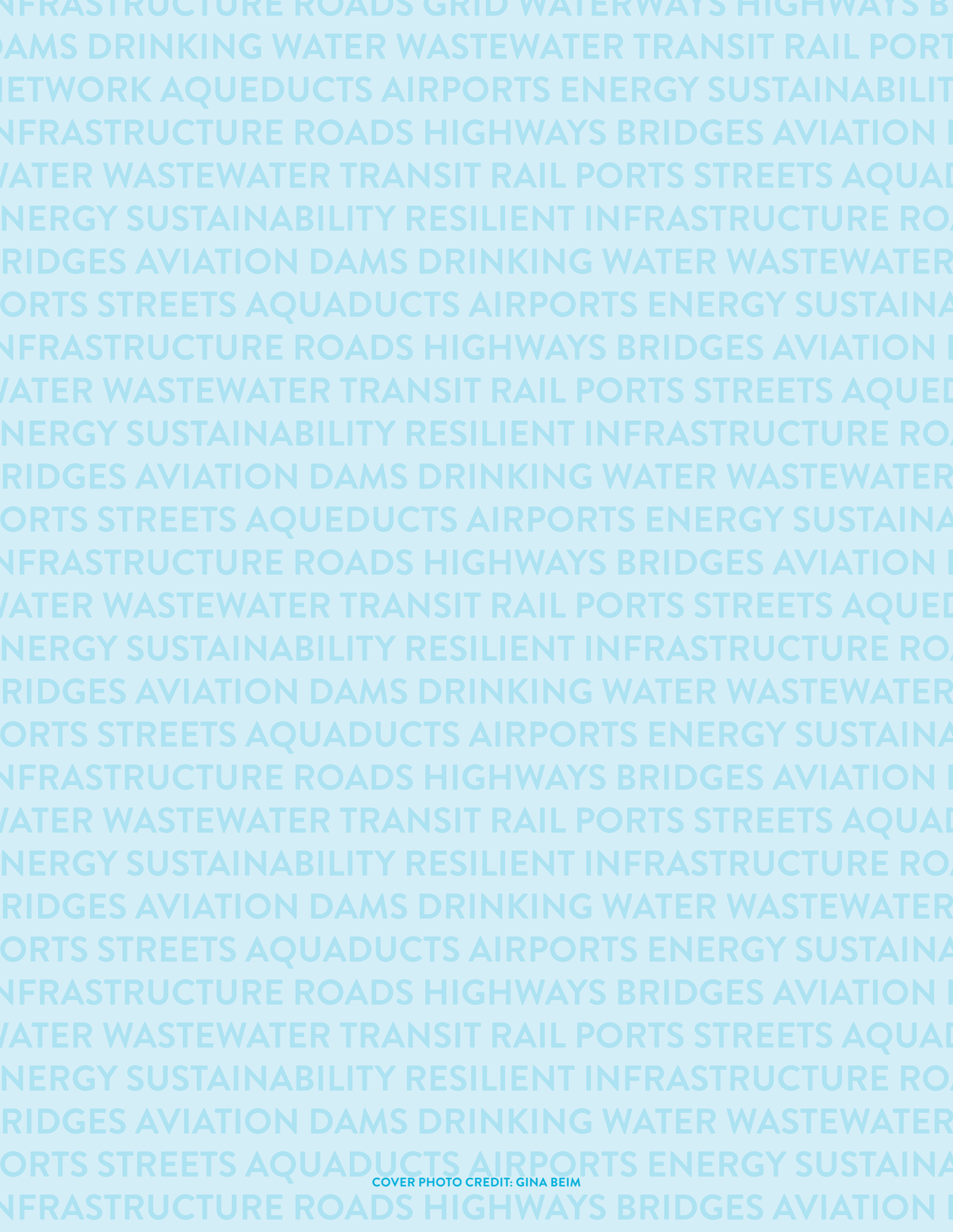


2019

REPORT CARD FOR NORTHEAST OHIO'S INFRASTRUCTURE



American Society of Civil Engineers Cleveland Section
INFRASTRUCTUREREPORTCARD.ORG/NORTHEASTOHIO



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EXECUTIVE SUMMARY and OVERALL GPA

Over the course of two years, the Cleveland Section of the American Society of Civil Engineers (ASCE) collected and analyzed data that shed light into the state of Northeast Ohio's infrastructure, which includes Cuyahoga, Geauga, Lake, Lorain, and Medina counties. The infrastructure categories ASCE examined were Bridges, Dams, Drinking Water, Energy, Roads, Schools, and Wastewater. This report summarizes the grades assigned to each category, explains the grading process rationale, and makes suggestions for improvement.

The infrastructure that serves Northeast Ohio has received an overall grade point average (GPA) of D+. A D+ grade is reflective of an infrastructure system that is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure.

In the following chapters, we attempt to highlight our region's successes and pinpoint its shortcomings. This report is not an engineering study and should not be interpreted as such.



REPORT CARD FOR
NORTHEAST OHIO'S
INFRASTRUCTURE

2019

BRIDGES



C-

DAMS



D+

DRINKING
WATER



C-

ENERGY



D

ROADS



D+

SCHOOLS



D

WASTEWATER



D+

G.P.A.



ASCE
CLEVELAND SECTION

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INTRODUCTION

Every four years, America's civil engineers provide a comprehensive assessment of the nation's infrastructure in the American Society of Civil Engineers (ASCE) Infrastructure Report Card. Using a simple A to F school report card format, the Report Card examines current infrastructure conditions and needs, assigning grades and making recommendations to raise them. The most recent report card gave the infrastructure of the United States a cumulative grade point average of D+ (ASCE, 2017a).

In 2016, the Cleveland Section of the American Society of Civil Engineers (ASCE) initiated a similar effort focused on Northeast Ohio (NEO), forming the NEO Infrastructure Report Card Committee. For nearly 18 months, its members volunteered their time and expertise to visit public officials, examine various sources of data, and participate in monthly progress meetings. The committee included professional engineers from the private, public and academic sectors. Case Western Reserve University civil engineering students also assisted in the effort. Our findings about each infrastructure category we studied were peer reviewed by experts in the appropriate field and by ASCE.

Northeast Ohio's Infrastructure has received a cumulative GPA of D+, a composite score of the seven key infrastructure categories evaluated. This report provides context and explains how the committee arrived at this grade.



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RATIONALE

Much of the country's infrastructure is aging and lacks funding. ASCE supports the development and prioritization of plans to sustain and enhance infrastructure (ASCE, 2017b), and encourages the involvement of individual citizens and coalitions in the legislative and regulatory infrastructure decision making processes, including at the local and state level (ASCE, 2013). Moving this process forward and taking action involves understanding the state of our roads, bridges, wastewater collection systems, and other infrastructure components.

Just as it is important to assess the condition of our nation's infrastructure, we felt it was important to understand our region's infrastructure needs. Is the infrastructure of Northeast Ohio also in peril? Are all funding mechanisms being utilized? How does NEO infrastructure compare to desired goals and the national grade?

OUR STUDY AREA

For purposes of the Report Card on the Northeast Ohio Infrastructure, Northeast Ohio is comprised of Cuyahoga, Geauga, Lake, Lorain and Medina Counties, corresponding to the Northeast Ohio Areawide Coordinating Agency's (NOACA) Metropolitan Planning Organization (MPO) service area. These five counties account for slightly more than 2 million people, or approximately 18% of the State of Ohio population. The population is spread throughout the region's 2,005 square miles (4.4% of the State's 44,828 square miles). Although the population is still concentrated around the City of Cleveland and its first-ring suburbs, it has been shifting towards outlying previously rural and more sparsely populated areas. Northeast Ohio encompasses 172 units of local government, 99 of which are incorporated cities (NOACA, 2016, 2017). Cuyahoga County is the second most populous county in the state, and represents a significant percentage of our study region, both in area and in population. The population of the five counties is shown on Table 1. Naturally, a significant portion of our data collection efforts was concentrated on the most populous portions of the study area.

TABLE 1 NORTHEAST OHIO COUNTIES AREA AND POPULATION

COUNTY	AREA (MI ²)	POPULATION (2015 CENSUS ESTIMATE)
Cuyahoga	1,246	1,256,000
Lorain	923	305,147
Lake	979	229,245
Medina	423	176,395
Gauga	408	94,102
		2,060,889

Lake Erie plays a major role in Northeast Ohio. Three of the counties in our study area – Cuyahoga, Lake and Lorain – border the Lake to the North. Lake Erie is a major source of our drinking water, receives a significant portion of our treated wastewater, provides us with recreation opportunities, and influences our climate. Many aspects of the Northeast Ohio infrastructure relate to the Lake.

GRADING METHODOLOGY

Our committee assigned grades to the Northeast Ohio Infrastructure using the criteria listed on Table 2 and according to the scale shown on Table 3, both following guidance from ASCE (ASCE, 2015):

- **CAPACITY:** Does the infrastructure's capacity meet current and future demands?
- **CONDITION:** What is the infrastructure's existing and near-future physical condition?
- **FUNDING:** What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?
- **FUTURE NEED:** What is the cost to improve the infrastructure? Will future funding prospects address the need?
- **OPERATION AND MAINTENANCE:** What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?
- **PUBLIC SAFETY:** To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?
- **RESILIENCE:** In the event of significant threats and incidents, how able is the infrastructure to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?
- **INNOVATION:** What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?



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The Northeast Ohio infrastructure was graded according to the following scale recommended to our Committee by ASCE:



EXCEPTIONAL, FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.



GOOD, ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable, with minimal capacity issues and minimal risk.



MEDIOCRE, REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.



POOR, AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure.



FAILING/CRITICAL, UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

INFRASTRUCTURE CATEGORIES

The NEO infrastructure report card committee assembled and analyzed data pertaining to our region's Bridges, Dams, Drinking Water, Energy, Roads, Schools, and Wastewater Systems infrastructure. Some important infrastructure categories examined by the National Report Cards were left unexamined in the NE Ohio Infrastructure report card. The decision to leave these categories out in no way reflects a lesser importance to our region of a robust aviation, transit and ports infrastructure, nor is it dismissive of the crucial role that Northeast Ohio parks play in the region's economy and in the health of its population. Rather, the limited number of infrastructure categories studied was solely determined by the availability of our team of volunteers.

The following chapters summarize the findings for each of the infrastructure categories that were part of this effort, discussing the rationale for the grade assigned to each category along with suggestions for improvement.



BRIDGES

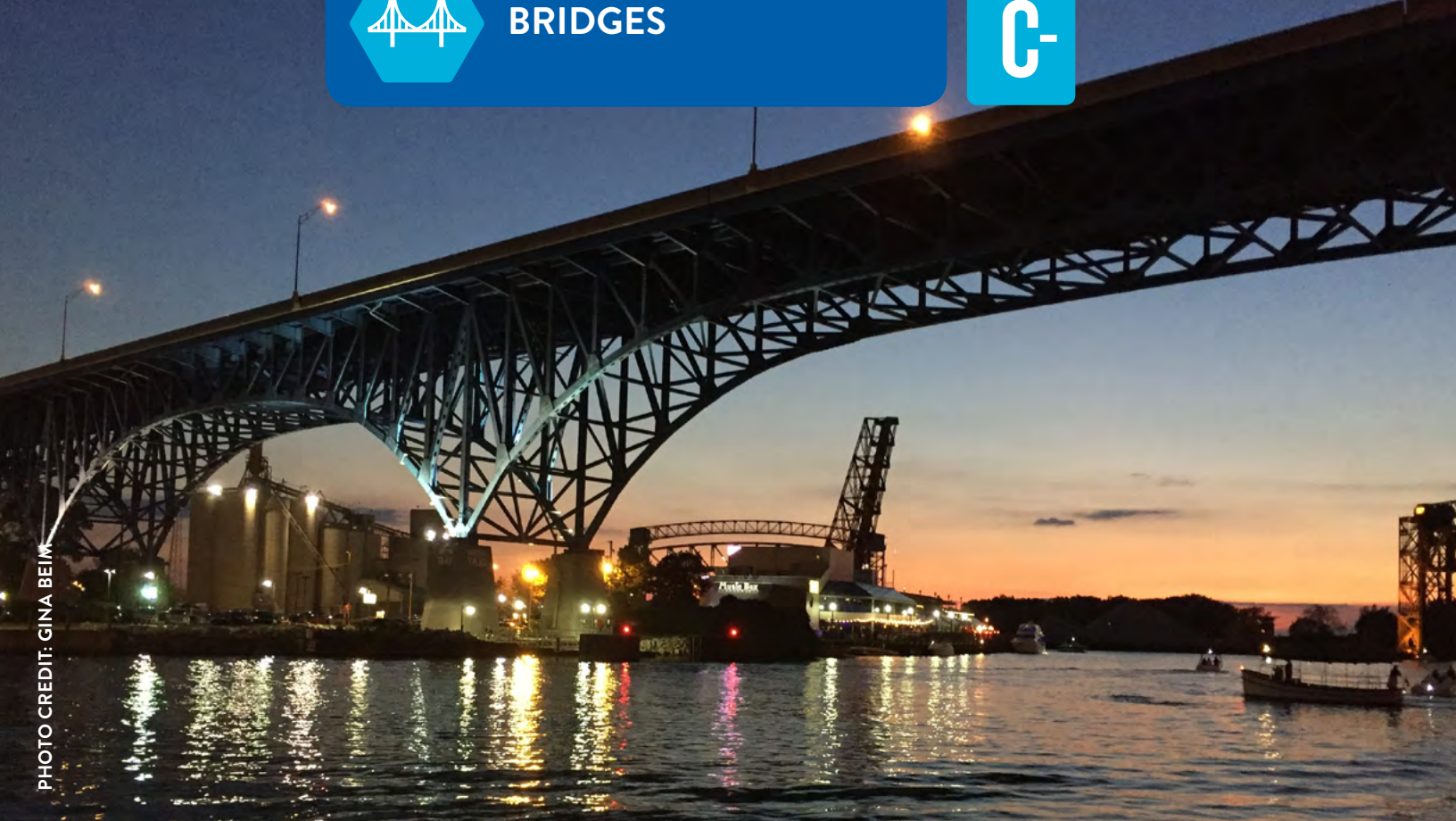


PHOTO CREDIT: GINA BEIM

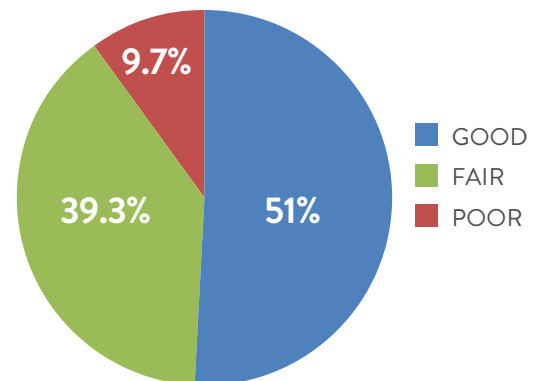


BRIDGES GRADE: C-

EXECUTIVE SUMMARY

Northeast Ohio is home to 3,090 bridges, of which 51% are rated in good condition, 39.3% are in satisfactory or fair condition, and 9.7% (299 bridges in Northeast Ohio versus 6% on a statewide basis) – are in poor condition. A poor condition rating means the bridge is structurally deficient and requires significant rehabilitation or replacement. In 2018-2019, the Ohio legislature paved the way for limited additional funding for the state’s transportation network by allowing counties the opportunity to increase vehicle registration revenues by imposing an additional \$5 permissive fee. Proceeds must be used for planning, constructing, improving, maintaining, and repairing public roads and bridges. Cuyahoga County and Lake County have recently passed additional permissive vehicle registration fees. The counties of Lorain, Medina, and Geauga currently are also collecting permissive fees for road and bridge repairs. Overall, however, Northeast Ohio faces a funding shortfall issue, particularly to address its future needs. Infrastructure funding challenges continue to limit the number of bridges which can be repaired or replaced.

FIGURE 1: NORTHEAST OHIO BRIDGE CONDITION SUMMARY



OVERVIEW

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. These significant rivers and their tributaries contribute to the high number of bridges in the five county, Northeast Ohio region- 3,069 bridges in total.

The Ohio Revised Code (ORC) defines a bridge as any structure of 10 feet or more clear span, or 10 feet or more in diameter, situated on, above or below a highway, and requires all bridges be inspected annually. The Federal Highway Administration (FHWA) National Bridge Inventory (NBI) defines a bridge as a structure that is 20 ft or longer and requires an inspection frequency of two years. Ohio's 10-foot-long bridge definition and the fact that inspection is required annually places a higher level of responsibility on bridge owners in the state, the only state in the USA with this requirement. The annual bridge inspection requirement along with the significant number of bridges in the state inventory requires additional staffing and other resources to inspect, report, and load rate all these structures. Supporting this point is the table below, identifying the bridge distribution by length based on the ORC:

TABLE 1: OHIO BRIDGES

NUMBER	BRIDGES IN OHIO
40,036	Total number (10 ft. +)
26,730	Total number of NBI bridges (20 ft. +)
13,306	Additional Ohio Bridges between 10 ft and 20 ft span

The State of Ohio ranks second in the nation based on the number of bridges statewide (26,730 NBI definition) and fourth in the nation based on interstate lane miles (6,800). From a bridge maintenance perspective, Ohio's 88 counties maintain 61% of the state's 40,036 bridges, while cities and other local agencies maintain 2,375 bridges (6%). The remaining structures (33%) are located on state-maintained facilities.

ODOT is responsible to maintain the high-volume interstate and freeway system, which carries 57% of all vehicular traffic and 67% of all freight on only 17% of total lane miles. ODOT has steadily programmed, repaired, and replaced mainline interstate bridges to preserve the system's integrity. ODOT is responsible for inspecting 1,323 bridges in Northeast Ohio and has invested significant financial resources on major bridges in the region, including the twin I-90 George V. Voinovich Bridge over the Cuyahoga River (\$573.6 million) and the Interstate 480 structures over the Cuyahoga Valley (\$227.8 million).

CONDITION AND CAPACITY

The MAP 21 Rulemaking defines bridge condition general appraisal ratings in the following ranges: Good (9-7); Fair (6-5); Poor (4-0). Brief descriptions of condition ratings are provided in Table 2 below. ODOT has established a statewide system goal of an average general appraisal rating of 6.8 for their structures, which is just slightly below the condition rating of "Good". This goal considers a constrained funding stream and the distribution of ODOT's resources among other high priority assets such as interstate and freeway pavement, interchanges, traffic signing, safety features and other Operation and Maintenance commitments.

Table 2 presents bridge condition ratings sorted by agency maintenance responsibilities within the 5-county area (2018 Data). Note: (OTIC *) references the Ohio Turnpike and Infrastructure Commission.

TABLE 2: BRIDGE CONDITION SUMMARY BASED ON STATEWIDE, 2018 ODOT BRIDGE INVENTORY

General Condition Category	General Condition Appraisal/Description	ODOT	OTIC *	Counties (Lorain, Lake, Medina,	Municipal	Rail	Metro-parks	Other (Private, ODNR, Transit)	NOACA Region	Percent of General Condition Rating
Good	9- As Built	93	0	65	19	1	1	3	182	5.9%
	8- Very Good	182	2	218	58	4	7	10	481	15.6%
	7- Good	405	63	276	137	16	10	6	913	29.5%
Fair	6- Satisfactory	452	25	188	121	20	23	8	837	27.1%
	5- Fair	142	7	142	58	20	4	5	378	12.2%
Poor (Structurally Deficient)	4- Poor	45	0	91	29	29	5	1	200	6.5%
	3- Serious	2	0	31	9	16	3	1	62	2.0%
	2- Critical	0	0	7	10	3	1	0	21	0.7%
	1- Imminent Failure	0	0	1	3	1	0	0	5	0.2%
	0- Failed	0	0	0	1	10	0	0	11	0.4%
Total		1,321	97	1019	445	120	54	34	3,090	100.0%
No. Bridges/ % Good		680/ 51.5%	65/ 67.0%	559/ 54.9%	214 48.1%	21 17.5%	18 33.3%	19/ 55.9%	1576 51%	51%
No. Bridges/ % Fair		594/ 44.9%	32/ 33%	330/ 32.4%	179/ 40.2%	40/ 33.3%	27/ 50%	13/ 38.2%	1215/ 39.3%	39.3%
No. Bridges/ % Poor		47/ 3.6%	0/ 0%	130/ 12.8%	52/ 11.7%	59/ 49.1%	9/ 16.7%	2/ 5.9%	299/ 9.7%	9.7%

A bridge is defined as structurally deficient (SD) by the FHWA if the minimum general condition rating of the structure (deck, superstructure or substructure or culvert) is rated 4 or less. The FHWA Performance Measure goal is for no more than 10% of the deck area of NBI bridges on the National Highway System in each state be SD. Current ODOT data (March 2017) indicates 2.7% of ODOT maintained bridge deck area statewide are structurally deficient. SD bridge deck area percentages by agency within the five county NOACA region are: 3.9% ODOT maintained bridges, 15.3% county bridges, and 15.5% of municipal bridges. A total of 299 bridges are structurally deficient in the five county area.

Nationally, the average age of the nation's bridges was reported as 43 years in the 2017 Report Card, which is just seven years shy of the typical 50-year design life expectancy. It is also recognized by owners that a bridge's service life is often longer than its design life, requiring additional repair and rehabilitation investment as the bridge continues to age. The Northeast Ohio Report Card Committee discovered a similar trend within the region. The Ohio inventory of existing bridges indicates that the average age of bridge assets continues to be a challenge. Agencies are stretching available funds to maintain the inventory at an acceptable operating and safety level. Local transportation agencies are doing a commendable job of inspecting, load rating, prioritizing, rehabilitating and, in some cases, replacing the bridges frequently well beyond the expected 50-year design life span. All Northeast Ohio bridge-owning agencies contacted reported 100% compliance with all required bridge inspections and load ratings for their structures.

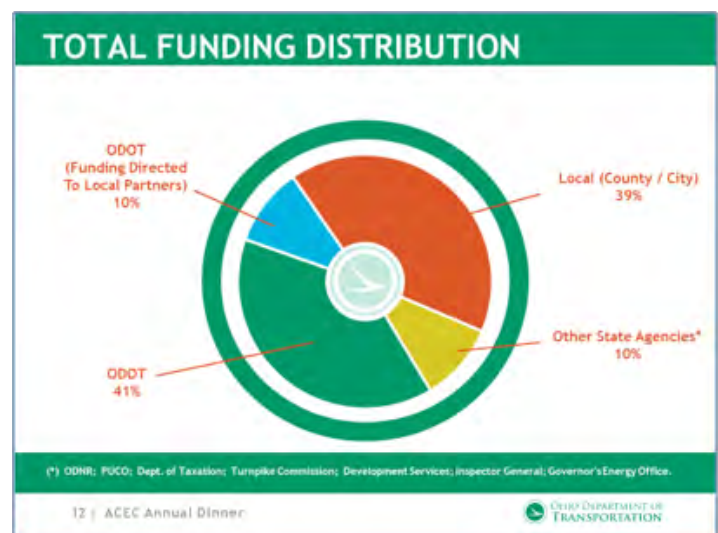
The Cuyahoga County Department of Public Works has a very mature bridge inventory and reports that 105 of the 210 (50%) bridges it inspects and maintains are over 50 years old, and an additional 18 bridges are between 40 and 50 years old. Cuyahoga County also reports city-maintained structures are increasing in age. It reports that 56 bridges out of the 141 with lengths between 10 and 20 feet are at least 50 years old. Lake County and Geauga County report average bridge ages of 38 and 33 years, respectively. Lake County reports that 35 of the 103 bridges they inventory are 50 years old or older. Based on information from BuckeyeAssets.org, there are 628 bridges in Lorain County and 550 in Medina County.

FUNDING AND FUTURE NEED

Funding for transportation projects in Northeast Ohio comes from several revenue streams. Federal funds are distributed by the local Metropolitan Planning Organization, the Northeast Ohio Areawide Coordinating Agency (NOACA). The transportation agencies and NOACA are very good at identifying available funding streams, partnering with sister agencies to co-fund projects, and securing unused funds from other state agencies. Fiscal Year 2018 revenue sources amounted to \$3.32 billion based on the Ohio Department of Transportation information. The primary source is gas tax revenue resulting from the sale of both gasoline and diesel fuel at the pumps.

The current per gallon tax rates are 28.01 cents (both standard and diesel) for the state plus a federal tax of 18.4 cents (gasoline) or 24.4 (diesel). Total gas tax collected per gallon is 46.4 cents for gasoline and 52.4 cents for diesel. ODOT distributes the \$3.32 billion of revenue on a percentage basis shown in Figure 3. Counties receive 11 cents of the 28 cents per gallon collected.

FIGURE 3: ODOT FUNDING DISTRIBUTION- STATEWIDE (FIGURE COURTESY OF ODOT DISTRICT 12)



ODOT maintains a statewide Bridge Management System (BMS) which prioritizes bridge repair and replacement needs based on condition assessments, functional classification, traffic volume, and impact to the community. The State BMS keeps up-to-date information on bridge load postings, structurally deficient bridges and bridge condition ratings. ODOT places a large focus and funding resources on system preservation when it prioritizes bridge project needs.

ODOT established a nine-member Transportation Review Advisory Council (TRAC) in 1997 with the purpose of assisting project selection and prioritization of major new projects. The TRAC project list is fiscally constrained and segmented into Tier I (fully funded through construction), Tier II (development commitments which can include some preliminary engineering) and Tier III (early development activities). Tier I projects are funded through 2023. Construction commitment levels will decrease from \$437 million in 2018 to \$107 million in 2022 and \$160 million in 2023. No construction funding is allocated for Tier II or Tier III projects, due to lack of committed funding.

County Engineers utilize a wide range of sources to fund bridge projects, with only a modest amount resulting from the state gas tax, i.e. Cuyahoga County- 8% gas tax; Lake County- 20% gas tax, Geauga County- 0% gas tax. Cuyahoga County, Ohio's most populous county (1,256,000), reported the following bridge funding sources for the period 7/1/2016 to 6/30/2017 providing a funding distribution snapshot ranging from \$15 million to \$25 million annually.

TABLE 3: FUNDING SOURCE PER AGENCY IN NORTHEAST OHIO

AGENCY SOURCE	FUNDING PROGRAM	AMOUNT
Federal	Local Bridge/ State Transportation/ CMAQ Congestion Mitigation & Air Quality/ Earmarks	10.8 M
State	Issue 1: Ohio Public Works Commission	1.1 M
County Roads and Bridge	Motor Vehicle Registration and Permissive License Fees	6.7 M
Municipality	None this year	0
ODOT Local Major Bridge	None this year	0
	TOTAL	18.6M

Northeast Ohio faces a funding shortfall issue, particularly to address its future needs. Infrastructure funding challenges continue to limit the number of bridges which can be repaired or replaced.

In 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law by President Obama. The FAST Act provides \$305 billion over five years to surface transportation. Although the FAST Act provides financial stability until 2020, its pending expiration causes uncertainty for the future. In addition to needing to reauthorize the legislation, Congress will need to address the Highway Trust Fund (HTF) shortfall at the same time. The HTF is funded by the federal gasoline and diesel taxes. The federal gas tax rate of 18.4 cents/gallon has been at the same level since 1993 and thanks in large part to inflation, the purchasing power has been reduced from \$1 to only 65 cents. Today, the gasoline and diesel taxes currently bring in \$34 billion annually, but the federal government is spending approximately \$50 billion/ year on transportation, causing a \$16 billion annual deficit. The lack of a well-funded, stable Highway Trust Fund hinders the planning of bridge rehabilitation and replacement projects based on actual infrastructure needs, not limited by a tightly constrained

budget based on historical investment data. Inflation continues to reduce the purchasing power for bridge construction. Meanwhile, the gas tax in Ohio has been at the same rate of 28 cents/gallon since 2005, while inflation has reduced the buying power of \$1 to 88 cents.

Fortunately, some action has been taken to increase revenue for transportation infrastructure in Ohio. Ohio's 2018-2019 Transportation Budget Bill (HB 26) allows counties the opportunity to increase vehicle registration revenues by imposing an additional \$5 permissive fee. Proceeds must be used for planning, constructing, improving, maintaining, and repairing public roads and bridges. Cuyahoga County and Lake County have recently passed additional permissive vehicle registration fees. The counties of Lorain, Medina, and Geauga currently are also collecting permissive fees for road and bridge repairs.

ODOT has also aggressively funded the Ohio Bridge Partnership Program, investing over \$120 million primarily on smaller local county and municipal bridges. Bridges selected for this program, which has the primary goal of eliminating structurally deficient bridges, were structurally deficient, of local responsibility, and met the federal bridge definition of 20 ft length. ODOT announced in October 2017 completion of the 200th bridge replacement with this program. The five counties in the NOACA region were able to replace 18 bridges through the Ohio Bridge Partnership Program.

Despite this progress, needs across the region are significant. The Cuyahoga County Department of Public Works estimates \$100 million is required to replace 39 bridges with a current condition appraisal rating of 4 or less. Replacement of these structures would boost the average condition rating of Cuyahoga County's bridges to nearly equal the ODOT goal of 6.8. Cuyahoga County Council recently passed an addition \$5 vehicle registration permissive fee which will generate approximately \$5 million per year and is targeted for roadway and bridge projects.

The Geauga County Engineer estimates \$1.5 million needed to close the gap between the current score and the desired goal. In summary, the lack of available funding is delaying needed maintenance and rehabilitation of bridge projects. Meanwhile, the Lake County Engineer estimates \$60 million is needed to close the bridge condition gap from a 6.0 average to a desired ODOT goal of 6.8. Lake County's permissive tax is targeted for roadway improvements.

OPERATION AND MAINTENANCE

Bridge operation and maintenance (O&M) responsibilities are performed by the various bridge owners/ agencies within the region. Bridge maintenance agencies include: ODOT, Ohio Turnpike and Infrastructure Commission, counties, municipalities, and transit agencies. Each agency has resources in personnel, equipment, and facilities to perform required O&M activities. O&M Bridge activities typically include: safety item repairs, wearing surface patching, minor rehabilitations, and drainage system maintenance. Extensive bridge repair and rehabilitation work is most often performed by bridge contractors and managed by the agencies.

Bridge maintenance work is generally prioritized based on the specific condition and situation. For example, the Cuyahoga County Engineer has developed four (4) distinct levels of Maintenance Priority Categories. The Categories are: Level 1- Emergency; Level 2-Routine; Level 3-Planned; Level 4- Preventative Maintenance. Maintenance recommendations result from the annual bridge inspections and are submitted to the Bridge Maintenance department for execution. A similar system exists within other maintaining agencies.

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ODOT is placing an increased emphasis on system preservation and preventive maintenance programs for bridges. A long term, life cycle cost approach to preserving their bridge assets will yield cost savings and ultimately improved structure conditions. In fiscal year 2018, ODOT statewide is spending 90% of its \$2.4 billion construction budget on system preservation projects.

The operation and maintenance capacity of each agency varies significantly based on available staffing resources, staff experience, bridge types, size, and need. Challenges for bridge O&M results from highly constrained budgets, staffing shortages, and increasing materials and equipment costs. In general, ODOT and the Ohio Turnpike and Infrastructure Commission are in a better position to operate and maintain their assets. County and municipal agencies are very strained to provide the needed O&M. For example, the Lake County Engineer reports its maintenance resources are based on an annual materials budget of \$60,000 plus one bridge crew for 12 weeks annually.



PUBLIC SAFETY

Agencies within the five county NOACA area have emergency response plans in place to handle situations which may result from weather events, infrastructure emergencies, and terrorism threats. Recent detailed planning occurred in the Northeast Ohio region during the summer of 2016 in preparation for the Republican National Convention (RNC). Safety forces across the region collaborated extensively to produce and execute a safety plan inclusive of roadways and bridges. Relationships and training investments made for the RNC continue to provide benefit to the region.

Northeast Ohio public agencies are well prepared as it pertains to bridge safety planning in the region. Public safety is certainly a high priority with all agencies due to the potential high-risk consequences.

RESILIENCE

The ASCE policy statement on infrastructure resilience focuses on the ability of the system to recover in the event of a catastrophic event. An event can be related to a natural disaster (tornado, earthquake, storm, snow), system failure (partial or complete failure in the case of a bridge), or other (terrorism, security, etc.). Northeast Ohio is fortunate to have a generally redundant transportation system. The highly urbanized areas of Cleveland and all of Cuyahoga County are well served by an extensive Interstate, freeway, and urban arterial roadway network. The counties of Lake, Lorain, and Medina have continued to develop and transform into strong suburban counties also served well by Interstates and major and minor arterial roadways. Geauga County is the most rural county, served by an adequate roadway network. In the event of a complete bridge closure, a suitable alternate transportation route would be available in nearly all cases to detour traffic, understanding that traffic congestion and travel delay could be significant.

We have used the availability of Emergency Operations plans as a proxy to assess resilience. Cuyahoga County and Lake County have emergency plans in effect. Cuyahoga county utilizes an addendum to the Cuyahoga County Emergency Operations Plan, which provides detail on responsibilities and actions required.

Regarding resilience as it pertains to climate change and weather-related impacts, ODOT has conducted an Infrastructure Resiliency Plan for the State. The detailed report has identified the 10 most vulnerable bridges in the State, none of which are in the Northeast Ohio region. Bridge agencies are actively focusing on eliminating/ reducing fracture critical bridges. Fracture critical structures are ones which can fail due to lack of structural redundancy.

The Northeast Ohio region's transportation system is generally redundant, and able to recover efficiently in the event of a sudden bridge closure due to structural issues, weather-related, or other events.

INNOVATION

Bridge owners continue to seek and experiment with new technologies to inspect, rehabilitate and replace their bridges. Unmanned aircraft vehicles, which reduce impacts to traffic flow and improve inspector safety, are being tested in bridge inspection applications. Cathodic protection technology on bridge structures has been used to extend bridge life and reduce future rehabilitation costs. Innovative delivery methods including design build and public private partnerships have accelerated projects and, in some cases, resulted in significant



RECOMMENDATIONS TO RAISE THE GRADE

- **Bridge agencies are doing the best they can with the available funding resources. However, the Northeast Ohio area still has 299 bridges, or 9.7% of the bridge inventory in poor (structurally deficient) condition, and these structures require significant rehabilitation or replacement.**
- **Counties should take advantage of the provision in HB 26 that allows counties the opportunity to increase vehicle registration revenues by imposing an additional \$5 permissive fee, until the state maximum amount is achieved.**
- **The state legislature should raise the motor fuels tax and index it to inflation.**
- **The federal government should raise the motor fuels tax and index it to inflation.**
- **Encourage the use of public private partnerships to replace bridges, when appropriate.**
- **Continue to upgrade/ rehabilitate bridges in poor condition.**
- **Continue to perform preservation/ rehabilitation projects to bridges in “fair” condition.**

SOURCES

Ohio Revised Code (ORC) section 5501.47 (B.1.c) titled-Bridge Inspections- the State of Ohio

ASCE Policy Statement 208- Bridge Safety

ASCE Policy-Statement-500—Resilient-Infrastructure

Ohio 2018-2019 Transportation Budget Bill (HB 26)

Federal Highway Administration (FHWA)

NOACA Aim Forward 2040 Long Range Transportation Plan

Buckeyeassets.org

ODOT District 12 Presentation at Annual Meeting of Cleveland Section of ASCE June 7, 2018



DAMS

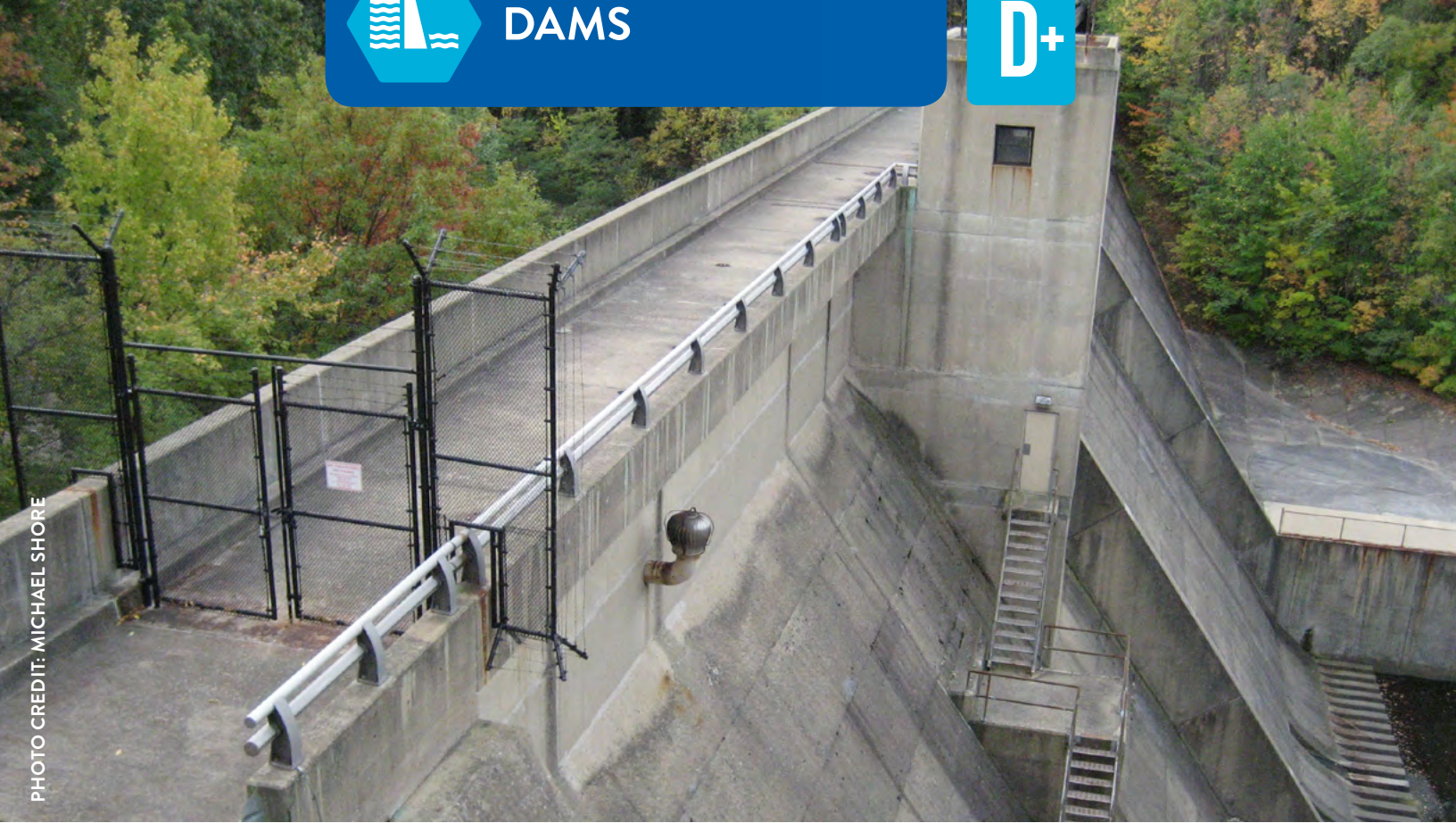


PHOTO CREDIT: MICHAEL SHORE



DAMS
GRADE: D+

EXECUTIVE SUMMARY

Dams support Northeast Ohio's recreation, irrigation, flood control, and drinking water needs. There are 618 dams in the NOACA region, most of which are constructed of earth and/or concrete. Almost 90% of the dams in Northeast Ohio are privately owned, with the remainder managed by municipalities, counties, or government agencies. Our region's dams are aging. Approximately 70% of the 618 dams in the NOACA region are over 50 years old, meaning they've reached the end of their design life. It is estimated that the repair cost for Ohio's state-owned deficient dams is nearly \$300 million and that over \$1.12 billion is needed to repair all non-federal deficient dams in the State of Ohio alone. The NOACA Region has approximately 11% of the dams in the state's inventory and would accordingly need approximately \$100 million to repair all non-federal deficient dams in the NOACA Region alone. The Ohio Water Development Authority has two low interest loan programs for the repair or removal of existing dams, but the lack of adequate funding for dam owners to conduct needed repairs continues to be a challenge.

OVERVIEW

The Northeast Ohio Areawide Coordinating Agency (NOACA) region, comprised of Cuyahoga, Geauga, Lake, Lorain, and Medina Counties, presents unique challenges in water management. Glacial retreat gave this region the invaluable gift of Lake Erie, one of the largest bodies of fresh water in the world. Feeding into Lake Erie are numerous rivers and streams criss-crossing the 25th largest metropolitan region in the United States. Many of these bodies of water have been dammed for purposes of recreation, irrigation, flood control, and drinking water.

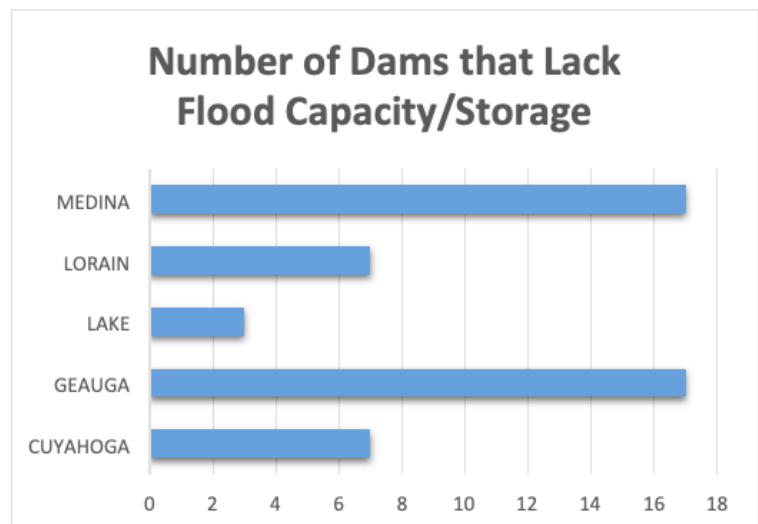
The NOACA region has a total of 618 dams out of the 5,737 in the state's inventory. Most of these structures are constructed of earth and/or concrete. Almost 90% of the dams in Northeast Ohio are privately owned; only 74 out of the 618 (12%) are public and managed by municipalities, counties, or government agencies. Note that the state inventory includes a larger number of dams than appear in the U.S. Army Corps of Engineers National Inventory of Dams (NID). The NID tracks larger dams, while the state of Ohio includes several thousand smaller structures in addition to those that appear in the NID.

The Ohio Department of Natural Resources, Division of Water, Dam Safety Program (ODSP) is responsible for inspection of Ohio's dams, with the exception of federally owned dams. The 2018 Ohio Dam Safety Program budget allocates an average of \$931 per regulated dam, higher than the national average of \$726. ODNR has made reducing dam risk and improving dam safety a top priority. Each year ODNR Dam Safety engineers and staff conduct about 350 detailed inspections of dams on a five-year schedule. However, Dam Safety Section staffing has been reduced by 30% since 1999 due to budgetary constraints, and the staff work load has increased to approximately 98.5 dams per full time equivalent (FTE) staff member. By comparison, the national average in 2015 was 191 dams per FTE staff member.

CAPACITY

The capacity of the dams in the NOACA region is insufficient, as shown in Figure 1. Dams must be built to pass their design flood; that is, they must have adequate storage capacity and a spillway system that safely conveys the flood flows for which they are designed, while remaining structurally intact. Only 24 out of 36 (67%) Class I dams in Northeast Ohio can pass their design floods, while 3 out of 3 (100%) state/public dams (four dams are exempt and unregulated) and 27 out of 66 (41%) federal/county/city dams can pass their design floods. This means less than half of the dams in the area can pass their design floods, which leaves room for improvement. However, it should be noted that the Northeast Ohio Regional Sewer District (NEORS), which manages many of the Class I dams in the region, has begun improving this score by rehabilitating their dams. Also, several cities in the region have set aside funding to upgrade their out-of-compliance dams.

FIGURE 1: PERCENTAGE OF NOACA CLASS I DAMS WITH INSUFFICIENT CAPACITY/STORAGE



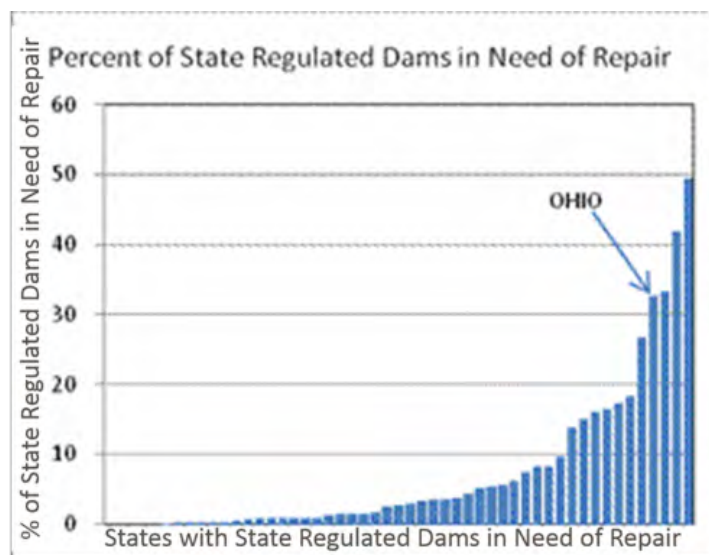
CONDITION

There are four different classifications of dams in Ohio, ranging from Class I to Class IV based on the height of the dam, volume of water stored, and the downstream hazard. Of the 618 dams in the NOACA region, 36 of them (6%) are considered Class I (High Hazard Potential) dams whose failure would cause a probable loss of life. These are larger structures which store a significant amount of water and are primarily for flood control or recreation. There are 120 Class II and III dams in the region (19%). Their failure has the potential to cause local damage, but not loss of life. An additional 116 dams (19%) in the NOACA region are Class IV, which store less than 50 acre-feet of water and are less than 25 feet in height, whose failure would only affect the dam itself and the adjacent (dam owner's) property. The remaining dams are either exempt, abandoned, or unclassified, and do not threaten life or property. Exempt dams are less than 6 feet in height (regardless of storage) or store less than 15 acre-feet of water (regardless of height). Exempt dams may also be between 6 and 10 feet tall as long as they store less than 50 acre-feet of water. The Ohio Department of Natural Resources (ODNR) has no regulatory authority over them and does not inspect them.

One-third of the state-regulated dams in Ohio have some deficiencies, based on 2017 data tabulated by the Association of State Dam Safety Officials (ASDSO) for all state dam safety programs. In addition, in 2010 ODNR prepared a Condition Rating for all their High Hazard Class I dams, as requested by the US Army Corps of Engineers for the National Inventory of Dams (NID). Based on 2018 data provided by ODNR to the NID, approximately 1% of the Class I dams were not given a rating, typically because they had not been inspected recently. Of the 360 dams that were rated (363 total High Hazard Dams, with 3 not rated), 6 (2%) were considered Unsatisfactory, 118 (33%) were rated Poor, 114 (32%) were rated Fair, and 122 (34%) were rated Satisfactory. The percentage rated Unsatisfactory and Poor compares very well with the 2017 ASDSO data and is significantly greater than the national average of 5% as shown by the thumbnail bar graph in Figure 2 below. Data suggests that the condition of the dam infrastructure in Northeast Ohio is at least equivalent, if not worse, with that of the State as a whole.

Like all man-made structures, dams deteriorate over time. Approximately 70% of the 631 dams in the NOACA region are over 50 years old. Additionally, just 11 out of the 36 Class I dams in the NOACA region, or 31%, can pass their design flood and have an Emergency Action Plan or Operation, Maintenance, and Inspection Manual, defined below.

FIGURE 2: STATE REGULATED DAMS IN NEED OF REPAIR



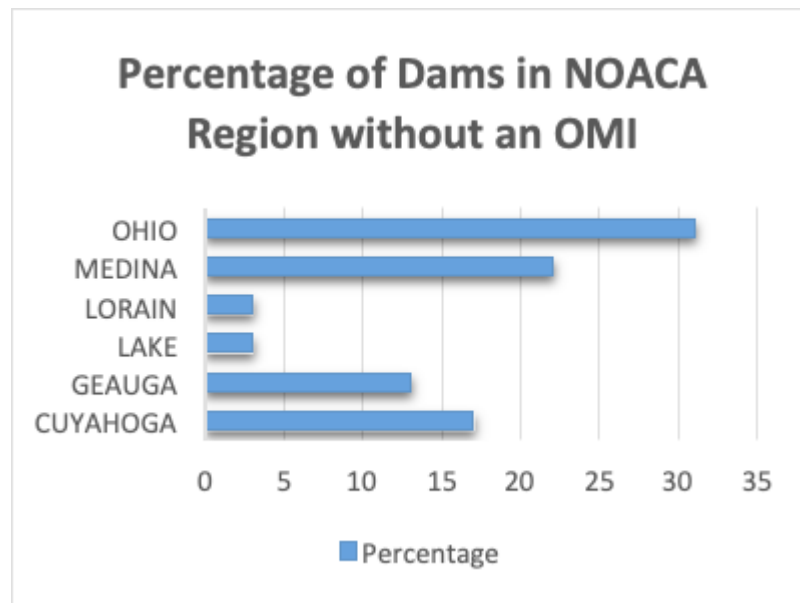
OPERATION AND MAINTENANCE

Regular operation and maintenance as well as thorough and consistent inspection must be practiced throughout the lifetime of a dam. In addition to maintaining proper function, cost efficiency, and compliance with safety regulations, this practice can lead to the early detection of deficiencies and prevention of failure.

An Operation, Maintenance, and Inspection Manual (OMI) is a guidance document developed to ensure that a dam is performing safely and according to its design and purpose, with portions devoted to dam operations and facility upkeep.

In Ohio, Class I dams are required by state statute to have an OMI Plan, as are Class II and III dams. The ODNR data obtained for all Class I dams in Northeast Ohio shows that 17 dams (42%) don't have any OMI that outlines dam upkeep procedures. Another 4 (11%) have yet to be approved by a certified signatory. That leaves a total of 21 dams (58%) without a set of approved OMI procedures. The Class I dams owned by NEORSO are some of the ones that have OMI Manuals. See Figure 3. It is in our vital interest to make sure every dam has appropriate OMI procedures to help insure that failures do not occur in the NOACA region.

FIGURE 3: PERCENTAGE OF NOACA AREA CLASS I DAMS WITHOUT AN OMI



PUBLIC SAFETY

If not properly maintained and operated, dams represent a risk to public safety, local and regional economies, and the environment. Historically, some of the largest disasters in the United States have resulted from dam failures. Regular inspection and rehabilitation are essential to public safety and to preserving the proper functionality of a dam. In addition, because signs of potential risk and failure often present themselves prior to a disaster, early detection of such issues is critical. As is the case with all Ohio state-regulated dams, those located in Northeast Ohio are inspected once every five years. This inspection schedule is satisfactory, and, according to the Association of State Dam Safety Officials, financial and personnel resources devoted to dam safety in Ohio are among the highest in the nation. On the other hand, state inspectors in Ohio have larger than average caseloads of high hazard dams to monitor, as shown in Table 1.

TABLE 1 – STATE OF OHIO RANKING FOR THE DAMS (ADAPTED FROM COLUMBUS DISPATCH)

	OHIO	US RANK
Total dams	1503	21
High-hazard dams	1495	19
Dam-safety budget	363 million	11
Full-time dam-safety staff	1.38 million	10
High-hazard dams per full-time staff	12	9
Total dams per full-time staff	30	31

Current understanding of how dams fail under major flood events or earthquakes frequently demands repairs to dams constructed decades before these failures were scientifically understood. The result of ODSP inspections is a written report, which contains a section entitled “Required Repairs”. If deficiencies are serious enough, the state has the power to enforce repairs. The threat of enforcement/ fines often forces a dam owner to make the necessary repairs. A dam owner may either be forced to lower the lake level until repairs are performed or in extreme cases in which the public is eminently in danger, ODNR can contract to have the dam removed and bill the owner, including putting liens on the property.

Fortunately, no regulated dams have failed in the past 20 years in Northeast Ohio; there have been no fatalities in the past 20 years as a result of a regulated dam failure.

FUNDING

Funding for the dams in Northeast Ohio is determined by federal and state level programs, however there are very few funding assistance programs specifically for Ohio dams.

At the federal level, the National Dam Safety Program provides almost \$1.4 million in each fiscal year for ODNR’s Dam Safety Program. In 2017, it received \$1.376 million for the state budget. Activities include dam inspections and oversight of dam construction projects to ensure that dams are physically sound and do not endanger public health and safety. The program is supported by the Dam Safety Fund which collects revenue from annual dam safety fees, permit fees, and the NDSP grant from FEMA.

The Ohio Water Development Authority has two low interest loan programs for the repair or removal of existing dams. The Dam Safety Loan Program offers loans to local governments, and the Dam Safety Linked Deposit Program offers low interest loans to private dam owners. To be eligible for these programs, the dam owner must have plans for repair or removal of the dam approved by the Division of Water, Dam Safety Program and they must qualify based on their ability to repay the loan. The Linked Deposit Program is offered through private banks.

The ODNR Dam Safety Program receives about \$620,000 each year in annual fee revenue (a net increase of about \$260,000 from previous years) and about \$80,000 per year in permit fee revenue. The annual fee is determined by the classification, height and length of the dam, and total storage volume stored behind the dam. Revenue from the annual fee is used to fund all aspects of Ohio’s Dam Safety Program including the periodic inspection efforts of the division.

On October 23, 2018 the president signed into law the America's Water Infrastructure Act of 2018 (AWIA), a new title for what is usually known as WRDA – the Water Resources Development Act. The AWIA reauthorizes programs within the National Dam Safety Program Act through fiscal year 2023 to reduce the risks to life and property from dam failure in the United States. It is not determined at this time how appropriated funding will be distributed to individual states.

FUTURE NEED

Our region's dams are not only aging but being stressed by increased downstream development and advancing scientific knowledge for predicting flooding, earthquakes, and dam failures. In addition, urban development tends to increase the frequency of flooding, thus increasing the magnitude of design floods. As a result, a dam designed for a 100 year flood years ago may not "pass" the current 100 year flood. This trend will continue in the future, although the population in northeast Ohio has not increased over the past decade. In addition, requirements for land improvements require that the proposed improvements do not increase flooding downstream.

It is estimated that the repair cost for Ohio's state-owned deficient dams is nearly \$300 million and that over \$1.12 billion is needed to repair all non-federal deficient dams in the State of Ohio alone. The NOACA Region has approximately 11% of the dams in the state's inventory and would accordingly need approximately \$100 million to repair all non-federal deficient dams in the NOACA Region alone.

RESILIENCE

The availability of a Dam Emergency Action Plan protects lives and reduces potential property damage and engages emergency management professionals and dam owners in emergency action planning.

In Ohio, High Hazard Class I dams are required by state statute to have an Emergency Action Plan, including failure inundation maps. Since a 2017 focused effort on these Class I dams, 75% of them statewide as of 2018 have Emergency Action Plans. All NEORSD-owned dams in Northeast Ohio have Emergency Action Plans.

INNOVATION

The State of Ohio allows for innovations based on sound science and laboratory testing. The State understands that the tried and true methods for building and rehabilitating dams is sound practice. However, the ODSP understands that innovations that result in safer dams are acceptable on a case by case basis. The ODSP has approved innovative spillways such as labyrinth weirs, movable gates, and inflatable weirs and gates. In addition, the ODSP allows for innovative overtopping protection methods, such as articulated concrete block, roller compacted concrete, and others.

In addition, the Ohio Revised Code 1521.062 allows for a critical flood to be approved and allows for the use of lower rainfall values based on a State funded Hydrometeorological Report that can lower the design flood in some cases.



RECOMMENDATIONS TO RAISE THE GRADE

The grade of Northeast Ohio dams could be improved by echoing the recommendations of the 2017 ASCE Report Card for America's Infrastructure, adapted for our region:

- **Developing emergency action plans for every high-hazard potential dam in our region.** Northeast Ohio has made good strides in this direction, and this should continue.
- **Promoting and supporting federal legislation to provide grants to support dams in Ohio.** Ohio should continue to offer low interest loans for dam repair through the Ohio Water Development Authority. Northeast Ohio will benefit from such a statewide program.
- **Educating the Northeast Ohio public on the location and condition of dams in the area, in particular high-hazard potential dams.**
- **Encouraging improved land use planning at the local level so that communication about how dams affect local areas is more accurately known and considered in future planning.**
- **Continuing to enforce the implementation of repairs to severely deficient dams.**
- **Increasing funding for dam inspections, oversight, and enforcement.**

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DRINKING WATER



PHOTO COURTESY OF GINA BEEM



DRINKING WATER GRADE: C-

EXECUTIVE SUMMARY

Lake Erie serves as the main source of drinking water for most of the five counties covered by this Report Card. The quality of drinking water in the region is high, keeping par with the standard across the U.S. The Cleveland Water Department (CWD) is the largest drinking water utility in the region, serving 70% of the Northeast Ohio. Over the last 30 years, CWD has spent more than \$1.6 billion on infrastructure updates. Most recently, it completed all major treatment facility and primary pump station renewals and considers these facilities in excellent condition. In 2013, the completion of this \$650 million Plant Enhancement Program enabled the agency to shift the focus of their Capital Improvement Program to the 5,200 miles of water mains in the Cleveland Water system. As of 2016, 74% of CWD's distribution pipes are in good or excellent condition. However, significant challenges across the five counties remain. For example, Lake County estimates that, on average, it can fix five to six miles of pipes per year, as compared to the eight to nine miles of pipe needing attention annually. Lead service lines are still in place in certain areas. Additionally, modest population decreases and a decline in consumption is contributing to less revenue available to reinvest in the system.

OVERVIEW

Northeast Ohio borders Lake Erie, part of the Great Lakes watershed which holds 20% of Earth's fresh water. Lake Erie supplies most of the drinking water for the five counties on which this Report Card focuses. After being treated, Lake Erie water is distributed through pressurized water mains to a significant portion of our study area. Many of these water main pipes were laid in the early to mid-20th century and have a lifespan of approximately 75 to 100 years.

The Cleveland Water Department (CWD), serves approximately 70% of Northeast Ohio, including not only the City of Cleveland itself but multiple suburban communities of Cuyahoga County. Since 1980, it has spent approximately \$1.8 billion in updates. Still, more work is needed. Other water providers in the area dealing with the same challenges include Aqua Ohio, a private agency, as well as Lorain County, Lake County, and various cities in the region who own and operate their water distribution system.

CAPACITY

The capacity of the Northeast Ohio water infrastructure system is not currently an issue, due in large part to the region's drinking water source, Lake Erie. However, water consumption is anticipated to rise. Therefore, it is still important to maintain and invest in capacity.

CONDITION

CWD has completed major renewal to all treatment facilities and primary pump stations and considers these facilities in excellent condition. In 2013, the completion of this \$650 million Plant Enhancement Program enabled the agency to shift the focus of their Capital Improvement Program to the 5,200 miles of water mains in the Cleveland Water system. Results of CWD's 2016 pipe condition assessment report show that 26% of the pipes are in good condition and 48% are in excellent condition. This, combined with the completed treatment facility renewal, is a success story in itself and shows proper maintenance/replacements. The assessment does however leave 26% of pipes in the fair, poor, or very poor condition. To put this into perspective, approximately 30 to 35 water main breaks are experienced each year, per 100 miles of pipe.

Major water providers in the region, outside of CWD, include county water departments. Based on available data, it is estimated that the average age of county water pipes is around 40 years old. The majority of the pipe network is cast iron or ductile iron, which can have a life expectancy of 100+ years in ideal conditions (130 years per American Water Works Association). However, soil in this region more corrosive and a life expectancy of 75 years is typical. This results in the average water pipes of the counties being 'over the hill' in their life expectancy.



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FUNDING

Drinking water infrastructure in the United States is funded primarily through a rate-based system, and that is no different in this region. Similarly, to the national trend, our region has experienced inadequate investment for decades and will continue to be underfunded without significant changes, while the revenue generated will fall short as needs grow.

CWD, like the other water providers in the region, is underfunded. Lead pipes are still in place within the region in spite of CWD's capital investment of over \$24 million, out of \$64 million capital budget, per year to replace water mains, of which includes lead service line replacement when the connecting main is replaced. The capital budget is supported by rate payers. Of course, other/additional funding would assist in offsetting the capital amount needed, which could lead to an increase in lead line replacement. Lead pipes in the counties is less of an issue due to the time period when a majority of the water infrastructure was constructed in the regional counties.

Lake County estimates that, on average, it can fix five to six miles of pipes per year, as compared to the eight to nine miles of pipe needing attention per year. With additional projects would come the need for additional staffing, as well as requiring sufficient funds. In spite of funding challenges, there are success stories of the region to be told. In 2016, CWD started a water main renewal program where \$15 million per year is invested for replacing suburban water mains. This yearly investment is estimated to eventually replace all of the CWD maintained water main pipes prior to their life expiration.

In addition, there are tax incentives and low interest rate programs in place for water projects in Northeast Ohio, to be utilized with proper funding. For example, the Drinking Water State Revolving Fund (DWSRF) is used to the amount feasible by the region. However, it is a relatively small available amount for relatively small, low impact projects. Also, there are no federally-supported Water Infrastructure Finance and Innovation Act (WIFIA) qualifying projects in the region. Maintaining and improving drinking water infrastructure is a priority for the region and the success will highly depend on updates to grant availability and the willingness/possibility of residents to pay increased rates.

FUTURE NEED

Per the ASCE National 2017 Report Card, municipal drinking water consumption in the United States has declined by 5% this decade, marking the first time in nearly 40 years that water use at home has decreased. Total freshwater withdrawals this decade, across the nation, continue to decline in almost every sector including agriculture, industrial, domestic, and thermoelectric. This is primarily due to increased efficiencies and the reduction in withdrawals for retired coal-fired power plants.

Drinking water needed for public supply in the region has been trending to become relatively flat. Water conservation efforts, including through water efficient fixtures, appear to have had a significant impact in reducing per capita water usage. On top of this, there is no indication that the abundant resource of Lake Erie is going anywhere any time soon. However, there have been conservation efforts needed in the past, in Lorain County, due to a frozen water intake. Also, algae bloom is being watched but not believed to be an issue in this region due to weekly testing that occurs through State of Ohio mandates. In addition, CWD has two scientific buoys on Lake Erie that are designed to detect early warnings of algae issues. However, lessons learned from other regions will serve to be valuable as times may arise to become vigilant with nutrient releases to the lake.

There are other challenges facing the region's drinking water infrastructure. Cuyahoga County, the most heavily populated county in Northeast Ohio, has seen a modest population decrease. The impact of a declining population is that there are fewer rate payers to support an aging infrastructure network. Additionally, the region is grappling with an aging workforce. Drinking water systems require sufficiently trained staff as current staff members retire.

PUBLIC SAFETY

Drinking water quality in the United States remains the safest in the world. The EPA sets legal limits for over 90 contaminants in drinking water. The Safe Drinking Water Act (SDWA) allows states to set and enforce their own drinking water standards as long as the standards meet or exceed EPA's minimum national standards. Public water systems are required to monitor their water regularly for contaminants.

The 2016 CWD Water Quality Report shows all detected contaminants falling within the allowable threshold. Lead, however, continues to be a presence. Based on the CWD lead map, it appears that approximately 50% or greater of their service area contains city side lead connections. This is in spite of CWD's capital investment of over \$24 million, out of \$64 million capital budget, per year to replace water mains, which includes lead service line replacement when the connecting main is replaced. Of course, more can be accomplished with more funding. Surrounding (less populated) areas are included in this assessment and believed to not contain as much lead due to the time period when water services were constructed in these surrounding areas (later than 1960). Lake County officials believe that about 15% of their network contains lead, but the lead is controlled with chemical treatment.

Lake Erie algae blooms and Chromium-6 are two water quality issues that threaten our drinking water if not kept in the forefront. Algae blooms, often caused by agricultural chemical runoff into the water system, can cause a toxic water system. Chromium-6 occurs naturally in the environment, but high quantities are also produced at industrial sites and can contaminate the drinking water system if not properly monitored and handled. In addition, upcoming unknown risks are present, associated with other emerging contaminants from landfills.

In spite of certain public safety concerns, no significant water quality issues have been reported in Northeast Ohio. With sufficient funding and proper oversight, health risks can be mitigated and water quality can remain safe.

RESILIENCE

The resilience of the Northeast Ohio drinking water infrastructure is not determined by the ability of the region to implement water conservation efforts during dry weather spells, as is the case in other areas of the nation. Rather, it is related to the ability to maintain an adequate water supply during storms.

After Super Storm Sandy which hit the region in the fall of 2012, the CWD installed emergency generators in its pump stations and treatment plants. Other storms familiar to the region come in the winter months, when colder than normal temperatures can be experienced. This can have a major impact on drinking water pipelines, which are typically buried for certain frost depth that can be surpassed by these winter temperatures.



**DRINKING
WATER**



RECOMMENDATIONS TO RAISE THE GRADE

Recommendations to raise the grade of the Northeast Ohio Drinking Water Infrastructure echo those issued for the US as a whole, and reflect the policies of ASCE:

- **Reinvigorate the State Revolving Loan Fund (SRF) program under the Safe Drinking Water Act**
- **through permanent reauthorization and tripling the amount of annual appropriations.**
- **Fully fund the Water Infrastructure Finance and Innovation Act (WIFIA) at its authorized level.**
- **Preserve tax exempt municipal bond financing. Low cost access to capital helps keep lending for drinking water upgrades strong and accessible for communities large and small.**
- **Establish a federal Water Infrastructure Trust Fund to finance the national shortfall in funding of infrastructure systems under the Clean Water Act.**
- **Eliminate the state cap on private activity bonds for water infrastructure projects to bring an estimated \$6 to \$7 billion annually in new private financing.**
- **Encourage utilities to take regional approaches for water delivery to take advantage of economies of scale.**
- **Encourage utilities to conduct revenue forecasting models to determine the necessary rate revenues over a period of time and then institute rates that reflect the true cost of supplying clean, reliable drinking water.**
- **Encourage utilities to undertake asset management programs, if they currently do not.**
- **Increase federal and local support for vocational training in the drinking water sector as engineers, operators, and maintenance staff begin to retire in large numbers.**
- **Utility managers must remain diligent to ensure science-based decisions control operations and facility function. While lead and other contaminants post significant health concerns when ignored, with proper funding safe and clean drinking water can be ensured.**



**DRINKING
WATER**



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ASCE Policy Statement 337 - Water Conservation

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ENERGY

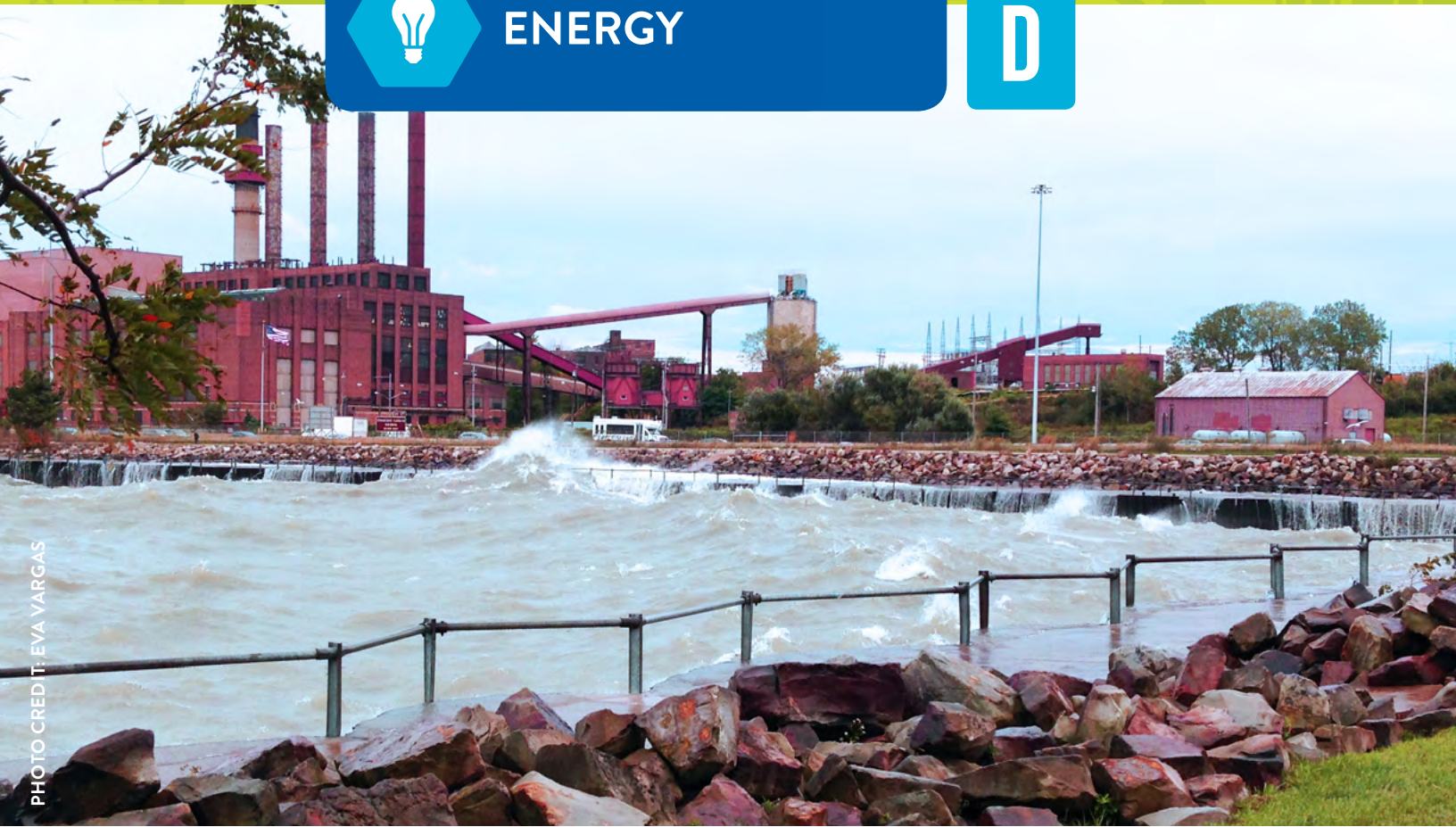


PHOTO CREDIT: EVA VARGAS



ENERGY GRADE: D

EXECUTIVE SUMMARY

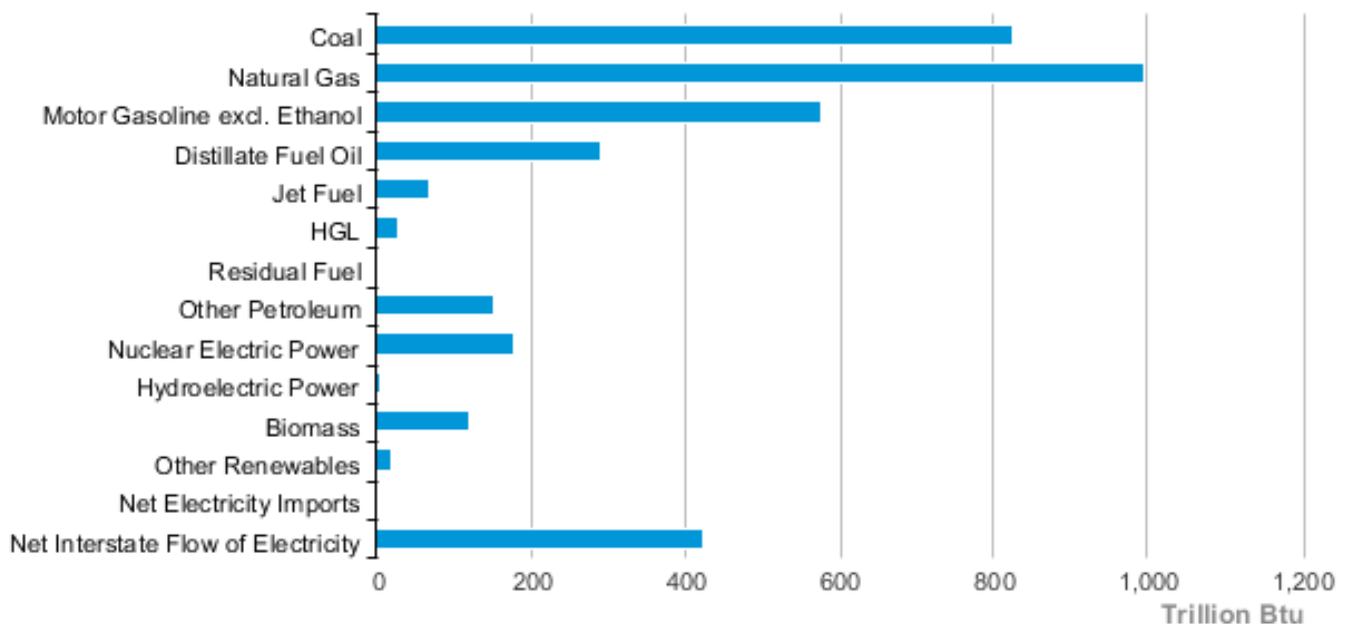
Energy infrastructure in Northeast Ohio is at risk. One third of energy consumed in the region is generated outside the region, and the region's aging distribution networks built in times of population expansion prior to the 1960s, require continuous care and improvement. Upgraded and/or new transmission lines are needed to bring replacement power into the constrained region as energy demands continue to increase. At present, the only investments in electric transmission lines in Northeast Ohio are for routine maintenance, and on-going natural gas pipe replacement plans are not intended to increase capacity. The permitting and siting of new transmission lines, both for electricity and oil & gas, is a lengthy process that encounters significant public opposition and regulatory hurdles. While NEO energy companies are reliable caretakers of the existing system, the uncertain regulatory climate discourages long-term investment decisions and the aging energy infrastructure remains vulnerable and stretched thin. Investments are lacking in redundancy, needed to prepare the network for the future while protecting it from major natural or human disasters.

OVERVIEW

Energy, for the purposes of the Northeast Ohio Infrastructure Report Card, includes electricity and oil and natural gas. Both sectors consist of vast networks of companies and agencies that generate, transmit, distribute, sell, and regulate a multitude of assets that result in electricity, heat or/and power for end users. The energy industry, which includes companies in electricity, natural gas, oil, coal, nuclear power, hydropower, solar cells and wind power, is undergoing continuous and fundamental changes as the need for energy increases while concerns over reliability, resilience, security, safety, sustainability and dependability become more significant.

Figure 1 shows Ohio's energy consumption estimates by source. Natural gas is the primary source, followed by coal and petroleum products.

FIGURE 1. OHIO ENERGY CONSUMPTION ESTIMATES, 2016
(SOURCE: EIA MONTHLY ENERGY REVIEW, JULY 28, 2018)



Over 80% of Northeast Ohio (NEO) energy customers are served by well-known large companies First Energy, Dominion Energy and Columbia Gas. These companies distribute energy services using an extensive network of generation and transmission systems, in which they also participate. The performance of this network is regulated by federal, state and local agencies which influence costs and therefore levels of infrastructure investment. To evaluate the condition of energy infrastructure in NEO, the condition of the generation, transmission and distribution networks must be considered, along with their regulation.

Regulation

Regulation of NEO energy includes the Federal Energy Regulatory Commission (FERC) and the Public Utilities Commission of Ohio (PUCO). There are numerous PUCO-certified suppliers operating in NEO who purchase wholesale electricity or natural gas from generation or producing companies and compete for the right to supply energy to consumers. PJM Interconnection is the regional transmission organization (RTO), voluntarily formed by transmission-owning utilities to coordinate the movement of wholesale electricity across multi-state regions, resulting from FERC's requirement to unbundle transmission service from generation service. Each PJM member must secure enough amounts of electrical generation to meet regional capacity needs.

Through certification by the Office of Pipeline Safety (OPS) within the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), PUCO inspects and enforces the pipeline safety regulations for intrastate and interstate gas pipeline operators in Ohio.

Energy Generation

Power plants active in NEO are listed in Table 1. The plant with the largest capacity is Perry Nuclear Power Plant in Lake County. This plant will be deactivated in 2021, and the remaining large plants are fueled by coal and natural gas. Several smaller plants use renewable primary fuels: solar, wind and biomass.

TABLE 1. POWER PLANTS IN NORTHEAST OHIO SOURCE: EIA, OHIO STATE ENERGY PROFILE, MAY 17, 2018

PLANT NAME	UTILITY NAME	COUNTY	PRIMARY FUEL	TOTAL NET SUMMER CAPACITY (MW)
Seville	American Mun Power-Ohio	Medina	Petroleum	5.4
Wadsworth	American Mun Power-Ohio	Medina	Petroleum	5.4
Wellington	American Mun Power-Ohio	Lorain	Petroleum	1
Oberlin (OH)	City of Oberlin - (OH)	Lorain	natural gas	17.9
Oberlin Spear Pt Solar One	Oberlin Spear Point Solar One	Lorain	Solar	2
Lorain County Project	Energy Developments Inc	Lorain	Biomass	27.2
FirstEnergy West Lorain	FirstEnergy Generation Corp	Lorain	natural gas	539
Avon Lake	NRG Power Midwest LP	Lorain	Coal	640
West 41st Street	City of Cleveland - (OH)	Cuyahoga	natural gas	32
Arcelormittal Cleveland Inc	ArcelorMittal Cleveland Inc	Cuyahoga	other gases	68
MCCo Solar Gen Facility	The Medical Center Company	Cuyahoga	Solar	0.9
Collinwood BioEnergy	Collinwood BioEnergy	Cuyahoga	Biomass	1
LE Wind Turbine 1	Lincoln Electric Company	Cuyahoga	Wind	2.5
Euclid Farm, Stamco N-54	Case Western Reserve University	Cuyahoga	Wind	1
FirstEnergy Eastlake	FirstEnergy Generation Corp	Lake	Petroleum	24
Painesville	City of Painesville	Lake	Coal	48.8
Perry	FirstEnergy Nuclear Operating Co.	Lake	Nuclear	1,240

The total power plant net summer capacity in NEO is 2656.1 MW, compared to 30,003 MW for the State of Ohio, or 8.9%, whereas the regional consumption is about 13% of the state's generation capacity. Upon closure of the Perry Nuclear Plant, the region's net summer capacity will drop to 4.7% of the State's total, accentuating NEO's dependency on other energy generation sources.

While the largest plants are owned by First Energy, plant ownership by municipal electric companies is also evident. American Municipal Power supplies wholesale power to its 135 municipal members, and develops and finances generation projects based on coal, natural gas, hydropower, bioenergy, solar and wind. Its largest member is Cleveland Public Power (CPP).

A unique situation in energy generation is provided by Cleveland Thermal, a division of the Corix Group of Companies. Cleveland Thermal owns and operates a district energy system, with a centralized plant converted from coal to natural gas in 2017. Cleveland Thermal is not regulated by PUCO and serves about 6% of the NEO population.

Energy Transmission

Transmission of electrical energy is provided by American Transmission Systems, Inc. (ATSI), a subsidiary of First Energy. PJM has functional control over the ATSI system and administers its tariffs. ATSI plans, operates, and maintains its transmission system in accordance with NERC reliability standards, and other applicable regulatory requirements including FERC and PUCO.

Gas transmission pipelines in NEO are owned by Dominion East Ohio and Columbia Gas of Ohio. Hazardous liquid pipelines are owned by Buckeye Partners, Inland Corporation and Sunoco.

Energy Distribution

Regulated electric service is distributed to most NEO customers by First Energy, through Ohio Edison Company and The Illuminating Company. The small remainder of electric customers in NEO is served by non-regulated municipal electric companies and rural cooperatives as noted in Table 2.

TABLE 2. ELECTRIC CUSTOMERS SERVED IN NE OHIO

County	First Energy (1)	Cleveland Public Power (2)	Lorain Co. Municipal Electric Companies (3)	Lake Co. Municipal Electric Companies (4)	Medina Co. Municipal Electric Companies (5)	Lorain-Medina Rural Electric Cooperative (6)	TOTAL
Cuyahoga	533,697	72,259					605,956
Lake	101,364			12,000			113,364
Lorain	118,349		12,000			8,000	138,349
Medina	59,242				15,400	8,000	82,642
Geauga	39,179						39,179
TOTAL	851,831	72,259	12,000	12,000	15,400	16,000	979,490
	86.97%	7.38%	1.23%	1.23%	1.57%	1.63%	100.00%

- (1) First Energy, which in the NE Ohio consists of Ohio Edison and the Illuminating Company. The number of customers is as listed in the Outage Report, July 2018 <http://outages.firstenergycorp.com/oh.html>
- (2) Number of customers in 2015, as listed in the Official Statement for Revenue Refunding Bonds
- (3) Consists of the municipal electric companies in Amherst, Grafton, Oberlin and Wellington. The number of customers in Amherst was 5,933 as listed in 2015 annual report and 3,100 were listed on the web page for Oberlin Municipal Light and Power System (OMLPS) in July of 2018. Number of customers for Grafton and Wellington were estimated at 2,000 and 1,000 respectively based on number of households.
- (4) Consists of the Painesville Municipal Electric Division, who listed 12,000 customers on their website in July 2018.
- (5) Consists of the municipal electric companies in Lodi, Seville and Wadsworth. The number of customers in Seville and Wadsworth are 1,876 and 13,000 respectively as listed on their web pages in July 2018. Number of customers for Lodi was estimated at 500 based on number of households.
- (6) The majority of customers are in Lorain and Medina Counties, but there is minor presence in Ashland, Huron, and Wayne Counties. For the purposes of this report, it was assumed that the total number of customers listed on the web page are distributed equally between Lorain and Medina Counties <http://www.lmre.org/>

Regulated natural gas service is provided by large companies Dominion East Ohio (a Dominion Energy Company) and Columbia Gas of Ohio (a NiSource Company), and by much smaller local companies Brainard Gas Corporation, Granger Energy of Lake County, Orwell Natural Gas Company, Northeast Ohio Natural Gas Corporation and Northern Industrial Energy Development. There are also two non-regulated gas cooperative companies: Consumers Gas Cooperative and Knox Energy Cooperative Association.

CAPACITY

Energy demand in NEO is growing, while local generation capacity is diminishing. NEO energy consumption is approximately 663 Trillion British Thermal Units (BTU) while its production is approximately 434 Trillion BTU, as estimated from EIA's State Energy Data for 2016. NEO depends on energy generation from outside the region, and therefore on multi-state transmission systems.

An indirect measure of electric energy capacity is given by the trend of costs in PJM's electric capacity market, which ensures long-term grid reliability by procuring the appropriate amount of power supply resources needed to meet predicted energy demand three years in the future. ATSI zone costs spiked in 2015/2016 because of the coal-fired plant closures and will rise again in 2021/2022 because of the First Energy nuclear power plant closures, including Perry. Upgraded and/or new transmission lines will be needed to bring replacement and additional power into the constrained NEO region. At present, the only investments in electric transmission lines are for routine maintenance. In addition, on-going pipeline replacement plans are not intended to increase capacity. The permitting and siting of new transmission lines, both for electricity and oil & gas, is a lengthy process that encounters significant public opposition and regulatory hurdles. NEO is lagging significantly in energy infrastructure capacity.

CONDITION

Electric outage reports are used to assess the condition of the electric grid, along with the length of time it takes to recover from an outage. EIA's 2017 Reliability data provides values for System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI), with and without Major Event Days (MED). While the data is not available by county, it can be segregated by state and specific utility. The values for the Cleveland Illuminating Company and Ohio Edison throughout Ohio are shown in Table 3.

TABLE 3. ELECTRIC ENERGY RELIABILITY DATA IN OHIO COMPARED TO US AVERAGE

INDEX	CLEVELAND ELECTRIC ILLUMINATING COMPANY	OHIO EDISON	US AVERAGE
Average yearly duration of outages, in minutes, excluding major event days (SAIDI without MED)	120	100	112
Average yearly duration of outages, in minutes, including major event days (SAIDI with MED)	281	284	250
Average yearly frequency of outages, excluding major event days (SAIFI without MED)	1.1	1.0	1.0
Average yearly frequency of outages, including major event days (SAIFI with MED)	1.3	1.4	1.3

While the values in Ohio are higher than the US average, they are not extremely so. However, it should be noted that average yearly durations of almost 5 hours should not be considered acceptable. In today's environment where technology, communications and power are driving economic growth and are integral parts of modern lifestyles, every effort should be made to increase electric reliability. There is also evidence of vulnerability in NEO, with recent outages affecting 20,000 customers for 9 hours in August 2018, and 40,000 customers in December 2017.

PHMSA collects incident reports for gas gathering, gas transmission, gas distribution, Hazardous Liquid, Liquefied Natural Gas (LNG) and Underground Natural Gas Storage (UNGS). For Ohio, the most numerous incidents are for the gas distribution pipelines, a total of 87 from 1998 to 2017. For the same 20-year period in the US, the number of incidents was 11,752. Ohio's share in the number of incidents was 0.7%.

FUNDING

In 2014, First Energy launched its “Energizing the Future” transmission program to upgrade or replace existing power lines, incorporate new smart technology into the grid, and upgrade dozens of substations with new equipment and enhanced security features. FirstEnergy is continuing these investments with planned spending totaling \$4.2 to \$5.8 billion between 2017 and 2021, which will benefit three projects in NEO: “Emily-Fox” Transmission Line relocation of two structures and three existing span guy stub poles; “Juniper-Newburgh, Juniper-Jennings and Juniper-Pleasant Valley” Transmission line replacement of two structures due to localized erosion along Tinker’s Creek; “North Medina-West Medina” Transmission Line Replacement of three wood poles with three wood laminate structures to support optical ground wire installation.

In 2007, PUCO required Dominion and Columbia gas to update old cast iron and bare steel pipelines with more modern protected steel and plastic lines. They are both on 25-year programs for this:

- Dominion East Ohio \$3.4 billion program: as of 2016, 1,374 miles of pipeline replaced out of the targeted 5,572 (25%) at a cost of \$1.188 billion (35%)
- Columbia Gas of Ohio \$1.8 billion program: as of 2016, 1,664 miles of pipeline replaced out of the targeted 4,153 (40%) at a cost of \$ 1.096 billion (61%)

The recent industry expansion provided by natural gas findings in the Utica and Marcellus Shales, part of which are within NEO, resulted in construction of transmission pipelines and underground storage sites. These new facilities have added significantly to the infrastructure network, but the movement along these pipelines needs to be coordinated to reach customers when needed.

The current level of funding in NEO provides for maintenance to satisfy immediate customer energy needs. The natural gas expansion because of the shale boom has resulted in significant investment in new infrastructure for transmission pipelines which will benefit markets beyond the local region. As the infrastructure for generation has aged, several local power plants have been closed or announced for closing, most recently First Energy’s Perry nuclear power plant. While FirstEnergy has sought emergency intervention from PUCO, PJM and the Department of Energy to receive additional compensation to preserve the plant, there has been no positive response and no public interest on debating whether this is the best long-term solution for the region. A significant investment was made in nuclear energy which is on the verge of being lost and not replaced.

ATSI, under regulation, has funding for maintenance of its transmission lines that serve NEO, and the companies responsible for energy distribution allocate funds for capital improvements and maintenance to support the needs of their customers. The presence of several municipal electric systems within First Energy’s service area fosters competition and has resulted in improved customer satisfaction where service areas overlap. Funding of energy infrastructure in NEO is adequate, but not plentiful, and redundant systems are severely lacking.

FUTURE NEED

In NEO, there is interest in renewables and distributed generation (energy generation and storage performed by a variety of small, grid-connected devices), as can be seen by the power plant ownership in Table 1. However, as a region, NEO is lacking in funding dedicated to improving and preparing the energy network for the future, including to support the needs of smart cities and electric and automated vehicles.

OPERATION AND MAINTENANCE

Owners in the NEO energy industry operate and maintain their facilities adequately, in compliance with government regulations. However, O&M depends on the availability and skills of the workforce, and the NE Ohio region experiences regular shortages of personnel trained to work in the energy sector. The lack of a reliable and steady source of labor to support operation and maintenance of the region's generation, transmission and distribution is an ongoing concern.

PUBLIC SAFETY

Government regulations provide requirements for reporting safety incidents and documenting how each public safety incident is addressed, and most energy companies in NEO self-regulate beyond government regulations. Another aspect of public safety is the measure of preparedness for extreme weather or other hazards which could impact the energy network. The region's energy providers have emergency plans which are deployed based on weather forecasts across their service areas. These plans have been tested during severe thunderstorms with substantial rainfall in short durations that have left many residents without power for days at a time. The weather trends in Northeast Ohio include increases in heavy precipitation events and increases in nighttime temperatures with rising humidity, so emergency plans will continue to be needed and improved.

RESILIENCE

Despite improvements since the Northeast Blackout of 2003, the resilience of the energy network remains questionable. It remains vulnerable to service interruptions such as outages or pipeline incidents, and it needs to be prepared to address exterior threats such as terrorist, electromagnetic or cyber-attacks. National-level policies are missing to provide direction, and state-level policies are lacking.

INNOVATION

NEO has benefited from the presence of companies promoting the use of renewable sources of energy and expects to see this trend grow as facilities using wind, solar and biomass become more proven and accepted. Renewable energy resources, including hydroelectric power, supply about 2.5% of Ohio's net electricity generation. Wind provides the largest share. The permitting process for new facilities is lengthy and streamlining the regulatory process in NEO would support even more innovation.

OFF-SHORE WIND ENERGY COMING TO NEO

Lake Erie Energy Development Corporation (LEEDCo) is a public-private nonprofit partnership devoted to catalyzing the offshore wind industry in the Great Lakes Region. After 8 years of regulatory review, it earned conditional approval in July 2018 from OhioEPA for Icebreaker Wind, a 6 turbine, 20.7 megawatt offshore wind demonstration project 8 miles from downtown Cleveland in Lake Erie – the first freshwater offshore wind project in North America. Regulatory review is ongoing with the Ohio Power Siting Board (OPSB) still accepting comments, but the project is one step closer to becoming a reality and gives hope for long-term energy capacity improvement and growth of renewable energy in NEO.



ENERGY



RECOMMENDATIONS TO RAISE THE GRADE

NEO is fortunate to have numerous responsible and reliable companies providing energy services. However, they require regulatory and funding support to adapt existing infrastructure to new technologies while ensuring public safety and protection from exterior attacks.

- The electrical grid requires hardening in a way that makes it more resilient to both natural and man-made disasters. Three key actions can help address the energy infrastructure crisis: increase leadership in infrastructure renewal; promote sustainability, resilience and innovation; and develop and prioritize plans to sustain and enhance infrastructure.
- The regulatory process should be stabilized and streamlined by developing and adopting a national energy policy that anticipates future energy needs and promotes the development of clean and renewable energy supplies while increasing the efficiency of energy use.
- NEO would benefit from the safe, economic increase of energy generation in the United States which would reliably increase energy capacity in the region. The growth in renewable energy sources is encouraging but is not on pace to replace nuclear sources which are being retired. There needs to be a national discussion about the disposition of existing nuclear power plants, the construction of new ones, and capacity upgrades to existing plants. This increase should be part of a balanced national energy portfolio in which nuclear power contributes to the national electric supply if justified economically and environmentally.



ENERGY



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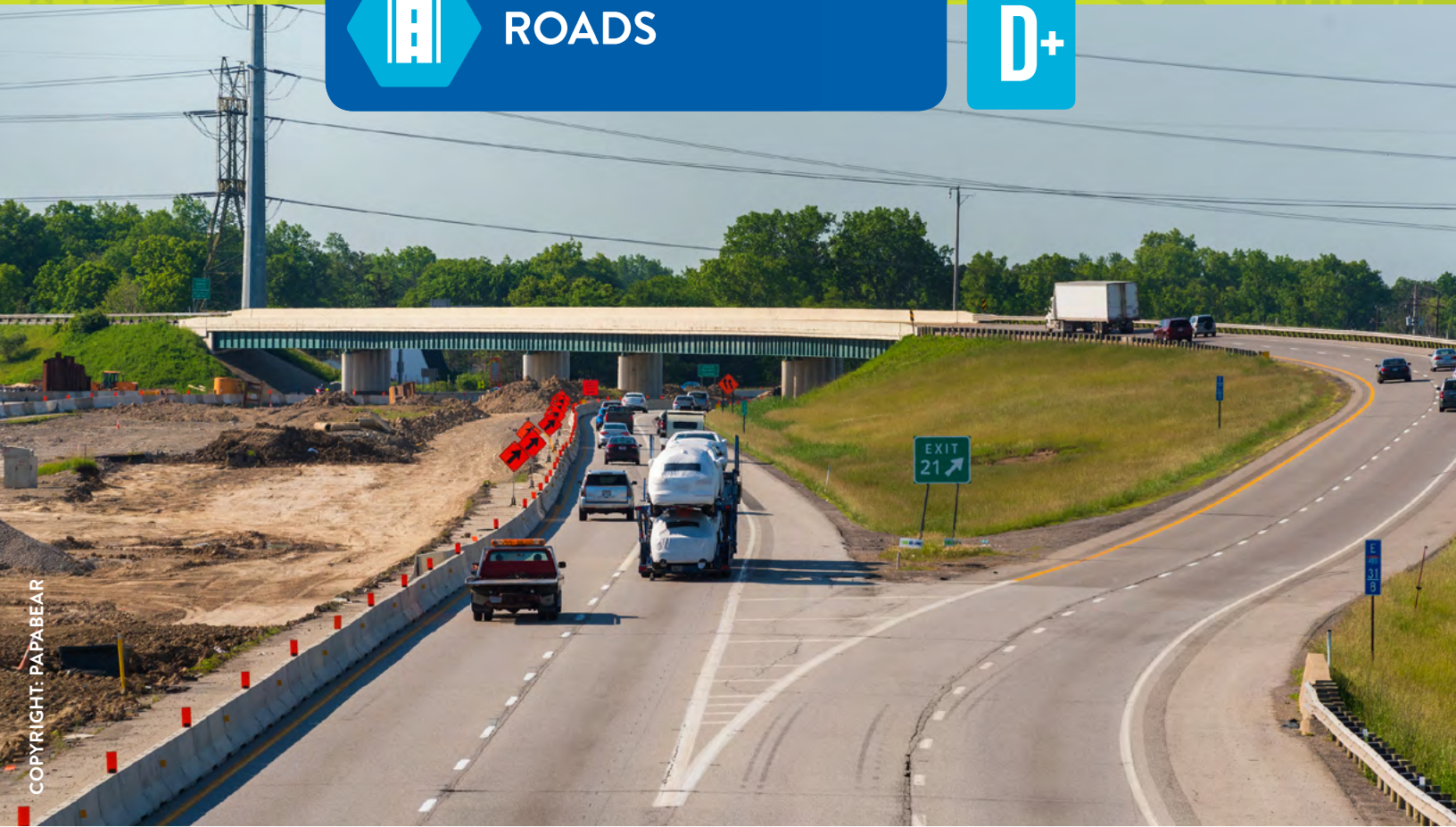
ASCE Policy Statement 299 - Infrastructure Investment

ASCE Policy Statement 489 - Energy Policy

ASCE Policy Statement 490 - Nuclear Power



ROADS



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ROADS GRADE: D+

EXECUTIVE SUMMARY

The State of Ohio has the nation's fourth largest interstate system. Approximately 15% of roadways on the state system lie within the Northeast Ohio Areawide Coordinating Agency's (NOACA) area, for a total of nearly 8,000 miles of roads, ranging in size from multi-lane interstates to local streets. Congestion is significant on the I-90 Innerbelt Expressway through downtown Cleveland and various segments of Interstate 480. Data shows that in 2017, there were 49,973 traffic accidents in the 5-county region, including 166 fatalities. Meanwhile, the condition of roadways is mixed. Many major roadways in Northeast Ohio have good pavement conditions, but Pavement Condition Ratings (PCR) are lower for county maintained and municipal roadways. For example, 52% of Cuyahoga County roadways are rated below the PCR goal of 80 (out of 100), and 40% the City of Cleveland system is below the PCR goal of 75. Transportation agencies such as the Ohio State Department of Transportation and the City of Cleveland are now prioritizing preservation projects utilizing sophisticated asset management systems. Ohio's legislature recently voted to allow counties to increase vehicle registration revenues by imposing an additional \$5 permissive fee.

OVERVIEW

The Ohio Department of Transportation (ODOT) oversees the state highway system, which encompasses a variety of roadways that range from interstates to arterial roadways. The counties and municipalities oversee the local roadway network within their jurisdictions. ODOT, counties, and municipalities inspect all or a portion of their respective roadway systems each year. Counties are responsible for maintaining and improving county roads located in townships and providing material costs for preventative maintenance projects performed by municipalities.

The Northeast Ohio road infrastructure was built for a larger population that is more concentrated around its major urban centers. Due to population density changes with growth in exurbia as well as a reduction in total population in recent years, newer travel patterns have emerged along with longer average commute distances. These changes have placed heavy strains on the existing roadway network.

CAPACITY

The NOACA region contains significant portions of Interstate routes I-71, I-77, I-80 (Ohio Turnpike), I-90, I-271, I-480 and I-490. Typically, the interstate and freeway systems carry the highest volume of traffic in the region, requiring more traveled lanes and full shoulders. Population shifts towards outlying suburbs and previously rural parts of the region have increased traffic along those routes. According to the ODOT 2018 Factbook, Cuyahoga County includes three of the State of Ohio's top 10 road segments with the highest average annual daily traffic (AADT) of all vehicle types, and four of the top 10 road segments with the highest AADT of cars. Notable among these high traffic segments is the portion of interstate I-271 (Emery Road to Harvard Road; 185,000 AADT), which is the second highest traffic volume segment in the state.

One way to measure the adequacy of roadway capacity is the Travel Time Reliability Index, which is the percentage of time between 5 am and 9 pm that Ohio's interstates and highways that look like interstates operate at free-flow speeds. All counties in our study area exceed the ODOT goal of 88% for this index.

Another indicator of roadway capacity is ODOT's "Level of Service" (LOS), which is based primarily on speed, geometry, and traffic volumes. LOS grades vary from A to F, with levels below D in urbanized areas identified as inadequate. Several freeway locations within our study area have a LOS of F, including the Innerbelt Expressway (I-90/71/OH-176) through downtown Cleveland and various segments of I-480 from west of Cleveland Hopkins International Airport to I-271 northbound. (NOACA Aim 2040, Fig. 3.1-28)

Additionally, the daily cost of congestion is another measure of roadway capacity, which is estimated at \$2.5 million per day in 2015 for the NOACA area.

As of this writing, there are 44 committed highway projects in the area, 18 of which aim to address capacity concerns and reduce congestion. The replacement of the Innerbelt bridge and its approaches is one notable project, as it will improve traffic conditions on I-77 and on the Innerbelt (I-90) trench east of I-77. The project will provide multiple downtown access ramps, improve geometry at the Innerbelt curve (a 35-mph interstate curve known colloquially as "Dead Man's Curve"), and better support operations at the I-77 terminal at the Innerbelt. Another large-scale capacity-improving project is the I-480 over Cuyahoga River bridge deck replacement, which will add capacity through the corridor with 4 express lanes, improving roadway capacity in this highly traveled segment. Additionally, improvements to the section of I-480 that overlaps with I-271 should improve operations in one of the most heavily traveled interstate segments in the state.

CONDITION

The northeast Ohio interstate system built in the late 1950s and early 1960s is now over 55 years old. Its condition is best reflected by the Pavement Condition Rating (PCR), which is based on visual inspection of pavement distress, with scores ranging from 0 to 100. The severity and extent of observable pavement distress types are calculated as deductions from 100.

TABLE 1: PCR CONDITIONS AND GOALS BASED ON ROADWAY TYPE

ROADWAY SYSTEM	DESCRIPTION	PCR GOAL	FINDINGS
Priority Roadways System	Interstate and “look-a-likes”	85	All counties exceeded goal in 2017
General Roadway System	(2 lane US and SR outside of Municipalities	80	All counties equaled or exceeded goal
Roadways	2 lane, Non- US routes	75	Significant number not meeting goal (i.e. 40% City of Cleveland system below goal)

NOACA prepares pavement condition and scenario reports for 90 communities in its five-county area. The reports contain pavement condition ratings for the federal-aid roadways not maintained by ODOT, where NOACA typically programs its Surface Transportation Program funding.

**TABLE 2: PERCENT TOTAL LANE-MILES IN PCR RANGE FOR 2016
(NOACA ROADWAY PAVEMENT MAINTENANCE REPORTS, 2018)**

PAVEMENT CONDITION / PCR RANGE	CUYAHOGA	GEAUGA	LAKE	LORAIN	MEDINA
Very Poor: 0 - 39	0.8%	0.6%	0.7%	0.3%	2.7%
Poor: 40 - 54	8.1%	7.7%	7.7%	4.5%	15.9%
Fair to Poor: 55 - 64	14.9%	26%	26%	12.7%	11.4%
Fair: 65 - 74	19.6%	22%	22%	31.3%	13.6%
Good: 75 - 89	35.8%	35.2%	35.1%	38.6%	30.8%
Very Good: 90 - 100	20.8%	8.5%	8.5%	12.6%	25.6%
Lane Mile Weighted Average PCR	76	80	71	75	74

Counties and cities in the NOACA area have been working to improve road conditions. In 2015, roadway improvements in Medina County totaled \$3.4 million. The City of Cleveland Pavement Management and Preservation Program is prioritizing road condition; 2017 was the City of Cleveland’s fourth straight year of major road repairs, targeting the streets in poorest condition first. A percentage of the city budget is allocated to a “fix it first” approach, implementing less expensive repairs such as crack sealing and pavement patching to roads in good condition to increase the roadway lifespan and lower life cycle costs.

FUNDING AND FUTURE NEED

Several revenue streams fund transportation projects in Northeast Ohio including federal programs, the Ohio Department of Transportation, Ohio Public Works Commission, local municipal programs, and County Motor Vehicle Registration and Permissive License fees. The Ohio Turnpike and Infrastructure Commission funds their own roadway and pavement replacement projects utilizing their toll revenue.

Federal funds are distributed by the local Metropolitan Planning Organization NOACA. NOACA investment strategies include “dedicating the bulk of State Transportation Block Grant (STBG) funds to pavement projects of regional benefit on the urban and local federal-aid-eligible systems.”

ODOT Fiscal Year 2018 revenue sources amounted to \$3.32 billion, with the gas tax being the primary revenue source (28 cents per gallon for the state plus a federal tax of 18.4 cents for gasoline or 24.4 cents for diesel). ODOT utilizes 41% of total collected revenue and distributes the remainder as shown in Figure 1.

ODOT established a nine-member Transportation Review Advisory Council (TRAC) in 1997 with the purpose of assisting project selection and prioritization of major new projects. The TRAC project list is fiscally constrained and segmented into Tier I (fully funded through construction), Tier II (development commitments, which can include some preliminary engineering) and Tier III (early development activities). Tier I projects are funded through 2023. Construction commitment levels will decrease from \$437 million in 2018 to \$107 million in 2022 and \$160 million in 2023. No construction funding is allocated for Tier II or Tier III projects.

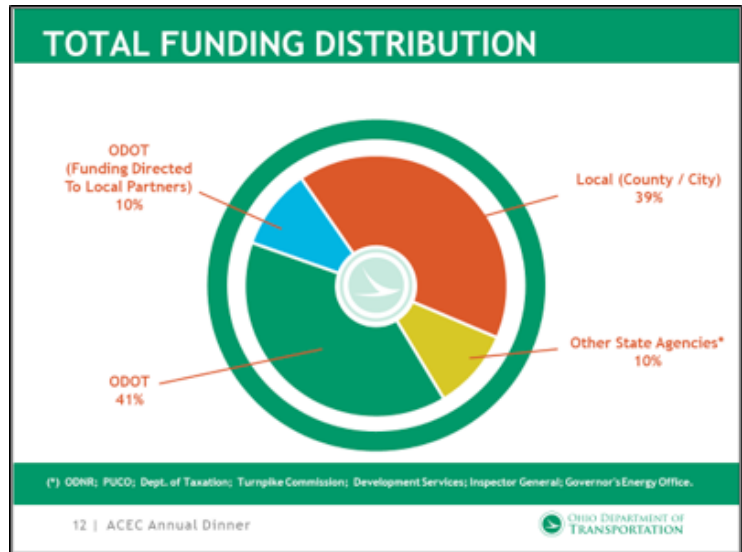
Counties utilize a wide range of sources to fund projects. Overall, counties receive 11 cents of the 28 cents per gallon collected by the State of Ohio from the state gas tax distribution. The gas tax distribution and its portion of the overall county program, however, varies greatly by county. For example, the state gas task funds only 8% of Cuyahoga County projects, while in Lake County, it funds 20% of its projects.

Northeast Ohio faces a funding shortfall issue, particularly to address its future needs.

Primary funding challenges include:

- The Fixing America’s Surface Transportation Act (FASTS Act) was enacted December 4, 2015 by President Obama. The FAST Act provides \$226.3 billion per year (FY 2016-2020) in funding authority. Although the FAST Act provides financial stability till 2020, its pending expiration causes uncertainty for funding future needs. Additionally, the Highway Trust Fund faces chronic insolvency due to the dwindling purchasing power of the traditional gas and diesel taxes. The federal gas tax rate of 18.4 cents per gallon has been at the same level since 1993. Its purchasing power has been reduced from \$1 to only 65 cents.
- The gas tax in Ohio has been at the same rate of 28 cents/gallon since 2005, while inflation has reduced the buying power of \$1 to 88 cents.
- Competition for the available federal funds is intense due to high local demand in the five county NOACA region.

FIGURE 1: ODOT FUNDING DISTRIBUTION- STATEWIDE
(FIGURE COURTESY OF ODOT DISTRICT 12)



However, the state and region have been successful in securing funding to support road infrastructure. Funding Successes include:

- Ohio's 2018-2019 Transportation Budget Bill (HB 26) allows counties the opportunity to increase vehicle registration revenues by imposing an additional \$5 permissive fee. Proceeds must be used for planning, constructing, improving, maintaining, and repairing public roads and bridges. All five counties have enacted some level of permissive fees. Actual vehicle registration permissive fees vary (from \$5 to \$25 per vehicle) by municipalities and cities within each county.
- The Ohio Turnpike and Infrastructure Commission partnered with the ODOT to leverage the Turnpike's bonding authority, which provided over \$930 million of funding for large scale, high priority regional roadway construction projects such as the \$331 million, Opportunity Corridor Project.
- The City of Cleveland increased its residential resurfacing fund to \$12 million in 2017 as a result of Issue 32, a municipal income tax passed by Cleveland voters November 2016. In 2018, the City of Cleveland resurfaced 120 streets with this program.

OPERATION AND MAINTENANCE

The Operation and Maintenance (O&M) capacity of each agency varies significantly based on available staffing resources and experience. Generally, ODOT and the Ohio Turnpike and Infrastructure Commission are in a better position to operate and maintain their assets, while county and municipal agencies are challenged to provide the needed O&M. For example, the Lake County Engineer reports its maintenance resources are based on an annual materials budget of \$60,000.

ODOT is placing an increased emphasis on system preservation and preventive maintenance programs for priority and general system roadways. A long term, life cycle cost approach to preserving roadway assets will yield cost savings and ultimately improve pavement conditions. In fiscal year 2018, ODOT statewide has spent 90% of its \$2.4 billion construction budget on system preservation projects. Similarly, NOACA has been incentivizing road maintenance and preservation through its support of a life-cycle approach to pavement management.

PUBLIC SAFETY

Vehicle miles traveled have been increasing to pre-economic downturn levels, and unfortunately, the rates of fatalities and injuries have increased also, especially in the heavily urbanized counties. In the past four years, preventable deaths and serious injuries have risen across Northeast Ohio, as shown in Figures 2 and 3 below:

FIGURE 2: NEO ROADWAY FATALITIES

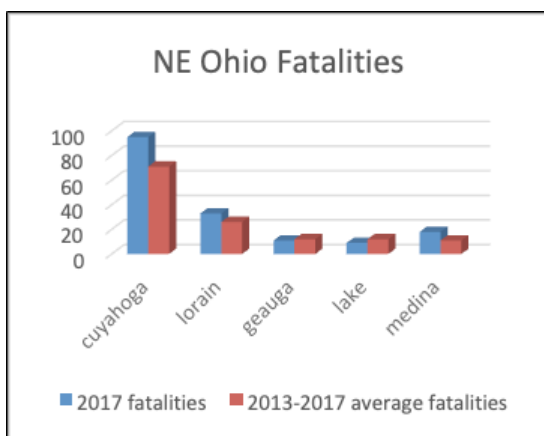
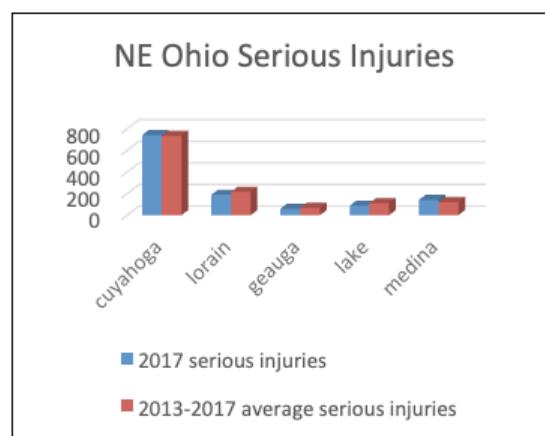


FIGURE 3: NEO SERIOUS ROADWAY INJURIES



2017 Highway Safety Statistics compiled by ODOT reveal a total of 1,179 fatalities and 303,283 crashes statewide. In the five county NOACA region, 2017 data reveal 166 fatalities (14% of state) and 49,973 crashes (16.47%). The silver lining is ODOT's robust safety program is a high priority and well-funded, providing \$102 million per year. It includes Ohio's Strategic Highway Safety Plan and Ohio's Journey Toward Zero Deaths program.

RESILIENCE

ODOT published an Infrastructure Resilience Plan on May 6, 2016. The key objective of this study was to identify the vulnerability of ODOT's transportation infrastructure to climate change effects and extreme weather events. A key action item of this study was the designation of a specialist within ODOT to manage a divisional cross-cutting initiative that maintains ODOT's focus on core infrastructure vulnerability to climate change impacts. NOACA has also addressed transportation system resilience by identifying climate-related risks such as intense precipitation and extreme temperature fluctuations.

Northeast Ohio is fortunate to have a generally redundant transportation system. The highly urbanized areas of Cleveland and all of Cuyahoga County are well served by an extensive Interstate, freeway, and urban arterial roadway network. Lake, Lorain, and Medina counties have continued to develop and transform into strong suburban counties also served well by Interstates and major and minor arterial roadways. Geauga County is the most rural county and is served by an adequate roadway network. In the event of a complete roadway closure, a suitable alternate transportation route would be available in nearly all cases to detour traffic, with the acknowledgement that traffic congestion and travel delay could be significant.

The availability of Emergency Operations plans serves as a proxy to assess resilience. Therefore, Cuyahoga and Lake Counties have emergency plans in place. Cuyahoga county utilizes an addendum to the Cuyahoga County Emergency Operations Plan, which provides detail on responsibilities and actions required.

SUCCESS STORY HIGHLIGHT:

The I-90 east corridor, located along Lake Erie east of Cleveland through Lake County, historically receives heavy snowfall and frequent white-out conditions. A crash in December 2016 received national press due to the large number of vehicles involved, which resulted in an extended closure of I-90. ODOT determined that high speed plays a prominent role in winter weather-related crashes along the corridor and worked with the state legislature to allow a temporary reduction of posted speed limits. During the winter of 2017-2018, ODOT deployed temporary portable speed limit signs as a pilot project to reduce speeds during inclement weather. The project included the monitoring of real-time speeds on I-90 and posting reduced speeds based on set criteria. In addition, ODOT worked closely with the National Weather Service to monitor weather conditions. ODOT plans to replace the temporary installations with permanent variable speed limit signs for all future projects. The results of the temporary portable signs were promising; unlike previous winters, no weather-related multi-vehicle crashes caused significant delays and/or closures of I-90.

INNOVATION

Northeast Ohio has seen a fair share of innovative practices related to road infrastructure. The region benefits from Ohio's Transportation Research Center (TRC), which is the largest independent vehicle proving grounds in North America, located in Columbus, Ohio.

In 2018, a system allowing for weather-dependent variable speed limits was implemented on Interstate 90 in Lake County, which is the road segment most significantly affected by lake-effect snow, the results of which were positive. In 2017, two pilot Signal Timing Optimization Program (STOP) projects resulted in significant emissions, delay, and fuel savings. The City of Cleveland is among select cities in Ohio that are investigating workforce mobility, healthcare and education access, and mobility access for underserved, elderly and disabled populations. NOACA has implemented Street Supplies, an innovative program which provides pavement markings, cones, and other materials to set up temporary road infrastructure such as bike lanes, curb bump outs, and traffic circles. The temporary demonstrations allow the local decision makers and the general public to experience potential benefits of a transportation project before permanent construction. Finally, the Ohio Turnpike, a significant portion of which lies within this report's study area, is a test bed for autonomous and connected vehicles equipment, maintenance data collection, and safety condition monitoring.



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ROADS



RECOMMENDATIONS TO RAISE THE GRADE

Roadway agencies in Northeast Ohio are delivering projects efficiently with available funding resources. ODOT and transportation agencies are focused on existing roadway system preservation and maintenance projects. However, pavement condition ratings (PCR) and traffic crashes demonstrate a significant need for additional projects and funding levels, especially in the urban locales where PCR's are substandard and crash data reveals high levels. Actionable Items:

- **An increase in the state gas tax is needed to fund roadway projects. As noted previously, the gas tax in Ohio has been at the same rate of 28 cents/gallon since 2005.**
- **Encourage the development of sustainable future revenue options such as an electric vehicle (EV) tax or developing a Vehicle Miles Traveled (VMT) pilot program.**
- **All counties should maximize the yield from the permissive vehicle registration fees.**
- **Congestion and safety projects, such as the Cleveland Innerbelt Plan, need to be completed earlier than currently planned. The current delivery schedule for Contracts Group 3 (Central Interchange 2020-2023), Group 4 (Innerbelt Curve 2024-2029), and Group 5 (Innerbelt Trench 2029-2034) delays the much-needed improvements and safety benefits.**
- **Reduce the number of traffic accidents (nearly 50,000) and roadway fatalities (166). Roadway Safety in Northeast Ohio could be further improved by enhanced focus on driver education to combat distracted driving caused crashes, and by evaluating which countermeasures are reducing crashes, which are reducing crash severity, and which may have unintended consequences.**



ROADS



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ROADS



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SCHOOLS



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SCHOOLS GRADE: D

EXECUTIVE SUMMARY

The NOACA (Northeast Ohio Area Coordinating Agency) region of Northeast Ohio is home to 67 school districts and approximately 250,000 students. A recent survey by the Cleveland Section of ASCE indicates 52% of schools in the region have not undergone significant renovations over the past 40 years, and only 57% of school districts have buildings that meet current state and/or federal standards. Funding from the Ohio Facilities Construction Commission (OFCC) is offered to schools based on an eligibility ranking system; those schools with the highest eligibility are ranked as #1. Within the NOACA region, school district eligibility rankings range from #1 to #606 out of 607 school districts statewide, with an average ranking of 447. OFCC's available funding spiked in 2008 from a tobacco settlement, resulting in four years of over \$800 million available per year to K-12 schools, but over the past five years construction disbursements have dropped to an average of approximately \$275 million per year. Resilience is another concern: 91% of school buildings are designated to serve as emergency shelters, but only 27% of school buildings have backup power systems, only 57% comply with state and/or federal health and safety codes and only 36% are constructed to withstand a natural disaster of the type common to northern Ohio.

CONDITION AND CAPACITY

Responses from a 2017 survey of the schools within the region by the Cleveland Section of ASCE indicate that 18% of districts are currently using temporary buildings (e.g. trailers) to house classrooms. For approximately 52% of school buildings, more than 50 years have elapsed since their last major renovation, and 55% of the buildings are rated as “fair” to “poor”. On the other hand, 85% of the outdoor facilities (i.e. parking lots, playgrounds, sporting fields, etc.) were rated as “good” to “new”.

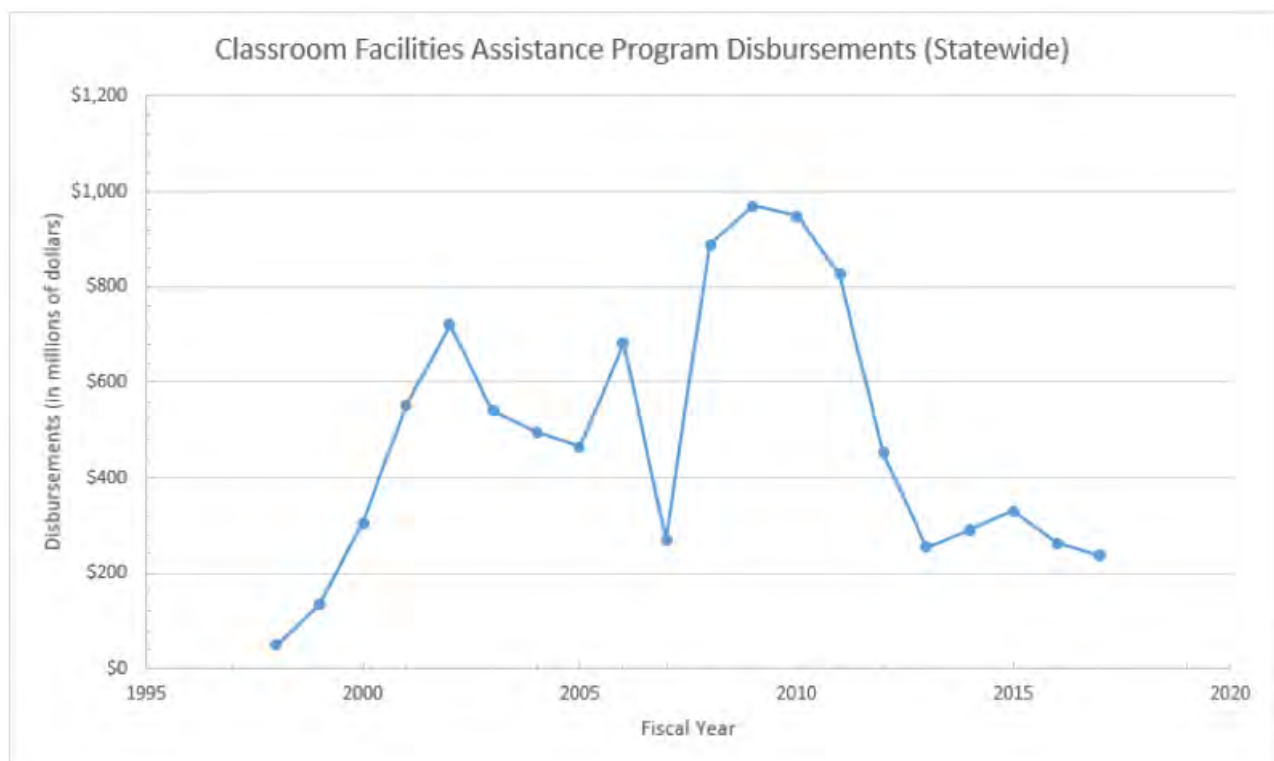
Only 57% of school districts have buildings that meet current state and/or federal standards. Although this may not necessarily make them unsafe, a great deal of operational efficiency is lost as a result, which hits the financial bottom line of the affected districts.

Student enrollment in the region has slowly decreased at an average rate of 1.7% over the last seven years. However, the need for modern facilities to foster an atmosphere where students can learn and grow into the next generation of leaders, business owners, trade workers, engineers, scientists and artists has never been greater. It is therefore encouraging that 82% of school districts in the region have a capital improvement plan or master plan to chart their course for the near future.

FUNDING AND FUTURE NEED

On average, 32% of the operational funding for schools within the NOACA region originates from the state, with state funding ranging from 13% to 67% across the region. Local revenue accounts for an average of 55% of the funding across the region and ranges from 13% to 79%. The remaining 13% of funding comes from federal or other, non-specified, sources. Local tax operating millage rates range from 34.7 mills to 183.4 mills with an average of 74.4 mills.

FIGURE 1: OFCC FUNDS DISBURSED TO OHIO SCHOOL DISTRICTS



The Ohio Schools Facilities Commission (OSFC), founded in 1997, and now part of the Ohio Facilities Construction Commission (OFCC), has made significant efforts over the past 20 years to fund school construction and assist school districts across the state to create and follow master plans, assess current conditions, identify needs and create a plan to move forward. Funding is offered to schools based on an eligibility ranking system; those schools with the highest eligibility are ranked as #1. Within the NOACA region, school district eligibility rankings range from #1 to #606 out of 607 school districts statewide, with an average ranking of 447. In some instances, the low-ranking number may be the result of the school district having completed necessary renovations and/or new construction and therefore not currently being in need of additional construction funding. Another reason for low ranking may be related to the local district wealth as assessed by the OFCC formula. Whatever the cause, the low eligibility rankings decrease the availability of funding, from both a schedule and percent match basis, since the amount funded to districts is often directly connected to the eligibility ranking.

Once offered funding, the school district must provide the local share before OFCC funds will be allocated. Most often, this requires the local school district to seek passing an additional levy (or levies), which typically requires an average of two to three attempts before being passed by local voters. Alternately, many local school districts elect to forego assistance from OFCC and fund construction entirely on their own. Spending data for this approach is not available and thus obscures the full effort being expended to fund construction. Since its inception in 1997, and as of the end of fiscal year 2017, the OSFC/OFCC has helped fund the construction of 1,167 K-12 school facilities across the state, equating to approximately one building a week. Funding for yearly construction spending has varied significantly over the 20 fiscal year lifespan of the OFCC, and has been punctuated by periods of significant investment, as shown in Figure 1.

Funding levels increased significantly during the first few years after the Classroom Facilities Assistance Program (CFAP), OFCC's most popular K-12 funding program began, followed by a generally steady drop until 2008 when additional funding was allocated to school construction from a tobacco settlement, resulting in four years of over \$800 million available per year. Following that spike in investment, construction disbursements through the CFAP has dropped to an average of approximately \$275 million over the past five years. Due to the variability of approaches to fund school construction and the limited availability of information other than that provided by OFCC, it is difficult to determine if the recent rate of construction spending is sufficient to address the deficiencies and needs of the school districts within the region.

OPERATION AND MAINTENANCE

The majority of districts from the 2017 ASCE Cleveland schools survey having sufficient staff to maintain the buildings and grounds along with 82% of districts having an operation and maintenance (O&M) plan. However, 45% of school districts reported the need to postpone replacement of major systems such as plumbing, electrical or heating, ventilation and air conditioning (HVAC) equipment due to budget shortages. Associatively, according to survey respondents, only 5% of school buildings utilize a sustainable energy source and only 3% of the buildings are LEED certified. It is noteworthy, however, that the State of Ohio leads the nation in LEED certified school buildings at 292 total buildings, easily outpacing the next highest state which has 148 LEED certified schools.

PUBLIC SAFETY AND RESILIENCE

91% of school buildings are designated to serve as emergency shelters in the event of an emergency in the community. However, only 27% of school buildings have backup power systems, only 57% comply with state and/or federal health and safety codes and only 36% are constructed to withstand a natural disaster of the type common to northern Ohio. The inability of buildings designated as public shelters to fully function in their appointed role presents a significant risk to the general public who may need to rely on these buildings in the event of a disaster.



SCHOOLS



RECOMMENDATIONS TO RAISE THE GRADE

- **Governments at every level should regularly require prescribed condition assessments of their public school facilities and publish this data.**
- **Encourage school districts to adopt regular, comprehensive major maintenance, renewal, and construction programs, and implement preventative maintenance programs to extend the life of school facilities.**
- **Expand existing funding mechanisms and explore new alternatives to funding school construction.**
- **Develop capital planning approaches that allow flexibility to address changes in technology, demographics and the needs of the community.**

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WASTEWATER



PHOTO COURTESY OF NEORS D



WASTEWATER GRADE: D+

EXECUTIVE SUMMARY

There are over 5,000 miles of underground pipes in Northeast Ohio connecting homes and businesses to 45 publicly-owned wastewater treatment plants. On a dry day, capacity in the system is double the average daily volume generated. However, the region is home to 860 communities with combined sewer systems (CSS), or sewers designed to collect rainwater runoff and sewage in the same pipe. The size and capacity of CSS are the limiting factor during rainfall events, and when the stormwater combines with the wastewater in the sewers, there simply is not enough capacity and the system must relieve itself, either through discharges into receiving waters or basement flooding. The Northeast Ohio Regional Sewer District has identified over \$3 billion of capital improvements needed to mitigate the combined sewer overflow issues in the region, plus another \$3 billion to address “non-CSO” (combined sewer overflow) contributing water quality issues, including basement flooding, failing septic systems and illicit sanitary discharges into the environment. In general, much of the wastewater infrastructure in the region is aging, and approximately 25% of the sewer pipes in NE Ohio are over 80 years old.

OVERVIEW

Northeast Ohio maintains a public wastewater infrastructure system. This system treats over 450 million gallons of wastewater daily, the equivalent of 700 Olympic size swimming pools. The regional wastewater infrastructure is comprised of pipes and treatment plants owned and operated by local communities and regional entities. Over 5,000 miles of sanitary sewers (underground pipes containing sanitary water) and combined sewers (underground pipes containing both storm water and sanitary water mixed together) flow into 45 publicly-owned treatment plants. If the length of these sewer pipes were laid end to end, they would extend from Cleveland to Los Angeles, and back.

This vast pipe network has different owners within each of the various communities. The collection of sewage is largely the responsibility of over 100 local municipalities. The smaller local sewer systems are connected to larger sewers that are owned by the Northeast Ohio Regional Sewer District (NEORS). These larger sewers, called interceptors, connect and convey sewage from the locally-owned pipes to the treatment plants. NEORS is the largest wastewater operator within the five-county Northeast Ohio area. It treats over 50% of the daily wastewater flow of the region [Ref. 1] with the rest of the flow treated by smaller plants owned by local communities, including some county agencies. Outside of NEORS, many communities own and operate their own treatment plants or have agreements with nearby communities. In the rural areas of Northeast Ohio, particularly in Geauga County, public wastewater infrastructure is extremely limited. Those areas are served primarily by privately owned septic tanks or very small treatment plants.

CONDITION

The condition of plant and pipe assets vary from community to community. It is largely influenced by the age of the infrastructure, the maintenance of the infrastructure, and the financial ability to address the needs. Plants treating the majority of regional wastewater are generally well maintained and plants are updated regularly. Therefore, no major condition issues were reported. The plants follow and exceed industry accepted standards for maintenance and capital improvement. For example, the region's largest treatment plant, the Southerly Wastewater Treatment Center, is operated by NEORS and continues to receive awards for high treatment quality including the Envision Silver Award for Sustainable Infrastructure [Ref 5 &6].

However, in general much of the wastewater infrastructure is aging, which can cause public health and water quality challenges. Approximately 25% of the sewer pipes in NE Ohio are over 80 years old. Most of the sewer pipes were made from bricks, with an average lifespan near 100 years. Over time, the mortar holding bricks and pipe joints together can weaken and crack. Surrounding tree roots can also intrude and interfere with the integrity of the pipes. The defective openings in the sewer pipes provide an opportunity for nearby storm water to enter the pipe system, producing much higher flow rates than the pipes were originally designed to carry. The additional flow can cause hydraulic surcharging in the sewers that may result in basement flooding and/or sewer overflows to local creeks, rivers or Lake Erie. This is particularly true in the older, urban areas.

Currently, communities that discharge untreated wastewater into rivers and other bodies of water are regulated by the Environmental Protection Agency (EPA) under the Clean Water Act and Combined Sewer Overflow (CSO) Policy. The EPA issues National Pollutant Discharge Elimination System (NPDES) permits to these communities that outline allowable levels of discharge that can occur. NEORS and many local municipalities have either already entered into or currently negotiating consent agreements to control CSO. To reduce CSO discharges to the environment from these communities, significant investment is required.

The condition of the wastewater infrastructure in Northeast Ohio is comparable to the national average and to the other 860 communities with combined sewer systems (CSSs). The collection system is aging and nearing the point where higher levels of investment will be needed to maintain the structural integrity of the pipes.

CAPACITY

On a dry day, Northeast Ohio's sewer system conveys sanitary flows to wastewater treatment plants for full treatment. The dry weather wastewater treatment capacity is nearly double the average daily volume generated in its service area. Many of the regional urban treatment plants were constructed when the population was higher and have ample capacity. As the population migrated away from the urban core of Cleveland, these plants were built and designed to accept higher flows. Even with the increased capacity of the larger treatment plants, the size and capacity of the CSS are the limiting factor during rainfall events. When the stormwater combines with the wastewater in the sewers, there simply is not enough capacity and the system must relieve itself, either through CSO discharges or basement flooding.

Communities within Northeast Ohio have been investing in new infrastructure to reduce and eliminate combined sewer overflows. By 2020, it is anticipated that the annual CSO volume will be 70% lower than the recorded 1972 levels within the NEORS service area [Ref. 4]. However, even with these reduced levels, over 2 billion gallons of annual CSO volume will enter local waterways until future planned projects are implemented through 2036.

In addition to CSOs, local municipalities report widespread basement flooding and sanitary sewer overflows. Some communities are attempting to address these issues on their own; however, due to design and construction approaches unique to Cleveland suburbs before 1970 has created a leaky sanitary sewer network. Most communities are unable to fund improvements on their own. The burden of addressing overflows and basement flooding will continue to be dual problems to the region even as agencies plan and implement improvements to the system.

OPERATION AND MAINTENANCE

Although the plants are well maintained, the upkeep of the sewer pipes remains a challenge. The majority of the region's 5,000 miles of sewer pipe were installed prior to 1970 and are owned by the local municipalities. Although the condition of most of the pipes are estimated to be adequate over the next 10 years, without proper maintenance, the structural integrity of the pipes will eventually erode and lead to pipe collapse and higher costs of repair. With the local municipalities bearing most of the burden for pipe inspection, maintenance and repair, upkeep will continue to place a strain on the region's wastewater infrastructure resources. Continued sewer rate increases are expected in future decades to address onset of failing infrastructure. Near-term rate increases are recommended to proactively inspect, quantify and address condition of the sewer pipes

PUBLIC SAFETY

Direct human exposure to high bacteria levels at Northeast Ohio beaches represent a significant risk to human health. In 2017, Northeast Ohio beaches experienced health advisories due to high bacteria every 1 out of 5 days (20% of the beach season) [Ref 3]. The inability of the current wastewater infrastructure to treat sewage combined with stormwater during rainfall events, creates CSO discharges into Lake Erie, in some instances in close proximity to recreational beaches.

FUNDING

Most wastewater infrastructure investment in Northeast Ohio comes from local wastewater fees. Like the rest of Ohio, Northeast Ohio rate payers have seen sewer rate increases outpace inflation since the mid-1980s [Ref 7]. The increased investment in wastewater infrastructure has resulted in enhanced treatment capabilities in capacity, water quality, and construction of the region's CSO mitigation program, Project Clean Lake. For the most part, these infrastructure improvements are funded through the Water Pollution Control Loan Fund (WPCLF, Ohio EPA's State Revolving Fund) and bond funding. While interest rates are low, the burden of debt repayment remains with the local rate-payers. Additional investment, either through additional rate increases of state and federal support to address the \$6 billion in infrastructure need, basement flooding and water quality issues will persist.

The Northeast Ohio Regional Sewer District has identified over \$3 billion of capital improvements are needed to mitigate the CSO issues in the region, plus another \$3 billion to address "non-CSO" contributing water quality issues, including basement flooding, reduction/elimination of CSOs, failing septic systems and illicit sanitary discharges into the environment. The CSO compliance cost will be shared between NEORSD's member communities while the funds for the remaining estimated \$3 billion needed in water quality infrastructure upgrades has yet to be identified. In addition to the WPCLF, federal programs such as the Water Infrastructure Finance and Innovation Act of 2014 (WIFIA) and the recent passage of the America's Water Infrastructure Act offers potential sources of investment funds

FUTURE NEEDS

Future wastewater infrastructure needs will be largely determined by long-term trends affecting the region. One trend is the outward migration from the urban core. NOACA estimates that through 2040 that the population of Cuyahoga County will decrease by 13% while surrounding counties will increase by 7% [Ref 8]. The outward migration will cause additional stress on both existing rural and urban wastewater infrastructure. Many of Northeast Ohio's septic systems require attention. Approximately 39% of these septic systems are considered failing [Ref 9]. Additional population in rural areas will add stress to these existing septic systems and possibly require new sewers and treatment facilities. The outward migration will also cause stress on the maintenance and upkeep of existing infrastructure. As the urban population decreases, less resources will be available to maintain the existing infrastructure. This will require new or increased sewer fees to maintain the future sewer infrastructure properly.

The second trend is increased focus on Lake Erie's water quality. The EPA recently designated Lake Erie's western basin as an impaired water body [Ref 10]. Water quality targets have been identified to reduce harmful algal blooms on Lake Erie. Northeast Ohio wastewater systems drain to Lake Erie's central basin where the lake is experiencing hypoxia (lack of oxygen) and harmful algal blooms, both of which are worsened by the over-abundance of nutrients like phosphorus. The Ohio Domestic Action Plan calls for a reduction of phosphorus discharge of 40% by 2025 in Lake Erie's central basin [Ref 11]. Local efforts to address Lake Erie water quality are ongoing and continue to focus on stormwater related discharges. New regional and stormwater programs are identifying flooding, erosion and water quality problems due to urbanization. The new programs offer infrastructure solutions.

In addition to problems due to storm water runoff, regional and community agencies continue to address the sanitary/combined overflows. While solutions are being developed for stormwater related issues, the changing regulatory environment continues to put pressure on local wastewater operators. As the US EPA further defines stormwater discharge and overflow enforcement policy, local operators may face increasingly higher water quality standards and enforcement. Several wastewater operators have either already agreed to federal consent decrees or face potential for future enforcement. The increased focus on water quality will require further investment on storm and wastewater infrastructure.

INNOVATION

Innovation within the wastewater industry is accomplished through creative engineering and sustainable programs. For example, at NEORS's Southerly WWTC, the new Renewable Energy Facility uses excess heat from the incineration process to generate electricity for 25% of the facility's electrical needs resulting in significant annual utility cost savings [Ref 12].

Recently, NEORS has also introduced several new programs and initiatives to assist local municipalities with their infrastructure needs. These programs include:

- **GREEN INFRASTRUCTURE GRANTS:** These grants are provided to communities within the CSS area for projects that control and divert stormwater from the CSS to stormwater control features such as rain gardens, bioswales, and bioretention facilities.
- **COMMUNITY COST SHARE PROGRAM:** NEORS's community cost share program provides funding to member communities to address stormwater related issues such as erosion or storm sewer upgrades.
- **MEMBER COMMUNITY INFRASTRUCTURE PROGRAM (MCIP) INVESTMENTS.** NEORS's Member Community Infrastructure Program (MCIP) is designed to provide matching funds to community infrastructure projects that provide water quality benefits to the region, including reduction of basement backups, failing septic systems, sanitary sewer overflows and illicit discharges.

Several regional efforts continue to bring clean water organizations together to improve infrastructure. The Northeast Ohio Area Coordinating Agency works with regional entities, municipalities, watershed groups, stakeholders, regulators and private citizens to collaborate on planning efforts across the region. Their programs help parties share information, continue education and collaboration on infrastructure and water quality issues. The Cleveland Water Alliance is a non-governmental organization working to drive and implement innovative partnerships between utilities, governmental agencies, academia, industry and other stakeholders. Their mission of economic development through water quality improvement is being realized through the establishment of partnerships of interested parties committed to improving Northeast Ohio's quality of life including advocating for smarter data infrastructure to support drinking and waste water partners. An example of a project the organization is leading includes a utility and industry supported Harmful Algal Bloom warning system that involves on the ground infrastructure investments (sensors, buoys, Internet of Things-based technology) tied to predictive data analytics tools and visualization products for both utility and community use.





WASTEWATER



RECOMMENDATIONS TO RAISE THE GRADE

Recommendations to raise the grade of the Northeast Ohio Drinking Wastewater Infrastructure echo those issued for the U.S. as a whole and reflect the policies of ASCE:

- Achieve Clean Water Act compliance in a way that minimizes the impact on lower-income residents and on economic competitiveness through bill payment assistance; revisiting EPA affordability guidelines; renewed or enhanced federal and state aid; and redirecting other aid sources to sewer-mandate compliance.
- Raise awareness of the rising costs of wastewater treatment. Utilize education programs to demonstrate wastewater infrastructure's impact on Clean Water with implementation of programs to provide rate payers sense of ownership over wastewater infrastructure.
- Support green infrastructure, which provides co-benefits such as water and air quality improvement, aesthetic value to communities, and cost competitiveness.
- Expand regional collaboration, particularly through NOACA, to find innovative solutions and partnerships to spur reinvestment.
- Create a regional data sharing network where regional agencies and local communities share information on Clean Water Issues, wastewater infrastructure, and innovative solutions.
- Reinvigorate the State Revolving Loan Fund (SRF) under the Clean Water Act by reauthorizing the minimum federal funding of \$20 billion over five years.
- Fully fund the Water Infrastructure Finance and Innovation Act (WIFIA) at its authorized level.
- Preserve tax exempt municipal bond financing. Low cost access to capital helps keep lending for wastewater upgrades strong and accessible for communities large and small.
- Establish a federal Water Infrastructure Trust Fund to finance the national shortfall in funding of infrastructure systems under the Clean Water Act.



WASTEWATER



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COMPARISON TO AMERICA'S GRADES

	Northeast Ohio	USA
OVERALL GPA	D+	D+
Bridges	C-	C+
Dams	D+	D
Drinking Water	C-	D
Energy	D	D+
Roads	D+	D
Schools	D	D+
Wastewater	D+	D+

The cumulative GPA of the Northeast Ohio infrastructure is a D+, identical to the National GPA. On a category by category comparison, we see that in spite of many challenges, our dams, drinking water and roads fare better than the national average. Our bridges, energy and school infrastructure have received a grade slightly lower than America's, while our wastewater systems are on par with the country as an average.

RECOMMENDATIONS TO RAISE THE NORTHEAST OHIO GRADES

Our highest rated categories, bridges and drinking water, are in mediocre condition, and the remaining five categories we studied are in poor condition and already at risk. It is possible, however, to raise the grades of all categories. The previous chapters contain multiple ideas to improve our region's bridges, dams, drinking water, energy, roads, schools, and wastewater systems' infrastructure. In a nutshell, our overall recommendations are:

- Increase the state gas and diesel taxes to pay for necessary road and bridge projects and ensure local governments receive adequate disbursements to maintain local surface transportation infrastructure. Ohio's fuel taxes have not been increased since 2005. By 2020, the Ohio Department of Transportation will face an annual budget shortfall of nearly \$1 billion when compared to what was available in 2014. Increasing the state gas and diesel taxes will provide much-needed funding to pave, fix potholes, provide bridge maintenance, create safety enhancements, and more.
- Make Northeast Ohio more economically competitive by increasing investment in infrastructure across all sectors. There have been modest population declines in the region as residents leave for opportunities elsewhere. Population decline can be slowed, and even reversed, with robust, sustained investment in our water and wastewater systems, energy grid, dams, roadways and more. Northeast Ohio would be wise to invest in the region's backbone – its infrastructure – to incentivize businesses to relocate or stay put.
- Plan for the future by investing in school facilities and training tomorrow's workforce. Schools infrastructure was one of the lowest categories in the 2019 Report Card for Northeast Ohio. Properly maintained facilities improve a student's ability to learn. Sufficient funding to repair and replace school facilities is needed. Additionally, students require training for in-demand careers in our region, including those in the drinking and wastewater operations industry.
- Continue to invest in wastewater infrastructure to ensure the health of Lake Erie.

ADDITIONAL REFERENCES

In addition to the documents referenced in each individual chapter, this report refers to:

American Society of Civil Engineers,
2017 Infrastructure Report Card

US Census Bureau

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ABOUT THE CLEVELAND SECTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

The beginnings of the Cleveland Section ASCE can be traced to 1880 when a group of Cleveland engineers formed the Civil Engineers Club. This group, which was not affiliated with ASCE, later changed its name to the Cleveland Engineering Society. On April 11, 1914, then Cleveland Engineering Society President, A. J. Himes, Bridge Engineer of the Nickel Plate Road, called a meeting, at which a committee was appointed to organize an ASCE Chapter in Cleveland. The first meeting of the "Cleveland Chapter, ASCE" was called to order on October 28, 1914, the first officers were elected on December 19, 1914, and on January 6, 1915, the National Board of ASCE approved the Cleveland Section's Constitution.

Prior to 1946 the Cleveland Section included much of northern Ohio. Today it encompasses the counties in northeastern Ohio extending from Elyria on the west to the Pennsylvania border on the east and south to Jefferson County, with the exception of the Akron-Canton and Mansfield areas. The Cleveland Section supports student chapters at Case Western Reserve University, Washkewicz College of Engineering at Cleveland State University and Youngstown State University and includes the Youngstown Branch. It has more than 700 members.

Two Cleveland Section members served as the ASCE Society (National) President: G. Brooks Earnest in 1962 and Randall S. Over in 2014. Its members include professionals in the public, private and academic sectors, and many have leadership positions within ASCE, both at the local and national levels.

The section holds several technical lectures throughout the year, as well as outreach events to help promote the profession to young students.

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MESSAGE FROM THE ASCE CLEVELAND SECTION PRESIDENTS

Our infrastructure needs improvement. You most likely have heard infrastructure being discussed by the government at the national and state levels, with funding estimates in the billions and trillions of dollars. You've probably had experiences with roads and bridges in your own neighborhood where it was clear they're in need of repair, not to mention seeing news reports around the nation of bridge collapses and water crises. This report card, much like ASCE's Infrastructure Report Card for the entire U.S., was created to highlight the most pressing infrastructure needs. It is, however, tailored to the needs of Northeast Ohio; it dials in the microscope another level, giving us, the residents and local decision makers, a more detailed idea of the state of the infrastructure of Cuyahoga, Geauga, Lake, Lorain and Medina counties.

This report card was produced by the effort of dozens of ASCE Cleveland volunteers over more than two years. Although I'm the president of the Section at the time of its release, I was not the president when it started, nor was I through its first years of data collection and organization. I would like to personally thank the past presidents who supported the Report Card Committee's efforts, and greatly thank the members of the Committee that spent their own time putting this report card together, collecting data, and procuring funding for its release. This is a true representation of the selflessness that our members exhibit by volunteering to be involved with the Section, all with the goal of using their skills and knowledge as civil engineers to improve the situations in which we all live and work.

Ryan O'Hearn, P.E.
ASCE Cleveland Section President 2018-19

"I would like to thank all the members of the ASCE Cleveland Section who volunteered countless hours of their own personal time to develop the Northeast Ohio Report Card. I would especially like to thank the Committee Chair, Gina Beim and Co-Chair Ed Adamczyk for leading the effort, as well as, the numerous public officials who took the time to assist the committee. Thank you!"—Craig Hebebrand, P.E., ASCE Cleveland Section Past President 2016-17

"The deteriorating infrastructure in this country is a critical issue that will continue to grow as a burden on our economy if not addressed. As a non-profit organization one of our best tools to effect change is education of the public. This report card is the result of the effort of a group of people who believe in the common goal of educating the public to help strive for a better country for future generations. To all that assisted in this cause, thank you for your dedication to this goal!"—Matthew Benovic, P.E., S.E., ASCE Cleveland Section Past President 2017-18