

# **NOACA Technical Memorandum**

## **Bridge and Pavement Technical Memorandum**



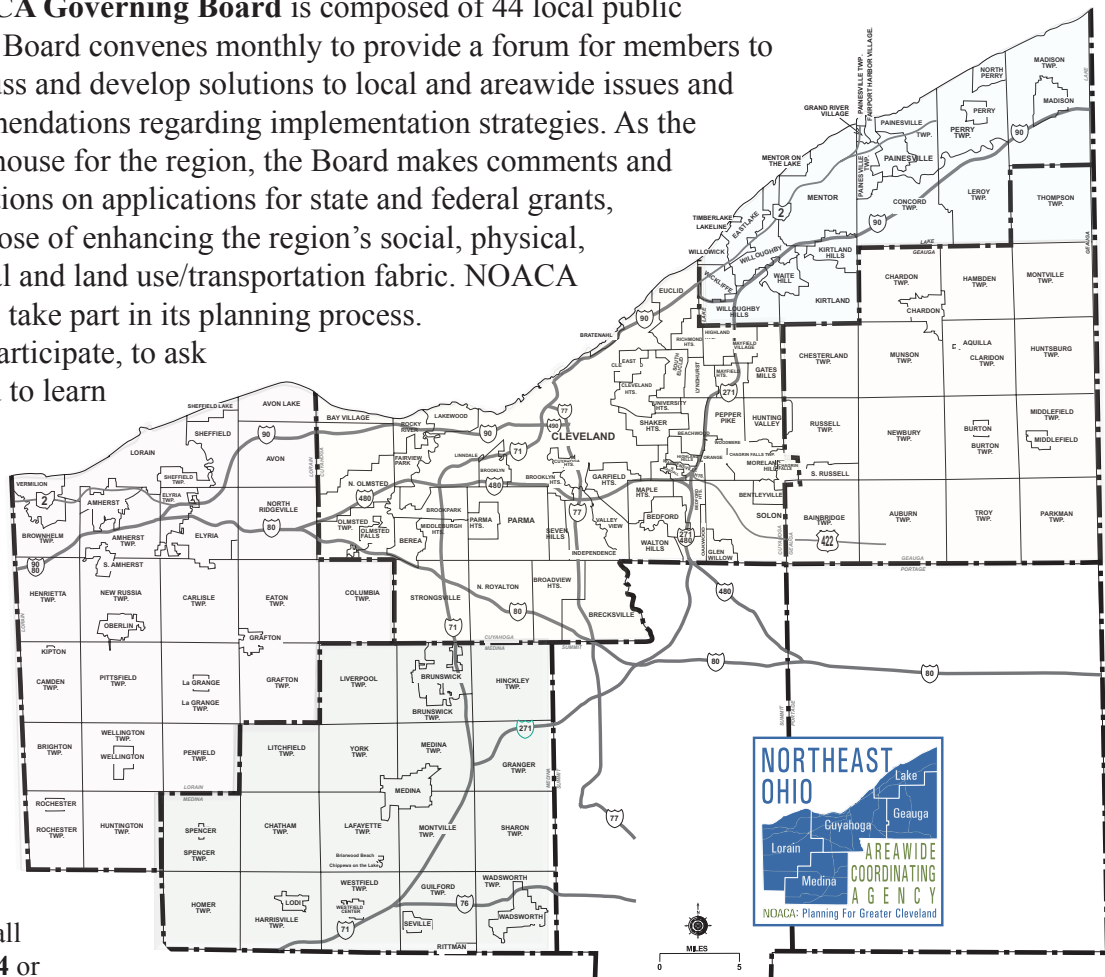
April, 2013

**The Northeast Ohio Areawide Coordinating Agency (NOACA)** is a public organization serving the counties of and municipalities and townships within Cuyahoga, Geauga, Lake, Lorain and Medina (covering an area with 2.1 million people). NOACA is the agency designated or recognized to perform the following functions:

- Serve as the Metropolitan Planning Organization (MPO), with responsibility for comprehensive, cooperative and continuous planning for highways, public transit, and bikeways, as defined in the current transportation law.
- Perform continuous water quality, transportation-related air quality and other environmental planning functions.
- Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.
- Conduct transportation and environmental planning and related demographic, economic and land use research.
- Serve as an information center for transportation and environmental and related planning.
- At NOACA Governing Board direction, provide transportation and environmental planning assistance to the 172 units of local, general purpose government.

**The NOACA Governing Board** is composed of 44 local public officials. The Board convenes monthly to provide a forum for members to present, discuss and develop solutions to local and areawide issues and make recommendations regarding implementation strategies. As the area clearinghouse for the region, the Board makes comments and recommendations on applications for state and federal grants, with the purpose of enhancing the region's social, physical, environmental and land use/transportation fabric. NOACA invites you to take part in its planning process.

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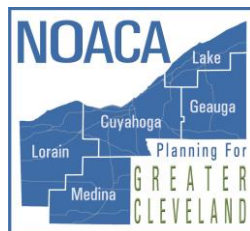
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# Bridge and Pavement Technical Memorandum

April 2013



**NORTHEAST  
OHIO  
AREAWIDE  
COORDINATING  
AGENCY**

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Preparation of this publication was financed by appropriations from the counties of and municipalities within Cuyahoga, Geauga, Lake, Lorain and Medina; the U.S. Environmental Protection Agency; and the U.S. Department of Transportation, Federal Transit Administration and Federal Highway Administration, in conjunction with the Ohio Department of Transportation.

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## **Abstract**

This technical memorandum estimates typical annual expenditures needed to keep the NOACA region's pavements and bridges in a state of good repair. This document was originally created in 2005, it is being updated in 2012 to reflect current needs and current cost estimates. This information will be used in NOACA's long range transportation plan (LRTP) analyses of financial needs. NOACA will adopt a new transportation plan in spring 2013. The information contained in this technical memorandum was produced in collaboration with NOACA staff and Ohio Department of Transportation (ODOT) staff from District 12 and Central Office.

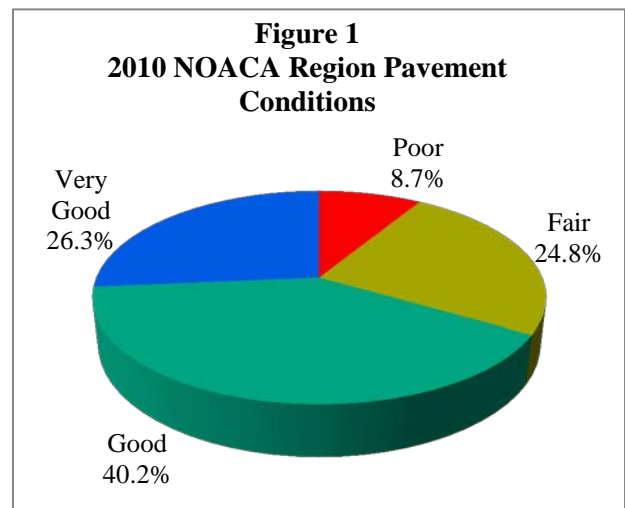
This technical memorandum estimates the cost of maintaining our region's pavements and bridges during the course of NOACA's LRTP. Between 2013 and 2035 this document estimates we will need more than \$4.2 billion to maintain the pavements and about \$2.2 billion to maintain bridges in our region. All financial estimates in this document are made in constant 2012 dollars.

## **Introduction**

In January 2012 NOACA worked with staff from ODOT District 12 to estimate the annual cost of keeping pavement and bridge systems in good repair. Over time, pavements and bridges deteriorate and need maintenance, repairs and eventually replacement. NOACA and ODOT staffs have developed a series of deterioration rates for bridges and pavements. These rates were based on historical monitoring of needed repairs and replacements on the bridge and highway systems. They were used to estimate needed annual repairs to both bridges and highways. Expenses for roadways were estimated based on the number of lane miles. For bridges, expenses were estimated by the deck area of the bridge in square feet (sq.ft.). These deterioration rates were applied to the region's roadways (on the federal-aid system) and bridges to estimate expected annual recurring expenses. These annual expenditures were also expanded to reflect expected total costs through the life of NOACA's LRTP.

The Regional Pavement Management System (RPMS) maintained by NOACA staff is a tool to analyze our region's pavement conditions. Data is collected and supplied by ODOT. Figure 1 shows the 2010 condition of the NOACA region's federal-aid roads. Over 66 percent of the region's roadway network is in good or better condition.

Figure 1 also shows that 8.7 percent of the 2010 federal-aid roadways are in poor condition (approximately 286 miles)<sup>1</sup>. Using the NOACA RPMS it was determined that \$619 million dollars in repairs would be needed to improve these pavements to very good condition.<sup>2</sup> Most of the repairs for these pavements are very expensive and typically involve complete replacements; this is due to their current poor condition. This expenditure of \$619 million dollars would be in addition to the \$4.2 billion dollars to maintain the region's pavements until 2035.



<sup>1</sup> 2010 pavement condition data is the most recent information available at the time this technical memorandum was written.

<sup>2</sup> NOACA staff used a backlog analysis in its RPMS to determine expenses needed to improve poor pavements. A backlog scenario allocates unlimited funding to provide every needed repair in the paving network.

## Estimated Expenditures for Pavements

ODOT estimated annual roadway repairs by lane mile. Financial estimates (cost indices) of repairs were also reported by lane mile. All roadways that have a functional classification higher than an urban or rural local road are eligible for federal-aid. These were the roadways to be considered in this analysis.

The first step in this process was to calculate the number of lane miles by functional classification in the NOACA region. This was completed by using 2011 ODOT road inventory GIS files. These road inventory files include information showing the functional classification, length, and number of lanes for all links or roads. The results of these calculations are shown in Table 1, which lists the number of lane miles, by functional classification, by county.

**Table 1**  
**Approximate Lane Miles from ODOT's 2011 Road Inventory Files**

FC Code	FC Name	Cuyahoga	Geauga	Lake	Lorain	Medina	Total Lane Miles
01	Rural-Interstate	0.00	0.00	30.32	22.02	147.60	199.94
02	Rural-Principal Arterial	0.00	65.48	0.00	59.76	91.48	216.72
06	Rural-Major Arterial	0.00	54.70	0.00	36.70	55.58	146.98
07	Rural-Major Collectors	0.00	278.86	35.94	172.92	277.36	765.08
08	Rural-Minor Collectors	0.00	18.10	45.90	112.68	75.58	252.26
11	Urban-Principal Arterial-Interstate	890.70	0.00	127.04	177.70	70.11	1,265.55
12	Urban-Principal Arterial-Freeways/Expressways	80.73	24.64	101.38	82.36	0.00	289.11
14	Urban-Principal Arterial-Other	981.09	59.78	144.63	199.00	39.30	1,423.80
16	Urban-Major Arterial	1,422.48	70.58	244.56	425.01	100.32	2,262.95
17	Urban-Collector	963.18	129.28	302.78	278.10	186.78	1,860.12
	Total	4,338.18	701.42	1,032.55	1,566.25	1,044.11	8,682.51

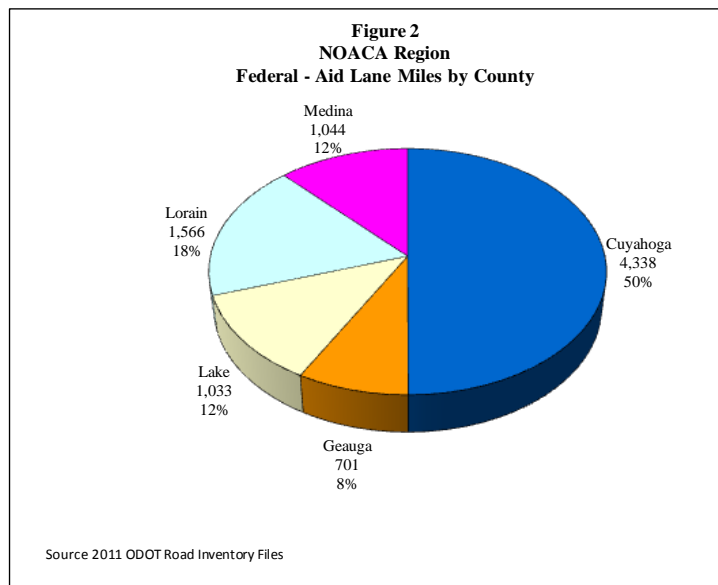


Figure 2 displays the information presented in Table 1. Note that 50% of the federal-aid roadways in the NOACA region are in Cuyahoga County.



ODOT identified three different paving categories to maintain its highway network. The priority system is identified as interstates and freeways on both the urban and rural systems. The city paving/maintenance system considers work within city boundaries. The rural two-lane system is for non-freeway paving projects outside of city boundaries. For this analysis we combined the number of lane miles for all roadways on the federal aid system in Table 1 into one of the three ODOT defined categories. The results are shown in Table 2.

**Table 2**  
**Approximate Lane Miles from ODOT's 2011 Road Inventory Files**  
**Compressed into ODOT's Defined Paving Categories**

Type of Paving	FC Codes	FC names	Cuyahoga	Geauga	Lake	Lorain	Medina	Total Lane Miles
Priority System	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	971.43	24.64	258.74	282.08	217.71	1,754.60
City Paving/Maintenance System	14,16,17	Urban; Principal Arterials, Minor Arterials, Collectors	3,366.75	259.64	691.97	902.11	326.40	5,546.87
Rural 2-Lane System	2,6,7,8	Rural; Principal Arterials, Major Arterials, Major & Minor Collectors	0.00	417.14	81.84	382.06	500.00	1,381.04
Total Federal-Aid			4,338.18	701.42	1,032.55	1,566.25	1,044.11	8,682.51

Table 3 shows the estimated percentage of lane miles that will need attention every year to keep roadways in acceptable condition. This information was provided by the technical services group at ODOT and estimated a long term average of repairs made by paving category by ODOT Districts 3 and 12. From this data the percentage of lane miles by paving category to be worked on annually were estimated. Also shown in this table is an approximate cost by lane mile for different types of roadway treatments that must be completed on an annual basis. The cost for paving treatments was estimated from NOACA's Regional Pavement Management System and by reviewing recently completed projects listed in ODOT's ELLIS database. NOACA counties within ODOT District 3 are Lorain and Medina Counties. NOACA Counties within ODOT District 12 are Cuyahoga, Geauga and Lake Counties.

**Table 3**  
**Cost per Road Treatment Type and**  
**the Percentage of Lane Miles of the System to be Addressed Annually**

Pavement Unit Costs	Unit Cost per Lane Mile	Functional Classifications to Consider	District 3 Percentage of System to be Addressed on an Annual Basis	District 12 Percentage of System to be Addressed on an Annual Basis
Rural 2-lane Paving	\$147,000	2,6,7,8	9.26%	4.73%
Rural 2-lane Ripout/Rehabilitation	\$475,000	2,6,7,8	0.69%	0.16%
City Paving	\$256,000	14,16,17	6.41%	4.50%
City Paving Ripout/Rehabilitation	\$800,000	14,16,17	0.55%	0.54%
Priority Paving Minor	\$183,000	1,11,12	4.99%	8.32%
Priority Paving Major	\$250,000	1,11,12	3.48%	4.12%
Complete Priority Ripout/Rehabilitation	\$800,000	1,11,12	1.36%	1.69%

The next step of this process was to calculate the number of lane miles by county that will need annual rehabilitation and maintenance. This information was further broken down by type of treatment needed. Specifically, the numbers of lane miles by type of paving category in Table 2 were multiplied by the annual percentages of pavements needing attention by ODOT in Table 3. Table 4 shows the estimated lane miles by county and by type of paving treatment that must be addressed annually to keep the system in a state of good repair.

**Table 4**  
**Estimated Annual Roadwork Completed**  
**on an Annual Basis**

Type of Paving	FC Codes	FC Names	Cuyahoga	Geauga	Lake	Lorain	Medina	Total Lane Miles
Rural 2-Lane Paving	2,6,7,8	Rural; Principal Arterials, Major Arterials, Major & Minor Collectors	0.00	19.73	3.87	35.38	46.30	105.28
Rural 2-Ripout/Rehabilitation	2,6,7,8	Rural; Principal Arterials, Major Arterials, Major & Minor Collectors	0.00	0.67	0.13	2.64	5.00	8.43
City Paving/Maintenance	14,16,17	Urban; Principal Arterials, Minor Arterials, Collectors	151.50	11.68	31.14	57.83	29.67	281.82
City Ripout/Rehabilitation	14,16,17	Urban; Principal Arterials, Minor Arterials, Collectors	18.18	1.40	3.74	4.96	3.26	31.54
Priority Minor	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	80.82	2.05	21.53	14.08	21.77	140.25
Priority Major	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	40.02	1.02	10.66	9.82	6.53	68.05
Complete Ripout/Rehabilitation	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	16.42	0.42	4.37	3.84	2.18	27.22
<b>TOTAL</b>			<b>306.95</b>	<b>36.97</b>	<b>75.44</b>	<b>128.53</b>	<b>114.71</b>	<b>662.59</b>

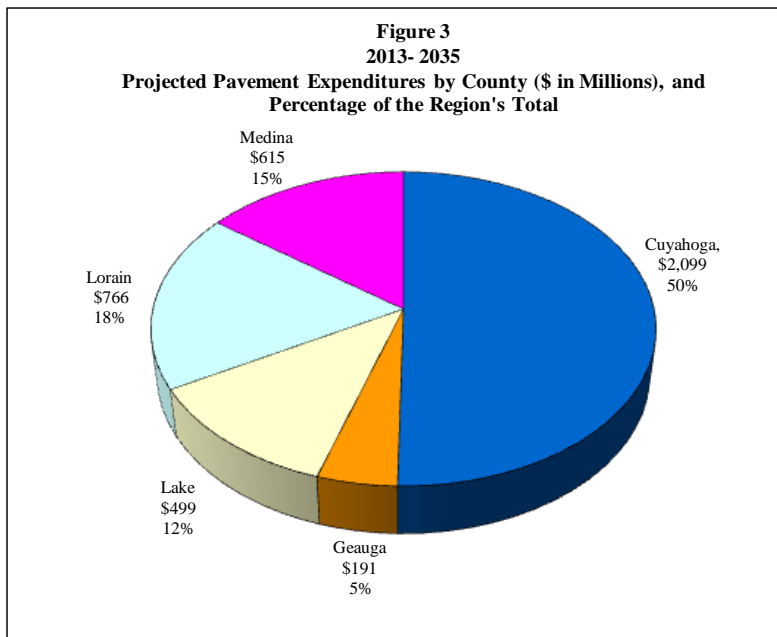
The last step of this process was to estimate the annual expense for the projected pavement treatments needed by each county. This was done by multiplying the results in Table 4 (number of lane miles needing road work) by the cost for each different paving treatment from Table 3. Table 5 shows the estimated annual expenses by county. Also included in Table 5 is the projected total cost to keep the pavement system in a state of good repair throughout the life of NOACA's LRTP. Current projections show that almost 4.2 billion dollars will be needed to maintain the roadway network from now until 2035.

**Table 5**  
**Estimated Annual Cost of Roadwork Completed**  
**and Total Pavement Expenses for the Life of NOACA's Long Range Transportation Plan**  
**(Cost in Millions)**

Type of Paving	FC Codes	FC Names	Cuyahoga	Geauga	Lake	Lorain	Medina	Total Cost
Rural 2-Lane Paving	2,6,7,8	Rural; Principal Arterials, Major Arterials, Major & Minor Collectors	\$0.00	\$2.90	\$0.57	\$5.20	\$6.81	\$15.48
Rural 2-Ripout/Rehabilitation	2,6,7,8	Rural; Principal Arterials, Major Arterials, Major & Minor Collectors	\$0.00	\$0.32	\$0.06	\$1.25	\$2.38	\$4.01
City Paving/Maintenance	14,16,17	Urban; Principal Arterials, Minor Arterials, Collectors	\$38.78	\$2.99	\$7.97	\$14.80	\$7.60	\$72.15
City Ripout/Rehabilitation	14,16,17	Urban; Principal Arterials, Minor Arterials, Collectors	\$14.54	\$1.12	\$2.99	\$3.97	\$2.61	\$25.24
Priority Minor	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	\$14.79	\$0.38	\$3.94	\$2.58	\$3.98	\$25.67
Priority Major	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	\$10.01	\$0.25	\$2.67	\$2.45	\$1.63	\$17.01
Complete Ripout/Rehabilitation	1,11,12	Urban & Rural Interstates, Urban Freeways/Expressways	\$13.13	\$0.33	\$3.50	\$3.07	\$1.74	\$21.78
<b>TOTAL Annual Expenses</b>			<b>\$91.26</b>	<b>\$8.29</b>	<b>\$21.69</b>	<b>\$33.32</b>	<b>\$26.75</b>	<b>\$181.32</b>
<b>* TOTAL expenses for the life of NOACA's Transportation Plan 2013 - 2035</b>			<b>\$2,098.97</b>	<b>\$190.72</b>	<b>\$498.98</b>	<b>\$766.46</b>	<b>\$615.17</b>	<b>\$4,170.29</b>

\* The total expenses are calculated by taking the annual expenses multiplied by 23.

\* Estimated costs are displayed in 2012 dollars.



Of the almost 4.2 billion dollars needed to maintain the pavements on the federal aid highway system during the life of NOACA's LRTP, approximately half of this amount is projected to be spent in Cuyahoga County. Figure 3 shows how the projected needs are distributed within the NOACA region.

## **Estimated Expenditures for Bridges**

ODOT maintains a database of all bridges/culverts in the state. The structures from this database within NOACA's region were analyzed. This is a dynamic database, the bridge information in this report is from January 2012.

ODOT defines a bridge as *any structure, including supports, of 10 feet or more total length on, above, or below a highway*. According to state law all bridges must be inspected at least once a year by a qualified inspector. This inventory includes all bridges including those not on the federal-aid system.

From this database, staff was able to retrieve the number of bridges, including deck area (in square feet), by county in the region. Within these totals were those that ODOT considered major bridges, which are extremely large or very complex structures. These bridges by nature are very expensive to construct and maintain. ODOT's Central Office is responsible for funding construction, rehabilitation and maintenance on major bridges on interstate, U.S., and state routes. ODOT also offers financial assistance for major bridges on local roads (non-state roadways).

For the purpose of this technical memorandum, major bridges and non-major bridges were handled in separate analyses.

## **Non-Major Bridges**

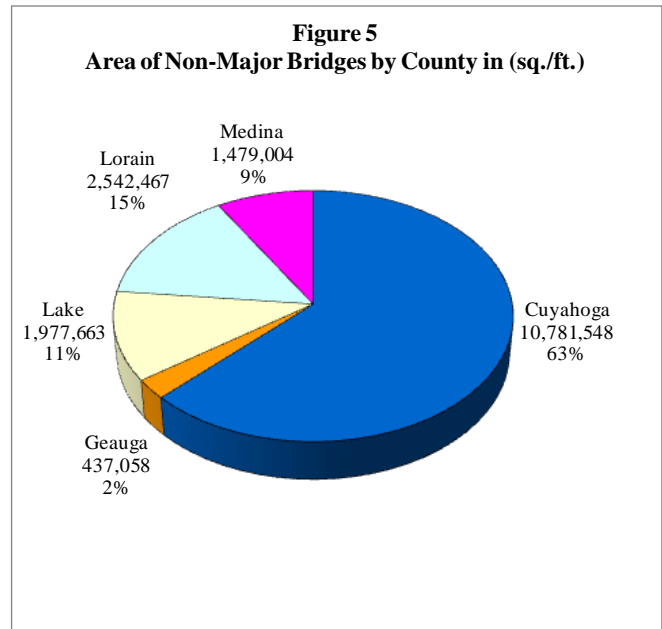
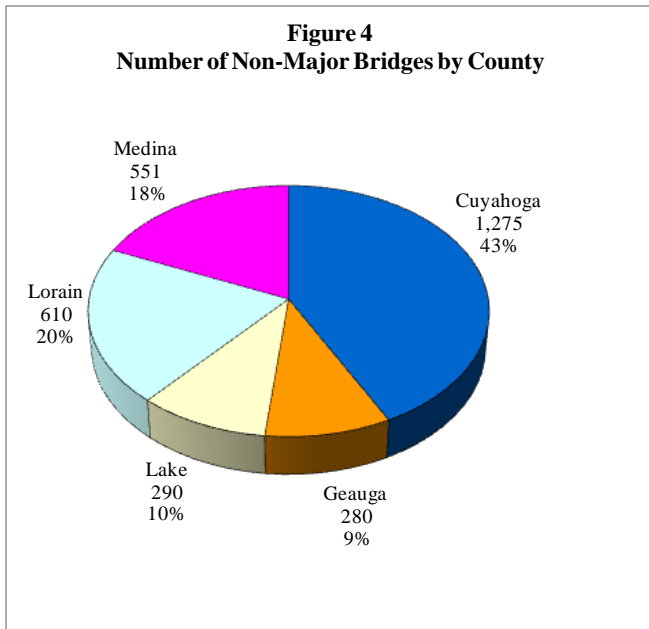
In NOACA's planning area there are 3,053 bridges. Of that number, 3,006 (or over 98 percent) fall into the non-major category.

Table 6 shows the number and area of all non-major bridges by county within the NOACA region. This information came from the ODOT database as of February 2012. The date of this information is significant because the bridge database is dynamic, always being updated with new structures being added or with old structures being retired from service.

The information presented in Table 6 is also reflected in Figures 4 and 5.

**Table 6**  
**Non-Major Bridges**  
**Number of Bridges & Area of Bridges by County**

<b>County</b>	<b>Number of Structures</b>	<b>Total Sq/Ft</b>	<b>Average Sq/Ft per Structure</b>
Cuyahoga	1,275	10,781,548	8,456
Geauga	280	437,058	1,561
Lake	290	1,977,663	6,820
Lorain	610	2,542,467	4,168
Medina	551	1,479,004	2,684
Total	3,006	17,217,740	5,728



Figures 4 and 5 show that Cuyahoga County has the largest number of bridges in our region, 43% of all the structures. Also, an even larger amount of bridge deck area (63%) is in Cuyahoga County. These figures and Table 6 show which counties have the most bridges and the largest bridges by square foot of deck area. Cuyahoga County had the most and largest bridges in our region, while Geauga County had the least and smallest bridges in our region.

ODOT also provided NOACA with expected annual degradation rates for the region's bridges. ODOT used the area of the bridge deck to predict annual bridge deficiencies, which is similar to their method for predicting distresses on roadways by lane mile. These rates were developed from years of monitoring the bridge system. The percentages in the table below are an estimate of the amount of bridge deck area to be maintained on an annual basis by bridge deficiency. Also on this table are estimated unit costs to repair or maintain the predicted deficiencies.

**Table 7**  
**Deficiencies and Expected Annual Degradation Rates**  
**and Unit Costs**

<b>Deficiency or Maintenance Activity</b>	<b>Recommended Treatment</b>	<b>Degradation Rates</b>	<b>Unit Costs per Sq./Ft</b>
Wearing Surface Problem	Replace wearing surface with 1"-3" of concrete	0.26%	\$10.00
Major Floor Problem	Replace the bridge deck	0.27%	\$90.00
Structural Problem	Replace the bridge	0.10%	\$300.00
Bridge Maintenance and Inspection	Annual preventative maintenance cost per Sq./Ft.	all bridges	\$1.00

The next step in this process was to estimate the area in square feet of bridge deck surface that needs to be addressed on an annual basis. To accomplish this, the bridge deck areas in Table 6 were multiplied by the degradation rates for the given deficiencies in Table 7. The results are shown in Table 8.

**Table 8**  
**Total Bridge Deck Area Needing Repair, Replacement and Maintenance Annually**

<b>Deficiency or Maintenance Activity</b>	<b>Recommended Treatment</b>	<b>Cuyahoga Sq./Ft.</b>	<b>Geauga Sq./Ft.</b>	<b>Lake Sq./Ft.</b>	<b>Lorain Sq./Ft.</b>	<b>Medina Sq./Ft.</b>	<b>Total Sq./Ft.</b>
Wearing Surface Problem	Replace wearing surface with 1"-3" of concrete	27,597	1,119	5,062	6,508	3,786	44,071
Major Floor Problem	Replace the Bridge Deck	29,408	1,192	5,394	6,935	4,034	46,963
Structural Problem	Replace the Bridge	10,432	423	1,914	2,460	1,431	16,660
Bridge Maintenance	Annual Preventative Maintenance	10,781,548	437,058	1,977,663	2,542,467	1,479,004	17,217,740

The last step of this process was to estimate the annual expense for the projected bridge treatments needed by county. This was done by multiplying the results in Table 8, deck area for bridges where work is needed on an annual basis, by the cost for each treatment in Table 7. The results are shown in Table 9, which lists the cost for each predicted bridge deficiency on an annual basis. Also included on Table 9 is the projected total cost to keep the non-major bridge system in good repair throughout the life of NOACA's LRTP. Current projections show that over \$618 million will be needed to maintain the non-major bridge network.

**Table 9**  
**Approximate Cost of Bridge Work Needed to Keep the Bridge System in a Good State of Repair by Repair Type**  
**(Cost in Millions)**

<b>Deficiency or Maintenance Activity</b>	<b>Recommended Treatment</b>	<b>Cuyahoga</b>	<b>Geauga</b>	<b>Lake</b>	<b>Lorain</b>	<b>Medina</b>	<b>Total</b>
Wearing Surface Problem	Replace wearing surface with 1"-3" of concrete	\$0.276	\$0.011	\$0.051	\$0.065	\$0.038	\$0.441
Major Floor Problem	Replace the Bridge Deck	\$2.647	\$0.107	\$0.485	\$0.624	\$0.363	\$4.227
Structural Problem	Replace the Bridge	\$3.130	\$0.127	\$0.574	\$0.738	\$0.429	\$4.998
Bridge Maintenance	Annual preventative Maintenance	\$10.782	\$0.437	\$1.978	\$2.542	\$1.479	\$17.218
<b>Total Annual Expenses</b>		<b>\$16.834</b>	<b>\$0.682</b>	<b>\$3.088</b>	<b>\$3.970</b>	<b>\$2.309</b>	<b>\$26.883</b>
*Total expenses for the life of NOACA's LRTP		\$387.18	\$15.70	\$71.02	\$91.30	\$53.11	\$618.310

\* Total expenses are calculated by taking the annual expenses multiplied by 23

\* Estimated costs are displayed in 2012 dollars.

## Major Bridges

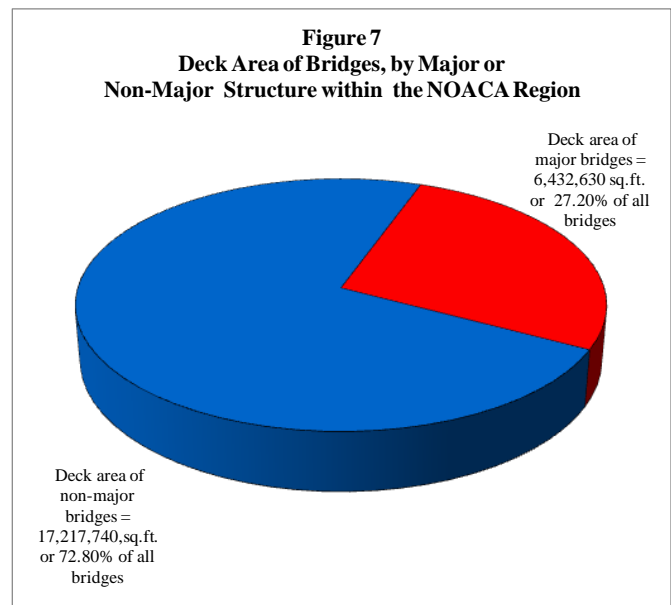
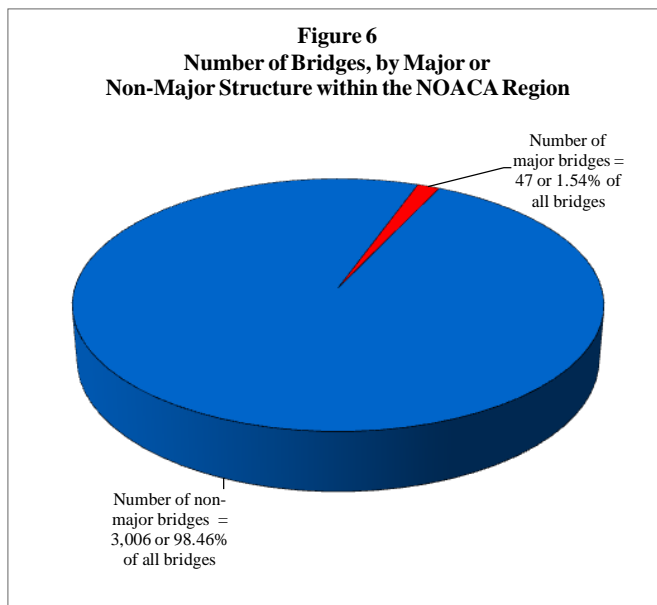
Due to the high cost and infrequent scheduling of major bridge projects, a fund managed by ODOT Central Office was created for these projects. On state, U.S. and interstate routes, ODOT defined a major bridge as:

- Any bridge greater than 1,000 feet long
- Single bridges of greater than 81,000 square feet of deck area
- Twin bridges of greater than 135,000 square feet of deck area
- Mechanically complex bridges such as a moveable bridge
- Suspension bridges
- Continuous/cantilever truss bridges
- All Ohio River crossings

Using this definition, currently there are 30 major bridges on state, U.S. and interstate routes within the region. Of the 30 major bridges, 24 are in Cuyahoga County, four are in Lorain County and two are in Lake County. There are no major bridges in either Geauga or Medina Counties.

ODOT will financially assist with bridges on the local system that meet major bridge criteria. A major bridge on the local system is defined by ODOT as a *moveable bridge or having a deck area greater than 35,000 square feet*. Also, the bridge must carry vehicular traffic. Currently there are seventeen bridges in the region that meet these criteria, all of which are in Cuyahoga County.

As previously mentioned, 3,006 or 98.5 percent of all bridges in the NOACA region are classified as non-major bridges. Currently there are 47 bridges, or 1.5 percent, that meet one of ODOT's definitions of a major bridge. The non-major bridges account for 72.8 percent of the deck area of all the bridges, while the 47 major bridges in NOACA's region account for 27.2 percent of the entire bridge deck surface area in our region. The graphs below show this relationship.



The components of major bridges and their replacement schedule were based upon historical monitoring of bridge repairs and expenses. In discussions with ODOT, NOACA staff decided to handle financial forecasts for major bridge expenses on a bridge-by-bridge basis and forecast any expense for a major bridge to occur within a ten year period. The following assumptions were made:

- Wearing surface overlay will last approximately 10 years
- Bridge painting will last approximately 25 years
- Redecking a bridge will last approximately 50 years
- The design life of a bridge is between 75 - 100 years

It should be noted that the assumptions above are not an exact science; uncertainty exists when planning for something on the bridge to fail or go wrong. Sometimes repairs do not last as long as anticipated, for example, a bridge deck may have been poured in unfavorable conditions resulting in a shorter life span, or other components of a bridge may last far longer than anticipated for no apparent reason. The repair timeframe and cost estimates in Table 10 are based upon the age of certain components of the bridge (deck, wearing surface, etc.). It is possible that the timeframe on some of the repairs can be extended into the future due to proper maintenance or due to funding restrictions. Since the mid 1970's bridge design methods, building materials and maintenance activities have improved. So a bridge being built today can be expected to last a minimum of 75 years.

Due to the uncertainty of how long bridge components or bridges themselves will last, repair estimates were made in ten year blocks of time, beginning in 2013. For example, if a bridge deck is due to be replaced in 2017, we made the assumption that the repair would occur between the ten year period of 2013 – 2022. If a bridge is due to be replaced in 2029, the assumption was that this replacement would occur during the ten year timeframe of 2023 – 2032. The final ten year period in this analysis went from 2033 – 2042; to include only projected expenses within the LRTP, the final ten year period was factored to 2033 – 2035.

Within the 23 years of the LRTP, expenses such as annual maintenance, painting, wearing surface replacements, deck replacements and complete rebuilding of the structure are provided. The following cost estimates were used to repair bridge components or replace the bridge entirely. These estimates were based upon the area of the bridge deck:

- Replace the bridge, \$300 per sq.ft.
- Replace the bridge deck, \$90 per sq.ft.
- Paint the structural steel on the bridge, \$63 per sq.ft.
- Replace the wearing surface on the bridge, \$10 per sq.ft.
- Annual preventive maintenance, \$1.00 per sq.ft.



Table 10 on the next page shows a listing of bridges that met ODOT's definition of a major bridge. Listed below is a description of information that is available in Table 10.

<b>Field Name</b>	<b>Description</b>
System	Either state or local roadway system
Structure File Number	A unique seven digit number to identify the bridge
Deck Area	Area of the bridge deck in sq.ft.
Inventory County	County abbreviation on where the bridge resides
Route/Street Name	Route or street the bridge is on
Feature Intersected	The name of the feature intersected at the structure
Facility Carried by Structure	The roadway name or route number carried by the bridge
Year Built	The year the bridge was completed if known-
Date Built, Age	The date the bridge was built and its age on 7/1/12
Rebuilt Date, Age	The date the bridge was rebuilt and time since the rebuilding 7/1/12
Wearing Surface Date, Age	The date the wearing surface was replaced and its current age on 7/1/12
Paint Date, Age	The date the bridge was painted and its current age on 7/1/12
2013 -2022 expenses	This amount includes the ten year estimated expenses to occur on the bridge. This includes annual maintenance expenses and any major bridge update expenses (total replacement, redeck, overlay or painting)
2023 -2032 expenses	This amount includes the ten year estimated expenses to occur on the bridge. This includes annual maintenance expenses and any major bridge update expenses (total replacement, redeck, overlay or painting)
2033 -2035 expenses (factored)	This amount includes the three year estimated expenses to occur on the bridge. This includes annual maintenance expenses and any major bridge update expenses (total replacement, redeck, overlay or painting)
2033 -2042 expenses	This amount includes the ten year estimated expenses to occur on the bridge. This includes annual maintenance expenses and any major bridge update expenses (total replacement, redeck, overlay or painting)
Total Plan Cost	This is the total estimated cost to maintain the specific bridge in a state of good repair

**Table 10  
Projected Major Bridge Repairs and Expenses for NOACA's Long Range Transportation Plan**

System	Structure File Number	Deck Area	Inventory County	Route/Street Name	Feature Intersected	Facility Carried by Structure	Year Built	Date Built, Age	Rebuilt Date, Age	Wearing Surface Date, Age	Paint Date, Age	Projected cost by major bridge by decade			
												2013 - 2022 Expenses	2023 - 2032 Expenses	2033 - 2035 Expenses (factored)	2013 - 2035 Total Plan Cost
state	1801244	106596	CUY	SR-8/Northfield Road	SR-14 & Tinkers Creek & WLE RR	SR -8	1985	7/1/1985, 26Yrs.		7/1/1985, 26Yrs.	6/15/2000, 11 Yrs.	\$10,659,600	\$7,781,508	\$319,788	\$18,760,896
state	1801325	79535	CUY	SR-10/Lorain Road	Valley Parkway/Rocky River	SR-10	1935	7/1/1935, 76Yrs.	1/1/1990, 22Yrs.	1/1/1986, 26Yrs.	10/15/1991, 20 Yrs.	\$6,601,405	\$7,953,500	\$7,396,755	\$21,951,660
state	1801503	272652	CUY	SR-10/ Lorain-Carnegie	Cuyahoga River Valley	SR-10	1932	7/1/1932, 79Yrs.	1/1/1983, 29Yrs.	9/1/2001, 10Yrs.	3/4/2004, 8 Yrs.	\$27,265,200	\$19,903,596	\$25,356,636	\$72,525,432
state	1801805	84713	CUY	SR-14/Broadway Avenue	NS & WLE RR @ Henry St.	SR-14	1929	7/1/1929, 82Yrs.		7/1/1986, 25Yrs.	1/1/1988, 24 Yrs.	\$13,808,219	\$26,261,030	\$254,139	\$40,323,388
state	1802046	123775	CUY	SR-17/Brookpark Road	Rocky River	SR-17	1933	7/1/1933, 78Yrs.	10/31/1989, 22Yrs.	10/31/1989, 22Yrs.	1/1/1987, 25 Yrs.	\$10,273,325	\$12,377,500	\$11,511,075	\$34,161,900
state	1803271	120557	CUY	US-42/Pearl (Brooklyn-Brighton)	Big Creek & NS and CSX RR	US-42	1912	7/1/1912, 100 Yrs.	9/30/1988, 24 Yrs	9/30/1988, 24 Yrs	1/1/1987, 25 Yrs.	\$19,650,791	\$1,205,570	\$361,671	\$21,218,032
state	1804650	59008	CUY	I-71	NS RR and RTA, Airport Freeway	I-71 S.B.	1969	7/1/1969, 42Yrs.	6/30/2000, 11Yrs.	6/30/2000, 11Yrs.	1/1/2000, 12 Yrs.	\$590,080	\$4,897,664	\$1,770,240	\$7,257,984
state	1804685	49880	CUY	I-71	NS RR and RTA	I-71 N.B.	1969	7/1/1969, 42Yrs.	6/30/2000, 11Yrs.	6/30/2000, 11Yrs.	6/30/2000, 11 Yrs.	\$498,800	\$4,140,040	\$1,496,400	\$6,135,240
state	1805371	115907	CUY	I-71	SR-176 Jennings Freeway	I-71 N.B.	1969	7/1/1969, 42Yrs.			1/1/1991, 21 Yrs.	\$18,892,841	\$1,159,070	\$347,721	\$20,399,632
state	1805436	57943	CUY	SR-176 (Jennings Freeway)	IR-71 NB	I-71	1968	7/1/1968, 43Yrs.			1/1/1991, 21 Yrs.	\$9,444,709	\$579,430	\$173,829	\$10,197,968
state	1806173	347031	CUY	I-77	Cuyahoga River & SR-17 & Canal Rd. & CSX RR	I-77	1976	7/1/1976, 35Yrs.		7/1/1991, 20Yrs.	1/1/1998, 14 Yrs.	\$56,045,310	\$3,470,310	\$1,041,093	\$60,556,713
state	1806726	267119	CUY	I-77	Kingsbury Run and RTS and NS RR	I-77	1964	7/1/1964, 47Yrs.		11/4/2000, 11Yrs.	1/1/2000, 12 Yrs.	\$26,711,900	\$19,499,687	\$801,357	\$47,012,944
state	1807870	89040	CUY	I-90	NS RR & Train Ave	I-90	1975	7/1/1975, 36Yrs.		7/1/1989, 22Yrs.	1/1/1975, 37 Yrs.	\$14,513,520	\$890,400	\$267,120	\$15,671,040
state	1808567	120815	CUY	I-90	Rocky River Valley	I-90	1971	7/1/1971, 40Yrs.		9/30/1993, 18Yrs.	1/1/1969, 43 Yrs.	\$34,208,150	\$8,893,150	\$362,445	\$43,463,745
state	1809393	590739	CUY	I-90	Cuyahoga River Valley and RTA	I-90	1959	7/1/1959, 52Yrs.			1/1/1986, 26 Yrs.	\$359,389,390	\$5,907,390	\$1,772,217	\$367,068,997
state	1810189	137542	CUY	SR-176 (Jennings Freeway)	Vally Rd, Big CreeK ,WLE & CSX RR	SR-176J Jennings Freeway	1997	7/1/1997, 14Yrs.		7/1/1997, 14Yrs.	1/1/1997, 15 Yrs.	\$22,419,346	\$1,375,420	\$412,626	\$24,207,392
state	1810715	80407	CUY	I-271	Tinkers Creek & WLR RR & Solon Rd	I-271 S.B.	1964	7/1/1964, 47Yrs.	1/1/1999, 13Yrs.	6/30/2002, 9Yrs.	1/1/1999, 13 Yrs.	\$804,070	\$6,673,781	\$2,412,210	\$9,890,061
state	1810774	82291	CUY	I-271	Tinkers Creek & WLR RR & Solon Rd	I-271 N.B.	1964	7/1/1964, 47Yrs.	1/1/1999, 13Yrs.	6/30/2002, 9Yrs.	1/1/1986, 26 Yrs.	\$6,007,243	\$1,645,820	\$2,468,730	\$10,121,793
state	1811991	478632	CUY	I-490	Cuyahoga River	I-490	1990	7/1/1990, 21Yrs.			1/1/1990, 22 Yrs.	\$78,017,016	\$4,786,320	\$1,435,896	\$84,239,232
state	1812521	303308	CUY	I-480	Cuyahoga River - Ohio Canal	I-480 W.B.	1975	7/1/1975, 36Yrs.		6/1/1989, 22Yrs.	10/31/2001, 10 Yrs.	\$47,645,580	\$22,141,484	\$909,924	\$70,696,988
state	1812548	303308	CUY	I-480	Cuyahoga River - Ohio Canal	I-480 E. B.	1975	7/1/1975, 36Yrs.		6/1/1989, 22Yrs.	10/31/2001, 10 Yrs.	\$47,645,580	\$22,141,484	\$909,924	\$70,696,988
state	1812831	226227	CUY	I-480	Rocky River Valley	I-480	1970	7/1/1970, 41Yrs.		9/30/2002, 9Yrs.	1/1/1991, 21 Yrs.	\$36,875,001	\$2,262,270	\$678,681	\$39,815,952
local	1830147	64498	CUY	Hilliard Road	Rocky River Valley	Hilliard Rd.	1925	7/1/1925, 86Yrs.	1/1/1983, 29Yrs.	1/1/1991, 21Yrs.		\$1,289,960	\$19,994,380	\$193,494	\$21,477,834
local	1832042	57437	CUY	Rockside Road	NS RR	Rockside Rd.	1981	7/1/1981, 30Yrs.		1/1/1987, 25Yrs.		\$5,743,700	\$574,370	\$172,311	\$6,490,381
local	1832344	195582	CUY	Harvard - Denison Roads	Cuyahoga River Valley	Denison Rd., Harvard Rd.	1977	7/1/1977, 34Yrs.		1/1/2003, 9Yrs.	1/1/1991, 21 Yrs.	\$31,879,866	\$1,955,820	\$586,746	\$34,422,432
local	1833073	127413	CUY	Fulton Road	Big Creek CSX/NS RR	Cleveland Metropark Zoo	2010	7/9/2010, 1Yrs.		7/9/2010, 1Yrs.		\$1,274,130	\$2,548,260	\$382,239	\$4,204,629
local	1833405	44111	CUY	W. 150th Street	NS RR	W. 150th St.	1967	7/1/1967, 44Yrs.		1/1/1992, 20Yrs.	1/1/1967, 45 Yrs.	\$7,190,093	\$441,110	\$132,333	\$7,763,536
local	1833421	54875	CUY	W. 140th Street	NS RR	W.140th St.	1959	7/1/1959, 52Yrs.		1/1/1987, 25Yrs.	1/1/1990, 22 Yrs.	\$8,944,625	\$548,750	\$164,625	\$9,658,000
local	1833758	21033	CUY	Columbus Avenue	Cuyahoga River	Columbus Rd.	1939	7/1/1939, 72Yrs.		1/1/1955, 57Yrs.	1/1/1940, 72 Yrs.	\$210,330	\$210,330	\$63,099	\$483,759
state	1800035	562591	CUY	SR-2 (Main Avenue Bridge)	Cuyahoga River, Waterfront line, Flats	SR 2	1940	7/1/1940, 71Yrs.	7/15/1992, 19Yrs.	1/1/1992, 20Yrs.	1/1/1984, 28 Yrs.	\$41,069,143	\$11,251,820	\$52,320,963	\$104,641,926
state	1800639	82011	CUY	US-6/ Lake Road	Rocky River	US-6	1964	7/1/1964, 47Yrs.	1/1/1997, 15Yrs.	1/1/1997, 15Yrs.	1/1/1997, 15 Yrs.	\$5,986,803	\$1,640,220	\$2,460,330	\$10,087,353
state	1800930	226205	CUY	US-6/ (Detroit-Superior Bridge)	Cuyahoga River	US-6	1917	7/1/1917, 94Yrs.	1/1/1997, 15Yrs.	11/15/1996, 15Yrs.	7/15/1999, 12 Yrs.	\$70,123,550	\$2,262,050	\$678,615	\$73,064,215
local	1869264	32970	CUY	Carter Road	Cuyahoga River	Carter Rd.	1939	7/1/1939, 72Yrs.			1/1/1992, 20 Yrs.	\$5,374,110	\$329,700	\$3,066,210	\$8,770,020
local	1869280	51990	CUY	Clark-Quigly Ramp	Industrial Flats West	Clark Ave.	1917	7/1/1917, 94Yrs.	1/1/1987, 25Yrs.		1/1/1987, 25 Yrs.	\$16,116,900	\$519,900	\$1,559,700	\$18,196,500
local	1869345	13799	CUY	Center Street	Cuyahoga River	Center St.	1901	7/1/1901, 110Yrs.	1/1/1989, 23Yrs.		1/1/1989, 23 Yrs.	\$4,277,690	\$1,379,900	\$41,397	\$5,698,987
local	1869442	205635	CUY	Huron Road	Canal Road, RTA	Huron Rd.	1930	7/1/1930, 81Yrs.	1/1/1986, 26Yrs.		1/1/1986, 26 Yrs.	\$17,067,705	\$63,746,850	\$616,905	\$81,431,460
local	1869604	14801	CUY	Eagle Avenue	Cuyahoga River	Eagle Ave.	1930	7/1/1930, 81Yrs.	1/1/1991, 21Yrs.	1/1/1991, 21Yrs.	1/1/1993, 19 Yrs.	\$148,010	\$4,588,310	\$44,403	\$4,780,723
local	1869728	14531	CUY	W.3rd Street	Cuyahoga River	W.3rd St.	1940	7/1/1940, 71Yrs.	1/15/2006, 6Yrs.		1/1/1955, 57 Yrs.	\$145,310	\$145,310	\$1,351,383	\$1,642,003
local	1869817	40602	CUY	E.55th Street	NS RR, GCRTA	E. 55th St.	1914	7/1/1914, 98 Yrs.	1/1/1990, 22, Yrs.	1/1/1990, 22, Yrs.	1/1/1990, 22, Yrs.	\$3,369,966	\$4,060,200	\$121,806	\$7,551,972
local	1869981	16803	CUY	Willow Street	Cuyahoga River	Willow St.	1965	7/1/1965, 46Yrs.	1/1/1987, 25Yrs.		1/1/1986, 26 Yrs.	\$1,394,649	\$168,030	\$504,090	\$2,066,769
local	1870025	121978	CUY	Prospect Avenue	Tower City, RTA	Prospect Ave.	1930	7/1/1930, 81Yrs.	1/1/1986, 26Yrs.		1/1/1986, 26 Yrs.	\$10,124,174	\$37,813,180	\$365,934	\$48,303,288
local	1870084	47017	CUY	Abbey Road	Scranton Rd., NS RR	Abbey Rd.	1991	7/1/1991, 20Yrs.		1/1/1991, 21Yrs.		\$470,170	\$4,701,700	\$141,051	\$5,312,921
state	4304969	49999	LAK	I-90	Grand River	I-90 W.B.	2008	9/1/2008, 3Yrs.		9/1/2008, 3Yrs.		\$4,999,900	\$499,990	\$149,997	\$5,649,887
state	4304993	49999	LAK	I-90	Grand River	I-90 E.B	2008	8/1/2008, 3Yrs.				\$4,999,900	\$499,990	\$149,997	\$5,649,887
state	4700813	65284	LOR	US-6/Erie Avenue	Black River	US-6/Erie Ave.	1939	7/1/1939, 72Yrs.	1/1/1988, 24Yrs.	8/23/1988, 23Yrs.	1/1/1989, 23 Yrs.	\$5,418,572	\$6,528,400	\$6,071,412	\$18,018,384
state	4706250	89524	LOR	SR-254/ North Ridge Road	Black River	SR-254/North Ridge Rd.	2001	7/1/2001, 10Yrs.		1/1/2001, 11Yrs.		\$1,790,480	\$895,240	\$2,685,720	\$5,371,440
state	4707443	84917	LOR	SR-611/ Henderson Drive	Black River Ship Channel	SR-611/Henderson Dr.	1939	7/1/1939, 72Yrs.	1/1/1989, 23Yrs.	6/8/1989, 22Yrs.	7/1/1989, 22 Yrs.	\$7,048,111	\$764,253	\$7,897,281	\$15,709,645
												\$1,104,424,923	\$354,014,487	\$144,382,518	\$1,602,821,928

- major expense in this 10 year period is replacing the wearing surface
- major expense in this 10 year period is replacing the bridge deck
- major expense in this 10 year period is painting the bridge
- major expense in this 10 year period is replacing the bridge
- major expense in this 10 year period is replacing the wearing surface and painting the bridge
- major expense in this 10 year period is replacing bridge deck and painting the bridge

Table 10 shows our projection that during the course of NOACA’s LRTP almost \$1.6 billion dollars will be needed to keep the 47 major bridges in our region in acceptable condition. This allows for 17 major bridge replacements plus annual maintenance on all bridges.

Table 11 shows a summary of all projected bridge expenses on both major and non-major structures within NOACA’s region.

**Table 11**  
**Summary of Major and Non-major Bridge Expenses During the Life of NOACA's Transportation Plan**  
 (cost in millions)

Bridge Expenses	Cuyahoga	Geauga	Lake	Lorain	Medina	Total Cost
Projected Expenses for <b>Non-Major</b> Bridges 2013 - 2035	\$387.179	\$15.695	\$71.020	\$91.303	\$53.113	\$618.310
Projected Expenses for <b>Major</b> Bridges 2013 - 2035	\$1,552.423	\$0.000	\$11.300	\$39.099	\$0.000	\$1,602.822
Total expenses for the life of NOACA's transportation plan	\$1,939.602	\$15.695	\$82.320	\$130.403	\$53.113	\$2,221.133
Estimated cost per year	\$84.33	\$0.68	\$3.58	\$5.67	\$2.31	\$96.57

Cost per year is calculated by taking the total expenses divided by 23

The estimates show that approximately \$97 million per year or almost 2.22 billion dollars during the life of NOACA’s LRTP will be needed to maintain our region’s bridges in an acceptable state of repair. Figures 8 and 9 show that the majority of bridge needs until 2035 will be in Cuyahoga County, 63 percent of the non-major bridge expenses and 97 percent of the major bridge expenses will be expended there. Cuyahoga County has all but five of the major bridges in the NOACA region, it also has more non-major bridges than any other county in the region.

