housing) that could provide more housing choices for lower-income or minority populations (see Chapters 5 and 6).

Figure 7-1. Euclidean Zoning Hierarchy of Land Use Intensity[6]



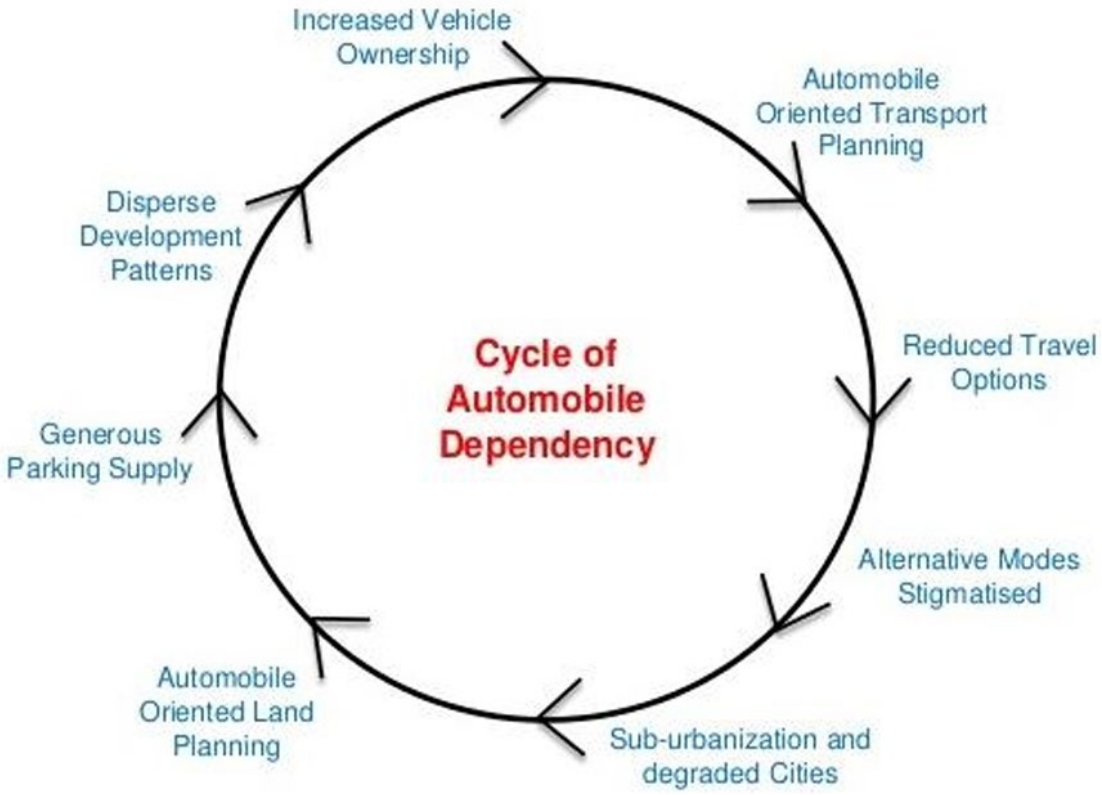
The intense motivation to strictly separate land uses, coupled with the rise in automobile prevalence and building on undeveloped sites, transformed Northeast Ohio. The region morphed from more compact, mixed-use, walkable, and transit-friendly urban neighborhoods and rural towns into a dispersed, car-dependent region with both population and jobs spread more thinly across the landscape in patterns of segregated uses. Residents of the newly created suburbs, towns, and villages initially continued to work and shop within the urbanized areas. However, movement of commercial uses to the new residential markets (e.g. decentralization of economic

[5] Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926)
[6] City of Cleveland Planning Commission, "How does Cleveland's zoning code work? Euclidean zoning and 'use districts,'" 2020, https://planning.clevelandohio.gov/zoning/index.php (accessed

districts through growth of suburban shopping malls, strip-style retail, and large office parks) contribute to the decline of formerly bustling downtown streets. Because the new developments are much more dispersed from one another, walking, biking, and public transportation are increasingly difficult modes to move from Point A to Point B.

Fortunately, there have been some recent counters to segregated-use districts in the region. The City of Cleveland has embraced a return to a form-first philosophy to counter Euclidian zoning;[7][8] NOACA also has adopted a Complete and Green Streets policy to provide the region a different template to enhance all modes of transportation (pedestrians, cyclists, microtransit users, transit riders, etc.) and provide more green infrastructure to help cool buildings, shelter street users, and mitigate stormwater runoff.[9] Figure 7-2 illustrates the self-reinforcing cycle of increased automobile dependency and sprawl.

Figure 7-2. Cycle of Automobile Dependency and Sprawl[10]



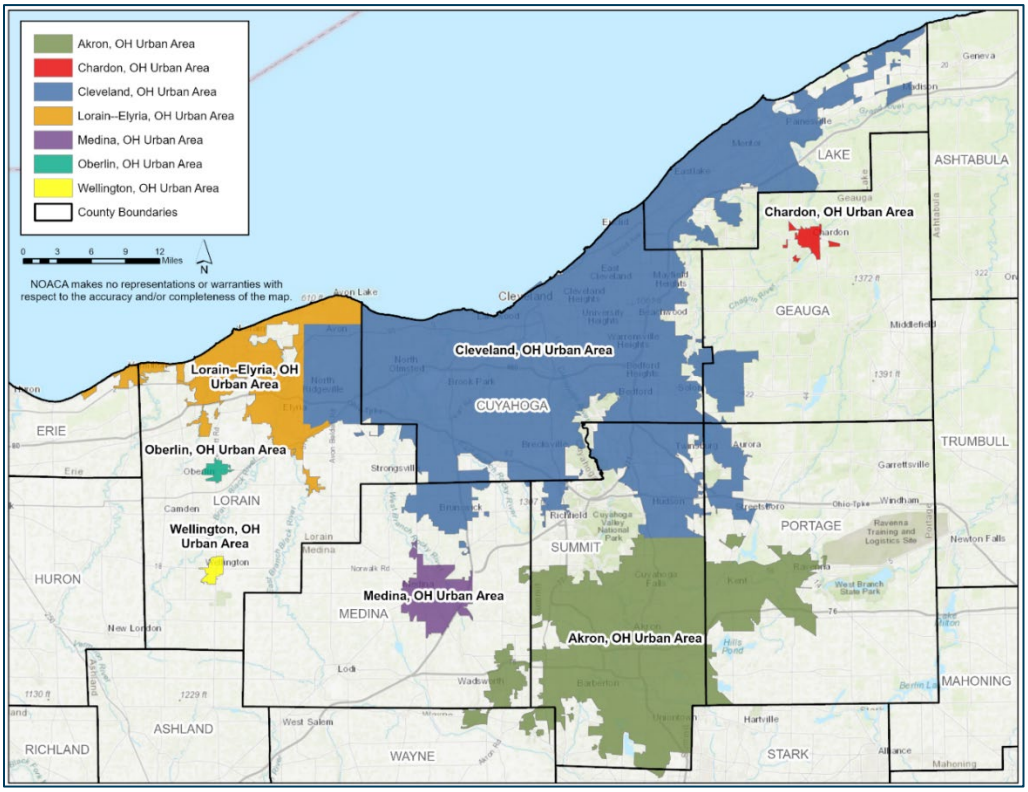
[7] Cleveland City Planning Commission, "Cleveland Zoning Code," https://planning.clevelandohio.gov/zoning/index.php (accessed May 28, 2025).
[8] Castele, Nick, March 15, 2024, "New, more flexible Cleveland zoning code pilot wins Planning Commission approval," *Signal Communications*, https://signalcleveland.org/new-more-flexible-cleveland-zoning-code-pilot-wins-planning-commission-approval (accessed Feb. 11, 2025)
[9] NOACA, *Complete and Green Streets Policy*, June 2020 https://www.noaca.org/home/showpublisheddocument/25242/637326542826470000 (accessed Oct. 22, 2024).
[10] Litman, Todd, 2019. Evaluating Transportation Land Use Impacts: Considering the Impacts, Benefits and Costs of Different Land Use Development Patterns (accessed May 28, 2025 from https://vtpi.org/landuse.pdf)

While outmigration clearly brought about changes in land use and supporting infrastructure in Northeast Ohio's urban core (see Chapters 1, 5-7), a parallel story exists in rural and agricultural areas suddenly inundated with new residents, stores, and employers. Over the past 70 years, farming communities were transformed into suburban communities. The pattern of development generally progressed along the fringe of urbanized areas and the corridors of major roadways. The following sections discuss these patterns and the outcomes of the region's shifting balance of population and development.[11]

Urbanized and Developed Communities

According to the U.S. Census Bureau, an urban area comprises a densely settled core of census tracts or census blocks that meet minimum population density requirements, along with adjacent territories that contain nonresidential urban land uses, as well as territories with low population density included to link outlying densely settled territories with the densely settled core (see Figure 7-3).[12] The 2020 Census Urban Area Criteria no longer distinguishes between Urbanized Areas and Urban Clusters. In 2010, the minimum population required to define an Urbanized Area was 50,000; an Urban Cluster required 2,500. In 2020, Urban Areas require a population of at least 5,000 or 2,000 housing units.[13]

Figure 7-3. Northeast Ohio Urban Areas in 2020



[11] NOACA, *Census 2020 Technical Analysis Report*. Feb. 14, 2022. https://www.noaca.org/home/showpublisheddocument/27763/637856175513800000 (accessed May 28, 2025)
[12] U.S. Census Bureau, "Redefining Urban Areas Following the 2020 Census," https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html (accessed May 28, 2025).
[13] Ibid.

As the region's urbanized area expands, new infrastructure (e.g., transportation, water, wastewater, and stormwater) is necessary to support intraregional migration. As a result, infrastructure costs for maintenance increase. The per capita costs increase even more given the decline in Northeast Ohio's population over the past 50 years.

Needed investment in maintenance of existing roadways and public transit competes with new transportation demands. Interregional migration leaves behind existing water, wastewater, and stormwater infrastructure and housing stock, and increases pressure for expanded infrastructure to serve new housing and commercial developments. Income moves out as people move out, which results in disinvestment in the previously developed area, often the urban core. The built environment continues to decline and becomes a burden on the populations that remain behind. Abandoned industrial areas, often requiring environmental remediation, increase as businesses seek new locations. As people and jobs move out, service sectors follow. Low-income and minority communities remain and must contend with the undesirable land uses and few remaining resources; they become "overburdened."

US EPA defines "Overburdened Communities" as "Minority, low-income, tribal, or indigenous populations or geographic locations that potentially experience disproportionate environmental harms and risks as a result of vulnerability to environmental hazards, lack of opportunity for public participation, or other factors."

Rural and Developing Communities

For the purposes of *WeNEO2050+*, "rural communities" are populated areas outside the regulated urbanized area boundaries. "Agricultural communities" are defined as those communities with the majority of land use dedicated to farming or agribusiness. Throughout Northeast Ohio, urbanized areas continue to expand into rural areas due to the development dynamics discussed in Chapter 6. The challenge this creates is two-fold: 1) New development consumes a valuable resource and potentially limits growth of local agriculture and food processing (see Chapter 5 and 2) New development in rural areas can actually create stormwater runoff and other pollution impacts for areas downstream. Many downstream areas are the overburdened communities described above, and excessive upstream development may lead to flooding, sewage backups, pollution transport, and other harmful impacts. Given overburdened communities are already struggling with abandonment, disinvestment, brownfields, and greyfields, additional development in upstream rural communities only exacerbates the hardships.

Land Use and Land Cover

In NOACA's *Clean Water 2020* (208 Plan), NOACA used the National Land Cover Data (NLCD) from 2001 and 2021 to illustrate land-use changes in Northeast Ohio.[14] The NLCD provides nationwide data on land cover and land cover change at a 30m resolution with a 16-class legend based on a modified classification system. The NLCD 2021 data represents the latest release and "now includes map products that characterize land cover and land cover changes across nine time periods from 2001 to 2021 (2001, 2004, 2006, 2008, 2011, 2013, 2016, 2019 and 2021)."[15] Tables 7-1 and 7-2 summarize the continued loss of cultivated lands, forests, wetlands, and grass

[14] Multi-Resolution Land Characteristics (MRLC) Consortium, "NLCD 2016," 2020, https://www.mrlc.gov (accessed Nov. 6, 2019)
[15] Multi-Resolution Land Characteristics Consortium (MRLC). "NLCD 2021 Now Available," https://www.mrlc.gov/ (accessed October 22, 2024).

lands to development which is illustrated in Figures 7-4 and 7-5.

Table 7-1. Northeast Ohio Land Cover Types in 2001 and 2021

Cover Type	2001 (mi^2)	2021 (mi^2)	2001-2021	Percent Change (%)
Barren Land	4.9	7.2	2.3	47.0
Cultivated Crops	415.8	419.8	4.0	1.0
Deciduous Forest	876.8	843.5	-33.3	-3.8
Developed - High Intensity	71.2	83.1	11.9	16.7
Developed - Medium Intensity	187.9	221.1	33.2	17.7
Developed - Low Intensity	415.3	430.2	14.9	3.6
Developed - Open Space	341.6	349.8	8.2	2.4
Emergent Herbaceous Wetlands	11.5	13.2	1.7	14.8
Evergreen Forest	8.9	8.8	0.0	-0.4
Grassland/Herbaceous	23.4	22.4	-1.0	-4.1
Mixed Forest	73.2	73.9	0.7	0.9
Pasture/Hay	486.0	442.9	-43.1	-8.9
Shrub/Scrub	3.7	6.3	2.6	71.5
Water	30.0	28.5	-1.5	-4.9
Woody Wetlands	127.8	127.1	-0.7	-0.5

Table 7-2. Northeast Ohio Land Cover Type Groups in 2001 and 2021

Cover Type Groups	Cover Types	2001 (mi^2)	2021 (mi^2)	2001-2021	% Change
Barren Land	Barren Land	4.9	7.2	2.3	47.0
Cultivated Lands	Pasture/Hay	901.8	862.7	-39.1	-4.3
	Cultivated Crops				
Developed Lands	Developed - High Intensity	1015.9	1084.2	68.3	6.7
	Developed - Medium Intensity				
	Developed - Low Intensity				
	Developed - Open Space				
Forested Lands	Deciduous Forest	958.9	926.2	-32.7	-3.4
	Mixed Forest				
	Evergreen Forest				
Grasslands	Grasslands/Herbaceous	23.4	22.4	-1.0	-4.1
Shrub/Scrub	Shrub/Scrub	3.7	6.3	2.6	71.5
Water	Water	30.0	28.5	-1.5	-4.9
Wetlands	Emergent Herbaceous Wetlands	139.3	140.3	1.0	0.7
	Woody Wetlands				

Figure 7-4. Northeast Ohio Land Cover in 2001

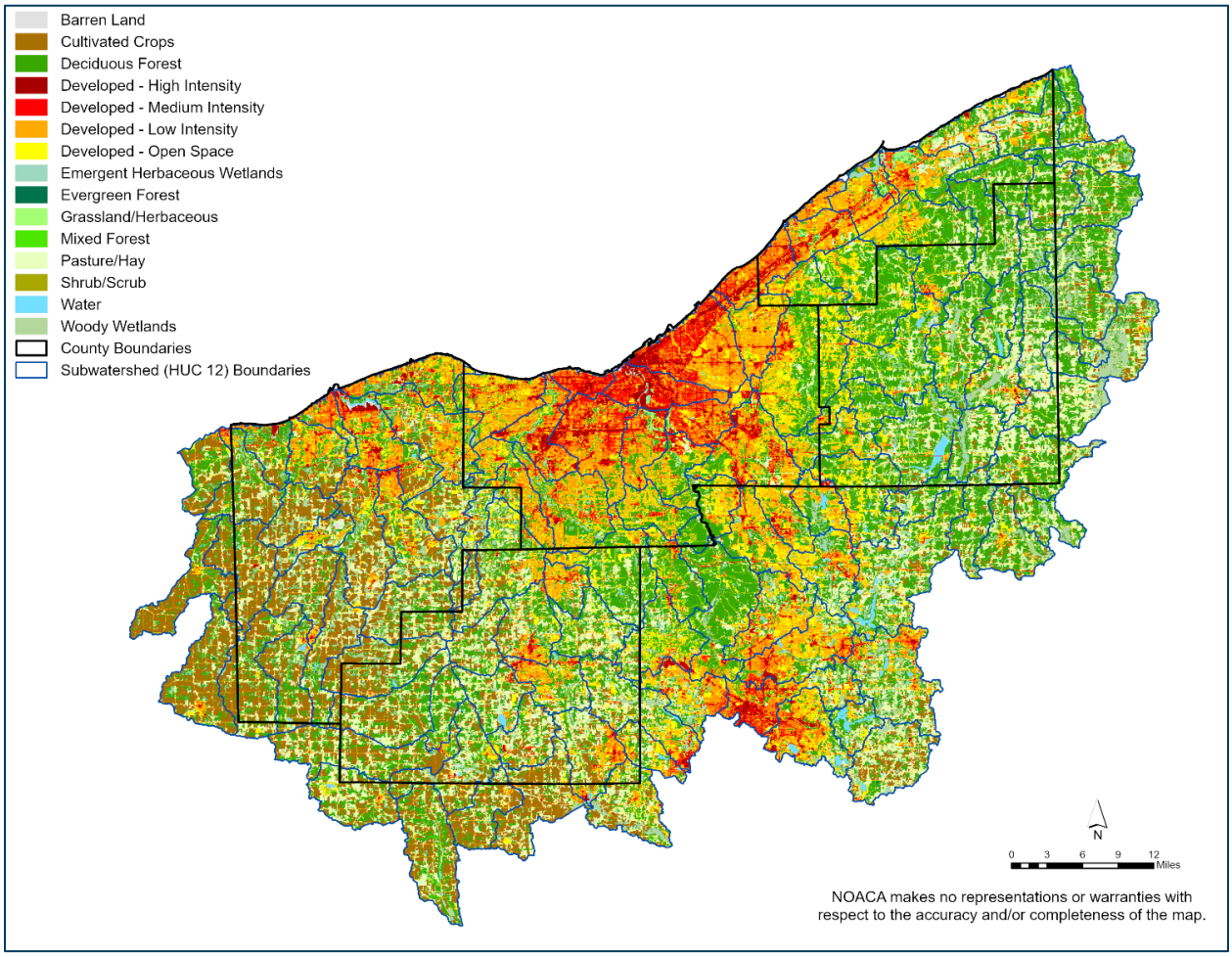
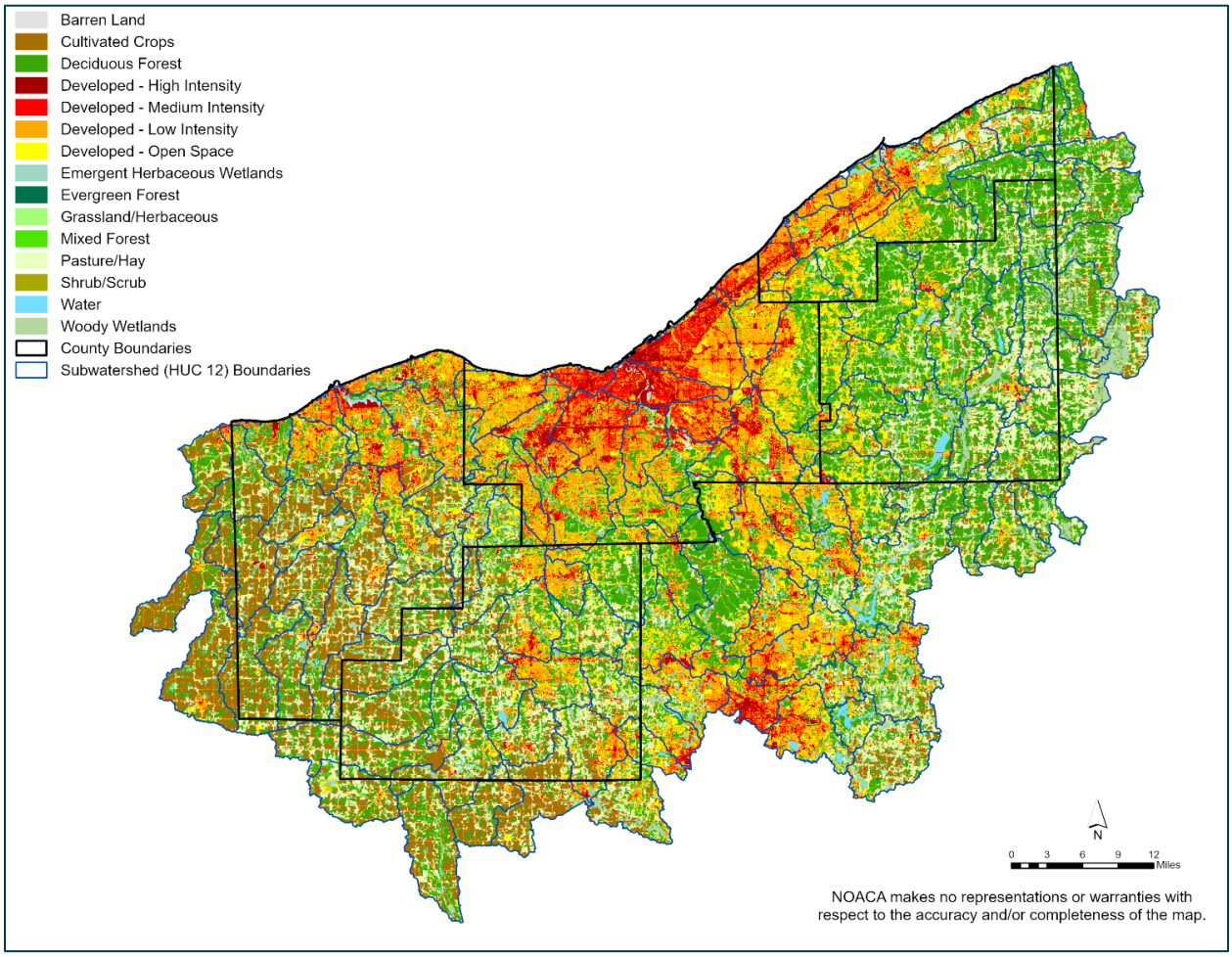


Figure 7-5. Northeast Ohio Land Cover in 2021



Land Use and the Transportation Network

The transportation network consists of the region's roadways, transit system, and facilities for bicycles and pedestrians. Route planning for each mode of travel requires analysis of current conditions and future expectations for safety, travel time, congestion, and mobility. Planners must also recognize how land use drives demand on specific modes or within certain locations.[16] Expansion of capacity (wider roadways and extended highways) accommodates the continued spread of the region's population. Investments in multimodal networks for walking, biking, and transit ridership, however, improve mobility within urban and suburban communities, and potentially stimulate redevelopment in higher-density, mixed-use neighborhoods closer to job hubs and serviced by existing infrastructure.

Figure 7-6 illustrates the cycle of how capacity expansion of the road network incentivizes new development and use of the network's roads until it justifies further expansion, and the cycle repeats itself. Table 7-3 illustrates how costs due to arterial/highway expansion impact land use far beyond the initial expense of design and construction.

[16] Mike McKeever and Bruce Griesenbeck, "Linking Transportation and Land Use," Federal Highway Administration, https://www.fhwa.dot.gov/policy/otps/innovation/issue1/linking.cfm (accessed November 15, 2024).

Figure 7-6. The Transportation Land Use Cycle

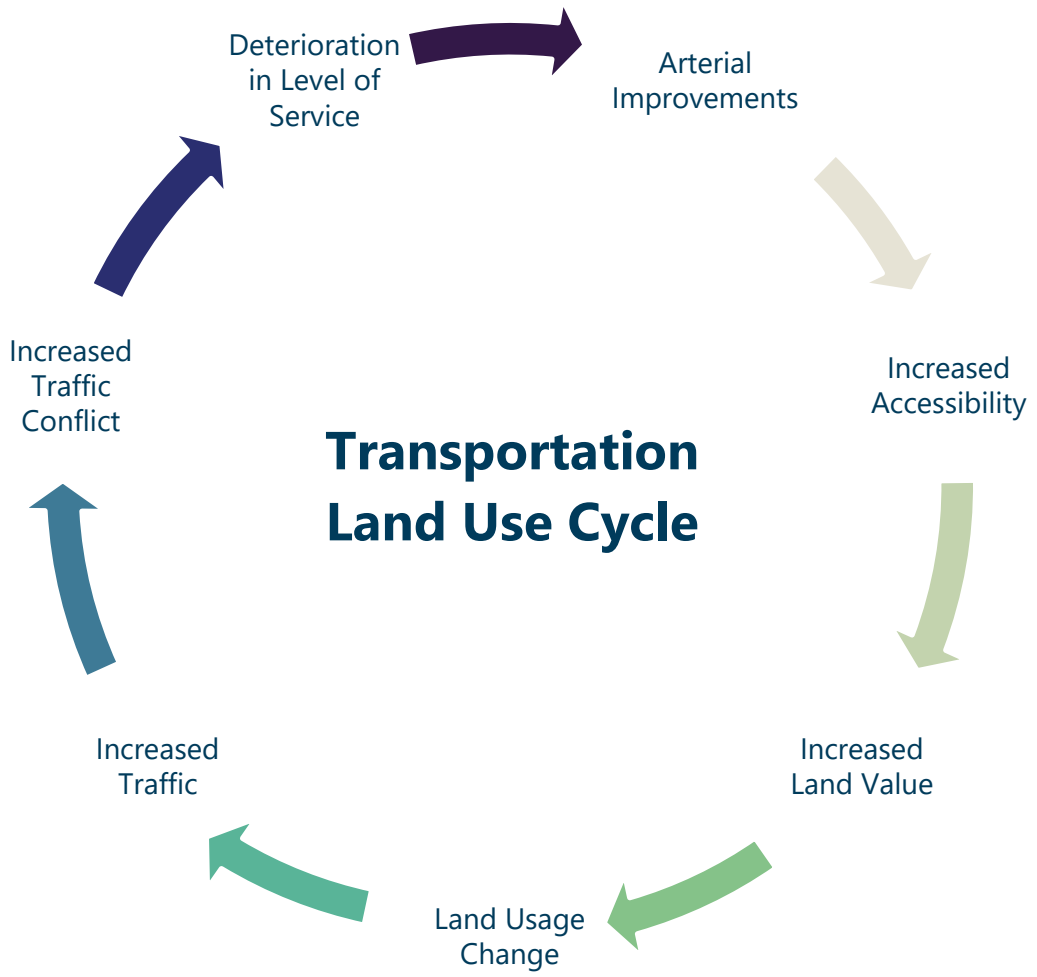


Table 7-3. Transportation Planning Land Use Impacts and Costs[17]

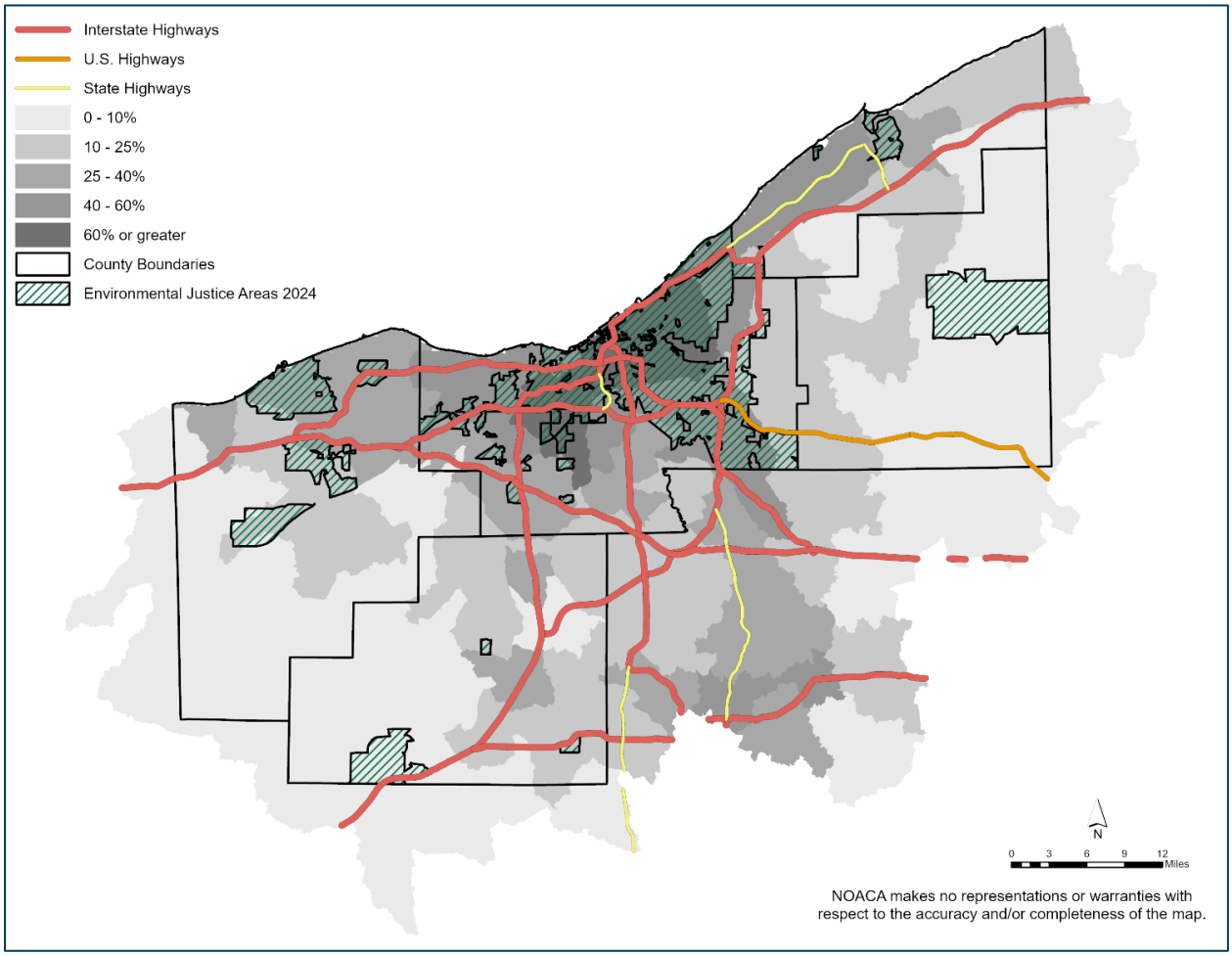
Increased Pavement Area	More Dispersed Development
• Reduced openspace (gardens, parks, farmlands and wildlife habitat). • Increased flooding and stormwater management costs. • Reduced groundwater recharge. • Aesthetic degradation.	• Reduced openspace (farmlands and wildlife habitat). • Longer travel distances, more total vehicle travel. • Reduced accessibility for non-drivers, which is inequitable (harms disadvantaged people). • Increased vehicle traffic and resulting external costs (congestion, accident risk, energy consumption, pollution emissions).

This table summarizes various land use impacts and costs from transport planning decisions.

[17] Litman, Todd, *Evaluating Transportation Land Use Impacts: Considering the Impacts, Benefits and Costs of Different Land Use Development Patterns*," pp. 2, 2023 https://vtpi.org/landuse.pdf (accessed April 23, 2025).

Another important aspect of land cover is the amount of paved or impervious surface as natural landscapes are vital to environmental quality protection and positive health outcomes for local populations. In Figure 7-7, environmental justice communities and the highway network are shown along with the percentage of impervious surface with the region's subwatersheds. As more highways are built to support more dispersed development, impervious surface coverage increases, and the compounding effects are disproportionately distributed to environmental justice areas. If development continues to expand outward from the urbanized areas, higher-intensity land uses will result in rising percentages of impervious cover within subwatersheds where highway access is available.

Figure 7-7. Northeast Ohio Major Highways, Subwatershed Percentage of Impervious Surface Coverage (2021), and Environmental Justice Areas



Real Estate

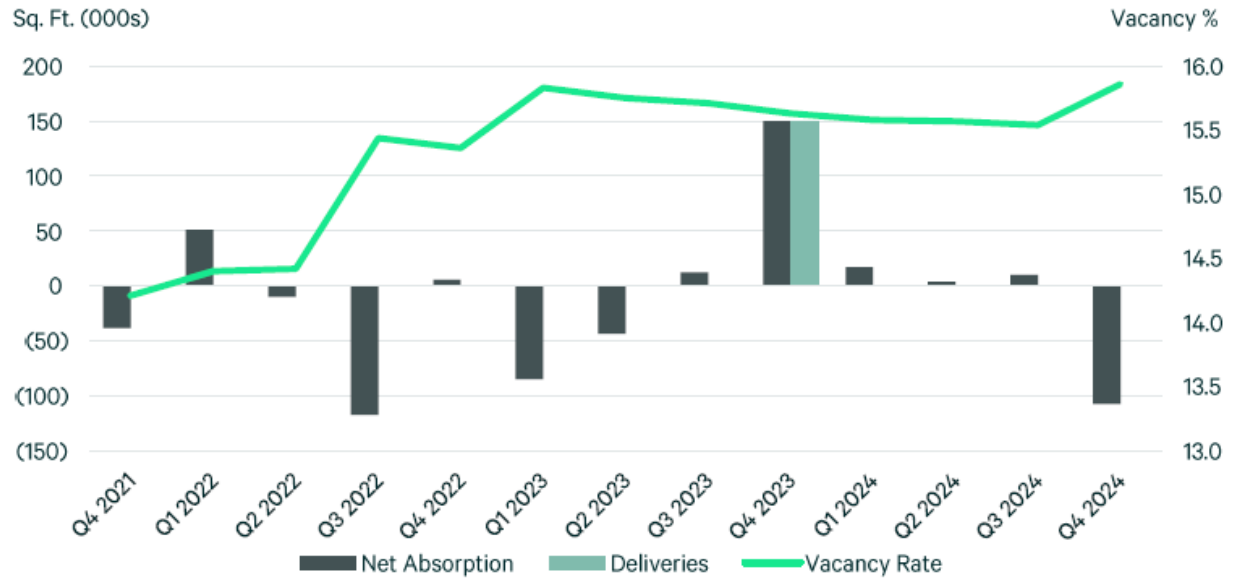
The saying in real estate is "location, location, location," and that is certainly true for land use. The cost of land and buildings, the cost and time to ship between locations, and the ability to attract workers and customers are all key factors in business profitability and, therefore, site selection. Similarly, location matters in residential real estate because people want to live where they can easily access their place of employment, stores and services, and recreation (see

Chapter 6 for more discussion about residential access to goods and services).

Commercial Office

The COVID Pandemic of 2020-2021 had significant impact on the commercial office real estate market across the United States; Cleveland was no exception. In its latest quarterly report, real estate firm CBRE notes that "the vacancy rate has floated around 15.5% for the past two years as the market has been recovering post-pandemic. Q4 2024 vacancy rate stands at 15.9%, a small increase from 15.6% in Q3 2024."[18] See Figure 7-8 for more details on post-pandemic absorption, deliveries and vacancies in greater Cleveland.

Figure 7-8. Historical Absorption, Deliveries and Vacancy (Commercial Space) 2021-2024[19]

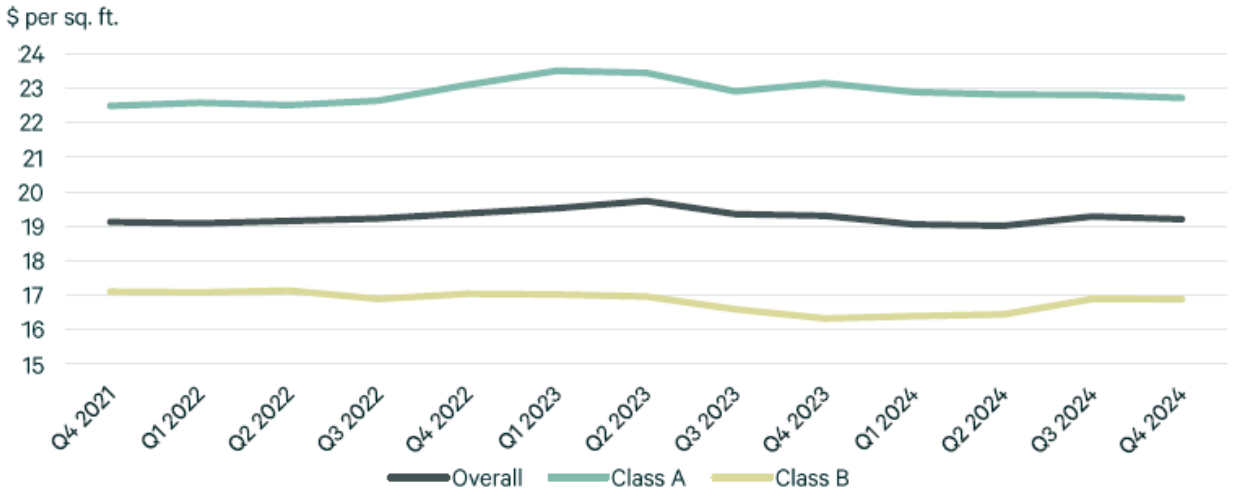


Source: CBRE Research, Q4 2024

The downtown vacancy rate sits at 19.5%, with a year-over-year change down 2%, while the suburban vacancy rate is at 13.4%, with a year-over-year change up 5%. The South submarket has the highest vacancy rate at 18.3% and has consistently been the regional sector with the highest vacancy rate since Q4 2022.[20] Additionally, Figure 7-9 shows the price per square foot to lease office space is higher in the central business district than the suburbs. However, while both markets saw a decline in year-over-lease rates, the decline was bigger downtown than in the suburbs.

[18] CBRE, "Consistent Vacancy Rates Indicate Stable Office Market;" https://mktgdocs.cbre.com/2299/9431b1e6-e09d-4449-a5c3-93f0dd722d20-893722070/Cleveland_Office_Figures_Q4_20.pdf (accessed February 17, 2025)
[19] Ibid.
[20] Ibid.

Figure 7-9. Average Commercial Office Lease Price for Greater Cleveland[21]



Source: CBRE Research, Q4 2024

CBRE also breaks down data by regional submarket.[22] Table 7-4 shows that 2024 closed on a downturn where the overall region and several submarkets saw net negative absorption. Absorption is the amount of office space leased (if a positive number) or made available (if a negative number). Although trends over several years are not available, CBRE does provide a good breakdown based on area of the region. Data show downtown Cleveland has the largest inventory of office space of any area, although the suburbs collectively exceed downtown. For the whole year 2024, data show that only downtown and the East, West, and Southwest markets had a net gain in leased office space. East contains three major regional job hubs: University Circle, Chagrin Highlands, and Solon. Southwest contains another major hub, Hopkins Airport.

Table 7-4. Commercial Office Space by Regional Area, Q4 2024[23]

	Net Rentable Area	Total Vacancy	Total Availability	Direct Availability	Sublease Availability	Avg. Direct Asking Rate (FSG/YR)	Current Quarter Net Absorption	YTD Net Absorption	Deliveries	Under Construction
Downtown	13,040,714	19.5	23.6	21.4	2.2	20.88	19,939	39,513	0	1,000,000
East	5,438,130	11.0	17.3	16.0	1.3	21.19	(24,812)	31,072	0	0
Northeast	1,522,490	12.8	14.4	14.4	0.0	15.94	(30,426)	(99,318)	0	0
South	5,904,965	18.3	26.2	24.8	1.4	17.51	(54,248)	(33,602)	0	165,000
Southeast	983,433	10.9	19.4	19.4	0.0	13.82	11,758	1,847	0	0
Southwest	2,111,124	15.2	25.4	25.4	0.0	15.51	(38,673)	(29,874)	0	0
West	3,808,886	9.4	15.3	14.8	0.5	16.79	8,935	13,374	0	0
Total	32,809,742	15.9	21.6	20.2	1.4	19.20	(107,527)	(76,988)	0	1,165,000

Source: CBRE

Commercial Retail

The retail subsegment of commercial space has improved somewhat since the onset of the COVID pandemic in 2020, according to research firm Colliers International (Figure 7-10).[24] The

[21] Ibid.
[22] Ibid.
[23] Ibid.
[24] Colliers International, "2024 Q4 Retail Cleveland Report," https://www.colliers.com/download-article?itemId=70302a50-afce-4181-ac13-b491d82eb17f (accessed February 20, 2025)

vacancy rate for retail is far lower than that for office and the retail trend is slightly improved over the past year (Figure 7-11).[25] More than 360,000 square feet of retail space is under construction with just over 92,000 square feet of retail absorbed in the last quarter. Retail sales in one community generally mean fewer sales in another; it represents a shift in economic activity rather than regional growth. It is noteworthy that retail lease rates have declined nearly 25% in the past year. It will be increasingly important to maintain or establish retail in areas with developed infrastructure so the region's development footprint does not continue to spread despite a declining population.

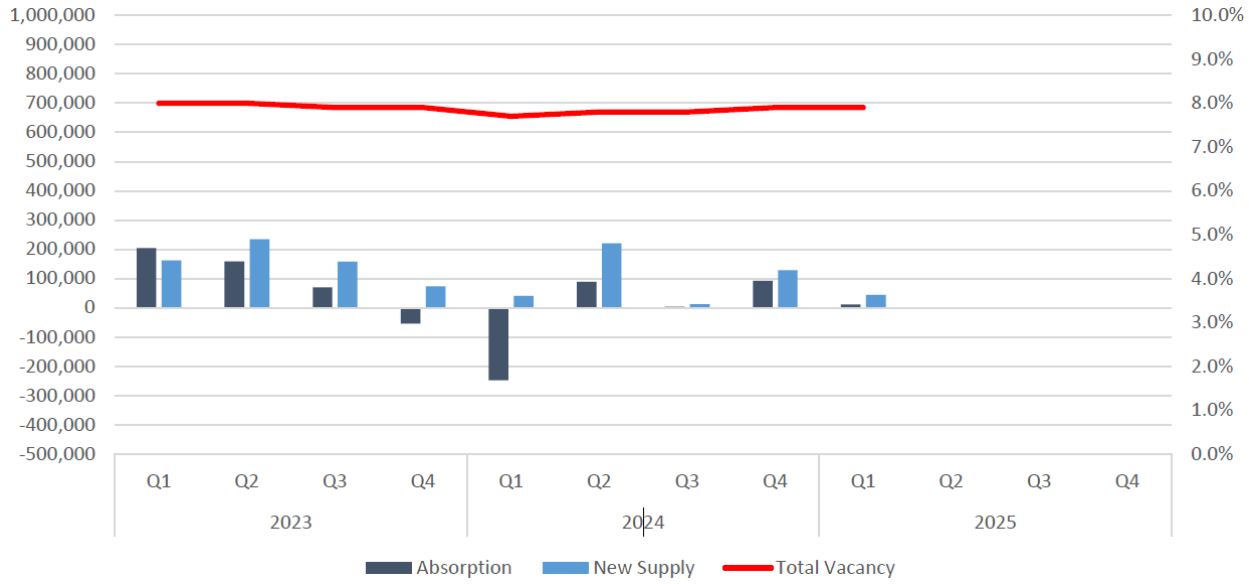
Figure 7-10. Commercial Retail Space for Cleveland/Akron Market, Q4 2024

Historic Comparison

	24Q1	24Q4	25Q1
"Total Inventory (in Millions of SF)"	123.3	124.6	124.8
"New Supply (in Thousands of SF)"	40.0	128.7	44.4
"Net Absorption (in Thousands of SF)"	-247.3	98.3	10.8
Overall Vacancy	7.7%	7.9%	7.9%
"Under Construction (in Thousands of SF)"	467.1	360.4	583.2
"Overall Asking Lease Rates (NNN)"	$10.58	$9.86	$10.01

Source: Colliers International

Figure 7-11. Commercial Retail Absorption and Vacancy Trends for Cleveland/Akron Market (2023 to Q1 2025)



Source: Colliers International

[25] Ibid.

The commercial retail situation illuminates Northeast Ohio development patterns. Economic developers recognize that retail tends to be zero-sum, where growth in one area corresponds with decline in another area. However, jurisdictions seek retailers because retailers pay commercial property taxes, employ many people who pay income tax (the third largest private sector employer), and may attract people from outside the jurisdiction who will pay sales tax to the jurisdiction. This helps explain why there are 24.5 square feet of retail space per person in the United States, compared to 4.5 square feet per person in Europe.[26] In the Greater Cleveland-Akron-Canton area (Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Stark, and Summit counties), the amount of retail is 25.2 square feet per person as of 2019. This statistic only reflects malls, strip malls, big boxes, and other facilities of at least 50,000 square feet, which means the actual square footage per person is even higher.[27] This makes retail extremely competitive and subject to failure, especially during shocks such as the coronavirus pandemic or an economic downturn.

Northeast Ohio examples of the retail transition from downtown to suburban shopping mall to lifestyle center include the City of Elyria, Midway Mall (Lorain County) and Crocker Park (Westlake). Elyria's historic, walkable downtown included two-to-three-story mixed-use buildings, with ground-floor retail and commercial office and residential on the upper floors. This made it possible for people of all incomes to live, work, and shop without needing a personal vehicle. It also surrounds a large public greenspace used for relaxing or recreation. In 1966, however, Midway Mall opened on the fringe of Elyria and was anchored by large national chain stores and no commercial office or residential uses. The mall not only attracted residents from a broad area, but neighboring communities also witnessed its boom and tried to replicate it with smaller retail centers and strips. This growth came at the expense of downtown Elyria, which lost several of its retailers and, subsequently, office and residential occupancy. Furthermore, the competition between Midway and the smaller venues created challenges for Midway.

Economic development within underutilized historic centers and districts more efficiently leverage the capital infrastructure investments already made without demand for new or expanded roads, surface parking lots, and highway interchanges. This strategy will also make available jobs and services within easier reach of low-income and minority populations who rely more on walking, biking, and transit to navigate the region.

Industrial

Unlike office and residential space, industrial property lease rates are higher (i.e. vacancy rates are lower) in most suburban areas versus the urban core. Q4 2024 is the third consecutive quarter in which the Cleveland industrial market has held a vacancy rate of 2.8%, which indicates a stable market in 2024 (Table 7-5).[28] The southern submarkets currently see the most lease activity as there is easy access to major transportation routes and large labor pools. It is unlikely companies in these sectors will choose dense downtown areas, nor do communities typically want them due

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[26] Gregory Scruggs, "The Unmalling of America: How Municipalities Are Navigating the Changing Retail Landscape," *Land Lines* (The Lincoln Land Institute, January 2020); https://www.lincolninst.edu/sites/default/files/pubfiles/unmalling-of-america-lla200105.pdf (accessed May 28, 2025)

[27] CBRE, "Cleveland Retail, H1 2020"; http://cbre.vo.llnwd.net/grgservices/secure/Cleveland_Retail_MarketView_H1_2020.pdf?e=1614260433&h=7c60251e02dfe9d0208feaccf16a7324 (accessed

[28] CBRE, "Cleveland Industrial Figures: Q4 2024," https://www.cbre.com/insights/figures/cleveland-industrial-figures-q4-2024 (accessed February 20, 2025)

to noise, pollution, and safety concerns with large trucks (although they often generate coveted tax revenue). A recent example is GOJO Industries, who leased space at Cleveland's I-X Center to expand its operations due to increased demand during the coronavirus pandemic. This happened just two months after the I-X Center announced its closure. The GOJO expansion makes excellent use of existing building, roads, and utilities in the Hopkins Airport hub, which demonstrates the importance of major regional job hubs and existing infrastructure for industry clusters.[29] Furthermore GOJO's expansion into Maple Heights also takes advantage of a mature transportation system and available capacity in an Environmental Justice community.

Table 7-5. Industrial Real Estate Metrics by Location, Q4 2024

	Net Rentable Area	Total Vacancy	Total Availability	Direct Availability	Sublease Availability	Avg. Direct Asking Rate (NNN/YR)	Current Quarter Net Absorption	YTD Net Absorption	Deliveries	Under Construction
Downtown	44,495,442	2.6	3.4	3.4	0.0	4.57	(129,225)	(126,939)	0	0
East	6,285,747	1.2	2.9	2.9	0.0	8.53	10,399	28,893	0	0
Geauga West	2,129,114	1.7	2.5	2.5	0.0	6.85	0	(13,000)	0	0
Lake County West	26,586,962	1.9	3.3	3.2	0.0	5.17	(6,470)	140,849	0	100,000
Northeast	26,821,191	1.8	2.7	2.7	0.0	3.92	0	159,713	0	434,000
Northwest	32,874,208	1.9	2.8	2.8	0.0	6.4	49,067	64,458	0	200,000
Out of Submarket	1,917,092	60.6	61.5	60.6	0.9		309,798	654,798	0	180,000
South	36,117,328	3.0	3.4	3.0	0.4	6.67	(19,684)	(375,216)	0	0
Southeast	57,957,238	3.7	5.2	4.7	0.5	5.82	(292,885)	(180,926)	0	153,000
Southwest	47,341,648	1.6	5.1	4.7	0.4	5.96	69,035	508,361	19,500	111,700
Total	282,525,970	2.8	4.3	4.1	0.2	5.62	(9,965)	860,991	19,500	1,178,700

Source: CBRE

Table 7-6 shows that industrial real estate can be broken into different property types. Over the past several years, distribution has been a rapidly growing segment, overtaking manufacturing as the largest industrial property type by square footage. In 2024, distribution space absorbed over 325,000 ft^2, while manufacturing space absorbed more than 505,000 ft^2. Nearly 900,000 ft^2 of warehouse space is under construction. Despite the higher absorption of manufacturing in 2024, the long-term trend of distribution space expansion is likely to continue, as online shopping continues to grow and people expect fast delivery of orders. To this extent, Amazon repurposed two vacant malls in the NOACA region and a third in neighboring Summit County. Community officials for the Euclid Square and Randall Park malls in Cuyahoga County recognized they could repurpose these large buildings and leverage the existing roads, sewers and utilities around them.

Table 7-6. Industrial Real Estate Metrics by Subsector, Q4 2024[30]

	Net Rentable Area	Total Vacancy	Total Availability	Direct Availability	Sublease Availability	Avg. Direct Asking Rate (NNN/YR)	Current Quarter Net Absorption	YTD Net Absorption	Deliveries	Under Construction
Distribution / Logistics	140,263,467	4.4	6.6	6.1	0.4	5.64	50,925	327,393	19,500	898,700
Manufacturing	114,688,638	1.2	1.9	1.9	0.0	4.82	(98,836)	505,080	0	280,000
R&D / Flex	19,605,203	2.1	3.3	3.2	0.1	8.31	26,201	25,963	0	0
Other Industrial	7,968,662	0.6	0.7	0.7	0.0	8.40	11,745	2,555	0	0
Total	**282,525,970**	**2.8**	**4.3**	**4.1**	**0.2**	**5.62**	**(9,965)**	**860,991**	**19,500**	**1,178,700**

Source: CBRE

[29] Eric Heisig, "GOJO, the Akron-based Maker of Purell, Will Lease Space at the Coronavirus-shuttered I-X Center in Cleveland," *Cleveland.com*, Nov. 20, 2020; https://www.cleveland.com/realestate-news/2020/11/gojo-the-akron-based-maker-of-purell-will-lease-space-at-coronavirus-shuttered-i-x-center-in-cleveland.html (accessed April 17, 2025).

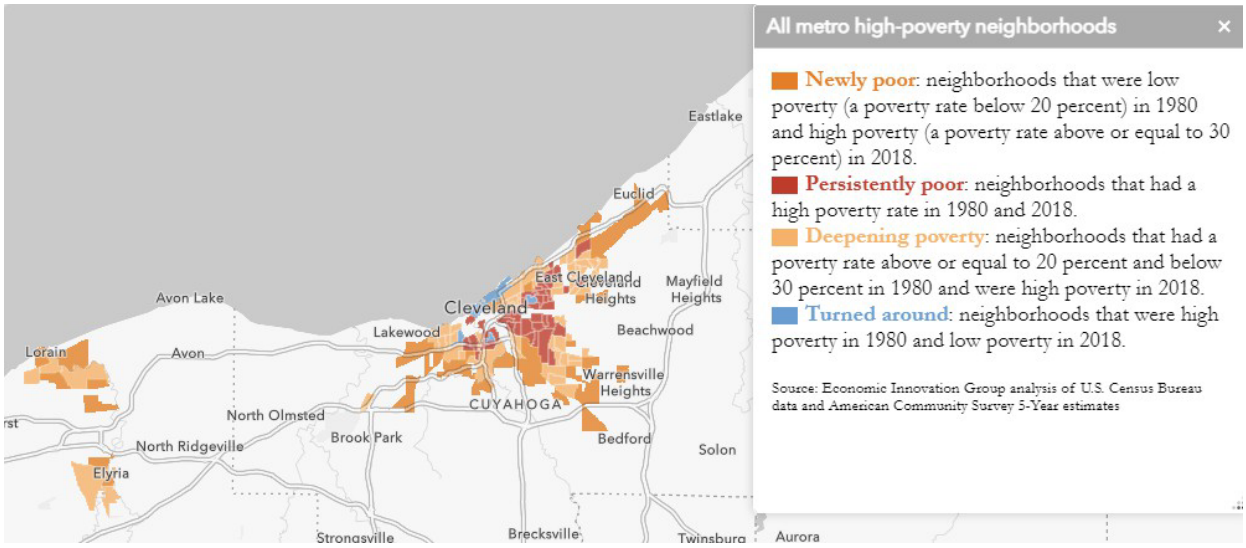
[30] CBRE, "Cleveland Industrial Figures: Q4 2024," https://www.cbre.com/insights/figures/cleveland-industrial-figures-q4-2024 (accessed February 20, 2025)

Residential

Research from the Center for Population Dynamics at Cleveland State University finds that the downtown population of college-educated young adults specifically has increased after the Great Recession at a faster rate than the nation as a whole (see Chapter 5). Residential growth may not seem as important to economic development as commercial or industrial growth, but cities around the country hope to attract young professionals because they are likely to have higher wages and spend more money. This further encourages commercial growth, as businesses want to be located near potential employees and customers. An exclusive focus on this group of young, highly educated office workers threatens to leave many people behind, however. It will be imperative for stakeholders to consider people of all ages and education in economic development to ensure a more equitable future for Northeast Ohio.

Deepening and expanding poverty has prevailed in certain areas of Northeast Ohio since 1980. Figure 7-12 shows that most east-side Cleveland neighborhoods were high-poverty in 1980 and remain so today, many with even higher poverty now. Additionally, poverty has suburbanized; many inner-ring suburbs now experience higher poverty rates. Elyria and Lorain also experienced new or worsening poverty. Please note this is the most recent study available from the Economic Innovation Group (not updated after 2018).

Figure 7-12. High Poverty Census Tracts, 1980 and 2018[31]



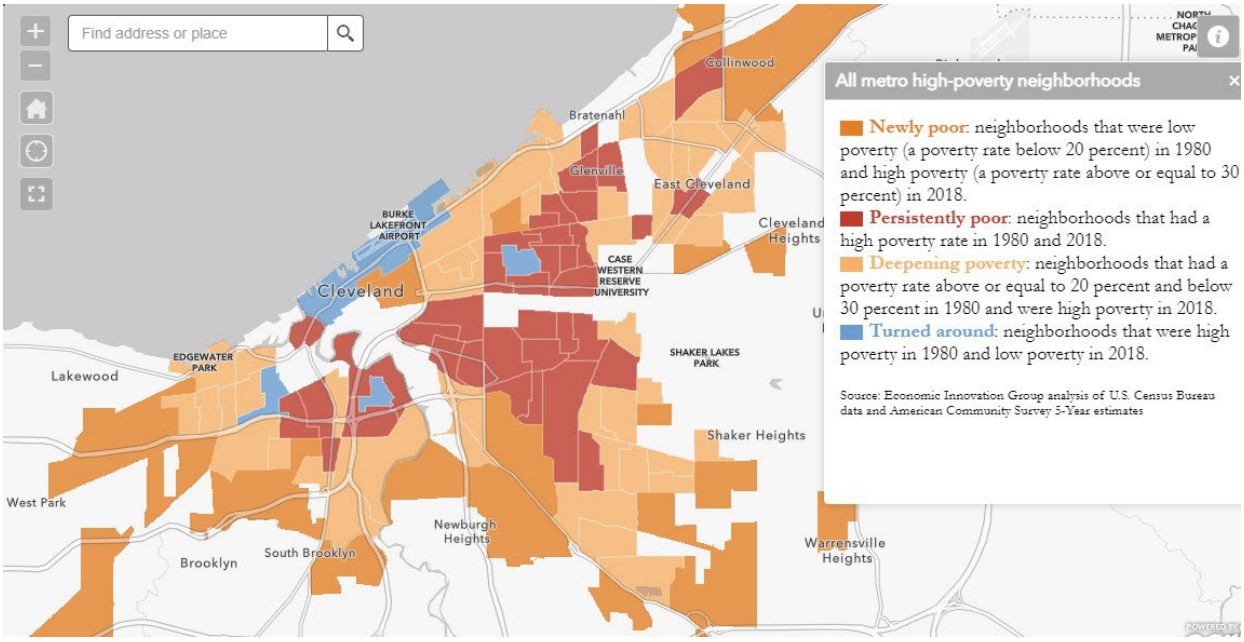
Source: Economic Innovation Group

A few Cleveland neighborhoods have maintained lower poverty rates during the period (University Circle, Ohio City) or experienced declines in poverty rates during the period (Downtown, Asiatown, Hough, Tremont, Detroit Shoreway) (see Figure 7-13). Some of these areas have undergone substantial growth and rapid increases in high-end residential sales (see Chapter 6). These are the areas where gentrification may be a concern. Planners and policymakers can work to ensure that existing residents benefit from neighborhood change through targeted housing assistance, new job training, and multimodal transportation connections to access employment

[31] Economic Innovation Group analysis of U.S. Census Bureau and American Community Survey data. Interactive map found at https://eig.org/neighborhood-poverty-project/interactive-map (accessed May 28, 2025).

opportunities. See Chapter 6 for a more detailed discussion on housing.

Figure 7-13. Shifting Poverty Rates in Cleveland Neighborhoods, 1980-2018[32]



Source: Economic Innovation Group

Parking

Parking is a relevant, but often overlooked, factor in real estate. Its availability, the space to provide it, and the cost to build it all influence where development occurs. Public infrastructure firm WGI notes that, in 2024, the average cost to build one parking space in an above-ground parking garage in Cleveland was $ $28,375.[33] Surface lot spaces cost less, and underground garage spaces cost more due to materials and design. Central business district spaces cost more than those in outlying areas due to greater demand for land. This is one factor that encourages both outward migration of development and more driving to reach outlying development.

In addition, downtown parking lots are a lucrative business, which means owners are often reluctant to sell. This reluctance to sell prevents a higher and better use that could employ more people and generate more income for a city. The high cost to purchase the lot for development discourages business relocation to these areas. Urban planning researcher Donald Shoup suggests three steps to change course: eliminate mandatory parking minimums, charge the right price at the right time for public parking, and invest these proceeds back into the neighborhood in the form of improved services or amenities, such as transit and cycling.[34]

Shoup's first step, eliminate parking minimums, does not mean there will be no parking. Rather, it

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[32] Ibid.
[33] Smith, Raymond and Rob McConnell, "Parking Structure Cost Outlook for 2024" (WGI, 2024); https://publications.wginc.com/hubfs/WGIs%20Parking%20Structure%20Cost%20Outlook%20for%202024.pdf (accessed April 23, 2025).
[34] Matt Hurst, "Q&A: UCLA's Parking Guru Donald Shoup," *UCLA Newsroom*, Jan. 15, 2014; https://newsroom.ucla.edu/stories/q-a-ucla-s-parking-guru-donald-249859 (accessed May 28, 2025)

means businesses and the free market can decide how much parking to provide. Parking minimums raise costs for businesses because they force developers to purchase enough land to accommodate the spaces, build the spaces, and maintain the constructed parking facility.

Parking is a low-value land use; every parcel dedicated to the temporary storage of vehicles does not have a viable business that provides jobs, sales, and higher tax revenue. The only exceptions are private parking facilities whose owners may employ attendants. Required parking minimums also consume excess land and reduce development density. Lower densities induce driving and make transit, cycling, and walking less feasible. Lower densities also raise housing construction costs, which can discourage people from staying in, or relocating to, the region. Reduced parking, higher densities, and increased emphasis on denser, walkable, transit-accessible, and mixed-use development may help low-income residents who currently struggle to access jobs because they do not own a vehicle. Reduced parking requirements may also help low-income residents more readily afford housing (i.e., lower housing costs if parking is not required with the unit).

NOACA, as a transportation agency, could offer to convene a discussion on parking best management practices. One NOACA program, the Transportation for Livable Communities Initiative (TLCI), funds planning and implementation of multimodal transportation improvements; parking is often a concern in these projects because road reconfigurations may change the amount of available parking. These site-specific plans to optimize parking may be scaled across neighborhoods or entire cities.

NOACA Efforts

NOACA has pursued several efforts that address the intersection of land use and transportation. As land use and zoning are a primarily local responsibility, NOACA has been working closely with counties and municipalities in ensuring that land use decisions and transportation investments are mutually beneficial. The subsequent section describes NOACAs efforts in assessing transportation demand based on land uses and in enabling communities to take an integrated look at their land use and transportation needs.

Transportation for Livable Communities Initiative (TLCI)

NOACA's Transportation for Livable Communities Initiative (TLCI) is a program that focuses on "integrated transportation and land use planning and projects that strengthen community livability."[35] TLCI advances the goals of NOACA's *Regional Strategic Plan* through the following objectives:

- Develop transportation projects that provide more travel options through complete streets and context sensitive solutions, increasing user safety and supporting positive public health impacts
- Promote reinvestment in underutilized or vacant/abandoned properties through development concepts supported by multimodal transportation systems
- Support economic development through place-based transportation and land use recommendations, and connect these proposals with existing assets and investments
- Ensure that the benefits of growth and change are available to all members of a community by integrating principles of accessibility and environmental justice into projects

[35] Northeast Ohio Areawide Coordinating Agency (NOACA), "Transportation for Livable Communities."; https://www.noaca.org/community-assistance-center/funding-programs/transportation-for-livable-communities-initiative-tlci (accessed May 28, 2025)

- Enhance regional cohesion through support of collaboration between regional and community partners
- Provide people with safe and reliable transportation choices that enhance their quality of life

The initiative is split into two categories: Planning Projects and Implementation Projects. Planning studies lead to improvements of transportation systems and the neighborhoods they support. Implementation projects help communities move forward with the development and installation of infrastructure from completed livability studies.

The TLCI program is especially useful to communities for maintenance and redevelopment of existing infrastructure. TLCI plans help improve safety and connections to work, business, and community amenities such as schools, libraries, and parks. Altogether the program looks to improve livability to retain residents and attract new ones. As of 2025, NOACA has invested nearly $10.1 million into 140 Planning Studies, and $18.6 million into 91 Implementation Projects.

NOACA's TLCI projects focus on bicycle and pedestrian improvements, multimodal connectivity, transit access, greenspace connectivity, traffic studies, downtown/district redevelopment master plans, and comprehensive corridor and complete street plans. These types of projects support existing neighborhoods and infill housing developments to increase modal choice and quality of life. Figure 7-14 shows some of the program scopes covered in funded projects from 2021-2025.

Figure 7-14. Examples of NOACA TLCI-funded projects and scopes (2021-2025)[36]

CORRIDOR & COMPLETE STREETS	Middleburg Heights - Southland District's Smith Road Complete Street (2022)
	Painesville - City of Painesville's Downtown Complete Street and Streetscape Enhancement (2022)
	Lorain - West Erie Avenue Road Diet (2022)
	Cleveland - East 140th Streetscape - St. Clair Avenue to Lakeshore Boulevard (2023) Cuyahoga County/Shaker Heights - Lee Road Complete Street Project (2025)
BIKE & PEDESTRIAN	North Ridgeville - North Ridgeville Active Transportation (2021)
	University Heights - Pedestrian Improvements along Warrensville Center Road at Traymore and Hillbrook Intersections (2022)
	Middlefield - Tare Creek Sidewalk Connector (2022)
	Cuyahoga County - Lake-Clifton Connector (2023) Lorain - Oakwood Connector-South Lorian Library Trail
TRANSIT	Berea - Downtown Berea Multi-Modal Transportation Improvements (2021)
	GCRTA /East Cleveland - Re-imagine Euclid Corridor: Multi-modal Transportation Plan (2021)
	Laketran - Joint Laketran GCRTA Transit Planning Study at Shoregate (2021)
GREENSPACE CONNECTIONS	Lorain County Metro Parks - Sheffield Village Frenck Creek Road Connector (2021)
	Parma - West Creek Greenway – South Park Connector (2022)
	Cleveland Heights, South Euclid, University Heights - The Heights Regional Neighborhood Greenway Phase 1 (2023)
	Sheffield Lake - Lakefront Connectivity Improvements Phase 3 (2023) Euclid – Euclid Heritage Trail (2025)
REDEVELOPMENT	Bedford - Bedford Historic District Connectivity (2021)
	Grafton - Grafton - Envision Main Street Project - Phase 2 (2021)
	Lorian - East 28th Street Corridor Planning Study (2021)
	Elyria - Elyria Downtown Revitalization Phase 5 (2023)

[36] Ibid.

Vibrant NEO

Vibrant NEO 2040, an extraordinary effort to articulate a regional vision framework for the 12-county region of Northeast Ohio (including NOACA's five counties), illustrated the fiscal implications of continued outward spread of development with simultaneous decline of the region's population (see Chapter 2). In this context, as businesses and jobs spread, they often move from one place to another in the region, with accompanying tax and job losses in some places and gains in others. While this is certainly beneficial for the receiving community, there is essentially no regional benefit. Furthermore, communities that were receiving population 50 years ago have now started to lose population. From a regional perspective, business and job attraction from other areas to our region are critical to grow every community's tax revenue to provide services and amenities. Indeed, the authors of *Vibrant NEO 2040* found that every county government budget will be unbalanced by 2040 if the status quo continues. Expenses would exceed revenues due to unsustainable development patterns. By law, budgets must balance, which means this financial shortfall would result in costly tax increases or decaying infrastructure, both of which discourage business retention, expansion, and attraction.

Vibrant NEO identifies six different "Place Types," based on the age and form of the housing stock, and 23 different "Development Types" within these places. Local community members and key stakeholders can determine the place type(s) and development type(s) they currently have or want to encourage. Vibrant NEO 2040 makes recommendations and describes initiatives for each place type to promote land use and transportation systems that result in equitable and sustainable growth to maintain or realize desired types.

One example is the list of Pilot Projects, a searchable database of best practices from around the region, updated in 2020.[37] It illustrates how many NOACA communities across the region continue to progress toward implementation of *Vibrant NEO 2040* recommendations. Examples include the City of Lakewood Affordable Housing Strategy, Lake County Better Flip housing revitalization effort, and the City of Lorain Broadway streetscape improvements. Another tool is the Vibrant NEO Policy Framework, which provides dozens of detailed recommendations that county or local governments can adopt.[38] NOACA itself has adopted several relevant policies such as its Complete and Green Streets Policy (described below). The Vibrant NEO framework can foster the growth of existing companies and the creation of new ones rather than the zero-sum movement of existing businesses within the region.

In 2021, NOACA and Vibrant NEO entered a Memorandum of Agreement (MOA) to form the NOACA-Vibrant NEO Brownfield Coalition (Coalition) in order to apply for a Brownfields Revolving Loan Fund (RLF) grant from the US EPA. The Coalition was awarded $1,000,000 in 2022 to implement the RLF for brownfields remediation projects. A Brownfields Steering Committee was created to review application for loans/subgrants, conduct standard due diligence normally undertaken by lending entities, and recommend projects to the NOACA and Vibrant NEO Boards of Directors based on criteria developed by Vibrant NEO. Upon executing its first loan in 2024, the Coalition applied for supplemental funding from the US EPA and was awarded an additional $1,000,000 to grow the RLF. A total of four loans have been approved, in the amount of $1,508,000.

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[37] Vibrant NEO, "Pilot Projects", 2020, https://vibrantneo.org/action-products/pilot-projects/ (accessed May 28, 2025)

[38] Vibrant NEO, "Vibrant NEO 2040 Policy Vision Framework, December 6, 2013, https://vibrantneo.org/wp-content/uploads/2014/01/Vibrant-NEO-2040-Policy-Framework.pdf (accessed May 28, 2025)

In 2023, the Vibrant NEO Board of Directors approved the Vibrant NEO Board Strategy: Background, Recommendations and Role. The following are recommended actions that track those in the Vibrant NEO report and are of critical importance to the region's future:

- Achieve Growth and Density in the Core of the Region with a Focus on Transit Oriented Development.
- Discourage Further Sprawl
- Consolidate Local Government Services
- Redevelop Land (i.e., reuse abandoned land, deteriorated sites and brownfields in a way that is consistent with the goals set out in the Vibrant NEO plan)
- Help Businesses and Jobs (i.e., revitalize the region's economy by helping existing businesses to expand and by bringing new businesses and jobs to the region)

Workforce Accessibility and Mobility

NOACA's Workforce Accessibility and Mobility study, completed in 2019, looks to the future of economic growth through regional job hubs and worker accessibility. Noting that Northeast Ohio's economy is only as strong as its workforce, the study highlights important considerations for job hub development and workplace access.

The study indicated that improved access and mobility was contingent upon job site selections and residential land use patterns and recommended that employee access and mobility factor into development and siting of job hubs. The primary analysis focused on commute time data based on workers' home ZIP codes and the ZIP codes of six major job hubs in the Cleveland metropolitan statistical area (MSA) which all happen to be in Cuyahoga County, with subsequent work focused on legacy and minor job hubs in the collar counties. NOACA created a travel time shed for each identified job hub using data from NOACA's travel forecasting model. The data included both auto and transit trips. Additionally, NOACA considered socioeconomic data (age, income, job industry, race, ethnicity, educational attainment, and gender) to draw correlations between worker characteristics and measurements of access. The objective was to spatially match employees to job hubs in order to achieve a goal of shorter commute times and reduced vehicle miles traveled.

NOACA can glean data from this extensive study in various ways to improve employment access, including:

- employment agencies to match job seekers to easily accessible employment
- business retention planning
- business location siting
- workforce development

The Workforce Accessibility and Mobility Study concludes with recommendations to further improve transportation to job hubs for a wide range of workers and their needs, and to incentivize development of new housing and workplaces closer to existing job hubs and transit stations (Transit Oriented Development).[39]

[39] NOACA, "Workforce Accessibility and Mobility" (Cleveland: NOACA, November 2019), https://www.noaca.org/home/showpublisheddocument/24551/637117481132970000 (accessed May 28, 2025)

Transit-Oriented Development (TOD)

Transit Oriented development (TOD) is "compact, walkable development integrally linked to public transportation." NOACA's "Regional TOD Scorecard and Implementation Plan" highlights that most successful TOD includes a mixture of the following elements:

- *Development that is compact and dense*. Compact in relative terms, especially compared to the surrounding area. This allows more people to live, work, shop, or go to school within walking distance of the station or stop.
- *A rich mix of land uses, if not at each station then in each segment of a corridor*. Mixed-use development helps create safe "24/7" places. When housing, jobs, and other uses are in close proximity, many daily activities are within safe, reasonable walking or biking distance. Mixed-use development also allows more efficient use of the transit system; it generates commuter trips both to and from the station in question.
- *A safe, inviting, and interconnected public realm that "glues" land uses to each other and to the transit station*. Transit-oriented development is also pedestrian-oriented development, and successful station areas include a grid of small, navigable blocks with ample sidewalks, active uses at street-level, attractive amenities, good lighting and way-finding, bicycle lanes and facilities, and uniform accessibility for seniors, the disabled, and people with baby carriages.
- *A new approach to parking***.** TOD doesn't mean "no cars"—even with an emphasis on transit, pedestrian, and bicycle use, successful TOD will generate car trips. But TOD does require less parking. It can afford lower parking ratios that take advantage of transit; shared parking facilities that take advantage of mixed uses; and location and design standards that blend into the district.[40]

TOD elements benefit communities because they prioritize compact development and save on infrastructure costs. Because TOD makes use of existing connections to the transportation network, residents have access to multimodal options in a pedestrian-friendly environment. Additionally, mixed uses in TOD create opportunities for residents to "live, work, play" all in one place, which can lower the cost of transportation.

Aging-in-Place with TOD. In Northeast Ohio and across the county, the rapidly aging population presents both challenges and opportunities. The population of individuals aged 65 and older in Northeast Ohio is expected to grow 12.9% by 2030 (see Table 7-7). The U.S. Administration for Community Living reports that as the population ages, more individuals continue to work past the traditional retirement age, whether for financial necessity or to remain invested in their careers and communities. In 2023, 11.2 million Americans aged 65 or older were working or proactively seeking employment.[41] Rising costs of housing, health care, and pharmaceuticals, as well as basic necessities such as food and transportation, negatively affect those who already have limited monthly incomes.

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[40] AECOM, *Regional TOD Scorecard and Implementation Plan*, (Cleveland: Northeast Ohio Areawide Coordinating Agency, November 2016); https://www.noaca.org/home/showpublisheddocument?id=19936

[41] U.S. Administration for Community Living, 2023 Profile of Older Americans (May 2024), https://acl.gov/sites/default/files/Profile%20of%20OA/ACL_ProfileOlderAmericans2023_508.pdf (accessed May 28, 2025)

Table 7-7. Current and Projected Senior (65+) Population in Northeast Ohio[42]

	2020		2030		2040		2050	
County	Pop. 65+	% of Total	Pop. 65+	% of Total	Pop. 65+	% of Total	Pop. 65+	% of Total
Cuyahoga	233,203	18.4%	259,702	21.4%	236,003	21.0%	214,608	20.8%
Geauga	19,918	20.9%	21,422	22.2%	20,215	20.2%	17,498	17.0%
Lake	47,371	20.4%	53,846	23.8%	49,844	23.1%	43,913	21.7%
Lorain	58,613	18.7%	67,541	21.3%	63,729	20.1%	57,986	18.3%
Medina	33,658	18.4%	41,080	22.0%	40,952	22.0%	38,036	21.0%
Total	**392,763**	**18.8%**	**443,591**	**21.8%**	**410,743**	**21.1%**	**372,041**	**20.3%**

Source: Ohio Department of Development, Office of Research

While traditional planning for older adults focuses on the development of nursing homes and long-term care and assisted living facilities, The American Association of Retired Persons (AARP) notes that "the vast majority of older adults want to age in place so they can continue to live in their own homes or communities." Their report, "Aging in Place: A State Survey of Livability Policies and Practices," specifically found that transportation was a core concern and that "increased mobility options can reduce reliance on transportation by personal car."[43]

As previously discussed, development and land-use patterns in Northeast Ohio have decentralized over the past 50 years so that housing, jobs, medical facilities, and social service resources have spread farther apart. For individuals who are dependent on transit and specialized transportation, this can create long-term social and economic exclusion.[44]

TOD presents a viable solution for an aging population through affordable, diverse housing options in pedestrian-friendly landscapes, near transportation options and other amenities. This compact development is ideal for individuals who cannot or do not want to drive, but also prefer to maintain their independence and mobility. NOACA's "Regional TOD Scorecard and Implementation Plan" includes an Aging-in-Place strategy.

TOD in Northeast Ohio. TOD presents itself as an innovative solution to development in the face of Northeast Ohio's changing landscape. Planned and incentivized redevelopment in the urbanized area, centered on public transportation, takes advantage of the "bus, pedestrian and bicycle amenities and land uses that can support reduced auto dependence commonly associated with TOD."[45]

NOACA's "Regional TOD Scorecard and Implementation Plan" is a useful tool to leverage future

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[42] Ohio Department of Development, Population Projections by County, 2020 to 2050, https://development.ohio.gov/about-us/research/population (accessed May 28, 2025)
[43] Farber, Nicholas and Douglas Shinkle, et al., *Aging in Place: A State Survey of Livability Policies and Practices*, National Conference of State Legislatures and the AARP Public Policy Institute (December 2011), https://assets.aarp.org/rgcenter/ppi/liv-com/aging-in-place-2011-full.pdf (Accessed May 28, 2025)
[44] Center for Transit-Oriented Development, "Creating Connected Communities: A Guidebook for Improving Transportation Connections for Low and Moderate-Income Households in Small and Mid-Sized Cities," (Washington, D.C.: U.S. Department of Housing and Urban Development, April 2014); https://www.huduser.gov/publications/pdf/Creating_Cnnted_Comm.pdf (accessed May 28, 2025)
[45] NOACA, "TOD in Northeast Ohio," (Cleveland: NOACA, June 2017); https://www.noaca.org/regional-planning/transportation-planning/transit-planning-tod/transit-oriented-development-tod (accessed May 28, 2025)

investment in and maintenance of the transit system to bring people, jobs, and services closer together.

Complete and Green Streets Policy

In June 2020, NOACA adopted the *Complete and Green Streets Policy*, which aims to create a more equitable, balanced, and resilient transportation system that enables safe, multimodal use of streets and roads, and that also mitigates harmful environmental impacts.[46] The Complete and Green Streets policy promotes a multimodal transportation system that is integrated with sustainable green infrastructure. The goals of this policy are:

- Create a comprehensive, integrated, and connected transportation network that supports sustainable development and provides livable communities.
- Ensure safety, ease of use, and ease of transfer between modes for all users of the transportation system.
- Restore the natural hydrologic function of the region's watersheds.
- Provide flexibility for different types of streets, areas, and users.

Complete Streets are roadways designed to safely and comfortably accommodate all users, including, but not limited to motorists, cyclists, pedestrians, disabled individuals, transit and school bus riders, Amish buggies, freight haulers, and emergency responders. All users includes people of all ages and abilities. Such streets encourage different modes and also a stronger mix of land use types that actively engage streets and roads to foster a friendlier user experience.

Green Streets reflect the transportation policy and design approach that minimizes environmental impact by focusing on efforts to retain, treat and eliminate runoff at the source using green infrastructure applications. Green infrastructure helps replicate natural hydrologic functions like storage, detention, infiltration, filtration, evaporation, transpiration, and uptake by plants, and can improve water quality and reduce runoff volumes (see Chapter 8). These natural functions are often lost in transportation projects where impervious road surfaces prevent rainwater from soaking into the ground. Green streets incorporate infiltration, biofiltration, and/or storage and use BMPs to collect, retain, or detain stormwater runoff while also providing design elements that creates attractive streetscapes. Green Streets can foster unique and attractive streetscapes that protect and enhance neighborhood livability and integrate, rather than separate, the built and natural environments.

Complete and Green Streets create a measurably better transportation system that is more equitable, balanced, and effective and which offers every user of the public right-of-way safe, connected, and sustainable transportation options. Every project that requests NOACA-administered funds is required to consider complete and green streets elements. NOACA will evaluate projects to ensure, depending on the context of the surrounding environment, that motorists, cyclists, pedestrians, disabled individuals, transit and school bus riders, Amish buggies, freight haulers, and emergency responders can safely share the road.

Development Impact Policy for Proposed Wastewater Facility Planning Area (FPA) Modification Requests

The NOACA Board of Directors approved this policy in 2019 as part of *Clean Water 2020*,

[46] Northeast Ohio Areawide Coordinating Agency (NOACA), *Complete and Green Streets Policy,* (Cleveland: NOACA, June 16, 2020), https://www.noaca.org/home/showpublisheddocument?id=25242 (accessed May 28, 2025)

NOACA's wastewater management and water quality plan (see Chapter 8).[47] The Ohio Environmental Protection Agency (Ohio EPA) defines Facility Planning Areas (FPAs) as "a discrete geographical planning area of sufficient scope to allow for an analysis of various alternatives for the treatment and disposal of wastewater."[48] The NOACA Board is responsible for maintaining FPA boundaries and reviewing any proposed changes. The Board can either approve or reject any changes to the FPA boundaries. The creation of any new FPAs require Board action as well. These changes are effective upon Board approval and reflected in the next plan update submitted to Ohio EPA for certification. The Development Impact Policy requires that "the NOACA Board shall consider regional development impacts if the FPA boundary modification is primarily for new residential or commercial development."[49] With this policy, the Board recognizes that a boundary modification may shift development within the region rather than facilitate new growth, and that the modification would have a net negative fiscal or environmental impact. The following questions guide staff review in their application of the policy to specific FPA boundary modification requests:

1. Is the modification request primarily for new construction (residential or commercial)?
2. Is the modification request area within a U.S. Census Bureau urban area?
3. Estimate of the number of new homes or structures proposed for construction.
4. Estimate of the amount of new sanitary sewer infrastructure to serve the requested modification area (e.g., linear feet of gravity sewers, linear feet of force main sewers, number of pump stations, etc.).
5. Is the proposed sanitary sewer infrastructure expansion part of an asset management plan?
6. Estimate the projected capacity impacts to the transportation system that may result from the proposed developments.

Where Will We Go?

Future Development Scenarios

Looking forward to 2050, there are a number of different possible paths for the NOACA region to realize its future. The following four scenarios serve as predictions for what could be, based on levels and types of transportation investment. There will be particular focus on worker accessibility to jobs and equity. The scenarios—MAINTAIN, CAR, TRANSIT and TOTAL—are discussed in relation to impacts on land use in the region. Chapter 9 provides a more detailed presentation of the scenarios, their components, and performance measures used for scenario comparison and selection.

Scenario 1: MAINTAIN-State of Good Repair

Scenario 1 focuses solely on maintenance of the existing transportation system, with no expansion of roads, bridges, highways, or public transit. The scenario assumes no variation from

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[47] Northeast Ohio Areawide Coordinating Agency (NOACA), *Clean Water 2020: 208 Areawide Wastewater Management and Water Quality Plan,* (Cleveland: NOACA, September 11, 2020), https://www.noaca.org/home/showpublisheddocument?id=25346 (accessed May 28, 2025)

[48] Ohio EPA, Water Quality Management Plans (CWQ Sections 208 and 303), Glossary, https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/water-quality-management-plans-cwa-sections-208-and-303- (accessed May 28, 2025).

[49] Northeast Ohio Areawide Coordinating Agency (NOACA), Resolution No. 2020-017: Water Quality Management Plan (208 Plan) Development Impact Policy for Proposed Wastewater Facility Planning Area (FPA) Modification Requests, March 2020; https://www.noaca.org/home/showdocument?id=24899 (accessed May 28, 2025)

the current population and employment forecasts for the region, which reflect recent trends (slight decrease in population, slight increase in employment).

While the population of the region and total households will both decrease, modest new housing starts and demand for new housing will likely remain as NOACA will prioritize projects to maintain roads and highways with good access to job hubs. An emphasis on maintenance will likely encourage continued outward migration of the region and continued deconcentration of development in the urban core. Average commute times will likely decline, but so will the number of people and jobs within a 15-minute (3/4-mile) walk of a transit (rail or bus) station. Modal choice will not expand under the MAINTAIN scenario; it's all about a state of good repair with regard to what the region currently has, not new investment.

Given the continued outward spread of people and jobs, there will be a limited demand for Transit Oriented Development (TOD). Any new TOD will likely occur in urban neighborhoods that already have momentum and access to jobs (e.g., University Circle, neighborhoods close to downtown, inner-ring suburbs near job hubs and rail/BRT transit). Regardless, the existing population of aging Baby Boomers will create demand for accessible, affordable housing of all types (independent living through skilled nursing levels). A demand for housing that allows individuals to "age in place" could be part of TODs and could grant access to transit, dining, entertainment, shopping, healthcare resources, and other essential needs.

Limited redevelopment and revitalization in traditional urban core communities and inner-ring suburbs is expected with population loss; however, some urban infill projects may persist where professionals and retirees demand housing (high-end, workforce type mix) in urban areas.

Increased transportation costs from more driving and less transit may strain household budgets a bit, but the improved state of existing roads may reduce vehicle maintenance needs and insurance premiums.

MAINTAIN will continue the land use trends of the past few decades; there will be little to no change.

Scenario 2: Captivating Auto Region (CAR)-Single—Occupancy Vehicles

In Scenario 2, road capacity expansion is the priority. This includes new and improved infrastructure (roads, highways, bridges, interchanges), shorter travel times through traffic signal timing optimization, reduction of highway bottlenecks, ramp metering,[50] and reduced commutes to job hubs. Like Scenario 1 (MAINTAIN), CAR assumes declining population and employment totals by the year 2050. Despite the expected loss of population, households, and employees in the CAR scenario, improved and expanded highways will accelerate existing migration of people and jobs to peripheral areas of the region. Slight to moderate new housing starts may occur in more rural and exurban areas, even outside NOACA entirely, due to fast and easy access to job hubs. New highway access points will incentivize greenfield development and disincentivize greyfield and brownfield redevelopment. There will be less motivation for urban core infill and revitalization since a centralized location won't mean as much. Average commute times by car will likely decrease given the anticipated improvements and even greater capacity in the arterial

[50] Ramp meters are signal systems near the end of entrance ramps onto limited-access highways. The meters detect speed and occupancy of mainline lanes, allowing cars to enter the highway from the ramp at appropriate times to promote the most efficient flow of mainline traffic https://www.transportation.ohio.gov/programs/traffic-operations/its/02-its (accessed May 28, 2025).

and highway network.

The CAR scenario promises an expanded, efficient transportation system for drivers, likely decreasing the demand for housing near job hubs as workers can live anywhere in the region, provided they have access to a private, reliable vehicle. Job hubs may even see increased demand for parking since there will likely be an increase in the number of workers incentivized to drive. Though the emphasis on personal, single-occupancy vehicles will lower demand for TOD, it will continue to be a useful development strategy for seniors who need accessible, affordable housing of all types (independent living through skilled nursing levels). TOD will also be necessary for low-income individuals and families who may not be able to afford personal vehicles. Unfortunately for these groups, overall demand for transit/BRT will likely decline and transit investment will be an even lower priority for government budgets. These groups will still need a mix of workforce and low-income housing, but it is unclear whether such housing can find a home in closer proximity to a major regional job hub.

CAR will accelerate the land use trends of the past few decades; there will be increased spread from the urban core and from major regional job hubs.

Scenario 3: TRANsportation System with Improved Transit (TRANSIT)-Multimodal Transportation System

Scenario 3, TRANSIT, is essentially the opposite of CAR (Scenario 2). TRANSIT expands all transit agencies in the region through implementation of BRT. TRANSIT also includes connections between transit stops and job hubs with autonomous shuttles and new pedestrian and bike routes. In Scenario 3, the projected 2050 population and employment is based on the same NOACA forecasts used in the MAINTAIN and CAR scenarios, plus reduced decreases.

The expanded BRT may increase the demand for TOD so people and employers can take advantage of greater modal choice, including transit, biking, and walking. More workforce housing in transit-accessible locations or near job hubs will be necessary. Housing demand, particularly demand for revitalized or repurposed housing in existing urban areas, may increase slightly. There will continue to be a need for accessible, affordable housing of all types for the aging population, and improved transit will increase options for dining, entertainment, shopping, healthcare resources, and other essential needs.

While TRANSIT does not necessarily help drivers (expect increased costs from lack of roadway maintenance), individuals who cannot afford personal vehicles will have greater mobility and can more easily access jobs. A transit mobile workforce may encourage companies and other employers to focus on, and prioritize proximity to, transit/BRT during location decisions.

Scenario 4: Transportation with Optimal Technology and Access for All (TOTAL)- Advanced Multimodal Transportation

The fourth scenario, TOTAL, incorporates all projects in the CAR (save highway interchanges) and TRANSIT scenarios. Additionally, the TOTAL scenario includes technological advances such as elected smart freeway lanes to autonomous cars and trucks; extra electric vehicle charging ports; and autonomous shuttle buses to improve workers' accessibility to the regional major job hubs and transit hubs. The projected 2050 population and employment in TOTAL is about half the decreases of the MAINTAIN and CAR scenarios.

An expanded BRT network that connects regional job hubs of the NOACA region means the

additional population (relative to MAINTAIN and CAR) is targeted for residential areas with easy and convenient access to these new transportation options and major job locations. How and if these denser, mixed-use transit connected neighborhoods materialize is certainly primary within the decision-making realm of local governments. Potentially, all five counties can benefit from this additional population if counties pursue transit investment and land use changes.

Scenario 4 should mean less stress on the transportation network with more workers on public transit and with shorter commutes due to workers who live closer to jobs and major transit stations. Scenarios 3 and 4 assume reduced population decline will occur in areas within five miles of the major regional job hubs and transit stops of the expanded BRT network. The five-mile radius encompasses both persons who would access the major regional job hubs and transit system via car, as well as those who might access these same locations through active transportation (biking, walking, etc.).

Performance Measures and Targets

While Chapter 9 presents a much more detailed discussion and analysis of the four future scenarios mentioned above, this section details performance measures to assess progress toward more efficient land use. The performance measures are variables used to assess the scenarios comparatively against each other. There are two important values associated with each performance measure: the baseline and the target. The baseline is the value of the performance measure in the current state (2024). The target is the value of the performance measure in the future state (2050). One of the four future scenarios will be the preferred scenario and its performance measures will be the target values NOACA will use to assess the region's progress from the current state to the preferred future state. Table 7-8 illustrates the performance measures and targets focused on efficient land use.

The outputs are presented in a specific way to help the reader digest the information clearly and concisely with the following guidelines:

1. The baseline represents current conditions (2024 conditions). The outputs reflect how the performance measure will change from the baseline to the target year (2050) under each of the four scenarios.
2. The "-" and "+" signs shown as outputs for each performance measure under each scenario indicate the direction of change. A "-" sign indicates a decrease from the baseline and a "+" sign indicates an increase from the baseline. There are two sizes for each sign; they represent the magnitude of change (smaller signs indicate slight change; larger signs indicate more substantial change).
3. The colors of the signs and numbers for each output are also important. Red color indicates a negative impact on the region, while green indicates a positive impact on the region. While many people commonly associate "-" signs with a negative impact and "+" signs with a positive impact, that is not always the case. It is possible to have a red "+" sign, meaning the value of that performance measure will increase under a scenario, but that increase will have a negative impact on the region.
4. Some of the performance measures in Table 7-8 are qualitative. To help the reader interpret the differences across scenarios, consider the performance measure, "future population and employment in communities with peak population in 1970."
    a. MAINTAIN: Maintenance of the status quo will likely yield moderate decline of population in those communities whose population peaked in 1970, the same year the region's population peaked. These communities make up the region's peak population development footprint; after 1970, all growth essentially came at the expense of older, urban core neighborhoods that experienced decline, disinvestment, abandonment,

and demolition.

b. CAR: Prioritization of arterial and highway infrastructure expansion will likely yield moderate decline in the population and employment of the 1970 development footprint.
c. TRANSIT: Investment in expansion of transit lines and stations instead of road/highway capacity will reduce some of the decline of the population and employment within the 1970 development footprint.
d. TOTAL: Investment in both transit and road capacity expansion will reduce population and employment even further (about half that of the MAINTAIN and CAR scenarios) within the 1970 development footprint.

Table 7-8. Performance Measures and Targets

Performance Measure	Scenario 1 MAINTAIN	Scenario 2 CAR	Scenario 3 TRANSIT	Scenario 4 TOTAL	2020 Baseline
Regional Population	- (235,000)	- (235,000)	- (174,000)	- (114,000)	2,068,546
Regional Employment	- (113,000)	- (113,000)	- (83,000)	- (54,000)	1,188,488
Ecologically Sensitive and Agriculturally Productive Lands	-	-	-	-	Current acreage of ecologically sensitive and agriculturally productive lands in Northeast Ohio
Future Population and Employment in Communities with Peak Population in 1970	-	-	-	-	Current estimate of total population and employment for all communities whose population peak occurred on or before 1970 [another option is to consider the median age of single-family homes (1970 or earlier)]

Principal Considerations for Transportation in the Context of Land Use

As NOACA and Northeast Ohio plan for the next three decades, here are some principal considerations that may help create more efficient land use for Northeast Ohio:

1. Diverse housing options within ¼ mile to public transportation stops provides greater transportation choice and employment opportunities, particularly relative to the rapid transit network.
2. Inclusionary, flexible land-use practice and zoning policies allow for more transportation options, particularly transit.
3. Greater collaboration between urban, suburban, exurban and rural communities may improve land use practice across all place types that can be better supported by transportation policy.
4. Regional data sharing about projects and programs that embody approaches to more efficient and equitable land use allow communities to learn from one another and replicate

success stories across multiple jurisdictions.

Implementation Action Items

NOACA should implement the following actions to move toward a more empowered future:

1. Continue to work with the City of Cleveland and GCRTA to implement the pilot TOD sites identified in the 2017 NOACA Regional TOD Scorecard and Implementation Plan.
   a. West Boulevard-Cudell
   b. East 116th Street
   c. Broadway-Slavic Village
2. Continue to fund TLCI planning and implementation projects and develop a portfolio of success cases to share with communities across the region.
3. Implement the Complete and Green Streets Policy and develop a portfolio of success cases to share with communities across the region.
4. Implement the Development Impact Policy for FPA Modification Requests and work with elected officials, wastewater managers and engineers to refine and improve NOACA's countywide FPA map effort to reduce the number of individual requests that do not comport with mapped (i.e. planned) wastewater management improvements.
5. Study how many acres of land are currently planned to be sewered. Assess how many households and residents can be accommodated within this area based on the average regional and county densities in the urbanized area. Examine the implications for transportation investments.
6. Conduct studies in collaboration with the transit providers and affected municipalities for each recommended rapid transit corridor (Chapter 9) including considerations of land redevelopment potentials along the corridors, impact on travel times in the transportation network, cost effectiveness, effects on travel choices in existing neighborhoods, support for economic development, and benefits to disadvantaged groups. .

Chapter 8: Environment and Health

Introduction

Overview

In the past three chapters, NOACA staff have illustrated how the evolution of the region's transportation network shaped the economy, housing, and land use for Northeast Ohio. This chapter focuses on the relationships between the same transportation network and the region's environment (water quality, air quality, and resilience to climate change) and health. As NOACA serves the region for both transportation and environmental planning, this plan integrates transportation, air quality, and water quality in a manner consistent with the priorities of NOACA as an Areawide agency.[1]

Within this chapter are several discussions centered on the equity and environmental justice outcomes of planning related to water quality, air quality, and climate resilience. Proposed future transportation scenarios will affect the region's air and water resources both directly and indirectly. Planning for the future requires consideration of strategies to develop resilience to, and mitigation for, regional effects of climate change.

What Role Can NOACA Play?

One of the five goals specified in NOACA's vision statement is "enhance quality of life." Embedded within that goal are the attributes of the natural environment and human health. Furthermore, there are numerous objectives under this and other goals in NOACA's Regional Strategic Plan that specifically address such attributes:

- Foster collaboration on issues of transportation, air and water quality that will lead to greater regional cohesion and cooperation on other issues of regional concern
- Reduce energy use and improve air quality
- Reduce greenhouse gas emissions
- Engage in regional efforts to control stormwater, protect and improve water quality, and control development in floodplains
- Enhance the public's access to and enjoyment of the region's parks, cultural assets and recreational activities
- Preserve agricultural lands, open space and important habitat areas, woodlands, and wetlands
- Promote healthy and active living

NOACA strives to fulfill its vision through attainment of these objectives. While NOACA does not, and cannot, regulate environmental quality within and across Northeast Ohio jurisdictions, staff can certainly inform its Board and community stakeholders about the environmental impacts of local decisions. NOACA can also apprise the public about current conditions and the potential impacts of decisions on future conditions.

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[1] Areawide Councils of Governments act as the lead planning agencies in 24 Ohio counties (those with large urban populations). These Areawide Agencies prepare and approve the 208 Plan in their counties. The State of Ohio prepares and maintains the 208 Plan applicable in the remaining 64 counties. The Governor then certifies the entire 208 Plan via submission to US EPA for their approval (accessed 5.27.2025 from Ohio EPA https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/water-quality-management-plans-cwa-sections-208-and-303-

Environmental Justice and Equity

"Environmental Justice" embodies the concept of equity among communities. Equity can only be achieved with the involvement of all stakeholders in decision making, especially when they bear the impacts that result from policies, programs, and projects. Negative impacts of development, industry, and natural processes disproportionately harm select communities, which results in reduced quality of life across income levels and ethnicities. While this chapter focuses on environmental quality and health outcomes related to air and water resources, environmental justice reflects equity on a broader scale and is central to w*eNEO2050+*. This section examines these issues and also reflects on the different perspectives of those who live inside and outside Environmental Justice Areas, per NOACA's Regional Survey (see Chapter 4).

Environmental Justice and Water Quality

As part of the engagement process, the 2020 NOACA Regional Survey[2] (Chapter 4) asked respondents whether they agreed or disagreed with the following two statements: 1) "The water I drink is clean," and 2) "The water in Northeast Ohio's rivers and lakes is clean." Tables 8-1 through 8-4 illustrate respondents' level of agreement or disagreement with these two statements. For each set of responses, the survey consultant broke out the responses by 1) whether respondents lived inside or outside an Environmental Justice area, and 2) the income/race group to which respondents belonged.

Table 8-1. NOACA Regional Survey Response to Statement "The Water I Drink is Clean" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		The water I drink is clean	
	NOACA Region	**NOACA Environmental Justice Areas**	**Non-EJ**
BASE	**2,431**	**1,163**	**1,233**
Strongly Agree (5)	39.12%	32.24%	45.99%
Somewhat Agree (4)	36.36%	35.43%	37.15%
Neutral (3)	15.14%	19.17%	11.27%
Somewhat Disagree (2)	6.58%	9.54%	3.57%
Strongly Disagree (1)	2.80%	3.61%	2.03%
	100%	*100%*	*100%*
MEAN	4.02	3.83	4.21
Monthly investment in cleaner water	$13.56	$15.93	$10.88

[2] This is the most recent such survey undertaken by NOACA staff. Given survey administration occurred post-COVID outbreak and post-2020 Census, staff employed the results in this update of the Long Range Plan.

Table 8-2. NOACA Regional Survey Response to Statement "The Water I Drink is Clean" (by Income/Race Group)

		The water I drink is clean			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	2,431	1,218	537	220	239
Strongly Agree (5)	39.12%	45.16%	33.33%	31.82%	29.41%
Somewhat Agree (4)	36.36%	37.44%	37.24%	33.64%	32.77%
Neutral (3)	15.14%	11.49%	17.69%	21.36%	21.85%
Somewhat Disagree (2)	6.58%	4.52%	7.82%	8.64%	10.92%
Strongly Disagree (1)	2.80%	1.40%	3.91%	4.55%	5.04%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	4.02	4.20	3.88	3.80	3.71
Monthly investment in cleaner water	$13.56	$10.12	$13.03	$19.45	$22.74

Tables 8-1 and 8-2 show there is general agreement in Northeast Ohio that consumed water is clean; however, there are some differences in the strength of that agreement, as indicated by the mean response scores in the tables. Table 8-1 shows stronger agreement from respondents outside Environmental Justice Areas (83% agree) than respondents inside Environmental Justice Areas (66% agree). Table 8-2 shows strongest agreement (83%) among respondents classified as "higher-income white" and weakest agreement (62%) among respondents classified as "lower-income nonwhite."

Table 8-3. NOACA Regional Survey Response to Statement "The Water in Northeast Ohio's Rivers and Lakes is Clean" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		The water in Northeast Ohio's rivers and lakes is clean	
	NOACA Region	NOACA Environmental Justice Areas	Non-EJ
BASE	2,429	1,163	1,231
Strongly Agree (5)	13.22%	12.55%	13.89%
Somewhat Agree (4)	34.71%	30.18%	38.83%
Neutral (3)	27.34%	28.03%	27.05%
Somewhat Disagree (2)	17.83%	20.03%	16.08%
Strongly Disagree (1)	6.92%	9.20%	4.14%
	100%	*100%*	*100%*
MEAN	3.29	3.17	3.42
Monthly investment in cleaner rivers and lakes	$13.57	$15.49	$11.30

Table 8-4. NOACA Regional Survey Response to Statement "The Water in Northeast Ohio's Rivers and Lakes is Clean" (by Income/Race Group)

		The water in Northeast Ohio's rivers and lakes is clean			
	NOACA Region	**Higher-income White**	**Lower-income White**	**Higher-income Nonwhite**	**Lower-income Nonwhite**
BASE	**2,429**	**1,217**	**537**	**220**	**239**
Strongly Agree (5)	13.22%	13.72%	10.06%	15.45%	14.64%
Somewhat Agree (4)	34.71%	40.92%	32.03%	26.36%	23.01%
Neutral (3)	27.34%	25.88%	30.35%	24.09%	27.20%
Somewhat Disagree (2)	17.83%	15.78%	20.11%	21.36%	23.43%
Strongly Disagree (1)	6.92%	3.70%	7.45%	12.73%	11.72%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.29	3.45	3.17	3.10	3.05
Monthly investment in cleaner water	$13.57	$10.39	$12.46	$17.77	$22.91

Tables 8-3 and 8-4 show there is less agreement in Northeast Ohio that regional surface waters are clean, compared with drinking water. Furthermore, there are differences in the strength of that agreement, as indicated by the mean response scores in the tables. Table 8-3 shows stronger agreement from respondents outside Environmental Justice Areas (53% agree) than respondents inside Environmental Justice Areas (43% agree). Table 8-4 shows strongest agreement (55%) among respondents classified as "higher-income white" and weakest agreement (38%) among respondents classified as "lower-income nonwhite." Nearly as many lower-income nonwhite respondents disagree (35%) with this statement as agree. The takeaway from these four tables is that: 1) Northeast Ohio respondents feel regional surface waters are not as clean as their drinking water; and 2) there is a substantial difference in perception toward water quality based on income and race.

Everyone lives in a watershed. Levels of protection for water resources within a watershed vary based on location and surrounding land uses. Several watersheds and subwatersheds within Northeast Ohio suffer from a legacy of pollution from industrial and urban sources. These legacies negatively impact both urban and rural Environmental Justice Areas. For urban communities, water quality concerns often focus on point source pollution at known discharge locations connected to industry and utilities. While these concerns also exist within suburban and rural communities, non-point source pollution (e.g. stormwater runoff) is of high concern.

Newly or recently developed areas with significant increases in impervious surface exacerbate the polluting effects of rainfall that carries pollutants into nearby streams, rivers, and lakes. If not mitigated, runoff pollution may also impact the urban areas frequently downstream from suburban and rural headwaters.

The good news is that Northeast Ohio individuals believe they can positively influence their water quality through individual actions. The NOACA Regional Survey asked respondents whether their individual actions can improve both drinking water and surface water quality (see Tables 8-5 through 8-8).

Table 8-5. NOACA Regional Survey Response to Statement "Actions I Take as An Individual can Improve Drinking Water in Northeast Ohio" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		Actions I take as an individual can improve drinking water in Northeast Ohio	
	NOACA Region	NOACA Environmental Justice Areas	Non-EJ
BASE	**2,431**	**1,163**	**1,233**
Strongly Agree (5)	24.72%	22.87%	26.12%
Somewhat Agree (4)	33.69%	32.93%	34.55%
Neutral (3)	29.04%	29.92%	28.47%
Somewhat Disagree (2)	7.73%	14.27%	6.97%
Strongly Disagree (1)	4.81%	8.77%	3.89%
	100%	*100%*	*100%*
MEAN	3.66	3.59	3.72

Table 8-6. NOACA Regional Survey Response to Statement "Actions I Take as An Individual can Improve Drinking Water in Northeast Ohio" (by Income/Race Group)

		Actions I take as an individual can improve drinking water in Northeast Ohio			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,431**	**1,217**	**537**	**220**	**239**
Strongly Agree (5)	24.72%	25.80%	22.35%	25.45%	23.01%
Somewhat Agree (4)	33.69%	35.09%	34.45%	30.91%	29.71%
Neutral (3)	29.04%	26.95%	31.47%	27.73%	33.47%
Somewhat Disagree (2)	7.73%	8.55%	6.33%	9.09%	6.69%
Strongly Disagree (1)	4.81%	3.62%	5.40%	6.82%	7.11%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.66	3.71	3.62	3.59	3.55

Tables 8-5 and 8-6 show there is general agreement in Northeast Ohio that individuals feel empowered to improve the quality of drinking water through their actions. Table 8-5 shows slightly stronger agreement from respondents outside Environmental Justice Areas (61% agree) than respondents inside Environmental Justice Areas (56% agree). Table 8-6 also shows slightly stronger agreement among respondents classified as "higher-income white" (61% agree) than among respondents classified as "lower-income nonwhite" (53% agree).

Table 8-7. NOACA Regional Survey Response to Statement "Actions I Take as An Individual can Improve Northeast Ohio's Rivers and Lakes" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		Actions I take as an individual can improve Northeast Ohio's rivers and lakes	
	NOACA Region	NOACA Environmental Justice Areas	Non-EJ
BASE	**2,431**	**1,163**	**1,233**
Strongly Agree (5)	27.77%	26.05%	28.95%
Somewhat Agree (4)	36.90%	34.65%	39.01%
Neutral (3)	25.50%	27.86%	23.52%
Somewhat Disagree (2)	6.62%	7.65%	5.84%
Strongly Disagree (1)	3.21%	3.78%	2.68%
	100%	*100%*	*100%*
MEAN	3.79	3.72	3.86

Table 8-8. NOACA Regional Survey Response to Statement "Actions I Take as an Individual can Improve Northeast Ohio's Rivers and Lakes" (by Income/Race Group)

		Actions I take as an individual can improve Northeast Ohio's rivers and lakes			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,431**	**1,218**	**537**	**219**	**239**
Strongly Agree (5)	27.77%	28.65%	26.82%	31.05%	22.18%
Somewhat Agree (4)	36.90%	39.33%	36.69%	31.51%	32.22%
Neutral (3)	25.50%	22.74%	27.56%	26.48%	34.31%
Somewhat Disagree (2)	6.62%	6.98%	5.59%	6.85%	5.44%
Strongly Disagree (1)	3.21%	2.30%	3.35%	4.11%	5.86%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.79	3.85	3.78	3.79	3.59

Tables 8-7 and 8-8 further demonstrate there is general agreement in Northeast Ohio that individuals feel empowered to positively influence the quality of the region's rivers and lakes through their own actions as individuals. Table 8-7 shows slightly stronger agreement from respondents outside Environmental Justice Areas (68% agree) than respondents inside Environmental Justice Areas (61% agree). Table 8-8 also shows slightly stronger agreement among respondents classified as "higher-income white" (68% agree) than among respondents classified as "lower-income nonwhite" (54% agree).

Environmental Justice and Air Quality

The NOACA Regional Survey asked respondents whether they agreed or disagreed with the following statement: "The outdoor air where I live is clean." Tables 8-9 and 8-10 illustrate respondents' level of agreement or disagreement with this statement. For each set of responses, the survey consultant broke out the responses by: 1) whether respondents lived inside or outside

an Environmental Justice area; and 2) the income/race group to which respondents belonged.

Table 8-9. NOACA Regional Survey Response to Statement "The Air Where I Live is Clean" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		The outdoor air where I live is clean	
	NOACA Region	**NOACA Environmental Justice Areas**	**Non-EJ**
BASE	**2,432**	**1,164**	**1,233**
Strongly Agree (5)	29.19%	22.16%	35.85%
Somewhat Agree (4)	43.46%	41.24%	45.99%
Neutral (3)	17.48%	22.85%	12.25%
Somewhat Disagree (2)	7.61%	10.22%	5.11%
Strongly Disagree (1)	2.26%	3.52%	0.81%
	100%	*100%*	*100%*
MEAN	3.90	3.68	4.11
Monthly Investment in cleaner air	$12.73	$14.84	$10.32

Table 8-10. NOACA Regional Survey Response to Statement "The Air Where I Live is Clean" (by Income/Race Group)

		The outdoor air where I live is clean			
	NOACA Region	**Higher-income White**	**Lower-income White**	**Higher-income Nonwhite**	**Lower-income Nonwhite**
BASE	**2,432**	**1,218**	**537**	**220**	**239**
Strongly Agree (5)	29.19%	32.68%	27.00%	22.73%	21.76%
Somewhat Agree (4)	43.46%	47.87%	39.85%	39.09%	36.82%
Neutral (3)	17.48%	13.22%	20.86%	22.27%	25.52%
Somewhat Disagree (2)	7.61%	5.25%	9.68%	11.82%	10.88%
Strongly Disagree (1)	2.26%	0.99%	2.61%	4.09%	5.02%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.90	4.06	3.79	3.65	3.59
Monthly Investment in cleaner air	$12.73	$9.29	$11.99	$19.78	$21.55

Tables 8-9 and 8-10 show there is general agreement in Northeast Ohio that outdoor air is clean; however, there are some differences in the strength of that agreement, as indicated by the mean response scores in the tables. Table 8-9 shows stronger agreement from respondents outside Environmental Justice Areas (72% agree) than respondents inside Environmental Justice Areas (63% agree). Table 8-10 shows strongest agreement among respondents classified as "higher-income white" (81%) and weakest agreement among respondents classified as "lower-income nonwhite" (59%).

Air pollution is a global burden, one that the World Health Organization (WHO) has called the greatest environmental health risk.[3] WHO data show that almost all of the global population (99%)

[3] Diarmid Campbell-Lendrum and Annette Prüss-Ustün, Department of Public Health, Environmental and Social Determinants of Health, World Health Organization; "Climate change, air pollution and noncommunicable diseases," *Bulletin of the World Health Organization* (2019). 97:160-161.

breathe air that exceeds WHO guideline limits and contains high levels of pollutants, with low- and middle-income countries suffering from the highest exposures.[4] There is a clear connection between land-use patterns and individual exposure to air pollution. The durability of land-use patterns prolongs the impacts of land-use decisions for decades (see Chapter 7). The Interstate Highway System (see Chapter 6) disproportionately harmed low-income and minority neighborhoods, displacing thousands of families and damaging local economic and cultural networks.[5] Consequently, displaced racial minorities are three times more likely to live in neighborhoods adjacent to the most heavily trafficked roads.[6] In some instances, highway construction literally cemented racial segregation through physical barriers such as urban freeways.[7] For decades, the built transportation network has contributed to and sometimes even exacerbated racial segregation. There have been severe impacts on pollution exposure and public health. Cities (e.g., Cleveland) with higher levels of segregation[8] suffer from higher levels of air pollution, and that pollution tends to harm minority populations disproportionately.[9] Communities of color are also more likely to be near locally unwanted land uses, such as landfills and hazardous waste facilities. Decision makers often site these facilities in areas with higher concentrations of racial minorities because such areas exhibited lower land values and local residents had less power to block such decisions.[10] The result is a disproportionately negative impact from air pollution on low-income and minority communities.

These disparities in exposure to air pollution all but ensure that the health burden is borne unequally as well. Whereas non-Hispanic whites are exposed to 17% less pollution than their consumption patterns produce, minorities (especially blacks and Latinos) endure pollution levels 56% and 63% higher than their consumption, respectively.[11] The disparity is even greater for mobile emissions. Neighborhoods with the highest shares of minority residents had nitrogen dioxide (NO_2) levels 2.7 times higher than neighborhoods with the lowest shares of minority residents in 2010.[12] Moreover, a study last year published in *Environmental Health* suggested regulatory monitor data may not adequately capture air quality exposures for some marginalized

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[4] World Health Organization, "Air Pollution: Overview" (accessed May 26, 2025 from https://www.who.int/health-topics/air-pollution#tab=tab_1).
[5] D.N. Archer, "'White Men's Roads through Black Men's Homes': Advancing Racial Equity through Highway Construction," *Vanderbilt Law Review* 73, no. 5 (2020), 1259-1330.
[6] G.M. Rowangould, "A census of the US near-roadway population: Public health and environmental justice considerations," *Transportation Research Part D* 25 (2013), 59-67.
[7] K.M. Kruse, *White Flight: Atlanta and the Making of Modern Conservatism* (Princeton, NJ: Princeton University Press, 2004). D. Kerr, *Derelict Paradise: Homelessness and Urban Development in Cleveland, Ohio* (Amherst, MA: University of Massachusetts Press, 2011), 107-108.
[8] William H. Frey, "Black-white segregation edges downward since 2000, Census shows," Brookings Institution, Dec. 17, 2018; https://www.brookings.edu/blog/the-avenue/2018/12/17/black-white-segregation-edges-downward-since-2000-census-shows/ (accessed May 27, 2025). R. Morello-Frosch & B.M. Jesdale, "Separate and Unequal: Residential Segregation and Estimated Cancer Risks Associated with Ambient Air Toxics in U.S. Metropolitan Areas," *Environmental Health Perspectives* 114, no. 3 (2006), 386-393.
[9] R. Morello-Frosch & B.M. Jesdale, "Separate and Unequal: Residential Segregation and Estimated Cancer Risks Associated with Ambient Air Toxics in U.S. Metropolitan Areas," *Environmental Health Perspectives* 114, no. 3 (2006), 386-393.
[10] P. Mohai & R. Saha, "Which came first, people or pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice," *Environmental Research Letters* 10 (2015), 11508.
[11] C.W. Tessum, et al. "Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure," *PNAS* 116, no. 13 (2019), 6001-6006.
[12] L.P. Clark, D.B. Millet, and J.D. Marshall, "Changes in Transportation-Related Air Pollution Exposures by Race-Ethnicity and Socioeconomic Status: Outdoor Nitrogen Dioxide in the United States in 2000 and 2010," *Environmental Health Perspectives* 125, no. 9 (2017), 097012.

race and ethnicity groups.[13] Though the combined emissions of the six common pollutants ($PM_{2.5}$ and PM_{10}, SO_2, NOx, VOCs, CO and Pb) dropped by 78 percent between 1970 and 2020,[14] these disparities have not improved. The racial gap in NO_2 levels actually grew to 2.7 from 2.5 in 2000, even as average NO_2 concentrations fell by 37%.[15] Nationally, the Census tracts with the highest levels of fine particulate matter ($PM_{2.5}$) in 1981 remained the most heavily polluted in 2016 (similarly true for the least polluted tracts).[16]

Air pollution is most acutely harmful to vulnerable groups in Northeast Ohio. Children suffer significant health impacts from pollution exposure, even during the prenatal period based on pollution exposure endured by pregnant women. Children may suffer long-term effects from this *in utero* exposure, including higher rates of chronic illnesses such as asthma. Air pollution is also an underappreciated factor behind racial disparities in birth outcomes and infant mortality rates, one of Northeast Ohio's most acute public health crises.[17] Researchers estimate that $PM_{2.5}$ pollution is responsible for 3.3% of preterm births in the U.S., which imposes $760 million in medical costs and $4.3 billion in lost productivity among these children. Pollution can affect educational outcomes through increased absenteeism, decreased concentration, and reduced academic performance. In these ways, exposure to pollution from a young age can set children up to struggle throughout their lives. A recent study found that children exposed *in utero* to pollution from toxic sites earn 28% lower wages, are 50% more likely to depend on public assistance, are 112% more likely to drop out of high school, and are 1.5 times more likely to be disabled than their siblings who were born in different locations. The effects are particularly acute for low-income and minority (especially black and Latino) children, who are more than twice as likely to live downwind of a toxic site.

The elderly and people with existing health conditions also bear a heavy toll from air pollution, as it can exacerbate these underlying issues, reduce their quality of life, and shorten their life expectancies. Unsurprisingly, air pollution is also uniquely harmful to people of color. Black Americans are three times more likely to die from $PM_{2.5}$ exposure as the average American.[18] The economic, environmental and health costs of Northeast Ohio's air pollution is significant; improved air quality can make the region a more attractive, equitable place to live and work.

Once again, an element of good news is that Northeast Ohioans believe they can positively influence their environmental outcomes, such as improving outdoor air quality through individual actions. The 2020 NOACA Regional Survey asked respondents whether they agreed that their individual actions can improve outdoor air quality (see Tables 8-11 and 8-12).

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[13] Kelly, T., Cova. B., Debbink, M., et al., December 4, 2024, "Racial and ethnic disparities in regulatory air quality monitor locations in the US," *Environmental Health*, 7(12) (accessed May 26, 2025, from https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2827225#google_vignette).

[14] United States Environmental Protection Agency, "Progress cleaning the air and improving people's health" (accessed May 26, 2025, from https://www.epa.gov/clean-air-act-overview/progress-cleaning-air-and-improving-peoples-health#:~:text=Between%201970%20and%202020%2C%20the,the%20air%20that%20we%20breathe

[15] C.W. Tessum, et al. "Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure," PNAS 116, no. 13 (2019), 6001-6006.

[16] J. Colman, I. Hardman, I. Shimshack, and J. Voorheis, "Disparities in $PM_{2.5}$ air pollution in the United States," *Science* 369, no. 6503 (2020), 575-578.

[17] B. Bekkar, S. Pacheco, & R. Basu, "Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review," *JAMA Open Network* 3, no. 6 (2020), e208243.

[18] M.S. Qian Di, et al., "Air Pollution and Mortality in the Medicare Population," *New England Journal of Medicine* 376, no. 26 (2017), 2513-2522.

Table 8-11. NOACA Regional Survey Response to Statement "Actions I Take as an Individual can Improve Outdoor Air in Northeast Ohio" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		Actions I take as an individual can improve outdoor air in Northeast Ohio	
	NOACA Region	NOACA Environmental Justice Areas	Non-EJ
BASE	**2,431**	**1,164**	**1,232**
Strongly Agree (5)	30.07%	28.87%	31.33%
Somewhat Agree (4)	36.73%	35.74%	37.82%
Neutral (3)	24.43%	25.86%	22.97%
Somewhat Disagree (2)	6.05%	6.53%	5.60%
Strongly Disagree (1)	2.71%	3.01%	2.27%
	100%	*100%*	*100%*
MEAN	3.85	3.81	3.90

Table 8-12. NOACA Regional Survey Response to Statement "Actions I Take as an Individual can Improve Outdoor Air in Northeast Ohio" (by Income/Race Group)

		Actions I take as an individual can improve outdoor air in Northeast Ohio			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,431**	**1,218**	**537**	**220**	**239**
Strongly Agree (5)	30.07%	30.95%	30.73%	29.55%	25.94%
Somewhat Agree (4)	36.73%	38.83%	36.31%	31.82%	32.64%
Neutral (3)	24.43%	22.41%	24.39%	27.27%	30.96%
Somewhat Disagree (2)	6.05%	5.83%	5.59%	8.64%	6.69%
Strongly Disagree (1)	2.71%	1.97%	2.98%	2.73%	3.77%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.85	3.91	3.86	3.77	3.70

Tables 8-11 and 8-12 show there is general agreement in Northeast Ohio that individual actions can make a positive difference on outdoor air quality' however, Table 8-11 shows slightly stronger agreement from respondents outside Environmental Justice Areas (69% agree) than respondents inside Environmental Justice Areas (65% agree). Table 8-12 shows strongest agreement among respondents classified as "higher-income white" (70%) and weakest agreement among respondents classified as "lower-income nonwhite" (59%).

Environmental Justice and Climate Resilience

The NOACA Regional Survey provided respondents several statements about climate change and, for each, asked whether they agreed or disagreed:

1. Climate change is real.
2. Human behavior contributes to climate change.
3. Northeast Ohio is prepared for climate change.
4. My efforts to help will contribute to doing something about climate change.

Table 8-13 illustrates respondents' level of agreement or disagreement with these statements across NOACA's primary geographic units. Tables 8-14 through 8-17 illustrate respondents' level of agreement or disagreement with the first two statements, with responses broken out by 1) whether respondents lived inside or outside an Environmental Justice area; and 2) the income/race group to which respondents belonged.

Table 8-13. NOACA Regional Survey Responses to Statements about Climate Change (by Geographic Unit)

	Agreement			
Climate Change *5 = Highest* *1 = Lowest*	**Climate change is real**	**Human behavior contributes**	**NEO is prepared for climate change**	**My efforts will help**
Cleveland	4.25	3.93	2.90	3.70
Cuyahoga	4.16	4.13	2.76	3.80
Lorain	4.04	4.00	2.70	3.65
Lake	4.04	4.04	2.76	3.69
Medina	3.89	3.81	2.84	3.51
Geauga	3.92	4.15	2.78	3.80
NOACA Region	4.11	4.04	2.79	3.72

Table 8-13 shows general agreement among respondents that: 1) Climate change is real; and Human behavior contributes to climate change. Although there is some variation in strength of agreement among geographic units on both statements, regional scores average higher than 4.00. City of Cleveland respondents agree most strongly with the first statement, while Geauga County respondents agree most strongly with the second statement. Medina County respondents, on the other hand, agree the least with both statements. Table 8-13 also shows general agreement among respondents that individual efforts can make a positive difference toward action on climate change. Again, Medina County respondents agree the least.

Despite agreement about the reality of the problem, Table 8-13 also shows respondents do not agree that Northeast Ohio is prepared for climate change. This disagreement is not very strong, but the sentiment is consistent across geographic units and marks a substantial gap between problem recognition and confidence in the future. These responses help frame the problem of climate change for policy makers and elected officials in Northeast Ohio.

Table 8-14. NOACA Regional Survey Responses to Statement "Climate Change is Real" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		Climate change is real	
	NOACA Region	**NOACA Environmental Justice Areas**	**Non-EJ**
BASE	**2,432**	**1,164**	**1,233**
Strongly Agree (5)	52.10%	55.58%	48.82%
Somewhat Agree (4)	20.89%	20.19%	21.49%
Neutral (3)	17.43%	16.15%	18.65%
Somewhat Disagree (2)	5.30%	5.07%	5.52%
Strongly Disagree (1)	4.28%	3.01%	5.52%
	100%	*100%*	*100%*
MEAN	4.11	4.20	4.03

Monthly Investment to reduce climate change	$14.15	$15.68	$12.34

Table 8-15. NOACA Regional Survey Responses to Statement "Climate Change is Real" (by Income/Race Group)

		Climate change is real			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	2,432	1,218	537	220	239
Strongly Agree (5)	52.10%	50.25%	54.75%	59.55%	48.12%
Somewhat Agree (4)	20.89%	20.03%	22.35%	21.82%	19.67%
Neutral (3)	17.43%	18.47%	14.90%	12.27%	22.59%
Somewhat Disagree (2)	5.30%	6.16%	3.35%	6.36%	5.02%
Strongly Disagree (1)	4.28%	5.09%	4.66%	0	4.60%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	4.11	4.04	4.19	4.35	4.02
Monthly investment to reduce climate change	$14.15	$11.38	$13.39	$18.17	$20.56

Tables 8-14 and 8-15 reiterate general agreement in Northeast Ohio that climate change is real; however, there are some differences in the strength of that agreement, as indicated by the mean response scores in the tables. Table 8-14 shows stronger agreement from respondents inside Environmental Justice Areas (76% agree) than respondents outside Environmental Justice Areas (70% agree). Interestingly, Table 8-15 shows strongest agreement among respondents classified as "higher-income nonwhite" (81%) and weakest agreement among respondents classified as "lower-income nonwhite" (58%).

Table 8-16. NOACA Regional Survey Responses to Statement "Human Behavior Contributes to Climate Change" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		Human behavior contributes to climate change	
	NOACA Region	NOACA Environmental Justice Areas	Non-EJ
BASE	2,428	1,161	1,232
Strongly Agree (5)	47.08%	47.46%	47.16%
Somewhat Agree (4)	25.08%	24.72%	25.08%
Neutral (3)	17.42%	17.48%	17.29%
Somewhat Disagree (2)	5.64%	5.86%	5.36%
Strongly Disagree (1)	4.78%	4.48%	5.11%
	100%	*100%*	*100%*
MEAN	4.04	4.05	4.04

Table 8-17. NOACA Regional Survey Responses to Statement "Human Behavior Contributes to Climate Change" (by Income/Race Group)

		Human behavior contributes to climate change			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Non-white	Lower-income Non-white

BASE	2,428	1,217	537	220	237
Strongly Agree (5)	47.08%	47.66%	48.79%	51.36%	37.55%
Somewhat Agree (4)	25.08%	26.46%	22.53%	22.73%	26.16%
Neutral (3)	17.42%	16.02%	18.06%	17.73%	22.78%
Somewhat Disagree (2)	5.64%	4.77%	5.96%	5.91%	8.44%
Strongly Disagree (1)	4.78%	5.09%	4.66%	2.27%	5.06%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	4.04	4.07	4.05	4.15	3.83

Tables 8-16 and 8-17 reiterate general agreement in Northeast Ohio that human behavior contributes to climate change; however, there are some differences in the strength of that agreement, as indicated by the mean response scores in the tables. While Table 8-16 shows the same level of agreement from respondents inside Environmental Justice Areas and respondents outside Environmental Justice Areas (72% agree). Interestingly, Table 8-17 illustrates some differences. Table 8-17 indicates strongest agreement among respondents classified as "higher-income white" and "higher-income nonwhite" (74%) and weakest agreement among respondents classified as "lower-income nonwhite" (64%).

Although no area is immune from the negative effects of a changing climate, these effects will impact different communities disproportionately. Just as other negative environmental impacts tend to fall more on low-income and minority neighborhoods, the same will be true for climate change. The impacts of climate change and climate-related hazards express themselves through existing socioeconomic disparities.

Two of the key facets of residential development patterns in Northeast Ohio— outward migration and racial segregation—both exacerbate the impacts of rising temperatures. While sprawling regions experienced 14.8 more extreme heat days in 2005 than in 1956 that number was only 5.6 for compact regions.[19] A more recent study of high-resolution remote-sensing land surface temperature (LST) and land-cover data for 293 European cities showed that — contrary to many previous findings — sprawling or polycentric urban forms do not necessarily lead to a decrease of LSTs over urban areas and may, in fact, lead to more pronounced surface urban heat island effect for some cities.[20] Segregation also exposes communities to higher levels of extreme heat. Blacks, Asians, and Latinos are, respectively, 52%, 32%, and 21% more likely to live in areas with limited tree cover and high levels of impervious surfaces.[21] The harmful effects of discriminatory zoning and land-use patterns can linger for decades; redlined neighborhoods are 2.6˚C (4.7˚C) hotter than non-redlined neighborhoods.[22] People living in formerly redlined areas are at increased risk from extreme heat due to lack of tree canopy shade, heat-trapping paved surfaces, and lack of investment in housing and infrastructure. A 2020 study found that formerly redlined areas in Cleveland were, on average, 2.55 degrees Celsius hotter than non-redlined areas.[23]

[19] B. Stone, J.J. Hess, & H. Frumkin, "Urban Form and Extreme Heat Events: Are Sprawling Cities More Vulnerable to Climate Change than Compact Cities?" *Environmental Health Perspectives,* 121.10 (2010), 1425–1428.

[20] Schwaab, J. December 2022. "Sprawl or compactness? How urban form influences urban surface temperatures in Europe," *City and Environment Interactions*, 12 (accessed May 26, 2025, from https://www.sciencedirect.com/science/article/pii/S2590252022000137).

[21] B.M. Jesdale, R. Morello-Frosch, & L. Cushing, "The Racial/Ethnic Distribution of Heat Risk-Related Land Cover in Relation to Residential Segregation," *Environmental Health Perspectives* 121.7 (2013), 811-817.

[22] J.S. Hoffman, V. Shandas, & N. Pendleton, "The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas," *Climate* 8, no.1 (2020).

[23] Hoffman, J., Shandas, V., and N. Pendleton. 2020. "The effects of historical housing policies on resident exposure to intra-urban heat: A study of 108 US urban areas," *Climate,* 8(1), (accessed

Extreme heat takes a particularly heavy toll on black mothers, dramatically raising the incidence of pregnancy complications and preterm births.[24] Failing to tackle the climate crisis risks could widen existing inequities in Northeast Ohio.

As demonstrated earlier in Table 8-13, NOACA Regional Survey respondents disagree that Northeast Ohio is prepared for climate change. Interestingly, those communities most vulnerable to climate change impacts disagree less about the region's lack of preparation than those in better positions to withstand climate change impacts. Table 8-18 shows 22% of respondents inside Environmental Justice Areas agree Northeast Ohio is prepared for climate change, compared with only 17% outside Environmental Justice Areas (45% of both groups disagree with this statement). Table 8-19 shows 31% of lower-income nonwhite respondents agree Northeast Ohio is prepared for climate change, compared with only 16% of higher-income white respondents.

Table 8-18. NOACA Regional Survey Responses to Statement "Northeast Ohio is Prepared for Climate Change" (Environmental Justice Areas versus Non-Environmental Justice Areas)

	Northeast Ohio is prepared for climate change		
	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,429**	**1,162**	**1,232**
Strongly Agree (5)	7.16%	8.09%	6.17%
Somewhat Agree (4)	12.68%	14.03%	11.28%
Neutral (3)	45.08%	42.77%	47.48%
Somewhat Disagree (2)	21.74%	21.43%	22.40%
Strongly Disagree (1)	13.34%	13.68%	12.66%
	100%	*100%*	*100%*
MEAN	2.79	2.81	2.76

Table 8-19. NOACA Regional Survey Responses to Statement "Northeast Ohio is Prepared for Climate Change" (by Income/Race Group)

		Northeast Ohio is prepared for climate change			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,429**	**1,216**	**537**	**219**	**239**
Strongly Agree (5)	7.16%	5.51%	6.70%	10.50%	11.72%
Somewhat Agree (4)	12.68%	10.86%	12.48%	17.35%	18.83%
Neutral (3)	45.08%	49.84%	43.20%	33.79%	41.42%
Somewhat Disagree (2)	21.74%	23.11%	21.79%	22.37%	15.06%
Strongly Disagree (1)	13.34%	10.69%	15.83%	15.98%	12.97%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	2.79	2.77	2.72	2.84	3.01

November 20, 2022 from https://doi.org/10.3390/cli8010012).

[24] J. Kim, A. Lee, & M. Rossin-Slater, "What to Expect When it Gets Hotter: The Impacts of Prenatal Exposure to Extreme Heat on Maternal Health," *NBER Working Paper No. w26384* (2019), https://ssrn.com/abstract=3472819 (accessed May 27, 2025). B. Bekkar, S. Pacheco, & R. Basu, "Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review," *JAMA Open Network* 3, no. 6 (2020), e208243.

Fortunately, NOACA Regional Survey results show that respondents generally agree their individual efforts can make a difference. This is true both inside and outside Environmental Justice Areas (see Table 8-20); however, Table 8-21 indicates weaker agreement with this statement among lower-income nonwhites (51%) compared with other income/racial groups, where 60-65% agree. This may suggest that lower-income nonwhite groups still feel less empowered to make a difference and they have to rely on other organizations and leadership to mitigate climate change impacts.

Table 8-20. NOACA Regional Survey Responses to Statement "My Efforts to Help will Contribute to Doing Something about Climate Change" (Environmental Justice Areas versus Non-Environmental Justice Areas)

		My efforts to help will contribute to doing something about climate change	
	NOACA Region	NOACA Environmental Justice areas	Non-EJ
BASE	**2,430**	**1,163**	**1,232**
Strongly Agree (5)	29.01%	30.18%	27.92%
Somewhat Agree (4)	31.40%	29.75%	32.87%
Neutral (3)	27.61%	29.06%	26.14%
Somewhat Disagree (2)	6.79%	7.05%	6.66%
Strongly Disagree (1)	5.19%	3.96%	6.41%
	100%	*100%*	*100%*
MEAN	3.72	3.75	3.69

Table 8-21. NOACA Regional Survey Responses to Statement "My Efforts to Help will Contribute to Doing Something about Climate Change" (by Income/Race Group)

		My efforts to help will contribute to doing something about climate change			
	NOACA Region	Higher-income White	Lower-income White	Higher-income Nonwhite	Lower-income Nonwhite
BASE	**2,430**	**1,217**	**536**	**220**	**239**
Strongly Agree (5)	29.01%	27.86%	29.66%	35.45%	24.27%
Somewhat Agree (4)	31.40%	32.70%	33.77%	26.36%	26.78%
Neutral (3)	27.61%	26.54%	25.37%	27.73%	35.98%
Somewhat Disagree (2)	6.79%	7.07%	6.34%	7.27%	8.37%
Strongly Disagree (1)	5.19%	5.83%	4.85%	3.18%	4.60%
	100%	*100%*	*100%*	*100%*	*100%*
MEAN	3.72	3.70	3.77	3.84	3.58

Regional Water Quality

NOACA is the federally designated areawide water quality management planning agency (Areawide) under Section 208 of the Clean Water Act.[25] NOACA plans for the five-county

[25] 33 U.S.C. § 1288.

Northeast Ohio Lake Erie Basin (NEOLEB) area. In 2020, the NOACA Board adopted *Clean Water 2020*, its new "208 Plan." *Clean Water 2020*, with NOACA's *Water Quality Strategic Plan* and the Agency's *Overall Work Plan (OWP)*, guide NOACA's water quality planning efforts.

Water Quality Plans

Water Quality Strategic Plan

NOACA staff updated its *Water Quality Strategic Plan* (WQSP) in 2023; the updated plan builds upon the consensus-driven mission, goals, objectives, and strategies to guide the staff-supported work of the agency. NOACA's WQSP guides the work of NOACA's water quality planning staff over a five-year planning period. Staff updated the 2023 WQSP Mission Statement, Goals, and Objectives in response to new and continued water quality issues facing the region.

The WQSP goals are intended to be broad, long-range, and guide NOACA's water planning work.

- **Goal 1:** Provide planning and technical support to protect and restore Lake Erie and the region's valuable water resources
- **Goal 2:** Protect the region's water quality/quantity to support regional economic competitiveness
- **Goal 3:** Identify and inform communities & organizations about the impacts of local decisions on valuable regional water resources and infrastructure
- **Goal 4**: Advance the philosophy of "One Water" through NOACA's water planning work
- **Goal 5:** Within NOACA's internal structure, address potential water quality & quantity impacts related to climate change on the region's transportation and water infrastructure

Clean Water 2020

Clean Water 2020 is NOACA's water quality and wastewater management plan under Section 208 of the Clean Water Act (CWA).[26] The plan focuses on the protection and restoration of water resources in a region where the population has slowly declined while it has spread out over a larger area. This pattern of lower density and a larger development footprint results in higher funding demands from fewer people both to construct new infrastructure and to maintain existing, aging infrastructure. *Clean Water 2020* emphasizes optimization of existing infrastructure, minimization of development impacts associated with sanitary sewer extensions, protection of regional water quality improvements, support for watershed planning, protection and restoration of critical water resources, and support for efforts to manage stormwater runoff and on-site sewage treatment systems. The following goals framed its development:

- **Goal 1:** Optimize investment in existing infrastructure to support existing and infill development and not encourage new development on greenfield sites.
- **Goal 2:** Provide a framework for locally determined development density that mitigates water quality impacts.
- **Goal 3:** Protect regional water quality gains and guide implementation measures to improve water resources that do not yet meet designated uses.
- **Goal 4:** Support programs that address stormwater and sewage treatment systems management.
- **Goal 5:** Protect and restore valuable water resource areas.
- **Goal 6:** Support watershed planning activities that address point and nonpoint source pollution.
- **Goal 7:** Educate local decision makers on regional water quality management issues.

[26] Ibid.

- **Goal 8:** Create a plan that can meet future water quality needs of Northeast Ohio.
- **Goal 9:** Educate and solicit support for implementation of *Clean Water 2020*.
- **Goal 10:** Allow flexibility in the plan to adapt to changes in future water quality needs of Northeast Ohio.

The result is that *Clean Water 2020* is a dynamic resource that will guide Northeast Ohio through the next 20 years of wastewater management and water quality planning.

Water Quality Conditions

Since the Ohio Environmental Protection Agency (Ohio EPA) began to monitor water quality nearly 50 years ago, there has been considerable progress in the protection and restoration of water resources in Northeast Ohio. Regulations have dramatically curtailed polluted discharges from pipes ("point" source pollution). The Cuyahoga River and the other large rivers (Black, Rocky, Chagrin, and Grand Rivers) have realized improved water quality and aquatic life conditions. Public wastewater treatment plant (WWTP) owners continue to reinvest in their facilities to maintain and improve nutrient removal processes. Numerous watershed groups actively focus on the development and implementation of plans to protect and restore water resources. Urban communities strive to reduce impacts from runoff through enforcing the implementation of Storm Water Management Plans (SWMP). Local health districts (LHDs) manage onsite sewage treatment system programs in areas not serviced by sanitary sewers.

Even so, local water quality problems persist, such as legacy polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) pollution, and new issues, e.g. harmful algal blooms (HABs) have moved to the forefront over time. Rapid exurban development, partly enabled by the region's automobile-centric transportation polices, contributes to current Northeast Ohio water quality conditions. Drinking water and wastewater infrastructure continues to expand into new areas, while the region's population slowly declines. Lake Erie's water quality had historically improved from the reduction in point source pollution, but more recently has wavered due to nonpoint source pollution from suburban, agricultural, and rural area stormwater runoff. This increased nutrient load to Lake Erie and other interior lakes leads to seasonal HABs, which produce toxins that contaminate drinking water and hinder recreational opportunities.[27]

Water Resource Concerns

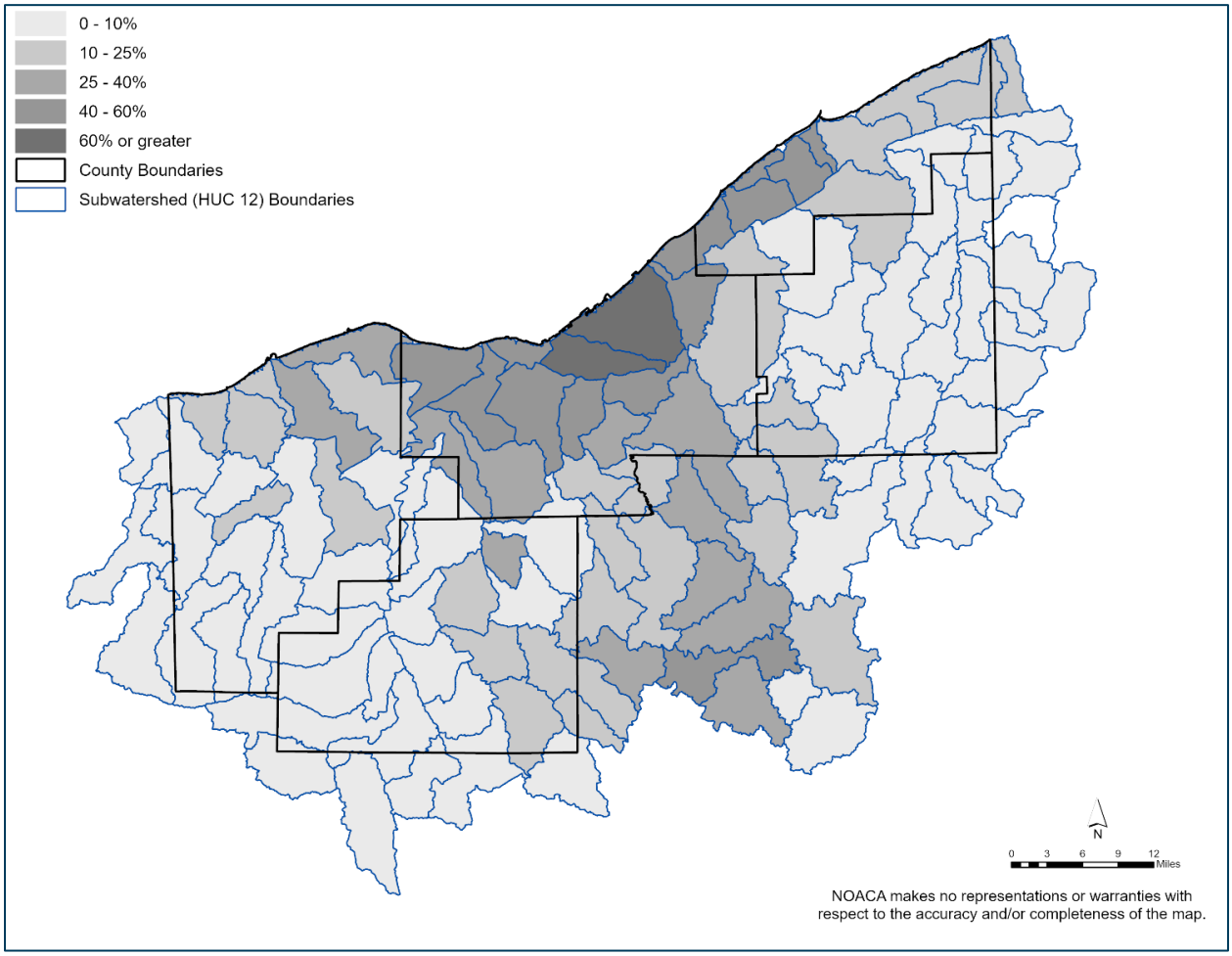
The quality of water resources in Northeast Ohio is the product of the natural landscape and human activities. According to Ohio EPA, the top five causes of impairments that affect aquatic life in Northeast Ohio are "related to landscape modification issues involving agricultural and urban development" and include sedimentation, organic enrichment, hydromodification, nutrient enrichment and habitat modification[28] Transportation policies and water and wastewater infrastructure investments influence the region's development patterns that are linked to many of the causes and sources of stream impairments. Specifically, Northeast Ohio's sprawling development patterns have resulted in increased impervious surfaces. Outmigration patterns have also required the extension of water/wastewater infrastructure to serve the migrating population, which results in a loss of customers from existing urban sewerage systems since the region has not seen an increase in total population. Additionally, changes in the number of people per household, coupled with outmigration, increases the region's development footprint and

[27] Alliance for the Great Lakes, "Lake Erie Algae Blooms: Polluting Our Drinking Water," https://greatlakes.org/campaigns/lake-erie-algae-blooms/ (accessed May 27, 2025)
[28] Ohio Environmental Protection Agency, "2024 Ohio Integrated Water Quality Monitoring and Assessment Report," https://epa.ohio.gov/static/Portals/35/tmdl/2024intreport/Full-2024-IR.pdf (accessed May 27, 2025).

increase impervious surfaces, ultimately impacting drinking water sources that rely on groundwater recharge areas

The conversion of natural areas or agricultural lands to residential, industrial, or commercial development increases impervious surfaces (e.g., roads, parking lots, roofs, sidewalks, etc.). From 2001 to 2021, impervious surface cover has increased in multiple Northeast Ohio Watershed Assessment Units (WAUs) (Figures 8-1 and 8-2). Multiple studies have shown increasing imperviousness harms water quality. Impervious surfaces increase the amount and speed of water runoff and lead to increased erosion and unstable streams. More runoff also brings more pollutants (e.g., nutrients, metals, bacteria, etc.) to the local waterways. Runoff over hot impervious surfaces can increase the water temperature in local waterways and deplete the dissolved oxygen for aquatic life.[29] Figure 8-3 presents the attainment status of subwatersheds within Environmental Justice Areas along with the subwatershed imperviousness percentage. Waterways within subwatersheds characterized by higher impervious cover are more likely to result in nonattainment. Figure 8-3 also shows subwatersheds (and their waterways) within identified Environmental Justice Areas are also more likely to be impaired.

Figure 8-1. Northeast Ohio Percentage of Impervious Surface Cover (2001)



[29] Ohio EPA, "Ohio 2024 Integrated Water Quality Monitoring and Assessment Report," March 2024, https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/ohio-integrated-water-quality-monitoring-and-assessment-report, A12-A13 (accessed May 20, 2025).

Figure 8-2. Northeast Ohio Percentage of Impervious Surface Cover (2021)

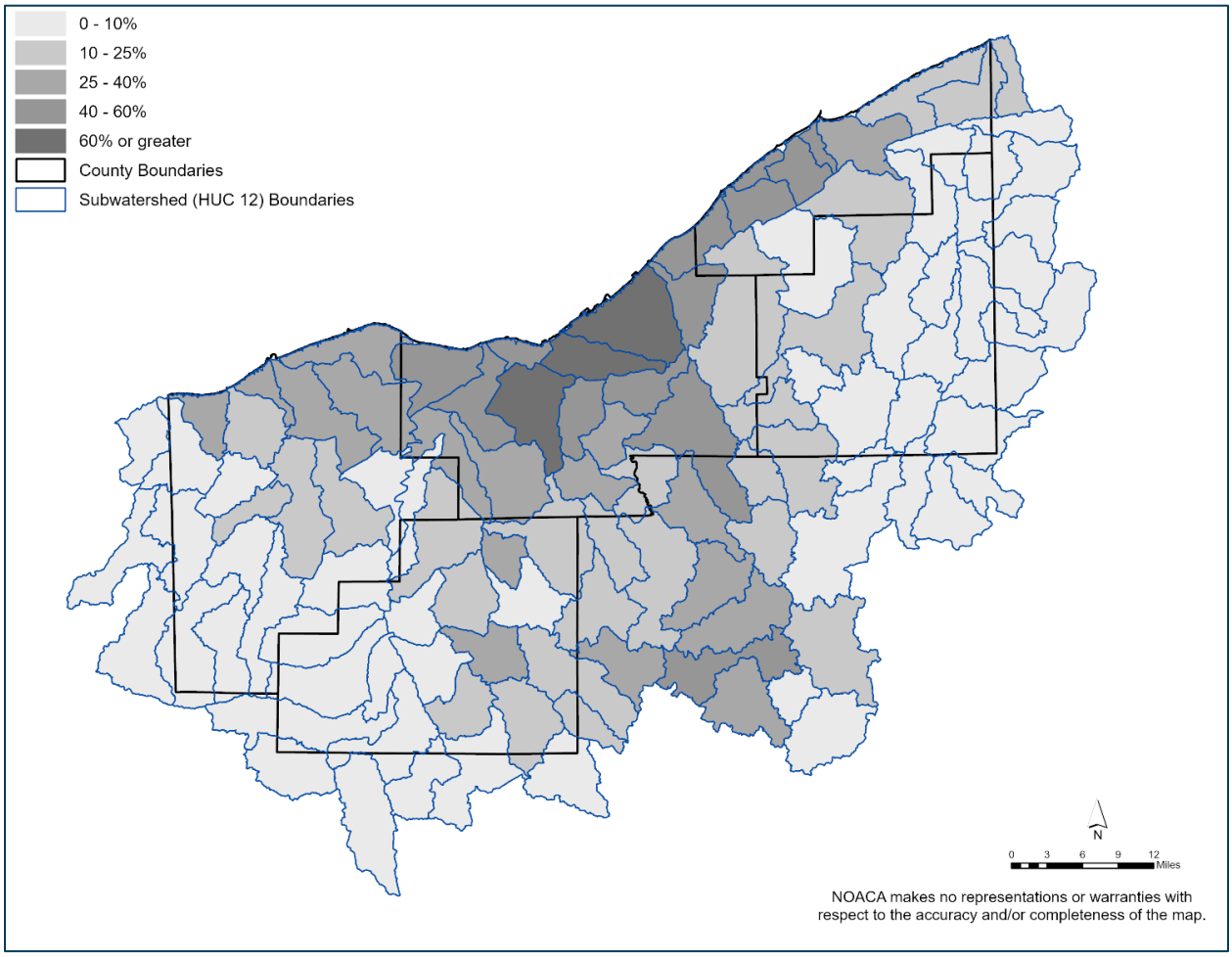
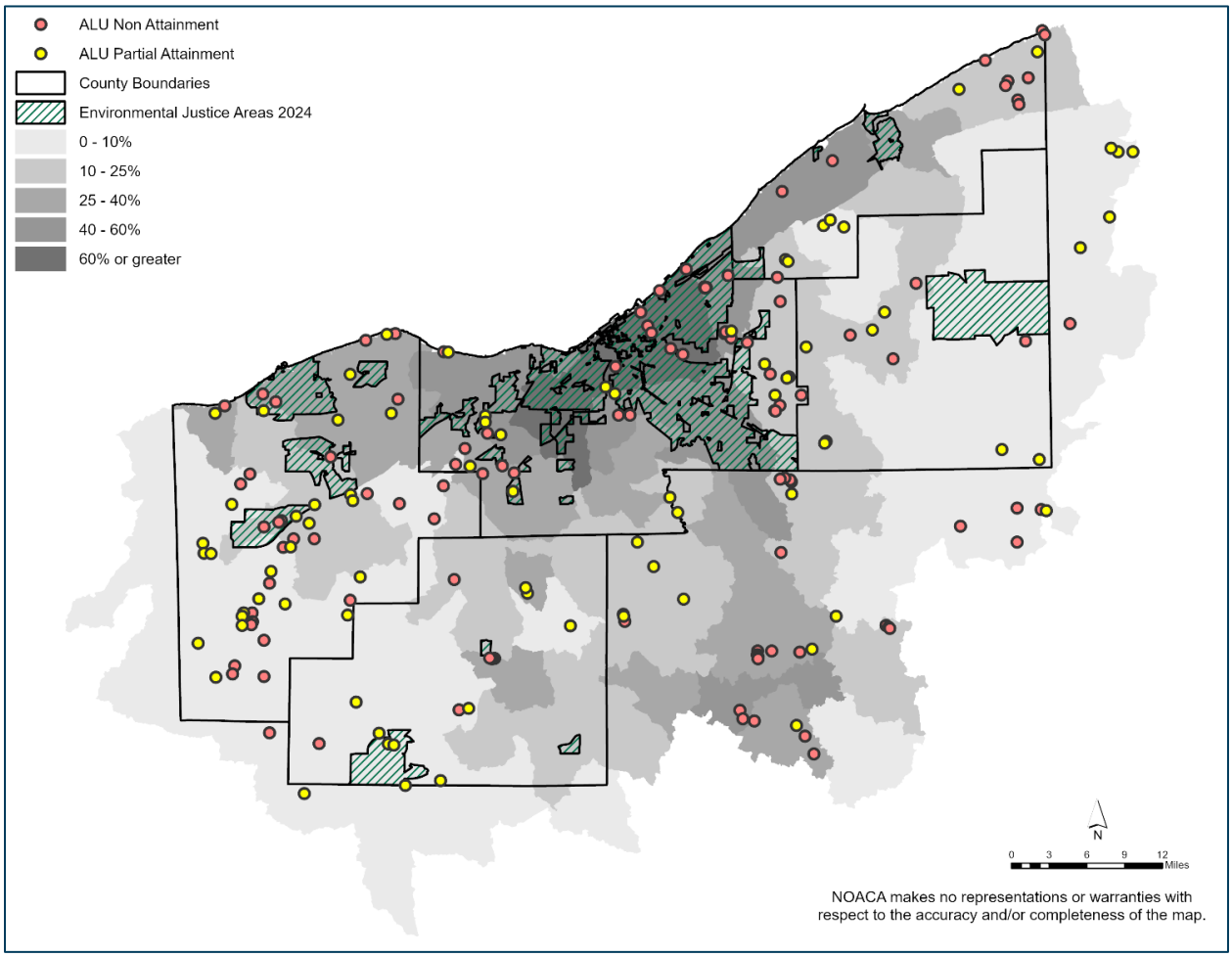


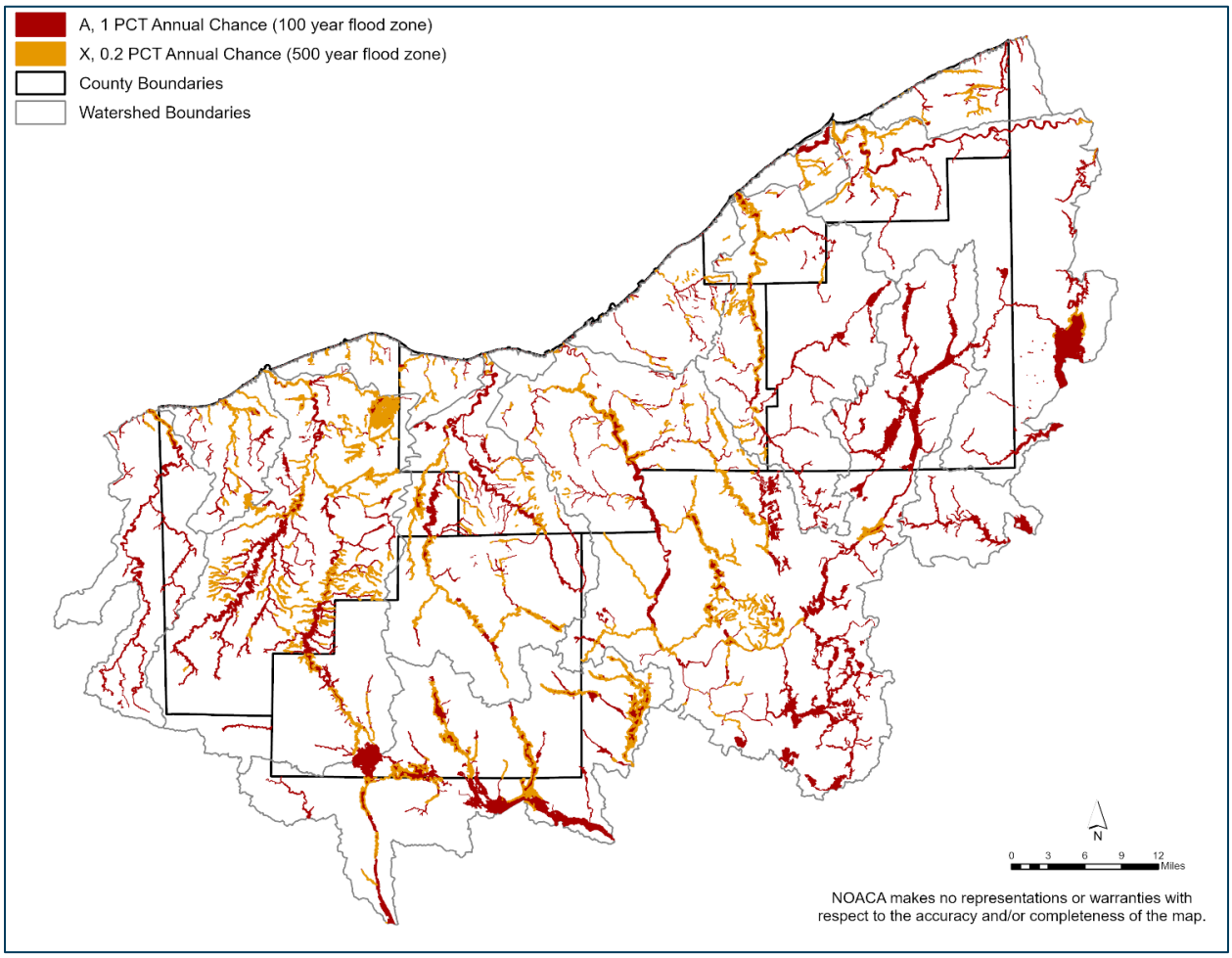
Figure 8-3. Northeast Ohio Subwatershed Percentage of Impervious Surface Coverage (2021), Aquatic Life Use Attainment Status (ALU), and Environmental Justice Areas



The continued outmigration of population and jobs has resulted in the further development of urban and suburban areas. Additionally, historical investment policies regarding transportation have prioritized automobile centric transportation infrastructure. As development continues outward, water, stormwater and wastewater infrastructure are also needed. Two of the future transportation scenarios identified by NOACA staff—1 (MAINTAIN) and 2 (CAR), which continue to support travel by car—are likely to result in continued expansion of low-density development (see Chapter 9). Low-density development also results in additional impervious surfaces, which may ultimately impact water quality. Increased imperviousness and reduction of natural open space and riparian vegetation generally increases the size and number of floods for a region. Expanded flood hazards from greater impervious surfaces may amplify the need for communities to repair, move, or redesign existing infrastructure such as roads, bridges, culverts and stormwater management structures.[30] Figure 8-4 shows the region's flood hazard areas and places most vulnerable to increased flooding from development.

[30] C.P. Konrad, "Effects of Urban Development on Floods," U.S. Geological Survey Fact Sheet 076-03, https://pubs.usgs.gov/fs/fs07603/ (accessed May 20, 2025)

Figure 8-4. Northeast Ohio FEMA Flood Hazard Areas



Wastewater Management

Infrastructure investment decisions enable development on undeveloped land as well as reinvestment in the urbanized areas. Urbanized and rural areas have different infrastructure needs. Adequate conveyance and treatment of wastewater is critical for watershed health. In Northeast Ohio, wastewater from residential, commercial and industrial establishments flow to major wastewater treatment plants (WWTPs), communal systems, or individual onsite sewage treatment systems (OSTS) of various sizes. Figure 8-5 and Table 8-22 illustrate and quantify the general areas served by sanitary sewers, areas planned to be served by sanitary sewers, areas served by OSTSs for the foreseeable future, and areas that follow community-specific wastewater planning objectives as defined by Local Prescriptions in *Clean Water 2020*.

Figure 8-5. NOACA Region Sanitary Sewer Plan Map

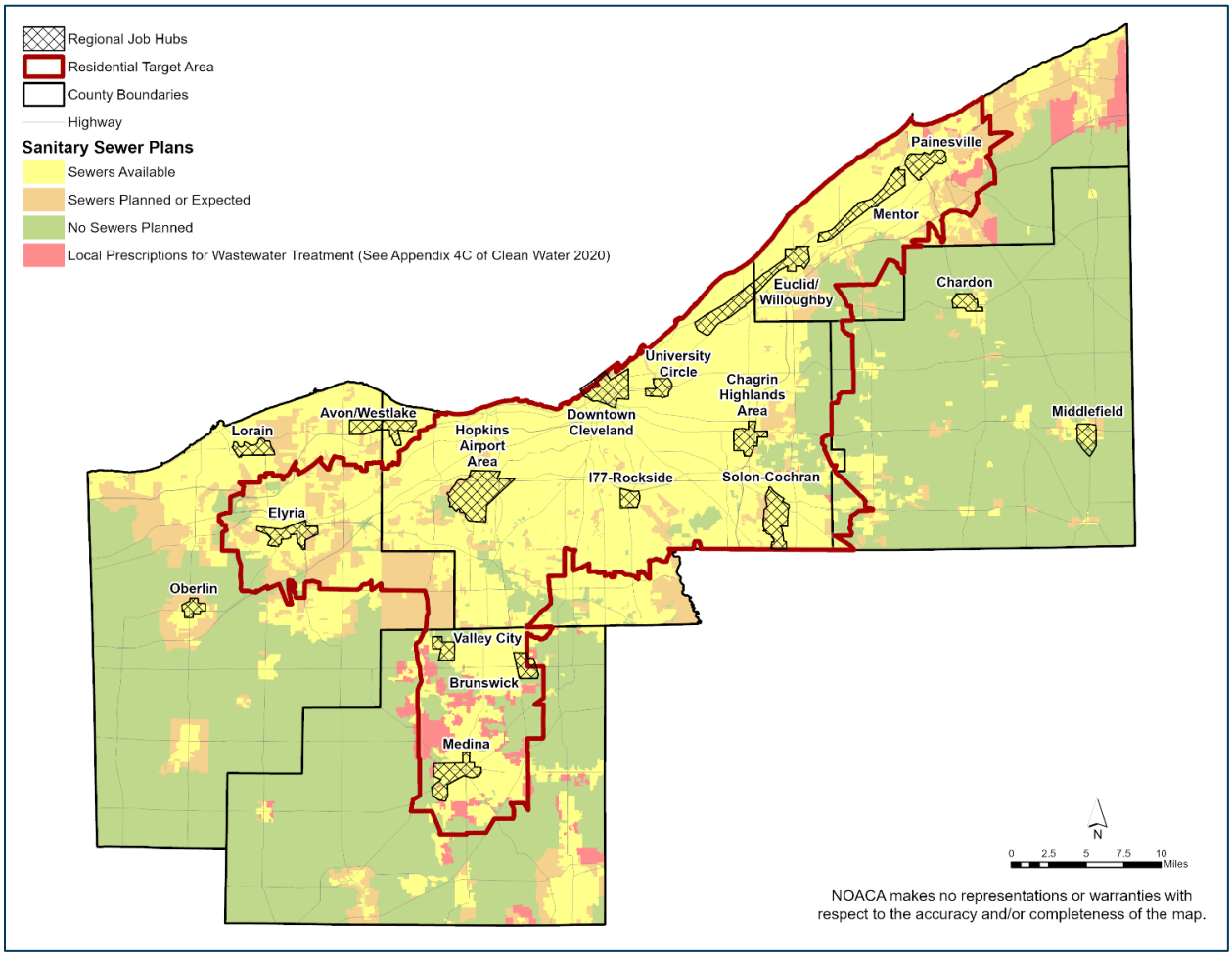


Table 8-22. NOACA Region Sanitary Sewer Plan Distribution[31]

Sewer Planning Areas and Residential Target Areas								
	NOACA Region		Residential Target Areas			Non-Residential Target Areas		
Sanitary Sewer Plans	**Total Area (mi^2)**	**% of Region**	**Total Area (mi^2)**	**% of Area**	**% of Region**	**Total Area (mi^2)**	**% of Area**	**% of Region**
Sewers Available	736.0	36.5	530.9	71.6	26.3	205.1	16.1	10.2
Sewers Planned or Expected	205.8	10.2	88.4	11.9	4.4	117.4	9.2	5.8
No Sewers Planned	1032.1	51.2	101.5	13.7	5.0	930.6	73.0	46.1

[31] The "Local Prescriptions" category was added since the last Long Range Plan update (*eNEO2050*) to align the classifications of Sanitary Sewer Plans with the Prescriptions for Wastewater Treatment in the NOACA region (as presented in *Clean Water 2020).*

Local Prescriptions	41.6	2.1	20.6	2.8	1.0	21.0	1.6	1.0
Total	2015.5	99.9	741.4	99.9	36.8	1274.1	100.0	63.2

The placement of wastewater infrastructure plays a critical role in enabling the disbursement of population, businesses and services. In turn, the disbursement of population, businesses and services play a critical role the placement of wastewater infrastructure. Developers interested in undeveloped land frequently approach communities, counties, water districts, and NOACA to secure sewer extensions for developments. At this point, the region faces the challenge of managing threats to water quality posed by both aging infrastructure in declining areas and new infrastructure and impervious surfaces in growing areas. The shift in population away from the urban core places a greater financial burden on remaining customers to pay for the maintenance of older sewage systems. This financial burden is even greater for customers who are connected to systems under state or federal orders to remediate combined sewer overflows (CSO) to protect local waterways from raw sewage during heavy rainfall events.

Drinking Water Resources

As square miles of open spaces are lost to development, the resulting increase in impervious surfaces impacts local and regional water quality. Impervious surfaces increase with the development of new roads, driveways, parking lots, and buildings (strip malls and additional households). Stormwater runoff flows over impervious surfaces and conveys pollution (heavy metals, oils, sediments, chemical residues, debris, etc.) into local and regional water ways that are connected to drinking water sources such as Lake Erie, inland lakes, and rivers.

The increase in impervious surfaces from the region's development patterns also impacts the region's groundwater. Additional impervious surface from development reduces the area where water can infiltrate the ground. The lack of groundwater recharge can lead to lower groundwater tables. Streams, lakes, wetlands, and other water resources replenish the groundwater table. Groundwater primarily maintains the base flow (sustained flow without direct runoff) for most streams.[32]

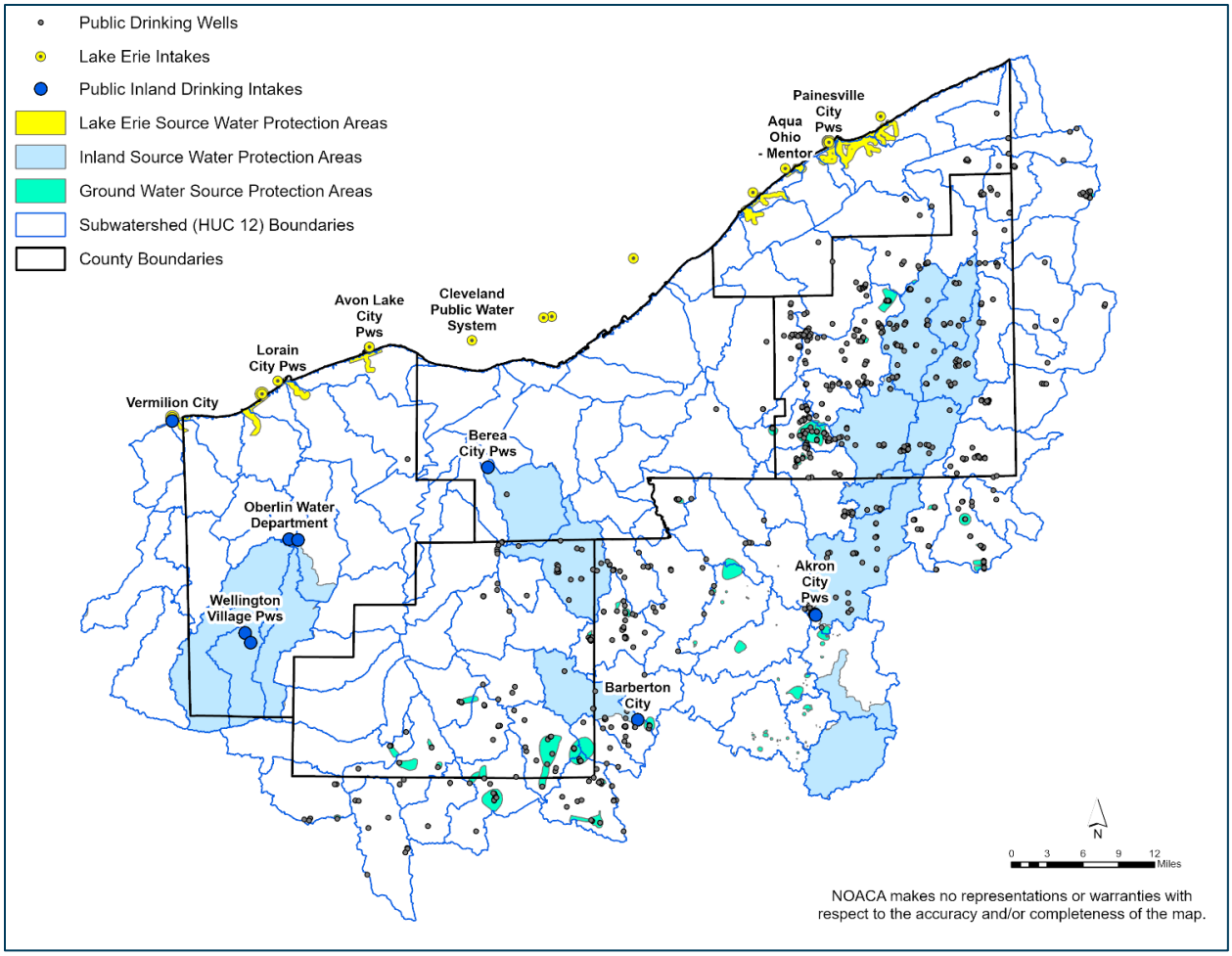
Many properties and communities rely on groundwater as their primary drinking water source (Figure 8-6). If development continues the current pattern of expansion, more of the region's population may rely on groundwater in the future. Future transportation scenarios 1 and 2 present this possibility and would likely result in higher percentages of impervious surface, which may result in increased vulnerability for groundwater contamination (see Chapter 9 for a description of the scenarios). Common groundwater pollution sources are industry, fertilizers, failing sewage treatment systems, construction sites, and oil, gas, and salt runoff from roads and other impervious surfaces. In scenarios 3 and 4, the areas targeted to attract residents and jobs are within currently developed portions of the region, which may slow the expansion of impervious surface and preserve natural open space (see Chapter 9).

Outmigration and intra-migration leave urban communities with older drinking water distribution systems that require maintenance and replacement without necessary customer base to realize such improvements. Population migration may delay infrastructure maintenance due to loss of revenues. Additionally, as the drinking water distribution systems age and erode, unhealthy lead levels may occur. According to USEPA, "the most common sources of lead in drinking water are lead pipes, faucets, and fixtures" (see Figure 8-7). Often, lead service lines that connect homes

[32] U.S. Geological Survey (USGS), "Surface Runoff and the Water Cycle," https://www.usgs.gov/special-topics/water-science-school/science/surface-runoff-and-water-cycle (accessed May 20, 2025)

to distribution lines are the most significant source of lead in water. USEPA also reports that "lead pipes are more likely to be found in older cities and homes built before 1986 and the most common problem is with brass or chrome-plated brass faucets and plumbing with lead solder."[33]

Figure 8-6. Northeast Ohio Source Water Intakes and Protection Areas



[33] USEPA, "Basic Information about Lead in Drinking Water," https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water#getinto, (accessed May 28, 2025).

Figure 8-7. Sources of Lead in Drinking Water

Regional Air Quality

National Ambient Air Quality Standards (NAAQS) and Attainment Status

In 1970, the United States Congress passed its first round of amendments to the existing federal Clean Air Act (CAA), which laid out a framework to control air pollution at the federal, state, and local levels. Because transportation accounts for a significant portion of air pollution, the 1977 Clean Air Act Amendments (CAAA) introduced the concept of transportation conformity. Under this provision, a region's transportation plans, programs, and projects cannot interfere with the region's air quality goals.[34] MPOs such as NOACA must demonstrate that their long-range transportation plans (LRTPs) and Transportation Improvement Plans (TIPs) conform to these goals through a process known as a conformity determination.[35]

Since its passage, the CAA has significantly enhanced air quality in the U.S. From 1970 to 2023, ambient concentrations of the six criteria air pollutants declined by 78% nationwide, even as the economy grew by 321% and vehicle miles traveled (VMT) nearly doubled.[36] This decline in pollutant concentrations has also reduced the associated health burden of air pollution. In 1997, US EPA concluded that, from 1970 to 1990, the CAA prevented approximately 205,000 premature deaths and generated $22.2 trillion in economic benefits.[37] US EPA also concluded that the 1990

[34] 42 C.F.R. §7506 (c)(2).
[35] FHWA, *Transportation Conformity: A Basic Guide for State and Local Officials* (Washington, DC: FHWA, 2010); https://www.fhwa.dot.gov/environment/air_quality/conformity/guide/ (accessed May 28, 2025
[36] US EPA, "Air Quality Trends," https://www.epa.gov/air-trends/air-quality-national-summary (accessed May 28, 2025)
[37] US EPA, *The Benefits and Costs of the Clean Air Act, 1970 to 1990—Retrospective Study*

CAAA would prevent 230,000 premature deaths by 2020.[38]

Historically, Northeast Ohio has struggled with poor air quality, due in part to its reliance on heavy industry and the use of coal to produce electricity. While the smokestacks from facilities such as steel mills, oil refineries, and coal-fired power plants long dominated the landscape in the region, mobile emissions have actually been the primary source of air pollution in Northeast Ohio since at least 1990. On-road vehicles continue to generate a plurality (27.4%) of criteria pollutant emissions. Additionally, two of the pollutants most closely linked to mobile emissions— ozone (O_3) and fine particulate matter ($PM_{2.5}$)—have declined by smaller margins. As Table 8- 23 illustrates, while the region's air quality has improved dramatically over the past 50 years, this rate of improvement has slowed since 2010, which mirrors the national trend.[39]

Table 8-23. Change in Concentrations of Criteria Air Pollutants in Northeast Ohio, 1990-2023[40]

Pollutant Type	1990-2023	2000-2023	2010-2023
Carbon Monoxide (CO)	-79%	-65%	-18%
Nitrogen Dioxide (NO_2) (1-hour)	-62%	-54%	-30%
Ozone (O_3) (Eight-Hour)	-18%	-12%	-1%
PM_{10} (24-hour)	-29%	-36%	0%
$PM_{2.5}$ (annual)	n/a	-37%	-15%
Sulfur Dioxide (SO_2) (1-hour)	-92%	-87%	-78%

Source: US EPA

The CAA (40 C.F.R. § 50) requires the US EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. US EPA has created NAAQS for six criteria air pollutants. Regions that do not comply with these standards are designated as nonattainment areas. Northeast Ohio is currently a marginal nonattainment area for the 2015 ozone (O_3) NAAQS (see Table 8-24). While Northeast Ohio is currently a moderate nonattainment area for the 2015 ozone (O_3) NAAQS (see Table 8-24), the region did not meet the attainment date on August 3, 2024. As a result, US EPA bumped the region to serious nonattainment status on December 17, 2024.

On February 7, 2024, the U.S. EPA strengthened the primary annual $PM_{2.5}$ NAAQS from 12 µg/m^3 to 9 µg/m^3, while retaining the primary and secondary 24-hour $PM_{2.5}$ NAAQS. The U.S. EPA plans to issue guidance on area designations by February 2026. Using this guidance, states must develop and submit attainment plans for areas that do not meet the revised primary annual $PM_{2.5}$ NAAQS within 18 months of the EPA's final designations. These designations will likely be based on the $PM_{2.5}$ values during 2022-2024. Based on 2021-2023 $PM_{2.5}$ values, the most recent years for which there is certified data, Cuyahoga County would be the only area in Northeast Ohio in nonattainment with a value of 12.4 µg/m^3.

(Washington, D.C.: US EPA, 1997), https://www.epa.gov/sites/production/files/2015-06/documents/contsetc.pdf (accessed May 28, 2025).

[38] US EPA, *Benefits and Costs of the Clean Air Act 1990-2020, the Second Prospective Study* (Washington, D.C.: US EPA, 2011), https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-second-prospective-study (accessed May 28, 2025)

[39] Z. Jian et al., "Unexpected slowdown of US pollutant emission reduction in the past decade," *Proceedings of the National Academy of Sciences* 115, 20 (2018), 5099-5014

[40] US EPA, "Air Trends," https://www.epa.gov/air-trends (Accessed May 28, 2025).

In 2023, Northeast Ohio experienced several days of elevated $PM_{2.5}$ emission levels, largely due to the wildfires that took place in Canada. As the wildfires burned across the country, the smoke drifted into the Midwest and impacted air quality and public health. The wildfire smoke led to several air quality alerts across Northeast Ohio. According to the EPA's Air Quality Index (AQI), Northeast Ohio experienced 236 moderate days, six (6) unhealthy days for sensitive groups, four (4) unhealthy days and one (1) very unhealthy day in 2023; compared to 127 moderate days, one (1) unhealthy day for sensitive groups, and one (1) unhealthy day in 2022. The number of $PM_{2.5}$ exceedance days in Northeast Ohio also increased from one (1) in 2022 to nine (9) in 2023.

As fine particulate matter becomes more of a concern in Northeast Ohio, NOACA has recently analyzed the accuracy of the National Oceanic and Atmospheric Administration (NOAA) fine particulate matter forecasting model. NOACA compared NOAA's forecasting data to the daily observation data to determine the accuracy of NOAA's forecasting model. The findings of the model analysis were presented at the National Air Quality Forecasters Workshop in Washington D.C. to help NOAA improve their forecasting model. NOACA staff will continue to monitor its own forecast performance and collaborate with others to improve.

Table 8-24. Summary of Nonattainment Status for Northeast Ohio[41]

Pollutant		Averaging Time	Level	Attainment Status	Counties in Nonattainment
Carbon Monoxide (CO)		8-hour	9 ppm	Maintenance	N/A
		1-hour	35 ppm		N/A
Lead (Pb)		Rolling 3-month average	0.15 µg/m^3	Maintenance	N/A
Nitrogen Dioxide (NO_2)		1-hour	100 ppb	Unclassifiable/ Attainment	N/A
		Annual	53 ppb	Unclassifiable/ Attainment	N/A
Ozone (O_3)		8-hour	70 ppb	Marginal Nonattainment	Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit
Particle Pollution	$PM_{2.5}$	Annual	9 µg/m^3	Maintenance	N/A
		24-hour	35 µg/m^3	Maintenance	N/A
	PM_{10}	24-hour	150 µg/m^3	Maintenance	N/A
Sulfur Dioxide (SO_2)		1-hour	75 ppb	Maintenance	N/A

Source: US EPA

Lead Contamination

Ambient and indoor air pollution impose substantial costs within Northeast Ohio, as described in

[41] US EPA, "Nonattainment Areas for Criteria Pollutants (Green Book)," https://www.epa.gov/green-book (accessed May 28, 2025)

subsequent sections. But these costs stretch beyond just health impacts. Perhaps the greatest environmental justice challenge facing the NOACA region is lead contamination, particularly among children in communities of color with aging housing stock. The use of lead-based paint was commonplace in residential settings prior to its prohibition in 1978. Due to its history as a hub for the paint and coatings industry, Northeast Ohio has a significant legacy lead pollution problem. While lead-based paint does not pose an acute health threat if it is properly sealed, that is often not the case in the older housing stock within the region's legacy cities. There is no safe level of lead in the human body, and children are most at risk. Lead can harm human health in a number of ways. Increasing from the 5th to 95th percentile of blood lead levels (BLLs) is associated with a loss of 6.9 IQ points among children; the majority of this decrement occurs at levels below 10 micrograms per deciliter (µg/dL), which health officials had previously considered safe.[42] Elevated BLLs are also linked to behavioral and mental health problems. Because lead remains in the body, its health effects can linger and exacerbate throughout the course of one's life.

The social and economic costs of lead contamination are enormous. Each child in Northeast Ohio who develops elevated BLL incurs an array of additional costs due to lost economic output and ongoing healthcare and social service demands. According to one study, elevated BLLs in the U.S. caused $165–233 billion in lost lifetime earnings, $25–35 billion in foregone tax revenue, $30–146 million in special education expenses, $11–53 billion in additional health-care costs, and $11.6 billion in additional indirect costs.[43] Conversely, the benefits of lead remediation are vast and outweigh the costs by orders of magnitude. Every $1 invested in lead paint hazard control measures generates $17-221 in total benefits.[44] The potential benefits for Northeast Ohio are apparent, as more than 10% of children in Cuyahoga County (more than 25% in the City of Cleveland) have elevated BLLs by the age of five.[45]

Recent reports from the Cleveland Department of Public Health (CDPH) indicate that 1,500 children are poisoned by lead every year. According to Dr. David Margolius, CDPH Director, that number dropped dramatically from 2005 to 2018 but has leveled off over the last five years. "That's not good enough for us," he said. The lack of recent improvement comes despite efforts to address the issue through local initiatives like the 2019 Lead Safe Certification Program.[46]

Because lead is more likely to be found in older housing stock and infrastructure, it is disproportionately likely to harm residents of our legacy urban areas, and they are disproportionately likely to be low-income and minority. This is why Cleveland enacted a 2019 law to reduce the number of children exposed to lead, and in 2020 followed up by committing funding to the effort.[47] This is another example of the need to address and eradicate poverty and racism

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[42] Bruce P. Lanphear, Richard Hornung, Jane Khoury, Kimberly Yolton, Peter Baghurst, David C. Bellinger, Richard L. Canfield, Kim N. Dietrich, Robert Bornschein, Tom Greene, Stephen J. Rothenberg, Herbert L. Needleman, Lourdes Schnaas, Gail Wasserman, Joseph Graziano, and Russell Roberts, "Low-level environmental lead exposure and children's intellectual function: an international pooled analysis," *Environmental health perspectives*, 113,no. 7, (2005), 894-899.

[43] Elise Gould, "Childhood lead poisoning: conservative estimates of the social and economic benefits of lead hazard control," *Environmental health perspectives* 117, no. 7 (2009), 1162-1167.

[44] Ibid.

[45] Elizabeth Anthony, Stephen Steh, Meghan Salas Atwell, M. & Rob Fischer, *Early Childhood Lead Exposure in Cuyahoga County and the Impact on Kindergarten Readiness* (Cleveland, OH: Mandel School of Applied Social Sciences, Case Western Reserve University, 2019).

[46] "VanMetre, E. October 11, 2024. "1,500 kids in Cleveland are being poisoned a year, some in 'lead safe' homes," *The Cleveland Plain Dealer* (accessed May 26, 2025, from https://www.news5cleveland.com/news/local-news/we-follow-through/1-500-kids-in-cleveland-are-being-poisoned-a-year-some-in-lead-safe-homes).

[47] Robert Higgs, "Cleveland City Council Approves $5M to Help Landlords Tackle Lead Paint Problem in Dwellings," *Cleveland.com*, Aug. 21, 2020; https://www.cleveland.com/cityhall/2020/08/cleveland-city-

to positively impact the region and improve quality of life and economic outcomes for all.

Major Sources of Air Pollution in Northeast Ohio

Broadly speaking, there are two main types of air pollutants—primary and secondary. Primary pollutants are emitted directly into the atmosphere from a given source and retain their same, basic chemical form. Two common primary pollutants are carbon monoxide (CO) and sulfur dioxide (SO_2). Secondary pollutants, in contrast, undergo a chemical change once they enter the atmosphere. Ozone (O_3) is a secondary pollutant; it is formed when nitrogen oxide (NO_x) combines with volatile organic compounds (VOCs) and oxygen in the lower atmosphere.

Table 8-25 outlines the contribution of mobile sources (highway and off-highway vehicles) to each of the criteria pollutants in Northeast Ohio. These include key primary pollutants (CO, PM_{10}, $PM_{2.5}$, and SO_2) and precursors for secondary pollutants of concern (NO_x and VOCs). As the charts indicate, transportation is a significant source of several pollutants, specifically CO, NO_x, $PM_{2.5}$, and VOCs.

Table 8-25. Share of Mobile Emissions for Criteria Pollutants in Northeast Ohio (2020)[48]

Pollutant		Total Emissions (Tons)	Mobile Emissions (Tons)	Highway Vehicles Emissions (% Total)	Non-Highway Vehicles Emissions (% Total)
CO		324,130	222,014	34.1%	34.4%
O_3	NO_x	40,793	29,603	47.4%	25.1%
	VOCs	87,617	14,915	8.0%	9.1%
Particle Pollution	PM_{10}	41,296	2,758	4.7%	1.9%
	$PM_{2.5}$	14,199	1,458	5.0%	5.3%
SO_2		2,361	135	3.5%	2.2%

Air Quality Trends and Analysis

Each year, NOACA produces its Air Quality Trends Report, which provides a comprehensive overview of air quality in Northeast Ohio and how the region performs on each of the NAAQS. Through this annual report, NOACA provides up-to-date information on how pollution levels change over time, which informs public education and policy making throughout the region.

NOACA plays a major role in the analysis of both the impacts of the region's transportation investments on greenhouse gas (GHG) emissions and climate resilience, and what actions the region should take to reduce emissions in order to achieve climate goals. The agency already completes an annual GHG emissions inventory for each of its five counties, and it has the capacity to provide detailed technical support to member communities. As part of its New or Modified Highway Interchange Projects Policy, NOACA staff analyze how new or modified highway interchanges influence equity measures and regional GHG emissions. This policy goes beyond

council-approves-5m-to-help-landlords-tackle-lead-paint-problems-in-dwellings.html (accessed April 8, 2021)

[48] US EPA, "2020 National Emissions Inventory Report," https://gispub.epa.gov/neireport/2017/ (accessed May 28, 2025)

existing transportation conformity requirements and informs the agency as it evaluates potential highway projects. NOACA also has the unique capacity to explore how changes to the transportation network may influence mobile emissions and public health in Northeast Ohio.

Social and Economic Costs of Air Pollution

Air pollution is connected to a host of health issues, including respiratory illnesses (e.g., asthma, bronchitis, and emphysema); pre- and neonatal health risks, including low birthweight, premature birth, and infant mortality; stroke; heart disease, including heart attacks; behavioral conditions, such as attention deficit hyperactivity disorder (ADHD); cognitive issues, including IQ decrements and dementia; lung cancer; and premature death.[49] To quantify these impacts for Northeast Ohio, NOACA used US EPA's Co-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool.[50] Table 8-26 details the total costs and certain public health impacts of all air pollutants emitted in the NOACA region during 2023. Table 8-27 details such costs and impacts of pollutants emitted just from mobile sources.

Table 8-26. Public Health Impacts of Air Pollutant Emissions in the NOACA Region in 2023

Type of Impact	Incidence	Total Cost (2023 $)
Mortality (low estimate)	670 deaths	$9.8 billion
Mortality (high estimate)	1,300 deaths	$19 billion
Infant Mortality	4 deaths	$63 million
Nonfatal heart attacks	360 heart attacks	$30 million
Respiratory Hospital Admissions	60 admissions	$1.7 million
ER Visits for Asthma[a]	1.6 visits	$1,300
Minor Restricted Activity Days	330,000 days	$42 million
Lost Work Days	56,000 days	$18 million
Asthma Exacerbations	310,000 attacks	$39 million
Total Health Costs (low estimate)[b]	$10 billion	
Total Health Costs (high estimate)[ab]	$19 billion	

[a] U.S. EPA now calculates ER visits for asthma based on ozone concentrations rather than $PM_{2.5}$. This is why the numbers shown in this report are substantially lower than those in the CY2022 Air Quality Trends Report NOACA released last year (Source: NOACA estimates through U.S. EPA).
[b] Total costs do not include all health impacts and are therefore greater than the sum of the individual impacts included in this table (Source: NOACA estimates through U.S. EPA's COBRA model).

Northeast Ohio has directly benefited from the long-term decreases in pollutant levels. One recent analysis found that, since 1970, air quality improvements associated with the CAA have extended the average life expectancy of people within the region by 2.3 years.[51] More recent reductions in pollution concentrations have also improved public health. Due largely to regulations on tailpipe emissions, transportation-related NO_2 pollution has fallen considerably. As a result, the number of childhood asthma cases in the NOACA region fell by 42.6% from 2000 to 2010.[52]

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[49] For further information on the public health effects of air pollution, consult the US EPA's *Integrated Science Assessments* on the criteria air pollutants at https://www.epa.gov/isa (accessed May 28, 2025).
[50] US EPA, Co-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool, https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool (accessed November 5, 2024)
[51] Michael Greenstone, "The Connection between Cleaner Air and Longer Lives," *The New York Times*, Sept. 24, 2015; http://www.nytimes.com/2015/09/25/upshot/the-connection-between-cleaner-air-and-longer-lives.html?_r=1 (accessed November 1, 2019)
[52] Raed Alotaibi, Mathew Bechle, Julian D. Marshall, Tara Ramani, Josias Zietsman, Mark J.

Table 8-27. Public Health Impacts of Mobile Emissions in the NOACA Region in 2023

Type of Impact	Incidence	Total Cost (2023$)
Mortality (low estimate)	50 deaths	$730 million
Mortality (high estimate)	79 deaths	$1.1 billion
Nonfatal heart attacks	17 heart attacks	$1.4 million
Respiratory Hospital Admissions	5 admissions	$110,000
ER Visits for Asthma[a]	1 visit	$280
Minor Restricted Activity Days	16,000 days	$2 million
Lost Work Days	2,600 days	$830,000
Asthma Exacerbations	31,000 attacks	$8.4 million
Total Health Costs (low estimate)[b]	$790 million	
Total Health Costs (high estimate)[ab]	$1.2 billion	

[a] U.S. EPA now calculates ER visits for asthma based on ozone concentrations rather than $PM_{2.5}$. This is why the numbers shown in this report are substantially lower than those in the CY2022 Air Quality Trends Report NOACA released last year (Source: NOACA estimates through U.S. EPA).
[b] Total costs do not include all health impacts and are therefore greater than the sum of the individual impacts included in this table (Source: NOACA estimates through U.S. EPA's COBRA model).

Air Pollution Costs by Future Transportation Scenario

NOACA staff evaluated each of the four future transportation scenarios developed in *eNEO2050* to see how they influence mobile emissions, pollution exposure, and public health in each of the region's zip codes (see Chapter 9 for the scenarios). This provides a more fine-grained understanding of the ways that transportation investments may influence quality of life within the region. It also better informs NOACA's efforts to enhance equity and minimize ongoing environmental justice disparities. Staff used US EPA's Motor Vehicles Emissions Simulator (MOVES4.0.1) and COBRA to complete this analysis. The aggregate regional public health costs of each scenario are given in Table 8-28.

Table 8-28. Total Public Health Costs of Mobile Emissions by Scenario (2050)

Type of Impact	MAINTAIN	CAR	TRANSIT	TOTAL
Mortality (low estimate)	17 deaths	17 deaths	18 deaths	18 deaths
Mortality (high estimate)	24 deaths	25 deaths	25 deaths	25 deaths
Nonfatal heart attacks	4 heart attacks	4 heart attacks	4 heart attacks	4 heart attacks
Respiratory Hospital Admissions	1 admission	1 admission	1 admission	1 admission
ER Visits for Asthma	15 visits	15 visits	15 visits	15 visits
Minor Restricted Activity Days	5,097 days	5,106 days	5,132 days	5,192 days
Lost Workdays	863 days	864 days	869 days	879 days
Asthma Exacerbations	6,639 attacks	6.649 attacks	6,682 attacks	6,752 attacks
Total Health Costs (low estimate)[a]	$190.5 million	$190.7 million	$191.7 million	$193.9 million
Total Health Costs (high estimate)[a]	$330.5 million	$330.6 million	$332.3 million	$336 million

Nieuwenhuijsen, and Haneen Khreis, "Traffic related air pollution and the burden of childhood asthma in the contiguous United States in 2000 and 2010," *Environment International* 127 (2019), 858-867.

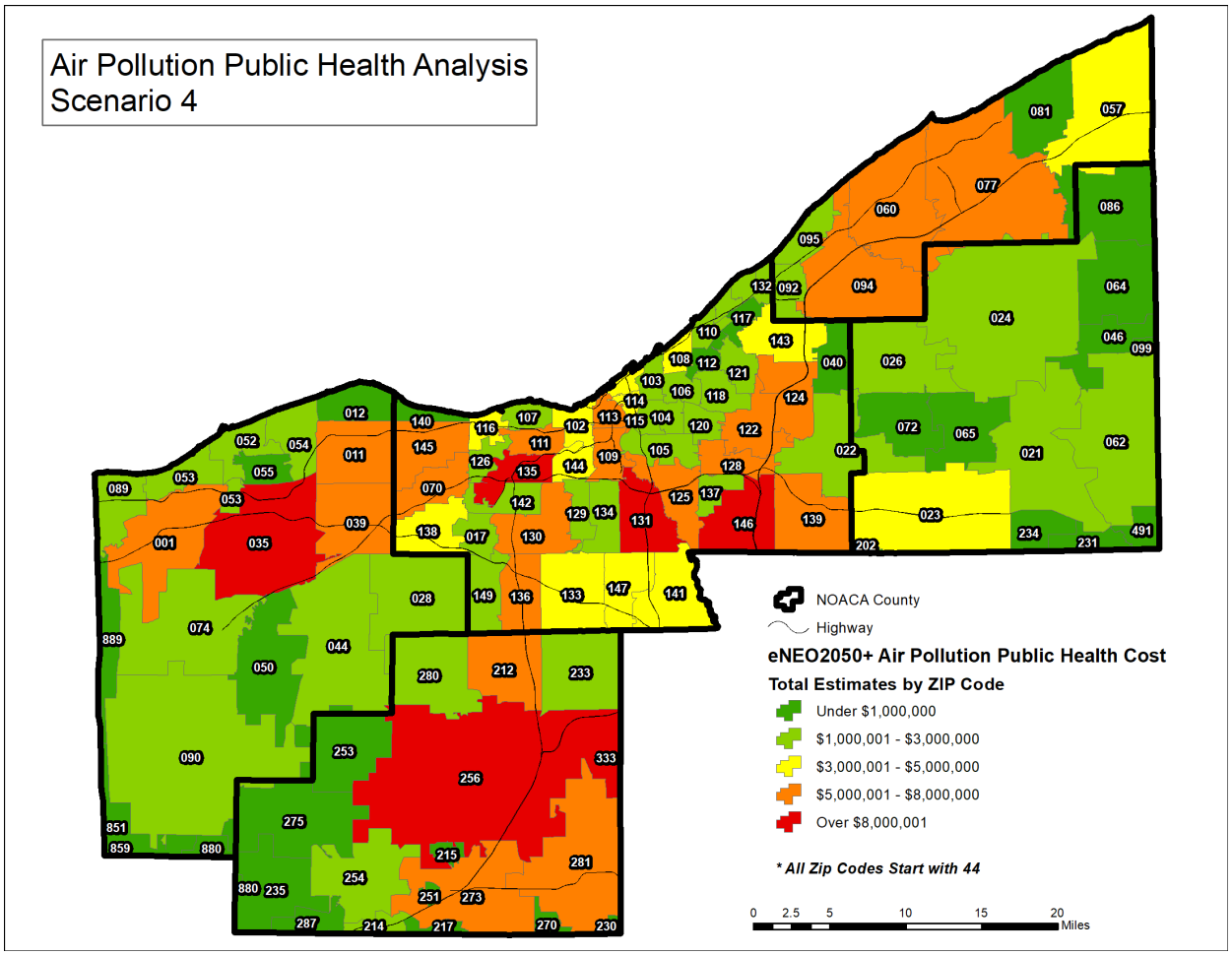
[a] U.S. EPA now calculates ER visits for asthma based on ozone concentrations rather than $PM_{2.5}$. This is why the numbers shown in this report are substantially lower than those in the CY2022 Air Quality Trends Report NOACA released last year (Source: NOACA estimates through U.S. EPA).
[b] Total costs do not include all health impacts and are therefore greater than the sum of the individual impacts included in this table (Source: NOACA estimates through U.S. EPA's COBRA model and US EPA's MOtor Vehicles Emissions Simulator, (MOVES4.0.1)

As Table 8-28 illustrates, the differences in total public health costs among the four scenarios are small, with the maximum difference (between MAINTAIN and TOTAL) of just 2%. But, while the differences among the scenarios are small, the difference between the scenarios and the 2023 baseline (Table 8-27) is stark. Premature mortality and total public health costs may each fall by 70% from baseline. As the tiny difference in costs among the scenarios attests, anticipated changes to federal mobile emissions standards account for these improvements. Tier 3 emissions standards (79 FR 23414), which came into effect in 2017, will cut emissions of NO_x and VOCs by 80%, relative to the Tier 2 standards implemented in 2000. They would also reduce particle pollution emissions by 70% and the sulfur content of gasoline by 60%. When Tier 3 standards fully come into effect in 2025, new passenger vehicles will be up to 99% cleaner than vehicles manufactured before the 1970 CAAA.[53] As new vehicles gradually replace older models with higher rates of tailpipe emissions, air pollution from mobile sources will decline dramatically in Northeast Ohio. Nevertheless, none of the scenarios fully mitigates the health impacts of mobile emissions. Tailpipe emissions will remain for vehicles with internal combustion engines, as will non-exhaust emissions (i.e., particles from brake and tire wear) from both internal combustion engine vehicles and fully electric vehicles.[54]

Figure 8-8 illustrates the distribution of mobile emissions health costs by zip code under the TOTAL scenario; this distribution remains almost perfectly constant across the four scenarios. NOACA staff derived the map from VMT data by zip code. Staff then converted those VMTs to mobile emissions, with data derived from MOVES4.0.1.[55] Next, staff entered those emissions data into the COBRA model to develop total health costs for each zip code in the region. The map below shows a fairly broad distribution of impacts across Northeast Ohio.

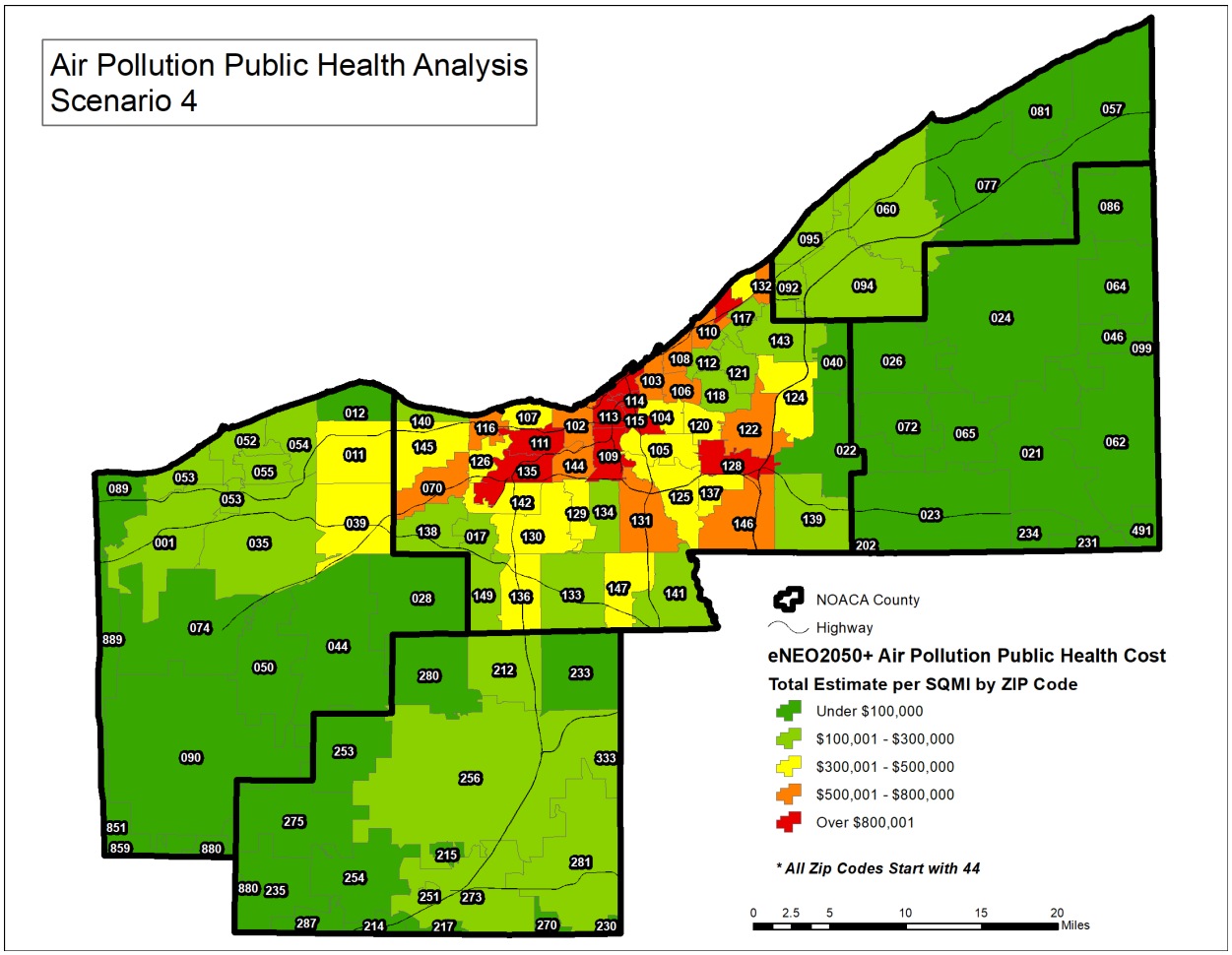
[53] US EPA, "History of Reducing Air Pollution from Transportation in the United States," https://www.epa.gov/transportation-air-pollution-and-climate-change/accomplishments-and-success-air-pollution-transportation (accessed May 28, 2025)
[54] Currently, non-exhaust emissions of $PM_{2.5}$ account for 57.8% of mobile particle pollution in the NOACA region. While exhaust emissions of $PM_{2.5}$ should fall by nearly 60% through 2050, non-exhaust emissions will remain the same or potentially even increase, as heavier electric vehicles and light-duty trucks make up a larger share of the vehicle fleet. While technological improvements, such as enhancements in regenerative braking, can help temper some of the issue, VMT reduction remains the only guaranteed way to cut further particle pollution from the region's vehicles.
[55] US EPA, MOtor Vehicles Emissions Simulator (MOVES), version 4.0.1, https://www.epa.gov/moves/moves-versions-limited-current-use (accessed May 28, 2025)

Figure 8-8. Distribution of Mobile Emissions Health Costs by Zip Code for Scenario 4 (TOTAL) (2050)



This distribution changes when staff control for the size of different zip codes. The highest aggregate costs occur in Medina County's 44256 zip code because it is the largest by area. This zip code is 131.2 square miles, more than 96 times the size of the region's smallest zip code (Medina County's 44251), which is only 1.4 square miles. To account for this discrepancy, NOACA staff divided the total health costs of mobile emissions for each zip code by the total area (square miles), to obtain an area-adjusted quotient. NOACA staff discovered a far higher share of the health costs would occur in the region's EJ areas when they controlled for area (Figure 8-9) Downtown Cleveland zip codes 44115, 44113, and 44114, which are the third, eighth, and thirteenth smallest zip codes by area, respectively, become the three highest ranking zip codes for health costs per unit area.

Figure 8-9. Distribution of Health Costs per Unit Area by Zip Code in Scenario 4 (TOTAL) (2050)



Accounting for area also makes it clear that the distribution of the health impacts of mobile emissions will differ across the four scenarios. Because Scenarios 3 (TRANSIT) and 4 (TOTAL) result in more people, economic activity, and VMT in the urban core, the associated health effects also become more concentrated in a smaller number of core communities, most of which are home to EJ areas. Shifting from Scenario 1 to 4, for instance, increases health costs in 45.1% of zip codes; these zip codes are home to 56.5% of the region's population. More than half (51%) of the zip codes where health costs increase are located in the City of Cleveland, including all 10 zip codes with the largest increases and 16 of the top 20. As a result, Scenarios 3 and 4 create additional environmental justice concerns that the region must address to promote equity and improve quality of life for low-income and minority communities.

Climate Action Planning/Climate Pollution Reduction

Greenhouse Gas Emissions and Climate Change

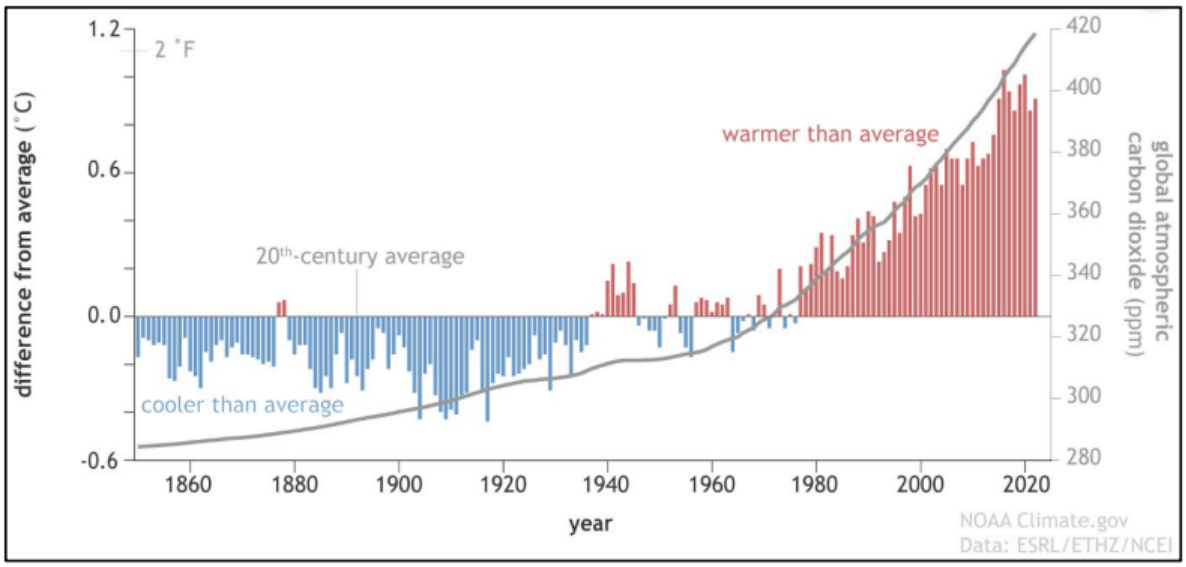
Climate change is a global phenomenon that includes any significant shift in the climate that lasts for extended periods of time. Global warming, which refers to the observed increase in average global surface temperatures over the past several decades, is one facet of climate change.[56]

[56] US EPA, "Climate Change: Basic Information,"

Other components include changes in precipitation, wind patterns, the cryosphere, and extreme weather events. Over the past century, humans have released large amounts of CO_2 and other greenhouse gases (GHGs) into the atmosphere. Most of these emissions have come from the combustion of fossil fuels, such as coal, natural gas, and oil; however, land-use changes, such as deforestation and agriculture, are also major contributors, both due to direct emissions and the elimination of carbon sinks (which pull carbon out of the atmosphere and sequester it), such as forests. According to the Intergovernmental Panel on Climate Change (IPCC), human activities have increased atmospheric concentrations of GHGs to their highest levels in at least 800,000 years, and human actions are the dominant cause of changes to the global climate since the mid-20th century.[57]

GHGs act like a form of atmospheric insulation, trapping energy in the atmosphere and increasing global temperatures. GHGs allow ultraviolet radiation from the sun to enter the atmosphere; however, because they trap infrared radiation, they prevent a portion of that energy from escaping back into space. Though GHGs make up a tiny fraction of the composition of the atmosphere (0.04%), they can significantly affect the global climate. As a result, global average surface temperatures have increased by approximately 1ºC since 1880.[58] Figure 8-10 shows the strong correlation between the increase in CO_2 concentrations and global temperatures.

Figure 8-10. Atmospheric CO_2 and Earth's Surface Temperature (1880-2022)[59]



Although CO_2 is not a criteria air pollutant, US EPA has taken steps to regulate GHG emissions under the Clean Air Act. In its 2007 ruling in *Massachusetts v. EPA,* the U.S. Supreme Court ruled that GHGs, including CO_2, are pollutants covered by the Act.[60] The Court ordered the US EPA to determine whether GHGs contribute to air pollution and pose a threat to human health. US EPA

https://19january2017snapshot.epa.gov/climatechange/climate-change-basic-information_.html (accessed May 28, 2025).

[57] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva: IPCC, 2014); http://www.ipcc.ch/report/ar5/syr/ (accessed May 28, 2025)

[58] Ibid.

[59] [49] Rebecca Lindsey, "If carbon dioxide hits a new high every year, why isn't every year hotter than the last?" https://www.climate.gov/news-features/climate-qa/if-carbon-dioxide-hits-new-high-every-year-why-isn%E2%80%99t-every-year-hotter-last (accessed May 28, 2025).

[60] Massachusetts v. EPA, 549 U.S. 497 (2007)

issued its "endangerment finding" on December 7, 2009, ruling that GHGs exacerbate air pollution and threaten human health and welfare (74 FR 66496). In December 2015, leaders of 196 countries adopted the Paris Agreement, which commits the international community to hold the increase in global temperatures "to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C."[61] To remain below 2°C, global GHG emissions must peak by 2030, decline approximately 40-70% by 2050 (compared to 2010 levels), and reach near-zero levels by 2100.[62] To meet these benchmarks, emissions will need to decline by approximately 2.7% and 7.6% per year to keep warming below 2°C and 1.5°C, respectively.[63]

Scope of Climate Action Planning in Northeast Ohio

NOACA launched its preliminary climate action planning work in fall 2021 and partnered with the Cleveland Foundation and the George Gund Foundation to establish its commitment to this work in spring 2022. NOACA held a Climate Action Summit on March 15, 2022, as a kick-off event with more than 200 stakeholders. NOACA staff assembled both a climate action planning strategy committee and technical working group shortly thereafter.

As part of this framework, NOACA utilized support from the Foundations to contract with ICLEI USA and initiate a Regional CAP in the mold of the Global Covenant of Mayors (GCoM) for Climate & Energy Initiative to expand regional climate action in the United States. The GCoM initiative evolved from the International Urban Cooperation North America (IUC NA) project.[64] As part of this process, the project supported efforts by four US 'regions' or 'metropolitan areas' to join the GCoM and respond to the reporting requirements. The four pilot regions were Chicago, IL; Kansas City, MO; Minneapolis, MN; and Washington, DC (also some additional work in Denver-Boulder, CO).[65] Although NOACA was too late to participate as a pilot, NOACA's Board Policy Committee did support a comprehensive approach for NOACA climate action planning that would inventory both mobile and stationary sources of GHG emissions and develop both mitigation (reduce emissions) and adaptation (build resilience to climate change) strategies.

According to the IUC NA project's Terms of Reference, there were four major required outputs:

1. GHG Emissions Inventory
2. Climate Risk and Vulnerability Assessment (CRVA)
3. Regional CAP - Adaptation/Resilience Strategies
4. Regional CAP - Mitigation/Emissions Reduction Strategies

NOACA committed to emulate this model and completed both a published GHG emissions inventory (2022) and a draft CRVA (2023) in partnership with ICLEI USA. NOACA had also initiated efforts to develop adaptation and mitigation strategies prior to US EPA's release of its Notice of Funding Opportunity (NOFO) and Guidance for the CPRG Program in spring 2023.

U.S. EPA Climate Pollution Reduction Grants Program

The United States Environmental Protection Agency (US EPA) makes it clear in its Climate

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[61] *Paris Agreement,* United Nations Framework Convention on Climate Change (UNFCCC), Dec., 12, 2015, FCCC/CP/2015/10/Add.1.
[62] IPCC, *Climate Change 2014*, 20.
[63] United Nations Environment Programme (UNEP), *Emissions Gap Report 2019* (Nairobi: UNEP, 2019); https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf?sequence=1&isAllowed=y (accessed May 28, 2025).
[64] International Urban Cooperation Programme - European Union (EU) (https://iuc.eu/na/home/).
[65] GCoM USA – Regional and Metro-scale Climate Leaders Terms of Reference (https://iuc.eu/fileadmin/user_upload/Regions/iuc_na/user_upload/GCoM_USA_Regions_ToR.pdf).

Pollution Reduction Grants (CPRG) Program Guidance that climate change is a serious issue for the United States and its population. Examples of extreme weather continue to increase in both severity and frequency across many areas, with significant consequences for quality of life, environmental health, economic productivity, and future generations. US EPA recognizes that, "if unchecked, future climate change is expected to further disrupt many areas of life and exacerbate existing challenges to prosperity posed by aging and deteriorating infrastructure, stressed ecosystems, and longstanding inequalities."[66] As with most challenges, there is opportunity to make the necessary investments to clean the nation's economy and catalyze innovation for more equitable, resilient and vibrant states and regions.

Section 60114 of the Inflation Reduction Act (IRA) appropriates $5 billion to US EPA for its CPRG efforts. This money will support states, territories, municipalities, tribes, and similar groups in their development and implementation of greenhouse gas (GHG) emission reduction plans. The total amount of appropriated funds goes toward the following:[67]

- Phase I planning grants ($250 million for eligible entities to develop GHG emissions reduction plans)
- Phase II implementation grants ($4.6075 billion for grants to GHG emissions reduction measures from funded plans)
- Administrative costs ($142.5 million)

The Cleveland-Elyria MSA, comprised of the same five counties as the NOACA region, is one of the 67 most populous metropolitan areas in the U.S. Therefore, it received a $1 million CPRG planning grant from US EPA in summer 2023. NOACA and the City of Cleveland partnered to design a climate action plan that incorporates a variety of measures (i.e., actions) to reduce GHG emissions from across Northeast Ohio's economy in six key sectors (electricity generation, industry, transportation, buildings, agriculture/natural and working lands, and waste management).

In addition to development of a regional climate action plan, NOACA and the City of Cleveland also allocated support for local climate action planning and engagement (community projects funding) as part of their CPRG Program Phase I planning grant workplan and budget narrative. NOACA and the City of Cleveland outlined community projects funding and a scope through the narrative. Total funding for community projects equals $300,000, separate from the $700,000 allocated for a regional climate action plan through three major deliverables:

1. Priority Climate Action Plan (PCAP): $75,000
2. Comprehensive Climate Action Plan (CCAP): $600,000
3. Status Report: $25,000

Regional Greenhouse Gas Inventory

One of the required elements of the CPRG is a complete inventory of GHGs present in the Cleveland-Elyria Metropolitan Statistical Area (MSA). Northeast Ohio recognizes that greenhouse gas (GHG) emissions from human activity and natural sources contribute to climate change. The consequences pose substantial risks to the future health, well-being, and economic prosperity of our community.

As Figure 8-11 shows, transportation was the leading source of GHG emissions in the U.S. at

[66] US EPA Office of Air and Radiation. March 1, 2023. Climate Pollution Reduction Grants Program: Formula Grants for Planning - Program Guidance for States, Municipalities, and Air Pollution Control Agencies; https://www.epa.gov/inflation-reduction-act/about-cprg-planning-grant-information) (accessed May 28, 2025).
[67] Ibid.

28.4% in 2020. It overtook the electric power sector in 2016, and projections indicate its share of emissions will grow further as coal continues to play a smaller role in electricity production. Since the release of *eNEO2050* in 2021, NOACA has partnered with ICLEI USA and the City of Cleveland, respectively, to produce a 2018 Baseline Regional GHG Inventory and a 2022 Baseline Regional GHG Inventory. Transportation accounted for just over one-quarter of total GHG emissions in Northeast Ohio in the 2018 baseline report (just below residential energy) but had risen to 29% in the 2022 baseline report (see Figure 8-12).[68]

Transportation sector GHG emissions vary by county. In the 2022 Regional Greenhouse Gas Emissions Inventory, Cuyahoga County's GHG transportation emissions were 26% of the county total, below the regional share of 29%. However, each of the four other counties in the NOACA region had shares of GHG transportation emissions higher than the regional share (see Table 8-29).

Table 8-29. GHG Emissions in NOACA Region and Counties (2018-2022)[69]

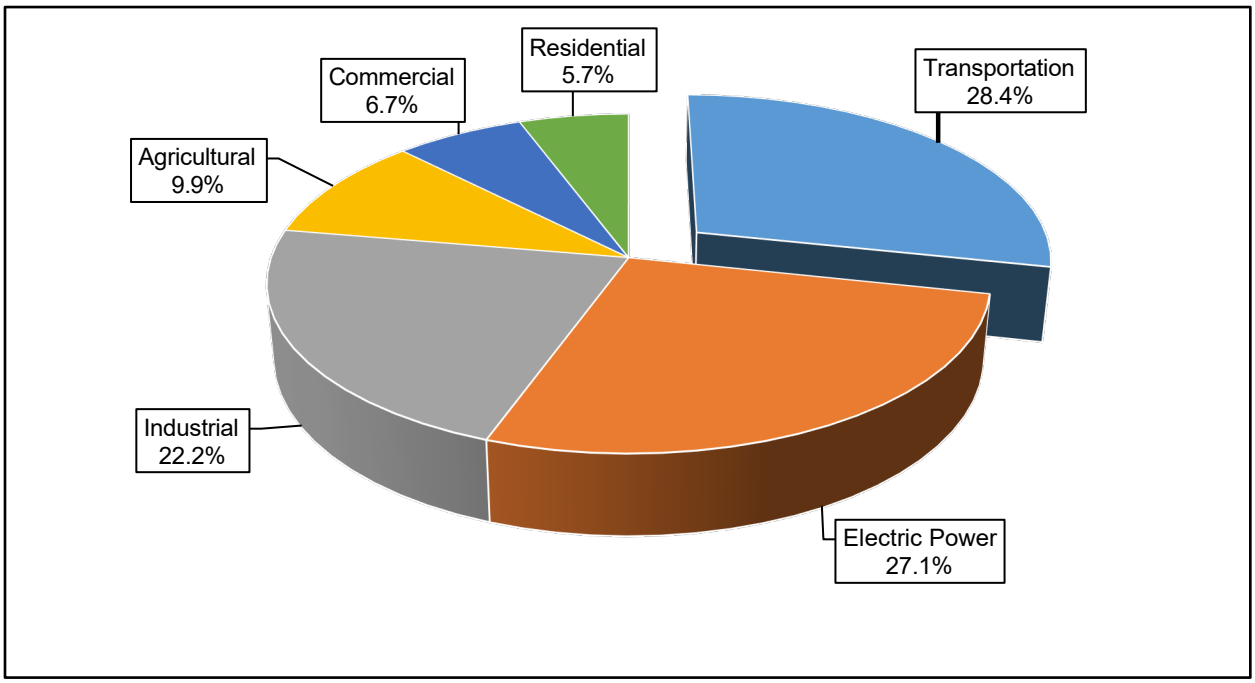
	EMISSIONS ($MTCO_2e$)							
				TRANSPORTATION				
	TOTAL			2018		2022		
COUNTY	2018	2022	% CHANGE	TOTAL	% SHARE	TOTAL	% SHARE	% CHANGE TOTAL
Cuyahoga	22,648,678	19,169,110	-15.4%	5,400,744	23.8%	5,075,639	26.5%	-6.0%
Geauga	1,441,821	1,334,679	-7.4%	422,580	29.3%	409,347	30.7%	-3.1%
Lake	3,725,227	3,392,180	-8.9%	1,007,399	27.0%	1,139,549	33.6%	13.1%
Lorain	4,227,680	3,705,403	-12.4%	1,313,400	31.1%	1,233,321	33.3%	-6.1%
Medina	2,922,867	2,549,792	-12.8%	1,000,469	34.2%	899,321	35.3%	-10.1%
TOTAL	**34,966,273**	**30,151,164**	**-13.8%**	**9,144,592**	**26.2%**	**8,757,177**	**29.0%**	**-4.2%**

Table 8-29 shows all counties experienced a decline in total GHG emissions (-7-15%); most counties experienced a decline in transportation GHG emissions (-3-10%), with the exception of Lake County (+13%); and all counties experienced an increase in transportation's share of their total GHG emissions (from 24-31% to 26-35%) between the 2018 and 2022 inventories. In each county (even Lake), there was improvement in fuel economy, which helped contribute to reduced transportation GHG emissions (except Lake).

[68] City of Cleveland, NOACA, and ICLEI USA, 2022 Regional Greenhouse Gas Emissions Inventory; https://www.eneo2050.com/_files/ugd/9911f1_c2a252cd915141fc8e2eb003f8abb312.pdf (accessed April 16, 2025.

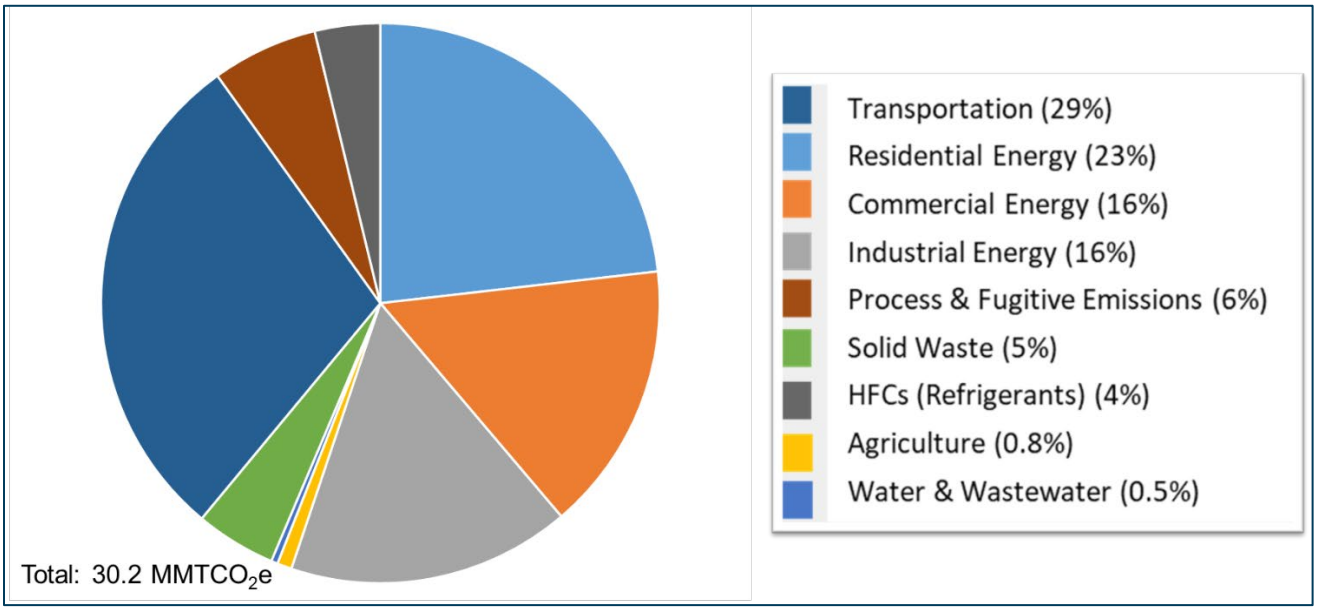
[69] Ibid.

Figure 8-11. Share of GHG Emissions by Sector- United States[70]



Source: US EPA; NOACA estimates using MOVES2014a.

Figure 8-12. Share of GHG Emissions by Sector- NOACA Region (2022)



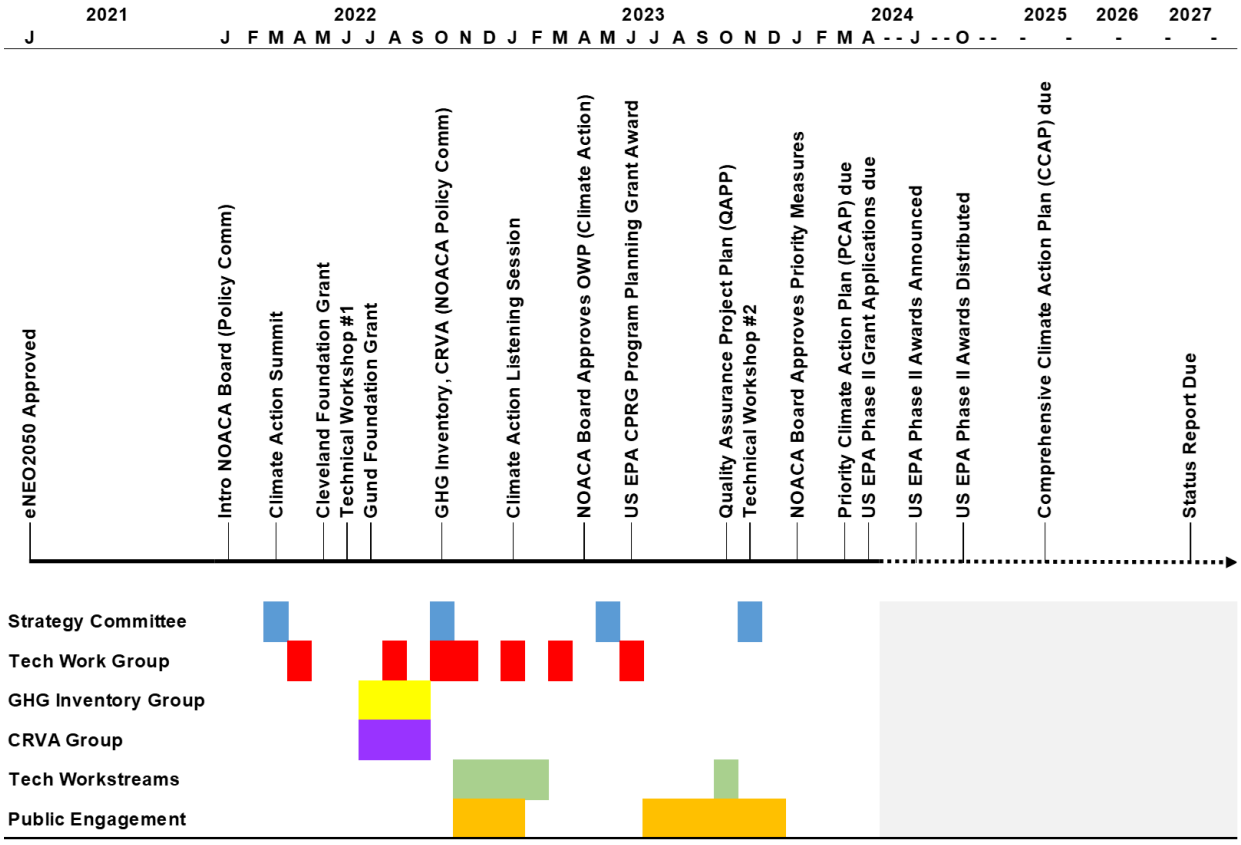
Key Decision-Maker and Technical Stakeholder Engagement

NOACA has engaged hundreds of key decision-makers and technical stakeholders since 2022. Figure 8-13 illustrates a timeline of significant climate action planning events and deliverables, along with key stakeholder groups and a schedule of engagement to achieve milestones. Figure

[70] US EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018* (Washington, D.C.: US EPA, 2020), https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf.

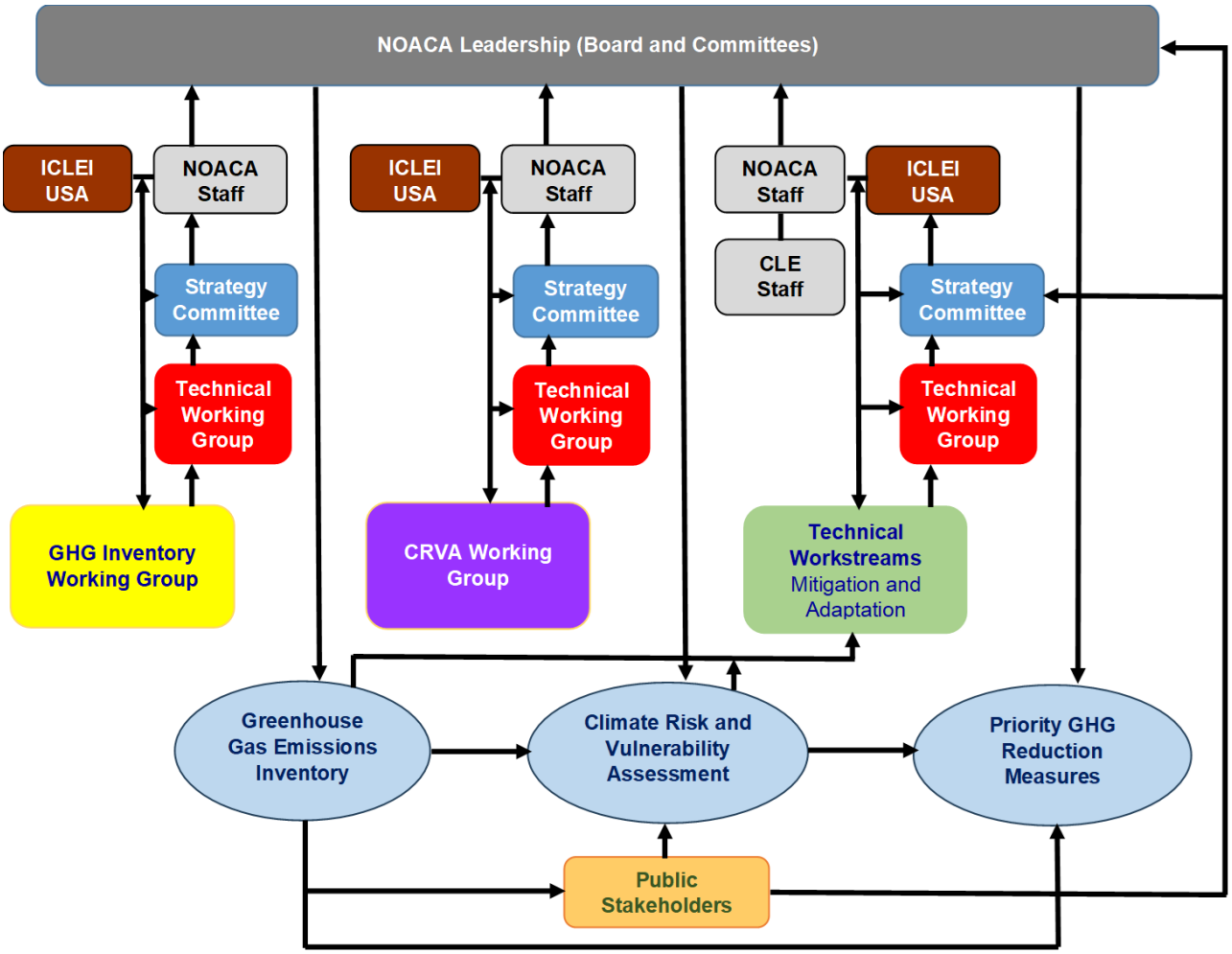
8-14 demonstrates the relational process by which these decision-makers and stakeholders interacted with one another to produce major deliverables.

Figure 8-13. Climate Action Planning Timeline of Key Events and Public/Stakeholder Engagement[71]



[71] NOACA and ICLEI USA, 2024, Cleveland-Elyria Metropolitan Statistical Area Priority Climate Action Plan; https://www.eneo2050.com/_files/ugd/2114d4_9aa04a96e04f43b4823270eb196196b6.pdf (accessed April 17, 2025).

Figure 8-14. Development of Key Deliverables from Professional, Technical Stakeholder, and Public Inputs[72]



Priority Climate Action Plan (PCAP) Measure Identification, Prioritization, and Selection

ICLEI USA presented 60 potential actions to stakeholders at a Regional Climate Action Priorities Workshop in November 2023. Attendees rated actions based on co-benefits, feasibility, and priority. Through additional discussion, attendees also generated requests for agricultural activity emissions and measures to reduce emissions from refrigeration. More input on priority measures came from the NOACA staff request of workshop invitees for post-workshop feedback.

NOACA staff analyzed all these inputs and prioritized potential actions that rated higher among the criteria of GHG emissions reduction potential, co-benefits, feasibility, priority, and inclusion in other local climate action plans. This prioritization exercise narrowed the list of potential actions from 60 to just under 40. NOACA staff then grouped these potential actions into 10 broader priority measures for the region. Table 8-30 shows the 10 measures, the sector(s) for which these measures will help reduce GHG emissions and a composite assessment of co-benefits, feasibility, and priority (high, medium, low) of each measure according to stakeholder feedback from the Regional Climate Action Priorities workshop and post-workshop.

[72] Ibid.

Table 8-30. Priority Measures and Stakeholder Assessment of Co-Benefits, Feasibility and Priority[73]

MEASURE	SECTOR(S)	CO-BENEFITS	FEASIBILITY	PRIORITY
Clean Electricity	Buildings, Electricity Generation, Industry			
Building Efficiency and Electrification	Buildings, Electricity Generation			
Green Steel Production	Industry			
Vehicle Miles Traveled (VMT) Reduction	Transportation			
Light Duty Vehicle Electrification	Transportation, Electricity Generation			
Heavy Duty Vehicle Electrification	Transportation, Electricity Generation			
Refrigerants Capture	Waste Management			
Solid Waste Diversion	Buildings, Waste Management			
Nature-Based Solutions	Agriculture/Natural and Working Lands, Carbon Removal			
Agriculture Actions	Agriculture/Natural and Working Lands			

ICLEI USA supported NOACA staff through use of its ClearPath model to project emissions reductions from the 10 priority measures presented in Table 8-30. These measures are implementable across the region and have sufficient impact and a high likelihood of moving forward. The projected emissions reductions are presented with the priority measures in Table 8-31 below.

[73] Ibid.

Table 8-31. Strategies with Net Reduction and Level of Impact (2030 and 2050)

Measure	Million MTCO2e reduced in 2030	2030 Level of Impact	Million MTCO2e reduced in 2050	2050 Level of Impact
Clean electricity	8.80	Very high	11.08	Very high
Building efficiency and electrification	3.28	High	8.39	Very high
Green steel production	1.49	Medium high	2.97	High
VMT reduction	0.96	Medium high	1.18	Medium high
EV - light duty vehicles	0.77	Medium high	2.71	High
EV - heavy duty vehicles	0.26	Medium low	2.22	High
Refrigerants capture	0.51	Medium low	0.08	Low
Solid waste diversion	0.43	Medium low	0.85	Medium high
Nature based solutions	0.15	Low	0.42	Medium low
Agriculture actions	0.06	Low	0.12	Low

Greenhouse Gas Emissions by Future Transportation Infrastructure Investment Scenario

In Scenario 1 (MAINTAIN), GHG emissions fall 58.2% between 2025 and 2050. The greatest decrease occurs in Cuyahoga County (60.3%), while the other counties experience smaller decreases (52-59%). This result reflects both the overall decline in regional population (-11.4%) and the fact that households will continue to expand outward, reducing Cuyahoga County's share of the region's population. VMT decreases by 7.5% overall, with considerable variability by county. Cuyahoga and Lake Counties will experience VMT decreases of 12.2% and 10%, respectively, while Geauga, Lorain, and Medina Counties will experience VMT increases of 6.7%, 1.4%, and 0.4%, respectively.

In Scenario 2 (CAR), which is similar to MAINTAIN but with a more fully developed highway system, GHG emissions fall by approximately the same percentage (58.1) between 2025 and 2050 as in Scenario 1. VMT decreases by 7.4% overall, with considerable variability by county. Cuyahoga and Lake Counties experience similar VMT decreases, while Geauga, Lorain, and Medina Counties experience similar, slight VMT increases.

In Scenario 3 (TRANSIT), population declines at a slightly lower rate (-8.5%) in the region, with the idea that often forecasts can be incorrect, and that alternate socioeconomic scenarios should be investigated to understand their potential regional impact (see Chapter 9). TRANSIT incorporates a more robust regional bus rapid transit (BRT) system and a better mix between jobs and housing development in the region. However, there remains very little difference between TRANSIT and the first two scenarios. GHG emissions fall by approximately the same percentage (57.9) between 2025 and 2050 as in Scenarios 1 and 2. VMT decreases by 6.8% overall (increased transit mostly offset by slower population decline), with considerable variability by

county. Cuyahoga and Lake Counties experience slightly lower VMT decreases (11% and 9%, respectively), while Geauga and Lorain experience VMT increases similar to Scenario 2; Medina County VMT is essentially flat.

In Scenario 4 (TOTAL), population declines at an even lower rate (-5.5%) compared to 11.4% decline in Scenarios 1 and 2, which represents about a 50% reduction in population loss (see Chapter 9). The TOTAL scenario encompasses slightly lower GHG emissions reductions (57.6%) and slightly lower VMT decreases (6.3%) with individual county VMT decreases reflective of this slightly lower number (due to slower population decline

Climate Action: Next Steps

Comprehensive Climate Action Plan (CCAP)

Upon approval of the PCAP by U.S. EPA on March 7, 2024, NOACA and the City of Cleveland redirected their focus to CCAP development. The CCAP (due December 1, 2025) will include the following elements:[74]

Greenhouse Gas (GHG) Inventory: Though NOACA prepared a regional GHG inventory for the PCAP, the baseline year was 2018 and newer data is now available. Both NOACA and the City of Cleveland agreed to update the regional inventory to reflect a 2022 baseline year and that work is now complete. The updated, comprehensive inventory includes all emissions and sinks by source and sink category following commonly accepted protocols for the following sectors: industry, electricity generation/use, transportation, commercial and residential buildings, agriculture, natural and working lands, and waste and materials management. NOACA and the City of Cleveland address GHG emission sources and sinks across the entire geographic scope of the Cleveland-Elyria MSA.

GHG Emissions Projections: The PCAP includes both near-term (2030) and long-term (2050) sector-based projections of GHG emissions under a “business-as-usual” scenario. The PCAP also includes projections of emission reductions through the implementation of each priority measure. However, the CCAP will include revised business-as-usual scenario projections based on a new GHG emissions inventory with a 2022 baseline year. The CCAP will also include projections for a “full plan implementation scenario.”

GHG Reduction Targets: NOACA and the City of Cleveland must develop economy-wide, near-term (2030) and long-term (2050) GHG emission reduction targets (on a gross or net GHG emission basis). The NOACA Board of Directors approved a 2030 emissions reduction target of 49% from 2018 baseline and a 2050 net zero emissions reduction target on December 13, 2024. NOACA and the City of Cleveland will also strongly consider sector-based emission reduction targets, especially for the highest priority sectors most targeted by emission reduction measures.

GHG Reduction Measures: The PCAP includes a full suite of implementation measures and projections of their impacts on emission reductions. However, NOACA and the City of Cleveland must update these measures for the CCAP, so the measures meet the newly-established GHG reduction targets. The CCAP measures will address the main GHG emission sectors: industry, electricity generation/use, transportation, commercial and residential buildings, industry, agriculture, natural and working lands, and waste and materials management. Like the PCAP, for each measure, the CCAP will identify the quantifiable GHG emissions reductions (or

[74] NOACA and ICLEI USA, 2024, Cleveland-Elyria Metropolitan Statistical Area Priority Climate Action Plan; https://www.eneo2050.com/_files/ugd/2114d4_9aa04a96e04f43b4823270eb196196b6.pdf (accessed April 17, 2025).

enhancement of carbon sinks), key implementing agency or agencies, implementation schedule and milestones, expected geographic location if applicable, milestones to obtain implementation authority as appropriate, identification of funding sources if relevant, and metrics to track progress. NOACA and the City of Cleveland will also include quantifiable cost information for each measure in the CCAP.

Benefits Analysis: NOACA and the City of Cleveland will assess benefits of GHG reduction measures across the entire MSA for the CCAP. Their analysis will include both base year estimates of co-pollutants (including criteria pollutants/precursors and air toxics) and anticipated co-pollutant emission reductions from plan measure implementation to meet GHG reduction goals. NOACA and the City of Cleveland will quantify estimates of co-pollutant reductions associated with GHG reduction measures. They will also track, minimize, and mitigate, to the extent possible, any potential disbenefits that result from plan measure implementation. NOACA and the City of Cleveland will also investigate a broader assessment of benefits associated with their GHG reduction measures including, but not limited to, analysis of air quality improvements (e.g., criteria air pollution and air toxics), improved public health outcomes, economic benefits, increased climate resilience, and other environmental benefits.

Low Income Disadvantaged Communities (LIDACs) Benefits Analysis: NOACA and the City of Cleveland identified LIDACs, recapped preliminary engagement of LIDAC stakeholders and provided a qualitative assessment of the impact of GHG reduction measures on LIDACs in the PCAP. However, the CCAP will include a quantitative analysis of the extent to which any GHG reduction measures will deliver co-pollutant emissions reductions and other benefits to LIDACs. NOACA and the City of Cleveland will also greatly expand on their engagement efforts in LIDACs, with focused guidance from LIDAC representatives who know best how to reach the most critical audiences in their jurisdictions. This expanded engagement is critical to ultimate buy-in from LIDAC stakeholders and a sense of ownership and optimism about their future in a world reshaped by climate change.

Review of Authority to Implement: As with the PCAP, NOACA and the City of Cleveland will indicate whether they have existing statutory or regulatory authority to implement each GHG reduction measure, or whether they must still obtain such authority. The CCAP will include a schedule of milestones for actions needed by key entities (e.g., legislature, administrative agency, etc.) to obtain any authority needed to implement each listed program or measure.

Intersection with Other Funding Availability: NOACA and the City of Cleveland will expand upon their initial identification of plan measure funding programs in the PCAP. This will include funding programs either available or secured from federal, state, local and private sources that could be leveraged to pursue CCAP objectives around the GHG reduction measures.

Workforce Planning Analysis: NOACA and the City of Cleveland will conduct an analysis of anticipated workforce shortages that could prevent them from achieving CCAP goals. They will also identify potential solutions and partners at the state, regional, and local levels that are equipped to help address those challenges. NOACA and the City of Cleveland will build upon the work of the recently completed Comprehensive Economic Development Strategy (CEDS) for Northeast Ohio and discuss workforce development priorities in accordance with GHG reduction measures. NOACA and the City of Cleveland will probe how activities or policies will lead to the creation of high-quality jobs in alignment with the U.S. Department of Labor's Good Jobs Principles.

Community Projects Funding Opportunities

The CPRG Program allows Northeast Ohio to expand climate action planning further through intentional engagement of additional communities and populations across the region. Implementation of this program will help Northeast Ohio entities integrate current parallel climate action planning processes and increase climate action planning capacity among local governments. Embarking on the effort described in NOACA's CPRG Program workplan (approved by US EPA) will enable the region to make far greater strides towards implementation of climate mitigation and adaptation projects than envisioned by NOACA and its partners at the CPRG Program's launch.

On February 18, 2025, NOACA opened an opportunity to fund community projects under the CPRG Program Phase I Planning Grant. NOACA seeks projects that aim to support climate action planning and climate pollution reduction in Northeast Ohio. However, GHG reduction implementation projects (e.g., clean energy installation, electric vehicle charging station installation, tree planting, etc.) are not eligible. The current funding opportunity is for planning and public engagement (outreach and education) purposes.

Specifically, applicants should consider projects that:

- Develop and expand public engagement to build support for the regional climate action plan and future implementation of strategies to reduce emissions. Potential stakeholders include:
  - urban, rural, and underserved or disadvantaged communities
  - general public
  - governmental entities
  - federally recognized tribes
  - Port Authorities
  - labor organizations
  - community and faith-based organizations
  - private sector and industry representatives.
- Climate action planning and support for plan implementation around areas of particular relevance to Geauga, Lake, Lorain, or Medina Counties (e.g., agriculture (including horticulture, livestock, nurseries, silviculture, viticulture, etc.), food processing and production, health care, light and heavy industry, manufacturing, recreation and tourism, research and development, and transportation).
- Climate action planning and support for plan implementation to ensure benefits to audiences that may be unique to Geauga, Lake, Lorain, or Medina Counties (e.g., rural populations, Amish communities, etc.).

NOACA also seeks projects that support one or more of the priority measures approved by the NOACA Board of Directors that form the foundation of the US EPA-approved Priority Climate Action Plan:

- Clean Electricity
- Building Efficiency and Electrification
- Green Steel Production
- Vehicle Miles Traveled Reduction
- Light Duty Vehicle Electrification
- Heavy Duty Vehicle Electrification
- Refrigerants Capture
- Solid Waste Diversion
- Nature-Based Solutions
- Agriculture Actions

The application window for this opportunity closed April 14, 2025. NOACA has subsequently

learned from US EPA that it will have to enter into Subaward Agreements with each of the four counties and they will have to distribute the allocated funds, per the original contract with US EPA in July 2023. NOACA will coordinate with each of the program applicants and update them based on NOACA's efforts with each county's leadership.

CPRG Implementation Grant

In addition to the CPRG Program Phase I Planning Grant opportunities, the City of Painesville (Lake County), the City of Cleveland, and Cuyahoga County were successful in their CPRG Phase II Implementation Grant application. On July 2024, those three entities received an award of $129.4 million from U.S. EPA. The selected application will support transition from reliance on a coal-fired power plant in Northeast Ohio. The grant will fund the deployment of 63 megawatts (MW) of solar installations on five brownfield and previous landfill sites and 10 MW of battery storage. The grant funds will also support the restoration of natural habitats and expand tree coverage on a blighted brownfield site along the shoreline of Lake Erie and create pollinator habitats at the Cleveland and Cuyahoga solar sites.[75]

The selected project will deliver the following benefits to reduce greenhouse gases and support communities:[76]

- Invest in the development of utility-scale solar to support the transition to clean energy production and reduction of community dependency on coal power.
- Revitalize contaminated brownfield sites through reforestation and conservation efforts.
- Create over 200 new jobs and offer job retraining and transition for individuals who are employed at a local coal-fired power plant.
- Plant 4,000 trees, reforesting 80 acres, and creating over 400 acres of native meadow and pollinator habitats that provide communities with accessible recreation.
- Improve the water quality of Lake Erie, which supplies drinking water to 11 million people, including all residents of Lake and Cuyahoga Counties.

Where Will We Go?

Future Development Scenarios

Looking forward to 2050, there are a number of different possible paths for the NOACA region to realize its future. The following four scenarios serve as predictions for what could be, based on levels and types of transportation investment. There will be particular focus on worker accessibility to jobs and equity. The scenarios—MAINTAIN, CAR, TRANSIT and TOTAL—are discussed in relation to impacts on air quality, water quality, and climate resilience in the region. Chapter 9 provides a more detailed presentation of the scenarios, their components, and performance measures used for scenario comparison and selection.

Scenario 1: MAINTAIN—State of Good Repair

Scenario 1 focuses on maintenance of the existing transportation system, with no expansion of roads, bridges, highways, or public transit. The scenario assumes no variation from the current population and employment forecasts for the region, which reflect recent trends (decreases in both population and employment).

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[75] U.S. EPA, 2024, General Competition Selected Applications Table: Cuyahoga County (Ohio); https://www.epa.gov/inflation-reduction-act/cuyahoga-county-ohio (accessed April 17, 2025).
[76] Ibid.

Under Scenario 1, the continued outward movement of the workforce in Northeast Ohio will exacerbate the existing jobs-housing disconnect in the region. This form of job sprawl makes it difficult for many employers to recruit an adequate workforce, and it exacerbates existing racial disparities by making it nearly impossible for many low-income minority workers to access those jobs without a private automobile.

One of the major drivers of mode shift—traffic congestion—is not a serious problem in most of Northeast Ohio, which may make it more difficult to increase the share of alternative modes. In Scenario 1, the improved roads and highways may increase the region's SOV rate. In turn, this induced demand may neuter any congestion reduction benefit.

Scenario 1 maintains the existing system and the persistent pattern of outward expansion of imperviousness into exurban and rural subwatersheds. These headwater streams and creeks may suffer the most from development, particularly without best practices such as those outlined in *Clean Water 2020.* Much of the work by local, grassroots watershed planning organizations is at risk, along with the health of Lake Erie.

Scenario 2: Captivating Auto Region (CAR)-Single—Occupancy Vehicles

In Scenario 2, road capacity expansion is the priority. This includes new and improved infrastructure (roads, highways, bridges, and interchanges), shorter travel times through traffic signal timing optimization, reduction of highway bottlenecks, ramp metering, and reduced commutes to job hubs. Like Scenario 1 (MAINTAIN), CAR assumes modest population and employment decline by the year 2050.

Under Scenario 2, the continued outward movement of the workforce in Northeast Ohio, facilitated by the expansion of the regional highway network, will exacerbate the existing jobs- housing disconnect in the region even more than in Scenario 1. This form of job sprawl makes it difficult for many employers to recruit an adequate workforce, and it exacerbates existing racial disparities by making it nearly impossible for many low-income workers and people of color to access those jobs without a private automobile.

In Scenario 2, the additional highway lane miles makes driving to work more attractive, slightly increasing the region's SOV rate. In turn, this induced demand eliminates any congestion reduction benefit and travel delays may increase.

Scenario 2 focuses on car travel throughout the region and exacerbates the spread of imperviousness through active widening of roads and highways and the addition of new highway interchanges. Scenario 2 would likely hasten degradation of headwater streams in exurban and rural areas that experience significant development, but also potentially increase the downstream impacts in more developed areas.

Scenario 3: TRANsportation System with Improved Transit (TRANSIT)—Multimodal Transportation System

Scenario 3, TRANSIT, is essentially the opposite of CAR (Scenario 2). TRANSIT expands all transit agencies in the region through implementation of BRT. TRANSIT also includes connections between transit stops and job hubs with autonomous shuttles and new pedestrian and bike routes. In Scenario 3, the projected 2050 population and employment is based on the same NOACA forecasts used in the MAINTAIN and CAR scenarios, plus reduced decreases.

The expanded BRT may increase the demand for TOD so people and employers can take

advantage of greater modal choice, including transit, biking, and walking. More workforce housing in transit-accessible locations or near job hubs will be necessary. Housing demand, particularly demand for revitalized or repurposed housing in existing urban areas, may increase slightly. There will continue to be a need for accessible, affordable housing of all types for the aging population, and improved transit will increase options for dining, entertainment, shopping, healthcare resources, and other essential needs.

While TRANSIT does not necessarily help drivers (expect increased costs from lack of roadway maintenance), individuals who cannot afford personal vehicles will have greater mobility and can more easily access jobs. A transit mobile workforce may encourage companies and other employers to focus on, and prioritize proximity to, transit/BRT during location decisions.

Scenario 3 focuses on increased residential density and economic growth in target areas. NOACA will need to take a holistic approach that includes multimodal transportation infrastructure, access to transit, and pollution mitigation features to address the region's air and water resource and climate resilience challenges.

Scenario 4: Transportation with Optimal Technology and Access for All (TOTAL)—Advanced Multimodal Transportation System

The fourth scenario, TOTAL, incorporates all projects in the CAR (save highway interchanges) and TRANSIT scenarios. Additionally, the TOTAL scenario includes technological advances such as elected smart freeway lanes to autonomous cars and trucks; extra electric vehicle charging ports; and autonomous shuttle buses to improve workers' accessibility to the regional major job hubs and transit hubs. The projected 2050 population and employment in TOTAL is about half the decreases of the MAINTAIN and CAR scenarios.

Although Scenario 4 experiences increased costs due to both congestion and emissions, the increases are lower than the other four scenarios. The wholesale changes in the transportation system (both expanded transit service and arterial/highway network) create better connections between jobs and housing.
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From a water quality standpoint, the expansion of the road network increases the spread of imperviousness, but that is tempered somewhat but the concentration of employment and population growth within the vicinity of major regional job hubs. More of the additional growth will take place within the developed footprint of the region, which will curb greenfield disturbance in exurban and rural areas.

Performance Measures and Targets

Although Chapter 9 will present a much more detailed discussion and analysis of the four future scenarios mentioned above, this section details performance measures to assess progress toward more efficient land use. The performance measures are variables used to assess the scenarios comparatively against each other. There are two important values associated with each performance measure: the baseline and the target. The baseline is the value of the performance measure in the current state (2024). The target is the value of the performance measure in the future state (2050). One of the four future scenarios will be the preferred scenario and its performance measures will be the target values NOACA will use to assess the region's progress from the current state to the preferred future state. Table 8-32 illustrates the performance measures and targets focused on efficient land use.

The outputs are presented in a specific way to help the reader digest the information clearly and

concisely with the following guidelines:

1. The baseline represents current conditions (2024 conditions). The outputs reflect how the performance measure will change from the baseline to the target year (2050) under each of the four scenarios.
2. The "-" and "+" signs shown as outputs for each performance measure under each scenario indicate the direction of change. A "-" sign indicates a decrease from the baseline and a "+" sign indicates an increase from the baseline. There are two sizes for each sign; they represent the magnitude of change (smaller signs indicate slight change; larger signs indicate more substantial change).
3. The colors of the signs and numbers for each output are also important. Red color indicates a negative impact on the region, while green indicates a positive impact on the region. While many people commonly associate "-" signs with a negative impact and "+" signs with a positive impact, that is not always the case. It is possible to have a red "+" sign, meaning the value of that performance measure will increase under a scenario, but that increase will have a negative impact on the region.
4. Some of the performance measures in Table 8-32 are qualitative. To help the reader interpret the differences across scenarios, consider the performance measure, "future population and employment in communities with peak population in 1970."
    a. MAINTAIN: Maintenance of the status quo will likely yield moderate decline of population in those communities whose population peaked in 1970, the same year the region's population peaked. These communities make up the region's peak population development footprint; after 1970, all growth essentially came at the expense of older, urban core neighborhoods that experienced decline, disinvestment, abandonment, and demolition.
    b. CAR: Prioritization of arterial and highway infrastructure expansion will likely yield moderate decline in the population and employment of the 1970 development footprint.
    c. TRANSIT: Investment in expansion of transit lines and stations instead of road/highway capacity will reduce some of the decline of the population and employment within the 1970 development footprint.
    d. TOTAL: Investment in both transit and road capacity expansion will reduce population and employment even further (about half that of the MAINTAIN and CAR scenarios) within the 1970 development footprint.

Table 8-32. Performance Measures and Targets (Air Quality, Water Quality, and Climate Resilience)

Performance Measure	Scenario 1 MAINTAIN	Scenario 2 CAR	Scenario 3 TRANSIT	Scenario 4 TOTAL	2020 Baseline
Regional Population	- (235,000)	- (235,000)	- (174,000)	- (114,000)	2,068,546
Regional Employment	- (113,000)	- (113,000)	- (83,000)	- (54,000)	1,188,488
Bike Lanes, Sidewalks and Bike/Walk Paths	SAME	SAME	+	+	Current bike infrastructure (lane miles of shared /separated service) and walk infrastructure (sidewalks, paths, crosswalks) in major regional job hubs
	-	-	-	-	Current acreage of ecologically sensitive and

Ecologically Sensitive and Agriculturally Productive Lands					agriculturally productive lands in Northeast Ohio
Future Population and Employment in Communities with Peak Population in 1970	-	-	-	-	Current estimate of total population and employment for all communities whose population peak occurred on or before 1970 [another option is to consider median age of single-family homes (1970 or earlier]
Attain National Air Quality Standards	-	-	-	-	Moderate Nonattainment for Ground-Level Ozone
Greenhouse Gas Emissions	+	+	+	+	Current greenhouse gas emissions for region
Flood Threat to Major Regional Job Hubs	+	+	**SAME**	+	current % major job hub areas within or proximal to designated floodplains or flood hazard zones

Principal Considerations for Transportation in the Context of Environment and Health

Given NOACA's role as the regional environmental planning agency for Northeast Ohio, it can play a major role in enhancing the region's water and air quality as well as in advancing the region's resilience to climate change. Overall, NOACAs efforts in these areas can improve equity and quality of life across the region. NOACA's continued investment in multimodal transportation infrastructure will be vital to reduce GHG emissions, improve public health, expanding transportation choice and access, and reduce racial and economic inequities.

To achieve the desired equitable future for Northeast Ohio, principal considerations must be contemplated in response to the anticipated challenges during the coming decades.

1. Populations can be disproportionately affected by impairments to water and air quality and the impacts of climate change.
2. Development of action plans to reduce greenhouse gas emissions substantially support state, regional, and local emissions reduction goals.
3. Substantial reduction of greenhouse gas emissions will reduce the impacts of climate change on the region.
4. Awareness of the region's air quality challenges and the linkages with air quality, transportation, land use, and public health will allow individuals to make informed transportation decisions.
5. Air quality planning integrated into proposed economic strategies can promote compact growth patterns, carbon neutral travel choices, and tree canopy and open space protection.
6. Transportation network and land-use patterns significantly influence water quality conditions and watershed planning efforts.
7. Regional collaboration through data sharing reduces redundancy, identifies information gaps, and develops more effective programs.
8. Decisions on the expansion/extension of wastewater services and transportation access made in accordance with one another that take into account the development implications of expanding infrastructure into undeveloped land mediates negative outcomes.

Implementation Action Items

Looking forward to 2050, NOACA should implement the following actions to move the region toward a more equitable future:

1. Facilitate the Climate Action Next Steps outlined earlier in this chapter.
2. Provide technical assistance to NOACA membership on development of local Climate Action Plans/Climate Adaptation Plans.
3. Continue to monitor, evaluate, and publish air quality conditions (e.g., daily Air Quality Index (AQI), annual Air Quality Trends Report).
4. Support public policies that provide greater transportation choice, reduce mobile emissions, benefit public health, create economic opportunity, and enhance the quality of life in Northeast Ohio.
5. Maintain and regularly update Water Quality Management Plans, including the Areawide 208 Plan to address regional water quality and water infrastructure needs.
6. Promote strategies outside NOACA to change transportation and infrastructure policy to recognize funding needs for clean air and water quality enhancement projects. Continue to promote mode shift from private automobiles to active transportation through NOACA's Transportation for Livable Communities Initiative (TLCI), its ACTIVATE Plan for bicycle and pedestrian planning, and technical assistance to local communities.
7. Continue to increase employer participation in the Gohio Commute platform, Ohio's premier trip planning, logging, and matching platform (enables individuals to find information on how to get from point A to point B via every available travel mode, and it provides them with transparent information on the true costs and benefits of each travel mode).
8. Continue to host the Commuter Choice Awards, which recognize employers throughout the region who do the most to promote TDM and alternative commuting.
9. Modify or enhance NOACA's use of the FPA boundaries to facilitate more long-term and comprehensive planning in the region.

Chapter 9: Equal Access Future Transportation Scenarios

Demographics

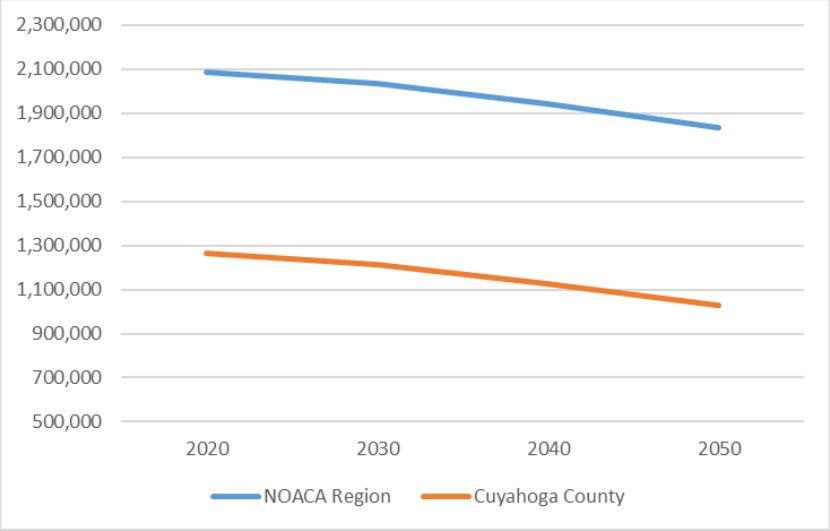
The following section presents how population and employment are forecasted to change in Northeast Ohio over the next 30 years. Forecasting demographic and economic trends is primarily based on looking into the past to determine the most likely pattern for the future. This trend analysis assists planners and decision-makers in developing and evaluating various land use and transportation planning scenarios.

Population (2020-2050)

Recent population forecasts follow a similar trajectory to the historic population trend between 2000 and 2010, which saw the region lose 3% of its population during that decade. This results in a regional loss of between 50,000 and 110,000 residents each decade between 2020 and 2050, which cumulates to an overall decrease of over 250,000 (12%) (see Figure 9-1 and Table 9-1). This forecasted population change would bring the regional population total to 1.83 million in 2050. Like the historic population data, the forecasts indicate that Cuyahoga County will continue to be the main source of the population losses for the NOACA region, losing an additional 19% of its population (-234,000) during that same period. This population loss is attributed to an aging population, declining fertility, and stagnant migration patterns.[1]

The previous forecast included in *eNEO2050* predicted that the region's population would only decrease by approximately 43,000 residents (a 2% decrease) compared to these updated forecasts that predict that the region will decrease by over 250,000 residents (a 12% decrease). These forecasts differ mainly because they were based on two different decennial Census years; this updated forecast being based on the latest 2020 Census data and the latest demographic trends (such as births, deaths, and migration), and the previous forecast being based on 2010 Census data and older demographic trends.

Figure 9-1. Population Forecasts for Cuyahoga County and NOACA Region (2020-2050)



Source: Ohio Department of Development (ODOD) County Population Forecasts, 2023

[1] Springer, Grace. "Northeast Ohio could face challenges of an aging population. Can we bend the curve?" The Canton Repository (accessed June 6, 2025 from https://www.cantonrep.com/story/news/local/stark-county/2025/02/03/northeast-ohio-could-face-challenges-of-population-decline/75686302007/)

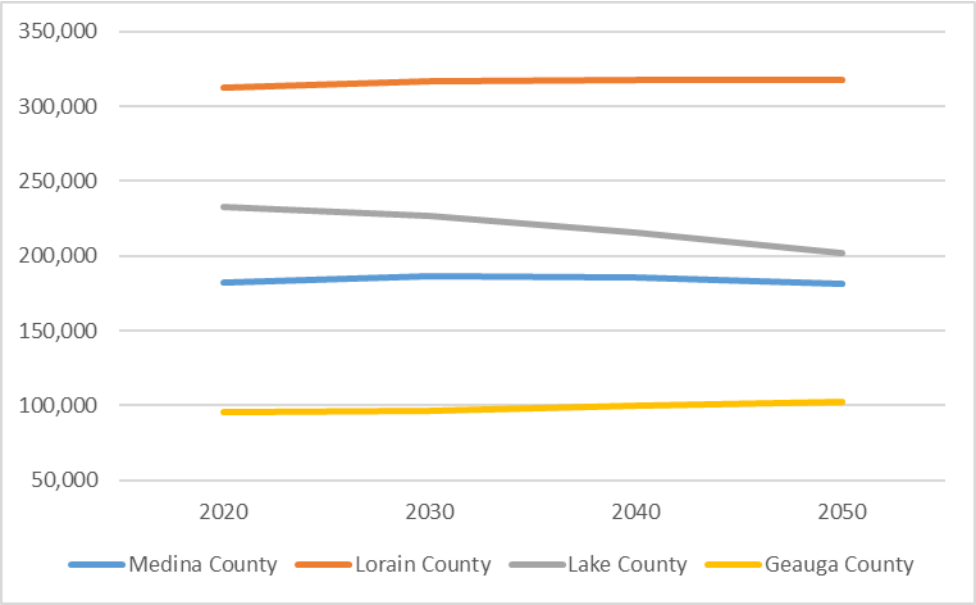
Table 9-1. Population Forecasts by County and NOACA Region (2020-2050)

Geography	2020	2030	2040	2050	Change 2020-2030	Change 2030-2040	Change 2040-2050	Change 2020-2050	% Change 2020-2030	% Change 2030-2040	% Change 2040-2050	% Change 2010-2050
Cuyahoga County	1,264,817	1,210,921	1,124,128	1,030,507	-53,896	-86,793	-93,621	-234,310	-4.3%	-7.2%	-8.3%	-18.5%
Geauga County	95,397	96,327	99,966	102,664	930	3,639	2,698	7,267	1.0%	3.8%	2.7%	7.6%
Lake County	232,603	226,501	215,440	201,932	-6,102	-11,061	-13,508	-30,671	-2.6%	-4.9%	-6.3%	-13.2%
Lorain County	312,964	316,704	317,331	317,491	3,740	627	160	4,527	1.2%	0.2%	0.1%	1.4%
Medina County	182,470	186,744	185,920	181,084	4,274	-824	-4,836	-1,386	2.3%	-0.4%	-2.6%	-0.8%
NOACA Region	2,088,251	2,037,197	1,942,785	1,833,678	-51,054	-94,412	-109,107	-254,573	-2.4%	-4.6%	-5.6%	-12.2%

Source: Ohio Department of Development (ODOD) County Population Forecasts, 2023

What is quite different about the forecasts compared to the past population trends is that the four collar counties of the NOACA region do not grow at the same historic pace, with some of the counties losing population between 2020-2050 (see Figure 9-2 and Table 9-2). In particular, Lake County is forecasted to lose population each decade out to 2050, which totals to over a 30,000 loss (13%). Medina County, which grew at the highest rate between 1990 and 2020, is forecasted to start losing population in the 2030-2040 decade, and by 2050 its total losses over the 30 years are nearly 1,400 population (1%). Lorain County, which grew at over 15% between 1990-2020, is only forecasted to grow at a very low level between 2020-2050, at over 4,500 population (1%). Geauga County is the only outlier of the group, as it is forecasted to grow in population at the moderately high rate of 8% and 7,200 population. However, this growth only amounts to about half of the historic population growth that Geauga County experienced between 1990-2020, which was 14,000 (18%). In summary, unlike the previous 3 decades, the collar counties are forecasted to experience some decline and much less growth, which ultimately adds to the overall forecasted regional population loss.

Figure 9-2. Population Forecasts for Geauga, Lake, Lorain, and Medina Counties (2020-2050)

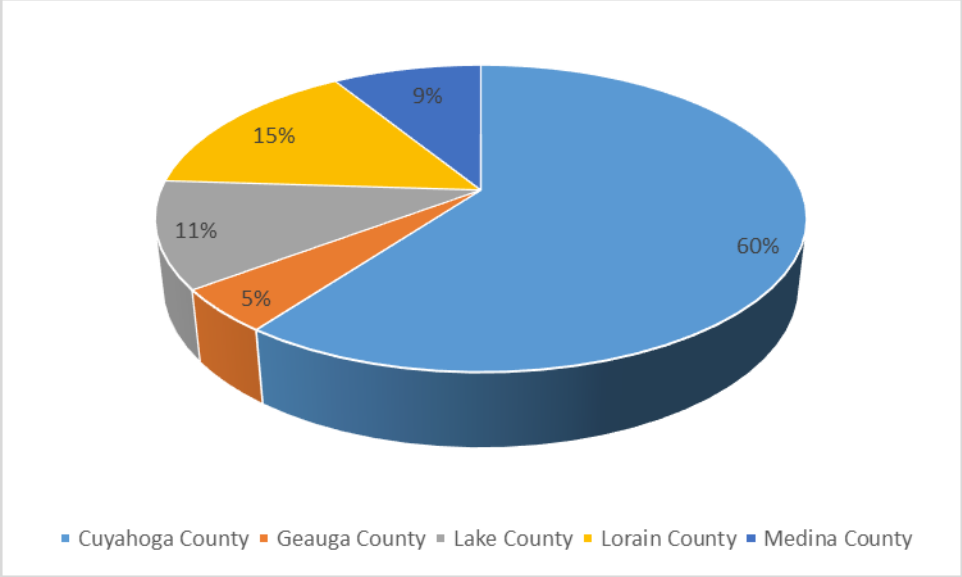


Source: Ohio Department of Development (ODOD) County Population Forecasts, 2023

Examining the county shares of the regional population shows that the pattern of population redistribution throughout the NOACA region also continues out to 2050 (see Figures 9-3 and 9-4). In 2020, Cuyahoga County accounted for 60% of the regional population, and the outer counties accounted for 40% of the regional population. By 2050, Cuyahoga County is forecasted

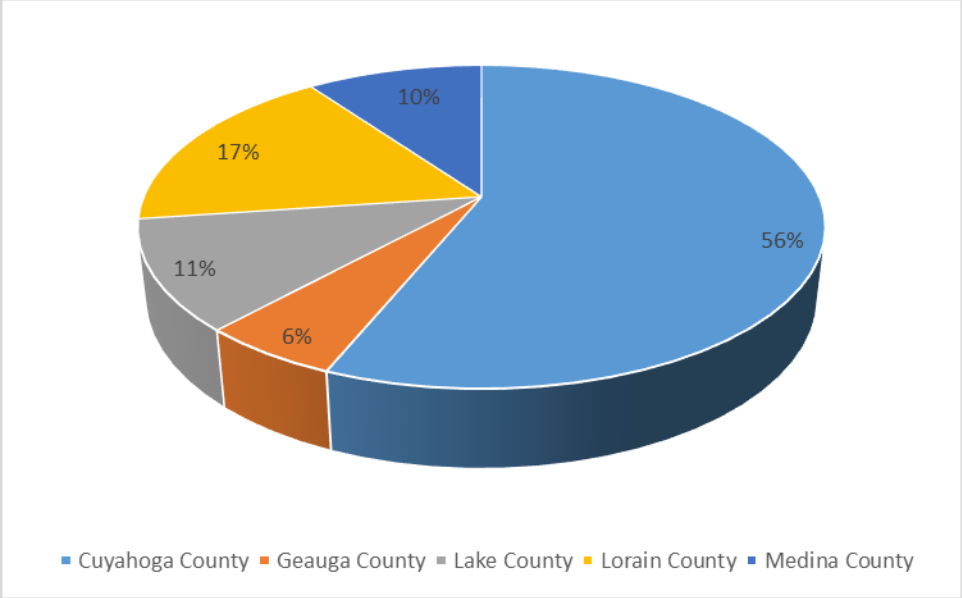
to drop to 56% of the regional population, and the outer counties are forecasted to grow to 44% of the regional population.

Figure 9-3. County Share of Regional Population 2020



Source: Ohio Department of Development (ODOD) County Population Forecasts, 2023

Figure 9-4. County Share of Regional Population 2050



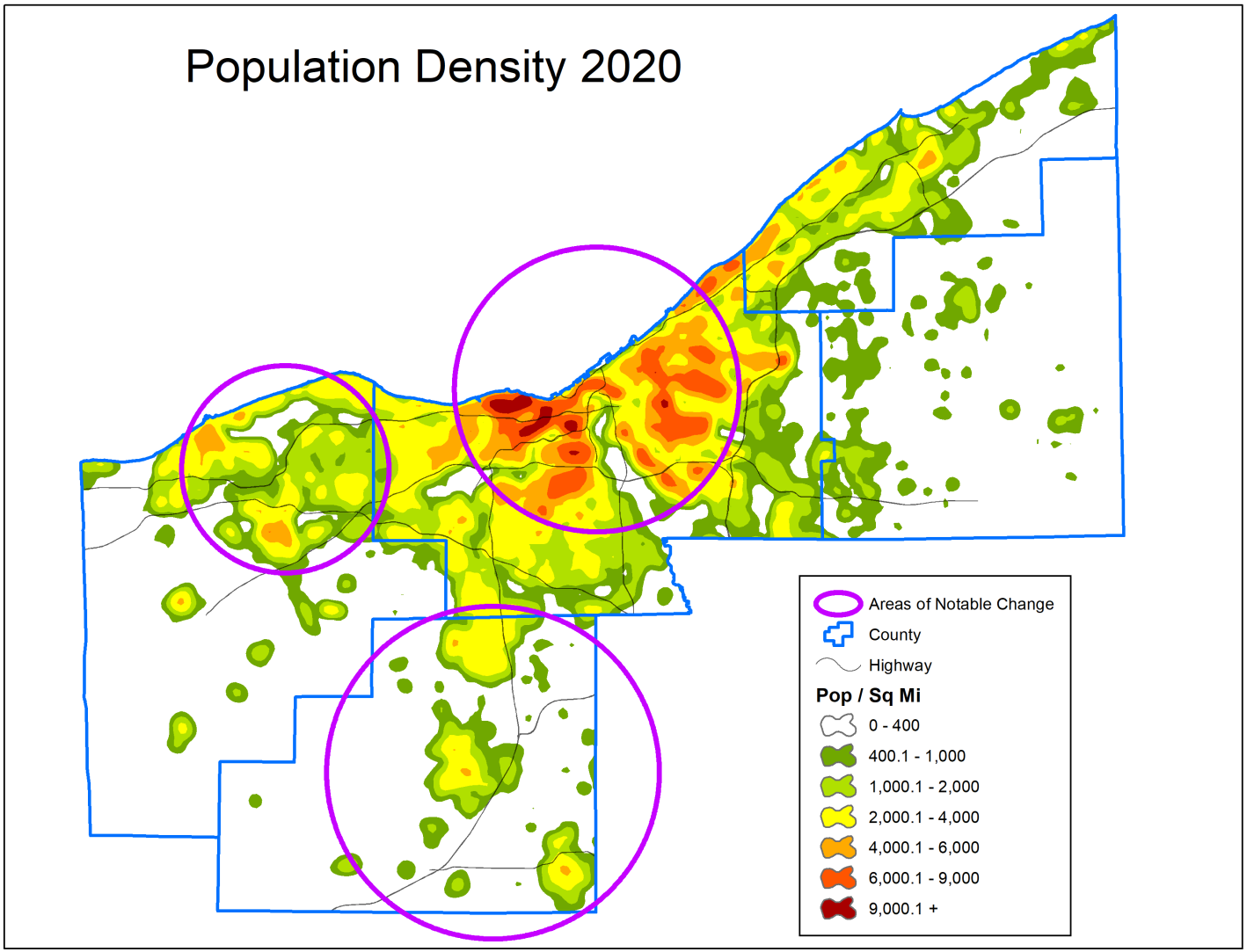
Source: Ohio Department of Development (ODOD) County Population Forecasts, 2023

Population Density (2020-2050)

Future population density at the sub-county level in 2050 shows much of the same trends apparent during the period between 2000 and 2020 (see Figures 9-5 and 9-6). The urban core of Cuyahoga County is forecasted to lose population, while downtown and near west side neighborhoods continue to grow. In northeast Lorain County, density levels are forecasted to continue to increase, as housing development will continue to replace former agricultural lands. Medina County's density growth out to 2050 is a bit subdued compared to the period between

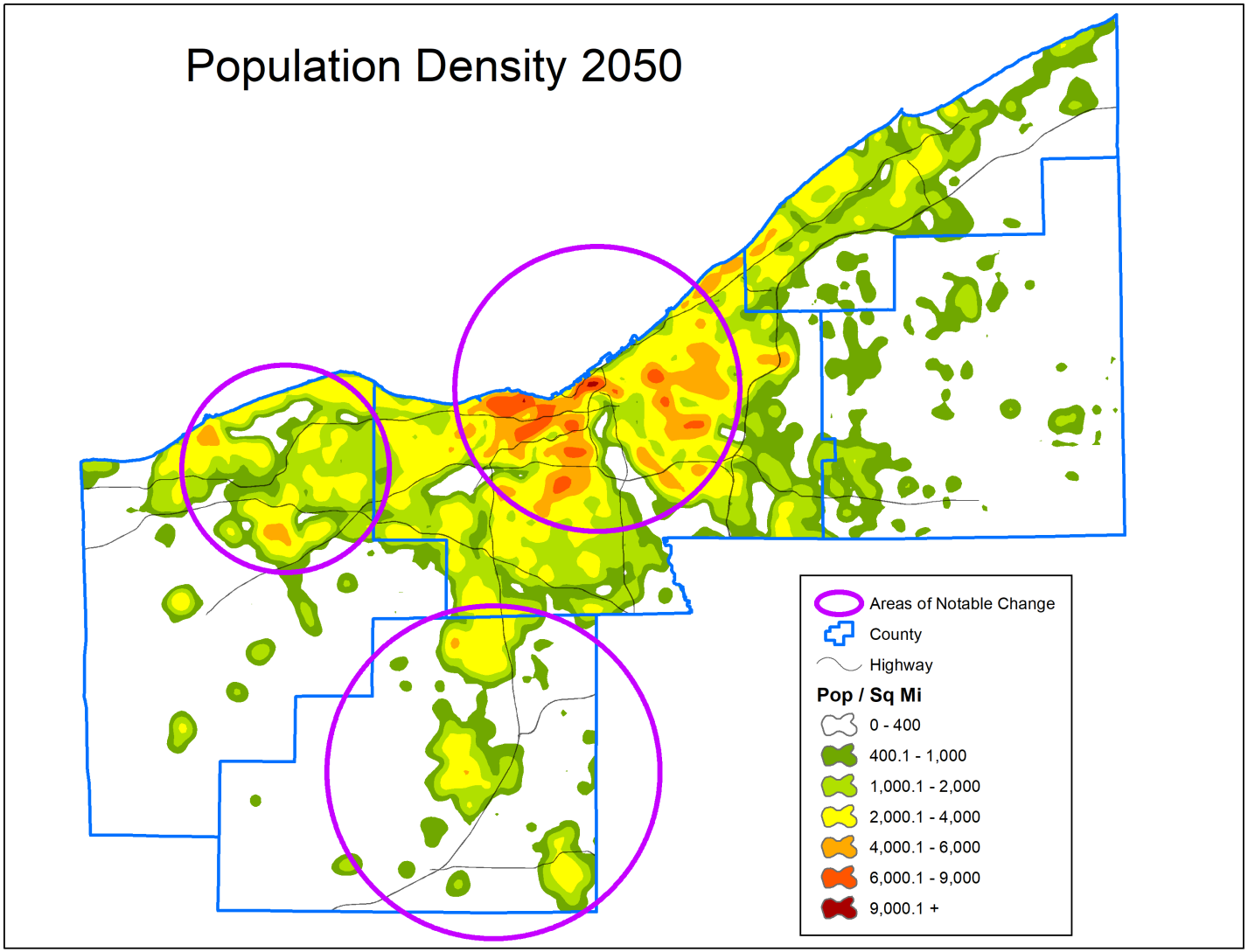
2000 and 2020. Lake and Geauga counties stay relatively similar in their density patterns out to 2050.

Figure 9-5. Regional Population Density (2020)



Source: NOACA Analysis of 2020 Census block data.

Figure 9-6. Regional Population Density (2050)

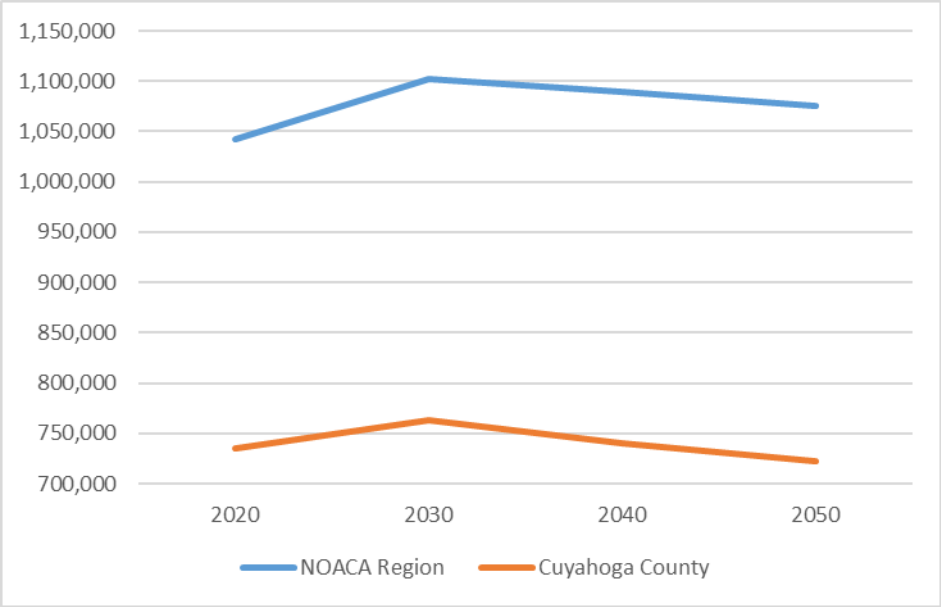


Source: NOACA Analysis of forecasted Census block data utilizing the Ohio Development Services Agency's (ODSA) county population forecasts (2023).

Employment (2020-2050)

The historic job trends of the NOACA region saw a pattern where Cuyahoga County experienced more job losses and less job gains on a proportional scale than the region over all. This trend continues into the future with the job forecast data (see Figures 9-7 and Table 9-2). Between 2020-2030, both Cuyahoga County and the NOACA region grow in jobs, 4% and 6% respectively. After 2030, Cuyahoga County is forecasted to lose jobs over the next two decades, erasing all job gains during 2020-2030, and causing the county to have an overall decline in jobs over the entire 30-year forecast period. The NOACA region follows a similar pattern, with one major difference: it is forecasted to lose only a portion of the job gains from 2020-2030 (boosted by job gains in the collar counties) and ends with a positive growth rate over the 30-year forecast period. More specifically, the NOACA region is forecasted to grow to about 1.08 million jobs from 2020-2050 at a rate of 3%, while Cuyahoga loses jobs at a rate of 2% over the same time period.

Figure 9-7. Total Employment Forecasts for Cuyahoga County and NOACA Region (2020-2050)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Table 9-2. Total Employment Forecasts by County and NOACA Region (2020-2050)

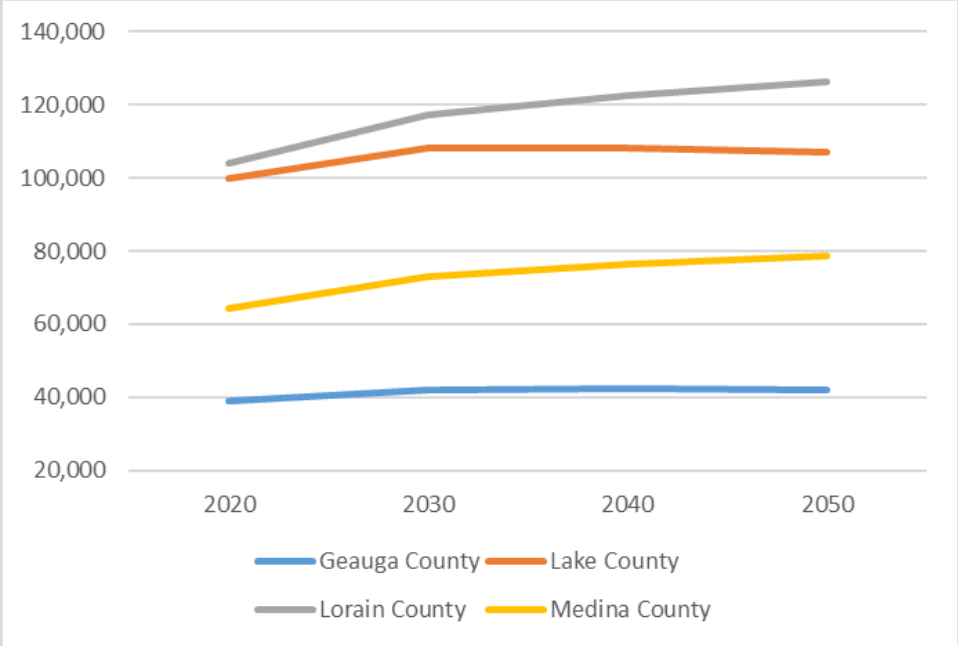
Geography	2020	2030	2040	2050	Change 2020-2030	Change 2030-2040	Change 2040-2050	Change 2020-2050	% Change 2020-2030	% Change 2030-2040	% Change 2040-2050	% Change 2020-2050
Cuyahoga County	734,809	762,791	740,051	722,200	27,982	-22,740	-17,851	-12,609	**3.8%**	**-3.0%**	**-2.4%**	**-1.7%**
Geauga County	39,064	41,966	42,226	41,903	2,902	260	-323	2,839	**7.4%**	**0.6%**	**-0.8%**	**7.3%**
Lake County	99,656	108,007	108,074	106,994	8,351	67	-1,080	7,338	**8.4%**	**0.1%**	**-1.0%**	**7.4%**
Lorain County	103,840	117,040	122,549	126,333	13,200	5,509	3,784	22,493	**12.7%**	**4.7%**	**3.1%**	**21.7%**
Medina County	64,441	73,065	76,338	78,546	8,624	3,273	2,208	14,105	**13.4%**	**4.5%**	**2.9%**	**21.9%**
NOACA Region	1,041,810	1,102,869	1,089,238	1,075,976	61,059	-13,631	-13,262	34,166	**5.9%**	**-1.2%**	**-1.2%**	**3.3%**

Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Forecasted job growth in the 4 collar counties of the NOACA region is fairly consistent from 2020 to 2050. All counties are forecasted to grow at high rates. Out of the approximately 34,000 jobs gained in the NOACA region from 2020 to 2050, the 4 collar counties account for 100% of all the growth (see Table 9-2 and Figure 9-8).

Even though the four collar counties account for all of the growth in the region between 2020-2050, the rates of growth follow a similar pattern to Cuyahoga County, with the highest portion of the growth occurring in the 2020-2030 decade, and the rates of growth by decade decreasing substantially for the following two decades. For example, Medina County's rate of job growth between 2020-2030 is 13% and by 2040-2050 it is forecasted to drop to 3%. Geauga and Lake counties are actually forecasted to experience job losses in the 2040-2050 decade with declines of about 1%.

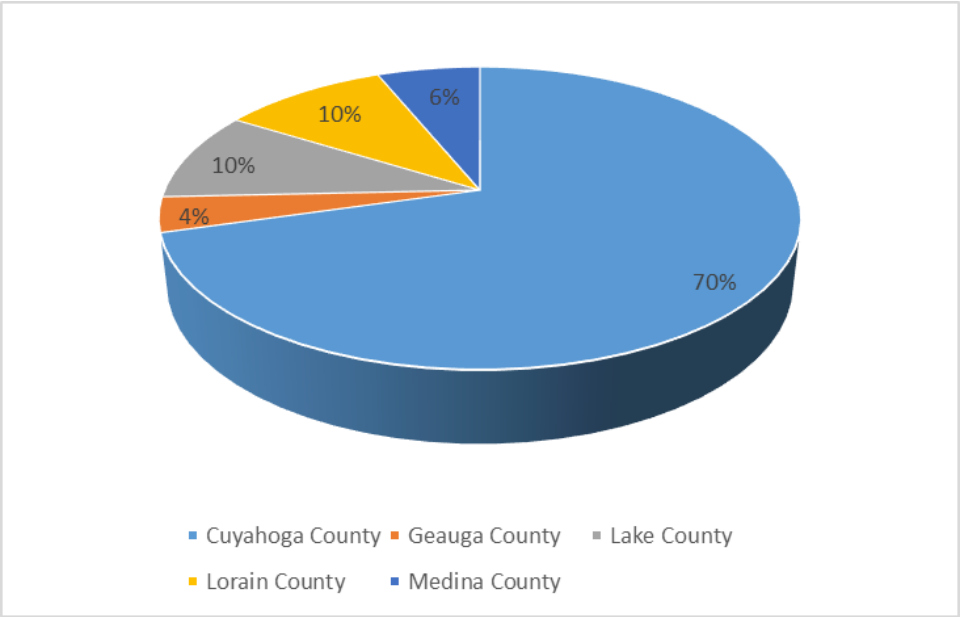
Figure 9-8. Total Employment Forecasts for Geauga, Lake, Lorain and Medina Counties; 2020-2050



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

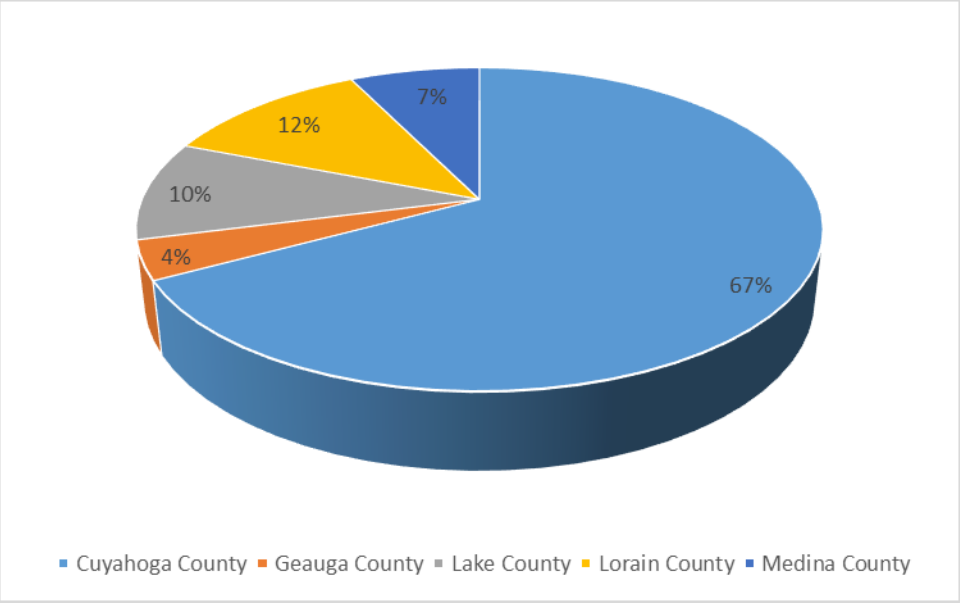
Since the baseline scenario projects Cuyahoga County to experience job declines compared to the four collar counties of the NOACA region from 2020 to 2050, it continues to see its percentage share of total jobs in the region decrease (see Figures 9-9 and 9-10). In 2020, 70% of the jobs in the region were located in Cuyahoga County, and 30% in the outer four counties. By 2050, Cuyahoga County's share is forecasted to drop to 67%, and the four outer counties are forecasted to collectively increase to 33% of all jobs in the region.

Figure 9-9: County Share of Regional Jobs 2020



Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Figure 9-10. County Share of Regional Jobs 2050

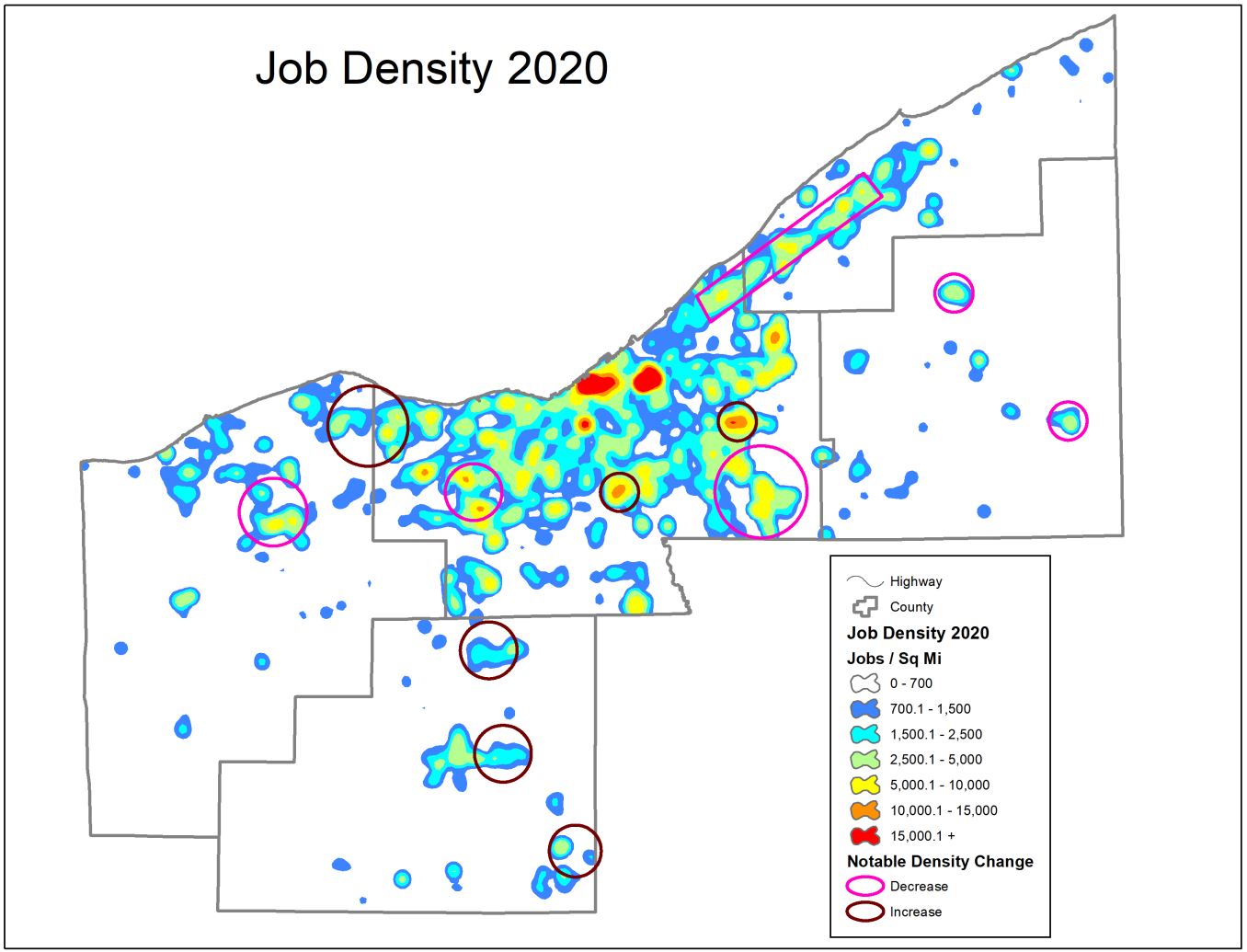


Source: Moody's Economy.com. Obtained from Team NEO in August 2024.

Employment Density (2020-2050)

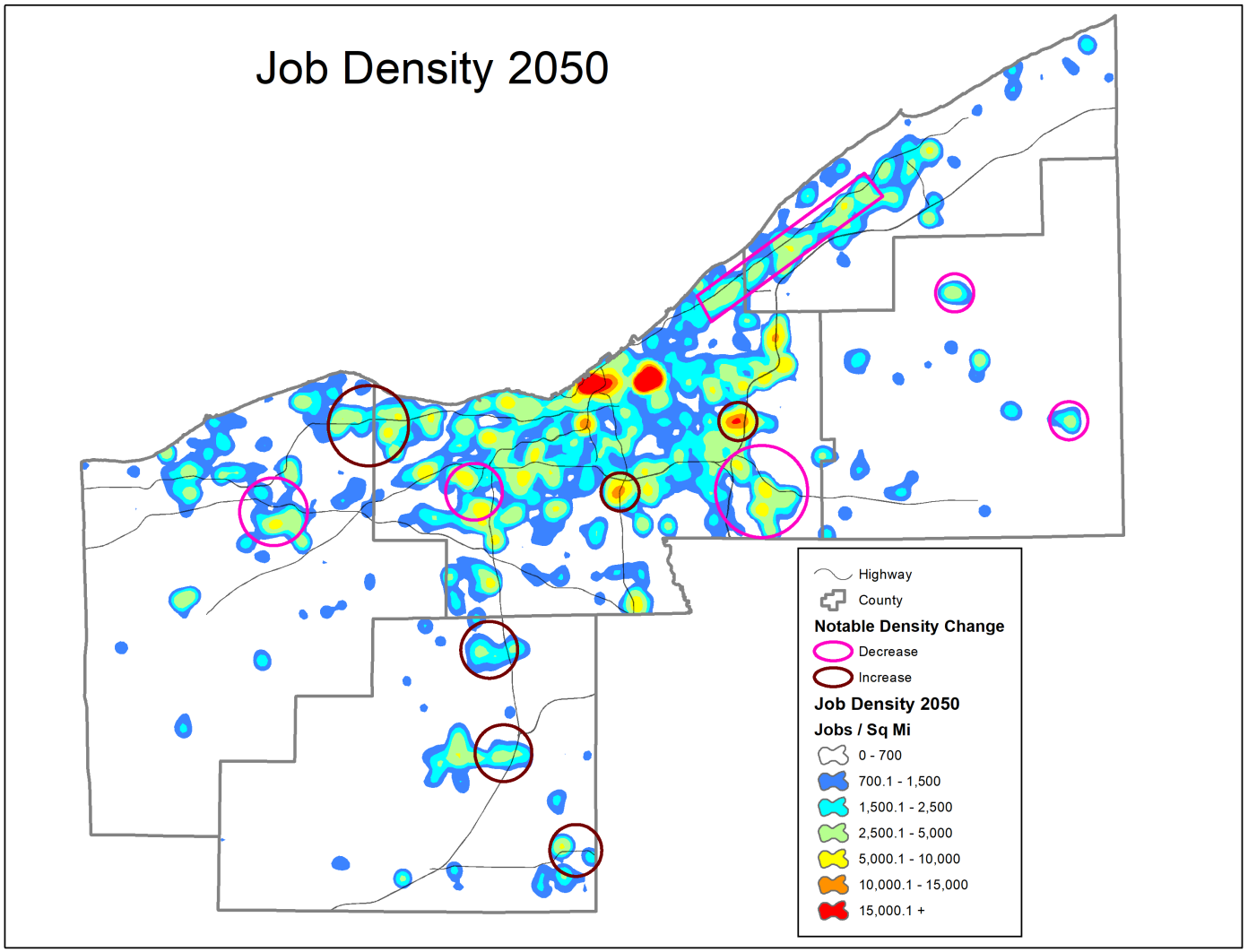
Forecasted job density trends follow a different pattern from what occurred during the period between 2010 and 2020. During those 10 years, there was a high amount of job growth throughout the region and in all sectors of the economy due to the rebound from the great recession of 2008/2009. Between 2020 and 2050, forecasts revert back to the pattern of basic jobs being replaced by service jobs, which was apparent prior to the economic recovery of the 2010s. This trend has great implications at the local level in areas that have a high concentration of basic jobs and a high concentration of service jobs. Areas with high levels of basic jobs, such as the Cleveland Hopkins airport area, Elyria, and Solon, are all forecasted to lose jobs and job density as basic jobs are lost in the future economy. Areas with high levels of service jobs, such as Avon, Medina, and Chagrin Highlands all are forecasted to see increases in their total number of jobs and density levels as the NOACA region shifts to a more service-based economy. Similar to past trends, downtown Cleveland and University Circle maintain the highest levels of job density in the region and will remain the largest employment centers in the region for the foreseeable future.

Figure 9-11. Regional Job Density (2020)



Source: NOACA-forecasted data based on the Quarterly Census of Employment and Wages (QCEW) 2010 and county data by Moody's Economy.com. QCEW data obtained from the Ohio Department of Transportation (ODOT) in 2012 and Moody's Economy.com data obtained from Team NEO in August 2024.

Figure 9-12. Regional Job Density (2050)

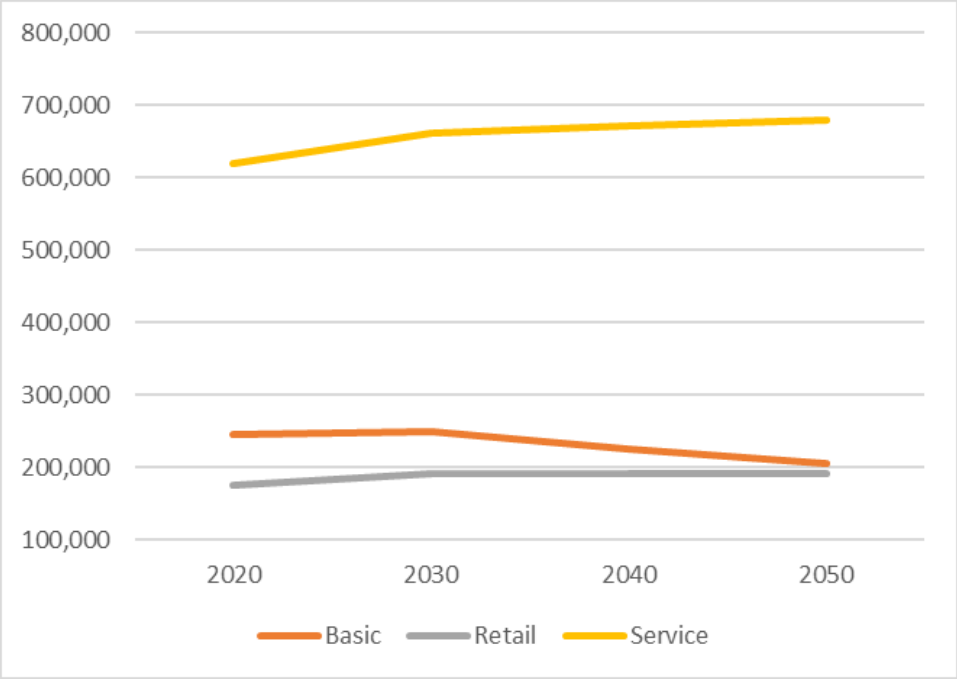


Source: NOACA-forecasted data based on the Quarterly Census of Employment and Wages (QCEW) 2010 and county forecasts by Moody's Economy.com. QCEW data obtained from the Ohio Department of Transportation (ODOT) in 2012 and Moody's Economy.com data obtained from Team NEO in August 2024

Employment by Major Sector (2020-2050)

The shift from basic to service jobs in the NOACA region is a pattern that is forecasted to continue out to 2050 (See Figure 9-13 and Table 9-3). Over the next thirty years, basic job losses are forecasted to be about 40,000 at a decline rate of 16%. Over the same period service jobs are forecasted to grow at 10% which equates to over 59,000 jobs. Unlike the past trend of slight growth in the retail sector, retail jobs are forecasted to grow at a moderate amount, 9% over the next 30 years, which is a growth of over 15,000 jobs.

Figure 9-13. Regional Employment Sector Forecasts (2020-2050)



Source: Moody's Economy.com. Obtained from Team NEO in August 2024

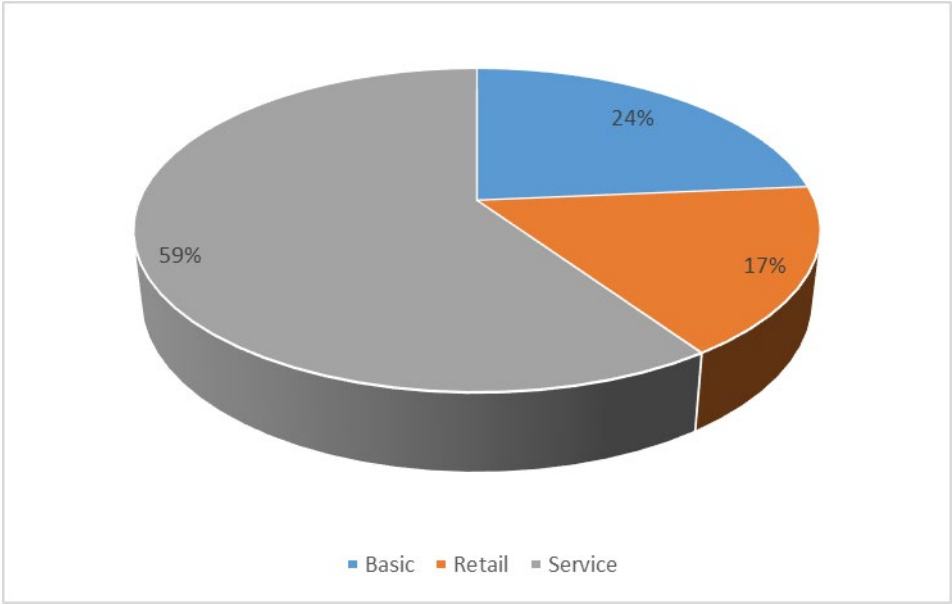
Table 9-3. Regional Employment Forecasts by Sector (2020-2050)

Job Type	2020	2030	2040	2050	Change 2020-2030	Change 2030-2040	Change 2040-2050	Change 2020-2050	% Change 2020-2030	% Change 2030-2040	% Change 2040-2050	% Change 2020-2050
Basic	245,846	249,060	225,445	205,815	3,214	-23,615	-19,630	-40,031	**1.3%**	**-9.5%**	**-8.7%**	**-16.3%**
Retail	175,877	192,441	191,682	191,032	16,564	-759	-650	15,155	**9.4%**	**-0.4%**	**-0.3%**	**8.6%**
Service	620,087	661,368	672,111	679,129	41,281	10,743	7,018	59,042	**6.7%**	**1.6%**	**1.0%**	**9.5%**

Source: Moody's Economy.com. Obtained from Team NEO in August 2024

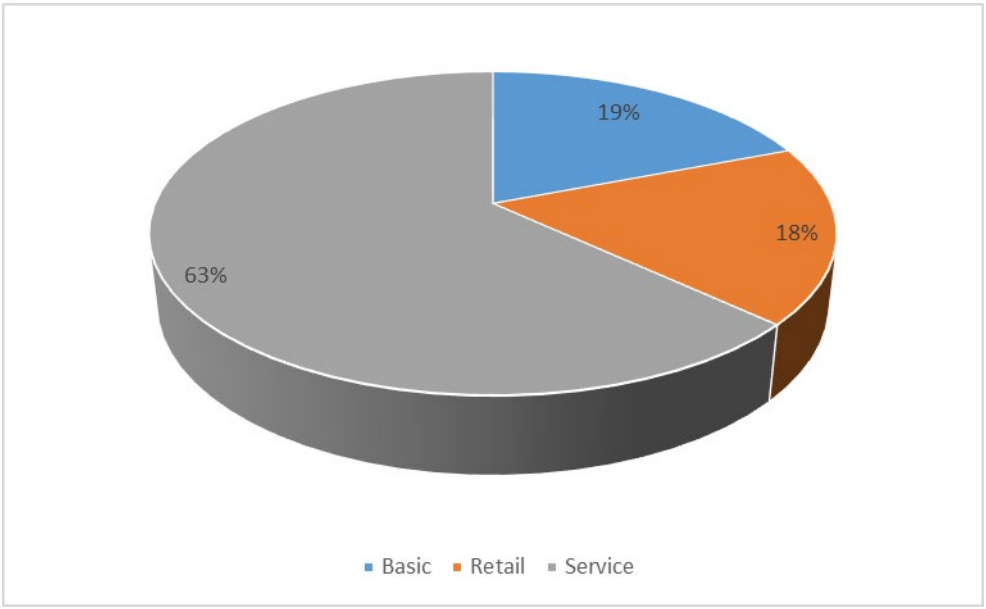
These forecasts of moderate growth of retail jobs and a large decline of basic jobs means that by 2050, retail is forecasted to be a similar-sized sector of the regional economy in terms of jobs compared to the basic sector (See Figures 9-14 and 9-15). In 2050, retail jobs will account for 18% of total jobs, and basic jobs will account for 19%. For basic jobs, this is a drop in industry share from a previous 24% of all jobs in 2020. Similar to the historic trends, the service sector picks up most of the industry share that is lost by the basic sector, increasing from a share of 59% of all jobs in 2020 to 63% of all jobs in 2050. The retail sector stays relatively constant in its share of total regional jobs, only slightly increasing from 17% of all jobs in 2020 to 18% in 2050.

Figure 9-14. Employment Sector Share of Total Regional Jobs 2020



Source: Moody's Economy.com. Obtained from Team NEO in August 2024

Figure 9-15. Employment Sector Share of Total Regional Jobs 2050



Source: Moody's Economy.com. Obtained from Team NEO in August 2024

Transportation Demand and Supply

As discussed in the previous section, there is population decline forecasted for the NOACA region. By continuing with the current transportation planning policies, various metrics indicate that job sprawl will gradually occur and more workers will commute from suburbs to major regional job hubs by single occupancy vehicles. These socioeconomic forecasts, travel behavior envisage and technological advances in transportation provide a platform for proposing different and more equitable plans focusing on moving people and goods rather than automobiles and trucks.

The automobile industry is replacing “Horse Power” with “Processing Power” and there is a little doubt that the Plug-in Hybrid Electric Vehicles (PHEV), Connected and Autonomous Vehicles (CAV), autonomous shuttles and other technology driven advancements are going to fill our highway network sooner than expected. This technology will not replace the existing modes of travel overnight. However, the PHEVs and CAVs will slowly replace the existing conventional cars and eventually all will be traveling in these futuristic vehicles. Traffic signals could be a thing of the past for cars as they will be in constant communication with each other to ensure they smoothly and safety weave through traffic condition. This could free up more space for pedestrian areas and bicycle lanes. This may take one or two decades but it will certainly happen by the planning year of 2050 with new social norms and travel patterns being established. Any future transportation plan should consider these technology advancements in different levels.

Travel Demand Forecasting

Forecasts of future travel are based on the data from;

- Existing travel patterns,
- Population and employment growth,
- Future land use and economic conditions,
- Understanding of how people make travel choices, and
- Future available travel modes

The most critical part of the travel demand forecasts is the travel modes availability. Trips between a given origin and destination are split into trips using automobiles, individually or shared, transit, bikes or just walk. All these indicate that travel forecasting requires large amounts of data for the substantially large uncertainty and predictions will be done under many assumptions.

Integrating the existing trip rates as travel patterns of the calibrated and validated NOACA travel forecasting model and the estimated future population and employment predicts the following travel characteristics for the planning year of 2050 in the NOACA region:

- Number of households: Over 850 thousand households
- Daily Person Trips Generated: more than 5.64 million trips
- Average Daily Person Trips per household: Approximately 6.6 trips

Assumptions regarding future trip rates, household sizes and residential locations, employment centers and their job opportunities, shopping and recreational habits, available travel modes, and traffic congestion and travel times add to the complexity of travel demand models and reduce the accuracy.

Practically, there are many uncertainties in these types of predictions and there is less reliable information, for instance, to say that the current calibrated trip rates will occur three decades from now. One way to mitigate this unreliability is to perform scenario planning. That means adopting several plausible future scenarios and predicting their potential demand. The next sections will discuss the scenario planning approach and the envisaged scenarios.

Supply Side Forecasting

On the supply side, uncertainties and unknowns can also be large, especially the availability of new technologies, their capabilities, costs evolution and respective benefit. Discussing what are not known about the new technologies are as important as what is known. For instance, the safety, reliability, price and commercial availability of CAVs are key parameters when predicting the prevalence of autonomous vehicles. Assuming normative values for the unknown parameters assists dealing with uncertainty effectively and communicating the prediction results.

These uncertainties coincide with possible gradual job displacements, and considering the development of more equitable transportation system makes the planning tasks complicated. This chapter attempts to lay the groundwork for overcoming these complexities and some of the uncertainties.

The current travel modes, in the NOACA region, are automobile, driving alone or sharing ride, public transportation and non-motorized modes including walking and biking. The 2024 base scenario of the calibrated and validated NOACA travel forecasting model indicates the following modal split for the current daily person trips[2]:

- Automobile is the dominant mode choice with over 98% share.
- Share of the driving alone is about 57%.
- Transit share is about 1 percent.
- Non-motorized mode share is about 0.5%.

These mode choice shares illustrate that this region currently is highly automobile dependent and the public transportation provides only a small percentage of the total passenger miles traveled. Therefore, owning an automobile is currently necessary for commuting to work and other trip purposes such as shopping, medical, recreational, etc. in the NOACA region. This limits the activities of households without access to a car which can make the job search experience more stressful.

At this juncture, many citizens, planners, and policy makers are slowly coming to appreciate that each transportation mode has a role to play in meeting travel needs. The need of alternative choices will increase as the roadway network becomes more congested. It is also a fact that more investment in transit increases the ridership leading to a more equitable transportation system.

A discussion of the future regional transportation system cannot move forward without an acknowledgement of the role that technology will play in the way we move around the region, and the resulting infrastructure changes necessary to support it. The next sections review future transportation modes and transportation networks at a high or “30,000 foot” level with the objective of developing scenarios across future modes and projects.
A set of proposed future projects are categorized in terms of infrastructure, service and mode of travel:

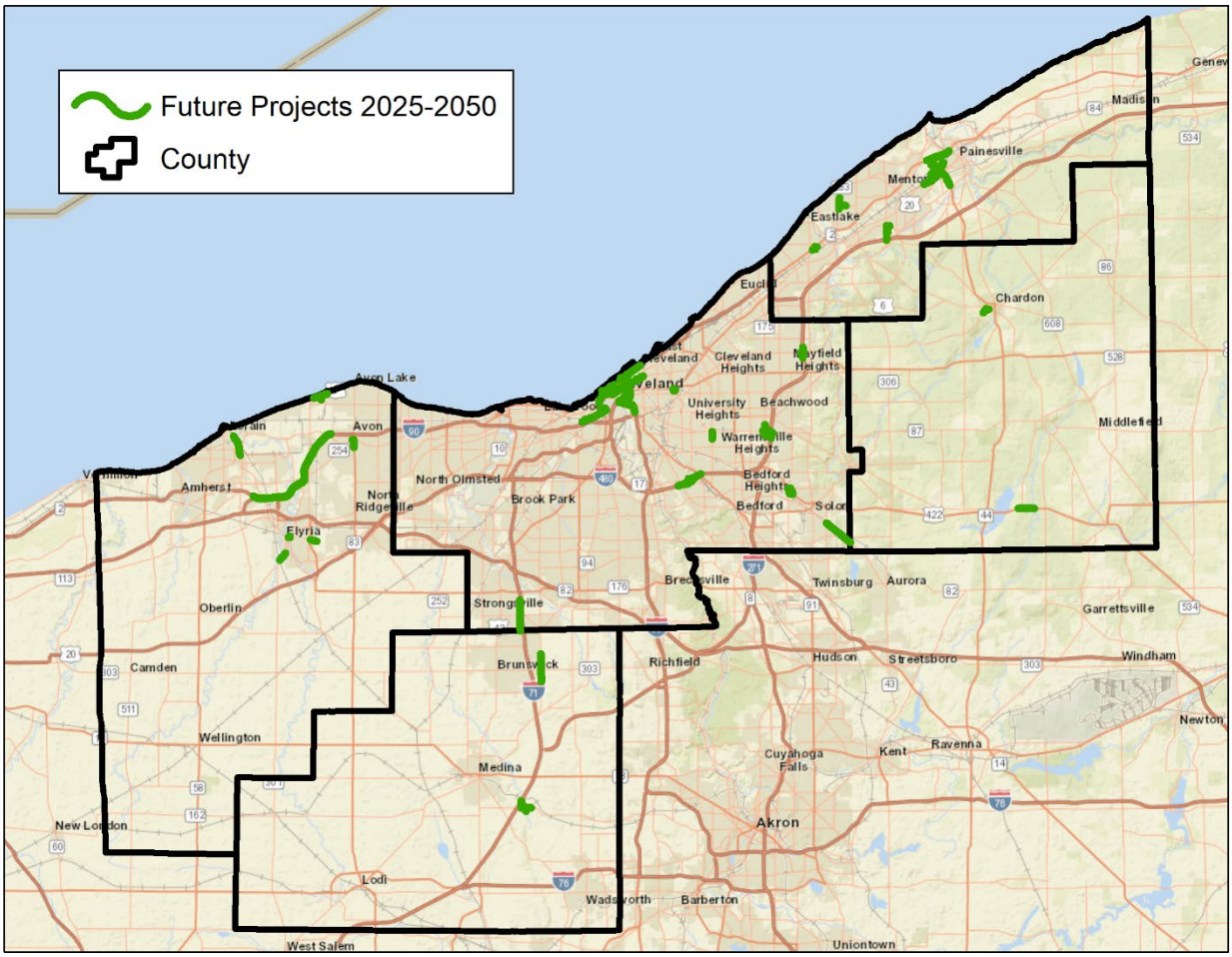
- Highway,
- Transit, and
- Facilities for non-motorized modes of travel.

[2] Within the NOACA Travel Forecasting Model, a person trip is defined as beginning from the first initial starting point and ending at the ultimate final destination. This differs from data presented in the 2025 NOACA Household Travel Survey section in Chapter 4, which defines each leg of an overall trip, such as intermediary stops of a change of travel mode, as 1 individual trip.

Proposed Highway Capacity Projects

The highway group includes adding capacity to the current highway network. Figure 9.16 shows the locations of proposed highway capacity major projects for the period of 2020 to 2050.

Figure 9-16. Location of Planned Highway Capacity Projects (2025-2050)

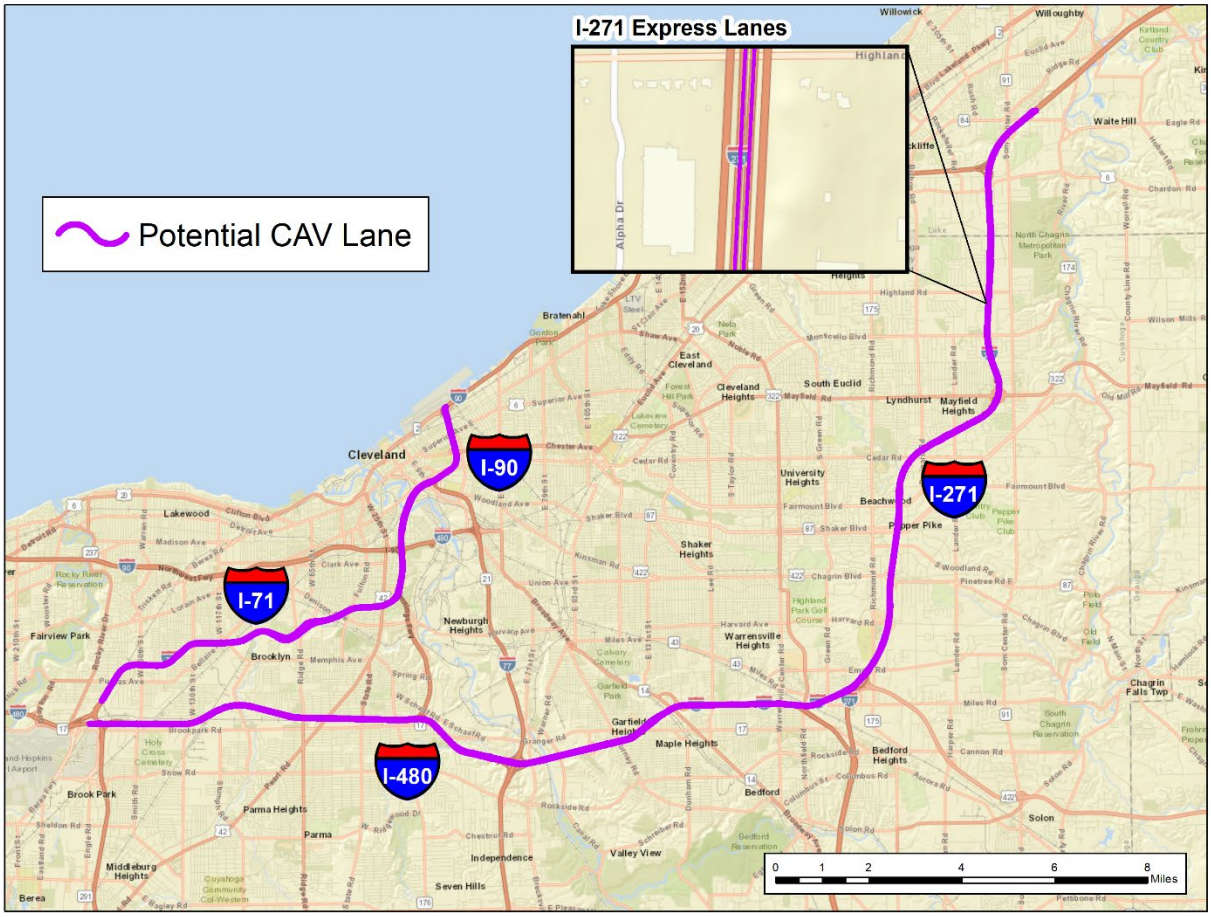


Proposed Connected and Autonomous Vehicle (CAV) Lanes

The technology associated with Connected and Autonomous Vehicles (CAV) is slowly being introduced to the consumer market in the form of autopilot vehicles. With such advancement, the infrastructure they will operate on also needs to be equally advanced. Just as CAVs are operating with artificial intelligence; the highways should as well. CAVs will communicate with other vehicles and roadway infrastructure. They will use real time traffic data to anticipate congestion, make better routes, and sync their speed. In addition to improving traffic management, establishing systems of communications between vehicles and the roads will also be necessary what is known as V2I (Vehicle to Infrastructure). CAVs are going to be equipped with multiple sensors which will be their eyes when it comes to travelling on a highway. An equipped highway can sharpen these sensors.

Figure 9-17 illustrates selected interstates where CAV lanes could be utilized. The exploded view depicts how the CAV lane could be implemented by designating two directional lanes on the existing interstates. Their applicability and effectiveness in future scenarios will be discussed in following sections.

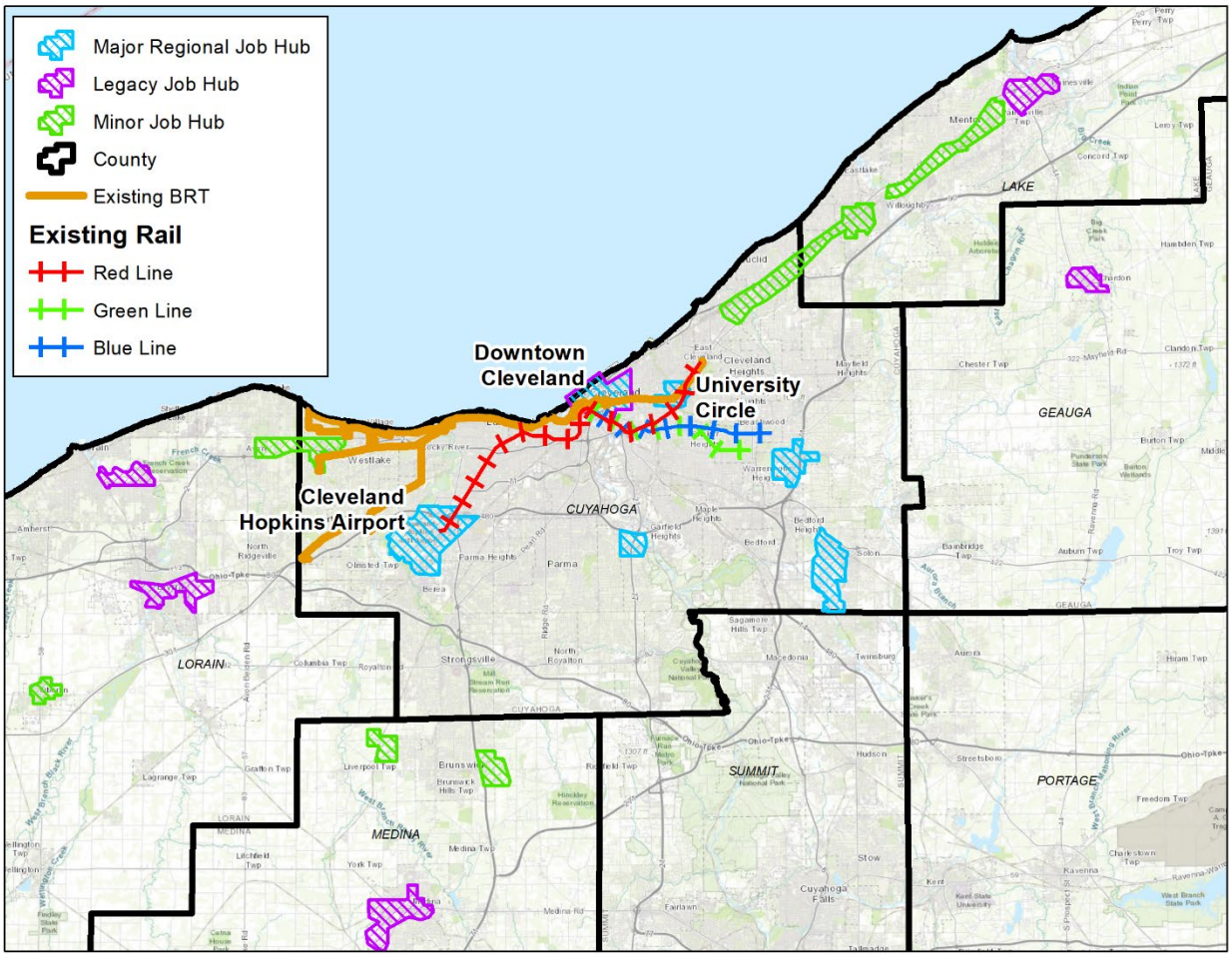
Figure 9-17. CAV Lanes of the Future Scenarios



Proposed Rail Line Extensions

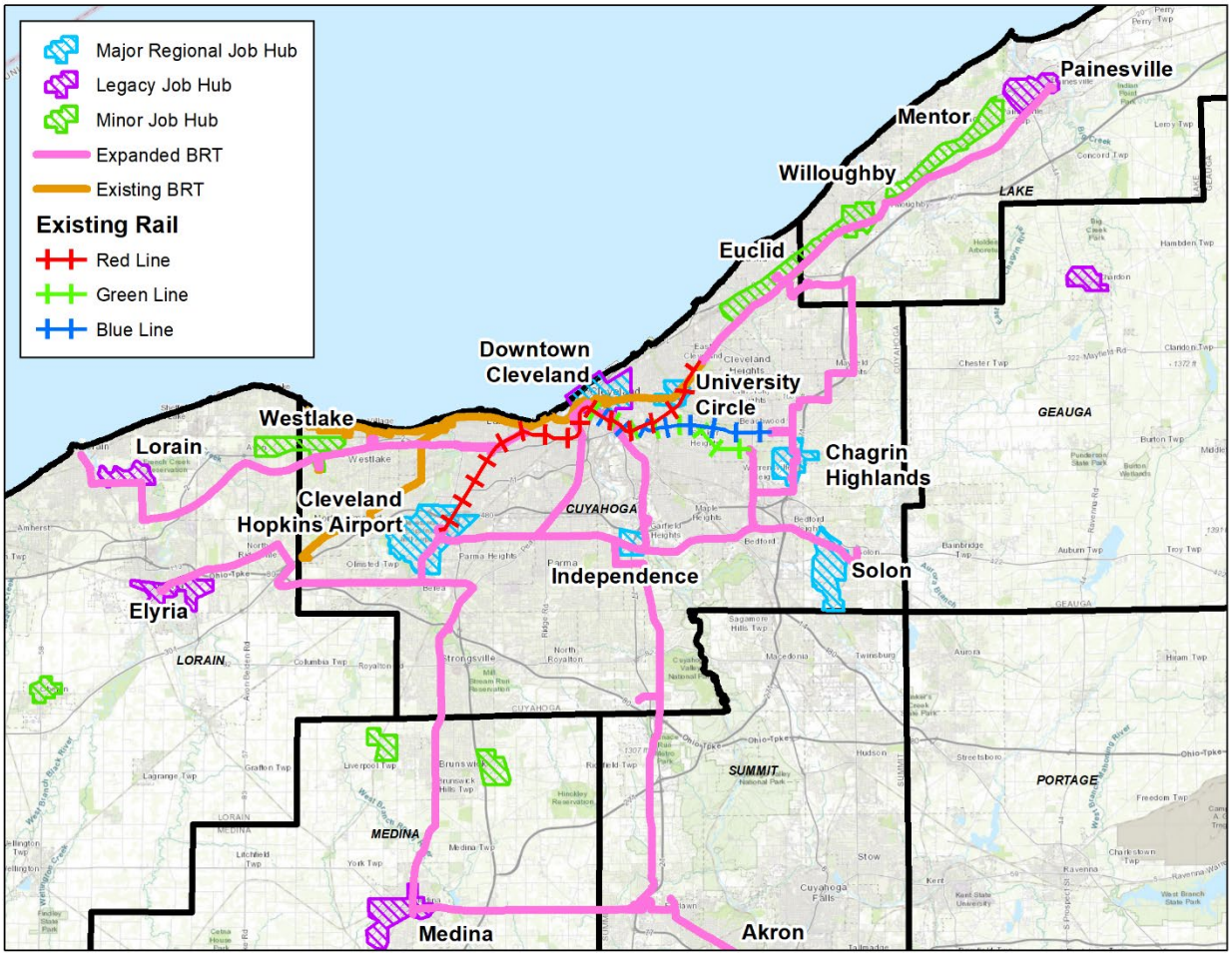
As previously discussed, the current transit network consists of various modes of transit, most notably local bus, premium/park-and-ride bus, bus rapid transit (BRT), and rail. Figure 9-21 shows the existing regional rail and BRT lines in the NOACA region.

Figure 9-18. Existing Regional Rail and BRT Network (2025)



The existing regional rail and BRT network only connects 4 of the 18 job hubs. The existing rail network was completed in the late 1960s and the expansion of jobs into the suburbs since then has left a rail network that does not adequately connect residents to many of the major job centers of the region. The two BRT lines opened in 2008 and 2014 and only connect to 3 job hubs. Also of note is that the regional rail and BRT network only currently serves Cuyahoga County. Growth of population into the outer counties since the 1960s has also resulted in a rail and BRT network that does not connect to new population centers of the region. Figure 9-19 displays a proposed expanded BRT network that serves 13 out of the 18 job hubs. Two future scenarios include this extended BRT network which will be discussed in the next sections.

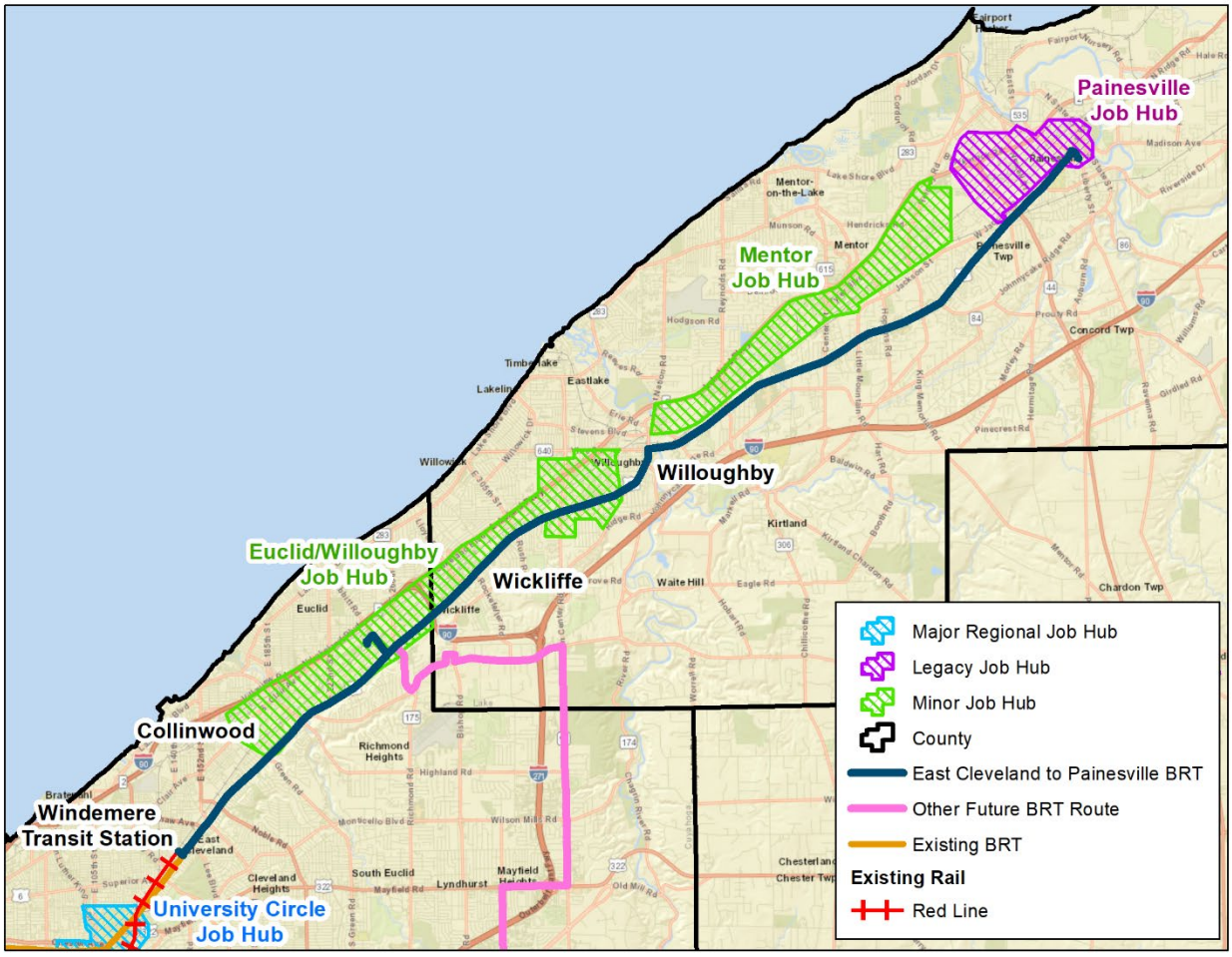
Figure 9-19. Proposed Expanded Regional BRT Network (2050)



An expanded BRT network, as seen in Figure 9-19, would greatly increase transit ridership in the region and connect thousands more residents to a transit network that serves all six major regional job hubs, multiple minor and legacy job hubs, and the growing suburban population centers of the NOACA region. This is especially important for residents of EJ areas because an expanded regional BRT network would greatly increase the number of jobs accessible within a reasonable commute time. Currently, the rail and BRT network is mostly confined to the urban core of Cuyahoga County and does not extend the connection to many of major regional job hubs or other growing job centers in the suburbs of Cuyahoga County or the other counties of the region. A BRT route connecting downtown Akron and downtown Cleveland through Independence would also greatly increase the transit accessibility between these very large employment centers. Each specific extension to the BRT network will be discussed in more detail in the next few sections.

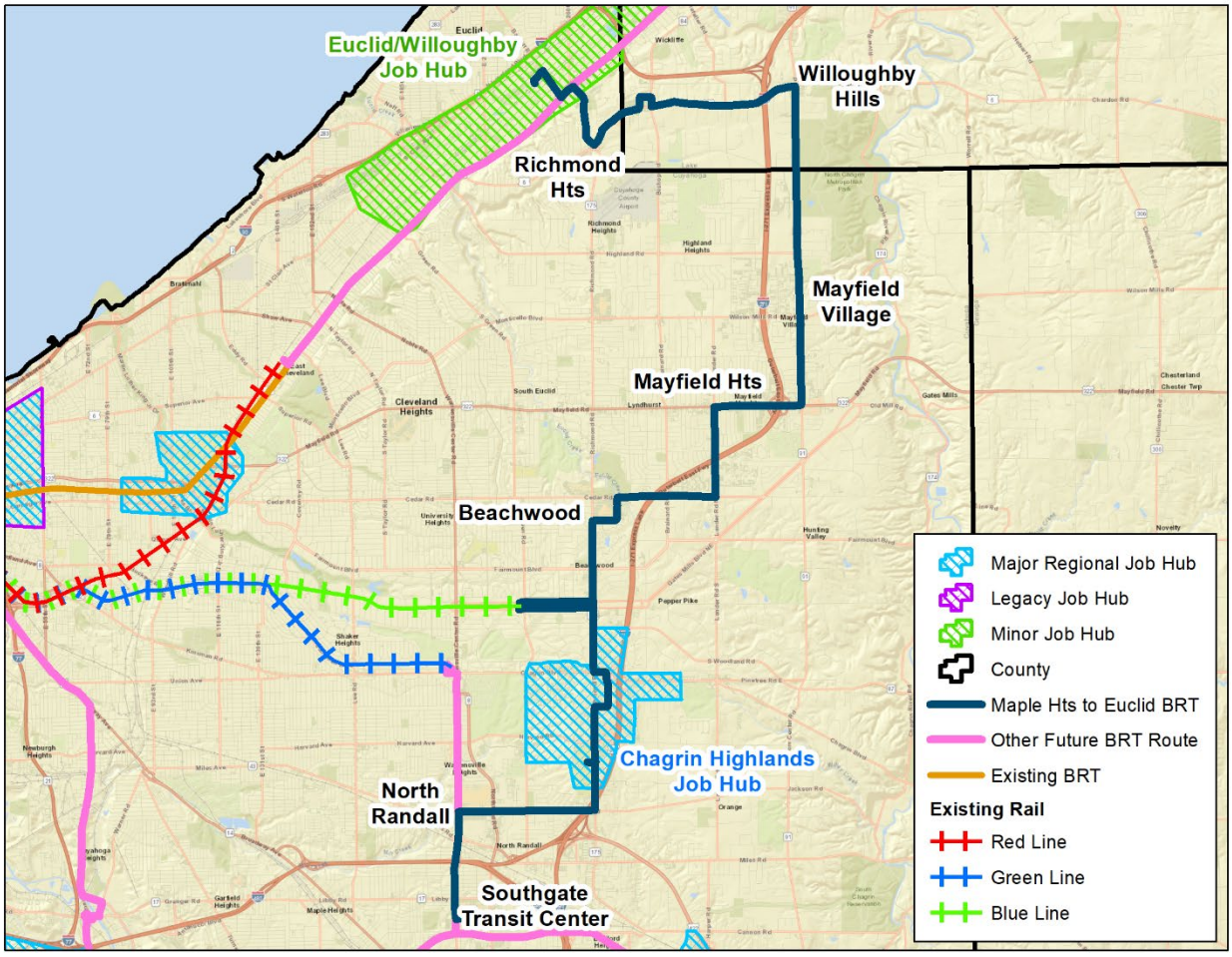
A proposed BRT line would connect the Windermere Transit Station in East Cleveland to many job locations to the northeast, such as Painesville, Mentor, Willoughby, Wickliffe, Euclid, and the Collinwood neighborhood of Cleveland. Conversely, the residents of Lake County and northeastern Cuyahoga County, would have increased access to the University Circle regional job hub and additional points in west, such as the downtown Cleveland regional job hub. Also, in Euclid near the Lake County border, there would be a transfer location to a future BRT route that travels north-south to Maple Heights, through many large employment centers, including the Chagrin Highlands regional job hub. Figure 9-20 displays the proposed BRT route from the City of East Cleveland to the City of Painesville in the northeast of the NOACA region.

Figure 9-20. Future BRT Route from East Cleveland (Windermere) to Painesville – 2050



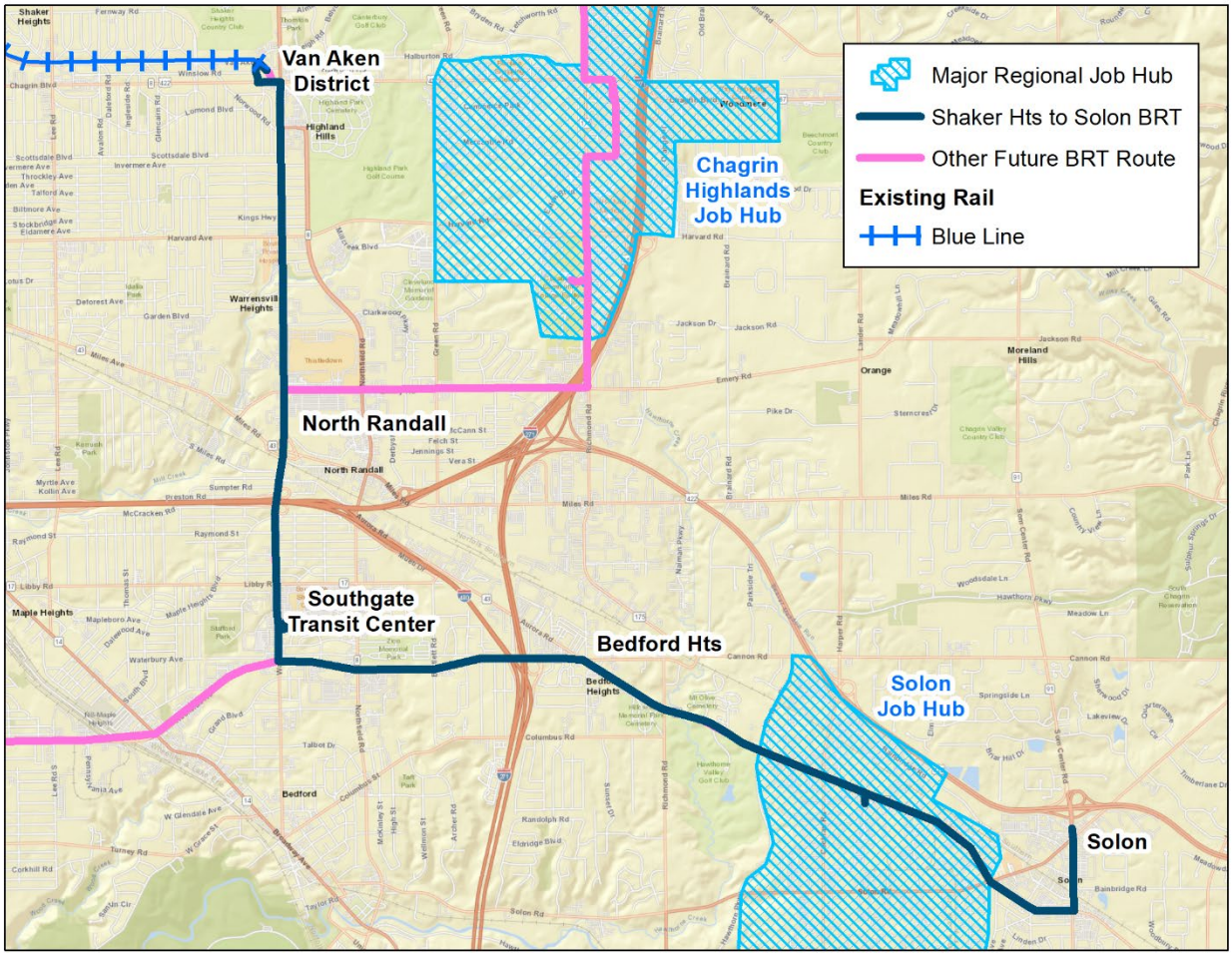
A proposed BRT line would connect Euclid to the Southgate Transit Center in Maple Heights, traveling through a dense corridor of suburban job locations, including the Chagrin Highlands regional job hub. Most of the major stations would be close to I-271 interchanges and would create opportunities for park-and-ride stations at many of the retail or office parking lots that surround these interchanges. As part of this expansion would also be the connection to the existing Green rail line, which currently ends at Green Rd in Shaker Heights. Other transfer points would be in Euclid with the proposed BRT line to East Cleveland and Painesville, and at the Southgate Transit Center, which would provide transfers to the proposed BRT line to Solon and the East-West BRT line to Cleveland Hopkins Airport. Figure 9-21 depicts the proposed BRT route from Euclid to Southgate Transit Center in Maple Heights.

Figure 9-21. Future BRT Route from Euclid to Maple Hts (Southgate Transit Center), 2050



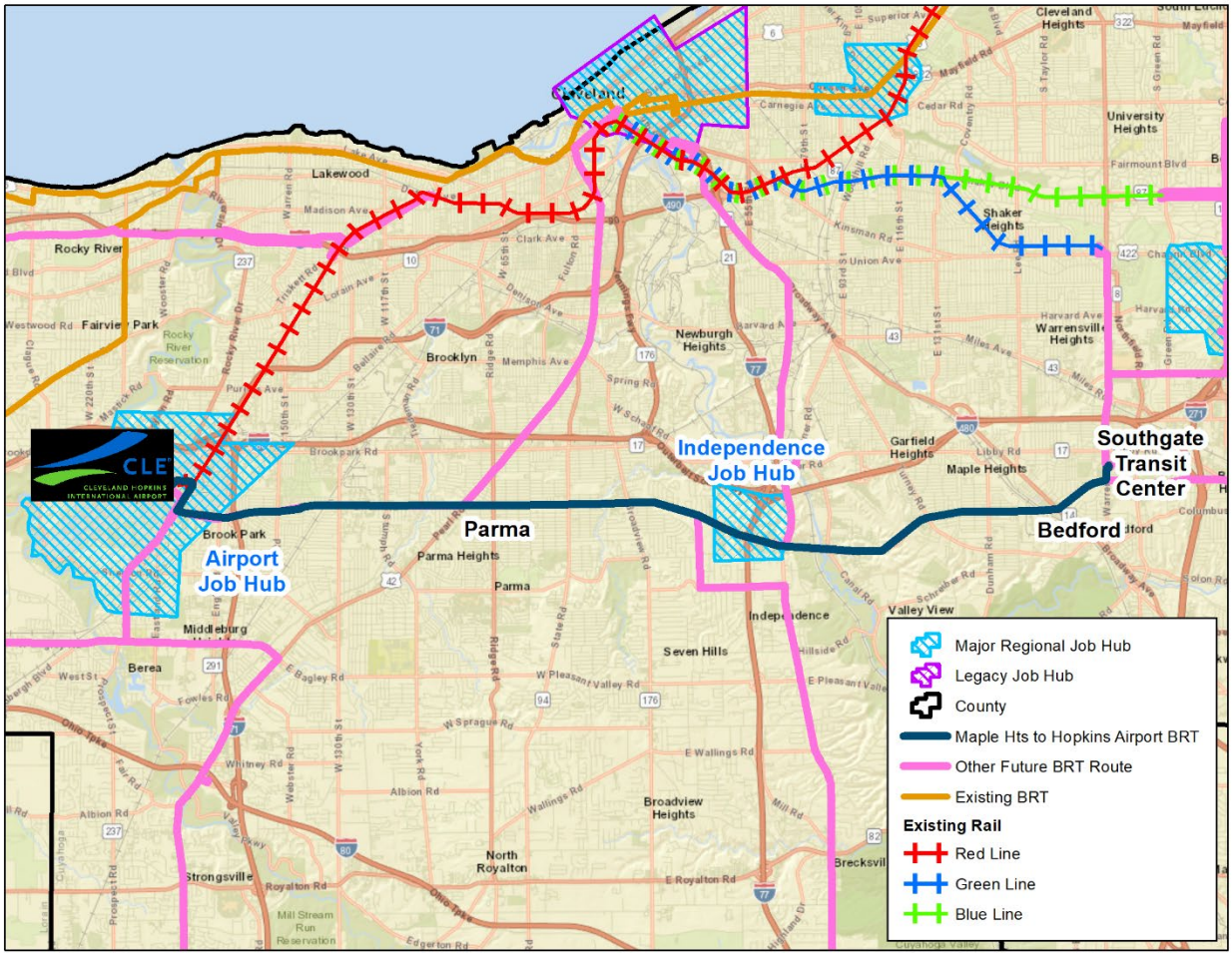
A proposed BRT line would connect the Van Aken District in Shaker Heights, (where the Blue rail line currently terminates) to the Southgate Transit Center in Maple Heights and ultimately the Solon regional job hub. Other suburban locations included in this extension would be North Randall, Warrensville Hts and Bedford Hts. Much of this line directly serves areas with many zero car households, and would provide a faster connection to the Solon regional job hub, which currently is only served by a small number of local buses. Transfers to the Blue rail line at the Van Aken District would take riders to Shaker Square and downtown Cleveland, while transfers at the Southgate Transit Center would allow riders to continue west on the proposed East-West BRT line to Independence and Cleveland Hopkins Airport or north on the proposed BRT line to the Chagrin Highlands regional job hub. Figure 9-22 shows the proposed BRT route from the Van Aken District in Shaker Heights to Solon.

Figure 9-22. Future BRT Route from Shaker Hts (Van Aken District) to Solon, 2050



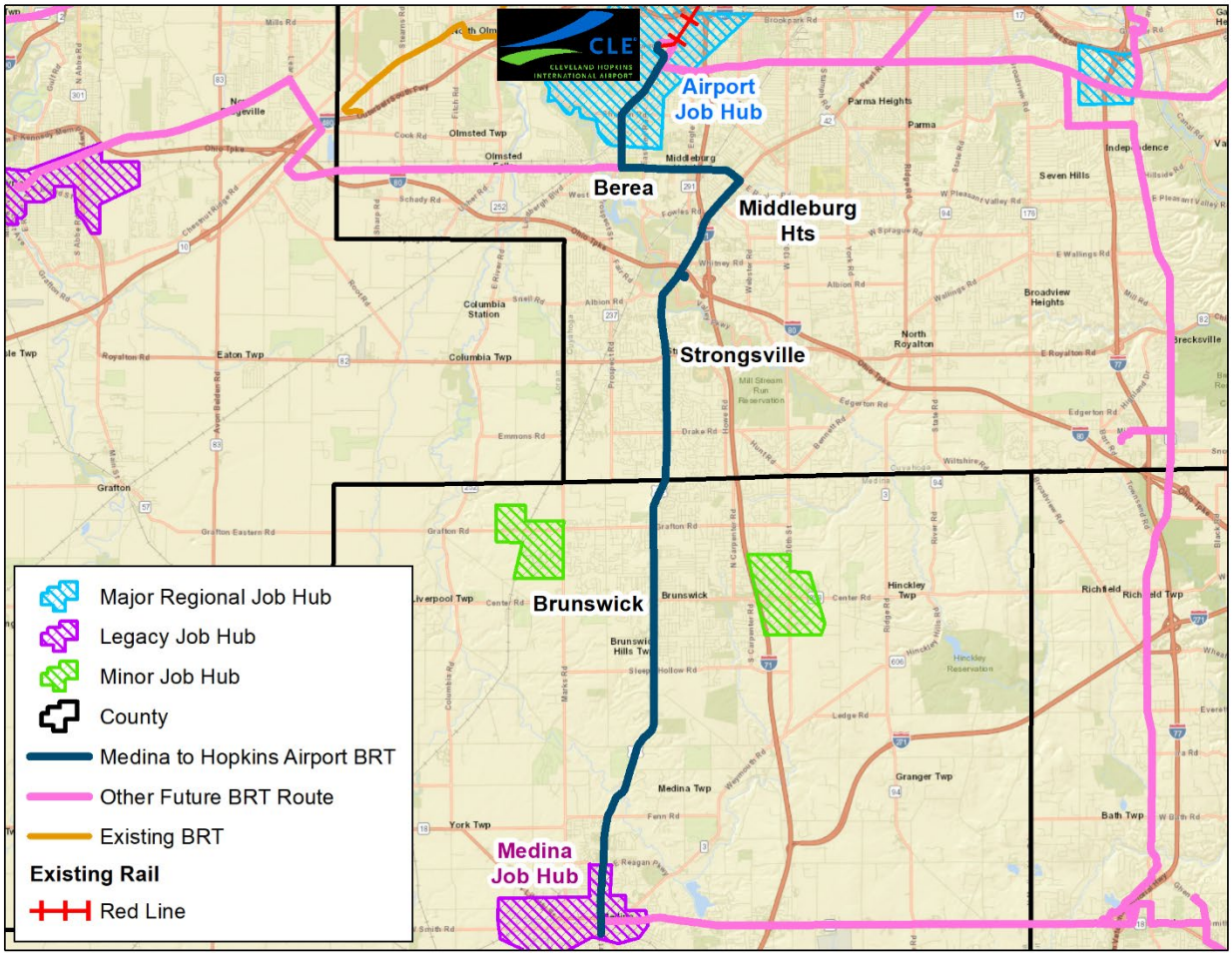
On either ends of the proposed East-West BRT line would be the Southgate Transit Center and Airport regional job hub, and in between would be major stations at the Independence regional job hub and in Parma. In the expanded BRT network, both the Southgate Transit Center and Cleveland Hopkins Airport function as major transfer points to other lines. At Southgate, riders can transfer to the proposed BRT route between Shaker Hts and Solon, and to the proposed BRT line to Euclid. From the airport, riders can transfer to the existing Red rail line north to downtown Cleveland, transfer to a proposed BRT towards Strongsville and Medina, or transfer to proposed BRT line westward to Elyria. At the major stop in Parma, riders could transfer to a proposed BRT line that travels northward to Cleveland via Pearl Rd. and W. 25th St. At the Independence stop along this route, riders can transfer to the proposed BRT route heading north and south, to either destinations towards downtown Cleveland or towards downtown Akron. Figure 9-23 displays the proposed East-West BRT line from the Southgate Transit Center to Cleveland Hopkins airport.

Figure 9-23. Future East-West BRT Route from Maple Heights (Southgate Transit Center) to Cleveland Hopkins Airport, 2050



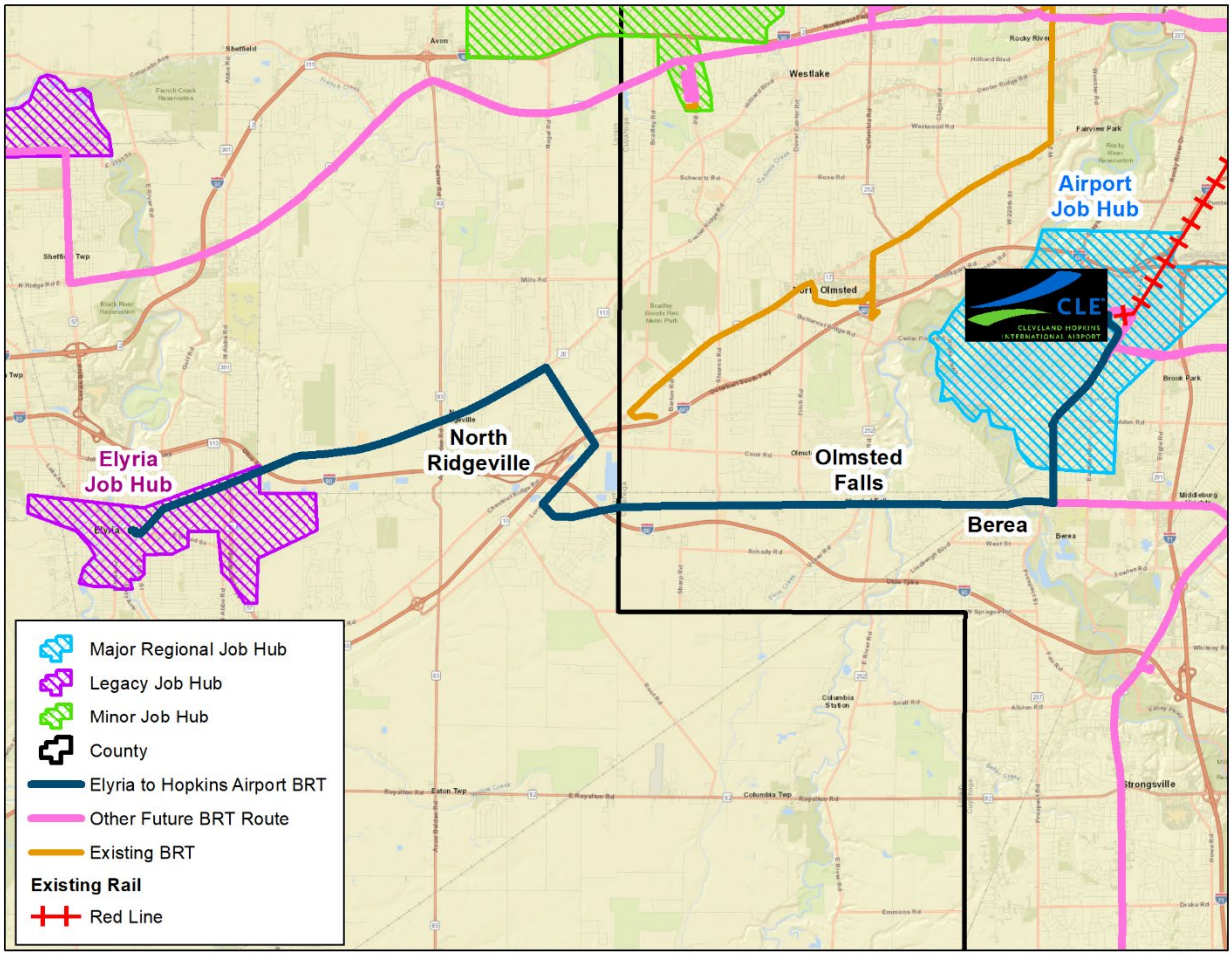
The proposed BRT line would travel from Cleveland Hopkins Airport, within the Airport regional job hub, and head south, making stops in Berea, Middleburg Hts, Strongsville, Brunswick and terminating in Medina. This line traverses through many areas of the region that have experienced high amounts of population growth and forecasted to continue to grow, such as Medina County and southeastern Cuyahoga County. This growth could lead to high ridership along this route. Other transfer points would include Berea, where a connection could be made to the proposed BRT route to Elyria, and Cleveland Hopkins Airport, where connections could be made to the Red rail line route heading north towards downtown Cleveland or to the proposed East-West BRT line heading east towards the Southgate Transit Center. At the lines southern end in Medina, riders could transfer to the proposed BRT line traveling eastward to Fairlawn, which provides transfer opportunities north and south to Independence and Akron respectively. Figure 9-24 illustrates the proposed BRT line from Cleveland Hopkins Airport to Medina.

Figure 9-24. Future BRT Route from Cleveland Hopkins Airport to Medina, 2050



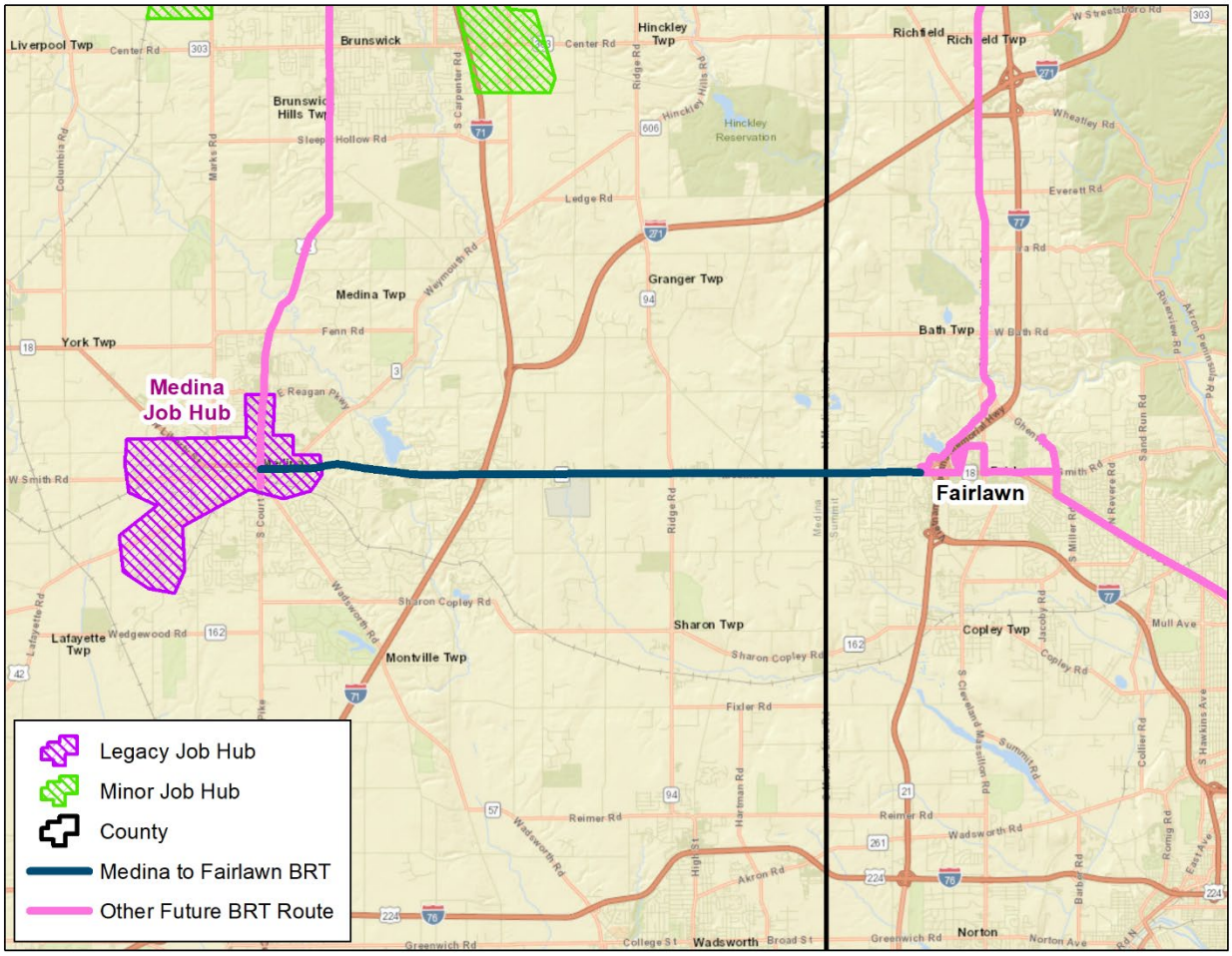
A proposed BRT line would travel from Cleveland Hopkins Airport through Berea and continue west to Elyria. Similar to the proposed BRT line to Medina, this route also travels though communties that have experienced high population growth in the recent past and are forecasted to continue to grow, such as Olmsted Falls, Olmsted Township and North Ridgeville. This could result in a high level of ridership for this extension in 2050. At a transfer point in Berea, riders could head south on the proposed BRT to Medina. Figure 9-25 displays the proposed BRT route from Cleveland Hopkins Airport to Elyria.

Figure 9-25. Future BRT Route from Berea to Elyria, 2050



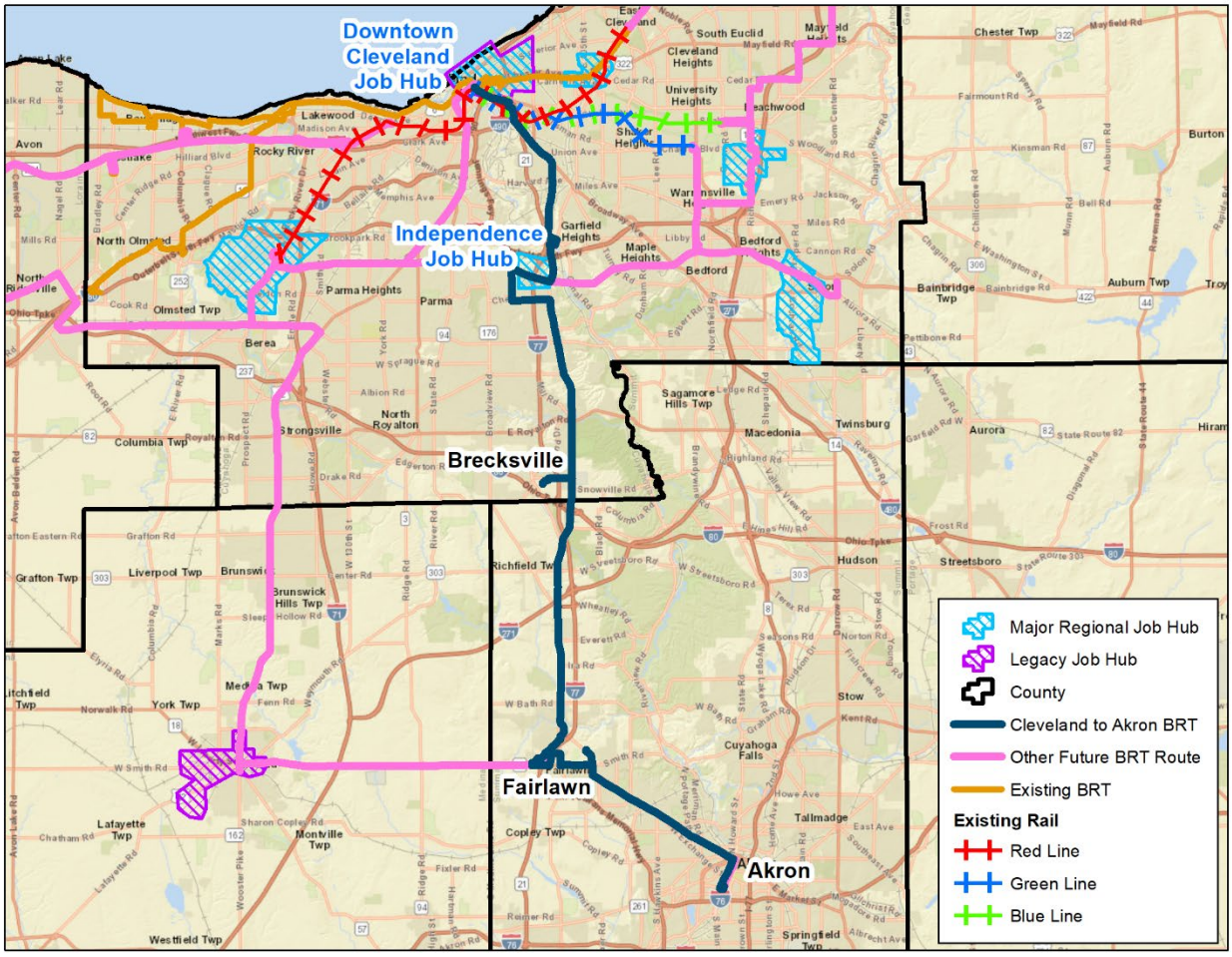
A proposed BRT line would travel from Cleveland Hopkins Airport through Berea and continue west to Elyria. Similar to the proposed BRT line to Medina, this route also travels though communties that have experienced high population growth in the recent past and are forecasted to continue to grow, such as Olmsted Falls, Olmsted Township and North Ridgeville. This could result in a high level of ridership for this extension in 2050. At a transfer point in Berea, riders could head south on the proposed BRT to Medina. Figure 9-25 displays the proposed BRT route from Cleveland Hopkins Airport to Elyria.

Figure 9-26. Future BRT Route from Medina to Fairlawn, 2050



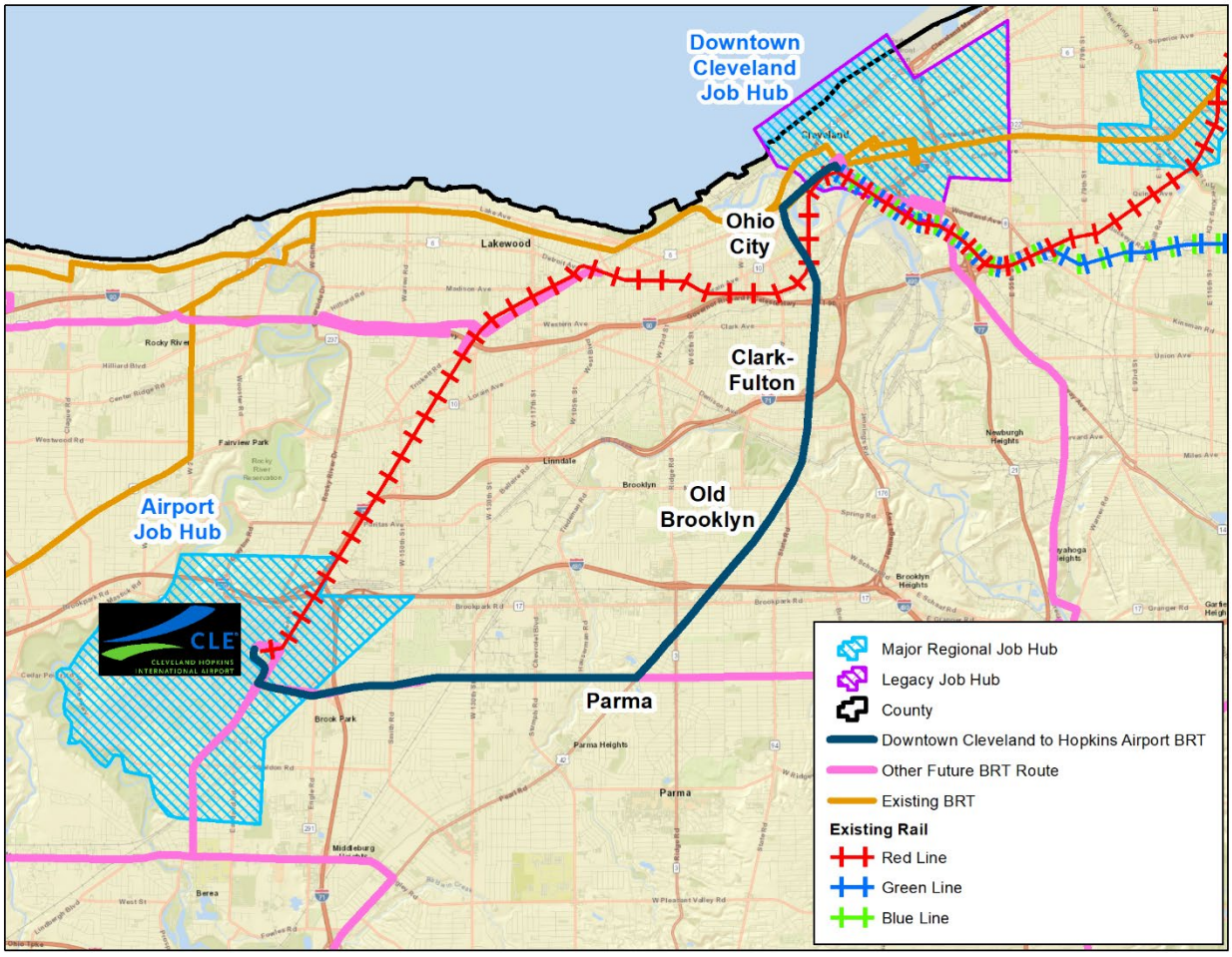
A proposed BRT line would travel from Medina to Fairlawn. This route would connect the City of Medina to major job locations outside the NOACA region, such as Fairlawn and Akron in Summit County, as well as to the Akron METRO transit system, which has major stops in Fairlawn. At a transfer point in Medina, riders could head north on the proposed BRT to Cleveland Hopkins Airport. At a transfer point in Fairlawn, riders could head northbound to two major regional job hubs in Independence and downtown Cleveland. Figure 9-26 displays the proposed BRT route from Cleveland Hopkins Airport to Elyria.

Figure 9-27. Future BRT Route from Cleveland to Akron, 2050



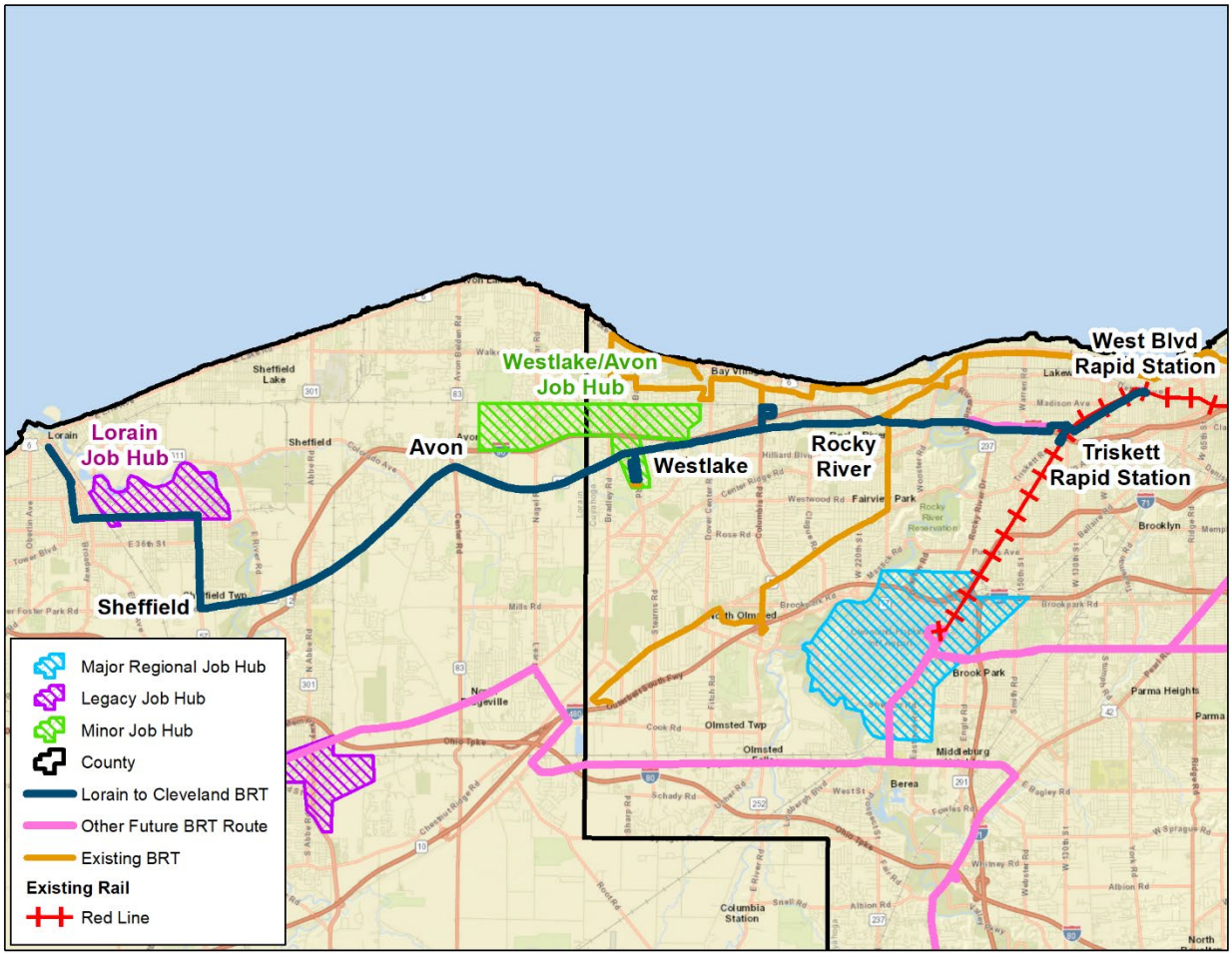
A proposed BRT line would travel from downtown Cleveland through Independence to downtown Akron, three of the largest job centers in Northeast Ohio region. Other large job locations along the route would be in Fairlawn and Brecksville. This proposed route would also provide a major connection between the GCTRA transit system and Akron METRO transit system, with termini at major transfer locations at downtown Cleveland's Public Square and downtown Akron's RKP Transit Center. At a transfer point in Fairlawn, riders could head west on the proposed BRT to Medina. At another transfer point in Independence, riders could head east or west to Southgate Transit Center or the Airport Job Hub respectively. Figure 9-27 displays the proposed BRT route from downtown Cleveland to downtown Akron.

Figure 9-28. Future BRT Route from Cleveland Hopkins Airport to Downtown Cleveland, 2050



A proposed BRT line would travel from Cleveland Hopkins Airport to Downtown Cleveland, through Brook Park, Parma, and the Cleveland neighborhoods of Old Brooklyn, Clark-Fulton, and Ohio City. At Cleveland Hopkins Airport, riders could transfer to the proposed BRT to the proposed East-West BRT line eastward to Southgate Transit Center. Transfers could also be made to the west, south, or north, to the proposed BRT lines to Elyria and Medina, or the existing Red rail line to the downtown Cleveland job hub. Figure 9-28 illustrates the proposed BRT route from Cleveland Hopkins Airport to downtown Cleveland.

Figure 9-29. Future BRT Route from Cleveland (West Blvd. Rail Station) to Lorain, 2050



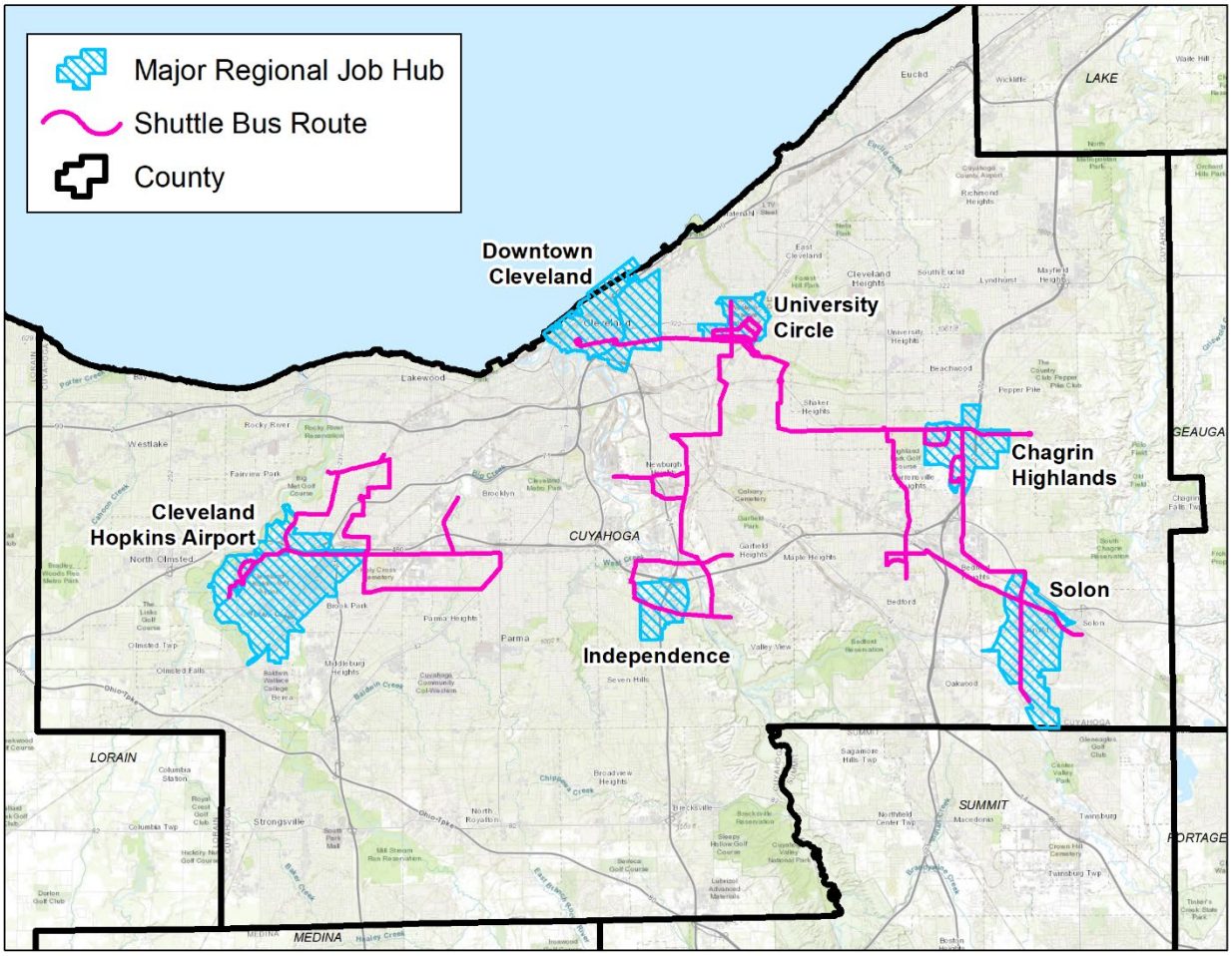
The proposed BRT line would travel between the West Blvd Red Line rail station in Cleveland and the Lorain job hub, making stops in Rocky River, Westlake, Avon and Sheffield. This line traverses through many areas of the region that have experienced high amounts of population growth and forecasted to continue to grow, such as northweastern Lorain County. This growth could lead to high ridership along this route. The major transfer points on this route would be at the Triskett and West Blvd. red line stations, where a connection could be made to the existing red line rail westbound to downtown Cleveland or southbound to Cleveland Hopkins Airport. Another transfer locations along this route would be at the Westlake Park-N-Ride station and in Rocky River to the existing #55 BRT line that connects to cities like North Olmsted, Bay Village, Lakewood and Cleveland. Figure 9-29 illustrates the proposed BRT line from Cleveland's West Blvd. Rail Station to Lorain.

Proposed Autonomous Shuttle Feeder Buses

Autonomous shuttle feeder buses would assist with the last-mile connections of transit riders to jobs. Once a rider reaches a job hub via the expanded transit network, the final location of their work trip might not be within a reasonable walking distance. A series of autonomous shuttles would help circulate riders within the job hub or to other employment centers nearby. In addition, these shuttles would help feed riders into the expanded transit network from nearby residential areas with direct and frequent service to the job hub stations.

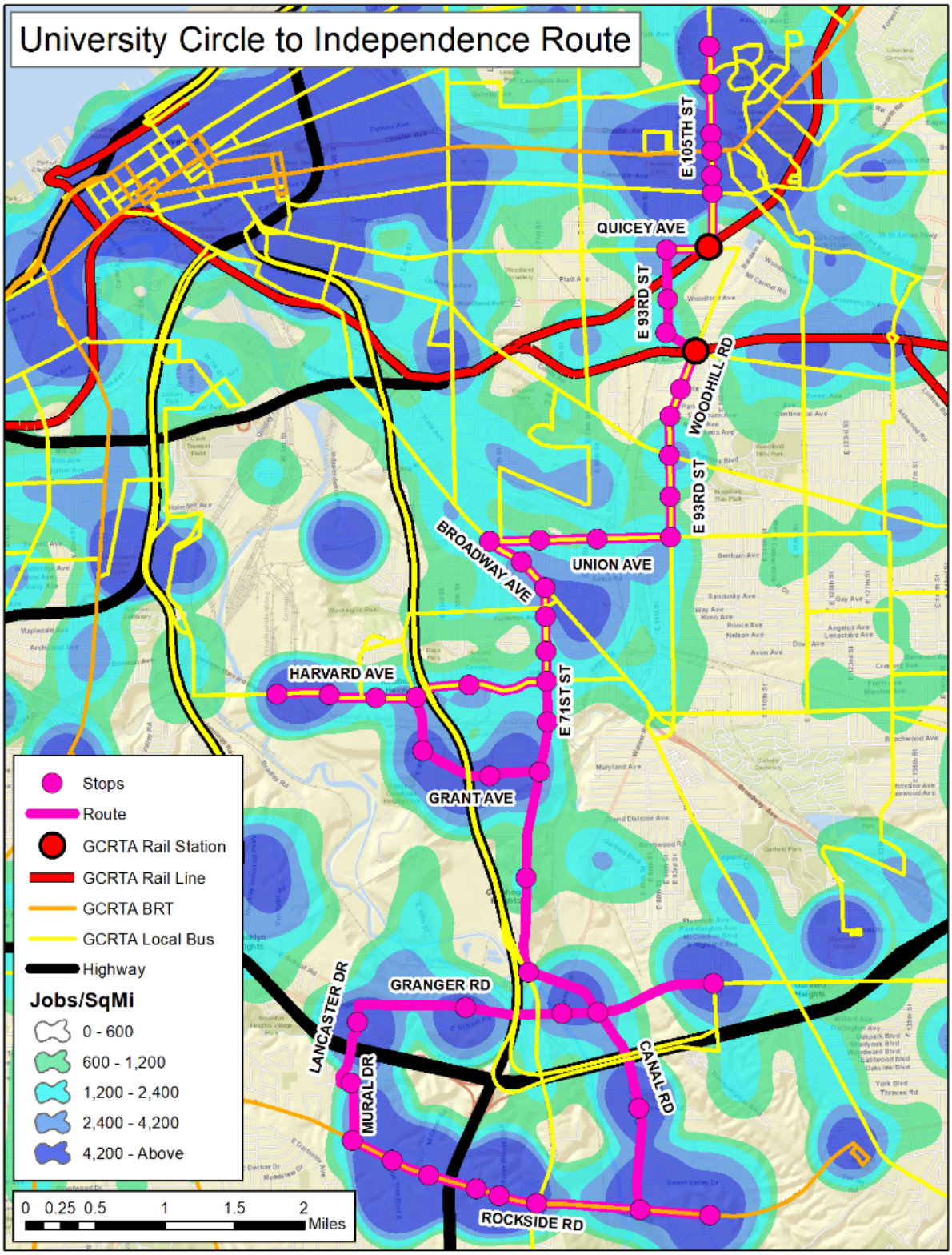
These shuttles would also provide connections to and from job hubs that might not have direct transit service between them, such as University Circle and Independence or Chagrin Highlands and Solon. Ultimately, these autonomous shuttles would serve two major purposes: helping transit riders make their last-mile connections and providing expanded access between residential areas and job hubs. Figure 9-30 illustrates the proposed future autonomous shuttle bus routes. As technologies emerge, shuttles may be able to operate not on fixed routes but rather on-demand similarly to a taxi service.

Figure 9-30. Autonomous Shuttle Feeder Buses and Connections to Major Regional Job Hubs



As a more detailed example, Figure 9-31 shows a potential route that an autonomous shuttle could take between the University Circle regional job hub and the Independence regional job hub. The shuttles would circulate riders to significant employment centers in and around the job hubs, as can be seen when examining the job density of the area. Transit riders living in between the two hubs would also have improved access to either hub, either by walking to a shuttle stop or transferring from a local bus onto the autonomous shuttle. The shuttle routes would also feed the expanded rail network by making stops at the various rail stations along the route, where riders could then travel to other job hubs and employment centers throughout the region.

Figure 9-31. Autonomous Shuttle Feeder Bus Route from University Circle to Independence

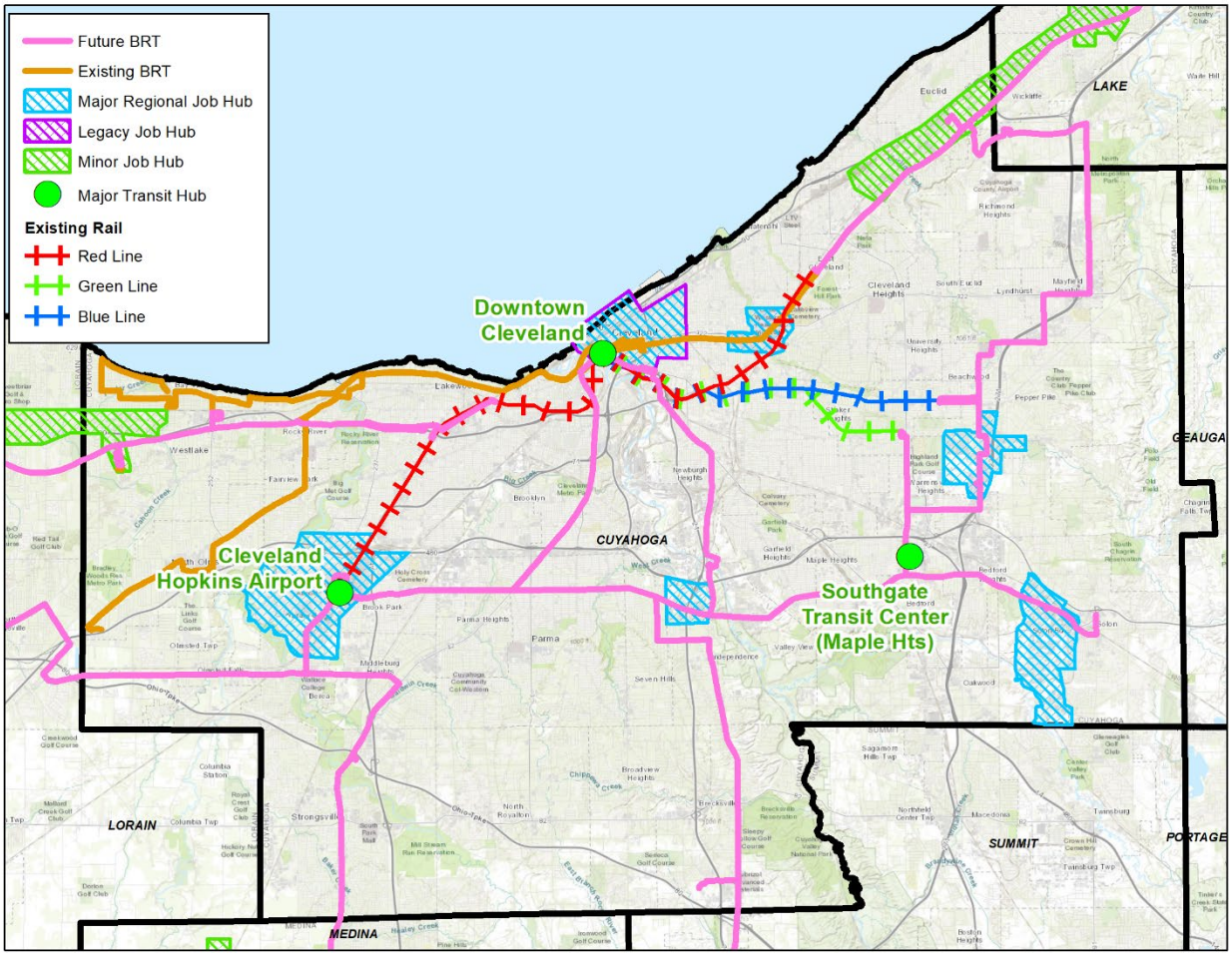


Major Transit Hubs

With the expansion of the BRT network into 2050, the transit system would need the establishment of new major transit hubs that would serve as transfer points between BRT lines, as well as other transit modes. Tower City and Public Square in downtown Cleveland would continue to be the largest major transit hub of the regional transit system with three rail lines and future BRT lines serving this location, and many other transit modes, such as exisitng BRT routes (Healthline and Cleveland State line), premium bus, local bus, and autonomous shuttles also connecting here. The Cleveland Hopkins Airport would also become a major transit hub, with the inclusion of new the BRT routes to Medina and Elyria, and the East-West BRT line terminating here. Local buses and autonomous shuttles would also serve the Cleveland Hopkins Airport hub.

On the eastside of Cuyahoga County, a transit hub would be established at the Southgate Transit Center in Maple Heights. This location currently has local bus service and the addition of 3 BRT lines to Cleveland Hopkins Airport, Euclid and Solon will create an even greater need to create a major transit hub here. Figure 9-32 displays locations of the major transit hubs in the NOACA region.

Figure 9-32. Major Transit Hubs in the NOACA Region (2050)



Plug-In Electric Vehicles (PEV)

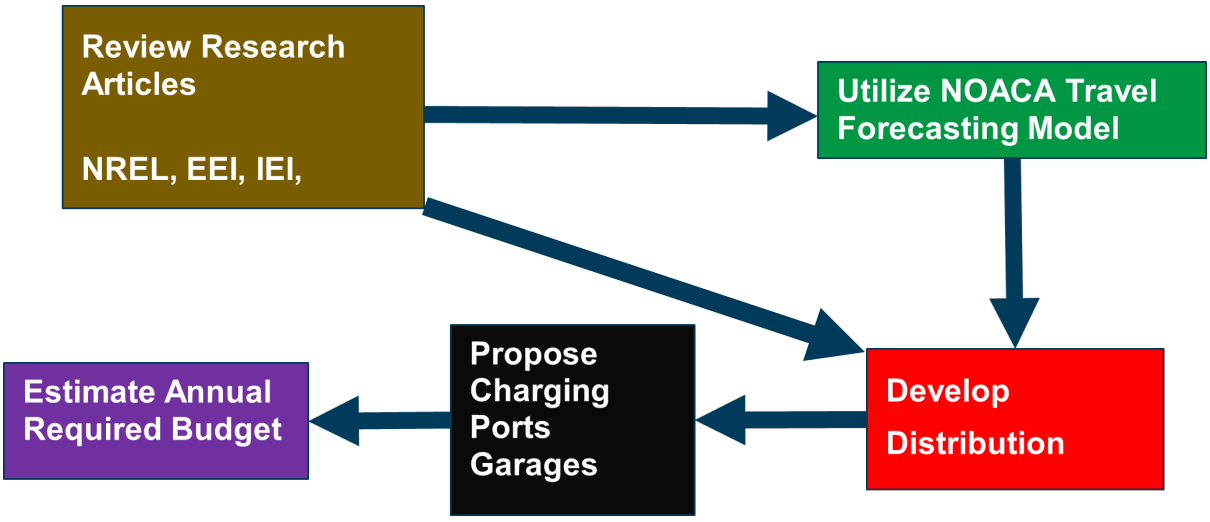
The future of Plug-in Electric Vehicles (PEVs) is evolving rapidly. The National Renewable Energy Laboratory (NREL) spearheads transportation research, development, and deployment to accelerate the widespread adoption of high-performance, low-emission, energy-efficient passenger and freight vehicles. This section has used those reports and materials extensively. This section summarizes the recently developed NOACA plan, "PEV Charging Station Site Plan". This plan discusses the current status and projected growth of PEVs over the next three decades in the NOACA region and also focuses on the required workplace charging stations and Direct Current Fast Charging (DCFC) stations. The plan also proposes parking garages and lots for locating these charging stations.

The required PEV charging station sites are a necessary part of the required Electric Vehicle Supply Equipment (EVSE). As expected, many PEV owners currently charge their vehicles overnight at home using residential charging ports, however, residential charging will not be adequate for the expected PEV growth in the next three decades. The NOACA site plan identifies the locations of the workplace charging stations and publically accessible DCFC stations as the required EVSE complement to residential charging. As the workplace station name indicates, these charging stations will be placed at the parking garages and lots close to major employment activities in the NOACA region. The main factor for selecting these parking garages is the walking distance of 0.5 miles to workplaces as the final destinations of workers. For financial and practical purposes, each selected parking lot was deemed to have 20 or fewer charging ports.

According to the NOACA charging station site plan, the location of the DCFC charging stations would be located along highly travelled identified routes of PEVs and also along major highway routes for long-distance travelers.

Figure 9-33 illustrates the study process of the NOACA-implemented charging station sitting plan for identifying charging ports in publicly and privately owned garages.

Figure 9-33. The Electric Vehicle Supply Equipment (EVSE) Study Process



Charging Station Type

Based on the NREL documents, there are currently three types of charging station for PEVs, and Table 9-4 shows their general level, location and other characteristics.

Table 9-4. Charging Station Types

Charging Level	Charging Time	Vehicle Range Added (Mile)	Power Rate (kw)	Supply Power
AC Level 1	One Hour	4 6	1.4 1.9	120VAC/20A (12-16A continuous)
AC Level 2	One Hour	10 20 60	3.4 6.6 19.2	208/240VAC/20-100A (16-80A continuous)
DC Fast Charging (DCFC)	20 Minutes	24 50 90	24 50 90	240/480VAC 3-phase (input current proportional to output power; ~20-400A AC)

Plug-In Electric Vehicle (PEV) Forecast

The recent NOACA "PEV Charging Station Site Plan" developed an estimated annual PEV forecast based on several independent forecasts of PEV sales projections. These forecasts included three key factors in their projections:

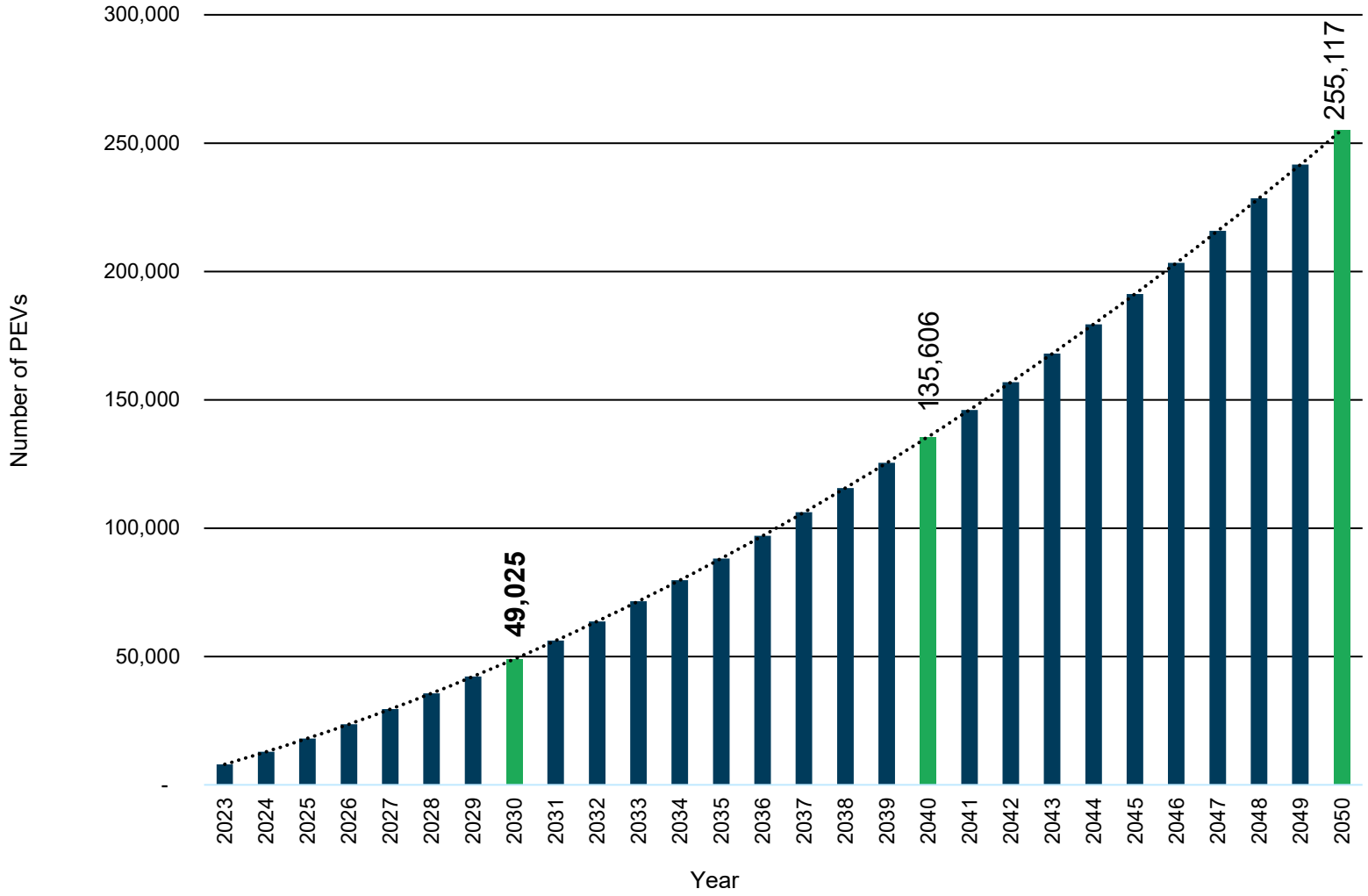
- Customer preference models that determine interest in PEVs,
- Declining battery costs influence PEV cost competitiveness with internal combustion engine vehicles and manufacturer profitability, and
- Fuel efficiency standard and environmental regulations.

The estimated number of Plug-in Electric Vehicles (PEVs) in the NOACA region by 2050 was calculated using online data on EV adoption by state in 2023. As of June 2024, this data reflected the number of registered electric vehicles (EVs) per 100,000 residents in each state. According to a Visual Capitalist's research infographic from 2024, in the State of Ohio, there are 391 EVs per 100,000 people.[3] Applying this figure to the NOACA region's population, we estimate that there are approximately 8,011 electric vehicles.
Future projections for PEV growth have been made using this data and a polynomial equation. The equation $y = 164.65x^2 + 4377.2x + 3470$ models the increase in EVs over time, where y represents the number of electric vehicles and x stands for the number of years. This equation demonstrates that the number of electric vehicles is not only increasing but also accelerating over time.

Based on this formula, it is anticipated that there will be 49,025 electric vehicles on NOACA roadways by 2030. By 2040, this number will rise to 135,606, and by 2050, it is projected that 255,117 electric vehicles will be in use, as illustrated in Figure 9-34 below.

[3] Venditti, Bruno. "Mapped: Electric Vehicle Adoption by State." Visual Capitalist, 20 Aug. 2024, www.visualcapitalist.com/mapped-electric-vehicle-adoption-by-s Accessed May 27, 2025

Figure 9-34. Estimated Number of PEVs in the NOACA Region



Plug-In Electric Vehicle (PEV) Charging Stations

The NOACA plan projects the yearly number of charging stations needed to meet the anticipated annual PEV usage. Table 9-5 lists the overall required expenditure for AC Level 2 and DCFC ports as well as the necessary charging ports by 2050.

FHWA recently recommended installing at least four EV charging ports at the same location and replicating the service ability of current fuel stations for conventional internal combustion engine vehicles, which can serve several users at the same time. The *eNEO2050* update applies to the FHWA recommendation. Hence, the charger allocation at each location is as follows:

1. **4 AC Level 2 Chargers**: Ideal for locations with extended parking durations, such as office buildings.
2. **4 DC Fast Chargers (DCFC)**: Strategically placed near major highways or roads, these chargers offer fast charging, allowing vehicles to recharge fully in about 45 minutes.
3. **2 AC Level 2 and 2 DCFC**

After estimating the total number of plug-in electric vehicles (PEVs), the required number of chargers was calculated based on an annual growth rate of 4%. This growth rate helps us project how many chargers will be needed by the year 2050. Out of the total estimated electric vehicle (EV) chargers, the distribution is as follows:

80% are for home use, meaning most people charge their electric vehicles at home, 10% are AC Level 2 chargers, which are typically found in public spaces or workplaces, 0.5% are DC fast chargers, which provide very quick charging, and other 0.5% is a mix of AC Level 2 and DC fast chargers. Hence, after calculating the estimated chargers for different categories, we came up with the total number of AC Level 2 and DCFC chargers. It has been assumed that there is one charger for every two cars. Given that we calculated the estimated number of charging ports needed in the NOACA region by 2050, as shown in Table 9-5.

The cost of each charger was determined based on the allocated budget, and the projected cost for the chargers required by 2050 was calculated by multiplying the cost of each charger by the total number of chargers needed.

Table 9-5. Estimated Number of Required Charging Ports by Planning Year

CHARGING TYPE	2025 - 2030	2030 - 2040	2040 - 2050
AC LEVEL 2	181	433	598
DCFC	108	260	359
TOTAL OF CHARGERS	**289**	**693**	**957**
TOTAL REQUIRED BUDGET FOR AC LEVEL 2 AND DCFC CHARGERS (2025$)	**$13.5 Million**	**$32 Million**	**$44.5 Million**

Figures 9-35 and 9-36 represent projections for the number of Level 2 AC and DCFC charging ports in the NOACA region by 2050, respectively.

Figure 9-35 illustrates the expected growth in the number of Level 2 AC charging ports, with 34 projected for 2030, 52 for 2040, and 67 for 2050. This steady increase highlights the region's effort to expand its electric vehicle (EV) charging infrastructure to accommodate the growing demand for EVs.

Figure 9-36, on the other hand, shows projections for DCFC ports, with 21 expected in 2030, 30 by 2040, and 40 by 2050. The figures indicate a gradual increase in fast-charging infrastructure to support the region's transition to electric vehicles.

Figure 9-35. Estimated Number of L2 Ports by 2050 in the NOACA Region

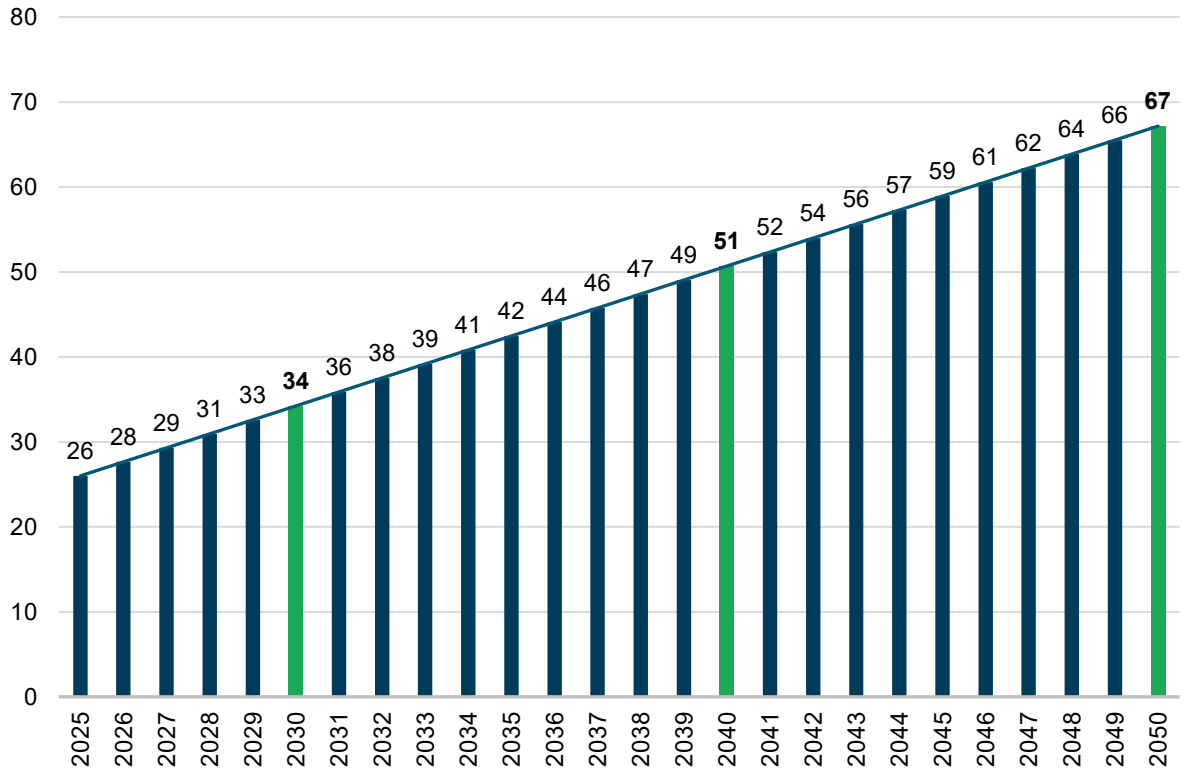
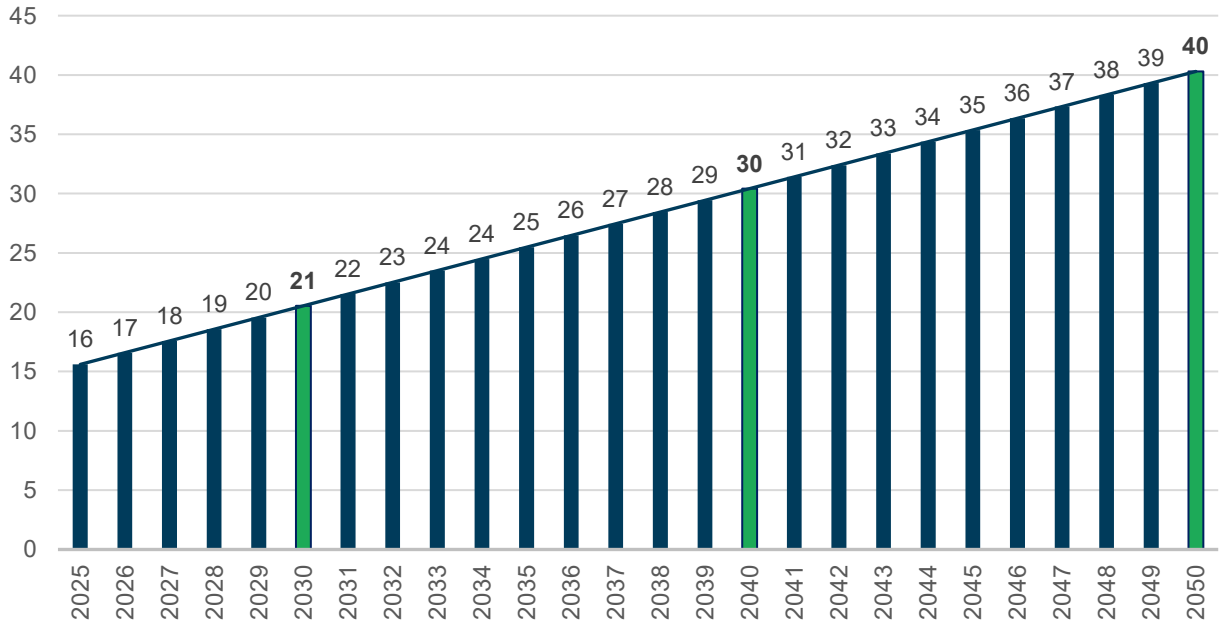


Figure 9-36. Estimated Number of DCFC Ports by 2050 in the NOACA Region



As previously stated, each location will have at least 4 charging ports. According to the projections of chargers, it is estimated that a total of 446 charging sites will be necessary in the NOACA region by 2050, as outlined in Table 9-6.

These 446 sites will be distributed across the 2,000-square-mile NOACA region. The chargers will be evenly spaced, each station approximately one to one and a half miles apart, ensuring easy access to electric vehicle charging ports throughout the region.

Table 9-6. Estimated Number of Required Sites by Planning Year

YEARS	TOTAL SITES
2025 - 2030	63
2030 - 2040	158
2040 - 2050	225
TOTAL	**446**

The plan emphasizes specific employment centers that have a high amount of work trip destinations, as well as high volume corridors that represent the traffic traveling through an area. The DCFC charging ports will mainly be located on high volume corridors of PEV early adopters and regional through-traffic, and regionally significant intersections and interchanges in terms of traffic volumes. PEV early adopters were identified as those travelers living in high income neighborhoods and it was posited that they were the likeliest in the region to be owners of PEVs in the near future due to their high cost compared to traditional gas vehicles. Regional through-traffic was included in the analysis since these users are generally traveling far distances and thus would have an increased need to use a DCFC station compared to users traveling shorter distances. The typical daily routes of all the PEV early adopters and regional through-traffic were generated by the NOACA travel forecasting model, and areas where there was a high amount of cross traffic of these early adopters' routes were selected as the optimal locations for DCFC

stations. All of these optimal locations are near busy highway interchanges, which makes sense since those are often locations where many current gas stations are found.

DCFC locations were also prioritized at locations along the major arterial network. The rational being that this would also provide access to DCFC ports to those residents not using the interstate system for longer trips. The intersections of the major arterial network were identified as possible locations that also represented a significant amount of cross traffic leading to a high usage rate of DCFC stations. Large parking locations, either privately or publicly owned, were then identified near these optimal interchanges and intersections to allow for immediate access off of these high traveled corridors. Some locations, due to their proximity to both high traveled corridors and employment centers, made them ideal candidates for both workplace Level 2 and DCFC ports, and the co-locating of these port types is being explored.

Currently, locations of fuel stations for the conventional internal combustion engine vehicles are distributed in such a way that drivers can reach one of these locations by driving a few miles. The ultimate objective of the PEV charging port location distribution and consequently their coverage area is to mimic the current gas station distribution.

Figures 9-37 and 9-38 show the selected public-owned parking locations, the selected privately-owned parking locations most suitable for PEV charging stations. Also, Figures 9-39 and 9-40 display the ultimate coverage area of DCFC ports in 2030 and 2050

Figure 9-37. Proposed Government Owned Workplace (Level 2) and DCFC Port Locations

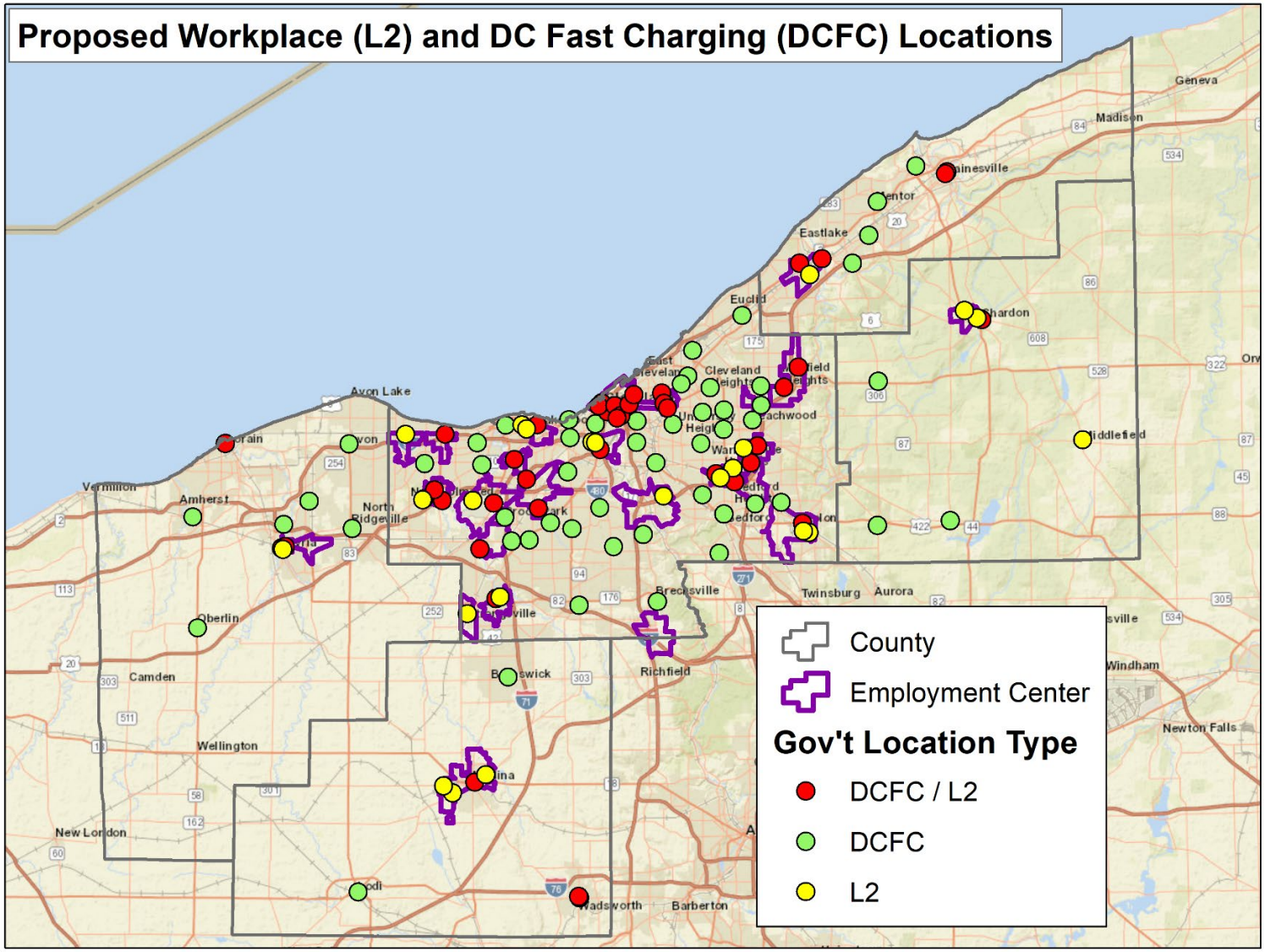


Figure 9-38. Proposed Private Owned Workplace (Level 2) and DCFC Port Locations

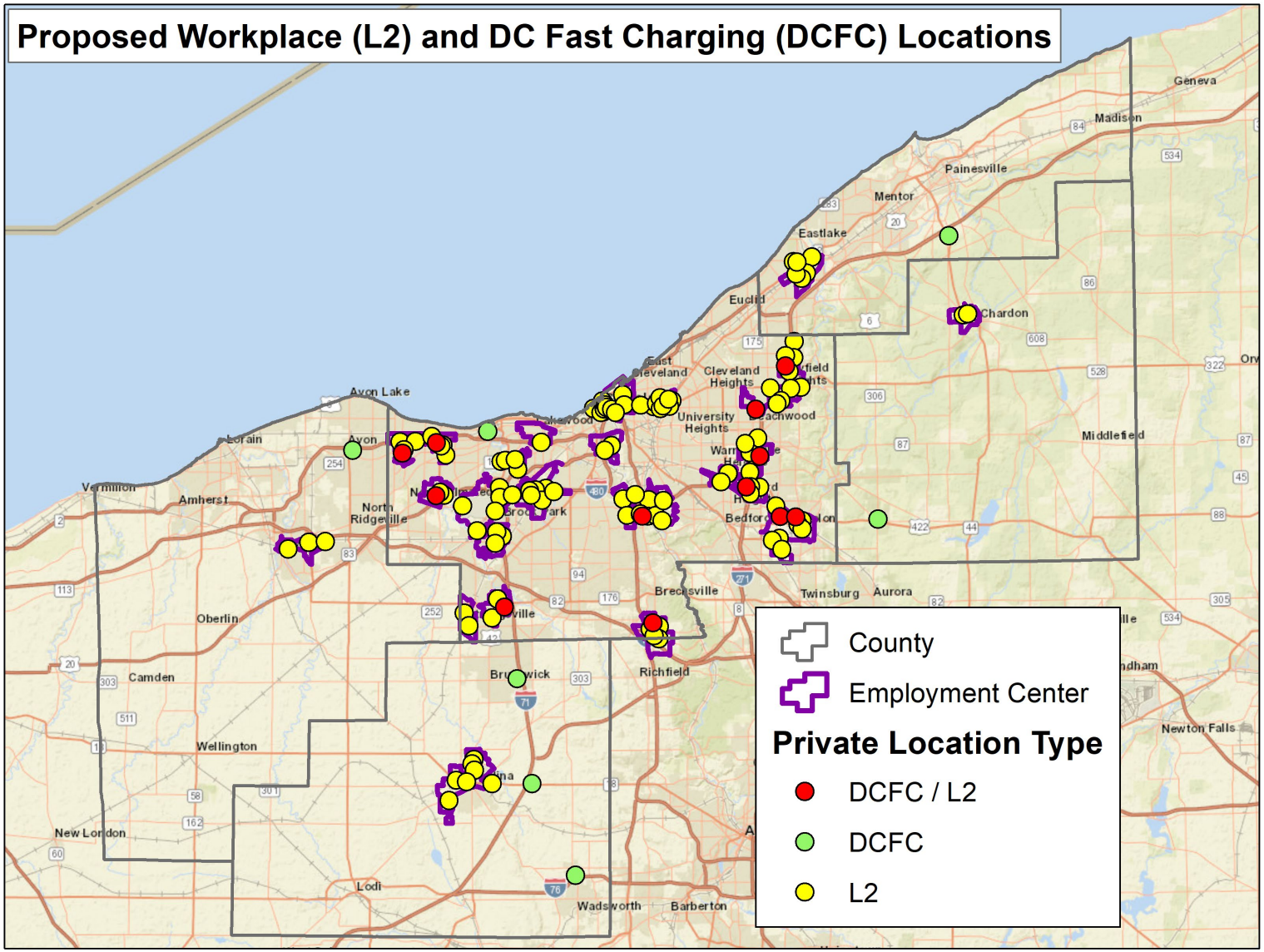


Figure 9-39. The Coverage Area for DCFC Locations (2030)

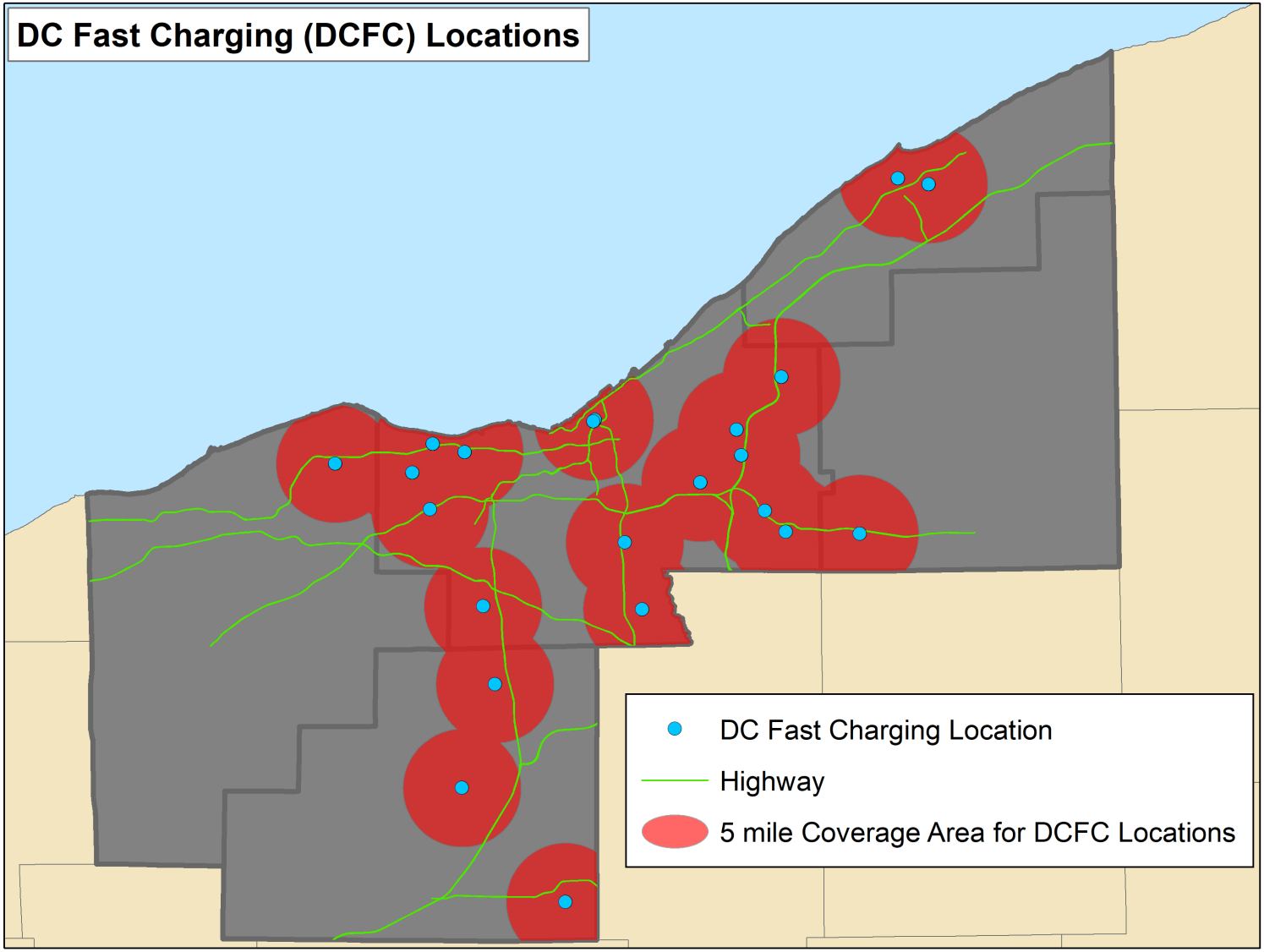
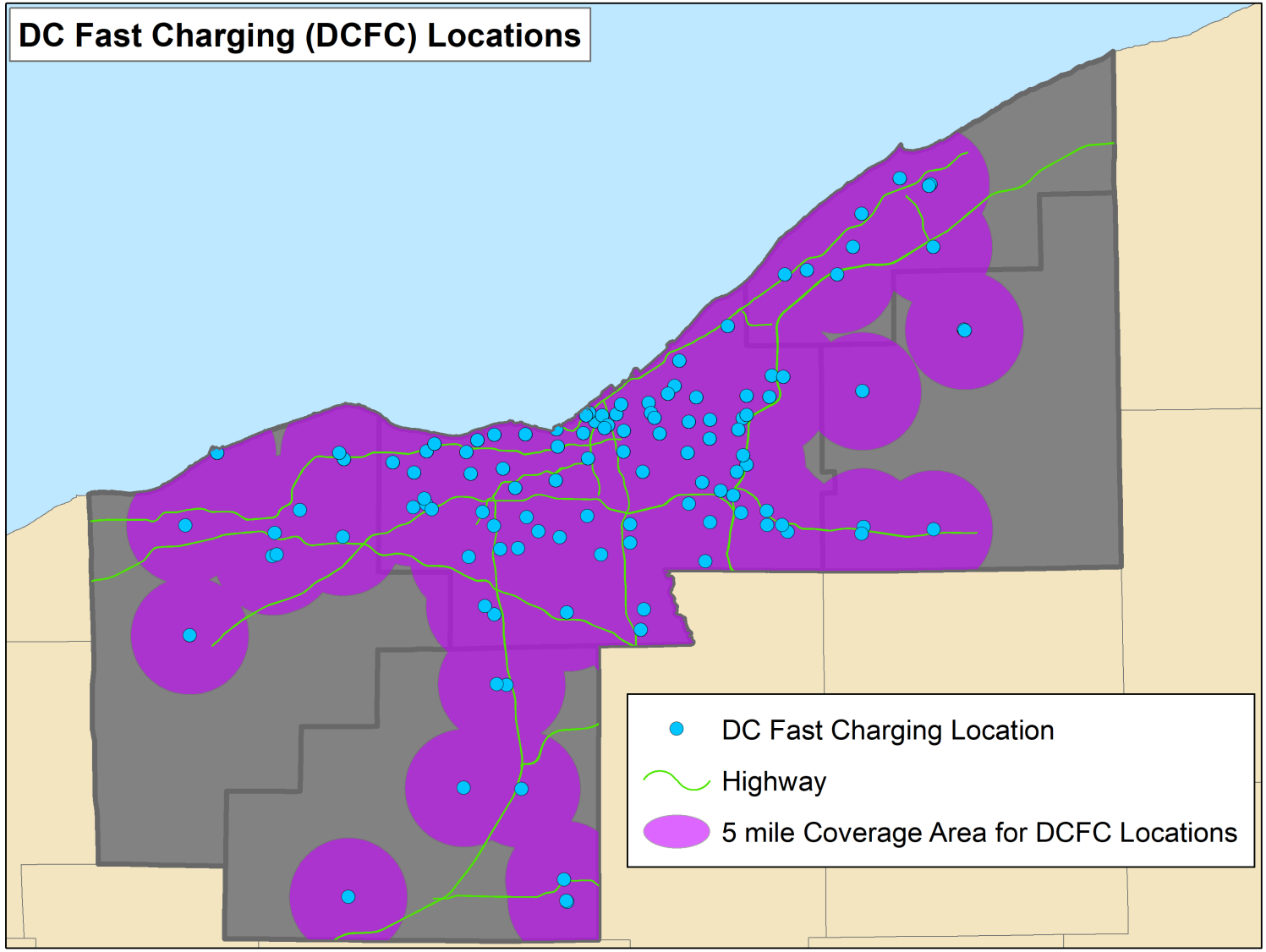


Figure 9-40. The Coverage Area for DCFC Locations (2050)



Connected and Autonomous Vehicles (CAVs)

Over a century ago, automobiles or horseless carriages were a revolutionary transportation option. Their deployment altered land use and travel patterns and drove the development of transportation infrastructure, policies, and regulations. Today it is Connected and Automated Vehicles (CAVs) that are poised to bring the next wave of changes to the transportation system in conjunction with related developments in vehicle electrification, shared mobility, and the emergence of new mode options such as electric scooters.

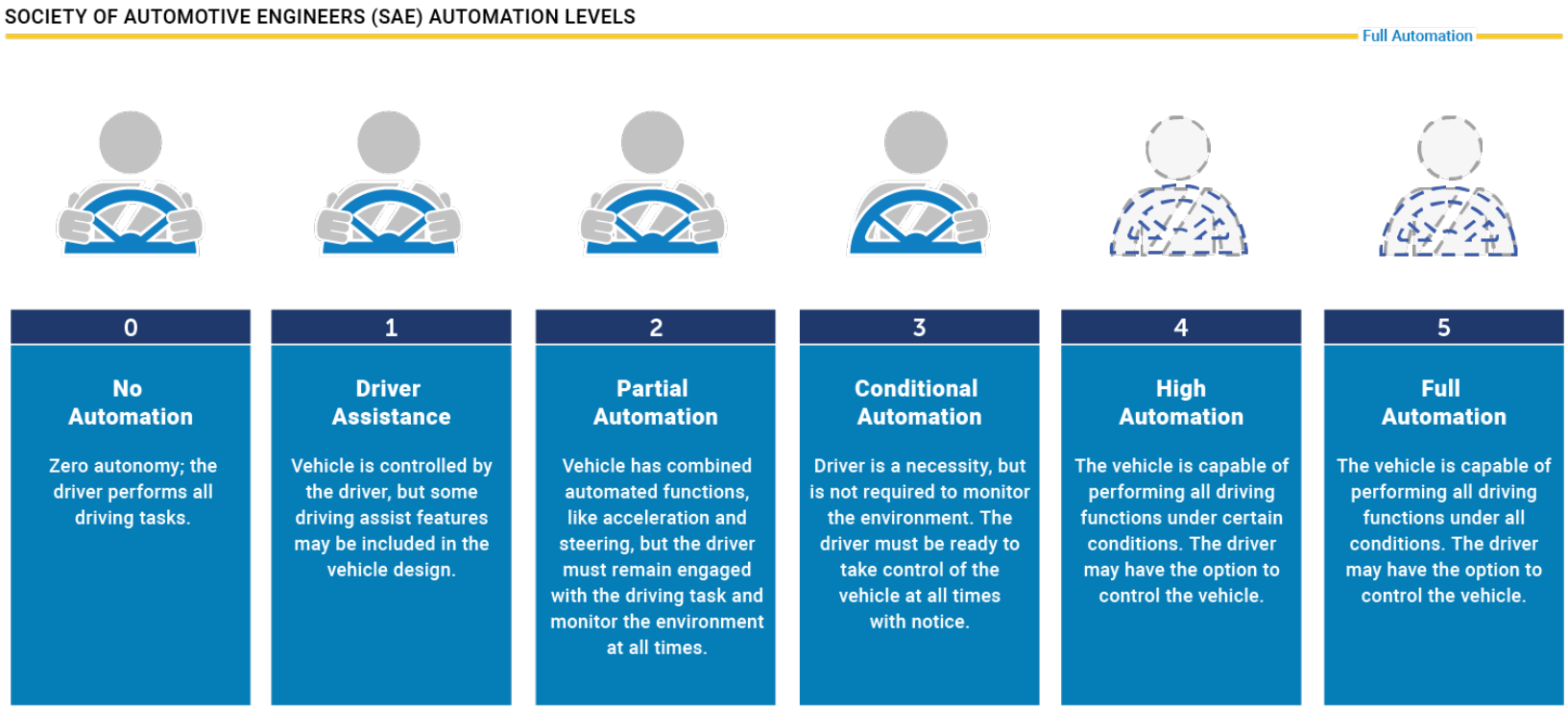
Connected vehicles are connected through interoperable wireless communications to other vehicles (V2V), transportation infrastructure (V2I), and to everything (V2X).

Automated vehicles use on-board and remote hardware and software to perform driving functions. The National Highway Traffic Safety Administration (NHTSA) has adopted the following Society of Automotive Engineers (SAE) Automation Levels:

- Level Zero: No Automation
- Level One: Driver Assistance
- Level Two: Partial Automation
- Level Three: Conditional Automation
- Level Four: High Automation
- Level Five: Full Automation

Table 9-7 displays these levels schematically.

Figure 9-41. Society of Automotive Engineers (SAE) Automation Levels[4]



[4] https://www.sae.org/blog/sae-j3016-update Accessed May 27, 2025

While there are vehicles in the current fleet with elements of connected and automated vehicle technology, there is still considerable uncertainty in how exactly full-scale deployment will play out. Although this makes it difficult to predict its impacts with certainty, this chapter explores what it means for the transportation system and its users.
Potential opportunities for CAVs are:

- Currently, user error is the main factor in accidents. CAVs will improve safety by reducing user error.
- Increased capacity, reduced congestion, and fewer high-capacity improvements due to the potential to operate with fewer incidents, decreased following distances, and narrower lane widths.
- Improved first and last mile connections with transit.
- With appropriate design, moderated or decreased growth in vehicle miles traveled and increased growth in ridesharing, public transportation use, bicycling, and walking
- New funding and financing mechanisms and the potential to leverage private sector funds
- Expanded mobility for those currently unable to drive
- Increased efficiency for freight movement through improved efficiency and applications such as freight platooning
- Additional data source
- Potential to retrofit the built environment and provide more complete streets, for example to repurpose parking

Challenges of CAVs are:

- Safety in a mixed fleet environment during early deployment
- Security from vulnerabilities and intrusions to connected elements
- Increased vehicle miles traveled due to improved traffic flow, additional mobility options, and zero occupancy vehicles
- Decrease in public transportation use due to the alternative mode options
- Impacts on current funding and financing mechanisms as individual ownership could transition to shared fleets or on demand services
- Cost of infrastructure required to support the new technology
- Need for better maintenance of the roads as vehicles rely on sensors and technology
- Potential for deployment to disadvantage some transportation system users or impact vulnerable road users
- Induce sprawl or encouraging “super-commutes”
- Certain transportation investments may become obsolete

Non-motorized Transportation Facilities

Scenarios 3 and 4 include potential future bicycle networks and pedestrian improvements. To determine the addition of new bicycle and pedestrian facilities, NOACA first identified active transportation projects, many that have been proposed in existing planning documents. After identifying the proposed projects, NOACA evaluated them along multiple criteria to determine likely implementation decades. This section briefly outlines both steps to provide context to the discussion of the scenarios.

Identification of Potential Active Transportation Initiatives

Active transportation facility projects are derived from various sources, both within and external to the organization. NOACA’s ACTIVATE plan and Regional Metroparks Trails Connectivity Study (RMTCS) are the foundation for the mapped bicycle and pedestrian facilities, featuring the results of ACTIVATE’s bicycle demand analysis and RMTCS’s project recommendations. ACTIVATE’s

Connectivity Quantitative Score Index (CQSI) analysis is used to guide recommended locations for both bicycle and pedestrian facilities. Another resource for the LRP is NOACA's Transportation for Livable Communities Initiative (TLCI) program that has completed more than 100 studies, many of which include recommendations for active transportation facilities. These studies were initiated in partnership with local communities and their insight is invaluable. Furthermore, other collaborations, such as the Cuyahoga Greenways and Cleveland Moves, provided additional project ideas, as did NOACA's Bicycle and Pedestrian Advisory Council. The Cuyahoga Greenways and Cleveland Moves plans are in the process of being completed at the time of publication. Preliminary project recommendations from the development of these plans informed RMTCS recommendations and LRP Scenario development. Lastly, needs were identified as part of the w*eNEO2050+* planning efforts, which included research, analysis and modeling as well as significant public outreach.

Bike and pedestrian facility projects are categorized according to the sources from which they were derived:

NOACA ACTIVATE and RMTCS plans identify the following projects:

- Increased sidewalk coverage,
- Pedestrian infrastructure crossing improvements at intersections,
- Pedestrian infrastructure crossing improvements at midblock crossings,
- Improved pedestrian and bicycle access to/from transit stops, and
- Regional Priority Bike Network (RPBN) routes.

weNEO2050+ identifies specific needs of the transportation network that can be supported through investments in active transportation:

1. Connections from major transit hubs to major job hubs,
2. Access connection from neighborhoods with many zero-car households to transit network stations (first-/last-mile),
3. Access from major residential areas to transit network stations (first-/last-mile),
4. Major transit hub bike storage improvements, and
5. Smart crossings at midblock locations along major arterials.

TLCI studies and plans by other organizations have identified active transportation projects for particular corridors and routes across the region:

- State and US bike routes along high stress corridors according to ODOT plans,
- Bike facility and pedestrian streetscape projects ,
- Cuyahoga Greenways Plan network,
- Cleveland Moves recommended projects,
- Bike project recommended by other studies or plans tracked in NOACA's bike network inventory file, and
- Projects submitted by local agencies.

While there is some attention to the improved utilization of major arterials for motorized vehicles, the conclusion does not preclude bicycle facilities on major arterials. Many factors will be evaluated to ensure safe travel for all modes, such as traffic volumes, destinations, geography, redundancy and local access. To that end, the following bike lanes along major arterials are included:

- An on-road facility type was specifically recommended along a potential road diet candidate.
- The recommended facility is an off-road all-purpose trail,
- The project is already in active status, and
- A lane reduction was already implemented.

For modelling purposes, however, bicycle facilities were excluded as non-motorized facility projects if an on-road facility type required lane reductions, but it was deemed not feasible due to roadway characteristics of the major arterial.

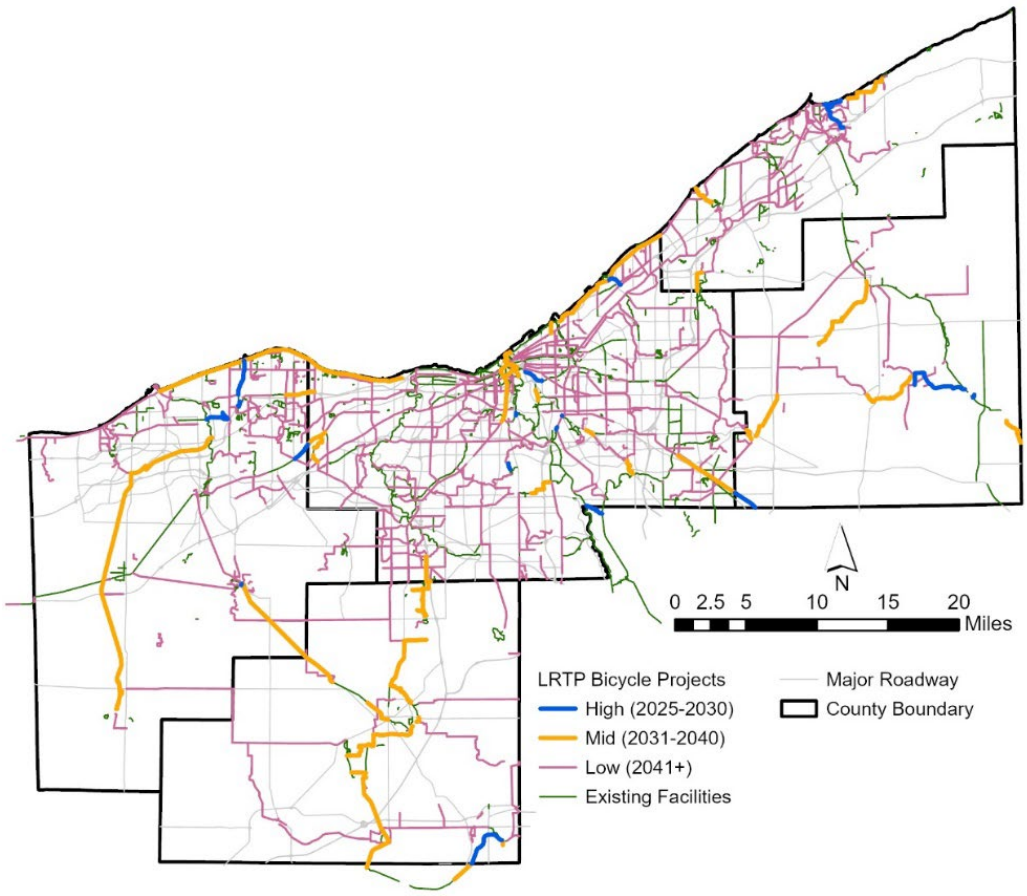
Prioritization Based on Implementation Decade

The bike and pedestrian projects considered have been divided into three Priority Tiers: HIGH, MID, and LOW, with each representing a different implementation decade of:

- 2025-2030,
- 2031-2040, and
- 2041-2050.

The project priority tier is determined by the process and methodology exposited in the RMTCS report. The study went through a multi-phase process analyzing existing conditions and plans, stakeholder input, community engagement, fiscal constraint, and technical analysis. Technical criteria considered in this analysis included quantified measures of connections between parks and trails, people and jobs, and regionally significant destinations. These measures were weighted based on stakeholder and community input to develop a composite Trip Potential score for routes analyzed during the network development phase, with report recommendations confirmed to be in accordance with the priorities of local jurisdictions and likely project sponsors via a final round of stakeholder input.

Figure 9-42. Bicycle Projects



Scenario Planning

Recent planning practices have demonstrated that the traditional approach of first generating predictions as a continuation of current or historical trends and then planning accordingly does not accommodate the uncertainty of events that may occur. To mitigate this uncertainty, the second level of planning adds an investment scenario analysis. A scenario analysis essentially accounts for the risks and preferences associated with various transportation investment decisions.

Scenario planning is a technique used to better prepare for the future by developing multiple plausible situations, or scenarios, representing alternative futures rather than committing to prepare for a single expected future. Scenario planning may consider situations which are not reachable by the current trend. For example, a traditional trend-based planning approach is unlikely to forecast a high investment in extending the current trail network in the NOACA region. Scenario planning approach shifts from predicting the future to preparing for potential futures. Similar to the traditional trend-based planning, the starting point of the scenario analysis is the current year rather than a future year.

Figure 9-43. Traditional and Risk Analysis Planning Approaches

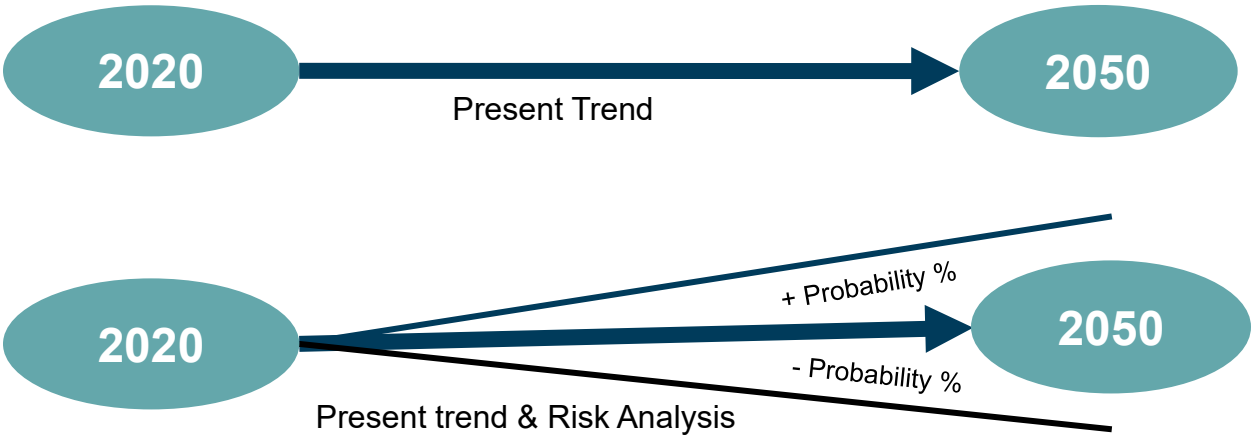
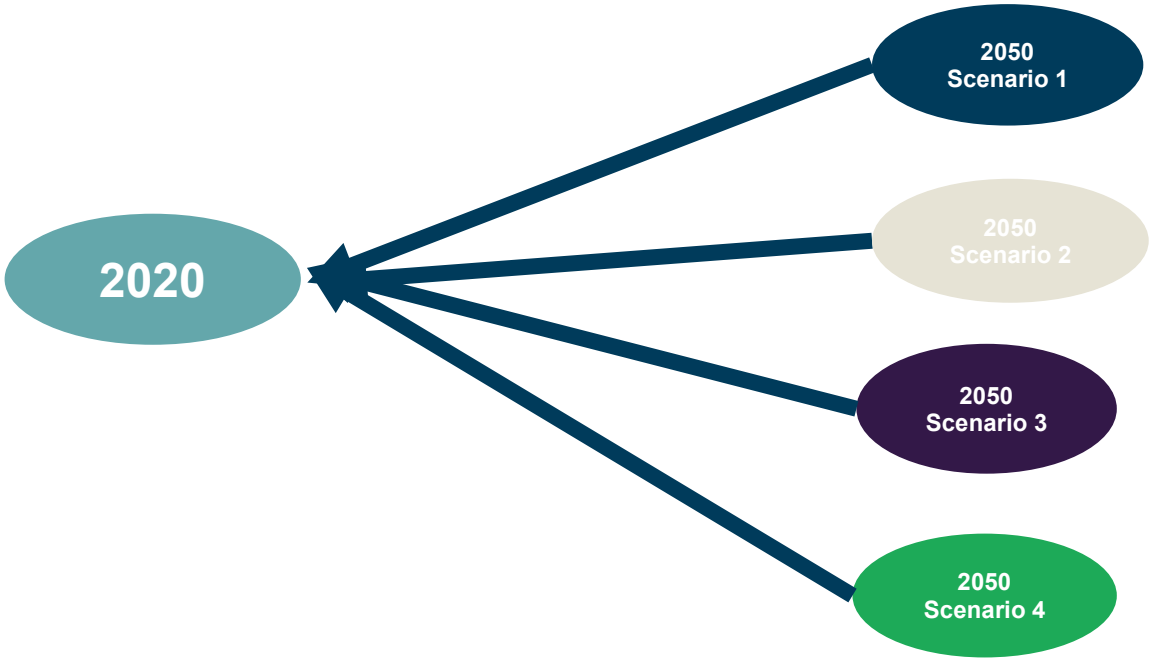


Figure 9-44. Scenario Planning Approach



Description of Four Investment Scenarios

The Long Range Transportation Plan (LRTP) scenarios are based on the projects discussed in previous sections. Each scenario includes a set of proposed projects, their implementation decades and applied technology levels. Each scenario uses assumptions about the regional growth/development patterns (see section 9.3.2 for details). The scenarios reflect that transportation investments on the one hand accommodate existing growth patterns while also perpetuating or changing them. Growth patterns and transportation investment taken together have implications for the quality of life in the region in 2050. The four scenarios are subsequently described. It needs to be noted that the scenarios make simplified assumptions about the transportation investments to establish reference points to explore a future mix of investments as part of the visioning. In other words, the scenarios are models that can aid a regional conversation about desirable transportation investments when developing the Transportation Improvement Program.

Table 9-8 displays the title and theme of the proposed scenarios.

Table 9-7. LRTP Scenarios: Name, Title and Theme

Scenario Name	Title	Theme
1:MAINTAIN	**Maintain** Infrastructure System	State of Good Repair
2:CAR	**C**aptivating **A**uto **R**egion	Single Occupancy Vehicle
3:TRANSIT	**TRAN**sportation **S**ystem with **I**mproved **T**ransit	Multimodal Transportation System
4:TOTAL	**T**ransportation with **O**ptimal **T**echnology and **A**ccess for AL**L**	Advanced Multimodal Transportation System

Short descriptions of each scenario are below.

Scenario 1: MAINTAIN

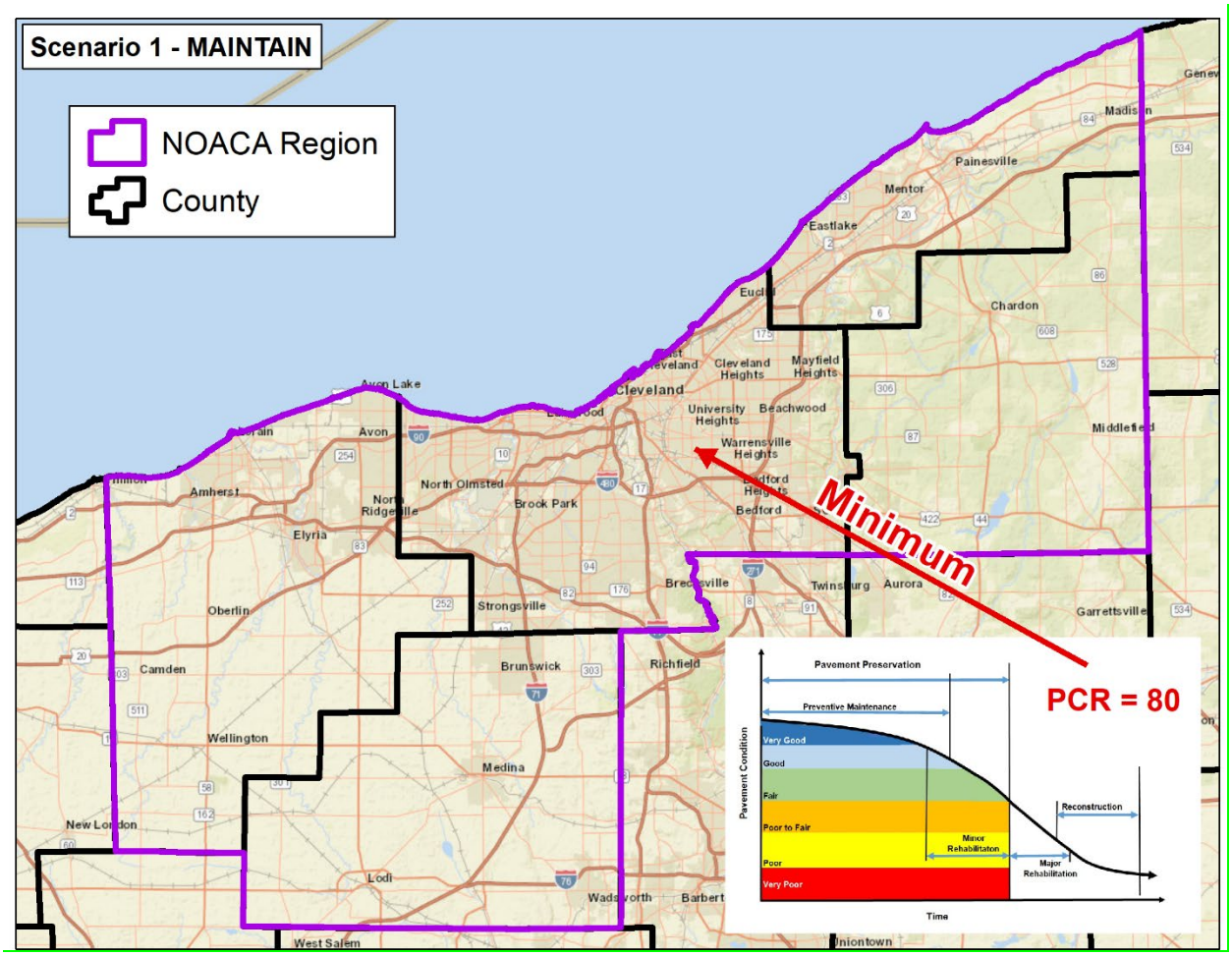
Preservation of the existing infrastructure is the theme of Scenario 1 - MAINTAIN. This scenario invests 100 percent in maintaining the existing transportation system and zero dollars in expansion.

Majority of daily trips are vehicular, and the highway and street network accommodates those trips. Therefore, maintenance of this important asset is a crucial investment for the transportation infrastructure. In addition, maintaining and replacing transit vehicles and rolling stocks are another part of this scenario.

Scenario 1 attempts to keep pavements, bridges, and transit vehicles in good condition all the time. It should be noted that the Pavement Condition Ratings (PCR) measure is a qualitative description of the structural state of the pavement. The PCR values span a spectrum of descriptive narrative ranging from “Very Good” to “Very Poor”. Each roadway segment is scored from 0 to 100 with 0 representing completely distressed pavement and 100 indicating perfect pavement condition.

The transit network of Scenario 1 is the current bus / BRT and rail networks with no extensions.

Figure 9-45. Scenario 1: MAINTAIN



Scenario 2: CAR

In the past decades, the regional investment in the transportation field was focused on supporting automobile movement. Continuation of investing in capacity adding projects is the theme of Scenario 2 – CAR.

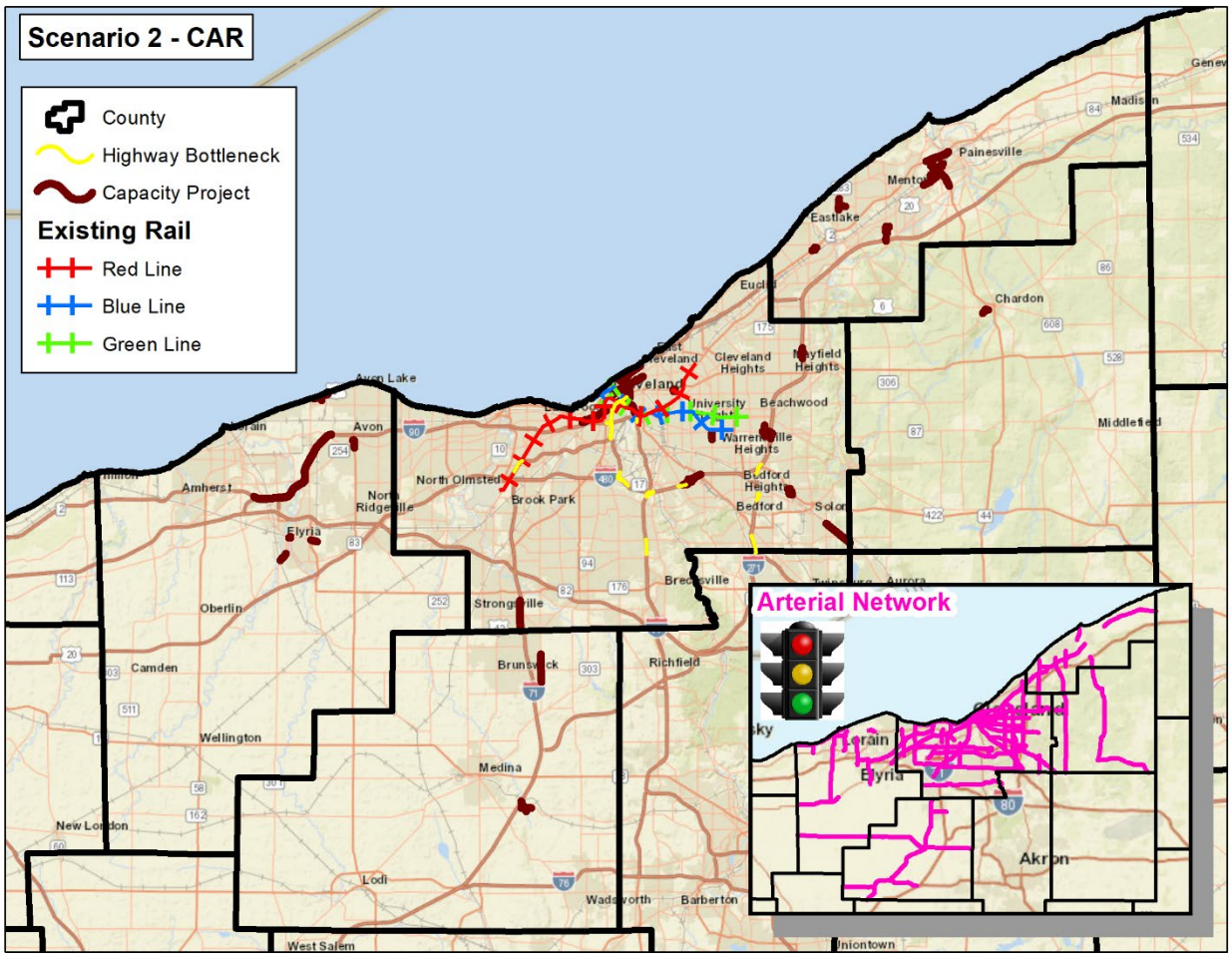
Investing in future highway network capacity projects is one major highway item in this scenario. Reducing highway bottlenecks is a major traffic management investment in this scenario. Also, banning truck movement in the Commercial Business Districts (CBD) during the AM peak period is the other traffic management policy in this scenario.

In addition, optimizing the timing of traffic signals and other similar arterial projects will restore mobility function of arterials as an alternative network to the freeway network.

Scenario 2 attempts to achieve the average auto work commute times to the regional major hubs to 30 minutes during the AM peak period.

The transit network of the Scenario 2 is the current bus / BRT and rail networks with no extensions.

Figure 9-46. Scenario 2: CAR



Scenario 3: TRANSIT

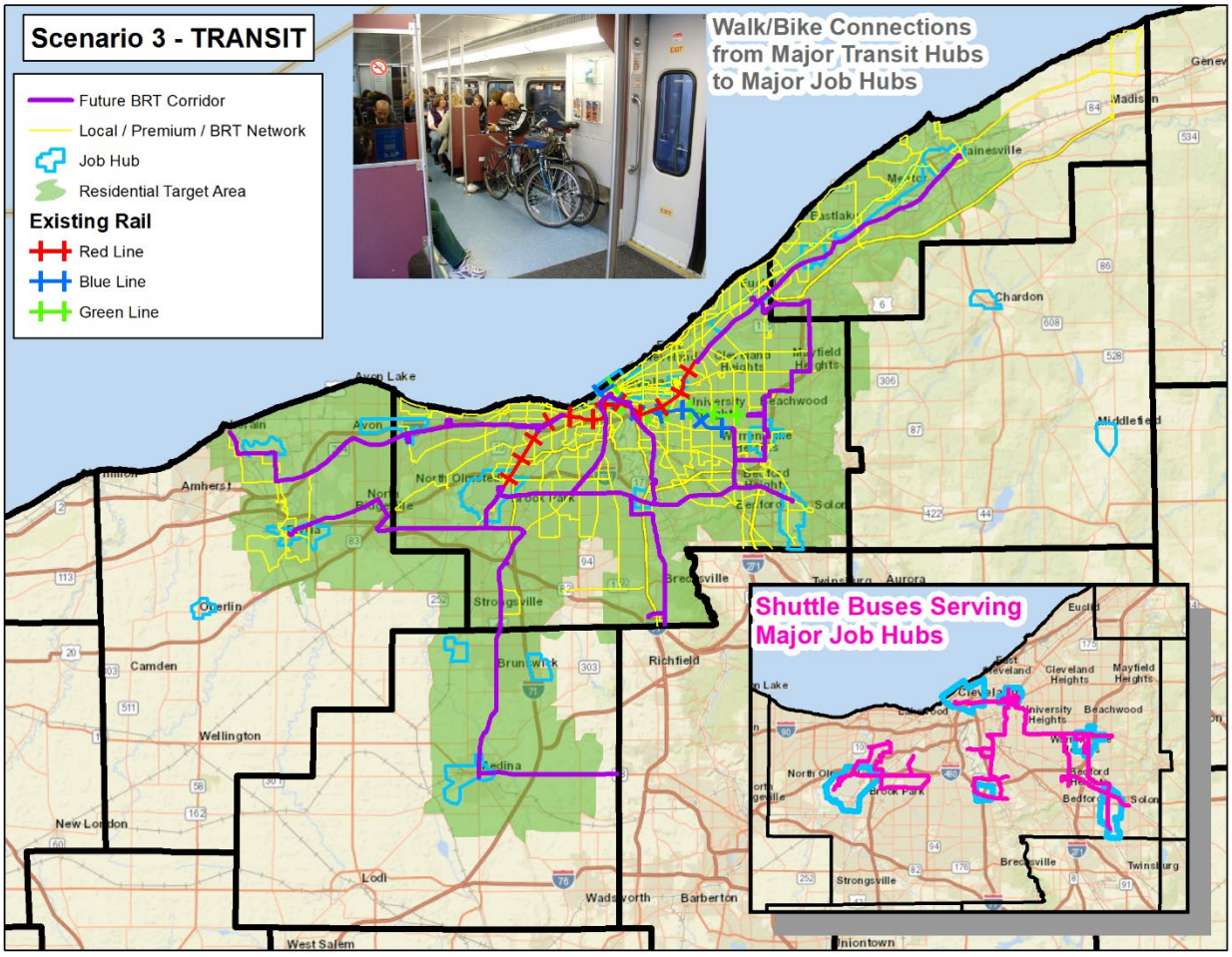
Developing a multimodal transportation system is the theme of Scenario 3 – Transit. The proposed BRT network is the backbone of the transit network of this scenario. The transit network also includes the transit agencies' future Bus / BRT plans.

The technology advancement will add autonomous shuttle buses to the scenario 3 transit network for the improved workers' accessibility to the regional job hubs and transit hubs. One objective of this scenario is to reduce the average transit work commute time to the regional job hubs to 45 minutes.

Scenario 3 does not include any extensions to the highway network and instead focuses investments to support significant bike and pedestrian improvements to ensure a multimodal system that supports access to jobs.

This scenario considers housing developments around transit stations and major job hubs so more workers live closer to where they work.

Figure 9-47. Scenario 3: TRANSIT



Scenario 4: TOTAL

An advanced multimodal transportation system using emerging transportation technology is the theme of Scenario 4 – Total. This scenario invests in all modes of travel:

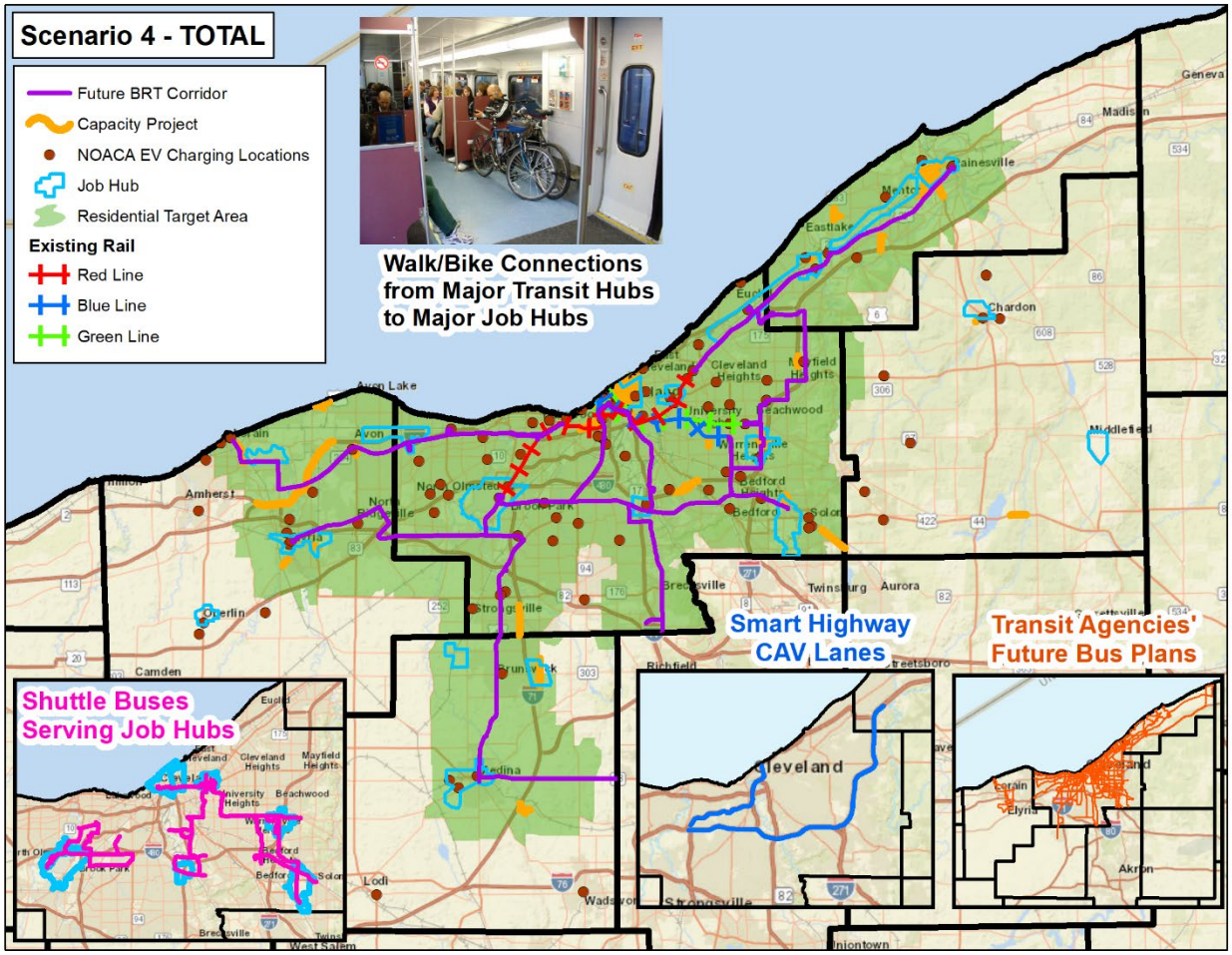
- The highway network will include major capacity projects.
- The proposed BRT network is the major transit investment of this scenario. The transit network also includes the transit agencies' future Bus / BRT plans.
- Walk and bike access from major residential neighbors to transit network and from major transit hubs to the regional major job hubs.

The emerging transportation technology will add:

- Selected smart freeway lanes to autonomous cars and trucks.
- Extra electric vehicle charging ports.
- Autonomous shuttle buses to improve workers' accessibility to the regional major job hubs and transit hubs.

This scenario attempts to reduce the average transit work commute time to regional job hubs to 45 minutes and auto commute time to 20-30 minutes.

Figure 9-48. Scenario 4: TOTAL



Scenario Development: Population and Employment Forecasts

Scenarios 1 and 2 follow the population and employment trends detailed in the previous sections. In summary, these scenarios assume that the population and employment of the NOACA region will continue along the same trend lines as they have in the past. Population loss in the urban core of Cuyahoga County and other legacy cities of the region will continue in these scenarios. Also, this continued outward migration will bring some growth to suburban and exurban communities, mostly in the outer counties of the region. However, the region as a whole will not grow leaving fewer residents to pay for the same or more infrastructure.

Scenarios 3 and 4 assume less decline in regional population and employment with the idea that often forecasts can be incorrect, and that alternate socioeconomic scenarios should be investigated to understand their potential regional impact. Scenario 3 assumes an 8.5% decline in population from 2024-2050 compared to 11.4% decline in Scenarios 1 and 2, which represents about a 25% reduction in the forecasted population loss. Scenario 4 assumes a 5.5% decline in population from 2024-2050 compared to 11.4% decline in Scenarios 1 and 2, which represents about a 50% reduction in population loss.

Since Scenarios 3 and 4 both establish an expanded BRT network that connects regional job hubs of the NOACA region, the additional population apparent in these scenarios is targeted for residential areas with easy and convenient access to these new transportation options and major

job locations. How and if these denser, mixed-use transit connected neighborhoods materialize is certainly primary within the decision-making realm of local governments. Potentially, all five counties can benefit from this additional population as depicted in Figure 9.49 if transit investment and land use changes are pursued.

By having more workers taking public transit and having shorter commutes due to workers living closer to jobs and major transit stations, the stress on the transportation network will be alleviated. Scenarios 3 and 4 assume that less decline in population out to 2050 will occur in areas within 5 miles of the major regional job hubs and transit stops of the expanded BRT network. A distance of 5 miles encompasses both persons who would access the major regional job hubs and transit system via car, as well as those who might be accessing these same locations by non-motorized modes, such as bicycling or walking, which would occur at distances shorter than 5 miles.

The additional population in Scenarios 3 and 4 compared to Scenarios 1 and 2 was distributed based on the 2024 distribution of population within the target area. The TAZs with the most population with respect to the target area's total population received more of the additional population, and those with less population received less. This type of approach increased the density of locations with the most population in 2024.

Tables 9-8 and 9-9 detail the increases in population, households and workers in Scenarios 3 and 4.

Table 9-8. Regional Population Change by Percent (2024-2050) – Scenarios 1 through 4

	Population	Workers	Households
Scenarios 1 & 2	-11.4	-11.0	-5.2
Scenario 3	-8.5	-8.1	-3.3
Scenario 4	-5.5	-5.2	-1.3

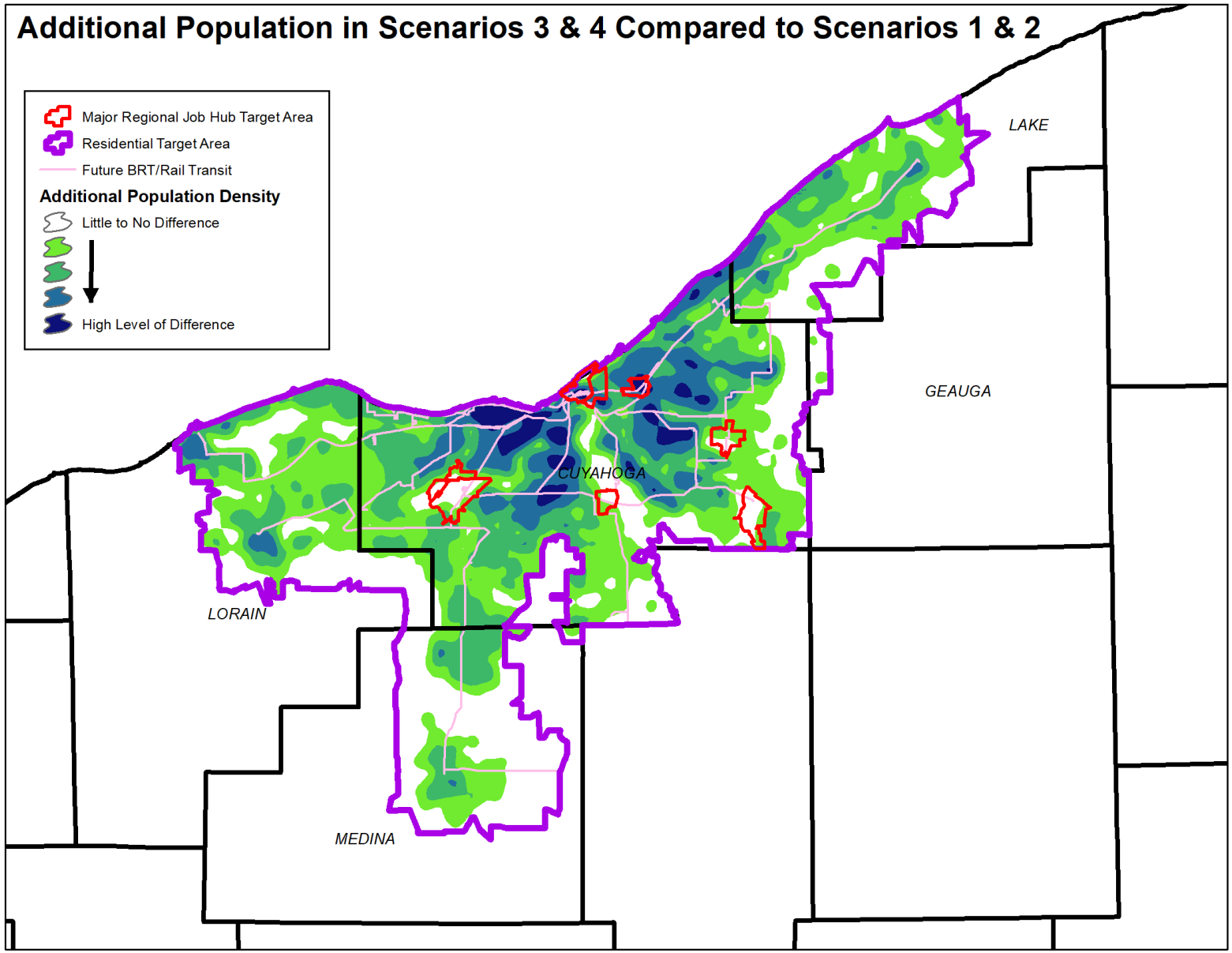
Table 9-9. Regional Population Change by Number (2024-2050) – Scenarios 1 through 4 (Continued)

	Population	Workers	Households
Scenarios 1 & 2	-234,868	-112,512	-47,636
Scenario 3	-174,298	-83,299	-30,543
Scenario 4	-113,826	-54,141	-13,497

Source: NOACA Travel Forecasting Model (February 2025)

Figure 9.49 displays the residential target area and where the population, households and worker density increase occurred in both Scenarios 3 and 4.

Figure 9-49. Additional Population Density within Residential Target Area for Scenarios 3 & 4



Source: NOACA Analysis of TAZ forecasts from the NOACA Travel Forecasting Model (February 2025)

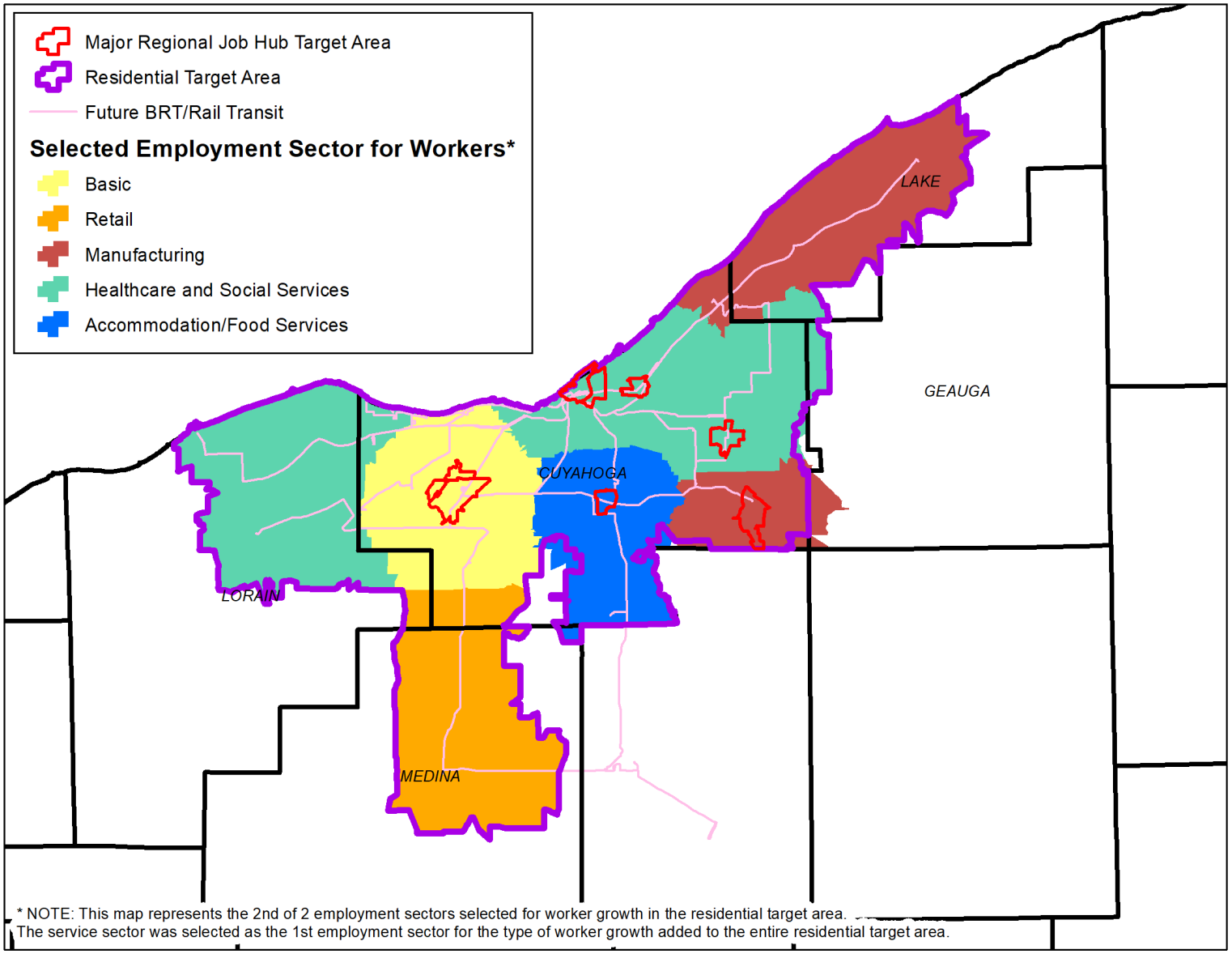
Along with population and housing considerations, the industries in which workers are employed were also a variable in Scenarios 3 and 4. The 5-mile buffer zones around the major job hubs and expanded transit rail corridors were analyzed for their 2020 employment industry sector breakdowns. Then workers employed in the particular employment sectors that are highly concentrated in these areas were then selected to make up the growth of residents living near the regional job hubs and rail corridors.

Then, two of the NOACA model employment categories that had the highest concentrations were selected for each 5-mile buffer zone around the major job hubs and future BRT corridors. Workers employed in these two industries were then directed in the NOACA travel forecasting model to these buffered areas. This process was utilized to have workers who work in certain industries live in areas with a high concentration of those types of jobs. This was designed to shorten the work commute of many residents in the region with the intent of reducing the region's overall VMT. The NOACA travel forecasting model divides employment into seven broad industry sector classifications:

- Basic (agriculture, construction, utilities, transportation, etc.)
- Retail
- Service (finance, insurance, real estate, information, government, management of companies, etc.)
- Manufacturing
- Education
- Healthcare and Social Services
- Accommodation and Food Services

The service sector is the largest employment sector for all the buffer zones. This may sound counterintuitive to the reader. The data provided in Chapter 5 clearly showed that healthcare and social assistance had become the largest sector in Northeast Ohio regarding total employment. However, the combination of all the other industries within the broader service sector still exceeds the health care component that NOACA staff separated for this particular analysis. Since the service sector is the largest across all the buffer zones of the major regional job hubs, service workers were selected for a portion of the employment increase in all TAZs throughout the targeted area. The second largest employment sectors varied throughout the buffer zones according to hub (see Figure 9-50).

Figure 9-50. Selected Employment Sectors for Workers in Targeted Residential Area in Scenarios 3 and 4



Source: NOACA Travel Forecasting Model (February 2025)

As with the differences in population between scenarios 1 & 2 and scenarios 3 & 4, employment followed a similar pattern. With more people residing in the region in 2050 in scenarios 3 and 4, this would mean that there would need to be an increase in a number of jobs as well. Since jobs follow a different pattern than population, with many people holding multiple jobs or some residents not in the workforce at all, scenarios 3 and 4 did see an increase in employment between 2024-2050. These increases were necessary in order to account for the additional population in these scenarios and, thus, the additional workers. Scenario 3 assumes very little growth in employment at a 0.3% increase, compared to a 1.9% decline in Scenarios 1 and 2. Scenario 4 assumes some growth in employment at a 2.2% increase, compared to a 1.9% decline in Scenarios 1 and 2.

For additional employment in both Scenarios 3 and 4, jobs were targeted for the six existing major regional job hubs. This occurred in a similar process to the additional population in these scenarios. TAZs with the most employment relative to all of the TAZs within all of the job hubs received the most additional employment; the others received less. This ensured TAZs with high job density in 2024 would experience the highest job density change by 2050. Figure 9-51 shows the target areas, and their associated job density increases under this distribution method.

The types of jobs destined for the job hubs were handled similarly. For the growth allocated to these major job hubs, the employment sectors with the highest concentrations in 2024 were selected for these targeted job areas. Service jobs were the highest category for each of the hubs, and thus jobs in this employment sector were selected for placement in all of the job hubs. The second highest grouping of job types varied throughout the hubs. Since employment sector types were not evenly distributed across the job hubs, all of the employment types were not increased by the same rates. To account for the differences in the breakdown of employment types, varying growth percentages were assigned to the selected employment sector types. In the end, these percentages balanced out regionally to the predetermined growth rate in total jobs for Scenarios 3 and 4. Tables 9-10 and 9-11 show the details of the employment changes for all of the scenarios.

Table 9-10. Regional Employment Change by Percentage (2024-2050)

	Regional Employment Change (%): 2024-2050							
	Total	Basic	Retail	Service	Mfg	Edu	Health	Accommodation/ Food Services
Scenarios 1 & 2	-1.9	-23.7	-6.9	+7.2	-16.0	+15.8	-0.7	+5.2
Scenario 3	+0.3	-22.4	-6.3	+10.1	-14.8	+17.6	+2.4	+6.9
Scenario 4	+2.2	-21.3	-5.7	+12.7	-13.6	+19.2	+5.2	+8.3

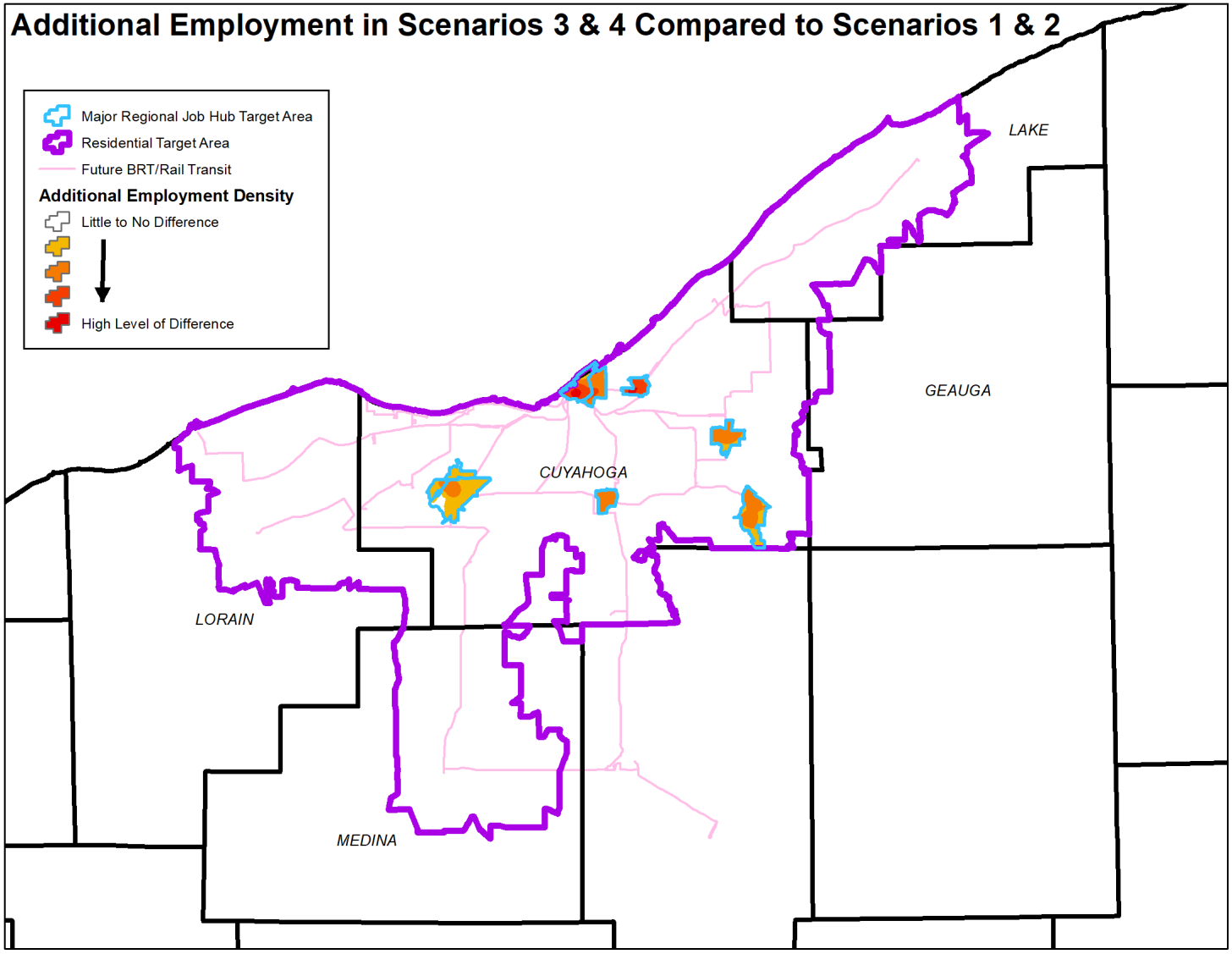
Source: NOACA Travel Forecasting Model (February 2025)

Table 9-11. Regional Employment Change by Number (2024-2050)

	Regional Employment Change (#): 2024-2050							
	Total	Basic	Retail	Service	Mfg	Edu	Health	Accommodation/ Food Services
Scenarios 1 & 2	-26,831	-45,975	-9,069	+31,237	-23,803	+17,287	-2,181	+5,673
Scenario 3	+4,205	-43,469	-8,276	+43,954	-21,905	+19,298	+7,109	+7,494
Scenario 4	+31,787	-41,243	-7,570	+55,249	-20,219	+21,084	+15,373	+9,113

Source: NOACA Travel Forecasting Model (February 2025)

Figure 9-51. Additional Employment Density within Job Hub Employment Target Areas – Scenarios 3 &



Source: NOACA Analysis of TAZ forecasts from the NOACA Travel Demand Forecasting Model (February 2025)

Scenario Development and Project Lists

Each LRTP scenario comprises three types of projects:

- Common projects,
- Shared projects between two scenarios (**Shown in bold**)
- Scenario specific projects.

Common Projects: The following common projects are included in all the scenarios:

- Addressing location-Specific Safety issues
- Reducing Traffic Fatalities & Major Injuries
- Installing EV charging Ports
- Pavement & Bridge Conditions with Average Pavement Condition Rating (PCR) of 75
- Smart Pedestrian Crossings.
- **Congestion Management Plan**
    - Work Zones Management
    - Implementing TDM
    - Special Events Traffic Management
    - Faster Traffic Incidents Responses
    - Encouraging Telecommute

Scenario 1: MAINTAIN: This Scenario includes the following projects:

- Allocating 100% of the annual budgets to Maintenance
- Maintaining Pavement & Bridge Conditions at the Average Network PCR of 80
- Maintaining Transit Vehicles in the Good State in the end of each Decade
-

Scenario 2: CAR: This Scenario includes the following projects:

- **Future Highway Network including Major Capacity Projects**
- Reinvigorating Arterial Network
- Traffic Signal Timing Optimization
- Reducing Highway Bottlenecks
- Reducing Average Auto Commute Times to Major Job Hubs to 30 Minutes

Scenario 3: TRANSIT: This Scenario includes the following projects:

- **Future BRT Network**
- **Adding Autonomous Shuttle and POD Routes to/from Major Transit Hubs**
- **Creating Walk & Bike Connections from Major Transit Hubs to Major Job Hubs**
- Implementing Transit Agencies' Future Bus / BRT Plans
- Reducing Transit Commute Time to Major Job Hubs to 45 Minutes
- Creating Walk & Bike Access to Transit Network.

Scenario 4: TOTAL: This Scenario includes the following projects:

- **Future Highway Network including Major Capacity Projects**
- **Future BRT Network**
- **Adding Autonomous Shuttle and POD Routes from Major Transit Hubs to Major Job Hubs**
- **Creating Walk & Bike Connections from Major Transit Hubs to Major Job Hubs**
- Reducing Transit Commute Times to Major Job Hubs to 30 Minutes
- Reducing Auto Commute Times to Major Job Hubs to 20 to 30 Minutes
- Allocating Selected Smart Freeway to Autonomous Cars and Trucks
- Installing Extra PEV Charging Ports
- Creating Walk & Bike Access from Major Residential to Transit Network

Infrastructure Scenario Development and Technology Adaptation

The previous section introduced the emerging new technology in transportation and in the sections that followed, these electric and driverless vehicles were embedded in scenarios 3 and 4 more than other two scenarios.

As discussed, there are high uncertainties regarding how these technologies will develop, when their acceptance in the marketplace will occur and what additional investments may be needed to facilitate their adoption. Considering all these uncertainties, predicting the modal share of these advanced vehicles would generally be difficult. As with many new technologies, the opinions and forecasts among industry experts wildly vary, but all experts agree that the development of these vehicles will be incremental in the next decades, advancing through the automation levels shown in Table 9.7. Some experts believe that by 2050 cars will be fully autonomous and electric, with advanced customization technology. Others predict that by 2050 there will be about three billion light-duty vehicles on the road worldwide, up from one billion now. At least half of them will be powered by internal combustion engines using petroleum–based fuel.

This plan considers a conservative prediction for replacing conventional cars and trucks with fully automated and electric vehicles and Table 9-12 shows the predicted percentage of vehicle shares of daily vehicular trips for the four developed scenarios.

Table 9-12. Vehicle Shares of Daily Vehicular Trips

Scenario	Conventional Car & Truck	PEV and Autonomous, Car &Truck	Autonomous Shuttle Bus and POD
Scenario 1: MAINTAIN	69%	30%	1%
Scenario 2: CAR	69%	30%	1%
Scenario 3: TRANSIT	68%	30%	2%
Scenario 4: TOTAL	44%	54%	2%

It should be noted that assuming higher share percent for autonomous vehicles in scenario 4 is due to allocating smart highway lanes to these types of vehicles in the modeling process and installing extra PEV charging ports.

Scenario Evaluation: Performance Measures

As discussed in the previous section, four differentiable scenarios were developed based on:
Moving forward to achieve the established NOACA five goals,

- Developing an equitable transportation system for improving the entire NOACA region socially and economically,
- Improving access to the transportation system for providing more modal options to all residents,
- Attracting commercial entities to the NOACA region in order to make it more globally competitive,
- Preparing the region for adaptation of emerging transportation technology,
- Reducing the potential negative impacts of transportation on society and the environment, and
- The results of the recent public engagement efforts.

The 2050 developed scenarios were modeled using the NOACA travel forecasting model, and the modeling results illustrate performance of scenarios from many various prospects. This section provides a framework based on a set of performance measures for evaluating scenarios and consequently prioritizing their projects and determining their implementation decades. The selected scenario will be one of the four scenarios or combination of them as an optimal scenario with a list of highway, transit, active transportation and technology adaptation projects.

Some scenarios include several future projects with significant investments. In the following sections, annual cost or required budget of scenarios will be estimated based on their project lists. In the next Chapter, the scenario required budget will be compared with the estimated annual available budgets as a set of constraints.

The final Chapter will include a practically applicable scenario which satisfies not only the transportation operation aspects, but the annual available budgets. Obviously, the budget constraint will impact on the priority and implementation decades and years of the included projects.

Performance Measure Categories

This section discusses a set of performance measures for scenario evaluation and comparative analysis. Table 9-13 displays the performance measure categories and the selected measures.

Table 9-13. Performance Measure Categories and Selected Performance Measures

Performance Measure Category	Performance Measures
Multimodal Transportation System	• Percent of Non-Single Occupancy Vehicles • Annual Transit Ridership
Access to Transportation System	• Access to All Transit Stops • Egress from All Transit Stops • Access to Highway System
Mobility & Delay	• Total Annual Total VMT per Capita • Total Annual Freeway Delay per Capita • Annual Total Annual Principal Arterial Delay Per Capita • Annual Person Hours of Excessive Delay per Capita (PHED)
Transportation Cost	• Annual Congestion Cost Per Capita
Travel Time	• Average Auto Work Commute Time to All Major Job hubs • Average Transit Work Commute Time for Zero-Car Households to All Major Job Hubs • Average Work Commute Time for Households with Zero Cars • Maximum Level of Travel Time Reliability (LOTTR) on Highways and Ramps • Maximum Level of Travel Time Reliability (LOTTR) on Arterials
Traffic Safety	• Fatalities, Serious Injuries and Non-motorized Fatalities and Serious Injuries
Emission	• Daily Volatile Organic Compound (VOCs) and Nitrogen Oxides (NO_x) • Annual Direct PM 2.5
Pavement & Bridge	• Average Highway Network Pavement Condition Rating (PCR) • Percent Structurally Deficient Deck Areas of All Bridges and NHS Bridges
Technology Adaption	• Daily Vehicular Trip Share of Autonomous or Electric Cars, Trucks and Shuttle Buses

Evaluation Method

The effectiveness of the developed scenarios is correspond to the accomplishment of the LRTP goals and objectives. The general effectiveness of each scenario is assessed based on its performance in regard with a set of selected transportation planning and traffic engineering measures.

Scenario 1 (MAINTAIN) does not include any specific expansion or enhancement projects apart from the common projects. Therefore, this scenario is considered as the "Do Nothing" case in similar planning processes and its performance measures are assumed as the benchmark values for evaluating other scenarios and implementing a comparative analysis.
The evaluation process comprises of four steps:

1. The scenario performance measure values of all the selected performance measures are estimated.
2. The estimated scenario performance measures is compared with those of scenario 1 to determine the percent of differences.
3. A weighting value is assumed for each performance measure. Public feedback had some impact on determining the weighting values.
4. All the weighted difference percent values are summed to a single Scenario Measure of Effectiveness (SMOE) value.

$$\boldsymbol{SMOE_i} = \sum \alpha_j \times PM_{ij}$$

Where;
$\boldsymbol{SMOE_i}$: *Total of the weighted performance measure values for scenario i*
PM_{ij}*: Difference value percent of performance measure j for scenario i compared with the same performance measure value of scenario 1*
$\boldsymbol{\alpha_j}$: *Weighting value of Performance measure j.*

Table 9-14 shows the weighting values and scenario performance measure values. In this Table, the performance measures that are highlighted in gray should have higher values in order to be more effective. In contrast, the performance measures that are highlighted in teal should have lower values in order to be more effective.

Table 9-14. Estimated Scenario Performance Values

Performance Measure	Weighting Value	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Population in 15-Minute Walk to any Transit Stop	2	61%	61%	67%	68%
Zero-Car Households within 15-Minute Walk to any Transit Stop	2	71%	71%	76%	76%
Number of Jobs within 15-Minute Walk egress from any Transit Stop	2	72%	72%	80%	81%
Population in 5-Mile Drive Access to Freeway System	2	91%	91%	91%	92%
Annual Transit Ridership (Including Transfer Trips) – Million Person Trips	3	22	22	37	38
Non-Single Occupancy Vehicle Work Commute during a Typical Morning Peak Period	3	21%	21%	22%	22%
Average Highway Network Pavement Condition Rating (PCR)	1	90.4	90.4	90.4	90.4
Daily Vehicular Trip Share of Electric or Autonomous Cars, Trucks and Shuttle Buses	4	31%	31%	32%	56%
Total Annual Vehicle Miles Traveled per Capita	1	7,669	7,682	7,479	7,314
Total Annual Freeway Delay per Capita (in Hours)	0.5	2.58	2.65	2.68	2.66
Total Annual Principal Arterial Delay per Capita (in Hours)	0.5	5.41	5.41	6.12	6.57
Annual Person Hours of Excessive Delay (PHED) per Capita (in Hours)*	1	0.65	0.61	0.75	0.78
Average Auto Work Commute Time to All Major Regional Job Hubs (in Minutes)	1	29	29	29	29
Average Transit Work Commute Time for Zero Car Households to All Major Regional Job Hubs (in Minutes)	0.5	38	38	43	43

*Calculated for the NOACA urbanized area per the FHWA performance measure guidelines for PHED.

Table 9-14. Estimated Scenario Performance Values (Continued)

Performance Measure	Weighting Value	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Average Work Commute Time for Households with Zero Cars (in Minutes)	0.5	41	41	39	39
Maximum Level of Travel Time Reliability (LOTTR) on Highways and Ramps	0.5	1.11	1.11	1.11	1.11
Maximum Level of Travel Time Reliability (LOTTR) on Arterials	0.5	1.10	1.10	1.11	1.11
Annual Congestion Cost per Capita (2050$)	0.5	588	598	632	639
All Estimated Fatalities and Serious Injuries for Motorized and Non-Motorized Modes (Vision-Zero)	1	0	0	0	0
Daily Volatile Organic Compounds (VOCs) (in Tons)	0.34	5.69	5.70	5.74	5.79
Daily Nitrogen Oxides (NO_x) (in Tons)	0.33	3.77	3.77	3.80	3.83
Annual Direct PM 2.5 (in Tons)	0.33	129.19	129.39	130.19	131.44
Structurally Deficient Deck Areas of NHS Bridges	1	1.84%	1.84%	1.84%	1.84%
Structurally Deficient Deck Areas of All Bridges	1	5.29%	5.29%	5.29%	5.29%

Table 9-15 exhibits the general effectiveness of all the scenarios in achieving the goals and objectives of the LRTP compared with that of that of scenario 1 as “DO nothing” case. For instance, the total weighted MOE of Scenario 4 is about six times that of Scenario 1.

Table 9-15. Estimated Total Measures of Effectiveness[5]

Scenario	Ratio of Estimated Scenario SMOE to the SMOE of Scenario 1
1:MAINTAIN	1
2:CAR	0.03
3:TRANSIT	2.6
4:TOTAL	5.8

In the following sections, the total capital cost and the annual required budgets of scenarios will be estimated and synthesized with the SMOE ratios.

Scenario Costs

Transportation projects are the building blocks of the developed scenarios and categorized as follows: highway, transit, non-motorized, and emerging technology. It is envisaged that these projects will progressively be implemented during the next three decades.

As discussed in section 9.3.3, each scenario comprises of common projects, shared projects with another scenario and scenario specific projects. Table 9-16 displays the list of scenario projects and their planned implementation periods.

[5] Appendix 9-1 shows details of the calculations that produced the values in Table 9-15.

Table 9-16. Scenario Projects and their Planned Implementation Periods

Scenario Projects	Time Periods		
	2025 - 2030	2030 - 2040	2040 - 2050
Highway			
Reinvigorating Arterial Network and Optimizing Traffic Signals	Scenario 2		
Reducing Highway Bottlenecks			
Implementing Major Highway Capacity Projects	Scenarios 2 and 4		
Implementing 2024 TIP Highway and Transit Projects	All Scenarios		
Maintain Pavement Conditions with average PCR = 92	Scenarios 2 - 4		
Addressing Location-specific Safety issues in order to Reduce Traffic Fatalities	All Scenarios		
Maintain Bridges in Good or Fair Conditions	All Scenarios		
Transit			
Implementing Transit Agencies' Future Routes		Scenarios 3 and 4	
Adding Future BRT Network		Scenarios 3 and 4	
Maintain Transit Vehicles in the Good State of Repair	Scenario 1		
Reducing Transit Service Headways		Scenario 3	

Table 9-16. Scenario Projects and their Planned Implementation Decades (Continued)

Scenario Projects	Time Periods		
	2025 - 2030	2030 - 2040	2040 - 2050
Workforce Accessibility and Mobility			
Improve Average Auto and Transit Commute Times to Major Job Hubs	Scenario 1		
Reducing Average Auto Commute time to Major Job Hubs to 30 minutes		Scenario 2	
Reducing Average Transit Commute Time to Major Job Hubs to 45 minutes		Scenario 3	
Reducing Average Auto Commute Time to Major Job Hubs to 20 - 30 minutes			Scenario 4
Reduce Average Transit Commute Time to Major Job Hubs to 30 minutes			
Non-Motorized Facility			
Creating Walk and Bike Access to Transit Network	Scenario 3		
Creating Walk and Bike Connections from Major Transit Hubs to Major Job Hubs	Scenarios 3 and 4		
Creating Walk and Bike Access from Major Residential Areas to Transit Network	Scenario 4		
Implement Smart Pedestrian Crossings	All Scenarios		

Emerging Technologies in Transportation			
Installing EV Charging Ports	All Scenarios		
Adding POD and Shuttle CAV Services to/from Major Transit Hubs			Scenarios 3 and 4
Installing Extra EV Charging Ports			Scenario 4
Allocating Selected Smart Freeway to Autonomous Vehicles			

The plan year for the LRTP is 2050 and therefore the analysis period comprises of the next three time periods of 2025-2030, 2030-2040 and 2040-2050. Considering the general budget and revenue annual basis, the project costs were estimated based of the dollar values of the project implementation years.

Table 9-17 displays the Net Present Value (NPV) of the total capital costs of projects by their categories.

Table 9-17. NPV (2025$) of Estimated Total Annual Budget Requirements by Project Category

Project Category	Net Present Value of Aggregated Annual Budget Requirements (2025$) Millions	Percent of the Total NPV (2025$)
Highway	13,943	67.5%
Transit	5,193	25.1%
Non-Motorized Facility	1,536	7.4%
Total	**20,672**	**100%**

Table 9-18 shows the NPV of the total capital costs of the common projects which are included in all the scenarios and also the scenario's specific costs. It should be noted that if there are projects shared with only two scenarios then their costs are included in both scenarios. This table also includes the NPV percent of the total costs for scenario specific projects compared with the grand total. It should be noted that the total NPV in Table 9-18 is higher than that of Table 9-17. This is due to the fact that there are a few projects, such as the BRT transit network project, which are shared between scenarios 3 and 4 and therefore their annual project costs are accounted for in both scenarios.

Table 9-18. NPV (2025$) of Estimated Total Specific Project Costs of Scenarios

Scenario	Net Present Value of Total Project Costs (2025$) Millions	Percent of the Total NPV (2025$)
Common Projects	11,441	36.0%
Scenario 1: MAINTAIN	2,607	8.2%
Scenario 2: CAR	1,825	5.7%
Scenario 3: TRANSIT	6,729	21.1%
Scenario 4: TOTAL	9,231	29.0%
Total	**31,833**	**100%**

Table 9-19 illustrates the percent of the NPV of the total project costs of the common projects and the scenario specific projects by project categories.

Table 9-19. Percent of NPV (2025$) of Estimated Total Specific Project Costs of Scenarios by Project Category

Scenario	Roadway	Transit	Non-Motorized Facility	Total
Common Projects	36.0%	0%	0%	**36.0%**
Scenario 1: MAINTAIN	0%	8.2%	0%	**8.2%**
Scenario 2: CAR	5.7%	0%	0%	**5.7%**
Scenario 3: TRANSIT	0%	16.3%	4.8%	**21.1%**
Scenario 4: TOTAL	7.9%	16.3%	4.8%	**29.0%**

As shown in Tables 9-18 and 9-19, the share of the common project costs is just under half of the NPV of the total project costs. As mentioned before, Scenario 1 maintains the system only and does not include any enhancement or expansion projects. The specific project cost for this scenario is the lowest value and the specific project cost of Scenario 4 is the highest.

The scenario specific projects determine the difference between scenario costs. Similar to the relative scenario effectiveness discussed in the previous section, the quotients of the additional scenario capital costs divided by the lowest scenario additional cost (that of the "Do Nothing" case) shown in Table 9-20, provide a set of comparison values.

Table 9-20. NPV Cost Percent of Scenarios and Comparison Ratios

Scenario	NPV Cost Percent of Scenario-Specific Projects	Ratio of Scenario-Specific Cost Percent to Scenario 1 Specific Cost Percent
Scenario 1: MAINTAIN	8.2%	1.0
Scenario 2: CAR	5.7%	0.7
Scenario 3: TRANSIT	21.1%	2.8
Scenario 4: TOTAL	29.0%	3.5

Combining the SMOE values with the estimated scenario specific project cost ratios in Table 9.20 results in an indication for the economic return of scenarios. Table 9-21 shows the ratio of SMOE and the total costs.

Table 9-21. Ratio of SMOE and Scenario Cost Ratios

Scenario	SMOE Value Relative to Scenario 1 SMOE	Specific Project Cost Quotient Values	Ratio of SMOE Values and Corresponding Cost Values
Scenario 1: MAINTAIN	1.0	1.0	1.00
Scenario 2: CAR	0.03	0.7	0.04
Scenario 3: TRANSIT	2.6	2.8	0.93
Scenario 4: TOTAL	5.8	3.5	1.66

Considering the ratio of SMOE and corresponding costs as an indication of economic return, then as illustrated in Table 9-21, the economic return of Scenario 2 is less than that of Scenario 1, the "Do Nothing" case, as the benchmark. Scenarios 3 and 4 both show economic returns above Scenario 1, with Scenario 4 having the highest value. Therefore, these comparison results indicate that Scenario 4 has a higher level of economic return out of all of the scenarios. In the next chapter the scenario costs will also be compared with the predicted available annual budgets to identify a fiscally constrained scenario with an economic return greater than 1.

Scenario Evaluation Summary

This section summarizes the comparative analysis results based on the scenario performance measures**.**

- **Scenario 1: MAINTAIN**
  - Transit ridership is the lowest.
  - The lowest number of people with 5-mile drive access to the freeway system.
  - Higher VMT per capita compared with the current VMT per capita.
  - Requires the least capital investment.
- **Scenario 2: CAR**
  - The percent of the drive alone choice is the same as today.
  - Access to the highway system is slightly improved.
  - The lowest arterial delay.
- **Scenario 3: TRANSIT**
  - Almost doubles the annual transit ridership.
  - More people and workers have walk access to buses and rails.
  - The number of zero-car households living inside the 30-minute transit commute time shed to major regional job hubs is higher than today.
- **Scenario 4: TOTAL**
  - Almost doubles the annual transit ridership.
  - Access to transit and freeway systems are simultaneously improved.
  - Technology adaptation rate is the highest.
  - Higher budget and efficient distribution are required.

Chapter 10. Expected Financial Plan

Introduction

weNEO2050+ identifies and prioritizes projects and strategies to maintain, enhance, and expand the region's multimodal transportation network through the year 2050. The purpose of the financial plan is to demonstrate that *weNEO2050+* is implementable and fiscally constrained. This means projects and strategies contained in the transportation plan (the Final Plan, or Plan) cannot exceed the amount of funding "reasonably expected to be available" during the life of the plan. The Plan will identify all necessary financial resources reasonably expected to be available to carry out the projects and strategies.

The Plan may also include visionary, or illustrative, projects that are cost prohibitive for adoption in the Plan but are critical to achieve the Plan's vision. These projects may advance if funding becomes available and if the projects align with NOACA planning requirements during the life of the Plan.

The financial plan consists of the following key components:

- Primary Transportation Revenue Sources
- Forecasted Revenue Scenarios
- Cost Assumptions
- Forecasted Projects

The financial plan also includes an evaluation and recommendation of financing strategies to fund additional or illustrative projects and programs. In the case of new funding sources, NOACA staff will identify strategies to ensure their availability.

Primary Transportation Revenue Sources

Federal, state, and local generated revenue sources make up the majority of funding to support transportation system projects in the Plan. On the federal level, the current Infrastructure Investment and Jobs Act (IIJA) transportation authorization bill, signed into law on November 15, 2021, apportions funding to the state from the Highway Trust Fund (HTF), which consists primarily of federal motor fuel tax revenues (currently 18.4 ¢ per gallon). Transfers from the general fund and the Leaking Underground Storage Tank Trust Fund supplement the HTF to keep it solvent.[1]

The IIJA authorized $550 billion nationwide over fiscal years 2022 through 2026 for highway and public transportation investments. The IIJA provides approximately $350 billion for Federal highway programs over a five-year period (fiscal years 2022 through 2026). Most of this funding is apportioned (distributed) to states based on formulas specified in Federal law. However, the IIJA also provides funding through a wide range of competitive grant programs. The IIJA provided more funding than the previous Fixing America's Surface Transportation Infrastructure Investment and Jobs Act (FAST Act) reauthorization bill did, with an annual average increase of 2% for highway spending and 1% for public transportation spending.[2]

On the state level, revenues generated through the motor fuel tax (MFT) (currently 38.5 ¢ per

[1] The Leaking Underground Storage Tank Trust Fund is a separate trust fund set up for certain environmental cleanup purposes, which is financed with a small portion of motor fuel taxes.
[2] U.S. Department of Transportation, Federal Highway Administration, Fixing America's Surface Transportation Act (FAST Act): A Summary of Highway Provisions (Washington, D.C.: Office of Policy and Governmental Affairs, July 2016) https://www.fhwa.dot.gov/fastact/fastact_summary.pdf.

gallon) are collected and distributed by law to state and local governments for transportation-related investments. In 2019, the State of Ohio passed legislation to increase taxes and fees associated with gasoline, diesel, and alternate fuels to provide additional funding for transportation projects:

- Gasoline fuel tax increased from 28¢ per gallon to 38.5¢ per gallon
- Diesel fuel tax increased from 28¢ per gallon to 47¢ per gallon
- New fully electric vehicle (EV) annual vehicle registration fee of $200
- New electric/gasoline hybrid annual vehicle registration fee of $100
- Plug-in hybrid annual vehicle registration fee of $150

Table 10-1 contains a breakdown of the MFT by enabling legislation in the Ohio Revised Code (ORC) and the associated distribution at the state, municipal, county, and township level. Also included is the set-aside for the Local Transportation Improvement Program (LTIP) administered by the Ohio Public Works Commission.

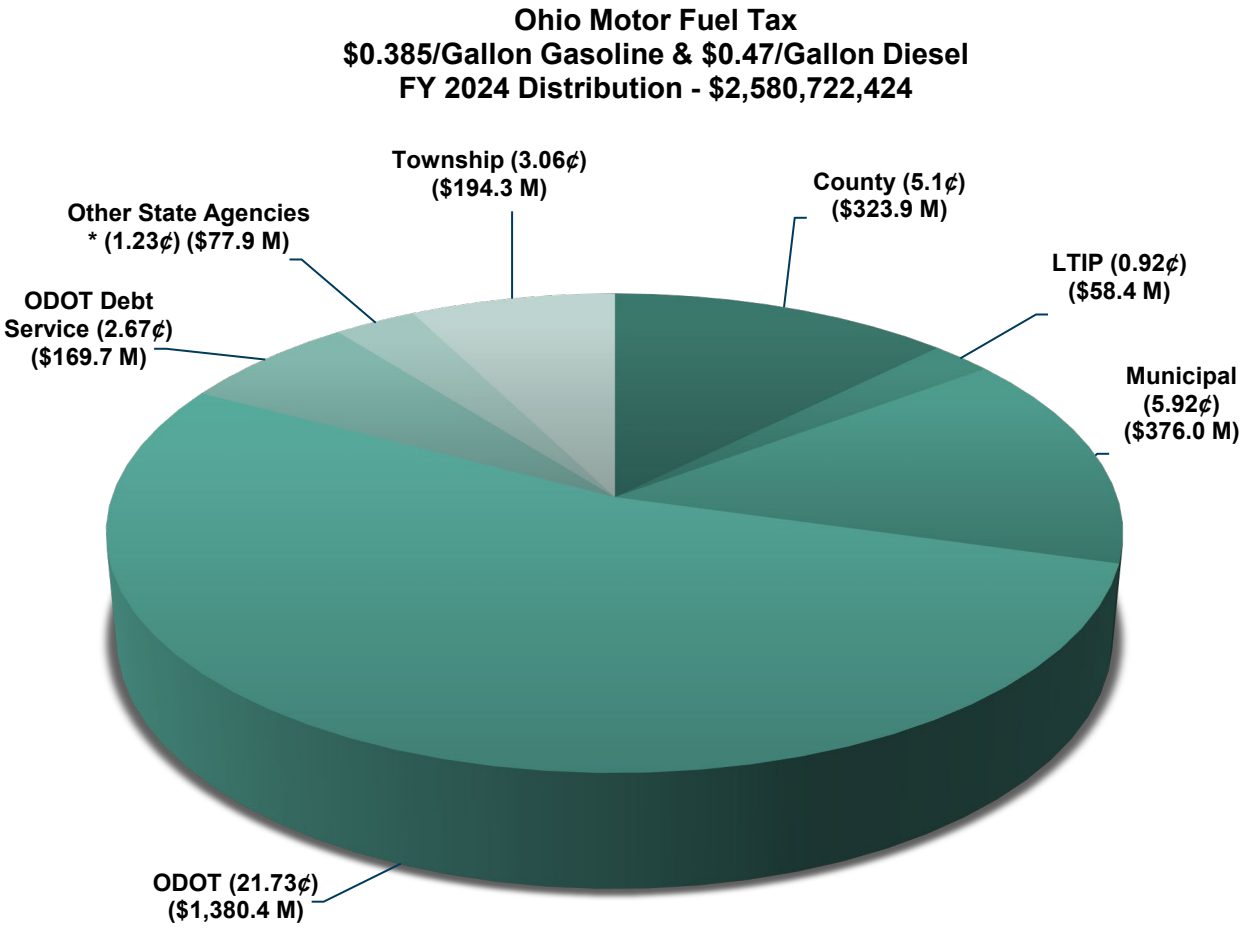
Table 10-1. Motor Fuel Tax Legislative Distribution[3]

ORC Section	¢ Per Gallon	State	Municipal	County	Township	OPWC LTIP
5735.051(A) 5735.051(A)(1) 5728.06(B) 5735.051(A)(2)	0.9	0.9 (100%)	-	-	-	-
5735.051(A) 5735.051(A)(2)(a)(i)	1.0	-	-	-	-	1.0 (100%)
5735.051(A) 5735.051(A)(2)(a)(iii)	14.0	10.5 (75%)	1.5 (10.7%)	1.3 (9.3%)	0.7 (5%)	-
5735.051(A) 5735.051(A)(2)(b)	1.1	-	0.47 (42.9%)	0.41 (37.1%)	0.22 (20%)	-
5735.051(B)	2.0	1.35 (67.5%)	0.28 (13.9%)	0.24 (12.1%)	0.13 (6.5%)	-
5735.051(C)	8.0	6.5 (81.3%)	0.64 (8.0%)	0.56 (7.0%)	0.30 (3.8%)	-
5735.051(D)	1.0	1.0 (100.0%)	-	-	-	-
5735.051(E)	10.5	5.7 (55.0%)	2.0 (19.3%)	1.8 (16.7%)'	1.0 (9.0%)	-
Gasoline Total	**38.5**	**25.95 (67.4%)**	**4.89 (12.7%)**	**4.31 (11.2%)**	**2.35 (6.1%)**	**1.0 (2.6%)**
5735.051(E)	47.0	30.65 (65.2%)	6.59 (14.0%)	5.71 (12.2%)	3.05 (6.5%)	1.0 (2.1%)
Diesel Total	**47.0**	**30.65 (65.2%)**	**6.59 (14.0%)**	**5.71 (12.2%)**	**3.05 (6.5%)**	**1.0 (2.1%)**

[3] Ohio Department of Transportation (ODOT), *Division of Finance Financial and Statistical Report Fiscal Year 2024*, Transportation Funding Sources (Columbus, Ohio: November 2024), https://dam.assets.ohio.gov/image/upload/transportation.ohio.gov/finance/annual-report/FY24.pdf

At current consumption rates, each 1.00¢ of the state MFT generates approximately $63,5 million of funding for transportation system maintenance and operation. As illustrated in Figure 10-1, the Ohio Department of Transportation (ODOT) receives a majority of the funding generated through the state MFT tax (gasoline/diesel) at 24.40¢ (61%), while municipalities receive 5.92¢ (15%), counties receive 5.10¢ (13%), townships receive 3.06¢ (8%), and the Ohio Public Works Commission (OPWC) receives 0.92¢ (2%) for its LTIP.

Figure 10-1. FY 2024 Ohio Motor Fuel Tax Distribution[4]



Annual registration fees for fully electric and hybrid vehicles ($200 and $150 per vehicle, respectively) are distributed based on the same percentage rates as the state MFT tax. These fees allow for estimated funding to remain constant through the life of the plan as the expected increase in shift from gasoline to alternate fuel vehicles occurs.

Other local sources include the State Motor Vehicle License Tax, collected through the vehicle registration fee, and other local taxes often committed as matching funds to federal or state-funded projects in the Plan and Transportation Improvement Program (TIP).

[4] Ibid.

Subsequent sections of this chapter describe all federal, state, and local funds that are reasonably expected to become available for transportation projects by highway/nonmotorized and transit funding categories.

Highway and Nonmotorized Project Funding Sources

Funds are made available through various federal, state, and local sources for highway and nonmotorized projects. Federal Highway Administration (FHWA) programs provide federal funds. ODOT and NOACA administer the funding programs. State and local funds derive primarily through taxes and fees associated with gasoline and motor vehicle registration taxes, which ODOT and local governments administer.

Federal Sourced

The IIJA apportions funding for highway and nonmotorized transportation projects through seven core programs (see Figure 10-2). Each program has a specific purpose to achieve specific goals.

Figure 10-2. FHWA Core Funding Programs

National Highway Performance Program (NHPP)
This program provides support for the condition and performance of the National Highway System (NHS) and for the construction of new facilities on the NHS, and ensures that investments of federal-aid funds in highway construction support progress toward the achievement of performance targets established in a state's asset management plan for the NHS. ODOT administers funds apportioned directly to Ohio.

Surface Transportation Block Grant Program (STBG)
The Surface Transportation Block Grant Program (STBG) provides flexible funding to states and localities to support projects that preserve and improve the conditions and performance on any federal-aid highway, bridge, and tunnel on any public road; pedestrian and bicycle infrastructure; and transit capital projects, including intercity bus terminals. ODOT-controlled STBG funding is primarily for the preservation of state- maintained roadways and state and U.S. routes within municipalities.

NOACA receives its STBG funding allocation by federal formula distribution to MPOs of regions with a population greater than 200,000. In addition, ODOT suballocates a portion of state-controlled STBG funding to all Ohio MPOs at its discretion. NOACA STBG funds primarily prioritize projects that support transportation asset management planning to preserve and enhance the operation and performance of federal-aid highways and regional transit systems. These funds are eligible for construction of bridge, pedestrian, and bicycle infrastructure; and transit capital projects. The NOACA Board of Directors also currently sets aside $2 million of STBG funds annually for the Transportation for Livable Communities Initiative (TLCI) program. The TLCI program supports transportation studies and implementation projects that focus on enhanced livability.

STBG Set-Aside: Transportation Alternative (TA) Program. NOACA refers to STBG Set-Aside

funds as TA funds. TA program provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities; infrastructure projects to improve nondriver access to public transportation and enhanced mobility, community improvement activities, and environmental mitigation; recreational trail program projects; safe routes to school projects; and projects to plan, design, or construct boulevards and other roadways largely in the right-of-way of former Interstate System routes or other divided highways.

STBG Set-Aside: TA Recreational Trails Program (RTP). The RTP provides federal funds to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized uses. Federal transportation funds benefit recreation, including hiking, bicycling, in-line skating, equestrian use, cross-country skiing, snowmobiling, off-road motorcycling, all-terrain vehicle riding, four-wheel driving, and other off- road motorized vehicle use. The RTP receives a set-aside of funds from the STBG set-aside for the TA program. The amount set aside is equal to the State's FY 2009 RTP apportionment. Ohio Department of Natural Resources (ODNR) manages the RTP in Ohio.

Highway Safety Improvement Program (HSIP)
The purpose of the HSIP program is to achieve a significant reduction in motor vehicle crashes that result in fatalities and serious injuries on all public roads, including non-state-maintained public roads. The HSIP requires a data-driven, strategic approach that focuses on performance to improve highway safety on all public roads. ODOT and the County Engineers Association of Ohio (CEAO) administer HSIP program funds.

Rail Highway Crossings Program (RHCP)
The Railway-Highway Crossings program provides funds for safety improvements to reduce the number of crashes that result in fatalities and injuries at public railway-highway grade crossings. ODOT administers funds apportioned directly to Ohio.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program
CMAQ provides flexible funding to the state for transportation projects and programs to help meet the requirements of the Clean Air Act. Funds must be expended in areas that are in non-attainment or maintenance of National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide, or particulate matter (nonattainment areas) and former nonattainment areas that are now in compliance (maintenance areas). ODOT administers funds apportioned directly to Ohio.

ODOT suballocates approximately 70% of the state's CMAQ apportionment to the eight large MPOs in Ohio, including NOACA, that contain NAAQS maintenance or non-attainment areas. These funds help MPOs implement programs and projects that improve air quality. This is the Ohio Urban Statewide CMAQ Committee (OSUCC) program. Under this program, the OSUCC MPOs collectively establish, prioritize, and manage annual programs of CMAQ projects. In the NOACA region, these funds commonly support air quality planning, transit vehicle replacements, bicycle facilities, intelligent transportation system improvement, traffic signal upgrades and operations, transit center improvements, and park-and-ride lot construction. It is important to note that CMAQ funds cannot be used for general roadway or bridge maintenance projects.

ODOT retains CMAQ funds to fund eligible highway projects, programs that assist transit agencies with capital projects, and a Diesel Emissions Reduction Grant (DERG) program administered in partnership with Ohio Environmental Protection Agency (EPA).

Based on historic NOACA project allocations, the Plan assumes 50% of NOACA CMAQ funding for transit, 25% for nonmotorized modes, and 25% for roadway operational improvements.

National Highway Freight Program (NHFP)
The IIJA continues the National Highway Freight Program, established in the Fixing America's Surface Transportation (FAST) Act, to improve the efficient movement of freight on the National Highway Freight Network (NHFN) and to support several goals, including:

- Invest in infrastructure and operational improvements that strengthen economic competitiveness, reduce congestion, reduce the cost of freight transportation, improve reliability, and increase productivity;
- Improve the safety, security, efficiency, and resiliency of freight transportation;
- Improve the state of good repair of the NHFN;
- Use innovation and advanced technology to improve NHFN safety, efficiency, and reliability;
- Improve the efficiency and productivity of the NHFN;
- Improve flexibility to support planning and address highway freight connectivity; and
- Reduce the environmental impacts of freight movement on the NHFN.

NHFP funds must contribute to the efficient movement of freight on the NHFN, identified in a freight investment plan included in the State's freight plan. ODOT administers funds apportioned directly to Ohio.

Carbon Reduction Program (CRP)
This program provides funds for projects designed to reduce transportation carbon dioxide emissions from on-road highway sources (§ 11403; 23 U.S.C. 175). CRP is a formula program with funds apportioned directly to states. CRP funding is further suballocated based on population.

Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT)
This program provides funds to help make surface transportation more resilient to current and future weather events, natural disasters, and changing conditions, such as severe storms, flooding, drought, levee and dam failures, wildfire, rockslides, mudslides, sea level rise, extreme weather, including extreme temperature, and earthquakes through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk costal infrastructure.

FHWA Discretionary Funding Programs
The IIJA also provides funding through a wide range of competitive grant programs. Since 2022, the NOACA region has been awarded funding through various competitive grant programs.

Charging and Fueling Infrastructure
This program provides grants for projects to develop electric vehicle charging and hydrogen, propane, and natural gas fueling infrastructure access along alternative fuel corridors throughout the country, including in rural areas, low- and moderate-income neighborhoods, and communities with a low ratio of private parking spaces to households or a high ratio of multiunit dwellings to single family homes.

Nationally Significant Multimodal Freight & Highway Projects (INFRA)
This program awards grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.

Better Utilizing Investments to Leverage Development (BUILD)
This program, previously known as Rebuilding American Infrastructure with Sustainability and

Equity (RAISE) and Transportation Investment Generating Economic Recovery (TIGER) discretionary grant, was established under the American Recovery and Reinvestment Act of 2009 and operated under annual appropriations acts until authorized in November 2021. The BUILD program provides grants for surface transportation infrastructure projects with significant local or regional impact. The eligibility requirements of BUILD allow project sponsors, including state and local governments, counties, Tribal governments, transit agencies, and port authorities, to pursue multi-modal and multi-jurisdictional projects that are more difficult to fund through other grant programs.

Reconnecting Communities
This program provides grants for capital construction, planning and technical assistance, which will restore community connectivity by removing, retrofitting, or mitigating highways or other transportation facilities that create barriers to community connectivity, including to mobility, access, or economic development and for construction funds to carry out a project to remove, retrofit or mitigate an eligible facility and, if appropriate, replace it with a new facility.
Safe Streets and Roads for All - This program provides grants to local and regional governmental bodies to plan, demonstrate, and implement projects that will reduce or eliminate road crashes that result in serious injury or death.

Strengthening Mobility and Revolutionizing Transportation (SMART)
This program provides supplemental funding grants to rural, midsized, and large communities to conduct demonstration projects focused on advanced smart city or community technologies and systems in a variety of communities to improve transportation efficiency and safety.

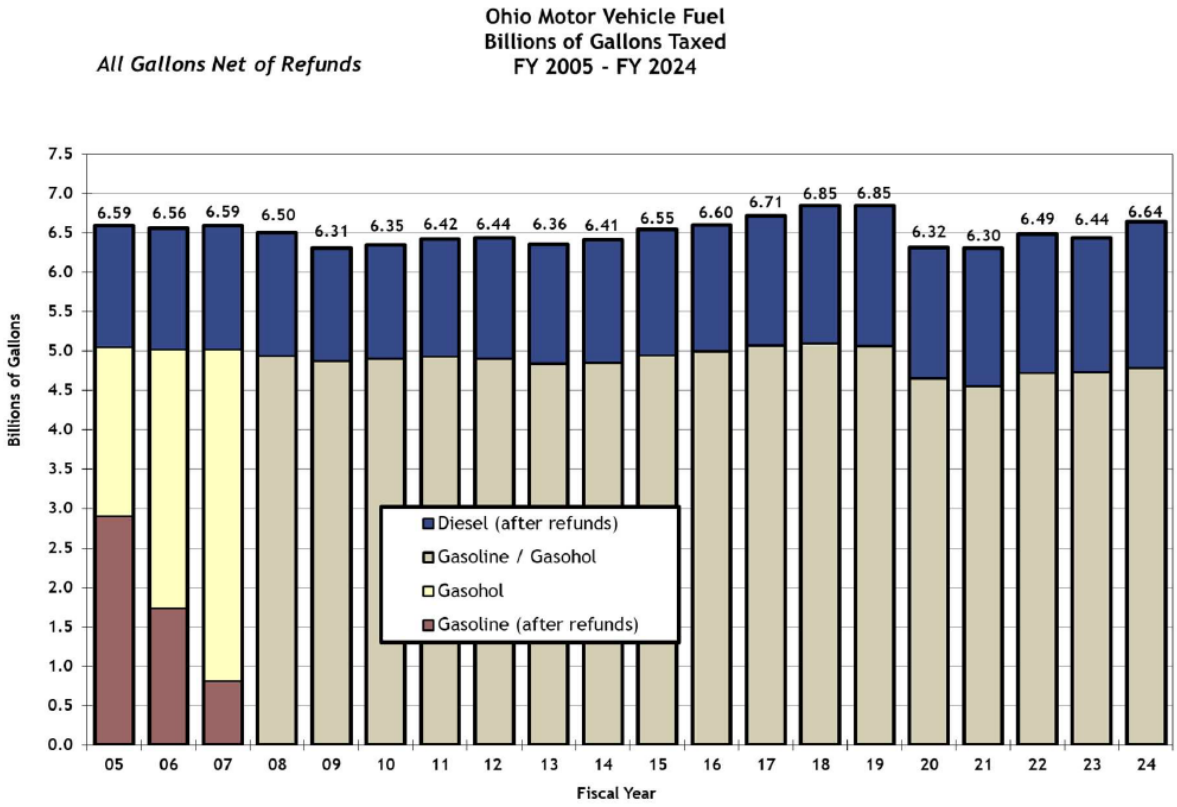
State Sourced

Motor Fuel Tax (MFT)
The state MFT generates the primary source of state funding. In 2024, the state MFT generated $2.6 billion, of which $1.550 billion went to ODOT and $0.953 billion went to local governments, townships and the counties for transportation projects. ODOT primarily uses state MFT funding to match federal funding, pay down debt service, and fund major new and safety project investments as well as non-federal-aid-eligible project activities.

As noted previously, local governments receive approximately 37% of the state MFT. Funds are collected and distributed at the state level. All 88 counties and all townships receive equal state MFT distribution. Motor vehicle license registrations determine the municipal share. In addition, the Ohio Public Works Commission receives one cent per gallon of the state MFT for its Local Transportation Improvement Program, highlighted below under the OPWC section.

State MFT is projected to increase through the 2050 planning horizon, due to a modeled 1% year over year increase in vehicle miles traveled (VMT). VMT increases mean more gallons of gas consumed and taxed. As a result, ODOT estimates a 1% growth in funding for those years. Figure 10-3 illustrates the historic gallons of fuel taxed through 2024. The lower levels of consumption since 2020 are primarily attributable to the COVID-19 pandemic. Consumption has increased but fluctuated since 2021 and not reached the peak year level in 2019.

Figure 10-3. Ohio Motor Vehicle Fuel Tax Historic Gallons Taxed[5]



Note: For FY08 and forward, detailed gasohol information is not available. Gasoline and gasohol are combined.

Ohio Public Works Commission (OPWC)

The OPWC provides financing for local road and bridge projects through both the State Capital Improvement Program (SCIP) and the LTIP. Geographic districts across the state receive OPWC fund allocations. The NOACA region comprises all of OPWC District 1 and portions of Districts 7 and 9. Historically, NOACA counties in Districts 7 (Geauga and Lake) and 9 (Lorain and Medina) have made up 87% of the funding in those districts. Therefore, the assumption is that 100% of District 1 funds and 87% of Districts 7 and 9 funds will be available for road and bridge projects contained within the Plan.

The SCIP is a grant/loan program for roads, bridges, and water-based infrastructure. The SCIP uses state general revenues as debt support to issue general obligation bonds up to $200 million statewide for grants. The Plan assumes that 50% of SCIP grant funds will be spent on road and bridge projects versus water-based infrastructure.

The LTIP is a grant program for roads and bridges only. The Ohio State legislature created the LTIP in 1989 and, as previously mentioned, provides the equivalent of one cent per gallon in gasoline tax receipts annually (approximately $61 million statewide).

State Motor Vehicle License and Permissive Taxes

The Ohio Bureau of Motor Vehicles (Ohio BMV) is responsible for the collection and distribution of taxes from the sale of license plates (collected at the point of sale). Ohio BMV allocates funding from the motor vehicle license tax directly to political subdivisions as follows:

- 34% distributed at the district level (this includes municipal and township registration)

[5] Ibid, 5.

- 47% distributed to the county in which the resident resides
- 9% distributed to counties by road mileage
- 5% distributed to townships by road mileage
- 5% distributed equally among the counties

Permissive license tax fees are also available in each county and taxing district. Permissive license tax is an optional tax levied by counties or taxing districts on vehicle registrations. The Plan incorporates permissive taxes levied by taxing districts into its revenue assumptions.

The federal-aid system represents 26% of the total roadway miles in the region, while 74% are local roads. Therefore, for the purposes of the Plan, only 26% of the total revenue generated from this source will be available for projects on the federal-aid system, and 74% will be available for local roads also maintained by taxing districts.

Ohio Department of Natural Resources (ODNR): Clean Ohio Trail Program
The Clean Ohio Trails Fund supports trail-related projects, including land acquisition for a trail, trail development, trailhead facilities, and engineering. ODOT administers and distributes federal and state highway and nonmotorized project funding through a variety of programs that target specific needs and geographies.

Appendix 10-1 describes state-developed programs (available for the NOACA region) through which ODOT allocates federal funds to highway and nonmotorized projects.

NOACA administers approximately $55 million of federal-aid funding each year. In addition to revenue sources from ODOT and FHWA, NOACA can influence local investments used to match federal funds and state funds through its project selections.

The NOACA funding sources used for highway and nonmotorized projects include:
- NOACA CMAQ – Federal
- NOACA CRP – Federal
- NOACA STBG – Federal
- NOACA STBG set-aside for Transportation Alternatives

Transit Project Funding Sources

Transit is an important aspect of the transportation network, and mobility choices are vital to the health and vibrancy of a region. Public transit options reduce congestion, personal transportation costs, and carbon output. Public transit is not just a form of alternative transportation, but provides options for lower-income households, the elderly, and people with disabilities. Public transit provides access to health care, entertainment, and educational facilities, among other daily activities and destinations.

There are five public transit systems operating within the NOACA region:
- Greater Cleveland Regional Transit Authority (GCRTA) – Cuyahoga County
- Geauga County Transit (GCT)
- Laketran – Lake County
- Lorain County Transit (LCT)
- Medina County Public Transit (MCPT)

In 2023, Geauga County Commissioners entered into contract with Laketran to operate Geauga County Transit.

Where service areas meet or overlap, a regional fare agreement allows riders to transfer once between systems with no additional cost to the rider, though LCT and MCPT are not part of this agreement.

In 2014, Medina County Public Transit (MCPT) transitioned from a rural system to an urban system. After the 2020 Census, the Cleveland UZA was amended to remove the City of Medina, which, as county seat, changed the county's designation by the state from urban to rural. Therefore, MCPT is no longer eligible for Section 5307 Urbanized Formula awards but instead receives allocations through the Section 5311 Formula Grants for Rural Areas funding.

The region receives transit funding from several Federal Transit Administration (FTA) programs, the state's General Revenue Fund (GRF) allocation (beginning in 2024), NOACA-administrated funding programs, and local funding sources.

Federal Sourced

Section 5307 Urbanized Area Formula
Section 5307 program funds make up about 45% of available federal funds. In Ohio urbanized areas with a population of 200,000 and more, transit agencies that apply for these funds receive them directly from the apportioned amount. In the NOACA region such agencies include the Greater Cleveland Regional Transit Authority (GCRTA), Laketran and Lorain County Transit (LCT). For urbanized areas under 200,000 in population, the governor distributes the apportioned funds. In the NOACA region, this includes Geauga County Transit (GCT) and Medina County Public Transit (MCPT).

Transit agencies can spend Section 5307 resources on capital projects, planning, and preventative maintenance, but not service operations (in most cases). Some exceptions are available for urban areas with a population of less than 200,000; these agencies may use Section 5307 funds for operating assistance, and in limited cases, urban areas with populations of 200,000 or more may use Section 5307 funds for operations if they operate 100 or fewer vehicles during peak periods.

Section 5311 Non-Urbanized (Rural) Area Formula
The Section 5311 program makes up about 9% of available federal funds. The program provides funding for rural transit capital, operating, and planning activities. ODOT receives Section 5311 funds and then allocates them to rural transit operators such as Geauga County Transit (operated by Laketran), and Medina County Public Transit. ODOT sets aside a small portion of the program funds for formula allocation to intercity bus services and the Appalachian Development program.

Section 5310 Enhanced Mobility for Older Adults and People with Disabilities
Roughly 2% of available federal program funds are for use in urban (80%) and rural areas (20%) to support services for older adults and people with disabilities. Capital projects planned, designed, and carried out to meet the special needs of seniors and individuals with disabilities must receive at least 55%. Up to 45% of Section 5310 funds may go to nontraditional projects including operating assistance. Program administration and technical assistance are also eligible. NOACA serves as a direct recipient for the 5310 program funds for the Cleveland Urban Area. ODOT serves as a direct recipient for the small urban and rural areas of the region.

Section 5337 State of Good Repair
Section 5337 program funds make up roughly 20% of available federal funds. The 5337 program supports existing fixed guideway (rail, streetcar, and BRT) services in operation for at least seven years. It replaces the former Section 5309 Fixed Guideway Modernization Program. GCRTA is

the only transit agency in the NOACA region with existing fixed guideway that meets the program requirements.

Section 5339 Bus and Bus Facilities
The Section 5339 program funds make up roughly 4% of available federal funds and replaced the former discretionary Section 5309 Bus and Bus Facilities program. Funding is available for capital purposes, including preventive maintenance; operating assistance is not an eligible expense.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program
As previously mentioned, CMAQ provides flexible funding to state and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Based on historic NOACA project allocation, the Plan assumes 50% of CMAQ for transit, 25% for bicycle and pedestrian, and 25% for roadway operational improvements.

Ohio Public Transportation Grant Program (OPTGP)
Supported by CMAQ and STBG through ODOT, the Urban Transit Program encompasses funding administered by ODOT for transit service in Ohio's urbanized areas with populations of 50,000 or greater. The program goals are to facilitate the most efficient and effective use of both federal and state funds in the provision of transportation services. The small urban transit systems receive state funds to leverage federal dollars, and the eight large transit systems receive federal funds ODOT allocates.

Federal Discretionary Funding Programs

The IIJA also provides funding through a wide range of competitive grant programs. Since 2022, the NOACA region has been awarded funding through various competitive grant programs.

All Stations Accessibility Program
This program provides capital funding to upgrade the accessibility of legacy rail fixed guideway public transportation systems for people with disabilities, including those who use wheelchairs by increasing the number of existing (as of the date of enactment of this Act) stations or facilities for passenger use that meet or exceed the new construction standards of Title II of the Americans with Disabilities Act of 1990 (42 U.S.C. 12131 et seq.).

Areas of Persistent Poverty Program
This program awards grants to eligible applicants for planning, engineering, or development of technical or financing plans for projects eligible under Chapter 53 of title 49, United States Code to assist Areas of Persistent Poverty or Historically Disadvantaged Communities.

Buses and Bus Facilities
This program provides capital funding to replace, rehabilitate, purchase, or lease buses and bus related equipment and to rehabilitate, purchase, construct, or lease bus related facilities.

Pilot Program for Transit-Oriented Development
This program helps support Federal Transit Administration's mission of improving public transportation for America's communities by providing funding to local communities to integrate land use and transportation planning with a new fixed guideway or core capacity transit capital investment.

Rail Vehicle Replacement Program
Capital projects for the replacement of rail rolling stock. Not more than three new competitive awards for eligible projects may be announced each fiscal year FTA may select projects for multi-

year awards. In awarding grants under this subsection, the Secretary shall consider (A) the size of the rail system of the applicant; (B) the amount of funds available to the applicant under this subsection; (C) the age and condition of the rail rolling stock of the applicant that has exceeded or will exceed the useful service life of the rail rolling stock in the 5-year period following the grant; and (D) whether the applicant has identified replacement of the rail vehicles as a priority in the investment prioritization portion of the transit asset management plan of the recipient pursuant to part 625 of title 49, Code of Federal Regulations (or successor regulations).
State and Local Sourced

Ohio Transit Preservation Partnership Program 2 (OTP2) – State
ODOT instituted the Ohio Transit Partnership Program (OTP2) to provide state funds to the rural and urban transit systems in Ohio, beginning in state fiscal year 2020. This program replaced the original Ohio Transit Preservation Partnership Program (OTPPP), which provided federal funds (flex) to urban systems since 2012. The OTP2 is a discretionary program, and projects compete with an emphasis on Tier I preservation projects that maintain, sustain, or keep Ohio transit systems in a good, sound state. Tier II priorities include projects that promote regionalization, coordination, technology, service expansion, workforce initiatives, and healthcare initiatives.

Local Taxes and User Fees – Local
Locally generated revenue sources make up the majority of funding available for transit operations and capital projects in the NOACA region. Local sources primarily consist of taxes (property, sales, and use tax) and fare box revenues.

Conclusion

Federal and state-defined programs are distributed or competitively sought based on a variety of formulas set by federal and state regulations and ODOT priority. They are broadly designed to allocate resources based - depending on the program - on factors that include population, population density, number of low-income individuals, elderly individuals, individuals with disabilities, and a number of transit service characteristics (e.g., revenue vehicle miles, route miles, etc.).

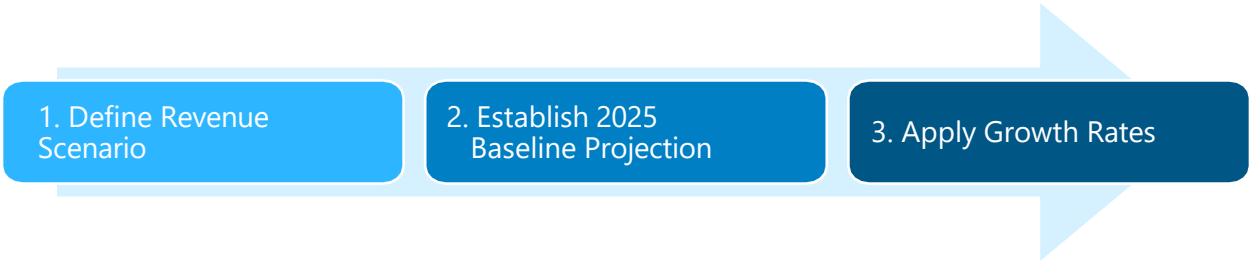
Ohio is among the states with the lowest state-funded support for public transit. Based on 2014 funding data submitted by transit agencies to the FTA, Ohio ranked in the bottom 14. Among neighboring states, Pennsylvania provides the highest support for transit operating expenses (i.e., 47% share). The State of Ohio provided less than 1% of operating expenses.

Forecasted Revenue Scenario

The financial resources projected to be available for the *weNEO2050+* planning horizon come from the various federal, state, and local funding sources explored in previous sections of this chapter. As previously noted, ODOT controls certain funds and allocates them through its project selection process for the particular fund program type. NOACA controls some of the funds and allocates them through its project selection process. Two of the five transit agencies in the region have urban direct recipient designation to receive direct federal assistance and manage project selection and implementation. Local jurisdictions provide funding, which is used to match federal funds and state funds, and for direct operations and maintenance of the local system.

This section defines baseline and growth assumptions used for the development of the forecasted revenue scenario. This process involved three defined steps (see Figure 10-4).

Figure 10-4. The Forecasted Review Scenario Process



Step 1: Define Revenue Scenario

The Status Quo: "Get what you get" revenue forecasting scenario is the approach NOACA has opted to follow to establish revenue assumptions for previous NOACA long-range plans (LRPs). This scenario establishes revenue levels based on funding historically received in the NOACA region, primarily the funding available for roadway and bicycle/livability projects controlled by ODOT. This scenario was built within the context of what could reasonably be expected to be available. It.

Recognizing that the federal, state, and local funding sources described in the previous sections are largely collected and allocated for specific project eligibility, the revenue and planned projected expenditures are focused into three categories: 1. Roadway, 2. Bicycle/Livability, and 3.Transit.

Step 2: Establish 2025 Baseline Projection

Roadway and Nonmotorized Transportation Baseline Assumptions
NOACA staff developed these assumptions based on historic (SFYs 2021-2024) regional expenditure data (federal, state, and local) queried from ODOT's Ellis project management database. Expenditure refers to encumbered and committed dollars. This timeframe represents the previous 2021-2024 and current 2024-2027 Transportation Improvement Programs (TIPs). Expenditures were categorized by federal, state, and local match dollars. NOACA staff then calculated averages for each type of funding by summation of yearly expenditures and division by the number of fiscal years.

Transit Baseline Assumptions

Baseline FTA federal funding levels are equal to 2025 apportionments to urbanized transit providers (GCRTA, LAKETRAN, and LCT) and historic allocations of FTA funding controlled by ODOT to rural transit providers (GCT, MCPT).

State General Revenue Fund funding that supports the ODOT OTPP2 program is equal to the 2020 program allocation of $28.2 million. 2020 is the first and only year of OTPP2 program allocation since the approval of increased GRF funding to transit in the 2019 state budget.

Baseline Revenue Tables
Tables 10.2 through 10.5 contain the calculated 2025 baselines for the forecasted revenue scenario based on the described assumptions.

Table 10-2. 2025 Baseline Revenue Calculations – Roadway

	Revenue Scenario
Source	**Status Quo**
Federal	
FHWA – ODOT	$245,713,837
FHWA – NOACA	$39,763,920
FHWA - Discretionary	$4,738,800*
Subtotal	**$290,216,557**
State	
State MFT – ODOT	$105,659,000
State MFT – Local	$31,489,400
OPWC	$25,756,332
Subtotal	**$162,904,732**
Local	
Vehicle Registrations	$23,826,659
Match	$20,482,165
Subtotal	**$44,308,824**
Grand Total	**$497,430,113**

* Based on an annual average over 4 years.

Table 10-3. 2025 Baseline Revenue Calculations – Nonmotorized

	Revenue Scenario
Source	**Status Quo**
Federal	
FHWA - ODNR	$396,897
FHWA - NOACA	$9,061,667
FHWA - Discretionary	$42,167,001*
Subtotal	**$51,625,565**
State	
ODNR - COT	$820,000
Subtotal	**$820,000**
Local	
Match	$2,637,974
Subtotal	**$2,637,974**
Grand Total	**$55,083,539**

* Based on an annual average over 4 years.

Table 10-4. 2025 Baseline Revenue Calculations – Transit

	Revenue Scenario
Source	**Status Quo**
Federal	
FTA - Formula	$63,318,998
FHWA - NOACA	$8,046,016
FHWA - OEPA	$2,600,000
FHWA - ODOT	$4,000,000
FTA/FHWA - Discretionary	$46,258,022*
Subtotal	**$124,223,036**
State	
State GRF	$8,000,000
Subtotal	**$8,000,000**
Local	
Capital	$3,914,580
Match	$31,380,760
Subtotal	**$35,295,340**
Grand Total	**$167,518,376**

* Based on an annual average over 4 years.

Table 10-5. 2025 Baseline Revenue Calculations – Summary by Category

	Revenue Scenario
Revenue Category	**Status Quo**
Roadway	$497,430,113
Nonmotorized	55,083,539
Transit	$167,518,376
Total	**$720,032,028**

Step 3: Annual Growth Rates through 2050

The next step is to apply annual growth rates to the 2025 baseline through the *weNEO2050+* planning horizon year. Revenue scenarios and cost estimates that support the metropolitan transportation plan must use inflation rates to reflect "year of expenditure dollars," based on reasonable financial principles and information, and developed cooperatively by NOACA, ODOT, and public transportation operators for the original long range plan.

NOACA has established three scenarios: Continued Growth, the most likely scenario; High Growth; and No Growth. The primary factor of difference between the developed scenarios is the estimated growth of federal funding. The IIJA authorized increased formula funding by approximately 18%. NOACA maintained the growth assumptions in the original long range plan.

Federal Revenue Assumptions

High Growth Scenario
Assumes an annual federal growth rate double to the annual growth rate - 4% for roadway and nonmotorized dedicated revenues and 2% for the Mass Transit Account for transit projects.

Continued Growth Scenario
Assumes an annual federal growth rate of 2% for roadway and nonmotorized dedicated revenues and 1% for transit revenues equal to the average increases realized over the life of IIJA (2022-2026).

No Growth Scenario
Assumes no federal growth past current IIJA funding apportionments for roadway, nonmotorized, and transit-dedicated revenue. Essentially, revenues reflect IIJA Act apportionment levels in 2025 dollars.

State Revenue Assumptions

Roadway and Nonmotorized Sources
Apply an annual growth rate of 1% through 2029 and 0.3% for each year thereafter, through 2050, based on NOACA transportation demand model projections of annual increase in vehicle miles traveled (VMT) for the region. This assumption is unchanged across all growth scenarios.

Transit Sources
In 2019, the Ohio legislature committed state General Revenue Funds (GRF) to the statewide OTPP2 for transit agency projects. Based on the annual funding awards since 2019, this plan conservatively assumes continued growth for the state GRF funded OTPP2 program through 2050. This assumption is unchanged across all growth scenarios.

Local Revenue Assumptions

Roadway and Nonmotorized Sources
Local funding projections are based on estimates of motor fuel and vehicle registration taxes distributed to local governments. Projections account for federal and state matching needs first, with the remainder expected to be available for operations and maintenance of the system. Based on historic expenditures, local match to ODOT is indexed at a rate of 3% of total federal and state funding. Local match to NOACA and other available programs is based on the individual requirements of those programs, which is typically 20%.

An assumption of continued growth for federal and state funding assumes continued growth for local funds.

Local Motor Fuel Tax: Assumes a growth rate consistent with the annual growth rate of 1% through 2029 and 0.3% for each year thereafter through 2050 based on NOACA transportation demand model projections of annual increase in vehicle miles traveled (VMT) for the region.

Vehicle Registration Tax (VRT): Assumes a growth rate equal to 0.06%, which is the average annual increase of actual disbursements to local governments for the immediate five-year period (2020-2024). This does not include permissive vehicle registration taxes.

Transit Sources
Total local revenue for capital projects is the difference between the amounts of federal and state projected assistance and the overall capital and operating budgets. The less federal and state revenue projected, the more the burden shifts to local funding to maintain service.

Table 10-6 contains summaries of total estimated revenues by scenario after application of the growth rates to the baseline.

Appendix 10-2 contains the annual growth rates for scenario by revenue source.

Appendix 10-3 contains the estimated revenues for each of the scenarios with applied growth rates. These tables represent the final revenue estimates for which project costs will be compared for demonstration of fiscal constraint.

Table 10-6. Summary of Estimated Revenues by Scenario

Status Quo Scenario		Not Adjusted			Adjusted for 2025$		
		Growth Scenario ($2025B)			Growth Scenario ($2025B)		
	Category	No (0%)	Continued (2%)	High (4%)	No (0%)	Continued (2%)	High (4%)
	Roadway	$12.75	$14.51	$16.87	$16.74	$16.94	$17.13
	Transit	$4.25	$4.81	$5.55	$5.20	$5.26	$5.32
	Bike / Livability	$1.38	$1.45	$1.54	$1.53	$1.53	$1.55
	TOTAL	**$18.38**	**$20.77**	**$23.96**	**$23.47**	**$23.74**	**$23.75**

Opportunities for Innovation and Increased Revenues

Innovative Financing Strategies

As the cost of transportation projects continues to outpace available financial resources, US DOT and state departments of transportation have identified and approved strategies to expand the capacity of the federal-aid and state-funded programs to implement projects.

Innovative financing tools assist ODOT and external funding program managers, such as NOACA, to advance projects while they reduce costs. This enhances efficiency and generates revenue. ODOT and NOACA will continue to pursue the innovative financing strategies identified below, where eligible, to advance the priority projects identified in the Plan. These strategies do not provide additional revenue; rather they are financing mechanisms that spread or delay the cost of a project, typically with interest, over a defined number of years. These strategies allow ODOT and NOACA to implement projects sooner than if they were funded with traditional allocations. These strategies are typically reserved for high-cost projects that could not be implemented with traditional program funding allocations.

MPO Funding Exchange

ODOT allows MPOs to exchange funding in an effort to accelerate project delivery while ensuring maximum use of all available funds. To accomplish this, MPOs that are not able to use all their allocated funding in a given state fiscal year may trade it all or a portion of it with another MPO to advance projects from the next fiscal year. The process is referred to as an exchange of budget. There are no costs or penalties incurred by either MPO in the execution of the budget exchange. Also, there are no funding or scheduling impacts to any other projects approved in the NOACA TIP. ODOT encourages the use of this process to ensure the timely expenditure of MPO-allocated funds and to realize a quicker public benefit. NOACA has used this strategy on an annual basis to advance ready projects.

Recommendation: NOACA aggressively pursues budget exchanges with other MPOs to advance projects identified in the TIP. Since SFY 2015, NOACA has borrowed more than $40 million to advance projects for implementation by one fiscal year and repaid those funds in the following fiscal year. Assuming an average inflation of 3%, that equates to savings of $1.2 million

in interest and delivery of the public benefit associated with the transportation improvement one year sooner.

NOACA will continue to pursue MPO budget exchanges as a means to advance projects in the TIP to save inflation costs and realize project benefits sooner.

Transportation Infrastructure Financing and Innovation Act (TIFIA)

The Transportation Infrastructure Financing and Innovation Act (TIFIA) provides federal credit assistance to eligible surface transportation projects. Innovative financing tools help project sponsors reduce costs, enhance efficiency, and generate revenue. TIFIA could be leveraged to close the funding gap for high-cost projects that have secured significant levels of funding or financing. Currently NOACA is coordinating with the City of Cleveland on a draft TIFIA application for the North Coast Connector project along SR 2 (Cleveland Memorial Shoreway) between the Main Avenue Bridge and E. 9th St. NOACA is utilizing our Regional Infrastructure Accelerator (RIA) grant through US DOT's Build America Bureau to provide technical assistance to this project.

Recommendation: NOACA will continue to inform sponsors of high-cost projects about the TIFIA requirements and benefits. NOACA will also help project sponsors submit applications for TIFIA project financing.

Advance Construction

ODOT uses advance construction to help manage fund appropriations and obligation limitations provided by the FHWA. Advance construction allows ODOT to gain federal authorization to begin federally eligible activities without obligating funding. At the time of authorization, FHWA confirms that ODOT has followed all requirements necessary to execute a federal agreement. By placing the funds into advance construction, FHWA does not guarantee funding for the project but indicates the activities would be eligible. ODOT places most of its projects in advance construction at the time of authorization.

The advance construction is placed into two groups: short term and long term. Short term is used for projects in which the funding will be converted as project expenditures take place and are exhausted by the completion of the federally eligible activities. ODOT can convert its appropriations and obligation limitation for costs that are currently incurred and maintain a balance throughout the federal fiscal year. Long term is used primarily for Grant Anticipated Revenue Vehicles (GARVEE) bonds and MPO or CEAO SIB (State Infrastructure Bank) loans used and managed by ODOT (see below).

Recommendation: NOACA (with ODOT) will explore the use of advance construction as a strategy to authorize projects with local funds to be converted to NOACA federal funds when available.

Grant Anticipated Revenue Vehicles (GARVEEs)

GARVEEs enable states to pay debt service and other bond-related expenses with future federal-aid highway funds. The law authorizing GARVEEs, however, makes it clear that a debt- financing instrument's eligibility for reimbursement with future federal-aid highway funding does not constitute a commitment, guarantee, or other obligation by the United States, nor does it create any right of a third party (such as an investor) against the federal government for payment.

The GARVEE bonds retire by future federal funding received through the active and future

highway authorization laws. Prior to a bond sale, the entire amount of the bond is put into advance construction by ODOT for the projects funded with its proceeds. These amounts convert over an eight- to 12-year period to retire the bonds. These payments are made on either a level principal or level interest payment schedule, depending on the bond structure.

ODOT does not allow NOACA-administered federal funds to be an eligible source of repayment for its GARVEE or State Infrastructure Bank (SIB) Bond Programs.

Recommendation: NOACA (with ODOT) will continue to explore the eligibility of NOACA administered funds as a means to secure GARVEE-backed financing.

State Infrastructure Bank (SIB)

ODOT maintains a direct SIB loan and bond financing program, authorized under the ORC, Chapter 5531, to develop transportation facilities throughout Ohio. The SIB is used as a method to fund highway, rail, transit, intermodal, and other transportation facilities and projects that produce revenue to amortize debt. Per the SIB policy, the SIB prioritizes projects that contribute to the connectivity of Ohio's transportation system and further goals such as corridor completion, economic development, competitiveness in a global economy, and quality of life.

The Ohio State Legislature capitalized the Ohio SIB with a $40 million authorization of state general revenue funds (GRF), $10 million in state motor fuel tax funds, and $87 million in federal Title XXIII Highway Funds. Any highway or transit project eligible under Title XXIII, as well as aviation, rail, and other intermodal transportation facilities, is eligible for direct loan funding under the SIB.

ODOT's objective is to maximize the use of federal and state funds to make direct loans to eligible projects. SIB loans are loans taken out by NOACA or a local sponsor and paid off with federal MPO or CEAO funding. These loans have a typical repayment term of 10 years and are paid down using a level principal amortization schedule. Repayments are then re-loaned to subsequent projects, hence creating a SIB revolving loan program.
In recent years NOACA has aggressively pursued funding through the SIB loan program to advance several high-cost projects identified in the TIP. To date NOACA has secured more than $75 million in financing through the SIB to advance transportation projects.

Recommendation: NOACA will continue to pursue SIB loan program financing as a means to advance needed high-cost projects for the region. The effectiveness of this strategy is based on the availability of SIB loan program funding at the time of project application.

Public-Private Partnerships (P3s)

With the passage of Ohio House Bill 114, ODOT has, like other state departments of transportation, embraced Public-Private Partnerships (P3s) for the delivery of public projects and services. P3s can provide numerous benefits in the finance, design, construction, maintenance, and operation of transportation facilities. ODOT has used P3s to advance several high-cost projects statewide, including Interstate 90 Innerbelt bridges.

NOACA also used a P3 model to develop a Hyperloop Feasibility Study in 2020. NOACA entered into an agreement with Hyperloop Transportation Technologies (HTT), a private Hyperloop company, for a 50/50 funding and resource share to develop the study.

Recommendation: NOACA will continue to explore P3 opportunities to develop and finance mutually beneficial transportation projects.

Toll Credits

Toll Credits (TCs) are credits that states earn from nonfederal capital expenditures that public or private agencies, such as the Ohio Turnpike, make "to build, improve, or maintain highways, bridges, or tunnels that serve the public purpose of interstate commerce."
Section 120(j) of Title 23 permits TCs to fulfill some or all of the federal matching fund requirements normally associated with eligible Title 23 and Title 49 surface transportation capital, operating, or planning project financing. The application of TCs increases the federal share of a project, which reduces nonfederal match requirements. It is important to note that TCs are not "cash" or additional funding but instead are credits applicable to surface transportation federal aid projects.

NOACA has authorized the use of TCs for the following activities, subject to ODOT's continued allocation of TCs to NOACA. Currently, TCs are authorized through SFY 2029.

1. *Urban Core Communities:* Projects sponsored by, and located within, communities identified in the current NOACA *Urban Core Communities Policy* are eligible for 90% NOACA funding participation, using 10% TCs.
2. *Disadvantaged Communities:* Projects sponsored by, and located within, communities identified in the current NOACA *Disadvantaged Communities Policy* are eligible for 100% NOACA funding participation, with up to 20% TCs to increase funding over the standard 80% rate.
3. Projects sponsored by, and located within, areas as defined by low-income and minority transportation analysis zones (TAZs) are eligible for 100% NOACA funding participation, with up to 20% TCs to increase funding over the standard 80% rate.
4. *Transportation for Livable Communities Initiative (TLCI):* Planning and implementation projects identified for funding though the NOACA TLCI Program are eligible for 100% NOACA funding participation, with 20% TCs to increase funding over the standard 80% rate.

Recommendation: NOACA will continue to use TCs provided by ODOT to increase the federal funding participation for projects in accordance with NOACA policy.

Opportunities for Increased Revenue

NOACA recognizes the need for increased revenue to support the maintenance and enhancement of the state and regional transportation system. Therefore, NOACA strongly supports increased funding for *weNEO2050+* implementation through the following opportunities.

Funding Policies that Consider Disproportionate Air Quality

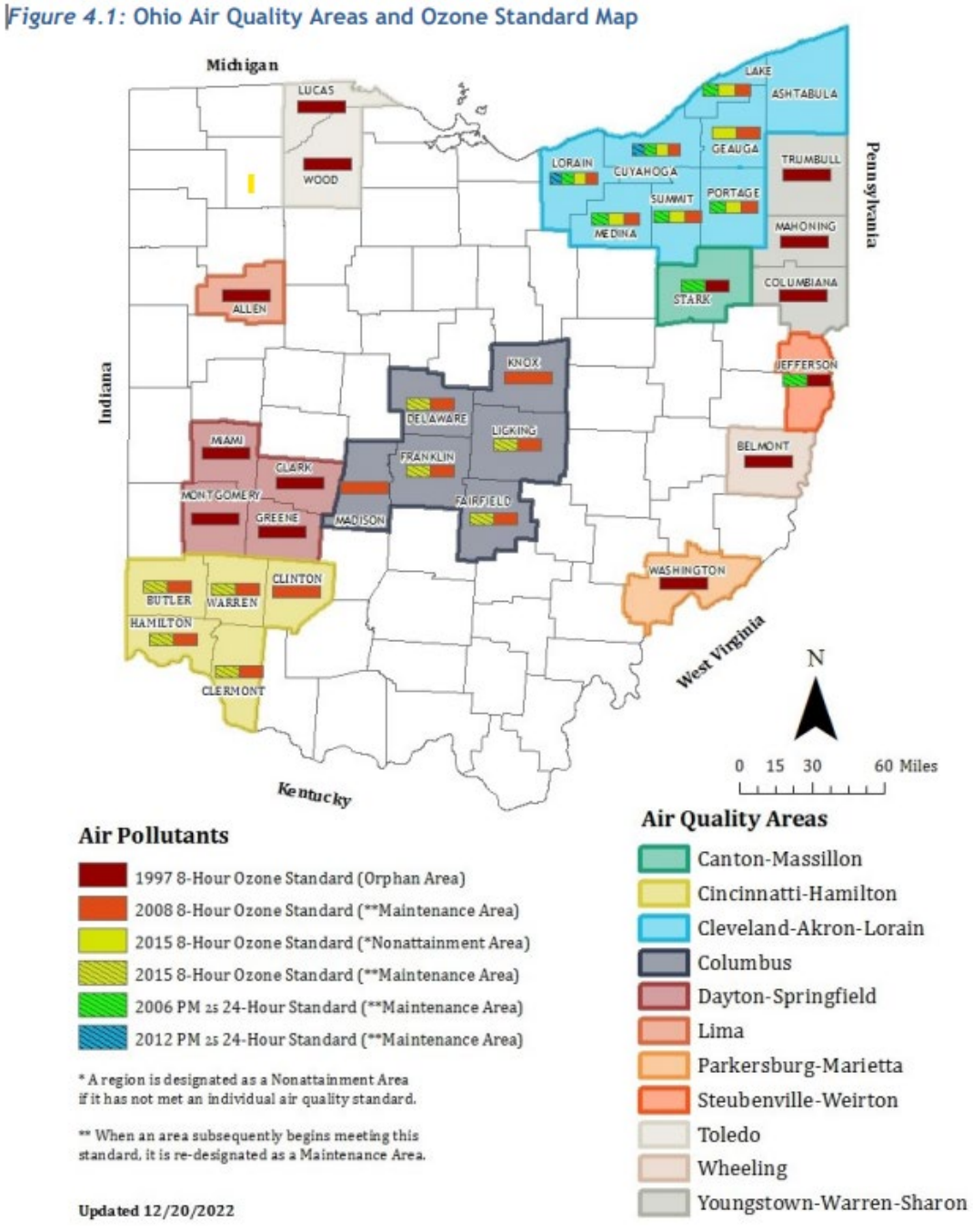
NOACA will continue to advocate for federal and state policies that direct increased funding to the region to address the disproportionate amount of air pollutants in the region compared to the rest of the state.

In April 2024, NOACA printed its 2023 Air Quality Trends Report, which summarizes the most current data on air quality in eight counties in Northeast Ohio (Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit), which constitute the NOACA air quality planning area. The report demonstrates portions of Northeast Ohio remain in nonattainment for one of the six NAAQS. Additionally, this report examines the links between transportation and air quality (Chapter 3), as well as greenhouse gas emissions and climate change (Chapter 6).[6]

[6] Northeast Ohio Areawide Coordinating Agency (NOACA), 2024 Air Quality Trends Report (Cleveland: NOACA, April 2025); https://www.noaca.org/regional-planning/air-quality-planning/air-quality-trends-

Through its air quality planning efforts, NOACA continues to collect information on regional air quality, educate the public, and increase transportation choice within the region (i.e., reduce single-occupancy vehicle trips). The agency also operates or implements a number of programs to serve these goals, such as Gohio Commute, the Commuter Choice Awards, Air Quality Advisories, CMAQ, and TLCI. Increased funding for additional programs and projects will help NOACA improve air quality through reduced mobile emissions.

Figure 10-5. 2020 NAAQS Non-attainment and Maintenance Counties Map[7]



reports (accessed April 21, 2025)

[7] Ohio Department of Transportation (ODOT), Ohio Statewide Transportation Improvement Program (STIP): State Fiscal Years 2024-2027 (July 2023), Chapter 4: Air Quality Conformity, 16;

As of Jan. 16, 2025, USEPA has reclassified the seven-county region of Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit to "serious" nonattainment for the 2015 Ozone National Ambient Air Quality Standard (NAAQS).

Transportation User Fees

In 2019, the State of Ohio legislature increased the state MFT to provide additional revenue for transportation projects. As lawmakers deliberated the increase, the NOACA Board of Directors passed a resolution to support increased revenue for transportation projects, such as the motor fuel user fee, and to advocate for the following:

- Align the amount of the user fee appropriately to the demonstrated need.
- Distribute revenue in an equitable manner, with calculations that better ensure that it goes back to, or is expended in, the communities and regions where it was collected. Current formulas, based on equal splits, registrations, and center line miles, may not provide a fair and adequate allocation of funds to cities, counties, and townships. These formulas are particularly detrimental to urbanized areas such as Northeast Ohio. A more accurate method of distribution would be to use VMT, or perhaps some combination of VMT and other formulas. When NOACA staff compare the current distribution formula to a VMT-based formula, the NOACA region loses $26 million (36%) of what it should receive annually.
- Increase funding for public transportation at a level representative of the value that it provides to the entire transportation system. This value includes important benefits to motorists, such as reduced wear and tear on our roads (and associated maintenance costs), improved public safety, and reduced traffic congestion (and the cost to add new roadway capacity).
    - Determine and codify an adequate percentage of total transportation funding that should be directed to transit to help Ohio achieve parity with per capita funding levels in other states. (Ohio is the seventh most populous state but ranks in the bottom quintile for transit funding).
    - Increase FHWA flex funds to transit providers by an additional $22.5 million annually for transit vehicle replacements. The 2015 ODOT Transit Needs Study recommends flexing a total of $62.5 million to meet vehicle needs. The current budget proposal includes $40 million, an increase of $7 million over the $33 million contained in the SFY 2019 budget.
    - Continue to exempt transit systems from the motor fuel user fee.
- Fund maintenance of both state and locally owned roads and bridges to a state of good repair prior to additional funding to support major new capacity projects as contained in the Transportation Review Advisory Council (TRAC). In Northeast Ohio, cost estimates for repair and maintenance of existing assets within the locally maintained non-interstate system reflect a backlog need of $892 million for pavements and $239 million for bridges. This deteriorating infrastructure poses critical safety concerns and costs each local resident an extra $887 per year for additional repair costs, accelerated deterioration and depreciation, increased maintenance costs, and additional fuel costs. Among metro areas with at least 500,000 residents, Cleveland ranks seventh in the country for highest extra costs.
    - Increase the percentage of total motor fuel user fee revenues that go to, or are expended in, counties, cities, and townships beyond the 31% currently allocated, to at least the 40% level as indicated by ODOT.

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https://www.dot.state.oh.us/Divisions/Planning/STIP/20242027%20STIP/2024-2027%20STIP-04.pdf (accessed April 21, 2025).

- More investment is needed in cost-effective strategies to improve efficiency and reduce congestion on the region's transportation system, rather than increase roadway capacity. New capacity induces demand, which creates more traffic congestion.

NOACA will continue to support opportunities for increased revenue for transportation projects, such as MFT increases, while it also ensures equitable approaches to distribution and alignment with regional priorities.

Other Taxes and Fees

ODOT and local and regional agency project sponsors could explore several tax and fee types to increase revenue for transportation system operations and maintenance. NOACA does not advocate for, or rely upon, additional taxes or fees to support projects identified in the Plan. These include, but are not limited to:

- *Sales Tax* – increased sales tax by district to support public transportation operations and capital infrastructure
- *Property Tax* – on all real and public utilities property
- *Fuel tax* – on gasoline and diesel
- *Vehicle Registration Tax* – for a "regional transportation improvement project" as permitted by law, as the eight already defined "permissive" taxes that counties may assess are unavailable for rail transit
- *Tolls* – tolling involves the imposition of a per-use fee on motorists for a given highway facility. Historically, these fees have generally been flat tolls that may vary by number of axles and distance driven, but not by time of day
- *Congestion Pricing* – congestion pricing can act as a tool for demand management. The variability of pricing depending on traffic conditions and policies capitalizes on market forces to manage the utility of finite roadway capacity
- *VMT User Fee* – Distance-based fees levied on a vehicle user for use of a roadway system. As opposed to tolls, which are facility specific and not necessarily levied strictly on a per-mile basis, these fees are based on the distance driven over a defined network of roadways.

The revenue impact of the above taxes and fees vary significantly given the type, geographic application, and potential range of the tax or fee assessed.

The following are federal discretionary programs that may also provide additional sources of revenue.

Better Utilizing Investments to Leverage Development (BUILD)

Since 2009, Congress has dedicated nearly $8.9 billion for twelve rounds of BUILD grants, previously called Transportation Investment Generating Economic Recovery (TIGER), to fund projects that emphasize improved access to reliable, safe, and affordable transportation for communities. Such projects also improve infrastructure condition; address public health and safety; and promote regional connectivity or facilitate economic growth or competitiveness of the nation, a region, or a metropolitan area. BUILD allows project sponsors at the state and local levels to obtain funding for multimodal, multi-jurisdictional projects that are more difficult to support through traditional DOT programs. BUILD can provide capital funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, MPOs, and others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state DOTs and transit agencies).

Infrastructure for Rebuilding America (INFRA)

The INFRA program awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas provides funding for highway and multimodal freight projects that generate national or regional economic, mobility, and safety benefits while these projects address critical freight issues that face our nation's highways and bridges. Like BUILD, INFRA can provide capital funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, MPOs, and others in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state DOTs and transit agencies).

Fixed Guideway Capital Investment Grant (CIP)

The discretionary Capital Investment Grant (CIG) program provides funding for fixed guideway investments such as new and expanded rapid rail, commuter rail, light rail, streetcars, bus rapid transit, and ferries, as well as corridor-based bus rapid transit investments that emulate the features of rail. There are four categories of eligible projects under the CIG program: New Starts, Small Starts, Core Capacity, and Programs of Interrelated Projects.

- *New Starts* projects are new fixed guideway projects or extensions to existing fixed guideway systems with a total estimated capital cost of $300 million or more, or that are seeking $100 million or more in Section 5309 CIG program funds.
- *Small Starts* projects are new fixed guideway projects, extensions to existing fixed guideway systems, or corridor-based bus rapid transit projects, with a total estimated capital cost of less than $300 million, or that are seeking less than $100 million in Section 5309 CIG program funds.
- *Core Capacity* projects are substantial corridor-based capital investments in existing fixed guideway systems that increase capacity by not less than 10 percent in corridors that are at capacity today or will be in five years. Core capacity projects may not include elements designed to maintain a state of good repair.
- *Programs of Interrelated Projects* are made up of any combination of two of the above projects. The projects in the program must have logical connectivity to one another, and all must begin construction within a reasonable time frame.

Each type of project has a unique set of requirements, although many similarities exist among them. All projects must be evaluated and rated by FTA in accordance with statutorily defined criteria at various points in the development process. To be eligible to receive a construction grant, all projects must go through a multistep, multiyear process and receive at least a "Medium" overall rating, in addition to other requirements.

Other sources may be pursued as well to include private sources such as civic foundations or developers that stand to benefit from a regional investment in transportation infrastructure. A strategic approach should be used to raise funds, which when best leveraged, will produce the highest possible "match" from federal sources.

Cost Estimate Assumptions and Forecasted Projects

Cost Estimate Assumptions

To estimate project inflation over the life of *weNEO2050+*, NOACA relied upon ODOT's *2024*

Construction Cost Outlook and Forecast report.[8] The ODOT Bid Analysis & Review Team in the Office of Estimating prepares the report annually. ODOT analyzes key factors and inputs in the report, including state and global economies and construction input trends associated with labor, contractor, and supplier margins; oil and gas; and other commodities, such as asphalt, concrete, and steel.

The expected ODOT Construction Cost Inflation Forecast is in Table 10-7. The table presents estimated inflation for high, most likely, and low scenarios. NOACA is using the "most likely" scenario to estimate all project costs planned in *weNEO2050+.*

Table 10-7. Annual Inflation Factors

	CY 2025	CY 2026	CY 2027	CY 2028	CY 2029	CY 2030-2034	CY 2035-2050
High	5.1%	7.3%	6.8%	5.9%	5.8%	-	-
Most Likely	**3.5%**	**5.0%**	**4.4%**	**3.8%**	**3.3%**	**3.0%**	**2.0%**
Low	1.5%	2.0%	2.0%	1.8%	1.8%	-	-

From CY2030 through CY2034 inflation is forecast to be 3.0%, based upon average rates over 30 to 60 years as measured by the GDP deflator and the Consumer Price Index (CPI). The long-term forecast beyond CY2034 is 2.0%, according to ODOT, based on the Federal Reserve's long-run inflation target rate.

Compounded, costs will increase an estimated 67%. Therefore, what costs $1.00 to purchase in the plan adoption year of 2025 will cost $1.67 in the 2050 horizon year. For this reason, it will be important to monitor inflation and adjust estimates of planned projects accordingly if the region is going to deliver the planned program of projects successfully in the optimal year of implementation.

All projects represented in the plan are also adjusted for expected construction administration and engineering costs in accordance with ODOT guidance.

Forecasted Projects

The development of the LRTP scenarios begins with the categorization of a set of proposed projects, their implementation decades, and technology levels to be used. The general descriptions for the scenarios detailed in Chapter 9 are:

- *Scenario 1*: MAINTAIN – allocate 100% of the annual budgets to transportation system maintenance only.
- *Scenario 2*: CAR – add the major highway capacity projects and viable freeway interchanges to support the Single Occupancy Vehicle (SOV) mode.
- *Scenario 3*: TRANSIT – add the improved 2017 visionary rail network and the transit agencies' future bus/BRT network plans to develop a multimodal transportation system.
- *Scenario 4*: TOTAL – add the major highway capacity projects, allocate freeway and arterial smart lanes to autonomous cars and trucks, and add the improved 2017 visionary rail network plus the transit agencies' future bus/BRT network plans to create an advanced

[8] Ohio Department of Transportation (ODOT), *January 2025 Construction Cost Outlook and Forecast*, (Columbus, Ohio: January 2025); https://www.dot.state.oh.us/Divisions/ConstructionMgt/Estimating/Pages/BART.aspx (accessed February 1, 2025).

multimodal transportation system.

Additionally, discussion of the future regional transportation network cannot move forward without acknowledgement of the role technology will play in the way people and goods move around the region and the infrastructure changes necessary to support it. The automobile industry continues to replace “Horsepower” with “Processing Power,” and there is little doubt that the Plug-in Hybrid Electric Vehicles (PHEV), Connected and Autonomous Vehicles (CAV), autonomous shuttles, and other technology-driven advancements are going to fill the transportation network in the near future. This technology will not replace the existing modes of travel overnight. This may take one or two decades, but it will certainly happen by the planning year 2050. Thus, each of the scenarios appropriately considers these technological advancements at different levels and stages of adoption.

To supplement NOACA scenario development, staff solicited projects from communities and regional transportation partners to capture all needs adequately. NOACA staff reviewed projects submitted by local and regional entities for alignment against NOACA plans and studies.

The process also identified projects proposed for the region that need further analysis to determine conformance with NOACA transportation and fiscal planning requirements before amendment to the fiscally constrained plan. Those projects are in the illustrative plan.

NOACA staff categorized projects contained in the Plan as follows:

- *Maintain* – Projects that preserve existing transportation system assets
- *Enhance* – Projects that enhance safety, operations, and multimodal options on the transportation system
- *Expand* – Projects that expand capacity of the transportation system through the addition of new infrastructure

NOACA staff then grouped and showed projects by mode and project types, as defined in Chapter 9. This is consistent with transportation revenue estimates to allow for accurate fiscal constraint analysis. The mode and project types include:

1. Roadway
    a. Roadway Preservation – Projects that preserve pavement and bridge conditions
    b. Roadway Enhancement – Traditional projects that improve operations and safety for all modes
    c. Roadway Expansion – Projects that add significant capacity, including new roadways and interchanges and major roadway widening
2. Nonmotorized
    a. Bicycle Facilities – Projects that improve infrastructure and promote safe bike travel on the existing roadway network, including off-road multiuse pathways and on-road facilities such as separated bike lanes and sharrows
    b. Pedestrian Facilities – Projects that connect gaps in the sidewalk network to increase accessibility and improve safety
3. Transit
    a. Transit Preservation – Projects that preserve vehicle and non-vehicle capital assets in a state of good repair
    b. Transit Expansion – Projects that add new transit infrastructure to extend service to areas of the region that are underserved
4. Emerging Technology
    a. Emerging technology projects that include ”smart” roadway features, alternate fuels and vehicle automation (i.e., shuttles, cars, trucks)
    b. For the purposes of the Plan, staff allocated Emerging Technology projects to

Roadway, Nonmotorized, and Transit as there is no dedicated revenue source for only technology projects.

Project Lists

The federal requirements (23 CFR 450.324) for transportation plans require a list of major projects proposed for implementation in the region during the Plan's life. NOACA defines major projects as those greater than $12 million that also meet the federal definition of a Regionally Significant Project (23 CFR, Section 450.104), or projects not defined as exempt in EPA's transportation conformity regulations (40 CFR part 93, subpart A). Figure 10-7 and Table 10-8 contain a map and list, respectively, of major projects contained in *weNEO2050+*. Table 10-9 contains a list of proposed major and minor Illustrative projects included in *weNEO2050+* that are pending review against NOACA planning requirements and/or demonstration of fiscal constraint.

Fiscally constrained minor projects, or those that do not meet the definition of "major" (see above), appear in Appendix 10-4, which is a list of all minor projects ranging in cost of $500,000 to $11,999,999. This list is a comprehensive listing of all minor projects generated from NOACA pavement, bridge, and nonmotorized plans and tools, and through the community and regional agency project solicitation.

Figure 10-7. Map of Major Projects

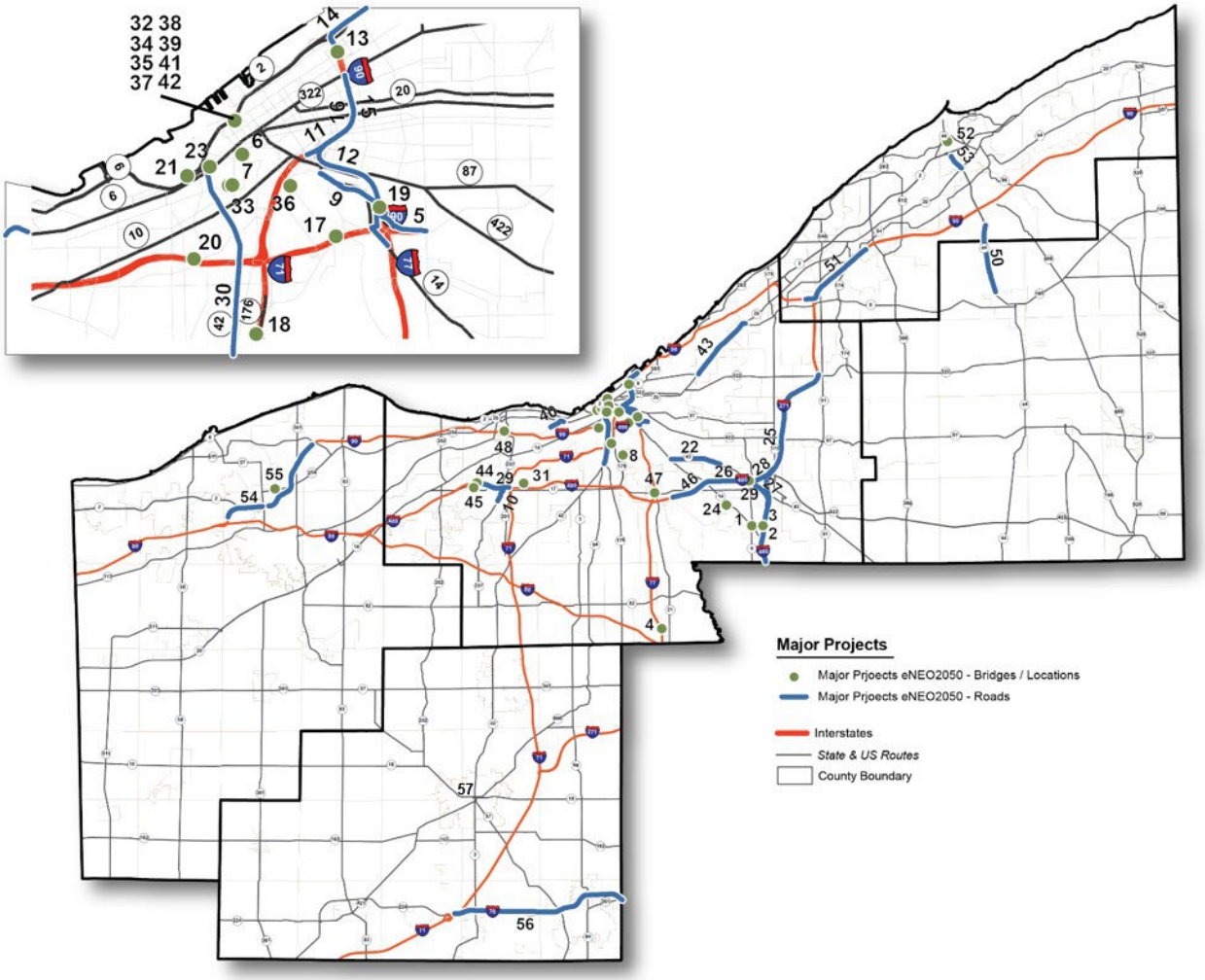


Table 10-8. List of we*NEO2050+* Major Projects: Projects >$12 Million or with Significant Impact to the System or Air Quality

MAP ID	COUNTY	LOCATION	PROJECT NAME	PROJECT DESCRIPTION	NEED SFY	ESTIMATED COST	MAINTAIN/ ENHANCE/ EXPAND	MODE	PRIMARY WORK TYPE
NA	CUYAHOGA	BEACHWOOD	IR 271/US 422 - 7.80/10.77	ALONG CHAGRIN BLVD. BETWEEN RICHMOND RD. AND ORANGE PL.-WIDEN THE SB/NB APPROACHES TO THE CHAGRIN BLVD./ RICHMOND RD. INTERSECTION, CONSTRUCT A WB RIGHT TURN LANE AT CHAGRIN BLVD. / RICHMOND RD. AND EXTEND THE THIRD EB TRAVEL LANE ON CHAGRIN BLVD. BEYOND RICHMOND RD., WIDEN THE I-271 NB EXIT RAMP FOR DUAL LEFT/RIGHT TURN LANES, WIDEN EB/WB CHAGRIN BLVD., INCLUDING THE BRIDGE OVER I-271 ALONG CHAGRIN BLVD. BETWEEN RICHMOND RD. AND ORANGE PL.-WIDEN THE SB/NB APPROACHES TO THE CHAGRIN BLVD./ RICHMOND RD. INTERSECTION,	2027	$15,451,097	ENHANCE	ROADWAY	ROAD WIDENING/ REHABILITATION
1	CUYAHOGA	BEDFORD	SR-8 (SFN 1801244)	REHABILITATION OF SFN 1801244 ON SR 8 OVER SR-14 & TNKRS CREEK & WLE RR	2030-2040	$17,443,665	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
2	CUYAHOGA	BEDFORD HEIGHTS	IR-271 N.B. (SFN 1810774)	REHABILITATION OF SFN 1810774 ON IR 271 N.B. OVER TNKRS CR & WLE RR & SOLON RD	2040-2050	$15,702,282	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
3	CUYAHOGA	BEDFORD HEIGHTS	IR-271 S.B. (SFN 1810715)	REHABILITATION OF SFN 1810715 ON IR 271 S.B. OVER TNKRS CR & WLE RR & SOLONRD	2040-2050	$15,342,042	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
5	CUYAHOGA	CLEVELAND	BROADWAY CONNECTOR BICYCLE-MULTIPURPOSE TRAIL	BICYCLE-MULTIPURPOSE FROM SLAVIC VILLAGE CONNECTOR NEAR BROADWAY/E.34TH ST TO E.55TH ST AND OPPORTUNITY CORRIDOR	2030	$12,000,000	ENHANCE	NON-MOTORIZED	SEPARATED BIKEPATH
6	**C**UYAHOGA	CLEVELAND	CARTER LIFT BRIDGE REHABILITATION	BRIDGE PRESERVATION (PAINTING, STEEL REPAIRS, DECK REPLACEMENT, UPGRADE MECHANICAL AND ELECTRICAL)	2030	$50,000,000	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
NA	CUYAHOGA	CLEVELAND	CLEVELAND NORTH COAST CONNECTOR	ADJUSTMENTS TO SR 2 THROUGH DOWNTOWN CLEVELAND BETWEEN THE MAIN AVE. BRIDGE AND THE I-90 INTERCHANGE, INCLUDING A LAND BRIDGE	2027	$284,486,390	ENHANCE	ROADWAY	ROAD DIET/ REHABILITATION
7	CUYAHOGA	CLEVELAND	COLUMBUS ROAD LIFT BRIDGE	BRIDGE PRESERVATION (PAINTING, STEEL REPAIRS, UPGRADE MECHANICAL AND ELECTRICAL)	2038	$15,000,000	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
8	CUYAHOGA	CLEVELAND	DENISON-HARVARD (SFN 1832344)	REHABILITATION OF SFN 1832344 ON DENISON-HARVARD OVER CR122 JENN CUY R, RRS	2030-2035	$38,199,864	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION

9	CUYAHOGA	CLEVELAND	DOWNTOWN CLEVELAND CONNECTOR, PH 2 SEPARATED BIKEPATH	BIKEWAY EXTENSION FROM PERSHING TO PUBLIC SQUARE	2035	$15,000,000	ENHANCE	NON-MOTORIZED	SEPARATED BIKEPATH
10	CUYAHOGA	CLEVELAND	HOPKINS AIRPORT / BEREA FREEWAY	IMPROVE THE BEREA FREEWAY RAMP ACCESS TO CLEVELAND HOPKINS AIRPORT.	2030	$19,694,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
11	CUYAHOGA	CLEVELAND	INNERBELT CCG3A IR-90 CENTRAL INTERCHANGE	CCG3A IR-90 16.28: IMPROVE IR-90 AT THE 'CENTRAL INTERCHANGE' FROM E. 9TH TO CARNEGIE; INCLUDES CARNEGIE OVERHEAD BRIDGE.	2026	$309,600,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
12	CUYAHOGA	CLEVELAND	INNERBELT CCG3B IR-77 14.57	CCG3B IR 077 14.57: RECONSTRUCTION OF THE IR-77 APPROACH TO THE 'CENTRAL INTERCHANGE'. WORK WILL INCLUDE WIDENING ALL MAINLINE BRIDGES, RESTRIPING THE KINGSBURY RUN BRIDGE TO ACCOMMODATE AN AUXILIARY LANE, AND REPLACING THE MAINLINE PAVEMENT.	2037	$171,000,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
13	CUYAHOGA	CLEVELAND	INNERBELT CCG4C NS RR NORFOLK SOUTHERN RAILROAD	CCG4C INNERBELT NS RR: SOUTH OF THE INNERBELT CURVE BUILD A NEW OVERHEAD NORFOLK SOUTHERN RR BRIDGE AT A NEW LOCATION TO ACCOMMODATE THE REALIGNMENT OF THE INNERBELT CURVE. THIS STRUCTURE WILL REPLACE THE EXISTING STRUCTURE.	2030	$61,000,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
14	CUYAHOGA	CLEVELAND	INNERBELT CCG4E CURVE	CCG4E INNERBELT CURVE: INNERBELT TRENCH TO E SHOREWAY, RELOCATION OF THE INNERBELT CURVE	2030	$249,700,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
15	CUYAHOGA	CLEVELAND	INNERBELT CCG5B EB PAVEMENT	CCG5B INNERBELT EB PAVEMENT: EB INNERBELT TRENCH, FROM E 22ND ST TO SUPERIOR AVE	2033	$240,750,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
16	CUYAHOGA	CLEVELAND	INNERBELT CCG5C WB PAVEMENT	CCG5C INNERBELT WB PAVEMENT: WB INNERBELT TRENCH FROM E 22ND ST TO SUPERIOR AVE	2033	$181,900,000	ENHANCE	ROADWAY	ROAD RESURFACING/ REHABILITATION/ STANDARDIZATION
18	CUYAHOGA	CLEVELAND	IR-71 N.B. (SFN 1805371)	REHABILITATION OF SFN 1805371 ON IR 71 N.B. OVER SR 176(1328)JENNINGS FWY	2030-2040	$18,966,674	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
19	CUYAHOGA	CLEVELAND	IR-77 (SFN 1806726)	REHABILITATION OF SFN 1806726 ON IR 77 OVER KNGSBRY RUN&RTA38&NSC RR	2040-2050	$50,967,781	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
21	CUYAHOGA	CLEVELAND	MILES RD (SR-43) REHABILITATION	REHABILITATE SR00043, FROM LEE RD TO BROADWAY AVE (SR-14), MAJOR REHAB/RECONSTRUCTION	2030-2035	$15,678,911	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION

22	CUYAHOGA	CLEVELAND	SR-2 (SFN 1800035)	REHABILITATION OF SFN 1800035 ON SR 2 OVER CUY RIVER,RTA,FLATS	2030-2040	$72,508,024	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
23	CUYAHOGA	CLEVELAND	US- 6 (SFN 1800930)	REHABILITATION OF SFN 1800930 ON USR 6 OVER CUY. RIVER & RTA	2030-2035	$29,153,744	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
24	CUYAHOGA	CLEVELAND	WEST 3RD LIFT BRIDGE OVER CUYAHOGA RIVER ROAD REHABILITATION	BRIDGE PRESERVATION (PAINTING, STEEL REPAIRS, DECK REPLACEMENT, UPGRADE MECHANICAL AND ELECTRICAL)	2030-2040	$12,000,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
25	CUYAHOGA	CUYAHOGA COUNTY	IR-271 MAJOR REHAB	IR-271 MAJOR REHAB; IR-480N TO IR-90	2030	$166,000,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
26	CUYAHOGA	CUYAHOGA COUNTY	IR-480 MAJOR REHAB	IR-480 MAJOR REHAB FROM I-77 TO I-480N	2030-2040	$195,360,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
27	CUYAHOGA	CUYAHOGA COUNTY	IR-480 MAJOR REHAB	IR-480 MAJOR REHAB FROM I-480N TO I- 271	2030	$40,280,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
28	CUYAHOGA	CUYAHOGA COUNTY	IR-480 MAJOR REHAB	IR-480N MAJOR REHAB FROM I-480 TO I- 271	2031	$53,130,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
29	CUYAHOGA	CUYAHOGA COUNTY	IR-480 MAJOR REHAB	IR-480 MAJOR REHAB; THE ROCKY RIVER TO I-71	2030	$22,000,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
30	CUYAHOGA	CUYAHOGA COUNTY	ROCKSIDE RD CR 53 (MAJOR) BRIDGE	BRIDGE REHABILITATION/REPLACE	2026	$23,000,000	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
31	CUYAHOGA	CUYAHOGA COUNTY	WEST 150TH ST (MAJOR) BRIDGE	BRIDGE REHABILITATION/REPLACE	2046	$18,000,000	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
32	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	COMMUNICATION SYSTEM REPLACEMENTS	REPLACEMENT OF COMMUNICATION SYSTEM INCLUDING RADIOS, CAD/AVL, CELLUAR, ROUTERS ON A TWELVE-YEAR CYCLE.	2032, 2044	$30,000,000	MAINTAIN	TRANSIT	TRANSIT EQUIPMENT
33	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	CUYAHOGA VIADUCT DECK REPLACEMENT	MAJOR DECK REPLACEMENT TO EXTEND THE LIFE OF THE BRIDGE CONSTRUCTED IN 1929.	2043	$106,000,000	MAINTAIN	TRANSIT	BRIDGE MAINTENANCE/ REHABILITATION
34	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	FARE COLLECTION SYSTEM REPLACEMENTS	REPLACEMENT OF FARE COLLECTION SYSTEM ON A TWELVE-YEAR CYCLE.	2037-2049	$50,000,000	MAINTAIN	TRANSIT	TRANSIT EQUIPMENT
NA	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	GCRTA 8 GREEN LINE STAT ADA 2024	REHABILITATE EIGHT STATIONS TO BE ADA COMPLIANT.	2026	$16,000,000	ENHANCE	TRANSIT	TRANSIT - FACILITIES IMPROVEMENTS
35	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	GCRTA BUS IMPROVEMENT PROGRAM	REPLACEMENT OF 30-35 BUSES ANNUALLY AS EXISTING VEHICLES REACH THE END OF THEIR USEFUL LIFE.	2026-2050	$520,000,000	MAINTAIN	TRANSIT	VEHICLE REPLACEMENTS

37	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	PRIORITY TRANSIT CORRIDORS	VARIOUS ROADWAY, TRAFFIC SIGNAL, SIDEWALK AND TRANSIT SHELTERS AND AMENITIES TO CREATE MORE EFFICIENT BUS SERVICE ALONG VARIOUS KEY TRANSIT CORRIDORS. MORE DETAILS WILL BE INCLUDED IN THE GCRTA STRATEGIC PLAN	2030-2035	$204,960,000	ENHANCE	TRANSIT	ROAD RESURFACING/ REHABILITATION/ SIGNS/ TRAFFIC SIGNALS/ TRANSIT SHELTERS
38	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	RAIL CAR MID-LIFE OVERHAULS	MID-LIFE OVERHAULS OF NEW RAIL CARS APPROXIMATELY 20 YEARS OF SERVICE.	2050	$60,000,000	MAINTAIN	TRANSIT	VEHICLE REPLACEMENTS
39	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	RAIL CAR REPLACEMENT PROGRAM	REPLACEMENT OF GCRTA HEAVY AND LIGHT RAIL VEHICLES INCLUDING ALL RENOVATIONS TO THE RAIL MAINTENANCE FACILITY AND RAIL STATION PLATFORMS TO ACCOMMODATE THE NEW VEHICLES. THIS IS THE REMAINDER OF THE PROJECT CONTAINED IN THE SFY 2021-24 TIP.	2028-2033	$179,250,000	MAINTAIN	TRANSIT	TRANSIT- VEHICLE REPLACEMENTS
40	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	RED LINE S-CURVE RELOCATION	RELOCATION OF THE RED LINE S-CURVE TO PROVIDE ADDITIONAL SEPARATION FROM THE NORFOLK SOUTHERN TRACKS. TIMING OF THE PROJECT WILL DEPEND ON THE PERFORMANCE OF MAJOR REPAIRS PERFORMED IN 2019.	2030	$18,000,000	ENHANCE	TRANSIT	TRANSIT - RAIL INFRASTRUCTURE
41	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	SECTION 5307 URBAN CAPITAL PROGRAM	PORTION OF GCRTA CAPITAL IMPROVEMENT PROGRAM FUNDED BY FTA SECTION 5307. INCLUDES REHABILITATION OF FACILITIES, INFRASTRUCTURE, VEHICLE REPLACEMENT, STATION IMPROVEMENTS, EQUIPMENT, ETC.	2030-2050	$1,037,400,000	MAINTAIN	TRANSIT	VEHICLE REPLACEMENTS/ RAIL INFRASTRUCTURE/ PARK AND RIDE LOTS/ FACILITY REHABILITATION
42	CUYAHOGA	CUYAHOGA COUNTY / GCRTA	SECTION 5337 STATE OF GOOD REPAIR PROGRAM	RAIL INFRASTRUCTURE PROJECTS TO REHABILITATED AND MAINTAIN THE RAIL SYSTEM.	2030-2050	$733,200,000	MAINTAIN	TRANSIT	TRANSIT - RAIL INFRASTRUCTURE
43	CUYAHOGA	EAST CLEVELAND	EUCLID AVE (US-6) REHABILITATION	REHABILITATE US00006, FROM SUPERIOR RD TO IVANHOE RD/BELVOIR BLVD, MAJOR REHAB/RECONSTRUCTION	2030	$15,927,769	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
44	CUYAHOGA	FAIRVIEW PARK	IR-480 (SFN 1812831)	REHABILITATION OF SFN 1812831 ON IR 480 OVER ROCKY RIVER	2030-2040	$37,019,576	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
45	CUYAHOGA	FAIRVIEW PARK	SR-17 (SFN 1802046)	REHABILITATION OF SFN 1802046 ON SR 17 OVER ROCKY RIVER	2025-2030	$30,000,000	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
46	CUYAHOGA	GARFIELD HEIGHTS	IR-480 / GRANGER ROAD INTERCHANGE	IR-480 / GRANGER RD INTERCHANGE: COMPLETION OF THE IR480/GRANGER ROAD PARTIAL INTERCHANGE IN THE CITY OF GARFIELD HEIGHTS. THE WESTBOUND EXIT AND EASTBOUND ENTRANCE RAMPS WILL BE ADDED, AND THE EXISTING WESTBOUND ENTRANCE RAMP WILL BE RECONSTRUCTED TO MEET CURRENT DESIGN STANDARDS.	2030-2040	$14,950,000	EXPAND	ROADWAY	NEW INTERCHANGE
47	CUYAHOGA	INDEPENDENCE	IR-77 (SFN 1806173)	REHABILITATION OF SFN 1806173 ON IR 77 OVER CUY RVR&SR17&CANAL RD&CSX	2040-2050	$66,214,040	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION

48	CUYAHOGA	LAKEWOOD	IR-90 (SFN 1808567)	REHABILITATION OF SFN 1808567 ON IR 90 OVER ROCKY RIVER VALLEY	2040	$15,570,943	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
49	CUYAHOGA	WARRENSVILLE HEIGHTS	IR-480N (SFN 1814494)	REHABILITATION OF SFN 1814494 ON IR 480N OVER SR-8 (NORTHFIELD)&480 WB	2040-2050	$14,677,278	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
50	GEAUGA	CHARDON//CONCORD TWPs	SR-44 MAJOR REHAB	SR-44 MAJOR REHAB IN 2026	2026	$11,750,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
51	LAKE	LAKE COUNTY	IR-90 MAJOR REHAB	LAK IR 090 MAJOR REHAB FROM ROCKEFELLER TO W OF KIRTLAND RD	2030	$12,600,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
52	LAKE	LAKETRAN	LAKETRAN CAPITAL BUS REPLACEMENTS	LAKETRAN'S COMMUTER EXPRESS AND FIXED ROUTE BUSES WILL BE REPLACED PER USEFUL LIFE GUIDELINES	2028-2045	$26,280,000	MAINTAIN	TRANSIT	TRANSIT- VEHICLE REPLACEMENTS
53	LAKE	PAINESVILLE	SR-44 ST 05.10 / JACKSON STREET INTERCHANGE	SR-44 05.10/ JACKSON ST INTERCHANGE: COMPLETION OF THE SRT-44/ JACKSON STREET PARTIAL INTERCHANGE AND RELATED IMPROVEMENTS IN THE CITY OF PAINESVILLE.	2030-2040	$17,250,000	EXPAND	ROADWAY	MODIFIED INTERCHANGE
NA	LORAIN	LORAIN	BROADWAY CORRIDOR	CYCLE TRACK WILL EXTEND FROM JUST SOUTH OF EAST 9TH STREET TO EAST 28TH STREET (APPROXIMATELY 1.35 MILES), CONNECTING SOUTH LORAIN NEIGHBORHOODS, ROUTE 2 AND DOWNTOWN LORAIN TO THE LORAIN HARBOR, FISHING PIER, AND BOAT LAUNCH. THE 9-FOOT-WIDE CYCLE TRACK WILL INCORPORATE GREEN PAINT AT CONFLICT POINTS INCLUDING INTERSECTIONS AND COMMERCIALS DRIVEWAYS 25 FEET OR GREATER IN WIDTH. THE PROPOSED PROJECT WILL INSTALL BIKE BUFFER CURBS AND DELINEATORS, AND BICYCLE SAFE GRATES, AS WELL AS LIGHTING FIXTURES UNDER THE FRANK J. NARDINI GATEWAY TRAIN BRIDGE.	2027	$3,122,300	ENHANCE	ROADWAY/ NON-MOTORIZED	ROAD DIET/ BICYCLE AND PEDESTRIAN/
54	LORAIN	ELYRIA/ LORAIN COUNTY	IR-90 MAJOR REHAB	IR-90 MAJOR REHABILITATION IN LORAIN COUNTY, FROM OHIO TURNPIKE BRIDGE TO FRENCH CREEK BRIDGE, ALSO BEING EVALUATED FOR POTENTIAL CAPACITY ENHANCEMENTS	2025	$136,618,449	EXPAND	ROADWAY	ROAD RESURFACING/ REHABILITATION/LANE ADDITION
55	LORAIN	SHEFFIELD	NORTH RIDGE ROAD (SFN 4706250)	REHABILITATION OF SFN 4706250 ON NORTH RIDGE ROAD OVER BLACK RIVER AND METROPRK	2040-2050	$19,462,465	MAINTAIN	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
56	MEDINA	MEDINA COUNTY	IR-76 MAJOR REHAB	IR-76 REHABILITATION FROM IR-71 TO SUMMIT COUNTY LINE, ALSO BEING EVALUATED FOR POTENTIAL CAPACITY ENHANCEMENTS	2030-2024	$138,000,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION
57	MEDINA	MEDINA COUNTY	TRANSIT VEHICLE REPLACEMENTS	REPLACEMENT OF BUSES PER USEFUL LIFE GUIDELINES	2030-2050	$24,375,000	MAINTAIN	TRANSIT	TRANSIT- VEHICLE REPLACEMENTS

Table 10-9. List of w*eNEO2050+* Illustrative Projects (Projects Pending Review against NOACA Planning Requirements and/or Demonstration of Fiscal Constraint)

COUNTY	LOCATION	PROJECT NAME	PROJECT DESCRIPTION	NEED YEAR	COST	MAINTAIN/ EHANACE/ EXPAND	MODE	PRIMARY WORK TYPE
CUYAHOGA	BAY VILLAGE	CAHOON MEMORIAL PARK LAKEFRONT PROJECT	STABILIZE THE COAST ALONG LAKE ERIE, RESTORE HABITAT, AND BUILD TRAILS AT CAHOON MEMORIAL PARK	2030-2040	$45,000,000	MAINTAIN	NON-MOTORIZED	BICYCLE/ PEDESTRIAN IMPROVEMENTS/ ROAD WIDENING/ SAFETY IMPROVEMENTS
CUYAHOGA	CLEVELAND	BESSEMER RAIL CROSSING SEPARATION	RAIL CROSSING SEPARATION AT BESSEMER RD	2030-2040	$15,000,000	ENHANCE	RAILROAD	GRADE SEPARATION
CUYAHOGA	CLEVELAND	CARTER ROAD TRAIL HUB	VARIOUS RIVERFRONT TRAIL CONNECTIONS ON THE SCRANTON PENINSULA	2030-2040	$8,000,000	EXPAND	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	CLEVELAND	CHEERS (CLEVELAND HARBOR EASTERN EMBAYMENT RESILIENCE STRATEGY)	PROTECT THE SHORE, CREATE HABITAT AND NATURAL ECOSYSTEMS, IMPROVE ACCESS AND CONNECTIVITY TO ALONG THIS SECTION OF THE LAKE ERIE COAST EAST OF BURKE AIRPORT ARIOUS RIVERFRONT TRAIL CONNECTIONS ON THE SCRANTON PENINSULA	2030-2040	$350,000,000	ENHANCE	NON-MOTORIZED	RESTORATION/MARITIME IMPROVEMENTS
CUYAHOGA	CLEVELAND	CLEVELAND CHARGING PROGRAM	IMPLEMENT ELECTRIC VEHICLE CHARGING STATIONS	2030-2040	$30,000,000	ENHANCE	EMISSIONS REDUCTIONS	ALTERNATIVE FUELS
CUYAHOGA	CLEVELAND	CLEVELAND'S MULTIMODAL TRANSPORTATION FACILITY TRANSIT- NEW FACILITIES	CONSTRUCT CLEVELAND'S MULTIMODAL TRANSPORTATION FACILITY	2040	$46,700,000	ENHANCE	TRANSIT	TRANSIT-NEW FACILITIES
CUYAHOGA	CLEVELAND	CLEVELAND SMART CORRIDORS	IMPLEMENT CLEVELAND'S SMART CORRIDORS (W. 25TH ST., KINSMAN RD., ETC.) WITH MULTIMODAL IMPROVEMENTS AND SENSORS	2030-2040	$30,000,000	ENHANCE	ROADWAY	BICYCLE/ PEDESTRIAN IMPROVEMENTS/ ROAD WIDENING/SAFETY IMPROVEMENTS
CUYAHOGA	CLEVELAND	CLEVELAND VISION ZERO	IMPLEMENT SAFETY INITIATIVES FROM CLEVELAND'S VISION ZERO PLAN	2030-2040	$50,000,000	ENHANCE	ROADWAY	ROAD WIDENING/ REHABILITATION/ INTERCHANGE AND INTERSECTION IMPROVEMENT
CUYAHOGA	CLEVELAND	CUYAHOGA RIVER BRIDGE LIGHTING	NEW LIGHTING FOR THE BRIDGES IN THE CUYAHOGA RIVER VALLEY	2040	$10,000,000	ENHANCE	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
CUYAHOGA	CLEVELAND	EAST SIDE TRAILS	CONSTRUCTING MORGANA RUN, SLAVIC VILLAGE-DOWNTOWN CONNECTOR, IRON CT., AND EUCLID CREEK TRAIL, ALL IN CLEVELAND	2030-2035	$20,000,000	ENHANCE	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES

CUYAHOGA	CLEVELAND	EUCLID BEACH CONNECTOR	SHORELINE PROTECTION AND BICYCLE AND PEDESTRIAN CONNECTIONS FROM LAKESHORE BLVD. INTO EUCLID CREEK RESERVATION	2030-2040	$16,000,000	ENHANCE	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	CLEVELAND	LAKEFRONT PEDESTRIAN CONNECTION	ENHANCED PEDESTRIAN ACCESS TO THE LAKEFRONT CONNECTING DOWNTOWN CLEVELAND, LEVERAGE A COHESIVE AND OPEN CITY GRID, AND CREATE SITES FOR ECONOMIC DEVELOPMENT	2030-2025	$249,610,000	ENHANCE	NONMOTORIZED/	BICYCLE/ PEDESTRIAN FACILITIES
CUYAHOGA	CLEVELAND	RECONNECTING CLEVELAND I-90	RECONNECTING COMMUNITIES THROUGH BRIDGE AND MULTIMODAL INVESTMENTS ALONG I-90	2030-2035	$50,000,000	ENHANCE	ROADWAY/ NON-MOTORIZED	BICYCLE/ PEDESTRIAN IMPROVEMENTS/ ROAD WIDENING/SAFETY IMPROVEMENTS
CUYAHOGA	CLEVELAND	RED LINE GREENWAY-PHASE 3	IMPLEMENT PH 3 OF THE REDLINE GREENWAY FROM FRANKLIN BLVD TO DOWNTOWN CLEVELAND	2030-2035	$10,000,000	ENHANCE	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	CLEVELAND	REGIONAL AIRPORT ACCESS IMPROVEMENTS	COMBINE SEVERAL SMALLER PROJECTS AIMED AT IMPROVING INGRESS AND EGRESS TO REDUCE CONGESTION AND IMPROVE OPERATIONS. ALTHOUGH STILL IN A CONCEPTUAL PHASE, RECOMMENDED IMPROVEMENTS INCLUDE A REVISED ROADWAY CONFIGURATION, ADJUSTED CURB CONFIGURATION AND OPERATION, ADDED PUBLIC PARKING WITH WALKABLE ACCESS, IMPROVED RENTAL CAR ACCESSIBILITY, AND ELIMINATING CERTAIN TRAFFIC CROSSINGS AND SIGNALS.	2030-2040	$115,000,000	ENHANCE	ROADWAY	ROADWAY REALIGNMENT
CUYAHOGA	CLEVELAND	SHAKER SQUARE RECONFIGUR ATION & ROAD REHABILITATION	REALIGNMENT OF SR 87, SOUTH MORELAND BLVD., VAN AKEN BLVD., NEW TRAFFIC CONTROL, PEDESTRIAN ENHANCEMENTS	2032	$12,000,000	MAINTAIN	ROADWAY	ROAD RESURFACING/ REHABILITATION/ REALIGNMENT
CUYAHOGA	CLEVELAND	SIDEAWAY BRIDGE RECONSTRUCTION	IMPLEMENT AN UPDATED VERSION OF THE SIDAWAY BRIDGE	2030-2040	$10,000,000	ENHANCE	ROADWAY/ NON-MOTORIZED	BICYCLE/ PEDESTRIAN IMPROVEMENTS/ ROAD WIDENING/SAFETY IMPROVEMENTS
CUYAHOGA	CLEVELAND	VETERANS MEMORIAL (DETROIT-SUPERIOR) BRIDGE SUBWAY LEVEL ENHANCEMENTS	RE-OPEN THE FORMER STREETCAR LEVEL OF THE VETERANS MEMORIAL (DETROIT-SUPERIOR) BRIDGE OVER THE CUYAHOGA RIVER WITH MULTIMODAL AND CULTURAL IMPROVEMENTS	2030-2040	$30,000,000	ENHANCE	ROADWAY/ NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES

CUYAHOGA	CLEVELAND	WHISKEY ISLAND BRIDGE ACCESS, NEW BRIDGE AND ROAD APPROACHES	WHISKEY ISLAND BRIDGE OVER CUYAHOGA RIVER, ABANDONING WILLOW LIFT BRIDGE, CREATING RELIABLE ISLAND ACCESS FOR REGIONAL SALT AND AGGREGATE SUPPLIERS	2030	$85,000,000	EXPAND	ROADWAY	NEW BRIDGE AND ROAD APPROACHES
CUYAHOGA	CUYAHOGA COUNTY	CUYAHOGA VALLEY SCENIC RAILROAD (CVSR) EXTENSION	10-MILE EXTENSION OF CVSR FROM ROCKSIDE STATION TO DOWNTOWN CLEVELAND USING EXISTING CSX AND NPS RIGHT OF WAY	2030-2040	$194,000,000	ENHANCE	RAILROAD	NEW RAILROAD/ UPGRADED RAILROAD
CUYAHOGA	CUYAHOGA COUNTY	GCRTA ELECTRIC BUSES	LOW EMISSION VEHICLES FOR GCRTA	2030-2040	$100,000,000	MAINTAIN	TRANSIT	TRANSIT VEHICLES
CUYAHOGA	CLEVELAND, SHAKER HEIGHTS	GCRTA LIGHT RAIL REPLACEMENT PROGRAM	RECONSTRUCT 10 MILES OF LIGHT RAIL TRACK, TURNOUTS, CROSSINGS AND ASSOCIATED APPURTENANCES LOCATED ALONG BLUE LINE AND GREENLINE	2030-2040	$80,500,000	ENHANCE	TRANSIT	TRANSIT - RAIL INFRASTRUCTURE
CUYAHOGA	CUYAHOGA COUNTY	GCRTA PRIORITY CORRIDOR STUDIES	STUDY AND IMPLEMENT VARIOUS PRIORITY CORRIDORS FOR TRANSIT ORIENTED DEVELOPMENT IN CUYAHOGA COUNTY	2030-2040	$100,000,000	EXPAND	TRANSIT	TRANSIT ORIENTED DEVELOPMENT
CUYAHOGA	CUYAHOGA COUNTY	IMPROVED AMTRAK SERVIICE IN NEO	IMPROVE AND ELEVATE CURRENT AND FUTURE REGIONAL AMTRAK CORRIDORS	2040-2050	$50,000,000	EXPAND	TRANSIT	NEW RAIL FACILITIES
CUYAHOGA	CUYAHOGA COUNTY	REGIONAL METRO PARKS CONNECTIVITY	IMPLEMENT REGIONAL METRO PARKS CONNECTIVITY TLCI PLANNING STUDY RECOMMENDATIONS	2030-2040	$50,000,000	EXPAND	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	FAIRVIEW PARK	CONNECTIVITY TRAILS TO CLEVELAND METRO PARKS ROCKY RIVER RESERVATION	CONSTRUCT TWO NEW ENTRANCE TRAILS TO THE ROCKY RIVER RESERVATION IN FAIRVIEW PARK, FROM SR-17 AND BROOKWAY DR	2030-2040	$3,850,000	ENHANCE	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	INDEPENDENCE	BRECKSVILLE ROAD RECONSTRUCTION AND STREETSCAPE IMPROVEMENTS	CONSTRUCT A 14' BOULEVARD ALONG THE CENTER OF BRECKSVILLE ROAD NORTH OF ROCKSIDE ROAD, PROVIDING 2 TRAVEL LANES IN EACH DIRECTION, A 14' MEDIAN, 8' SIDEWALK ON ONE SIDE OF BRECKSVILLE ROAD AND A 5' SIDEWALK ON THE OTHER. WIDEN THE EXISTING BRIDGE OVER I-480	2030	$17,976,522	EXPAND	ROADWAY	ROAD REHABILITATION/WIDENING/ STREETSCAPE
CUYAHOGA	INDEPENDENCE	I-77 / PLEASANT VALLEY ROAD INTERCHANGE IMPROVEMENT	IMPROVE THE SAFETY AND INCREASE THE CAPACITY OF THE I-77 / PLEASANT VALLEY ROAD INTERCHANGE WITHIN THE CITY OF INDEPENDENCE.	2030-2040	$6,900,000	EXPAND	ROADWAY	ROAD WIDENING/ REHABILITATION/ INTERSECTION IMPROVEMENT/ TRAFFIC SIGNALS/ INTERCHANGE IMPROVEMENT

CUYAHOGA	MAYFIELD	I-271 AND WHITE ROAD INTERCHANGE	CONSTRUCT A NEW INTERCHANGE AT IR-271 AND WHITE ROAD	TBD	TBD	EXPAND	ROADWAY	NEW INTERCHANGE
CUYAHOGA	MAYFIELD	I-271 AND WILSON MILLS ROAD INTERCHANGE MODIFICATION	ADDITION OF A THIRD LANE IN BOTH THE EAST AND WEST BOUND DIRECTION ON WILSON MILLS ROAD TO FACILITATE AN ADDITIONAL LEFT-TURN LANE ONTO BOTH I-271 NORTH AND SOUTH BOUND ON RAMPS. WIDENING THE EXISTING NORTH AND SOUTH BOUND ON-RAMPS FROM ONE LANE TO TWO LANES TO ACCEPT THE ADDITIONAL LEFT-TURN LANE FROM WILSON MILLS ROAD.	2030-2040	$2,300,000	EXPAND	ROADWAY	ROAD WIDENING/ REHABILITATION
CUYAHOGA	NORTH ROYALTON	ROYALTON ROAD (SR82) YORK RD. TO RIDGE RD. PHASE II	WIDEN ROYALTON ROAD FROM 2 TO 3 LANES FOR A CENTER TWO-WAY LEFT-TURN LANE, FROM YORK ROAD TO RIDGE ROAD	2030-2035	$13,625,000	ENHANCE	ROADWAY	ROAD WIDENING/ REHABILITATION
CUYAHOGA	NORTH ROYALTON	ROYALTON ROAD (SR82) RIDGE ROAD TO BROADVIEW HEIGHTS CORP LINE PHASE III	WIDEN ROYALTON ROAD FROM 2 TO 3 LANES FOR A CENTER TWO-WAY LEFT-TURN LANE, FROM RIDGE ROAD TO BROADVIEW HEIGHTS CORP LINE	2030-2040	$16,100,000	ENHANCE	ROADWAY	ROAD WIDENING/ REHABILITATION
CUYAHOGA	SOLON	SOLON HEADWATERS TRAIL CONNECTOR	ALL PURPOSE TRAIL, SOLON HEADWATERS TRAIL CONNECTOR ALONG NORFOLK RAILROAD CORRIDOR BEGINNING AT HARPER ROAD IN SOLON AND ENDING AT TREAT ROAD IN AURORA	2030-2040	$30,763,360	ENHANCE	NON-MOTORIZED	BICYCLE/PEDESTRIAN FACILITIES
CUYAHOGA	SOUTH EUCLID	S. GREEN ROAD (CR 14) RESURFACING, SOUTH	MILL AND RESURFACE, INSTALL NEW SIGNALS AT THREE INTERSECTIONS, RECONFIGURE FOUR-LANE ROADWAY INTO A "ROAD DIET" CONFIGURATION. TRAFFIC CONTROL PAVEMENT MARKINGS AND SIGNAGE WILL BE REPLACED FOR THIS NEW CONFIGURATION.	2037	$2,073,000	ENHANCE	ROADWAY / NON-MOTORIZED	ROAD DIET/ BICYCLE AND PEDESTRIAN / REHABILITATION
CUYAHOGA	STRONGSVILLE	HOWE ROAD WIDENING	WIDEN HOWE ROAD FROM BOSTON ROAD TO POMEROY BOULEVARD FROM A 2-LANE ROAD WITH NO CURBS AND DRAINAGE DITCHES TO A 3-LANE ROAD WITH CURBS AND STORM SEWERS.	2030-2040	$11,500,000	EXPAND	ROADWAY	ROAD WIDENING

CUYAHOGA	STRONGSVILLE/ CUYAHOGA COUNTY	IR-71 SUBAREA CORRIDOR (BOUNDED BY PEARL RD/ US 42, TO THE NORTH AND WEST, W. 130TH ST TO THE EAST, AND CENTER ROAD/ SR-303 TO THE SOUTH	IMPLEMENT RECOMMENDATIONS OF STUDY ON IMPROVEMENT OF TRANSPORTATION INFRASTRUCTURE, TRAVEL PATTERNS, AND TRAFFIC CONDITIONS ALONG A SUBAREA CORRIDOR OF I-71.	TBD	TBD	ENHANCE	ROADWAY	CORRIDOR IMPROVEMENTS
CUYAHOGA	UNIVERSITY HEIGHTS	CEDAR ROAD WEST RESURFACING AND ROAD DIET	RESURFACING WITH MINOR BASE REPAIRS, AS NECESSARY, COVERING APPROXIMATELY THREE-QUARTERS OF A MILE OF CEDAR ROAD FROM TAYLOR ROAD TO FENWICK ROAD. INCLUDES A ROAD DIET BETWEEN S. TAYLOR ROAD AND WASHINGTON BOULEVARD, INCLUDING MID-BLOCK CROSSWALKS.	2042	$1,255,556	MAINTAIN	ROADWAY/ NON-MOTORIZED	ROAD DIET/ BICYCLE AND PEDESTRIAN/ REHABILITATION
LAKE	EASTLAKE	SR-91 AND SR - 640 INTERSECTION UPGRADE AND SAFETY IMPROVEMENTS	REALIGN INTERSECTION, ADD NEW LANES AS NEEDED, NEW SIGNALS, RECONFIGURE ADJACENT BIKE PATHS, AND PEDESTRIAN CROSSINGS TO ENHANCE ECONOMIC DEVELOPMENT FOR FACILITIES APPURTENANT TO CLASSIC PARK	2030-2035	$2,310,000	ENHANCE	ROADWAY/ NON-MOTORIZED	BICYCLE/ PEDESTRIAN IMPROVEMENTS/ ROAD WIDENING/ SAFETY IMPROVEMENTS
LAKE	LAKE COUNTY	JACKSON STREET REALINGMENT	REALIGNMENT OF JACKSON STREET, FROM NYE RD TO THE WEST SIDE OF PROPOSED SR44 INTERCHANGE.	2029	$8,000,000	ENHANCE	ROADWAY	ROAD REALIGNMENT
LAKE	LAKE COUNTY	LANE ROAD WIDENING AND GRADE SEPARATIONS	WIDENING OF LANE ROAD, ROW ACQUISITION, GRADE SEPARATION AT TWO RAILROAD CROSSINGS, TWO CULVERT WIDENINGS/REPLACEMENTS, AND DRAINAGE IMPROVEMENTS.	2030	$30,000,000	ENHANCE	ROADWAY	BRIDGE MAINTENANCE/ REHABILITATION
LAKE	LAKE COUNTY	SR2 REHABILITATION EAST OF SR 44 TO RICHMOND ROAD INTERCHANGE	EXTEND 3 LANES IN BOTH DIRECTIONS FROM THE END OF 2012 3-LANE EXTENSION PROJECT. WIDEN BRIDGES AND CULVERTS AS REQUIRED. CENTERLINE MEDIAN BARRIER AND DRAINAGE SYSTEM REPLACEMENT. LED LIGHT POLES AND SOUND BARRIERS AS REQUIRED.	2035	$45,000,000	EXPAND	ROADWAY	ROAD REHABILITATION

LAKE	LAKE COUNTY	SR-2 REHABILITIATION, LAK 2- 0.00-3.63	RECONSTRUCT THE PAVEMENT AND REPLACE THE ROCKING CONCRETE SLABS BENEATH. ALSO INCLUDED ARE REPLACEMENT OF DRAINAGE SYSTEM AND SINGLE CENTER MEDIAN WALL REPLACEMENT.	2035	$30,000,000	MAINTAIN	ROADWAY	ROAD REHABILITATION
LAKE	LAKETRAN	COMMUTER EXPRESS TO UNIVERSITY CIRCLE	NEW COMMUTER EXPRESS SERVICE FROM EXISTING LAKETRAN PARK-N-RIDE LOTS TO KEY SITES IN UNIVERSITY CIRCLE, SUCH AS CLEVELAND CLINIC AND UNIVERSITY HOSPITALS	2030-2035	$6,427,200	EXPAND	TRANSIT	TRANSIT - NEW SERVICE
LAKE	MENTOR	LAK-90-09.45 BRIDGE WIDENING	WIDENING OF SR-615 BRIDGE OVER I-90 TO FOUR LANES WITH INTERCHANGE RAMP AND SIGNAL MODIFICATIONS. PROJECT NECESSARY TO ACCOMMODATE TRAFFIC GROWTH FROM NEARBY DEVELOPMENT.	2035	$12,000,000	EXPAND	ROADWAY	ROAD WIDENING/ BRIDGE REHABILITATION
LAKE	WILLOUGHBY	ADKINS RD RECONSTRUCTION	RECONSTRUCTION OF ADKINS RD	2030-2040	$3,500,000	MAINTAIN	ROADWAY	ROAD REALIGNMENT
LAKE	WILLOUGHBY	ERIE STREET GRADE SEPARATION	GRADE SEPARATION AT ERIE STREET. PART OF LARGER PLAN TO UPDATE UNDERSIZED STORM SEWERS OF ERIE STREET.	2035	$20,000,000	ENHANCE	ROADWAY	GRADE SEPARATION
LAKE	WILLOUGHBY	HODGSON RD/ LOST NATION RD INTERSECTION REALIGNMENT	REALIGN HODGSON RD. WITH APOLLO PARKWAY AT LOST NATION RD	2030-2040	$5,000,000	ENHANCE	ROADWAY	ROAD REALIGNMENT
LAKE	WILLOUGHBY	I-90 AT SR-91 INTERCHANGE CITY GATEWAY	REVITALIZATION OF MAJOR ENTRY POINT FOR CITY	2036	$10,000,000	ENHANCE	ROADWAY	ROAD REHABILITATION/ CITY GATEWAY REVITALIZATION
LAKE	WILLOUGHBY	THOROUGHFARE INTELLIGENT TRAFFIC MANAGEMENT SYSTEM	PHASED IMPROVEMENTS TO ENCOURAGE PARKING, MARKETING, PUBLIC OPEN SPACES, AND RETAIL.	2035	$2,000,000	ENHANCE	ROADWAY	TRAFFIC SIGNALS
LAKE	WILLOUGHBY	VINE STREET SMART TRAFFIC SYSTEM [WILLOUGHBY - LAKE ERIE]	WIDEN VINE STREET, RECONFIGURE STREET PARKING, AND CREATE A MORE PEDESTRIAN & BUSINESS FRIENDLY ENVIRONMENT.	2040-2050	$5,750,000	ENHANCE	ROADWAY/ NONMOTORIZED	ROAD WIDENING/ REHABILITATION/ TRAFFIC SIGNALS

LORAIN	AVON LAKE	WALKER ROAD WIDENING LEFT TURN LANE PROJECT	WIDEN WALKER ROAD TO ADD A CENTER LEFT-TURN LANE AND ADDITIONALLY WIDEN THE BIKE LANES TO 6 FEET. THIS PROJECT HAS BEEN REVIEWED BY ODOT AND IS FOR SAFETY IMPROVEMENTS TO BOTH VEHICULAR AND BICYCLE TRAVEL. TOTAL PAVEMENT WIDENING SHALL BE 16 FEET, (8 FT. ON EITHER SIDE), TO CREATE 12 FT. WIDE VEHICLE LANES AND 6 FT. WIDE HARD BERM BIKE LANES	2030	$2,500,000	ENHANCE	ROADWAY/ NON-MOTORIZED	ROAD WIDENING/ REHABILITATION
LORAIN	ELYRIA	E. BROAD ST. (ABBE RD. S. TO NORTH RIDGEVILLE CORP. LIMITS)	WIDEN ROADWAY TO INCLUDE A TWO-WAY LEFT TURN LANE AND IMPROVE TRAFFIC SIGNALS TO INCLUDE PEDESTRIAN TRAFFIC, PREEMPTION, AND VEHICLE DETECTION. INCORPORATE NEW SIDEWALKS/BICYCLE TRAIL.	2030	$1,453,965	ENHANCE	ROADWAY/ NON-MOTORIZED	ROAD WIDENING/ REHABILITATION
LORAIN	LORAIN	E 36TH ST IMPROVEMENTS	APPROXIMATELY 3.3 MILES OF NEW AND IMPROVED ROADWAY AND MULTI-USE PATHS. IT WILL ALSO DESIGN ROADSIDE, GREEN INFRASTRUCTURE AND ADDRESS APPROXIMATELY ONE MILE OF DEGRADED STORM WATER CHANNEL RUNNING ADJACENT TO E. 36TH STREET IN AN AREA IMPACTED BY SIGNIFICANT FLOODING	2030-2040	$15,000,000	ENHANCE	ROADWAY/ NON-MOTORIZED	ROAD DIET/ BICYCLE AND PEDESTRIAN/ REHABILITATION
LORAIN	ELYRIA	ELYRIA AMTRAK STATION ACCESSIBILITY	ACCESSIBILITY IMPROVEMENTS AND ENHANCEMENTS AT THE ELYRIA AMTRAK STATION	2040-2050	$5,000,000	ENHANCE	RAILROAD	TRANSIT - FACILITIES IMPROVEMENTS
LORAIN	ELYRIA	OBERLIN-ELYRIA RD. (MIDDLE AVE. TO CARLISLE TOWNSHIP CORP. LIMIT)	PERFORM ROAD DIET TO REDUCE 4 LANES TO 3 LANES WITH CENTER LANE BEING A TWO-WAY LEFT-TURN LANE. UPGRADE TRAFFIC SIGNAL AT WEST AVE. MODIFY SIGNAL AT MIDDLE AVE. INSTALL NEW SIDEWALK AND/OR MULTIUSE PATH. RECONFIGURE WEST AVE. INTERSECTION	2031	$1,208,742	ENHANCE	ROADWAY/ NONMOTORIZED	ROAD DIET/ BICYCLE AND PEDESTRIAN/ REHABILITATION
MEDINA	BRUNSWICK	SR 303 / CENTER ROAD RIGHT TURN LANE	EXTEND WESTBOUND THIRD LANE ON SR 303 TO NORTH CARPENTER ROAD INTERSECTION TO PROVIDE A RIGHT-TURN LANE	2030	$550,000	EXPAND	ROADWAY	ROAD WIDENING/ REHABILITATION
MEDINA	BRUNSWICK	WEST 130TH STREET - SOUTH	REHABILITATION / WIDENING FOR TWO-WAY LEFT-TURN LANE	2030	$2,940,000	EXPAND	ROADWAY	ROAD WIDENING/ REHABILITATION

MEDINA	MEDINA COUNTY	IR-71 AND SR-57 (OR SR-162)	CONSTRUCT A NEW INTERCHANGE AT IR-71 AND SR-57 (OR SR-162)	TBD	TBD	EXPAND	ROADWAY	NEW INTERCHANGE
REGIONAL	CUYAHOGA, LAKE, LORAIN COUNTIES	LAKE ERIE LAKEFRONT TRAIL	PROVIDE EROSION MITIGATION AND PUBLIC MULTIPURPOSE ACCESS ALONG THE SHORELINE OF LAKE ERIE IN CUYAHOGA, LAKE AND LORAIN COUNTIES. PARTS OF THIS PROJECT COULD BE MODELED AFTER A SIMILAR PROJECT CONSTRUCTED BY THE CITY OF EUCLID, AND OTHER PARTS WOULD PROVIDE GENERAL ACCESS TO ENHANCE CONNECTIVITY FOR RESIDENTS AND VISITORS. NOACA AND CUYAHOGA COUNTY ARE CURRENTLY PERFORMING STUDIES ALONG THE LAKE ERIE SHORELINE.	2030-2040	$862,500,000	ENHANCE	NON-MOTORIZED	BICYCLE FACILITY
REGIONAL	REGIONAL	GREAT LAKES HYPERLOOP	CONDUCT AN ENVIRONMENTAL IMPACT STATEMENT FOR THE GREAT LAKES HYPERLOOP	2040-2050	$5,750,000	EXPAND	TRANSIT	TRANSIT FACILITIES
REGIONAL	REGIONAL / GCRTA	REGIONAL RAIL EXTENSION	EXTENSION OF THE EXISTING GCRTA RAIL NETWORK WITHIN CUYAHOGA COUNTY SUBURBS, AND TO THE CITIES OF ELYRIA, MEDINA, SOLON, AND MENTOR IN THE SURROUNDING COUNTIES. THE EXTENDED RAIL NETWORK WOULD CONNECT RESIDENTS TO MAJOR JOB HUBS AND REGIONAL PLACES OF BUSINESS AND ATTRACTION.	2040-2050	$16,100,000,000	EXPAND	TRANSIT	NEW RAIL FACILITIES
REGIONAL	LOW EMISSION VEHICLES	TRANSIT AGENCIES LOW EMISSION VEHICLES	PROVIDE THE PURCHASE OF LOW EMISSION VEHICLES FOR TRANSIT AGENCIES	2030-2040	$100,000,000	ENHANCE	TRANSIT	TRANSIT- VEHICLES

Fiscal Constraint Conclusion

Table 10-10 compares the estimated project costs and revenues (or available budgets) by scenario and project category. The Status Quo – Continued Growth scenario is the most likely to occur and serves as the selected scenario for demonstration of fiscal constraint. This scenario anticipates $23.74 billion to be available through 2050.

Results of the scenario efficiency evaluation with regard to project costs in Chapter 9 and also the above comparison of the scenario costs and revenues lead to the development of a hybrid scenario. The hybrid scenario will combine the projects from all the scenarios to provide a robust multimodal transportation system that is also financially implementable. Chapter 11 will introduce this hybrid scenario as the *weNEO2050+* Final Plan. The total project costs included in the hybrid scenario total $4.662, therefore fiscal constraint requirements are satisfied.

Looking closer at Table 10-10, it is important to note that dedicated sources of revenue to nonmotorized and transit are insufficient, while dedicated sources for roadway are in excess of project needs. It is expected that available roadway funding will be utilized to supplement nonmotorized project needs as many of these projects are done in coordination with roadway projects – i.e. bike lanes, sidewalks. It is expected also that available roadway funding will be utilized to supplement transit project needs through flex fund transfers of eligible federal funds, such as STBG and CMAQ.

Table 10-10. Projected Costs of Plan Projects in *weNEO2050+* Future Scenarios against Revenue Scenarios

		Status Quo Scenario (2025$) Billions			
Revenues	**Growth Rates**	**Roadway**	**Nonmotorized**	**Transit**	**Total**
	No Growth	$16.74	$1.53	$5.20	**$23.47**
	Continued Growth	**$16.94**	**$1.54**	**$5.26**	**$23.74**
	High Growth	$17.13	$1.54	$5.32	**$23.99**

Projects	**Category**	**Net Present Value (2025$) Billions**	**% NPV (2025$)**	**Aggregated Annual Project Costs Total Dollars for Period of 2025-2050 in Billion**
	Roadway	$13.91	79%	17.5
	Transit	$2.81	16%	3.77
	Nonmotorized Facilities	$0.54	3%	0.69
	Emerging Technology	$0.45	2%	0.71
	Total	**$17.71**	**100%**	**22.76**

Transportation Conformity

All regions designated as nonattainment or maintenance areas for the National Ambient Air Quality Standards (NAAQS) related to mobile emissions—specifically ozone (O_3), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and carbon monoxide (CO)—must demonstrate that emissions from planned transportation system improvements will not exceed an area's motor vehicle emissions budgets (MVEBs). This requirement is known as transportation conformity. US DOT issues formal transportation conformity determinations to nonattainment

areas following a quantitative analysis that demonstrates that emissions from vehicles that travel on the planned transportation system are less than the area's MVEBs (or other emission targets in the absence of an approved budget). Transportation conformity determinations ensure that the transportation sector contributes to an area's progress toward national air quality standards.

MPOs in Ohio and ODOT must reestablish conformity for the 2006 and 2012 $PM_{2.5}$ NAAQS and the 2008 and 2015 8-hour O_3 NAAQS when they adopt new LRTPs or TIPs. Because conformity is determined at the level of the nonattainment/maintenance area rather than at the sub-area level, each of the area's planning partners must approve a new conformity finding for the area based on these updates.

The analyses for O_3 and the 2006 $PM_{2.5}$ NAAQS cover the pertinent portions of the counties of Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit. The analysis for the 2012 $PM_{2.5}$ NAAQS includes only Cuyahoga and Lorain counties, as they were the only counties included in the region's moderate nonattainment area for this standard. The analysis for the 2008 O_3 NAAQS covers Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit counties, while the 2015 NAAQS covers Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit. Conformity for both O_3 analyses is based upon the MVEB developed for the 2008 NAAQS. The analyses for the 2006 and 2012 $PM_{2.5}$ NAAQS are based on the budgets outlined for the 1997 and 2006 $PM_{2.5}$ maintenance plans, which the Ohio Environmental Protection Agency (Ohio EPA) developed. The current analyses reflect a comparison of projected transportation emissions against the approved or submitted budgets for each standard. All analyses used the MOVES2014a, an approved emissions modeling tool from US EPA.

Federal law requires that *weNEO2050+* contain the design concept and design scope descriptions of all existing and proposed transportation facilities in sufficient detail, regardless of funding source, in nonattainment and maintenance areas for conformity determinations under the US EPA's transportation conformity regulations (40 CFR part 93, subpart A). NOACA staff considered the projects identified in Table 10-11 in the conformity analyses for *weNEO2050+*.

These tests are required because all areas with a current or former designation of nonattainment must maintain conformity findings for the designated pollutants. The tests ensure that transportation planning efforts do not hinder efforts to bring the area into attainment of the standards or maintain attainment of the standards.

Tables 10-12 through 10-15 show the test results. For all tests, projected emission levels are beneath the respective MVEBs, demonstrating conformance with the goals of the Clean Air Act.

Table 10-11. w *eNEO2050+* Transportation Conformity Highway Networks Summary

weNEO2050+ Transportation Conformity Networks Summary		
2027	**In addition to the existing system, and the projects identified in the network, the 2027 network contains the following additional capacity projects that will open to traffic by calendar year (CY) 2027**	
County	**Project Description**	**PID**
Cuyahoga	CUY IR 077 00.42 Interchange: Complete the existing partial diamond interchange at IR-77 and Miller Road by adding a northbound (NB) exit ramp and a southbound (SB) entrance ramp; adding an auxiliary lane between new SB entrance ramp and the IR-80 exit ramp; widening of Miller Road to provide left-turn lanes including structure widening; and adding dual westbound (WB) right turn lanes onto the IR-77 NB entrance ramp.	104983
Cuyahoga	CUY US 422 16.20 Interchange: Reconfigure US-422 interchange at Harper Road (CR-18) in Solon. Work will include changing the interchange to a Diverging Diamond Interchange and eliminating the existing NB to WB loop ramp. Includes minor modifications to other exiting ramps.	113889
Lorain	LOR US 0020 22.19 US-20 (Center Ridge Rd): (Greenlawn Drive) to 24.56 (McKinley Street) Widening to 5 lanes from Stony Ridge Rd to Lear Nagel Rd in North Ridgeville. Project includes 2.32 miles of improvements on US20 by pavement widening from 3 lanes to 5 lanes, multi-use path, sidewalks, storm sewer, traffic signals, and two bridge replacements.	82632
Medina	MED SR-018-13.54: Medina Twp., Montville Twp.: SR-18-13.54 (Foote Rd) to 15.15 (Nettleton Rd) Widen to 5 lanes from Foote Rd to River Styx and 7 lanes from River Styx to Nettleton Rd. (Project is related to PID 76946 MED SR-18 MED SR-0018 13.00)	92953
Medina	US-42 (Pearl Rd) 17.68: Reconstruct and add lanes on US 42 Harding St to Fenn Rd (related PID 75995)	92954
Summit	SUM IR- 77/277/US 224 VARIOUS: Provide two lane ramps on identified ramps in the IR-77/IR-277/US-224 interchange, with additional lanes and pavement replacement and bridge work on SUM IR-77 from Arlington Road Interchange to the IR-77/IR-277/US 224 Interchange	106002
2030	**In addition to the existing system, and the projects identified in the 2021 and 2022 networks, the 2030 network contains the following additional capacity projects that will be open to traffic by calendar year (CY) 2030.**	
County	**Project Description**	**PID**
Cuyahoga	CUY INNERBELT CCG3 Design: Improve IR-90 in the Central Interchange area between E 9th Street and Carnegie Avenue; replace the East 22nd Street bridge over IR-90; remove the Cedar Avenue bridge over IR-90; improve IR-77 north of the Kingsbury Run Bridge; and replace the Carnegie Avenue bridge over IR-90. See PIDs 82382 and 80406 for construction.	82380
Cuyahoga	CUY IR 090 16.53 WB STUDY: Study capacity improvements along I-90 WB from SR-2 to IR-77 SB in the City of Cleveland. Potential work includes restriping the existing lanes, hard shoulder running / smart lane.	106263
Lorain	LOR IR 0090 10.76 - Major Rehab with Complete Pavement Replacement and Lane Addition to convert from a 4 lane facility to a 6 lane facility. OTP Booth to SR2 will remain a 4 Lane facility.	107714

	10.76 (OTP Booth) to 13.17 (west of SR57) / 13.57 (east of SR57) to 18.61 (French Creek Bridge).	
Medina	MED SR-018-13.54: Medina Twp., Montville Twp.: SR-18-13.54 (Foote Rd) to 15.15 (Nettleton Rd) Widen to 5 lanes from Foote Rd to River Styx and 7 lanes from River Styx to Nettleton Rd. (Project is related to PID 76946 MED SR-18 MED SR-0018 13.00)	92953
2040	**In addition to the existing system, and the projects identified in the 2027 and 2030 networks, the 2040 network contains the following additional capacity projects that will be open to traffic by calendar year (CY) 2040.**	
County	**Project Description**	**PID**
Cuyahoga	CUY IR 090 16.28 CCG3A - IR-90 in the central interchange from E. 9th to Carnegie; Includes Carnegie overhead bridge. PE/DD In PID 82380. See also PID 80406 For IR-77 Section of CCG3.	82382
Cuyahoga	CUY IR-077 14.57 CCG3B: Reconstruction of the IR-77 approach to the Central Interchange. Work will include widening all mainline bridges, restriping the Kingsbury Run Bridge to accommodate an auxiliary lane, and replacing the mainline pavement. PE/DD in PID 82380. See also PID 82382 for IR-90 section of CCG3 (CUY IR 090 16.28 CCG3A). Project split from CUY INNERBELT RAILROAD BRIDGES GRP5: PID 80408	80406
Cuyahoga	CCG4E CURVE: Innerbelt Trench to East Shoreway. Relocation of the Innerbelt curve. PE/DD with PID 80408 (CUY INNERBELT CCG4B CSX RR). DD, RW, & CO in TRAC Tier 2.	77413
Cuyahoga	CCG5B EB PAVEMENT: EB Innerbelt Trench, from E 22nd St to Superior Avenue. Reconstruction of the eastbound innerbelt from East 22nd Street to Superior Avenue. TRAC PROJECT	25795
Cuyahoga	CUY INNERBELT CCG5C WB PAVEMENT: Reconstruction of the westbound Innerbelt from East 22nd Street to Superior Avenue.	86746
Cuyahoga	CUY SR 237 07.16 TRAC Improve the Berea freeway ramp access to Cleveland Hopkins Airport. City to hire consultant for plans using TRAC funding. Tier 2 on 6/30/06 TRAC list. Moved while waiting on Cleveland Port Authority. SR-237/Hopkins Airport: Upgrade Berea freeway ramp access to Cleveland Hopkins Airport	23051
Cuyahoga	CUY IR 480 20.47 Granger Road Interchange: Expansion of partial interchange at I-480 and Granger Road in Garfield Heights to a full interchange.	114642
Lake	LAK SR 044 05.10 Interchange SR 44 and Jackson Street interchange in Lake County. Study the alternative for the reconfiguration/relocation of the SR 44 and Jackson Street interchange. LAK SR-44/JACKSON ST: Convert the existing partial diamond interchange at SR-44 and Jackson Street to a full diamond interchange at Relocated Jackson Street/Renaissance Parkway just north of Jackson Street	76236

Table 10-12. 2015 Daily 8-Hour Ozone Standard

Attainment status: 2015 8-Hour Ozone standard – serious nonattainment area (Federal Register/Vol. 89, No. 242 /Tuesday, December 17, 2024)

SIP Status: Federal Register/Vol. 82, No. 4/Friday, January 6, 2017 – direct final rule adequacy finding for Motor Vehicle Emission Simulator (MOVES) based 2008 ozone standard Motor Vehicle Emission Budget (MVEB)

No submittals required under 2008 8-Hour ozone standard until approved budgets are received. The budgets found adequate for 2008 standard will satisfy the 2015 tests, per U.S. EPA.

8-Hour Geography: Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 2008 Standard 8-Hour budget tests

Analysis Years: 2027 Attainment and 1st Analysis year
2030 Interim and SIP Budget year
2040 Interim year
2050 Plan horizon year

8-Hour Ozone Test	2027 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2050 Emissions
AMATS	tons/day				
VOC	4.89		3.70	2.90	2.82
NOx	5.49		5.47	4.52	4.5
NOACA	tons/day				
VOC	12.42		10.18	6.70	5.68
NOx	14.55		11.12	4.57	3.76
Totals	tons/day				
VOC	17.31	30.80	13.88	9.60	8.50
NOx	20.03	43.82	16.59	9.08	8.31

Table 10-13. 2008 Daily 8-Hour Ozone Standard

Attainment status: 2008 8-Hour Ozone standard – maintenance area (Federal Register/Vol. 82, No. 4/Friday, January 6, 2017)

1997 8-Hour Ozone Standard - maintenance area (Federal Register Notice Final Rule Tuesday, September 15, 2009)

SIP Status: Federal Register/Vol. 78, No. 53/Tuesday, March 19, 2013 – direct final rule adequacy finding for MOVES based 1997 Ozone standard MVEB

No submittals required under 2008 8-Hour Ozone standard until approved budgets are received. The budgets found adequate for the 1997 standard will satisfy both 1997 and 2008 tests, per U.S. EPA.

8-Hour Geography: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit Counties, OH

Conformity Tests: 1997 Standard 8-Hour budget tests

Analysis Years: 2027 1st Analysis year
2030 Interim and SIP Budget year
2040 Interim year
2050 NOACA Plan horizon year

8-Hour Ozone Test	2027 Emissions	2030 8-Hour Budget	2030 Emissions	2040 Emissions	2050 Emissions
AMATS	tons/day				
VOC	4,89		3.70	2.90	2.82
NOx	5.49		5.47	4.51	4.55
NOACA	tons/day				
VOC	12.42		10.18	6.70	5.68
NOx	14.55		11.12	4.57	3.76
Ashtabula County	tons/day				
VOC	0.64		0.48	0.40	0.39
NOx	0.67		0.66	0.56	0.59
Totals	tons/day				
VOC	17.96	30.80	14.36	10.00	8.89
NOx	20.70	43.82	17.26	9.65	8.90

Table 10-14. $PM_{2.5}$ 2006 Standard

Attainment: 2006 Annual $PM_{2.5}$ Standard – maintenance area (Federal Register/Vol. 78, No. 144/Friday, July 26, 2013)

SIP Status: Cleveland area to attainment for 1997 and 2006 $PM_{2.5}$ Standards – FR notice included an adequacy finding for the MOVES based MVEBs

Geography: Cuyahoga, Lake, Lorain, Medina, Portage and Summit counties, OH,

Conformity Tests: Budget tests

Analysis Years: 2022 Budget Year
2027 1st Analysis year
2030 Interim year
2040 Interim year
2050 NOACA Plan horizon year

$PM_{2.5}$ Test	2022 Budget	2027 Emissions	2030 Emissions	2040 Emissions	2050 Emissions
AMATS	tons/year				
Direct PM		99.97	93.26	80.34	81.76
NOx		2,115.47	1,641.55	778.87	693.94
NOACA	tons/year				
Direct PM		194.23	171.48	134.12	128.93
NOx		4,648.76	3,573.32	1,454.87	1179.01
Totals	tons/year				
Direct PM	880.89	294.20	264.74	214.46	210.69
NOx	17,263.65	6,764.23	5,214.87	2,233.74	1,872.95

Table 10-15. $PM_{2.5}$ 2012 Standard

Attainment status: 2012 Annual $PM_{2.5}$ Standard – maintenance area (80 FR 2205/January 14, 2015)

SIP Status: Federal Register /Vol. 83, No. 246 /Wednesday, December 26, 2018 – approval of SIP and finding in support of MOVES based 2012 standard $PM_{2.5}$ MVEB

Geography: Cuyahoga and Lorain counties, OH

Conformity Tests: 2012 SIP Maintenance Plan tests

Analysis Years: 2027 1st Analysis year
2030 Budget year
2040 Interim year
2050 Plan horizon year

$PM_{2.5}$ Test	2027 Emissions	2030 Budget	2030 Emissions	2040 Emissions	2050 Emissions
	tons/year				
Direct $PM_{2.5}$	151.47	270.57	133.69	104.42	99.94
NOx	3,570.73	4,907.54	2,745.76	1,110.56	894.79

Chapter 11: eNEO2050 Final Plan

Summary

In Chapter 9, Scenario 4, “TOTAL” resulted in the best cost-benefit ratio compared to the other three scenarios analyzed. This chapter illustrates the list of projects from Scenario 4 and their planned implementation decades for each project. The scenario effectiveness based on the selected performance measures is evaluated by comparing them with those of Scenario 1: MAINTAIN as the benchmark values. The evaluation results are then combined with the net present value of the total scenario-specific project costs, which produces an acceptable level of economic return indicator.

The rest of this chapter introduces the new *weNEO2050+* projects with a succinct description. These projects are:

- **Interchange evaluation:** Four partial existing interchanges of Interstate 77 at Miller Road, Brecksville, Cuyahoga County; Interstate 480 at Granger Road, Garfield Heights, Cuyahoga County; US highway 422 at Harper Road, Solon, Cuyahoga County; State Route 44 at Jackson Road, Painesville, Lake County will be full diamond interchanges by 2050.
- **Congestion Management Plan (CMP):** CMP objectives in relation to the eNEO2050 goals and objectives are introduced and a set decennial targets is determined for a selected performance measures.
- **Principal Arterial Network:** Principal arterial corridors are evaluated and prioritized for the STOP and transit services. In this section the “TOP 10” corridors for STOP projects and transit are introduced.
- **Safety:** NOACA utilizes a systemic safety approach based on the formulas for predictive crashes from the Highway Safety Manual. This is primarily implemented through biannual community safety reports, which analyze the arterial segments and intersections within NOACA cities and villages to identify the ones that have the highest risk of crashes based on their roadway configurations and number of lanes, traffic levels, and estimated numbers of driveways (access points).
- **Pavement and Bridge Maintenance Management:** NOACA Pavement preservation plan based on the Maintenance & Rehabilitation (M&R) program is described and then applied to maintain the average pavement condition rating at 75 during the period of 2025 - 2050. This application is similar to the NOACA biennial pavement maintenance community approach.
- **Complete Transit Connectivity:** As a complement to existing modes for “First-Mile” and “Last-Mile” connections, autonomous shuttle feeder bus services in four counties are designed to provide complete connection for the major transit corridors.
- **Workforce Accessibility and Mobility:** The *weNEO2050+* plan includes a set of transit and land use recommendations based on the NOACA recent Workforce Accessibility and Mobility study for work commutes during the morning peak period.
- **Non-motorized Facilities:** NOACA has completed a new pedestrian and bicycle plan, called ACTIVATE. This plan includes three usage categories of non-motorized modes; utilitarian trips, access to transit services, and recreational pursuits. Also *weNEO2050+* Plan proposes 928 miles of bike facility, over 11,000 pedestrian ADA and safe crossings and 760 bike storage lockers for cyclist in the next three decades.
- **Emerging Technology in transportation:** The *weNEO2050+* plan proposes a set of locations for Electric Vehicle (EV) charging ports and discusses the emerging electric vehicles in the NOACA roadway network in relation to air quality and equity.

- **Fiscally Unconstraint eNEO2050:** The future BRT network expansion did not satisfy the fiscal constraints of the long range plan. However, Scenario 4 (TOTAL) did include this expansion and it had the highest measure of effectiveness. Therefore, *weNEO2050+* will include this project as a fiscally unconstrained project for the future plan amendments.
- **Illustrative Project:** The Hyperloop is an illustrative project of the *weNEO2050+* plan.

The Journey

weNEO2050+ is an update a year in the making but firmly based on the foundation of the development of the *eNEO2050* Long Range Plan (LRP or Plan). The journey of developing *eNEO2050* began with the NOACA Board of Directors approval of the AIM2040 plan with research, analysis, policy development, as well as the development of project and plan components. The more concentrated efforts to build and assemble the Plan began in January 2018 with the launch of a public outreach campaign. The load for the journey was heavier than that of the previous plan as with the integration of land use, housing, environment, economic development, into the traditional Long Range of Transportation Plan (LRTP). Additionally, the time period for the plan was expanded to 2050, resulting in further visioning, forecasting, and modeling, but better reflecting the possibility of futuristic travel modes.

The vehicle for the journey was equipped with advance planning tools for considering all the available routes and the probable destinations. The vehicle used the engine of "Scenario Planning." At several stations, the public were queried for adjustments to the route ahead. While the journey costs and available budgets were the main determinants, like with any other long trip, there were hidden costs when turning any corners and stopping at any stations.

At the finish line, were happy and cheering spectators who also demanded explanations for design steps and costs incurred, as well as reports of all the places and happenings along the way. Equipped with many stories about the journey, we have arrived at the *weNEO2050+* Plan.

weNEO2050+: Scenario 4 "TOTAL"

Overview

This section summarizes Scenario 4 "TOTAL" and the list of its projects and the planned implementation decades of those projects. Section 11.3 completes the outlines of the scenario by discussing scenario performance measures, project costs and the economic return indicator. The following sections of this chapter, although titled differently, fill in others details of the outlined picture of the eNEO2050 plan. Each section describes some important projects of each category. In previous chapters, four scenarios with common and specific projects were introduced and simulated using the NOACA Travel Forecasting Model. The selected effectiveness measures were analyzed for evaluating the performance of scenarios from various angles. Those measures of effectiveness were combined with project costs and annual budgetary constraints to identify an economic return indicator. The scenario 1: MAINTAIN did not have any specific enhancement or expansion projects, therefore its performance measure values were assumed as the benchmark values. This scenario is similar to "Do Nothing" or "No Build" case in other planning projects. The scenario economic return values were calculated by combining the total measures of effectiveness values with the total scenario specific project costs and Scenarios 3 and 4 returned an acceptable level of economic return indicator, with Scenario 4 having the highest value. Therefore, Scenario 4 was selected as the preferred scenario for the *weNEO2050+* plan. Table 11-1 displays the projects of the *weNEO2050+* Plan in the four categories of "Roadway", "Transit", "Non-motorized Facilities", and "Emerging Technologies in Transportation" and their planned

implementation decades indicated by a grey box. This table also includes the workforce accessibility and mobility objectives for each decade, which will be discussed in the later section.

Table 11-1. *weNEO2050+* Projects and their Planned Implementation Decades

Scenario Projects	Original Scenario	Time Periods		
		2025 - 2030	2030 - 2040	2040 - 2050
Objectives: Workforce Accessibility and Mobility				
Reducing the Average Auto Commute time to Major Job Hubs to 30 minutes	2 & 4			
Reducing Average Transit Commute Time to Major Job Hubs to 45 minutes	3 & 4			
Roadway				
Implementing 2024 TIP Highway and Transit Projects	All Scenarios	■		
Implementing Major Highway Capacity Projects	2 & 4	■	■	■
Adding Harper Road, Jackson Street, Miller Road, and Granger Road Interchanges	2 & 4	■	■	
Reducing Highway Bottlenecks	2 & 4	■	■	■
Reinvigorating Arterial Network	2 & 4	■	■	■
Maintain Pavement Conditions with average of PCR = 75	All Scenarios	■	■	■
Maintain Bridges in Good or Fair Conditions		■	■	■
Addressing Location-specific Safety issues in order to Reduce Traffic Fatalities		■	■	■
Transit				
Implementing Future Transit Agencies' Bus/BRT Routes	3 & 4		■	
Conduct feasibility studies and/or Environmental Impact Statement (EIS) for achieving the visionary rail scenario and the Great Lakes Hyperloop	3 & 4	■	■	
Maintain Transit Vehicles in Good State at the end of each Decade	2 & 4	■	■	■
Non-Motorized Facility				
Creating Walk and Bike Access to the Transit Network	3 & 4	■	■	■
Creating Walk and Bike Connections from Major Transit Hubs to Major Job Hubs	3 & 4			■
Creating Walk and Bike Access from Major Residential Areas to Transit Network	3 & 4		■	■
Implement Smart Pedestrian Crossings	All Scenarios	■	■	■
Emerging Technologies in Transportation				

Installing EV Charging Ports	All Scenarios			
Adding POD and Shuttle CAV Services from Major Transit Hubs to Major Job Hubs	3 & 4			
Installing Extra EV Charging Ports	4			
Allocating Selected Smart Freeway and Arterial Lanes to Autonomous Vehicles	4			

Scenario Performance and Costs

In Chapter 9, a set of performance measure categories was introduced, and a comparative analysis was conducted based on a set of selected measures used for evaluating the performance of the four scenarios. Similarly, in this section, the performance of the *weNEO2050+* scenario is evaluated based on those performance measures. Table 11-2 displays the *weNEO2050+* performance measure values and compares them with those of the current base year of 2025, and also, as before, with those of Scenario 1 ("Do Nothing" case) shown in Chapter 9 as the benchmark values. In this Table, the performance measures highlighted in gray should have higher values in order to be more effective. In contrast, the performance measures highlighted in teal should have lower values in order to be more effective.

Table 11-2. *weNEO2050+* Performance Measures

Performance Measure	Scenario 1	weNEO2050+ (Scenario 4: TOTAL)
Population within 15 Minutes Walk to any Transit Stop	61%	68%
Zero-Car Households within 15 Minutes Walk to any Transit Stop	71%	76%
Number of Jobs within 15 Minutes Walk egress from any Transit Stop	72%	81%
Population in 5-Mile Drive Access to Freeway System	91%	92%
Annual Transit Ridership (Including Transfer Trips) – Million Person Trips	22	38
Non-Single Occupancy Vehicle Work Commute during a Typical Morning Peak Period	21%	22%
Average Highway Network Pavement Condition Rating (PCR)	90.4	90.4
Daily Vehicular Trip Share of Autonomous, Electric Cars and Trucks	31%	56%
Total Annual Vehicle Miles Traveled per Capita	7,669	7,314
Total Annual Freeway Delay per Capita (in Hours)	2.58	2.66
Total Annual Principal Arterial Delay per Capita (in Hours)	5.41	6.57
Annual Person Hours of Excessive Delay (PHED) per Capita (in Hours)*	0.65	0.78
Average Auto Work Commute Time to All Major Job Hubs (in Minutes)	29	29

Average Transit Work Commute Time for Zero Car Households to All Major Job Hubs (in Minutes)	38	43
Average Work Commute Time for Households with Zero Cars (in Minutes)	41	39
Maximum Level of Travel Time Reliability (LOTTR) on Highways and Ramps	1.11	1.11
Maximum Level of Travel Time Reliability (LOTTR) on Arterials	1.10	1.11
Annual Congestion Cost per Capita (2050$)	588	639
All Estimated Fatalities and Serious Injuries for Motorized and Non-Motorized Modes (Vision-Zero)	0	0
Daily Volatile Organic Compounds (VOCs) (in Tons)	5.69	5.79
Daily Nitrogen Oxides (NO_x) (in Tons)	3.77	3.83
Annual Direct PM (in Tons)	129.19	131.44
Structurally Deficient Deck Areas of NHS Bridges	1.84%	1.84%
Structurally Deficient Deck Areas of All Bridges	5.29%	5.29%

*Calculated for the NOACA urbanized area per the FHWA performance measure guidelines for PHED.

The Measure of Effectiveness (MOE) for Scenario 4 TOTAL was estimated based on the weighting of the measures used in the scenario comparative analysis of Chapter 9. Table 11-3 shows the estimated total MOE of the *weNEO2050+* scenario 4.

Table 11-3. Estimated Total Measures of Effectiveness of *weNEO2050+* Scenario 4

Scenario	Ratio of Estimated SMOE
1: MAINTAIN	1
4: TOTAL	5.8

Table 11-4 displays the NPV (2025$) of estimated total project costs of the *weNEO2050+* scenario 4 by project category.

Table 11-4. NPV (2025$) of Estimated Total Project Costs by Project Category weNEO2050+ Scenario 4

Project Category	Net Present Value of Project Costs (2025$) Millions	Percent of the Total NPV (2025$)
Roadway	$13,943	67.5%
Transit	$5,193	25.1%
Non-Motorized Facility	$1,536	7.4%
Total	**$20,672**	**100%**

Tables 11-5 and 11-6 show the percent of NPV of the *weNEO2050+* scenario 4 specific projects costs and the comparison ratio values.

Table 11-5. Percent of the Additional weNEO2050+ Scenario 4 Costs and Comparison Ratios

Scenario	Percent of NPV of Costs for Scenario Specific Projects	Ratio of Scenario Specific Project NPV Costs to Scenario 1 Specific Cost Percent
1: MAINTAIN	8.2%	1.0
4: TOTAL	29.0%	3.5

Table 11-6. Ratio of SMOE and Additional Quotients of weNEO2050+ Scenario 4

Scenario	SMOE Value Relative to Scenario 1 SMOE	Specific Project Cost Quotient Values	Ratio of SMOE Values and Corresponding Costs
1: MAINTAIN	1.0	1.0	1.00
4: TOTAL	5.8	3.5	1.66

Chapter 9 discussed the ratio of SMOE and the corresponding value as an economic return indicator. According to Table 11-6, the *weNEO2050+* scenario 4 economic return is 1.57, and since that is greater than one, therefore this scenario has an acceptable level of economic return.

Roadway

Interchange Evaluation

Proposals for highway projects include a set of major high-capacity interstate projects, which will be added to the current highway network during the next three decades. Notably, eight interchanges, including four modifications to existing interchanges and four new interchanges, are assessed for inclusion in the plan. This evaluation utilized the "New or Modify Interchange" policy adopted by the NOACA Board in December 2020. The evaluated interchanges are:

- **Modifications to Existing Interchanges**
  - Interstate 77 at Miller Road, Brecksville, Cuyahoga County
  - Interstate 480 at Granger Road, Garfield Heights, Cuyahoga County
  - US Highway 422 at Harper Road, Solon, Cuyahoga County
  - State Route 44 at Jackson Road, Painesville, Lake County

- **New Interchanges**
  - Interstate 71 at Boston Road, Strongsville, Cuyahoga County
  - Interstate 71 at State Route 57(or 162), Medina, Medina County
  - Interstate 271 at White Road, Highland Heights, Mayfield, Willoughby Hills, Cuyahoga, Lake Counties
  - State Route 10 at State Route 57, Elyria, Lorain County

Applying the approved board policy, the transportation planning criteria include "Interchange Spacing" and a "Cost-Benefit Analysis". The "Cost-Benefit Analysis" is applied to three levels of geography: Influence subarea, NOACA region and if appropriate, the neighboring counties.

The “interchange spacing” criterion does not apply to the modified interchanges since they already exist. The proposed new interchanges along Interstate 71 at Boston Road and State Route 57 satisfy the interchange spacing criterion, but the proposed interchange at White Road does not. Also, adequate design information about the new interchange of State Route 10 was not available at the time of developing the *eNEO2050* plan to evaluate it.

Figure 11-1 displays the influence subareas of the proposed interchanges, which are identified based on the VMT difference density of the “Build” and “No Build” cases.

Figure 11-1. Influence Subarea of the Proposed Interchanges

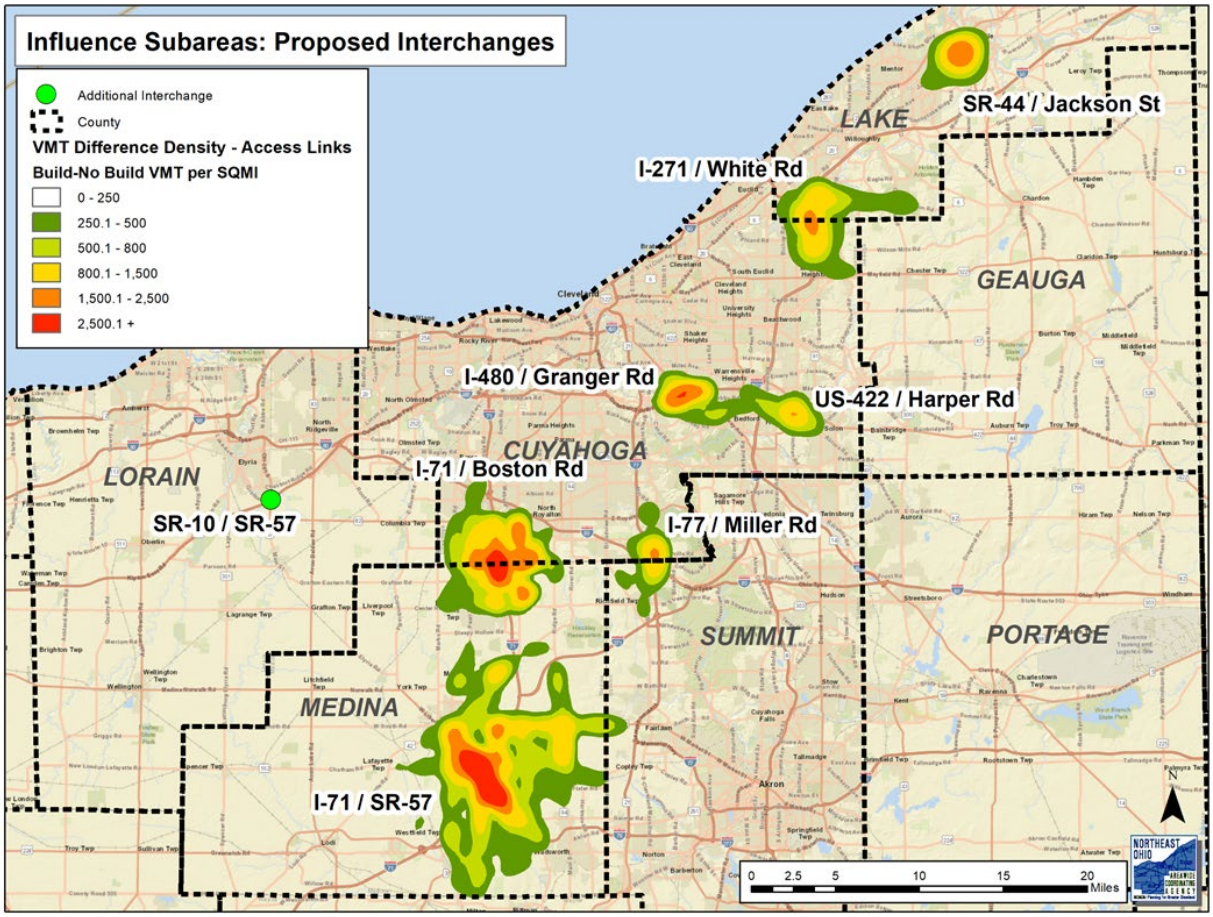


Figure 11-2 shows the cost items and procedure of the “Cost-Benefit” analysis.

Figure 11-2. Cost-Benefit Analysis Procedure

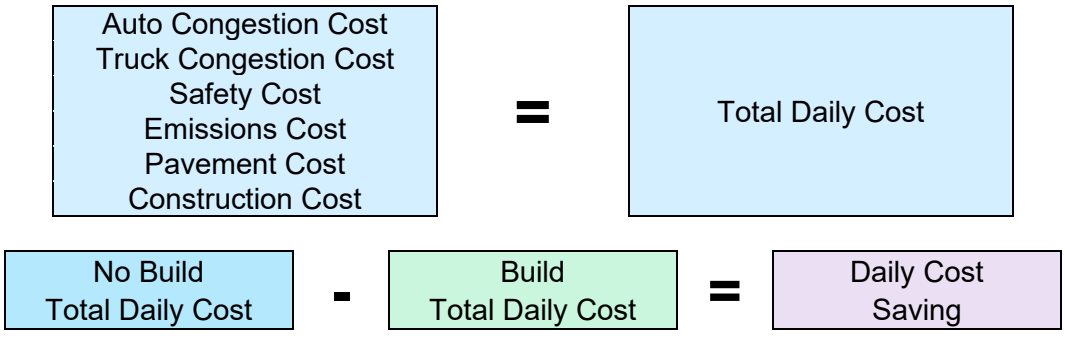


Table 11-7 shows the "Cost-Benefit Analysis" results for the influence subarea proposed interchanges.

Table 11-7. Cost-Benefit Analysis Results for the Influence Subareas

Interchange	Daily Cost / Saving (2050$)	Margin of Error (2050$)		Investment Return Threshold (2050$)
Granger Road	+$9,890	-$25,870	+$25,870	$0 (Break/Even)
Miller Road	-$6,766	-$18,277	+$18,277	$0 (Break/Even)
Jackson Street	+$9,913	-$10,956	+$10,956	$0 (Break/Even)
Harper Road	+$14,696	-$27,251	+$27,251	$0 (Break/Even)
Boston Road	-$776	-$38,818	+$38,818	$77,636
White Road	-$5,396	-$18,524	+$18,524	$37,048
SR 57 (or 162)	-$3,144	-$60,449	+$60,449	$120,897

As shown in Table 11-7, the "Cost-Benefit" analysis produces several values for each interchange. The positive values in the second column indicate that the total benefit for each interchanger is higher than its total cost. The third and fourth columns provide a range for the margin of errors. The margin of error is assumed to be 5% of the total cost of the "No Build" case. The last column shows the minimum values for the investment returns, and it is assumed that the break-even value for the modified interchanges and 10% of the total cost of the "No Build" case for the new interchanges.

Therefore, using the "Cost-Benefit" analysis, the completion of the existing interchanges at Granger Road, Miller Road, Jackson Street, and Harper Road satisfied the transportation planning criteria and then were considered for the regional impact analysis. The proposed new interchanges did not satisfy the transportation planning criteria at the influence subarea level; therefore, they were not further considered for the regional impact analysis. However, if conditions change, and as new data becomes available, the interchanges will be evaluated for amendment to *weNEO2050+*.

Table 11-8. Cost-Benefit Analysis Results for the NOACA Region

Interchange	Daily Cost / Saving (2050$)	Margin of Error (2050$)		Investment Return Threshold (2050$)
Granger Road	+$4,122	-$1,039,849	+$1,039,849	$0 (Break/Even)

Miller Road	-$44,738	**-$1,040,053**	**+$1,040,053**	$0 (Break/Even)
Jackson Street	-$138,223	**-$1,039,882**	**+$1,039,882**	$0 (Break/Even)
Harper Road	-$7,127	**-$1,039,849**	**+$1,039,849**	$0 (Break/Even)

As Table 11-8 indicates, an evaluation was conducted at the NOACA regional level for those interchanges as well, which included another "Cost-Benefit" analysis, as well as other regional impact criteria such as equity, environmental, and economic. Although the daily cost is higher than the benefits, the difference is within the margin of error, thus meeting the threshold. The Interchange of Miller Road at I-77 is located close to the border of the NOACA region, and its influence subarea is extended to the neighboring county. Therefore, it warrants conducting the "Cost-Benefit" analysis for the seven-county region, which also meets the threshold and satisfies the criteria.

Table 11-9. Cost-Benefit Analysis Results for the Seven-County Region

Interchange	Daily Cost / Saving (2050$)	Margin of Error (2050$)		Investment Return Threshold (2050$)
Miller Road	-$44,738	**-$1,040,053**	**+$1,040,053**	$0 (Break/Even)

As indicated in Table 11-9, although the daily cost is higher than the benefits, the difference is within the margin of error; therefore, the Miller Road interchange modification fully satisfies the "Cost-Benefit" Criteria.

Evaluation of Congestion Management

Congestion management is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods. A CMP, as defined in federal regulation, is an objective-driven and performance-based process that intends to integrate effective management and safe operation of the existing multimodal transportation facilities.

The CMP is intended to be an ongoing process and fully integrated into the LRTP of the *weNEO2050+* plan. The CMP is continually evolving to improve transportation system performance measures, address concerns of communities and ultimately achieving NOACA objectives and goals.

The purpose of the NOACA congestion management plans is to:

- Identify the spatial and temporal characteristics of traffic congestion in the region,
- Measure the congestion severity, duration, extent, and variability, and
- Develop congestion mitigation strategies for enhancing the mobility of people and goods in the NOACA region.

In alignment with the FHWA's purposes, the following three regional strategic plan goals have been adopted as the focus of the NOACA congestion management plans:

- System preservation,
- Provision of a safe and efficient multimodal transportation system for all travelers, and
- Advance the region's economic conditions and improve quality of life based on sustainable development.

The current planning demi-decade and future planning decades for the NOACA congestion management are 2025 -2030, 2031-2040, and 2041-2050 and each plan will be evaluated during the third and sixth years of its implementation.

Congestion management objectives define what the NOACA region intends to achieve regarding the traffic congestion management process every decade cycle. A set of Specific, Measurable, Agreed, Realistic, and Time-bound (SMART) objectives were established for each planning decade. These regional and local objectives of each planning decade are also the continuation of the prior planning decade's objectives, and the continuity will eventually fulfill the NOACA regional strategic goals. It should be noted that the congestion management objectives are a subset of the NOACA long-range objectives and goals and thus focus on providing a multimodal transportation system and strategies to alleviate traffic congestion.

During the third and sixth years of each decade cycle, a monitoring procedure will be invoked to evaluate the progress and effectiveness of the implementation of the congestion management plans, and adjust or update their objectives, if necessary.

Figure 11-3 depicts the relation between the congestion management objectives and w*eNEO2050+* goals and objectives.

Figure 11-3: Congestion Management Plan Objectives and *weNEO2050+* Goals and Objectives Relation

The congestion management plan objectives have been developed based on the following guidelines:

- Reduce average delay per traveler during peak periods,
- Increase the percentage of Non-Single occupancy vehicles,
- Regulate the flow of traffic entering freeways,
- Increase the efficiency of interchanges,

- Increase capacity of non-freeway corridors,
- Increase transit accessibility, and
- Increase transit and non-motorized mode shares.

Table 11-5 displays the congestion management objectives for the planning timeframes of 2025-2030, 2031-2040, and 2041-2050.

Table 11-5: Congestion Management Objectives

Objective/Planning Decade	2025 Base	2025 - 2030	2031 - 2040	2041 - 2050
Reduce Percentage of Total Vehicle Delay During a Typical AM and PM Peak Periods	9%	Decrease by 1%	Decrease by 2%	Decrease by 2%
Annual Hours of Peak Hour Excessive Delay (PHED)*	2.4 Million	Reduce to 2.2 Million	Reduce to 1.7 Million	Reduce to 1.3 Million
Annual Hours of Peak Hour Excessive Delay (PHED) Per Capita*	1.3	Reduce to 1.2	Reduce to 1.0	Reduce to 0.8
Increase the Percentage of Non-Single Occupancy Vehicle Work Commutes during the AM Peak Period	21%	Increase by 1%	Increase by 1%	Increase by 2%
Reduce Average Auto Work Commute Time to Regional Major Job Hubs During the AM Peak Period	28	Reduce to 28 Minutes	Reduce to 27 Minutes	Reduce to 26 Minutes
Reduce Average Walk Access Transit Work Commute Time to Regional Major Job Hubs During the AM Peak Period	37	Reduce to 36 Minutes	Reduce to 35 Minutes	Reduce to 34 Minutes
Reduce Average Walk Access Transit Work Commute Time for Zero-Car Households to Regional Major Job Hubs During the AM Peak Period	41	Reduce to 40 Minutes	Reduce to 39 Minutes	Reduce to 38 Minutes
Reduce Average Transit Work Commute Time for Zero-Car Households to All Jobs During the AM Peak Period	42	Reduce to 41 Minutes	Reduce to 40 Minutes	Reduce to 39 Minutes
Reduce Average Drive Access Transit Work Commute Time to Regional Major Job Hubs During the AM Peak Period	42	Reduce to 41 Minutes	Reduce to 40 Minutes	Reduce to 39 Minutes
Implement Signal Timing Optimization Program (STOP)	12 Corridors	5 Additional Corridors	10 Additional Corridors in each Decade	
Implement Diverging Diamond Interchange (DDI)	1	2 more Locations		

Objective/Planning Decade	2025 Base	2025 - 2030	2031 - 2040	2041 - 2050
Increase the Percentage of Population within 5-Mile Drive Access to a Park & Ride Station	65%	Increase to 66%	Increase to 68%	Increase to 70%
Increase the Percentage of Population within 15-Minute Walk Access to a Transit Stop	66%	Increase to 67%	Increase to 69%	Increase to 70%
Increase the Mode Share of AM Peak Period Work Commutes via Transit and Non-Motorized Modes	4.7%	Increase to 5.5%	Increase to 7.5%	Increase to 9.5%

*Calculated for the NOACA urbanized area per the FHWA performance measure guidelines for PHED.

As discussed, the congestion management plans lay out the objectives for each decade cycle, and to achieve those targets, a congestion management process has been adopted, which includes the following steps:

1. Define the current and future transportation system networks.
2. Develop multimodal performance measures.
3. Collect data and evaluate system performance.
4. Analyze traffic congestion problems.
5. Identify and assess congestion mitigation strategies.
6. Prioritize and program the selected congestion mitigation strategies; and
7. Monitor the effectiveness of congestion management and evaluate the progress.

Figure 11-3 illustrates the cyclical nature of the congestion management process.

Figure 11-4: Congestion Management Process

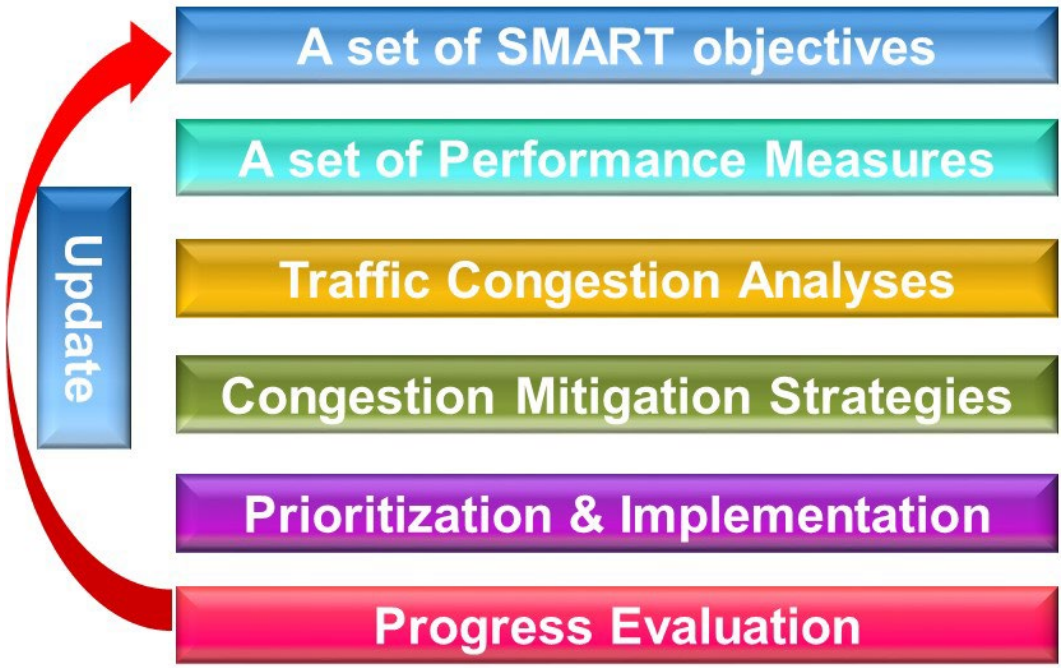


Figure 11-5. Existing Freeway Bottleneck Locations during the AM Peak Period

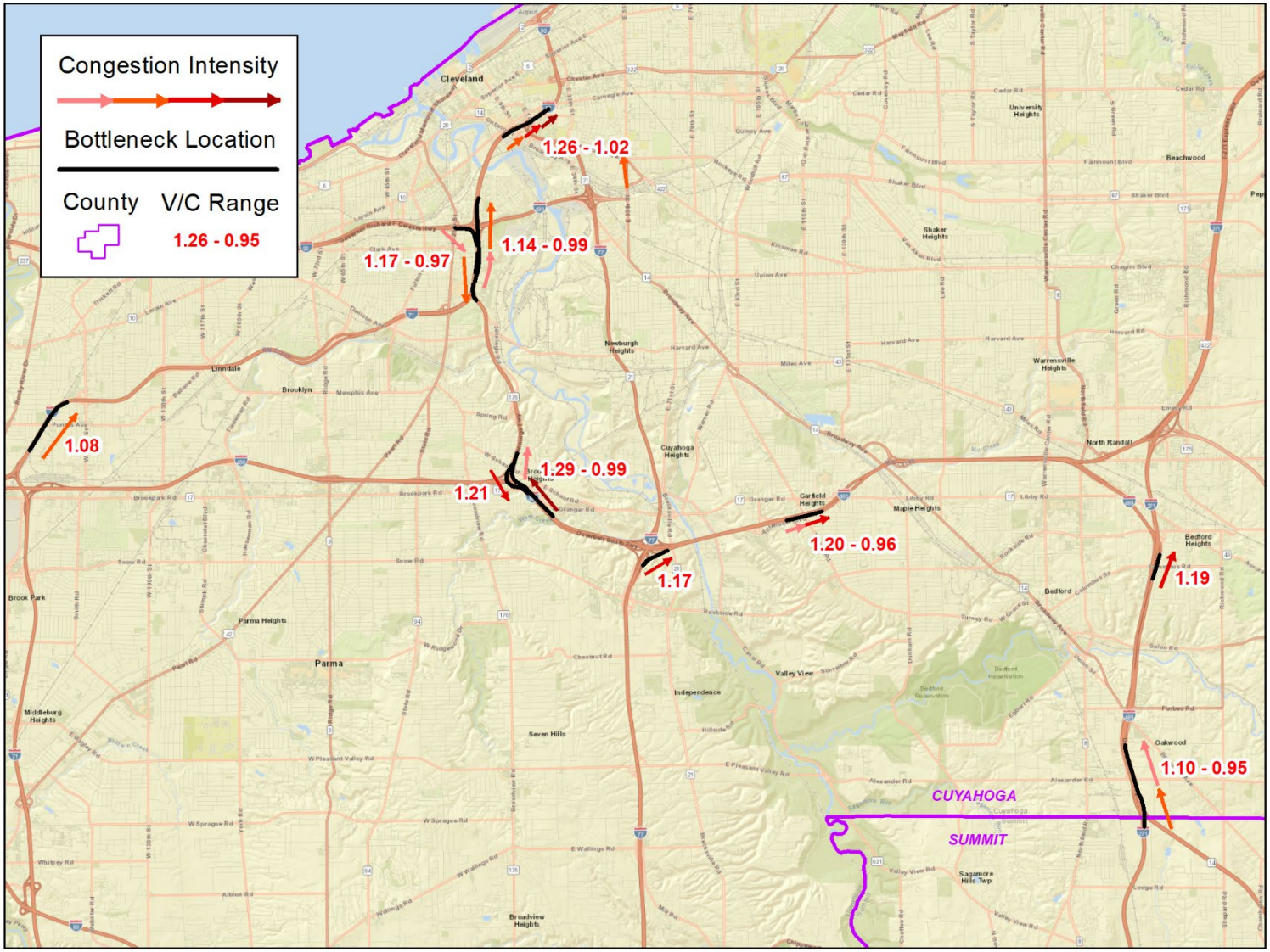
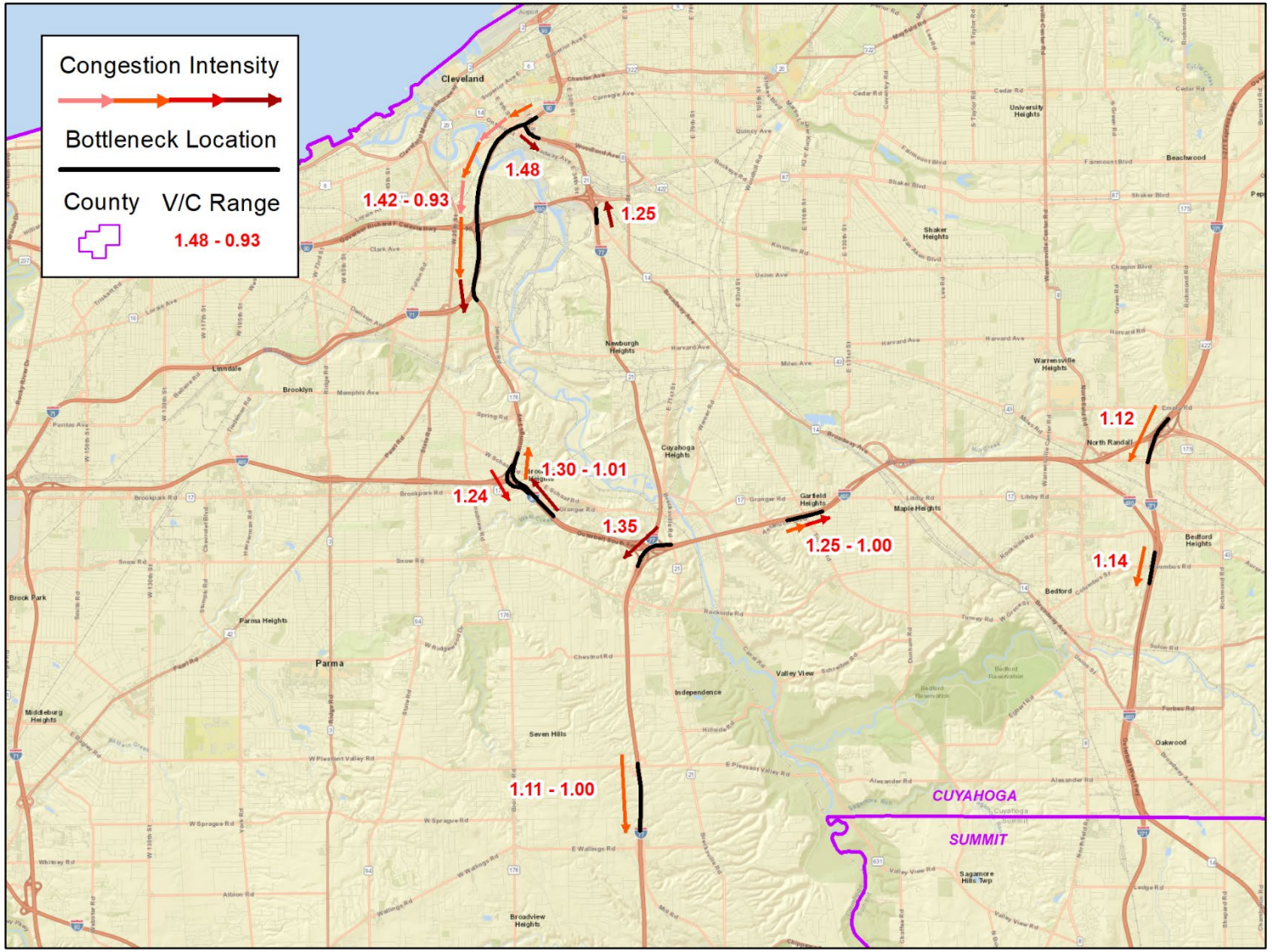


Figure 11-6. Existing Freeway Bottleneck Locations during the PM Peak Period



Tables 3-19 and 3-20 present the V/C, TTI, and speed ranges for the identified freeway bottleneck locations during the AM and PM peak periods.

Table 3-19. Existing Freeway Bottleneck during the AM Peak period

No.	Freeway	Direction	From	To	V/C Range	TTI Range	Actual Speed (mph) Range
1	I-480 Ramp to SR-176	WB / NB	E. Granger Rd. Exit Ramp	SR-176 NB	0.99 - 1.29	1.18 - 2.57	18 - 39
2	I-90	EB	Carnegie Ave. Exit Ramp	Ontario St. Exit Ramp	1.02 - 1.26	1.23 - 2.25	22 - 41
3	SR-176 Ramp to I-480	SB / EB	I-480 WB Ramp	Tuxedo Ave. Bridge	1.21	1.93	24
4	I-480	EB	Transportation Blvd Entrance Ramp	Granger Rd. Exit Ramp	0.96 - 1.20	1.43 - 4.00	16 - 45
5	I-480	WB	I-271 Split	Rockside Rd. Exit Ramp	1.19	1.8	26
6	I-77 Ramp to I-480	NB / EB	Ramp from I-77 NB to I-480 WB	Ramp from I-77 SB to I-480 EB	1.17	1.69	28
7	I-90 Ramp / I-71 / SR-176 Ramp	EB / SB	Ramp from I-90 EB to I-71 SB	Ramp to SR-176 SB	0.97 - 1.17	1.16 - 1.68	23 - 36
8	I-71	NB	Ramp to W. 14th St.	I-90 Merge	0.99 - 1.14	1.37 - 1.89	23 - 45
9	I-271 / I-480	NB / WB	I-271 / I-480 Merge	Fairoaks Rd. / Broadway Ave. Exit Ramp	0.95 - 1.10	1.27 - 1.92	32 - 49
10	I-71	NB	Ramp from I-480 EB / SR-237 NB	W. 150th St. Exit Ramp	1.08	2.23	28

Note: NB: Northbound, SB: Southbound, WB: Westbound, and EB: Eastbound.

Table 3-20. Existing Freeway Bottleneck during the PM Peak period

No.	Freeway	Direction	From	To	V/C Range	TTI Range	Actual Speed (mph) Range
1	I-90 Ramp to I-77	WB / SB	E. 14th St. Entrance Ramp	Bridge over E. 22nd St.	1.48	5.71	6
2	I-90 / I-71	WB / SB	I-77	SR-176	0.93 - 1.42	1.11 - 4.21	11 - 47
3	I-480 Ramp to I-77	WB / SB	Ramp from I-480 WB to I-77 NB	Ramp from I-480 EB to I-77 SB	1.35	3.23	18
4	I-480 Ramp to SR-176	WB / NB	E. Granger Rd. Exit Ramp	SR-176 NB	1.01 - 1.30	1.21 - 2.68	17 - 38
5	I-77 Ramp to I-490	NB	Broadway Ave Bridge	I-490 EB and WB Ramps	1.25	2.23	16
6	I-480	EB	Transportation Blvd Entrance Ramp	Granger Rd. Exit Ramp	1.00 - 1.25	1.60 - 5.47	12 - 41
7	SR-176 Ramp to I-480	SB / EB	I-480 WB Ramp	Tuxedo Ave. Bridge	1.24	2.12	22
8	I-480	EB	Rockside Rd. Entrance Ramp	I-271 Merge	1.14	1.56	30
9	I-271	SB	I-271 Express Lane Merge	Ramp from I-480 WB	1.12	2.06	29
10	I-77	SB	Pleasant Valley Rd. Exit Ramp	Wallings Rd. Exit Ramp	1.00 - 1.11	1.39 - 2.00	31 - 45

Note: NB: Northbound, SB: Southbound, WB: Westbound, and EB: Eastbound

In order to identify the top interchange and intersection bottleneck locations, a calculation based on the following equation, was performed to average the volume over capacity (V/C) values for all approaches of a given interchange or intersection.

$$WVC = \frac{\sum_{i=1}^{n} VOL_i \times (V/C)_i}{\sum_{i=1}^{n} VOL_i}$$

Where

WVC = Weighted V/C values
n = Number of approaches
VOL = Approach traffic volume (weighting factor)

For example, a four-legged intersection has four approaches, each with their own V/C value. A weighted average of each approach's V/C value was calculated, using the total volume of each approach as the weighting factor. Weighting was used in order to give a more heavily traveled roadway's congestion level more influence over the intersection's final calculated value. The locations with the highest weighted V/C values were then identified as the top bottleneck interchanges and intersections in the region.

A number of the bottleneck locations were grouped together based on their proximity and interactions with each other. For example, in downtown Cleveland, three PM peak period bottleneck locations were identified along Euclid Ave and E 14th St. Since these locations are located along the same corridors, congestion at one location leads to increased congestion at a nearby location. It was determined that these locations should be grouped together and discussed as one due to these inter-relationships. Similar groupings can be seen on the map (indicated with black circles), showing bottleneck locations that have some relationship with each other, such as neighboring interchanges along the same freeway and intersections in a similar geographic area, like downtown Cleveland.

Figures 3-21 and 3-22 present the existing interchange and intersection bottleneck locations during the AM and PM peak per

Figure 11-7. Existing Interchange/ Intersection Bottleneck Locations during the AM Peak Period

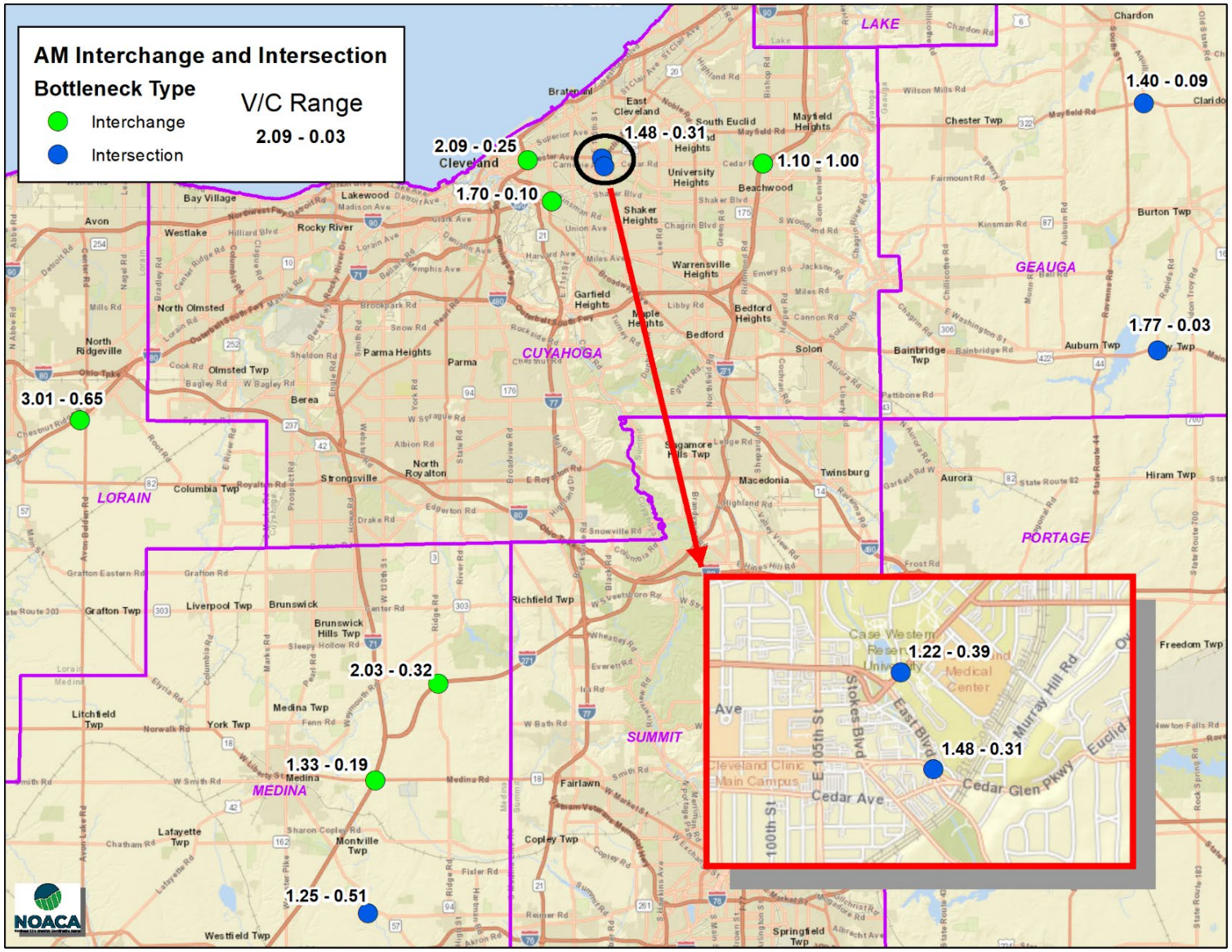
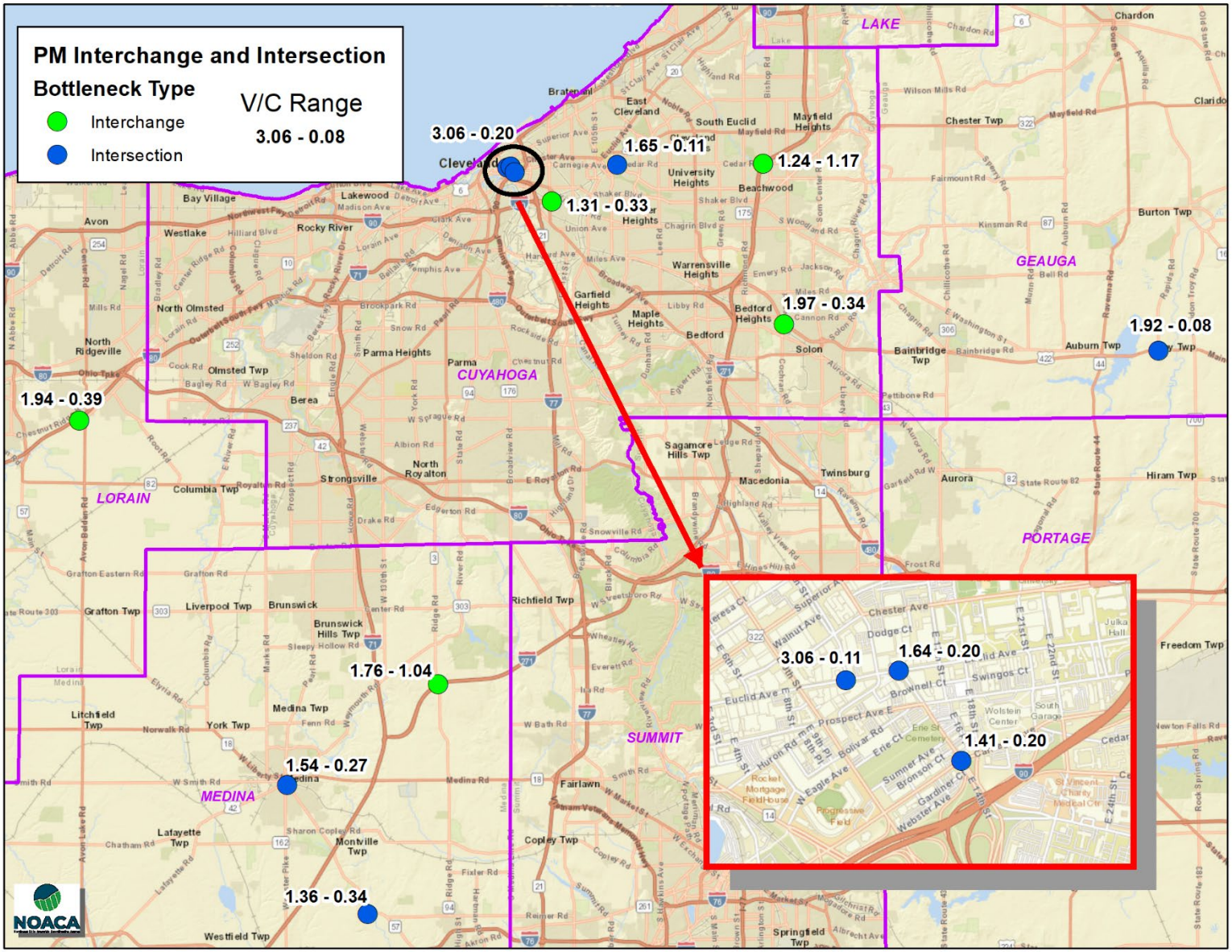


Figure 11-8. Existing Interchange/ Intersection Bottleneck Locations during the PM Peak Period



Tables 3-21 and 3-22 present the V/C values for the identified interchanges and intersection bottleneck locations during the AM and PM peak periods.

Table 3-21. Existing Interchange/ Intersection Bottleneck during the AM Peak Period

No.	Location	County	Type	AM Peak Period (6AM - 9AM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
1	SR-10 NB Ramps / Butternut Ridge Rd / Chestnut Ridge Rd	Lorain	Interchange	1.78	3.01 - 0.65	2
2	I-90 EB Exit / Chester Ave (US-322)	Cuyahoga	Interchange	1.67	2.09 - 0.25	1
3	I-271 SB Ramps / Ridge Rd (SR-94)	Medina	Interchange	1.47	2.03 - 0.32	1
4	I-490 / Opportunity Corridor (SR-10) / E.55th St	Cuyahoga	Interchange	1.46	1.70 - 0.10	2
5	Main Market Rd (US-422) / Rapids Rd	Geauga	Intersection	1.44	1.77 - 0.03	2
6	I-71 NB Ramps / Medina Rd (SR-18)	Medina	Interchange	1.12	1.33 - 0.19	2
7	University Circle Area	Cuyahoga	Intersection	1.08 - 1.07	1.48 - 0.31	4
-	*MLK Jr Dr / Carnegie Ave*	*Cuyahoga*	*Intersection*	*1.08*	*1.48 - 0.31*	*2*
-	*Euclid Ave (US-20) / East Blvd*	*Cuyahoga*	*Intersection*	*1.07*	*1.22 - 0.39*	*2*
8	Mayfield Rd (US-322) / Aquilla Rd	Geauga	Intersection	1.06	1.40 - 0.09	1
9	I-271 SB Ramp / Cedar Rd	Cuyahoga	Interchange	1.05	1.10 - 1.00	2
10	Wadsworth Rd (SR-57) / Styx Hill Rd / River Styx Rd	Medina	Intersection	1.03	1.25 - 0.51	3

Table 3-22. Existing Interchange/ Intersection Bottleneck during the PM Peak period

No.	Location	County	Type	PM Peak Period (3PM - 7PM)		
				Volume Weighted Average of V/C for Intersection Approaches	Volume over Capacity (V/C) Ratio Range	Number of Approaches over 0.85 V/C Ratio
1	**Downtown Cleveland Area**	**Cuyahoga**	**Intersection**	**1.86 - 1.15**	**3.06 - 0.20**	**5**
-	*Euclid Ave (US-20) / E 12th St*	*Cuyahoga*	*Intersection*	*1.86*	*3.06 - 0.11*	*1*
-	*Euclid Ave (US-20) / E 14th St*	*Cuyahoga*	*Intersection*	*1.28*	*1.64 - 0.20*	*1*
-	*Carnegie Ave / E 14th St*	*Cuyahoga*	*Intersection*	*1.15*	*1.41 - 0.20*	*3*
2	**Main Market Rd (US-422) / Rapids Rd**	**Geauga**	**Intersection**	**1.58**	**1.92 - 0.08**	**2**
3	**I-271 SB Ramps / Ridge Rd (SR-94)**	**Medina**	**Interchange**	**1.37**	**1.76 - 1.04**	**3**
4	**Cedar Glen Pkwy / Cedar Rd / Euclid Heights Blvd**	**Cuyahoga**	**Intersection**	**1.28**	**1.65 - 0.11**	**1**
5	**I-271 SB Ramp / Cedar Rd**	**Cuyahoga**	**Interchange**	**1.20**	**1.24 - 1.17**	**2**
6	**US-422 / Harper Rd**	**Cuyahoga**	**Interchange**	**1.20**	**1.97 - 0.34**	**1**
7	**SR-10 NB Ramps / Butternut Ridge Rd / Chestnut Ridge Rd**	**Lorain**	**Interchange**	**1.19**	**1.94 - 0.39**	**2**
8	**Wadsworth Rd (SR-57) / S Broadway St / Lafayette Rd**	**Medina**	**Intersection**	**1.16**	**1.54 - 0.27**	**2**
9	**I-490 / Opportunity Corridor (SR-10) / E.55th St**	**Cuyahoga**	**Interchange**	**1.15**	**1.31 - 0.33**	**2**
10	**Wadsworth Rd (SR-57) / Styx Hill Rd / River Styx Rd**	**Medina**	**Intersection**	**1.14**	**1.36 - 0.34**	**3**

The next paragraphs discuss the identified freeway, interchanges, and intersection bottleneck locations and their congestion severity.

Freeway Bottlenecks

I-90 / I-77 Interchange Area

Many trips heading to downtown Cleveland, as well as through-traffic from west to east and vice-versa, travel along I-90 through the central interchange area where I-77 and I-90 meet. These two major interstates meeting near a downtown area creates many congested segments in the immediate area, with one of the top congested segments in the AM peak period being I-90 EB from Carnegie Ave to Ontario St. This segment's AM peak period V/C ratio ranges from 1.02 to 1.26, a TTI range from 1.23 to 2.25, and an actual speed range of 22 to 41 mph. In the PM peak period, traffic wanting to exit to I-77 from I-90 WB creates a bottleneck situation at this southbound ramp. This segment's PM peak period V/C ratio is 1.48, its TTI is 5.71, and the actual speed is 6 mph.

I-90 / I-71 / SR-176 Interchange Area

The I-90 / I-71 / SR-176 interchange area is a highly traveled corridor leading to and from downtown Cleveland. In particular, I-71 and SR-176 heading northbound feed into I-90 heading towards downtown Cleveland, creating a bottleneck situation in the AM peak period. Conversely, in the PM peak period, traffic heading towards these two freeways creates a lot of congestion upstream before splitting into their separate directions. In the AM peak period, the I-71 NB segment between W 14th St and I-90 EB has a V/C ratio range of 0.99 to 1.14, a TTI range of 1.37 to 1.89, and an actual speed range of 23 to 45 mph. Also in the AM peak period, the opposite direction along I-71 SB from I-90 EB to SR-176 SB has a V/C range of 0.97 to 1.17, a TTI range from 1.16 to 1.68, and an actual speed range of 23 to 36 mph. In the PM peak period, this southbound section of I-71 is also congested and actually begins upstream along I-90 WB starting at the I-77 interchange. This segment has a V/C ratio range of 0.93 to 1.42, a TTI range of 1.11 to 4.21, and an actual speed range of 11 to 47 mph.

I-480 / SR-176 Interchange Area

The ramps between I-480 and SR-176 are used by many commuters during both the AM and PM peak periods to travel to downtown Cleveland, as well as the job hubs along I-480, such as the Hopkins Airport area and Independence. More specifically, the ramps from I-480 WB to SR-176 NB and SR-176 SB to I-480 EB are the most congested during both peak periods. In the AM peak period, the I-480 WB Ramp to SR-176 NB has a V/C ratio that ranges from 0.99 to 1.29, a TTI range from 1.18 to 2.57, and an actual speed range from 18 to 39 mph. In the PM peak period, this same segment is also congested with a V/C ratio range of 1.01 to 1.30, a TTI range of 1.21 to 2.68, and an actual speed range of 17 to 38 mph. The ramp in the opposite direction, from SR-176 SB to I-480 EB, is congested in both the AM and PM peak periods. In the AM peak period, the V/C ratio is 1.21, the TTI is 1.93, and the actual speed is 24 mph. In the PM peak period, the V/C ratio is 1.24, the TTI is 2.12, and the actual speed is 22 mph.

I-71 / I-480 Interchange Area

Many trips destined for downtown Cleveland travel along I-71, and many of these trips also transfer from I-480 or SR-237, creating a lot of congestion where these three highways meet. In particular, the segment along I-71 NB just north of I-480 to W 150th St is quite congested due to this being the segment where all traffic from I-71, I-480, and SR-237 converge on a northbound path to downtown Cleveland. In the AM peak period, this segment has a V/C ratio of 1.08, a TTI of 2.23, and an actual speed of 28 mph.

I-77 between I-480 and I-80
I-77 between I-480 and I-80 is a busy portion of the interstate system with many trips traveling NB to job hubs such as Independence and downtown Cleveland or heading SB to the I-80 turnpike and points outside the NOACA region. In particular, the SB segment of I-77 between Pleasant Valley Rd and Wallings Rd is quite congested in the PM peak period. It has a V/C ratio range of 1.00 to 1.11, a TTI range of 1.39 to 2.00, and an actual speed range of 31 to 45 mph.

I-480 between I-77 and I-271
I-480 between I-77 and I-271 is a highly traveled east-west highway corridor connecting eastern and western suburbs to nearby job hubs, such as Independence, Chagrin Highlands, and Solon. In the AM peak period, the ramp from I-77 NB to I-480 EB is congested with a V/C ratio of 1.17, a TTI of 1.69, and an actual speed of 28 mph. Not far to the east, there is another highly congested segment in the AM peak period along I-480 EB, specifically between Transportation Blvd and Granger Rd. This segment has a VC ratio range of 0.96 to 1.20, a TTI range of 1.43 to 4.00, and an actual speed range of 16 to 45 mph. This same segment is also congested in the PM peak period with a V/C ratio range of 1.00 to 1.25, a TTI range of 1.60 to 5.47, and an actual speed range of 12 to 41 mph. Traveling back westward to the I-480 / I-77 interchange, the ramp from I-480 WB to I-77 SB is congested, with a V/C ratio of 1.35, a TTI of 3.23, and an actual speed range of 18 mph.

I-480 / I-271 Corridor Area
I-480 and I-271 merge in southeastern Cuyahoga County to form one combined highway corridor for about a 4-mile stretch. Due to the convergence of these two major and highly-traveled highways, this area has many congested segments in both the AM and PM peak periods. In the AM peak period, the NB/WB segment between the I-480/I-271 merge and Broadway Ave has a V/C range ratio of 0.95 to 1.10, a TTI range of 1.27 to 1.92, and an actual speed range of 32 to 49 mph. A few miles to the north, I-480 WB between the I-271 split and Rockside Rd is also congested. This segment has a V/C ratio of 1.19, a TTI of 1.8, and an actual speed of 26 mph. In the PM peak periods, the SB/EB sections of this corridor become more congested. In particular, I-271 SB between the express lanes and the ramp from I-480 WB has a V/C ratio of 1.12, a TTI of 2.06, and an actual speed of 29. A short distance to the south, the I-480 EB segment between Rockside Rd and the I-271 merge is congested, with a V/C ratio of 1.14, a TTI of 1.56, and an actual speed of 30 mph.

I-77 / I-490 Area
The I-77 / I-490 interchange area is just south of the I-90 / I-77 interchange area near downtown Cleveland. As a result, this area has many trips heading to and from the downtown interchanges to the north. There are other trips that are seeking destinations to the east and west, such as points along the Opportunity Corridor to the east or I-490 to the west. In the PM peak period, the ramp from I-77 NB to the I-490 EB and WB ramps is quite congested. This segment has a VC ratio of 1.25, a TTI of 2.23, and an actual speed of 16 mph.

Interchange/Intersection Bottlenecks

Downtown Cleveland Area
Downtown Cleveland is the largest job hub in the NOACA region. With many workers traveling to and from the area in the AM and PM, as well as a growing residential population, traffic congestion at peak travel times is common. One such area of downtown Cleveland that has higher levels of congestion during peak times is the area near Playhouse Square and Cleveland State University, on the eastern side of downtown Cleveland. In particular, four signalized intersections have high levels of congestion: two located on the city's traffic grid and two at the innerbelt freeway. The intersection of E 12th St and Euclid Ave is congested in the PM peak period, with one approach, southbound E 12th St, having a V/C ratio value of above 3. In the AM peak period, none of the approaches are congested at this

intersection. Just to the east, the intersection at E 14th and Euclid Ave is also congested in the PM peak period, with the eastbound approach having a V/C ratio of above 1.5. In the AM peak period, none of the approaches are congested at this intersection. Just to the south and adjacent to ramps leading to/from the innerbelt freeway, the intersection at E 14th St and Carnegie Ave is congested in the AM and PM peak periods. In the AM peak period, the northbound approach along E 14th St has a V/C ratio value of above 1.25. In the PM peak period, three approaches at this intersection have V/C ratio values above 1: northbound on E 14th St, southbound on E 14th St, and westbound on Carnegie Ave. On the eastern edge of downtown, the intersection of the eastbound I-90 exit ramp and Chester Ave is also congested in both the AM and PM peak periods. In the AM peak period, the eastbound exit ramp has a V/C ratio above 2. In the PM peak period, this same ramp has a V/C ratio above 1.

University Circle Area

Like Downtown Cleveland, the University Circle area is one of the region's largest job hubs, and with that distinction comes traffic congestion during peak travel times. In particular, two signalized intersections are quite congested in the AM peak period: MLK Jr Dr / Carnegie Ave and Euclid Ave / East Blvd. At the MLK Jr. Dr / Carnegie Ave intersection, two approaches are congested with V/C ratios above 1, specifically westbound Carnegie Ave and northbound MLK Jr Dr. At the Euclid Ave / East Blvd intersection, two approaches are congested with V/C ratios above 0.85, specifically westbound Euclid Ave and eastbound Euclid Ave. In the PM peak period, one of the main entry points into the University Circle area, the Cedar Glen Pkwy / Cedar Rd / Euclid Heights Blvd intersection, is congested. This signalized intersection has one approach with a V/C ratio above 0.85, specifically Cedar Glen Pkwy eastbound. In the AM peak period at this intersection, Euclid Heights Blvd westbound is congested, with a V/C value of 0.88.

I-271 / Cedar Rd Interchange

The I-271 / Cedar Interchange is located along the border of the cities of Lyndhurst and Beachwood in eastern Cuyahoga County. This interchange is near large retail areas to the west, such as Beachwood Place and Legacy Village, as well as large office parks to the east. In the AM and PM peak periods, the signalized intersection at Cedar and the southbound ramp to I-271 is congested. In both time periods, both the eastbound and westbound approaches on Cedar Rd have V/C values above 0.85.

I-490 / Opportunity Corridor / E 55th St Interchange

I-490 terminates at E 55th in the City of Cleveland. At this location east-west highway turns into the Opportunity Corridor that leads to and from the University Circle job hub. In both the AM and PM peak periods, the signalized intersection of I-490 / Opportunity Corridor / ramp to E 55th St is congested. Specifically, both the eastbound and westbound approaches along I-490 and Opportunity Corridor have V/C values above 0.85.

US-422 / Harper Rd Interchange

The US-422 / Harper Rd interchange, located in the City of Solon, southeastern Cuyahoga County, is the main entry point from the highway system to the Solon job hub along the Harper Rd / Cochran Rd corridor. Large employers, such as Nestle, are located in close proximity to the interchange, which creates traffic congestion conditions. The signalized intersection where Harper Rd meets the eastbound ramps is particularly congested in the PM peak period. Specifically, the northbound approach on Harper Rd has a V/C value of 1.97, indicating high levels of congestion. In the AM peak period, one approach has a V/C value above 0.85, specifically the eastbound exit ramp, and one approach has a V/C value close to 0.85, specifically northbound Harper Rd at 0.81.

US-422 / Rapids Rd Intersection
The US-422 / Rapids Rd intersection is located in Troy Township in southern Geauga County. This intersection is near where US-422 changes from a 4-lane divided highway to a 2-lane roadway. In both the AM and PM peak periods, this intersection is congested, with 2 approaches having high levels of congestion. Specifically, in both time periods, the eastbound and westbound approaches on US-422 have V/C values above 0.85.

US-322 / Aquilla Rd Intersection
The US-422 / Rapids Rd intersection is located in Claridon Township in northern Geauga County. This is a signalized intersection where two one-lane roads meet in a rural area. In the AM peak period, this intersection has 1 congested approach, which is US-322 westbound. None of the approaches are congested in the PM peak period.

I-271 / Ridge Rd Interchange
The I-271 / Ridge Rd Interchange is located in northeastern Medina County in Granger Township. This interchange mostly serves rural areas of the county, being located a few miles away from the largest urban areas in the county, such as the cities of Brunswick and Medina. In both the AM and PM peak periods, the intersection at the southbound exit ramp has congestion issues. In the AM peak period, the southbound approach on Ridge Rd has a V/C ratio value above 2, which indicates an extremely congested situation during that time frame. In the PM peak period, all three approaches have V/C ratios above 1 (southbound and northbound on Ridge Rd and the southbound exit ramp from I-271).

I-71 / SR-18 Interchange
The I-71 / SR-18 interchange is located in central Medina County along the Medina Township and Montville Township border, just east of the City of Medina. This interchange is one of the main access points to and from the City of Medina, and thus has high traffic volumes along its ramps and along SR-18. In particular, the intersection at the northbound exit ramp is congested in both the AM and PM peak periods. In the AM peak period, this signalized intersection has two approaches with V/C ratios above 0.95, both on SR-18. The same two approaches are also congested in the PM peak period, with V/C ratio values above 1.

SR-10 / Butternut Ridge Rd / Chestnut Ridge Rd Interchange
The SR-10 / Butternut Ridge Rd / Chestnut Ridge Rd interchange is located in southeastern Lorain County near the border of North Ridgeville and Eaton Township. Butternut Ridge Rd and Chestnut Ridge Rd run parallel to SR-10 with an access road connecting the interchange ramps to the two roadways. The unsignalized intersection of the eastbound ramps and the access road is congested in both the AM and PM peak periods. In the AM peak period, two approaches (the eastbound exit ramp and northbound access road) have V/C values above 0.85. The same two approaches have V/C values above 0.85 in the PM peak period as well.

SR-57 / Styx Hill Rd / River Styx Rd Intersection
The SR-57 / Styx Hill Rd / River Styx Rd Intersection is located in Guilford Township in southern Medina County, just northwest of the City of Wadsworth. This location is a 4-way intersection with multiple congested approaches in both the AM and PM peak periods. In the AM peak period, three out of four approaches have V/C values above 0.85 (SR-57 westbound, River Styx southbound, and River Styx northbound). In the PM peak period, traffic congestion is worse, with the same three approaches having V/C values above 1.

SR-57 / S Broadway St / Lafayette Rd
The SR-57 / S Broadway St / Lafayette Rd intersection is a 4-way stop located in the City of Medina, just south of Medina's historic square. In the PM peak period, two approaches have V/C values above 0.85, and 1 approach is just below at 0.78. The two congested approaches are Lafayette Rd eastbound and Broadway St southbound, and the approach at near-congested levels is SR-57 westbound. In the AM peak period, the situation is somewhat improved but still congested, with only one approach, SR-57 westbound, having a V/C value of over 0.85.

Principal Arterial Network

As discussed in Chapter 3, the principal arterial network plays an alternative role in reducing traffic congestion in the existing freeway system. The eNEO2050 plan attempts to restore the mobility function of the principal arterial network by implementing capacity-improving strategies such as Signal Timing Optimization Programs (STOP). Map 3.8 in Chapter 3 illustrates the principal arterial network in the NOACA region. This section describes the prioritization process for implementing STOP and major transit corridors. Also, as a part of the eNEO2050 plan, the resulting top 10 priority lists for STOP and transit corridors are displayed.

The corridors in the principal Arterial Network were evaluated and ranked into "Top 10" priority lists for different purposes. During the prioritization process, the attributes of the corridors were weighted, normalized, and then added together for one composite corridor value. For the STOP priority list, the all-user delay attribute was given the highest weighting factor so that corridors with very high user delay would rise to the top of the list. For the transit priority list, the bus-miles traveled attribute was given the highest weighting factor so that corridors with high amounts of bus travel would be highly ranked. The rest of the attributes were given lower weighting values based on their level of importance to each purpose. Tables 11-6 and 11-7 show the attribute weighting values for the corridor prioritization in STOP and major transit corridors.

Table 11-6: Attribute Weighting Values for the Corridor Prioritization in STOP

All User Delay	Person-Miles Traveled by All Modes	Emissions Reduction	Signal Density	Crash Density	Bus-Miles Traveled	Freight-Miles Traveled	**Total**
25	20	20	15	8	7	5	**100**

Table 11-7: Attribute Weighting Values for Prioritization of Transit Corridors

Signal Density	Crash Density	Freight-Miles Traveled	Person-Miles Traveled	All User Delay	**Bus-Miles Traveled**	**Total**
5	5	0	5	5	**80**	**100**

After these coefficients were applied to each program accordingly, two lists were created for each program:

1. A "General" list, in which composite scores for both directions and time periods were summed to result in one score for each corridor, and
2. An "Extremity" list, in which each direction and time period for every corridor was evaluated separately.

The final “Top 10” priority lists resulted from merging these two lists based on which corridors appeared highly on both the “General” and “Extremity” lists. The “General” list was created so that the overall conditions on each corridor could be summarized regardless of direction and time, and the “Extremity” list was created so that any one direction or time period with particularly severe conditions could be identified and prioritized, if necessary. Therefore, the combination of these two lists accounts for both the extreme situations and the entire corridor in general.

Both “Top 10” priority lists can be used to identify which corridors of the region are highly traveled by different modes and should be highly considered for transportation investments.

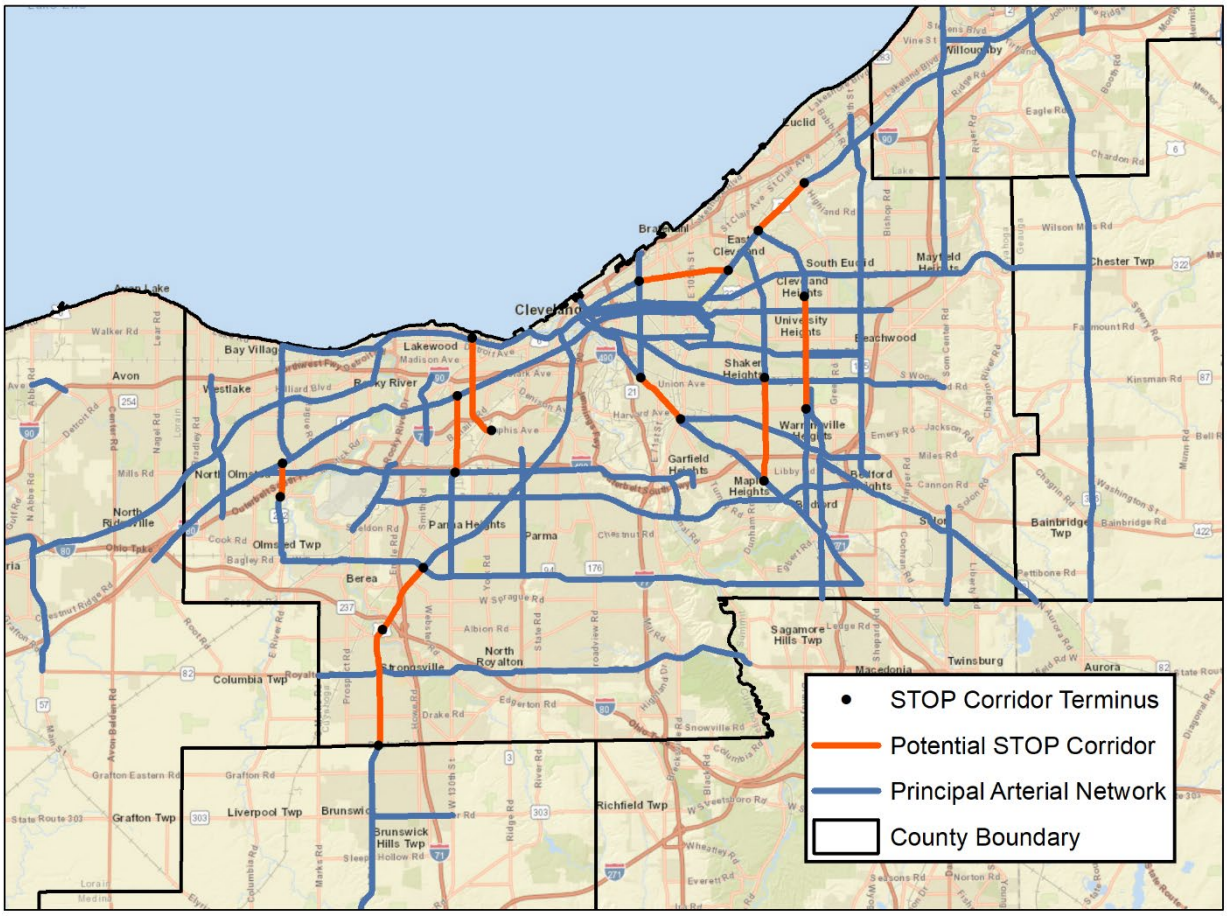
Signal Timing Optimization Program (STOP)

As discussed in the previous section, Table 11-8 shows the “Top 10” priority list for implementing STOP projects. Also, Map 11-3 displays the locations of these corridors in the principal arterial network.

Table 11-8: “Top 10” Priority Corridors for STOP Projects

Street Name	From	To
Pearl Rd (US-42)	Valley Pkwy	E Bagley Rd
Superior Ave (US-6)	E 55th St	Euclid Ave
Euclid Ave (US-20)	Noble Rd	Chardon Rd
Great Northern Blvd (SR-252)	Butternut Ridge	Lorain Rd
West 117th St/Memphis Ave	Tiedeman Rd	Lake Ave
Pearl Rd (US-42)	Boston Rd	Valley Pkwy
Warrensville Center Rd	Harvard Ave	Stonehaven Rd
West 130th St	Brookpark Rd	Lorain Ave
Broadway Ave (SR-14)	E 55th St	Miles Ave
Lee Rd	Broadway Ave	Van Aken Blvd

Map 11-3: Locations of the "Top 10" Priority Corridors for STOP Projects



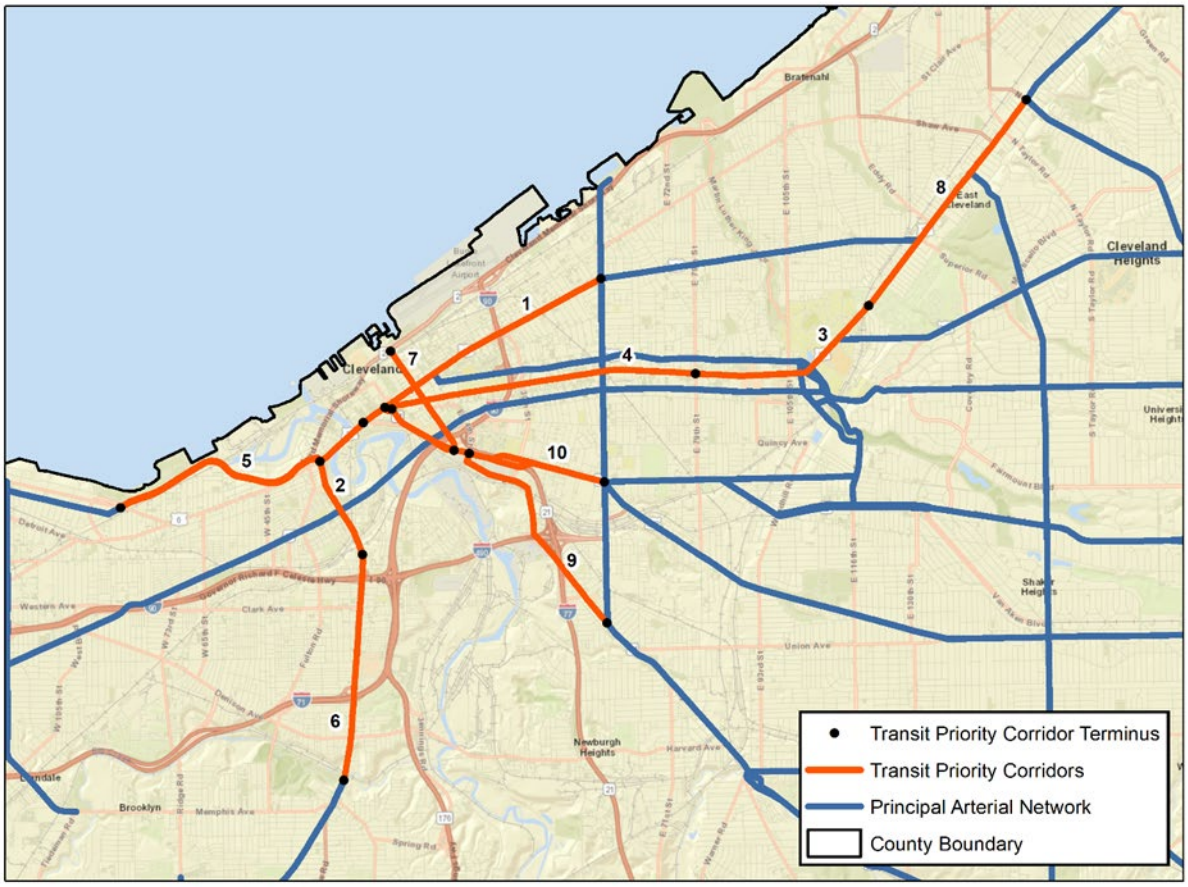
Main Transit Corridors

Similar to STOP corridors, Table 11-9 shows the "Top 10" priority list of Transit corridors. Also Map 11-4 displays the locations of these corridors in the principal arterial network.

Table 11-9: "Top 10" Priority Corridors for Transit

Street Name	From	To
Superior Avenue (US 6)	West 9th Street	East 55th Street
West 25th Street (US 42)	I-90 (Potter Ct)	Detroit Avenue
Euclid Avenue	East 79th Street	East 123rd Street
Euclid Avenue	Superior Avenue	East 79th Street
Clifton Road /W. Shoreway / Superior Avenue	Lake Avenue	West 9th Street
Pearl Road / West 25th Street (US 42)	Broadview Avenue (Brookside Park Dr.)	I-90 (Potter Ct)
East 9th Street	State Route 2	Ontario Street
Euclid Avenue	East 123rd Street	Noble Road
Broadway Road (State Route 14)	Orange Avenue	East 55th Street
Ontario Road/ Orange Avenue / Woodland Road (US 42)	Euclid Avenue	East 55th Street

Map 11-3: Locations of the "Top 10" Priority Corridors for Transit



Traffic Safety

Current Safety Improvement Programs
The international Vision Zero initiative envisages having a transportation network with zero deaths or injuries. One of NOACA's transportation planning goals is to achieve this vision in its five-county region in the future. NOACA has several safety programs, such as the Transportation Safety Action Plan (TSAP), Regional Safety Program (RSP), Safe Route to School (SRTS), SAVE Plan, etc., to improve the efficiency and safety of the transportation system. However, the cornerstone of NOACA's safety implementation comes from biannual Community Safety Reports.

The SAVE plan intends to save lives by identifying high-crash locations and implementing safety treatments at those sites. The plan was developed with the vision that traffic deaths and injuries can be prevented with appropriate planning, policies, and programs. The long-term goal is to reduce the number of fatalities and serious injuries to zero by 2050.

The SAVE Plan is a localized companion document that supports the Ohio Department of Transportation's (ODOT) Strategic Highway Safety Plan (SHSP), which is the cornerstone of the federal Highway Safety Improvement Program (HSIP) in Ohio. The 10 emphasis areas identified for specific action in the SAVE Plan are:

1. Intersection,
2. Roadway Departure,
3. Young Driver,
4. Speed,
5. Impaired Driving,
6. Older Driver,
7. Distracted Driving,
8. Pedestrian,
9. Motorcycle, and
10. Bicycle

Since creating the SAVE Plan, NOACA has added a localized approach through its community safety reports, identifying predictive high-crash locations in cities and villages throughout the NOACA region. We also now use an equal annual reduction to reach zero fatal or serious injury crashes by 2050, which leads to a decrease of 26% by 2030 and 63% by 2040, thereby being more aggressive than SAVE.

Systemic Safety Management Approach

NOACA has incorporated a Systemic Safety Management approach within its safety improvement programs. This approach is used to program the implementation of safety treatments at sites that reduce the potential for crashes using Crash Prediction Models. The Systemic Safety Management approach addresses crash types that occur with high frequency across the roadway network but are not concentrated at individual locations, which tend to be overlooked when ranking sites using a crash-history-based safety management approach.

As a proactive approach, the Systemic Safety Management programs countermeasures for implementation at locations that may not have a history of crashes. In particular, even sites with zero crash history can be identified for potential safety improvement. By applying this approach, NOACA will consider the potential for future crashes and crash history when determining where to make safety improvements.

The NOACA Systemic Safety Management approach is community-based, and specific Safety Performance Functions (SPFs) are being developed for each community based on road inventory, traffic volume, and crash data. This approach also uses the FHWA Crash Modification Factors (CMF) that indicate how much crash experience is expected to change following a design or traffic control modification. CMF is the ratio between the number of crashes per unit of time expected after a modification or measure is implemented and the number of crashes per unit of time estimated if the change does not take place.

This approach is mainly based on the Highway Safety Manual (HSM), a publication of the American Association of State Highway Transportation Officials (AASHTO).
Finally, NOACA produces biennial safety community reports for communities in the NOACA region.

Pavement, Bridge, and Transit Asset Management

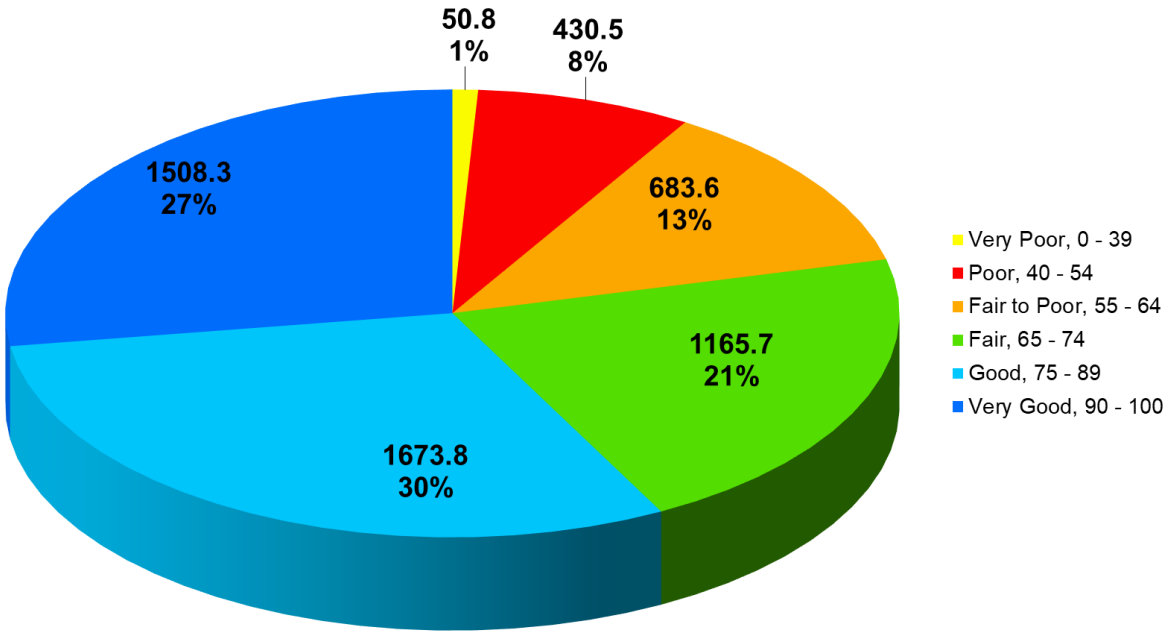
Current and Future Pavement Conditions
The majority of vehicular trips take place through the highways and street network. This network is an important asset item of the transportation infrastructure and its expansion, maintenance and operation very much depend on the available funds in any period of planning. The overall pavement and bridge condition of the highways and streets is an indicator of the quality of service provided to traffic through the system.

In order to provide an accurate assessment of the current status and further pavement analyses, the pavement network is required to be divided into homogeneous discrete sections in terms of surface distress, traffic volumes, pavement structure, etc. The Pavement Condition Ratings (PCR) measure is a qualitative description of the structural state of the pavement. The PCR values span a spectrum of descriptive narratives ranging from “Very Good” to “Very Poor”. Each roadway segment is scored from 0 to 100, with 0 representing completely distressed pavement and 100 indicating perfect pavement condition.

The NOACA region has a total of 3,342 centerline miles of roadways, including freeway and federal–aid highways, which is equivalent to 8,682 lane-miles. In 2022, the all road types network weighted lane-mile average PCR is about 78. The PCR average for the NOACA Federal Aid Eligible roads is similar, at about 77. Although this average indicates a generally fair to good pavement condition for the region, it obfuscates the fluctuating condition observed by traffic.
NOACA prepares to produce biennial pavement maintenance management community reports for each community in the NOACA region for each community in the NOACA region.
This section describes the *weNEO2050+* pavement maintenance management plan succinctly.

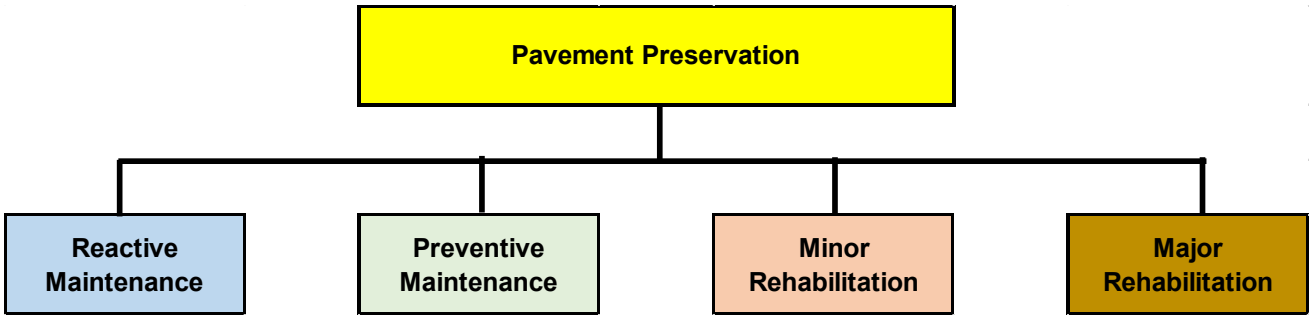
Figure 11-8 displays the 2022 lane miles of PCR categories for the NOACA Federal Aid eligible road system.

Figure 11-8. 2022 Lane-Miles of the PCR Categories for NOACA Federal-Aid Eligible Roads



Pavement Preservation is a program employing a network-level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet motorist expectations. A pavement preservation program consists primarily of four components: Reactive Maintenance, Preventive Maintenance, Minor Rehabilitation, and Major Rehabilitation/ Reconstruction, as shown in Figure 11-9.

Figure 11-9. Components of Pavement Preservation



Reactive Maintenance, also known as routine or corrective maintenance, consists of work that is performed to respond to specific conditions and deficiencies on pavements that are distressed and possibly unsafe. These activities are not planned in advance and seldom improve the pavement system performance in a long term.

Preventive Maintenance is considered as cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, delays future deterioration, and maintains or improves the functionality condition of the system without increasing structural capacity.

Pavement Rehabilitation is defined as resurfacing, restoration, and rehabilitation (3R) work consisting of structural enhancements that extend the service life of an existing pavement and/or improve its structural capacity. Rehabilitation techniques include restoration treatments and/or structural overlays. This may include partial recycling of the existing pavement, placement of additional surface materials, and/or other work necessary to return an existing pavement to a condition of structural or functional adequacy.

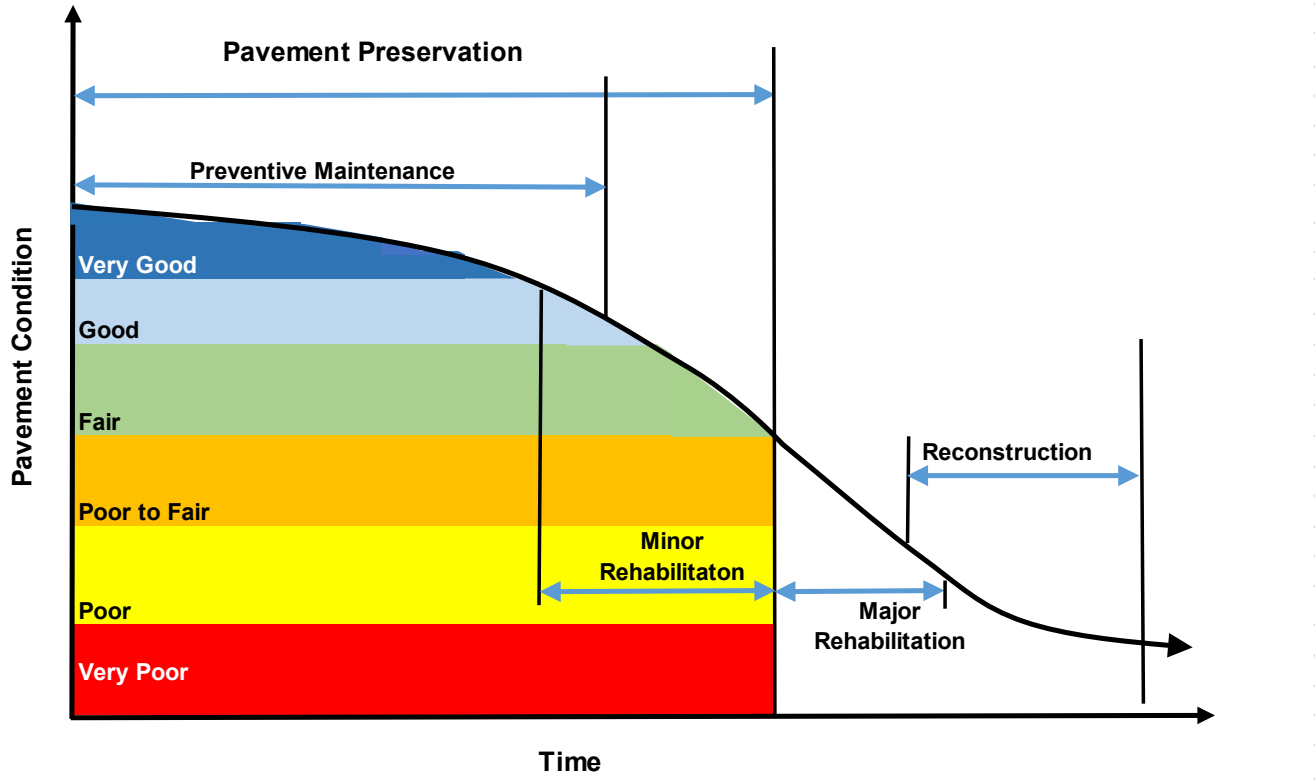
Minor Rehabilitation consists of non-structural enhancements made to the existing pavement sections to eliminate age-related, top-down surface cracking that develops in flexible pavements due to environmental exposure. Because of the non-structural nature of minor rehabilitation techniques, these types of rehabilitation techniques are placed in the category of pavement preservation.

Major Rehabilitation consists of structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability.

Pavement Reconstruction is defined as the replacement or reestablishment of the original pavement structural capacity by the placement of the equivalent or increased pavement structure. Reconstruction may utilize either new or recycled materials for the reconstruction of the complete pavement structure.

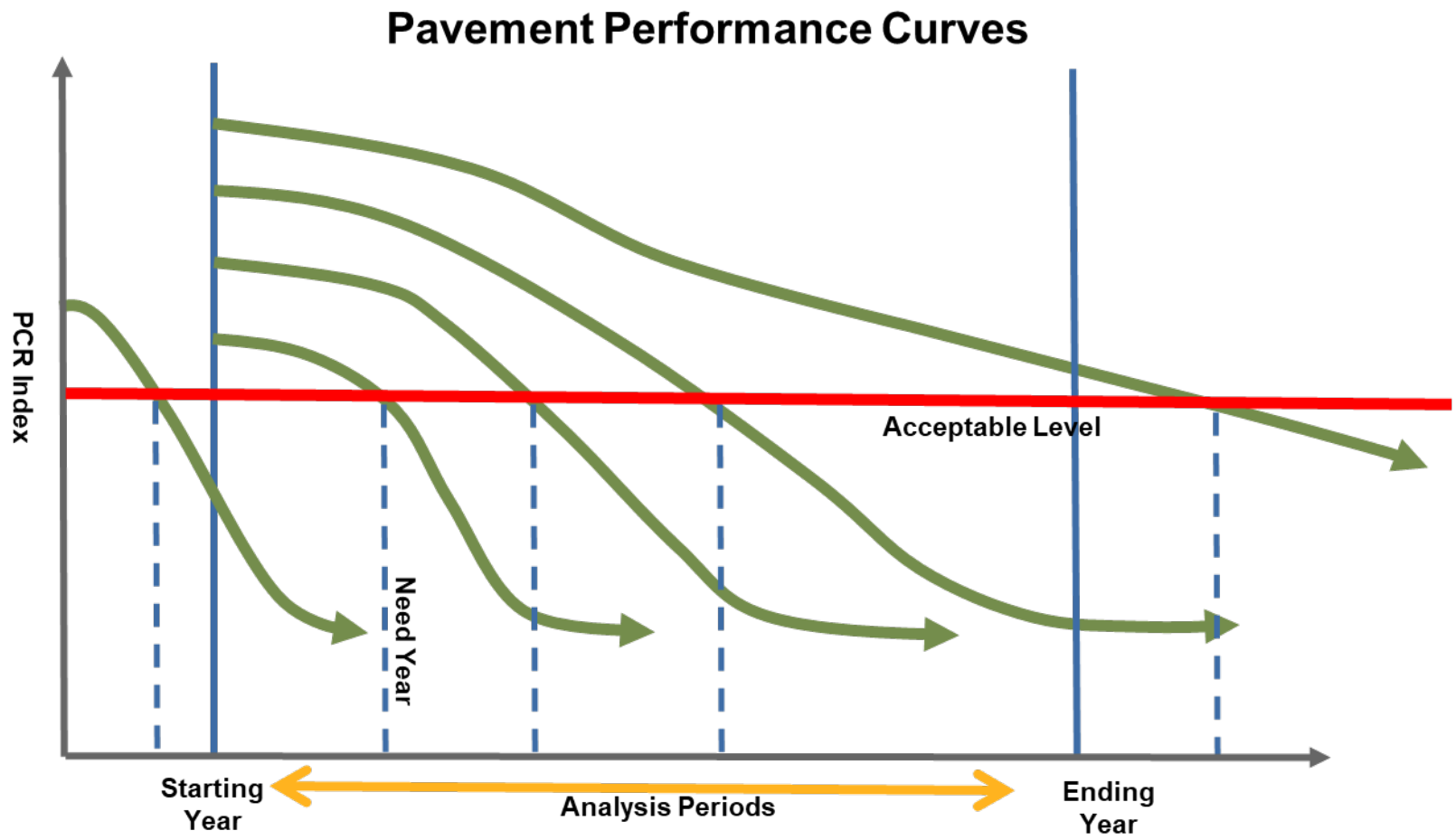
Figure 11-10 illustrates a general schematic for the timing of the pavement preservation Components.

Figure 11-10. A General Schematic for the Timing of Pavement Preservation Components



Maintenance and Rehabilitation (M&R) Program. In order to estimate the preventive maintenance and rehabilitation requirements of a pavement network over a period of time, the first step is to determine the “Need Year,” or when a pavement segment requires rehabilitation. The “Need Year” of a pavement is defined as the year in which the pavement condition falls below a critical level. The pavement condition of a road segment deteriorates due to traffic, climate, etc., and consequently, its PCR value is reduced. Without any treatments and depending on the deteriorating factors, pavements perform differently, and Figure 11-11 depicts the typical acceptable level and “Need Year” relation for several road segments. As shown, the definition of the acceptable level is a critical factor in determining the “Need Year” for any road segment.

Figure 11-11. The PCR Acceptable Level and "Need Year" Relationship



The critical level is set by the minimum acceptable PCR. In the NOACA region, the minimum acceptable PCR for the arterial roadway function class is 55 and for the major and minor collector is 50.

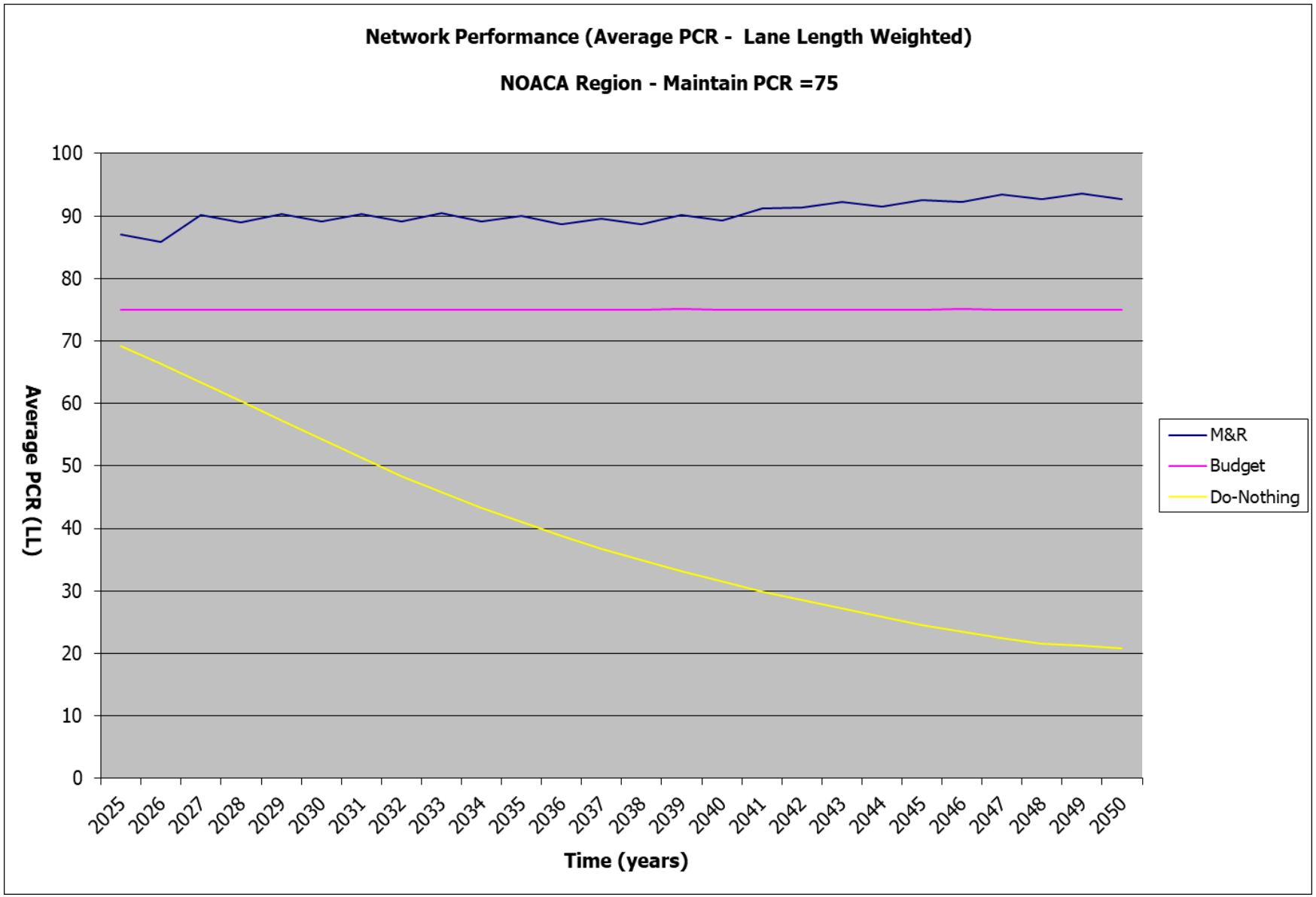
The second step is to determine any feasible preventive maintenance and/or rehabilitation strategies based on a decision tree approach. The “M&R” program determines the optimal preventive maintenance and rehabilitation strategy for each segment and its recommended implementation year based on the considered decision tree.

As shown in Table 11-1, *weNEO2050+* includes maintaining pavement conditions with average PCR of 75. The following paragraphs compare three scenarios of “Budget”, “M&R” and “Do-Nothing”.
The “M&R” program is applied to the Federal-Aid network, and the treatments are applied in their recommended years. The lane-length weighted average PCR would be 90.4, and at the end of the program, the network PCR would be 92.7, with 0% falling below the minimum acceptable PCR. The total required budget is $2.6 billion.

If no rehabilitation is implemented (Do-Nothing), the network is expected to have an average of 39.3. At the end of the program, the network PCR would drop to 20.8, with 100% falling below the minimum acceptable PCR.

Finally, the strategy of maintaining average PCR of 75 applies a set of maintenance treatments in order to keep the roadway network average PCR equal to 75 each year from 2025 to 2050. The total required budget is over $3.7 billion. Figure 11-12 shows the annual network average PCR for the discussed maintenance and rehabilitation strategies and the advantage of the “M&R” program.

Figure 11-12. PCR Acceptable Level and "Need Year" Relationship



Current and Future Bridge Conditions
Northeast Ohio has several major river drainage basins flowing into Lake Erie, including the Black River, Rocky River, Cuyahoga River, Chagrin River, and the Grand River. As a result, the area contains a significant number of bridges.

ASCE Policy Statement 208- Bridge Safety reports the average age of the nation's bridges is 42 years, which leaves just eight years until a typical 50-year design life is exceeded. In general, it can be said that additional repairs and rehabilitation investment is likely required as bridge structures continue to age.

The Northeast Ohio Report Card Committee discovered a similar trend. The inventory of existing bridges indicates that the average age of bridge assets continues to rise. Agencies are stretching available funds to maintain the inventory at an acceptable operating level. Local transportation agencies are doing a commendable job of inspecting, load rating, prioritizing, rehabilitating, and in some cases replacing the bridges, most often well beyond a 50-year life cycle.

The National Bridge Inspection Standards (NBIS) defines Bridge Condition Ratings that apply across the United States as: Good: 9-7; Satisfactory; 6 Fair:5; Poor: 4-0. Brief descriptors of condition ratings are provided in Table 11-10, and this table also presents consolidated bridge ratings for all the bridges in the NOACA region.

Table 11-15. 2025 Bridge Condition Ratings for Bridges in the NOACA Region

General Appraisal Ratings	Condition Description	Percentage of each Category
Less than or Equal to 4	Poor (Rating Value = 4) Serious (Rating Value = 3) Critical (Rating Value = 2) Imminent Failure (Rating Value = 1) Failure (Rating Value =0)	5%
5	Fair	14%
6	Satisfactory	28%
7	Good	31%
8	Very Good	17%
9	As Built	5%

ODOT has established a Statewide System Goal of 6.8 for their structures, which is just slightly below the condition rating of “Good”. This goal considers a constrained funding stream and balancing of ODOT resources between other high priority assets such as interstate and freeway pavement, interchanges, traffic signing, safety features, and operations and maintenance commitments.

It is always possible to rank bridges or prioritize the attention they need based on their Bridge Condition Ratings or General Appraisal Values (GAV) and /or Sufficiency Rating Values (SR), based on their condition only. Other factors, however, should be taken into consideration when

assessing the immediacy of attention needed for infrastructure improvements. These factors include the importance of the various functional classes of the roadways that the bridges serve, and the level of traffic demand on these bridges expressed in average daily traffic.

The current total deck area of all the highway bridges in the NOACA region is over 22.8 million square feet. The FHWA has presently set the target as maintaining NHS bridges at less than 10.0% of deck area as structurally deficient. The total structurally deficient on NHS bridges in the NOACA region is less 2% (419,155 Sq. FT). The percentage of the NHS bridges and bridges on other type of roads is less than 3.5% (786,600 Sq. Ft).

Bridge Priority Index

There are 168 bridges in the NOACA region that have bridge appraisal values of 4 or less. Appraisal values range between 0 and 9 (failure condition to excellent condition). Bridges with general appraisal values of 4 or less require urgent or expeditious attention as they demonstrate a condition of poor, very poor, near failure (must be closed), or failure (closed). Bridge conditions are also evaluated using numerical "sufficiency rating" values ranging from zero to 100.

While bridges may be ranked solely based on their conditions described by their general appraisal values, and or by their sufficiency rating values, it is possible and perhaps preferable to rank them or prioritize them according to the attention they deserve based on an index that takes into consideration the functional class of the roadways they carry, and the traffic demand in addition to the general appraisal and sufficiency rating values. All these factors, therefore, should be taken into account when assessing the immediacy or urgency of attention needed for infrastructure improvements. These factors, hence, are weighted according to the relative importance of the various functional classes of the roadways, the bridges' service, the level of future traffic volumes that will pass over these bridges, expressed in a typical daily Passenger Car Equivalent (PCE) volume, the general appraisal, and sufficiency rating.

The concept of Bridge Priority Index (BPI) was developed in order to rank all bridges, or at least those that are in poor condition, in a manner to help present them for repair or reconstruction in priority order based on a combination of categorical elements, namely condition, functional class, and future traffic volume. Each categorical element consists of factors that were given weighted values to reflect the level of their relative importance.

Bridge Priority Index (BPI) =
Average Daily Traffic Weighted Value × A Significance Factor of 3 +
General Appraisal Weighted Value × A Significance Factor of 4.5 +
Sufficiency Rating Weighted Value × A Significance Factor of 4.5 +
Functional Class Weighted Value × A Significance Factor of 1.5 +
Functionality Obsolete Value × A Significance Factor of 1.5 +
Structurally Deficient Value × A significance Factor of 1.5

$$\boldsymbol{BPI} = \mathbf{3} \times \boldsymbol{ADT_{wv}} + \mathbf{4.5} \times (\boldsymbol{GA_{wv}} + \boldsymbol{SR_{wv}}) + \mathbf{1.5} \times \boldsymbol{FC_{wv}} + \mathbf{1.5} \times (\boldsymbol{FO_{wv}} + \boldsymbol{SD_{wv}})$$

Where:

- *BPI*: Bridge Priority Index
- ADT_{wv}: Typical Future Daily Traffic Volume in PCE Weighted Value
- GA_{wv}: Bridge Condition General Appraisal Weighted Value
- SR_{wv}: Bridge Condition Sufficiency Rating Weighted Value
- FC_{wv}: Functional Class Weighted Value
- FO_{wv}: Functionality Obsolete Weighting Value
- SD_{wv}: Structurally Significant Weighting Value

The higher the Bridge Priority Index, the more urgent or compelling the need is for prioritizing addressing the condition of the bridge. Weighted Values and Significance Factors associated with the Bridge Priority Index parameters in the above captioned equation are shown below, as well as a description for the various general appraisal values:

FORECAST TRAFFIC DEMAND	**Weighting Value**	**Category Significance Factor: 3**
0001-2,000 Vehicles per Day per lane	**1**	
2,001-4,000	**2**	
4,001-8,000	**3**	
8,001-12,000	**4**	
12,001-16,000	**5**	
16,001-20,000	**6**	
20,001-40,000	**7**	
40,001-50,000	**8**	
50,001-70,000	**9**	
70,001-100,000	**10**	
100,001 or more	**11**	

GENERAL APPRAISAL VALUE	**Weighting Value**	**Category Significance Factor: 4.5**
0	**9**	
1	**8**	
2	**7**	
3	**6**	
4	**5**	
5	**4**	
6	**3**	
7	**2**	
8	**1**	
9	**0**	

SUFFICIENCY RATING	**Weighting Value**	**Category Significance Factor: 4.5**
00-20	**4**	
21-40	**3**	
41-60	**2**	
61-80	**1**	
81-100	**0**	

FUNCTIONAL CLASS	**Weighting Value**	**Category Significance Factor: 1.5**
Interstate / Other Freeway	**6**	
Principal Arterial	**5**	
Minor Arterial	**4**	
Major Collector	**3**	
Minor Collector	**2**	
Local	**1**	

STRUCTURALLY DEFICIENT	**Weighting Value**	**Category Significance Factor: 1.5**
On NHS Bridge	**2**	

On Non-NHS Bridge	1

FUNCTIONALITY OBSOLETE	**Weighting Value**	**Category Significance Factor: 1.5**
Obsolete	1	

Table 11-16. Future Rehabilitation Costs

	Rehabilitation and Maintenance Cost for Each Decade in Millions (2025$)			
Bridge Road Type	2025 - 2030	2031 - 2040	2041 - 2050	Total
NHS	$40	$68	$97	$205
Non-NHS	$81	$135	$193	$409

The required annual budget range is about $20 to $30 million for maintaining the deck area of the structurally deficient bridges less than 10 percent in the next three decades. In addition, the required budget for immediate bridge replacement is about $11 million.

Transit Asset Management

In 2019, NOACA developed a group Transit Asset Management Plan, which covers the three tier II transit agencies in Lake, Lorain, and Medina Counties (see Table 11-12). Together, the three counties cover a population area of about 703,729 people (US Census, 2010), making up approximately 6% of the state population. Laketran is Lake County's public transportation system, providing the following services: six in-county local routes, four commuter park-and-ride routes to Cleveland, and door-to-door dial-a-ride. Laketran maintains a total of 123 revenue vehicles and reported a 2017 ridership of over 750,000. The second plan participant, Medina County Public Transit, serves Medina County residents, providing 84,672 demand response trips, 22,048 Medina loop trips, and 654,897 total vehicle miles in 2012. Medina County Transit maintains a total of 23 revenue vehicles. Finally, Lorain County Transit serves Lorain County residents. The agency maintains a revenue fleet of 13 vehicles serving an average of 120 passengers per day. In 2016, Lorain County Transit recorded a fixed-route ridership of 30,271.

The plan covers the four-year period between 2019 and 2022 and contains the following elements: (i) an asset inventory, (ii) a condition assessment of assets for which the group plan participants have direct capital responsibility, (iii) an investment prioritization list, and (iv) documentation of the analytical processes and decision support tools used in the plan development.

Table 11-17. Transit Asset Management Plan Elements

Asset Category/ Class	Count	Avg. Age	Avg. Mileage	Avg. TERM Condition	Avg. Value	% At or Past ULB	FY19 Performance Target
Revenue Vehicles	159	3.8	101,547	-	$164,043.07	4.4%	
BR - Over-the-road Bus	20	1.0	20,040	-	$632,500.00	0.0%	0%
BU - Bus	16	8.5	255,888	-	$475,000.00	0.0%	0%
CU - Cutaway Bus	115	3.7	100,457	-	$103,048.00	5.2%	6%
MV - Mini-van	2	1.0	35,212	-	$36,600.00	0.0%	0%
VN – Van	6	7.0	110,331	-	$80,000.00	16.7%	17%
Equipment	28	9.5	47,899	-	$86,212.00	17.9%	
Non-Revenue/Service Automobile	6	7.3	72,539	-	$26,000.00	16.7%	17%
Trucks and other Rubber Tire Vehicles	9	4.3	35,579	-	$44,600.00	22.2%	23%
Facilities	9	12.8	N/A	4.4	$3,838,889.00	-	
Administration	2	16.0	N/A	4.0	$13,875,000.00	-	0%
Maintenance	2	9.0	N/A	4.0	$1,000,000.00	-	0%
Passenger Facilities	5	13.0	N/A	4.6	$960,000.00	-	0%

Transit

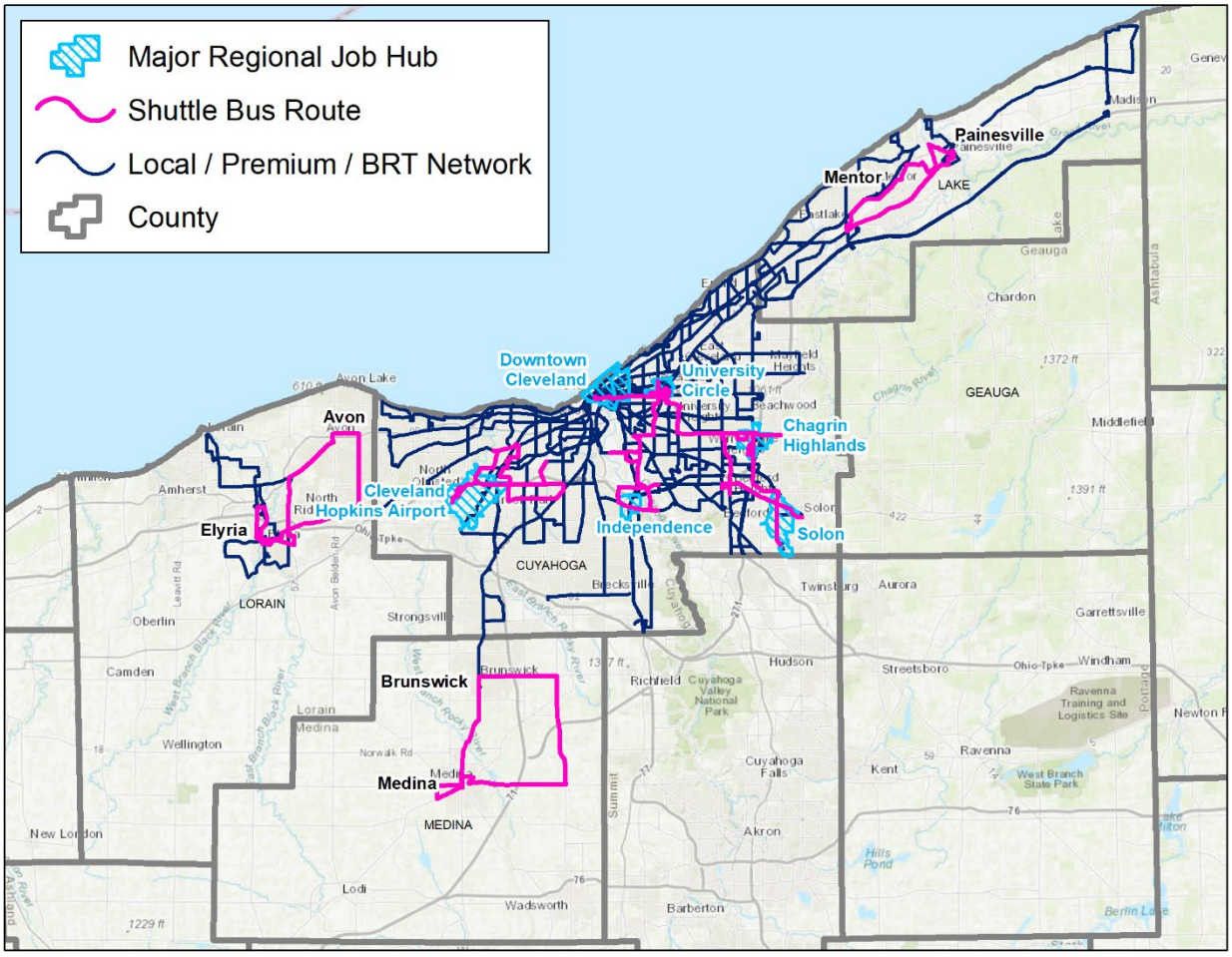
Complete Transit Connectivity

Corridors with higher residential and employment densities are the backbone of the transit network. Rapid transit is most viable at densities of at least 30 units per acre or 50 to 75 employees per acre. To compare, the minimum density for on-street bus service is about 6 to 8 units per acre. Interested municipalities can support the transit system by ensuring sufficient densities that permit the operation of transit services. NOACA will support communities that are interested in rezoning for higher densities within ¼ mile of locally proposed and regionally coordinated rapid transit stops. Rezoning in these locations will also help diversify the housing stock of the region. The other important factor in increasing transit ridership is connectivity. As discussed in Chapter 9, the “first mile” and “last mile” bus services connected to the main transit corridors are the missing links in providing a complete transit connectivity from riders’ actual origins to their destinations. Autonomous shuttle buses contribute not only the local demand but also complete the connectivity of transit services running through the main corridors. With new technology, some companies offer automated on-demand bus shuttle services that operate similar to taxi services. Exploring these technologies for Northeast Ohio can be a viable option to connect residents to nearby rapid transit stops and job hubs.

Furthermore, investment in bike sharing infrastructure as well as separate bike lanes within a 2-mile radius of job hubs and rapid transit stops will enable additional mobility of residents in the region.

Figure 11-13 displays a set of suggested autonomous shuttle feeder bus services in four counties in the NOACA region. These services circulate transit riders between transit hubs, job hubs, and neighboring urbanized areas.

Figure 11-13. *weNEO2050+* Transit Network and Shuttle Bus Routes



Workforce Accessibility and Mobility

Work trips are the most crucial mandatory trips in an urbanized area. Previous NOACA studies indicated that the available workers in the commute sheds of any major job hub is higher than the number of workers currently living in that commute shed. These discrepancies illustrate the mismatch between where workers live and work, and the lack of transit services makes it more apparent. Shortening work travel time will not only benefit commuters but also mitigate traffic congestion severity, reduce VMT in the region, lessen stress and load on road pavements, and lower the overall burden on the transportation system. Therefore, the success of any future transportation plan depends significantly on reducing travel time and improving the safety of work journeys.

In order to:

- Reduce the mismatch between workers and employers' locations.,
- Reduce the work commute times and
- Fulfill the workforce objectives stated in Table 11-1,

The *weNEO2050+* plan recommendations include the following transportation solutions:

Transit Solutions

- More frequent express and local buses to regional job hubs
- Implement low-cost traffic engineering solutions at identified arterial bottleneck locations on transit routes
- Extend the transit network to/from major regional job hubs and inter-county transit services
- Adding more park-and-ride locations throughout the region
- Dedicate highway lanes to express buses and car pooling
- Develop more bike lanes and sidewalks to access major transit stations

For these transportation solutions to be successful, NOACA relies on coordination with local governments on land uses that are adjacent to major transit stops and within job hubs. A transit system can be supported by looking at the use of land and densities:

- Rapid transit is most viable at densities of at least 30 units per acre or 50 to 75 employees per acre
- On-street bus service needs at least a density of about 6 to 8 units per acre
- Mixed-use development at major transit stops and in job hubs can support the viability of the station
- Some businesses value close proximity to existing rapid transit services as it is an element of attracting and retaining high-skilled workers. Ensure that developable lots (e.g., cleaned-up brownfields) are available in locations with rapid transit access.

NOACA Policies

Regarding the above recommended solutions, the potential planning policies currently under discussion at NOACA's policy committee are:

- Support and prioritize transportation funding, especially transit expansion and enhancements around major job hubs
- Support and prioritize funding for multimodal accessibility to job hubs and connections to transit services
- Support regionalized transit system – inter-county transit routes and expansion of park-and-ride system
- Encourage efficient mixed-use development
- Implement mobility-accessibility study for any current and potential employment centers

Non-Motorized Transportation

Non-Motorized modes of travel (also known as Active transportation and human powered transportation) are not used extensively as a means of transportation in the NOACA region today. According to the NOACA travel forecasting model, walking and bicycling total shares are less than 0.5 percent of the total daily person trips. This is especially the case for utilitarian trips, which are trips undertaken with the purpose of reaching a particular destination for accomplishing an activity. The low usage of walk and bicycle modes of transportation is due to many reasons such as:

- The concomitant increasing usage of motorized vehicles for transportation,
- The relatively low cost of operating motorized automobiles,
- The sprawling land use patterns.
- The adverse climatic conditions in Northeast Ohio

The usage of non-motorized modes may be categorized as:

1. Utilitarian trips,

2. Access to transit services, and
3. Recreational pursuits (including exercise)

Trip distance is a well-established determinant of non-motorized mode choice: all else being equal, the farther away one is from a destination, the less likely one is to use bicycling or walking. Although distance is objectively measurable, its effect may vary for individuals depending on their physical condition, attitudes, perception of distance, and trip purpose. A reasonable distance to walk for utilitarian trips is about ¾ miles. That is estimated based on a travel time of 15 minutes with a walking speed of three miles per hour. Similarly, an average distance for utilitarian biking trips is about three miles. Compared to other trip purposes, bicycling is used the most for recreational pursuits.

Considering the acceptable walking and biking distances for land use and transportation planning purposes, access to transit by non-motorized modes is an important aspect of a cohesive, multimodal transportation system. As discussed previously, these connections to the transit network are often referred to "first mile" and "last mile" trips, and those short trips, combined with a transit trip, create a complete connection from travelers' origins to their destinations.

The *weNEO2050+* plan recommends investing in non-motorized facilities for accessing the transit network for the purpose of creating a true multimodal transportation system for the NOACA region. These connecting projects were highlighted in Table 11-1 as typical non-motorized facilities and riders should be able to safely and conveniently reach transit stops via a well-connected system of pedestrian and bicycle infrastructure. Table 11-18 displays the *weNEO2050+* plan proposal for non-motorized modes by facility type and implementation for decades.

Table 11-18. Quantity of Non-Motorized Mode Facilities in weNEO2050+ Plan

Non-Motorized Mode	2025 - 2030	2030 - 2040	2040 - 2050	Total
Bike Facility Projects	Miles	Miles	Miles	Miles
All Purpose Trail	26	146	200	**372**
Low-Stress, In-Street Bike Facility	85	170	170	**425**
	2025 - 2030	**2030 - 2040**	**2040 - 2050**	**Total**
Pedestrian Projects	Miles	Miles	Miles	Miles
Sidewalk	40	80	80	**200**
	Count	Count	Count	Count
Smart Pedestrian Crossing	20	40	40	**100**
ADA Curb Ramp	122	230	230	**582**
High Visibility Crosswalk	1,239	2,460	2,460	**6,159**
Pedestrian Signal	844	1,690	1,690	**4,224**
Midblock Enhancements	20	42	42	**104**

Further information regarding non-motorized investment is available in NOACA's ACTIVATE plan, which provides a vision for increasing the use of bikeways and walkways for transportation and commuting and also serves as a guide for future bicycle and pedestrian improvements. The plan includes a prioritization model based on a Connectivity Quantitative Score Index (CQSI) for investing in non-motorized facilities for accessing the transit network.

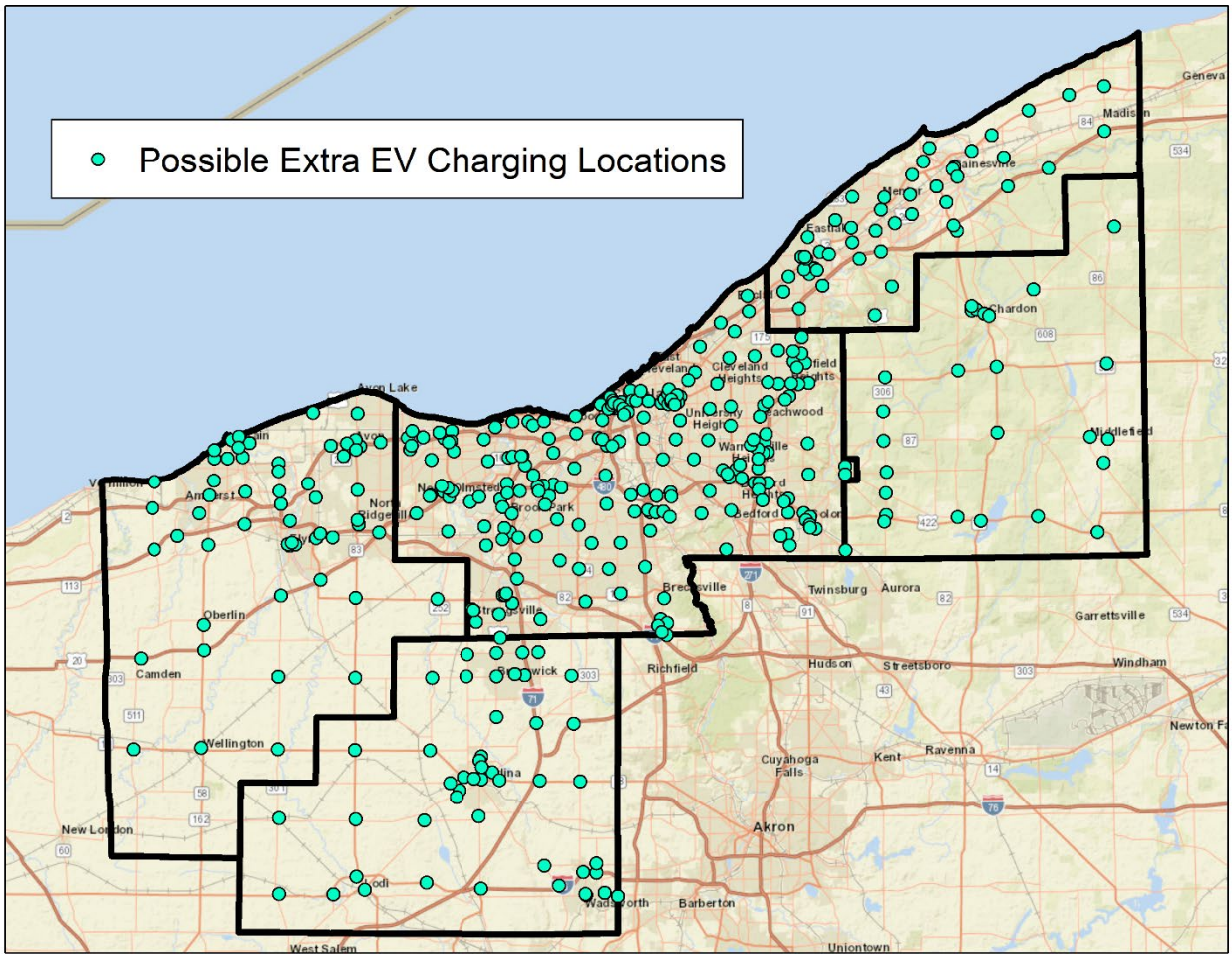
Emerging Technology in Transportation

Electric Vehicles

Future of Charging Stations

The charging station sites for Electric Vehicles (EVs) are a necessary part of the required Electric Vehicle Supply Equipment (EVSE). EV owners currently charge their vehicles overnight at home using residential charging ports. However, residential charging will neither be adequate nor a strong reinforcement for the expected EV growth in the next three decades. Similar to the location distribution of fuel stations for the conventional Internal Combustion Engine Vehicles (ICEV), the EV charging port locations' ultimate coverage area should be in such a way that drivers can reach one of these facilities by driving a few miles. Figure 11-14 shows the proposed EV charging ports to support the projected number of EVs by 2050.

Figure 11-14. *weNEO2050+* EV Charging Locations



Fiscally Unconstrained and Illustrative Projects

Illustrative Project: Hyperloop

Background

On February 26, 2018, the Northeast Ohio Areawide Coordinating Agency (NOACA) and Hyperloop Transportation Technologies (HTT) entered into a public private partnership to complete a feasibility study for the technical analysis and evaluation of a Cleveland, Ohio to Chicago, Illinois and Pittsburgh, Pennsylvania corridor; known as the Great Lakes Hyperloop Feasibility Study. The project launched on July 1, 2018, with the feasibility study being completed in December 2019. NOACA also conducted a peer review of the feasibility study with participants from Cleveland State University, Carnegie Mellon, the University of Illinois, Chicago, and Northwestern University to provide an independent review of the project framework, assumptions, and analysis approach. The project had many collaborating partners, such as the Illinois Department of Transportation, Indiana Toll Road, Federal Highway Administration, NASA, Eastgate Regional Council of Governments, Erie Regional Planning Commission, Southwestern Pennsylvania Commission, Team NEO, and Toledo Metropolitan Area Council of Governments. The feasibility study assessed the technical and financial feasibility of the environmental, financial, operational, and structural requirements to create a Hyperloop Transportation System. The feasibility study also addressed the requirements for building and achieving optimal alignment of the system, siting requirements for location of major structures, assessing the constraints on alignment of the system, integrating the Hyperloop transportation system with existing transportation infrastructure, and identifying issues with construction of the optimized system.

The Feasibility Study for the Great Lakes Hyperloop revealed positive financial and cost benefit results creating a strong case for developing the corridor connecting Chicago, Cleveland and Pittsburgh as a passenger and freight system. As a result of these positive findings the Preliminary Development phase becomes the next necessary step forward in the project development process.

Why Cleveland to Chicago and Pittsburgh?

Cleveland to Chicago represents a natural convergence of major interstate travel routes: I-80 from New York City, NY, and I-90 from Boston, MA, both come together at Cleveland and share the corridor to Chicago. I-76 feeds directly into I-80 from the east, adding direct connections from Pittsburgh, Philadelphia, Baltimore, and Washington, D.C. This geography naturally funnels traffic from the entire East Coast via Cleveland towards Chicago and beyond. As such, it is clear that a Cleveland to Chicago Hyperloop will develop into a critical component of a national Hyperloop network. Since a Cleveland to Chicago link is essential for making so many connections, this would be an excellent place to begin developing a national Hyperloop network.

Technology

The Hyperloop is an entirely new mode of transportation based on early theoretical and experimental work in reduced-pressure transport in the early 20th century. Hyperloop consists of an evacuated guideway tube within which a magnetic levitation system is used to propel self-contained capsules carrying either passengers or cargo. Since maglev is used and most of the air has been removed from the tubes, friction is very low. This makes it possible for vehicles to reach very high speeds with minimal resistance. Since very little energy will be dissipated by air resistance, and magnetic drag actually reduces as speeds go up, much of the energy imparted to vehicles upon acceleration can be electrically recovered when the vehicles slow down. In addition,

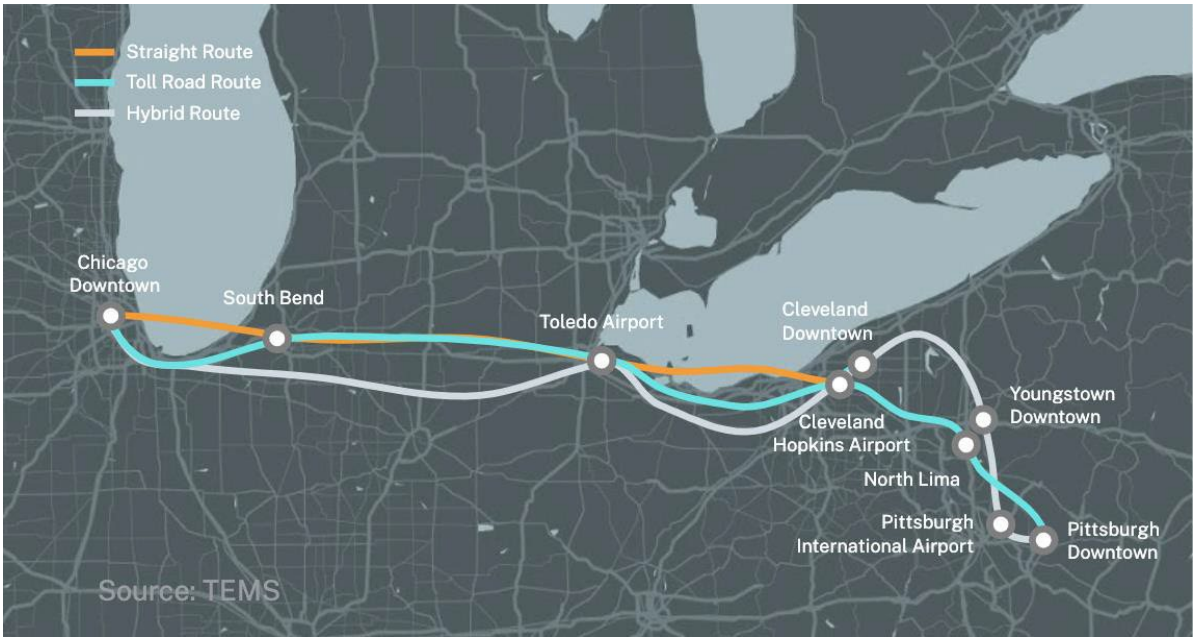
because of the lack of friction, vehicles will be able to accelerate on straight sections of guideway to very high speeds (700 mph+), exceeding even those of commercial jetliners. Capsules are powered by passive magnetic levitation, powered by solar power. Magnets are arranged in a Halbach array configuration, enabling capsule levitation over an unpowered but conductive track.

Feasibility Study Results

Representative Routes

Three representative routes between Cleveland and Chicago were studied, as well as two representative routes between Cleveland and Pittsburgh. The first route (Straight Route) connects Cleveland to Chicago on as close to a straight line as possible. The original concept for the second route (Toll Road Route) was to utilize existing right-of-way, but the existing highway alignment proved to be too curvy for the Hyperloop's use. As a result, a new approach generally following the corridor of the toll road was adopted. The proposed Toll Road alignment crosses the tollway on numerous occasions as it follows the general course of the highway. The Toll Road Route was extended to Pittsburgh via Cranberry Township. The third route (Hybrid Route) is primarily based on the use of some very straight Midwestern rail lines from Cleveland to Chicago, but also includes a number of short interconnecting greenfield links. Some straight sections of highway right-of-way have also been included. The Hybrid Route was extended to Pittsburgh via Youngstown to Pittsburgh (see Figure 11-17).

Figure 11-17. Representative Hyperloop Routes: Chicago-Cleveland-Pittsburgh



Economic Competitiveness

Creating a corridor, and eventually a network, for ultra high-speed transportation between remote regional hubs will enhance opportunity and economic mobility throughout the region. Unlike other forms of transportation, the low-cost and efficient operation of the Hyperloop system enables a return on investment for system operators. Reducing the travel times between cities will allow residents to access jobs across the connected corridor, which will expand local job markets and add entirely new industries relying on the network.

Through operational efficiencies, reduced variable costs, sustainable net-positive energy production, and dynamic uses of space and system infrastructure, the Hyperloop system enables an affordable travel experience throughout the connected region.

The Hyperloop, similar to other transportation projects, will have various economic impacts such as employment, productivity, business activity, property values, investment, and tax revenues for communities; and will also improve accessibility and reduce transportation costs, allowing individuals to have improved access to education, employment, and services. Unlike other transportation projects, the Hyperloop will have transformational impacts on the communities it serves. Table 11-15 demonstrates how transformational the Hyperloop is forecasted to be.

Table 11-20. Potential Socioeconomic and Tax Benefits of Hyperloop

Time Frame	Socioeconomic Benefit	Tax Benefit	Impact (Increase)*
2025 - 2050	Employment		931,745 persons/yr
2025 - 2050	Income		$47,577 M
2025 - 2050	Property Value		$74,842 M
2025 - 2050		Local Income Tax	$2,021 M
2025 - 2050		Federal Income Tax	$9,401 M
2025 - 2050		Property Tax	$1,273 M

*Great Lakes Feasibility Study

Increase in income equals twice the capital cost of the project, property value increase equals three times the capital cost of the project and expanded tax base equals 50 – 55 percent of project capital costs.

The construction of a Hyperloop system will also create significant temporary construction employment while the project is built. This will include the following jobs:

- Construction labor (civil engineers, skilled trades, laborers)
- Manufacturing labor (equipment, vehicles)
- Financial labor (financial, bankers)

The Hyperloop, with speeds up to 760 mph, will have a significant property development potential. Table 11-16 provides details for the property value improvement that is forecasted to be realized from the Hyperloop.

Table 11-21. Property Value Improvement at Hyperloop Stations

Station Name	Property Value Improvement 2020~2050 (million $)*
Chicago-Downtown, IL	27,112
Chicago-Airport, IL	6,933
South Bend, IN	5,457
Toledo, OH	5,169
Hopkins Airport, OH	3,037
Cleveland, OH	12,257
Youngstown, OH	2,994
Pittsburgh, PA	11,882
Total	**74,842**

*Great Lakes Feasibility Study

The Hyperloop is forecasted to obtain 25 to 30 percent of the transportation market, and has approximately 30 percent induced demand with 50 percent being diverted from auto. This results in millions of people using the Hyperloop for commuting, business and special occasions. Table 11-17 demonstrates the volume of individuals utilizing the Hyperloop.

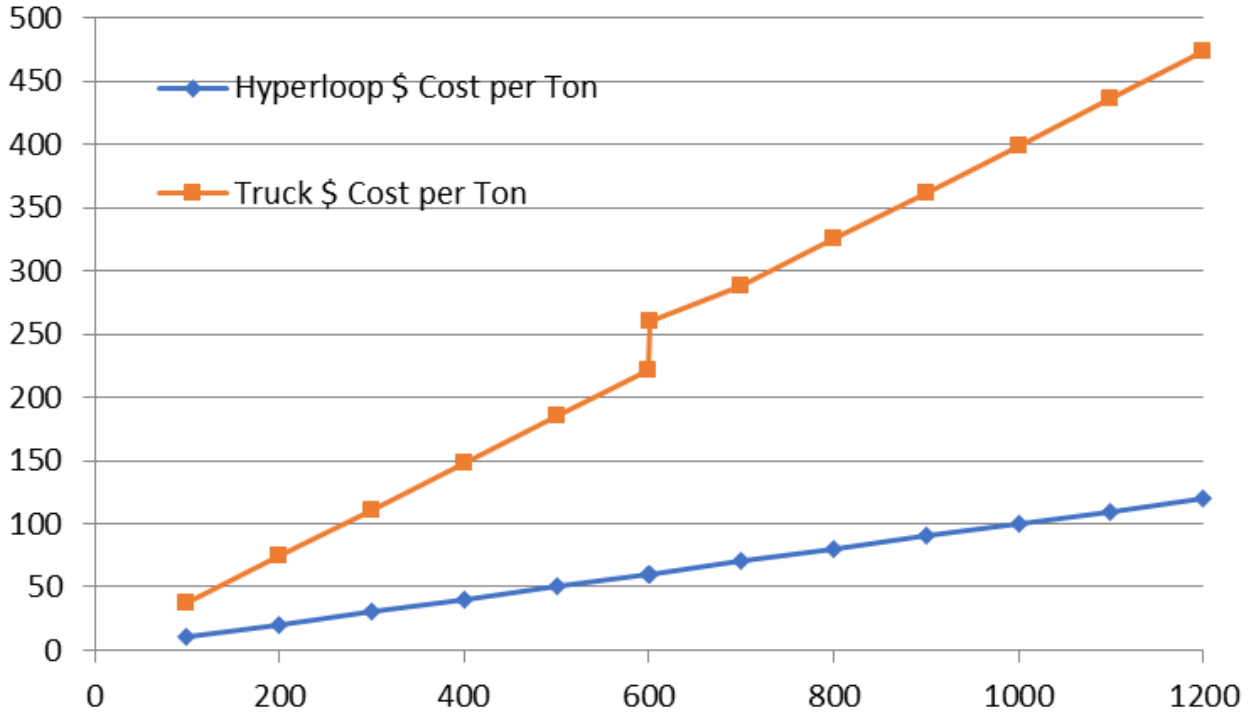
Table 11-22. 2030 Hyperloop Station Forecasted Volume (On and Offs)

Station Location	Volume (Millions)*
Chicago, IL	6.81
South Bend, IN	3.11
Toledo, OH	2.80
Hopkins Airport, OH	2.11
Cleveland, OH	5.14
Youngstown, OH	1.25
Pittsburgh, PA	6.25

*Great Lakes Feasibility Study

Hyperloop promises to develop a freight service that is faster than truck and cheaper than air, which would undoubtedly position it as a premium freight service. With Hyperloop being cheaper than trucks and faster than air, it would likely become a dominant mode for intercity freight transport rather than just a niche provider of transportation services. Once the Hyperloop becomes a reality, existing logistics patterns will adjust to take advantage of the capabilities of this new mode of transportation. Figure 11-18 depicts the freight cost savings for the Hyperloop over trucks.

Figure 11-18. Hyperloop vs Truck Freight Cost



According to FAF-4 there are 80,000 tons of air cargo moving annually within the corridor, most of that from Cleveland to Chicago. Hyperloop service will be both faster and much cheaper than the existing air service, so a 76% market share has been projected.

The LTL ground express market is much larger, consisting of 2.09 million tons of express cargo in 2022. Of this, Hyperloop is forecasted to capture a 52% share, which results in 1.08 million tons of freight captured by the Hyperloop system in 2022, which is the first year of operations in the feasibility study analysis.

The overall freight tonnage therefore is 1.14 million per year which is 52% of the overall express freight that will be available in the Chicago-Cleveland-Pittsburgh corridor by 2022. It is clear that most of this volume would be attracted from ground LTL freight. If the corridor were longer than it is, then the Air Cargo share of freight might be expected to increase.

This forecast grows by 4% for LTL traffic and by 5% for Air Cargo tonnage every year.

Environmental Sustainability

Air pollution is the fourth leading risk factor for premature deaths worldwide. Motor vehicle air pollution (whose pollutants include ozone, particulate matter and total suspended particulate, sulfates, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead) contributes to various health problems including cancer, cardiovascular and respiratory diseases, chronic diseases like diabetes, preterm birth, diseases of the central nervous system, dementia, decreased cognitive function, and perinatal mortality.

The Hyperloop system accelerates the shift toward renewable electrification of transportation while preserving local ecosystems and utilizing low impact processes and structures. Surface-level or subsurface iterations of the Hyperloop system disturbs fewer habitats and requires less natural space to operate than road or air facilities.

The Hyperloop system reduces CO2 emissions by 143 million tons[1], while facilitating shifts away from key emitters of carbon dioxide like electricity-generating plants and petroleum-powered vehicles. Creation of ultra high-speed travel along the corridor could lead to a shift among consumers from current modes of transportation between connected cities and toward faster and cheaper alternatives. Likewise, as passengers and goods travel through the system, congestion in surface-level facilities, and therefore pollution, will decrease from the displacement of trucks, trains, and people moving along the corridor.

Safety

Transportation systems are most effective when safety is engineered at the earliest stages, and not as an afterthought in the design process. The Hyperloop system is designed around creating the safest mode of transportation possible. During the early phases of designing the Hyperloop systems, redundant safety measures were designed to ensure additional layers of protection. In addition, longer headways are planned for initial rollouts of the system, which will be reduced over time along with increased capacity as operational experience and service data are available.

The vast majority of transportation-related accidents are related to human error; as the Hyperloop system operates autonomously, the system is substantially safer. The enclosed tube system isolates the capsule from obstacles and outside conditions including weather, traffic, pedestrians, and wildlife. The low-pressure tube environment provides a natural fire-resistive separation that is superior to other forms of transportation. Removing obstacles from the guideway reduces risk factors from collisions at high speeds. Likewise, operating in all weather conditions provides reliable and consistent connections during inclement weather and peak traffic conditions.

The elevated tube or subterranean design eliminates travel conflicts with other modes of transportation. Subsurface operations provide additional isolation from transportation systems operating on the surface level. Public transit and transit-oriented development create safer communities by implementing human design elements into the framework of the community. As these developments reduce reliance on single occupancy vehicles, creation of Hyperloop facilities could bolster safety by enabling less interactions with other transportation systems.

The Hyperloop will integrate engineering, operations, and safety concepts from aviation and highway, as well as from rail. This is why the Hyperloop has been called a “fifth mode” of transportation, since it doesn’t fit neatly into any of the pre-established models, but rather it integrates design and operational concepts from a number of different pre-existing modes. So many of Hyperloop’s concepts are not really new but rather integrate already proven technologies in a new way.

Next Steps/Implementation Strategies

The Feasibility Study for the Great Lakes Hyperloop revealed positive financial and cost benefit results creating a strong case for developing the corridor connecting Chicago, Cleveland and Pittsburgh as a passenger and freight system. As a result of these positive findings the Preliminary Development phase becomes the next necessary step forward in the project development process.

[1] https://www.glhyperloopoutreach.com/feasibility-study (Accessed May 29, 2025)