Bridge and Pavement Condition Management System

2019-2020 UPWP Report

Syracuse Metropolitan Transportation Council

SEPTEMBER 2020

SMTC

BRIDGE & PAVEMENT
CONDITION MANAGEMENT SYSTEM

Syracuse Metropolitan Planning Area

September 2020

2018-2019 Unified Planning Work Program

This document was prepared with financial assistance from the Federal Highway Administration and the Federal Transit Administration of the U.S. Department of Transportation through the New York State Department of Transportation. The Syracuse Metropolitan Transportation Council is solely responsible for its contents.

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Introduction

The purpose of the Bridge and Pavement Condition Management System (BPCMS) report is to serve as a comprehensive clearinghouse for condition information on selected bridges and pavements throughout the Metropolitan Planning Area (MPA) of the Syracuse Metropolitan Transportation Council (SMTC). Infrastructure improvements such as bridge rehabilitation and pavement milling routinely make up a significant portion of Transportation Improvement Program (TIP) funds spent in the MPA. Through the BPCMS report, member agencies are able to track investments in infrastructure across the system.

In 2017, one of the Federal Highway Administration (FHWA)'s final rules establishing performance measures on the National Highway System (NHS) for State Departments of Transportation and Metropolitan Planning Organizations took effect. The rule establishes measures to assess the condition of bridges and pavements, and addresses requirements established in the two most recent transportation legislations, the Moving Ahead for Progress in the 21st Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Act. With these performance measures, the methods of collecting condition data on bridges and pavements has changed, along with the reporting of this condition data.

This report contains different datasets than in years past. Most notably, in 2019, the SMTC collected pavement conditions on the entirety of the City of Syracuse's system, regardless of federal-aid eligibility. Additionally, due to changes in the way pavements are rated in accordance with new performance measures, data on the New York State system was unavailable at the time of the publishing in this report.

Included in this report is information on all roadway bridges, and non-State federal-aid eligible roads. Additionally, as noted above, supplemental pavement data on the entirety of the City of Syracuse system is provided. Bridge data was collected in 2018 and 2019, and pavement data was collected in 2019.

Bridges

The New York State Department of Transportation (NYSDOT) inspects all highway bridges that it owns, as well as those owned by local municipalities, at a maximum of 24 months. Tolling authorities (such as the New York State Thruway Authority) are responsible for their own inspections but are required to submit their data to NYSDOT.

There are many different types of bridges in the SMTC MPA, which includes all of Onondaga County and portions of Madison and Oswego Counties. This report includes information on roadway bridges open to vehicular travel – it does not contain information on private railroad bridges or pedestrian or bicycle overpasses. In the MPA, there are 550 bridges that meet this definition.

Of these bridges, NYSDOT owns a majority, with 313. The second most is owned by a county (either Madison, Onondaga, or Oswego), with 131. The Thruway Authority, the City of Syracuse, and local towns and villages make up the remainder. Figure 1 illustrates bridge ownership in our area, and Figure 2 gives National Bridge Inventory (NBI) ratings by structure for these bridges.

Figure 1 - Roadway Bridges by Owner in the MPA

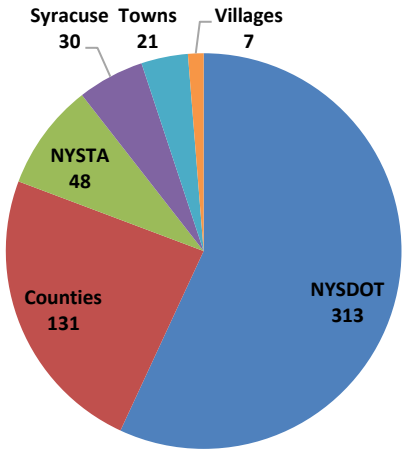
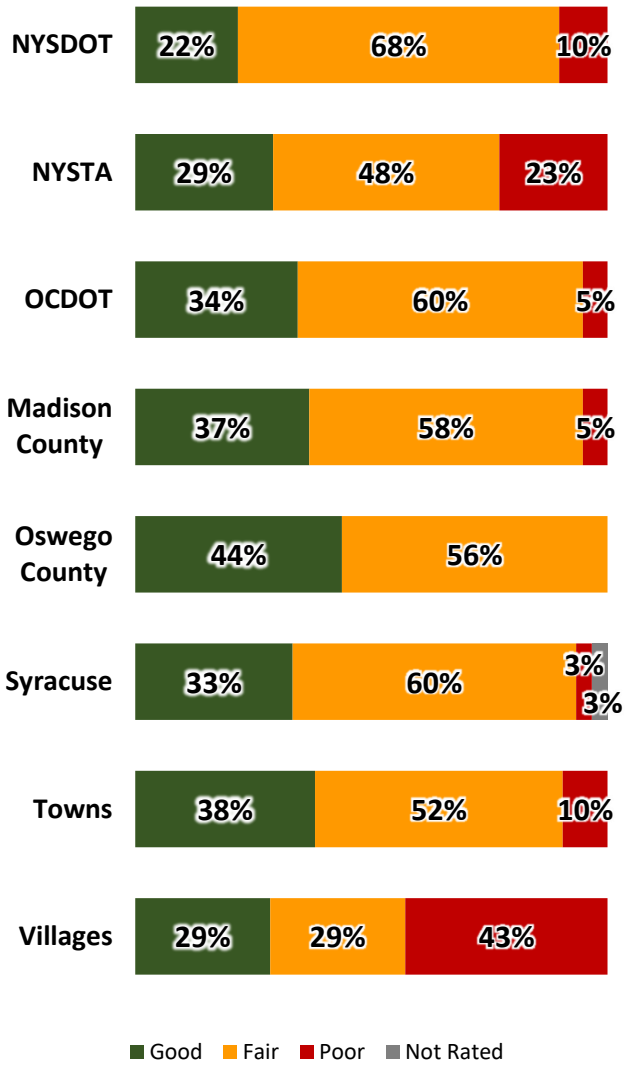


Figure 2 - NBI Rating by Owner, by Structure



Bridge Condition Ratings

Bridge condition ratings are given on a scale of Good-Fair-Poor. This classification is based on the NBI condition ratings for Item 58 (Deck), Item 59 (Superstructure), Item 60 (Substructure), and Item 62 (Culvert). Each of these items are rated on a scale of 0-9. If the lowest rating is greater than or equal to 7, the bridge is classified as "Good." If the lowest rating is less than or equal to 4, it is classified as "Poor." Bridges rated below 7 but above 4 are classified as "Fair."

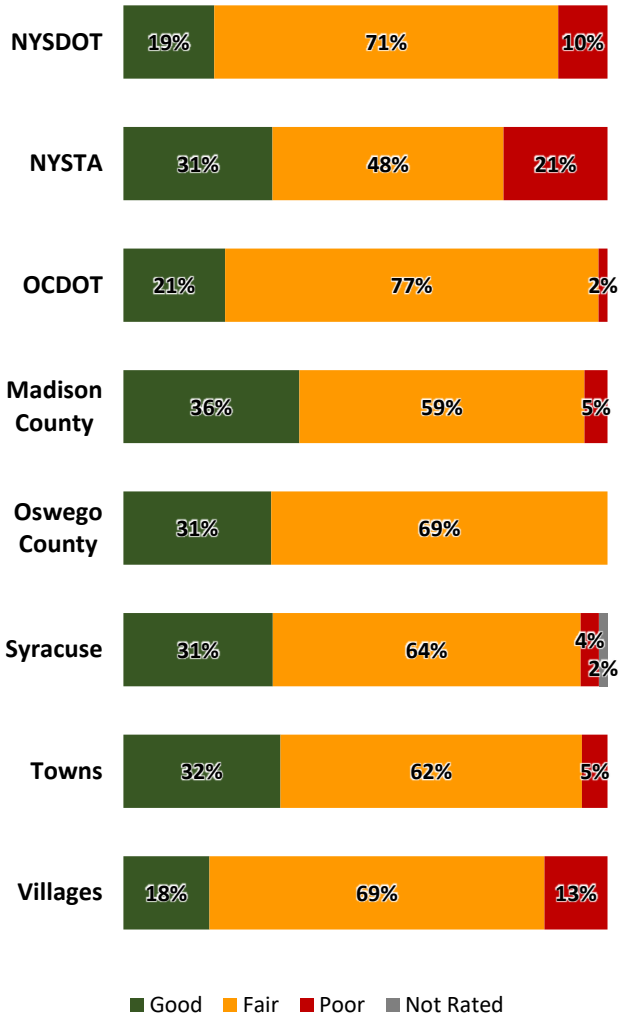
Current federal performance measures for bridges monitor condition by deck area, not number of structures. Ownership by deck area paints a different picture of bridge maintenance needs than simply the number of structures owned. For example, although

NYSDOT owns 57% of bridges in the MPA, it is responsible for 80% of the total roadway bridge deck area examined in this report. Figure 3 below illustrates the percentage of bridge deck owned by each jurisdiction, and Figure 4 gives the percentage of deck area rated Good, Fair, or Poor by each bridge owner, and the total number of Good, Fair, and Poor deck area in the MPA.

Figure 3 - Bridge Ownership by Deck Area

Agency	Deck Area (sq ft)	% of Deck Area	Bridges	% of Bridges
NYSDOT	4,423,563	80.3%	313	56.9%
NYSTA	469,458	8.5%	48	8.7%
OCDOT	336,585	6.1%	96	17.5%
Madison County	37,168	0.7%	19	3.5%
Oswego County	28,943	0.5%	16	2.9%
Syracuse	162,305	2.9%	30	5.5%
Towns	26,938	0.5%	21	3.8%
Villages	24,339	0.4%	7	1.3%

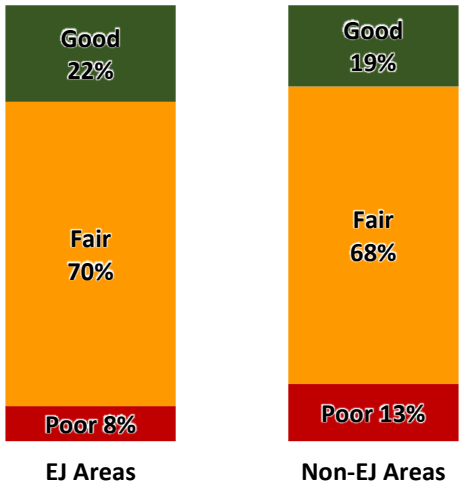
Figure 4 - NBI Rating Weighted by Deck Area



Environmental Justice

Periodically, the SMTC evaluates recent and future transportation planning projects and programs throughout the MPA, with a goal of ensuring that both the positive and negative impacts of transportation planning are fairly distributed across all socioeconomic populations and that no one population is adversely affected or neglected. As a part of this analysis, the SMTC uses data from the US Census to identify geographic areas with significant minority and low-income populations. These areas are known as Environmental Justice Priority Target Areas. Figure 5 compares bridge assessments (by deck area) in priority and non-priority areas. A map of priority target areas can be found in *Appendix A*.

Figure 5 - Bridge Ratings by EJ Area



National Transportation Performance Measures

The Federal Highway Administration has published a final rule establishing performance measures to use in managing bridge conditions on the National Highway System (NHS). The measures are the percentage of NHS bridges by deck area in Good condition and the percentages of NHS bridges by deck area in Poor condition. NHS bridges are defined as structures carrying the National Highway System. As noted earlier in this section, if the lowest NBI Item rating (for Items 58, 59, 60, and 62) is greater than 7, the bridge is classified as Good. If the lowest rating is less than or equal to 4, it is classified as Poor. Bridges rated below 7 but above 4 are classified as Fair but are not used in the performance measure.

Metropolitan Planning Organizations (MPOs), like the SMTC, must either support their DOT's targets or establish their own targets for these measures. The SMTC has chosen to support NYSDOT's targets. Figure 6 shows NYSDOT's targets, and the current performance of bridges in the SMTC MPA. Figure 7 gives extended definitions of individual NBI condition ratings.

Figure 6 - Performance Targets on the National Highway System

Performance Measure	NYSDOT Baseline	SMTC MPA Value	Two-Year Target	Four-Year Target
Percent of NHS bridges by deck area in Good condition	22.8%	17.9%	23.0%	24.0%
Percent of NHS bridges by deck area in Poor condition	10.6%	10.4%	11.6%	11.7%

Figure 7 - NBI Bridge Condition Ratings

(9) Excellent Condition

(8) Very Good Condition – no problems noted.

(7) Good Condition – some minor problems.

(6) Satisfactory Condition – structural elements show minor deterioration.

(5) Fair Condition – all primary structural elements are sound but may have minor corrosion, cracking, or chipping. May include minor erosion on bridge piers.

(4) Poor Condition – advanced corrosion, deterioration, cracking, or chipping. Significant erosion of concrete bridge piers.

(3) Serious Condition – corrosion, deterioration, cracking, and chipping, or erosion of concrete bridge piers have seriously affected deck, superstructure, or substructure. Local failures are possible.

(2) Critical Condition – advanced deterioration of deck, superstructure, or substructure. May have cracks in steel or concrete, or erosion may have removed substructure support. It may be necessary to close the bridge until corrective action is taken.

(1) "Imminent" Failure Condition – major deterioration or corrosion in deck, superstructure, or substructure, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic, but corrective action may put back in light service.

(0) Failed Condition – out of service. Beyond corrective action.

(N) Not applicable.

As a reference, maps with additional bridge assessments and other applicable information are found at the end of this document in *Appendix A*.

Pavement

As a part of the BPCMS report, the SMTC collects pavement conditions either through staff-led rating or through partnerships through member agencies. The BPCMS largely deals with federal-aid eligible roads in the MPA. Federal-aid eligibility on roadways is based on functional classification – the process by which streets and highways are grouped into classes or systems according to the character of services they are intended to provide. Roads are considered federal-aid eligible if they have a functional classification of Principal Arterial, Minor Arterial, Major Collector, or Urban Minor Collector.

Figure 8 - Functional Classifications

Urban Classifications	Rural Classifications
Urban Principal Arterial (interstates, other expressways and other principal arterials)	Rural Principal Arterial (interstates, other expressways and other principal arterials)
Urban Minor Arterial	Rural Minor Arterial
Urban Major Collector Urban Minor Collector	Rural Major Collector *Rural Minor Collector*
Urban Local	*Rural Local*

Functional Classifications in Italics are not federal-aid eligible.

Note: Functional classifications and NHS designations in the SMTC MPA were updated in 2018. Last year's report used the previous designations, whereas this year's report uses the new, updated classifications.

The pavement condition rating data in this document is based on linear centerline miles of roads, not lane miles of roads. A linear centerline mile of road is a continuous line of pavement along the center of the length of pavement, whereas a lane mile is the length of each lane in a given section of pavement.

There are approximately 1,028 centerline miles of federal-aid eligible roads in the MPA, excluding ramps. These roads are owned by many different jurisdictions and municipalities: the NYSDOT, the New York State Thruway Authority (NYSTA), the Onondaga County Department of Transportation (OCDOT), Madison County, Oswego County, and the City of Syracuse. Additionally, there are some federal-aid eligible roads that are not owned by one of the entities listed above but by some other municipality, such as a town or village. For purposes of this report, these roads are grouped into a "Local" category – not to be confused with the "Local" functional classification.

In the interest of consistency with road ratings, SMTC staff began rating federal-aid eligible roads owned by Onondaga County and the City of Syracuse in 2015. SMTC staff was trained in the NYSDOT system at the time, so that road ratings across our MPA could be presented on a single, uniform scale. NYSDOT is still responsible for rating the Interstate System, the US Highway System, and the State Touring Route System, regardless of ownership. Through a partnership with the SMTC, NYSDOT staff also rate all federal-aid eligible roads in the portions of Madison and Oswego Counties that are in the SMTC MPA, as well as Local federal-aid eligible roads in Onondaga County.

In 2019, at the request of the City of Syracuse, the SMTC also began rating the entirety of the City's system. A report detailing this data collection process and the results is included in *Appendix B*.

Pavement Condition Ratings

The FHWA published a final rule establishing performance measures for State Departments of Transportation to manage pavement performance on the National Highway System. This rule specifies that pavement condition is rated based on cracking, faulting (concrete) or rutting (asphalt), and International Roughness Index (IRI) or the Present Serviceability Rating (PSR). Pavements are rated Good, Fair, or Poor based on the values of these individual metrics. Pavement in Good condition suggests that no major investment is needed. Pavement in Poor condition suggests major reconstruction investment is needed in the near term.

As this new rating process requires intricate and specialized technology, NYSDOT will lead the data collection effort statewide. The condition survey will occur on the state system (Interstates, US Routes, and the State Touring System) every year, and the federal-aid system over the course of two years, regardless of ownership. This data collection schedule began in 2018.

Figure 9 - New Condition Ratings

Metric	Good	Fair	Poor
IRI (in/mi)	< 95	95-170	> 170
PSR* (0.0 - 5.0)	≥ 4.0	2.0 - 4.0	≤ 2.0
Cracking Percent	< 5%	CRCP 5-10 Jointed 5-15 Asphalt 5-20	CRCP > 10 Jointed >15 Asphalt >20
Rutting (in)	< 0.20	0.20 - 0.40	> 0.40
Faulting (in)	< 0.10	0.10 - 0.15	> 0.15

*PSR may only be used in place of IRI on routes with posted speed limit < 40mph.

IRI, International Roughness Index, objectively measures the cumulative deviation from a smooth surface in inches per mile.

PSR, Present Serviceability Rating, is a subjective rating system based on a scale of 0 to 5.

Cracking Percent is defined as the percentage of pavement surface exhibiting cracking: fissures or discontinuities of the pavement surface not necessarily extending through the entire thickness of the pavement.

Average Rutting, longitudinal surface depressions in the asphalt pavement derived from measurements of a profile transverse to the path of travel on a highway lane.

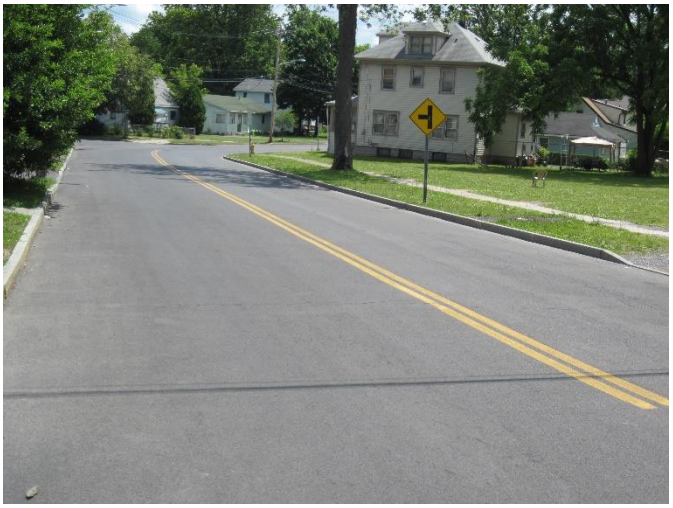
Average Faulting, vertical misalignments of pavement joints on concrete pavements.

Prior to the adoption of the new performance measures, the NYSDOT used a moving-vehicle windshield survey to assess pavement condition. The SMTC adopted this method for rating. This system is used throughout this report, and SMTC staff will continue to use this system for non-performance measure purposes for the foreseeable future. The procedure involves the use of a carefully crafted scale, ranging from "1" (very poor) to "10" (excellent condition), based on the frequency and severity of pavement distress. This procedure is designed to permit rapid estimates of overall condition. Drawing from the NYSDOT standard, this report breaks the 1-10 rating into four categories: Excellent (9-10), Good (7-8), Fair (6), and Poor (1-5). This scale is shown in Figure 10 below. There are also a small number of roads listed as "unrated," largely due to either construction occurring, or the use of road materials not suited to pavement rating (such as brick or bridge deck). *The new FHWA conditions are **not** congruent to the Good and Poor SMTC conditions used at this time*.

Figure 10 - NYSDOT Surface Score Scale

Rating		Condition Description
9 - 10	**Excellent**	No or slight pavement distress.
7 - 8	**Good**	Minor to moderate distress occurring infrequently to occasionally.
6	**Fair**	Moderate to severe distress occurring occasionally to frequently.
1 - 5	**Poor**	Severe or very severe distress occurring frequently. Travel may be impaired.

At the time of this report's publication, updated data from NYSDOT (which includes NYSTA data) was not made available to SMTC staff. The current NYSDOT data available to both the public and the SMTC is from 2017 and was featured in the 2018-2019 BPCMS report. In the interest of avoiding combining datasets from previous reports and this report, MPA-wide analyses of pavement data are not included in this document.



Pavement Performance Metrics and Long-Range Transportation Planning

NYSDOT established statewide performance planning targets for pavement on May 20, 2018. The SMTC agreed to support NYSDOT's performance targets on December 11, 2018 via SMTC Policy Resolution No. 2018-14. By adopting NYSDOT's targets, the SMTC will partner with the State to plan and program projects that achieve these targets.

As a result of adopting these targets, the SMTC is required to report conditions in the MPA as a part of the agency's Long Range Transportation Plan (LRTP). As the data used to calculate these metrics was not available at the time of this report, the SMTC reported older data which does not conform to the federal performance measures in the 2020 LRTP Update. The data used in the LRTP is shown below in Figure 11.

Figure 11 - LRTP Pavement Performance Targets

Performance measure	New York Performance (Baseline)	SMTC Performance (Baseline)	New York 2-year Target	New York 4-year Target
Percent of Interstate pavements in good condition	52.2%*	69.7%**	46.4%*	47.3%
Percent of Interstate pavements in poor condition	2.7%*	7.4%**	3.1%*	4.0%
Percent of non-Interstate NHS pavements in good condition	20.4%	46.7%**	14.6%	14.7%
Percent of non-Interstate NHS pavements in poor condition	8.3%	24.2%**	12.0%	14.3%

* These values are those that were calculated by NYSDOT and agreed to by the SMTC on December 11, 2018. These may differ compared to those published by the Federal Highway Administration, which utilized a different calculation methodology.

** This information is based on 2017 and 2018 data collected using the NYSDOT Surface Score Scale cited in Figure 10, and cannot be directly compared to the performance targets because the targets involve the newer condition rating system described in Figure 9. However, this was the most recent data made available to the SMTC at the time of this report. Consistent with the NYSDOT Transportation Asset Management Plan (2019), for this analysis, "Good" pavements have a Surface Score of 7-10, and "Poor" pavements have a Surface Score of 1-5. ***The ratings shown above are from 2017 and 2018, unlike the rest of this document.***

Pavement Condition Data

The pages that follow detail information about pavement rating by owner in the SMTC MPA. Each page includes percentage of ratings by category for all federal-aid eligible roads and breakdowns into Principal Arterials, Minor Arterials, and Collectors. Ratings are also given based on whether a road falls into an Environmental Justice Area, and rating trends are shown over time. Additional maps are shown in *Appendix A*.

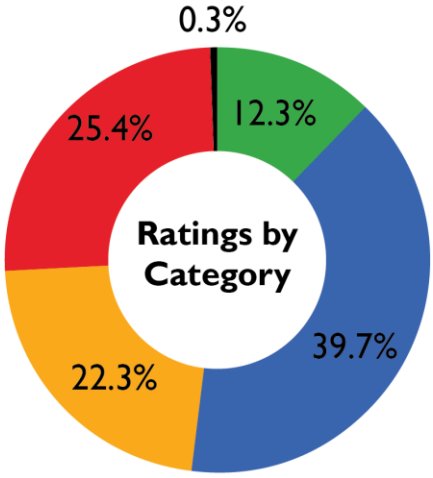
NOTE

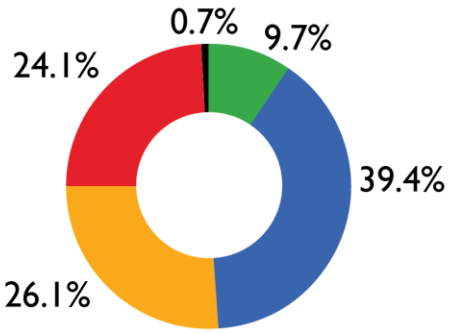
All road measurements in the following section are based off of the SMTC's roads database, built using a Geographic Information System (GIS). These measurements are not survey- or engineering-grade and should be considered for planning purposes only. This report is not intended to be the system of record for road ownership in the MPA. The SMTC is constantly updating our roads database to better and more accurately depict conditions on the ground, to the best of our ability. Thus, small deviations in road measurements from year-to-year in this report are to be expected.

City of Syracuse

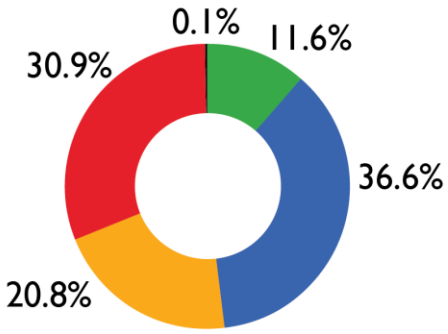
Total FAE Miles 129

Weighted Average Rating 6.6

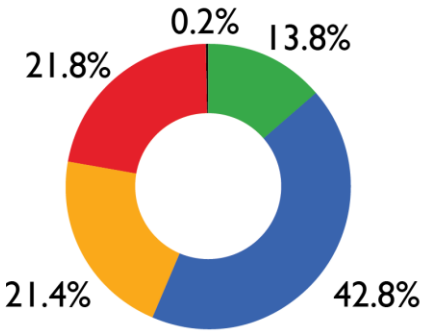




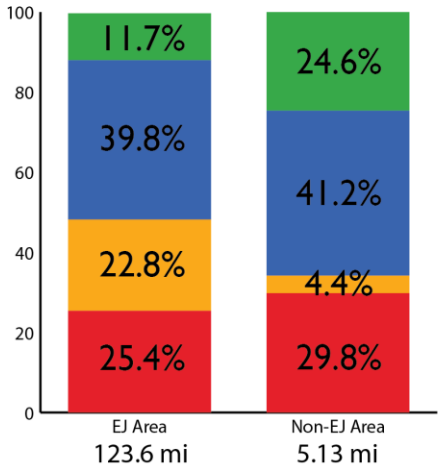
Principal Arterials

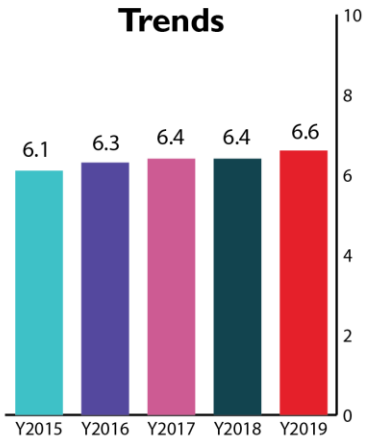


Minor Arterials



Collectors



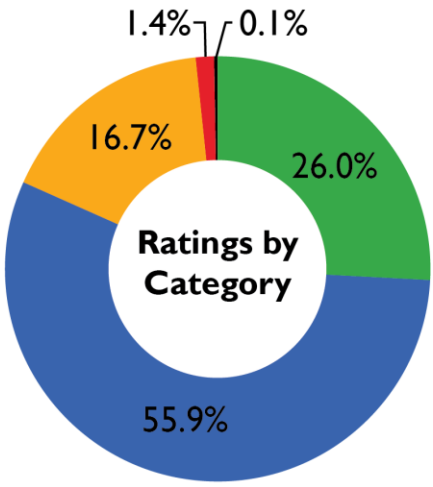


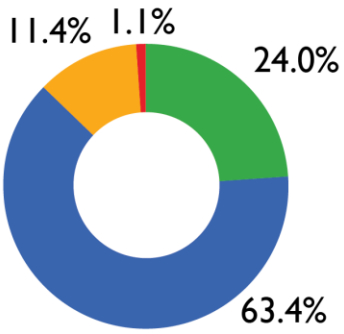
Excellent Good Fair Poor Not Rated

OCDOT

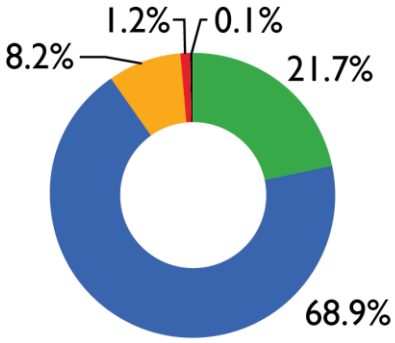
Total FAE Miles 279

Weighted Average Rating 7.6

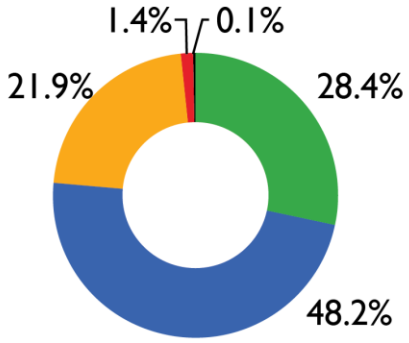




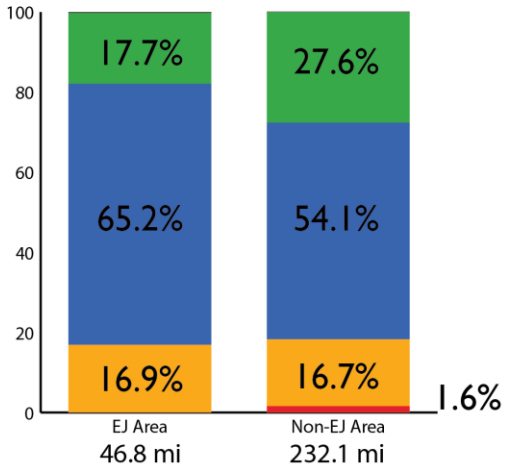
Principal Arterials

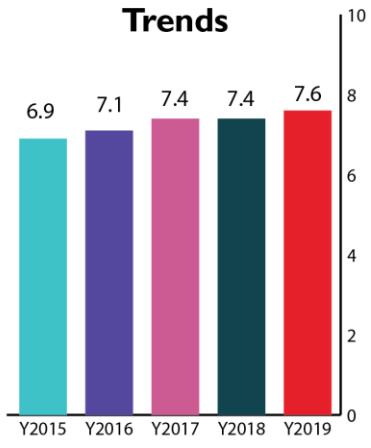


Minor Arterials



Collectors



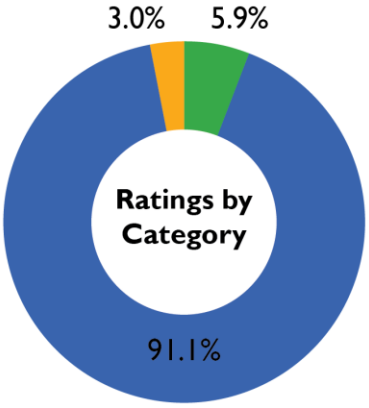


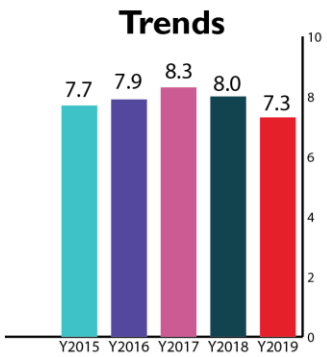
Excellent Good Fair Poor Not Rated

Madison County (SMTC MPA)

Total FAE Miles 18

Weighted Average Rating 7.3





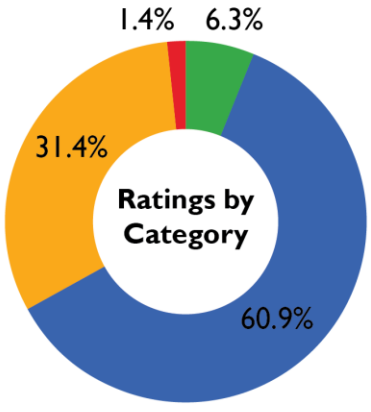
NOTE

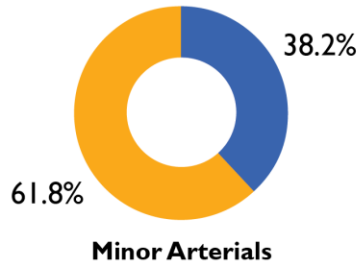
All rated Madison County roads are Collectors and fall in Non-EJ Areas.

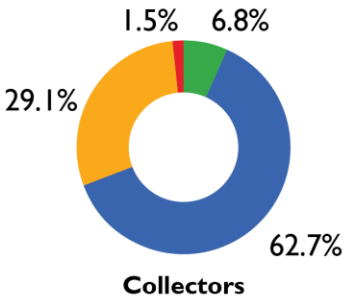
Oswego County (SMTC MPA)

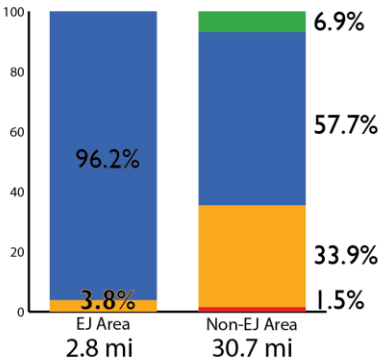
Total FAE Miles 34

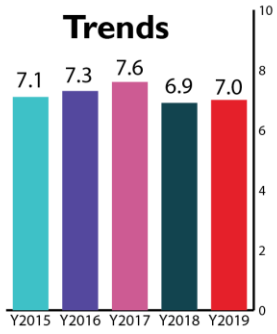
Weighted Average Rating 7.0









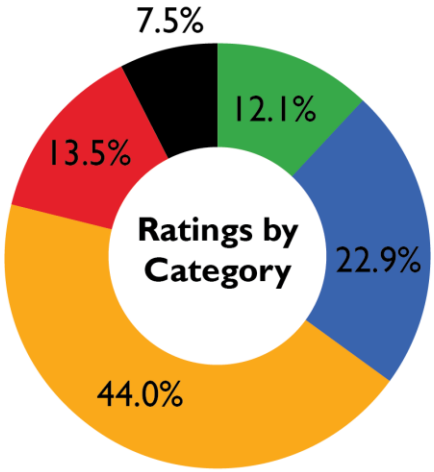


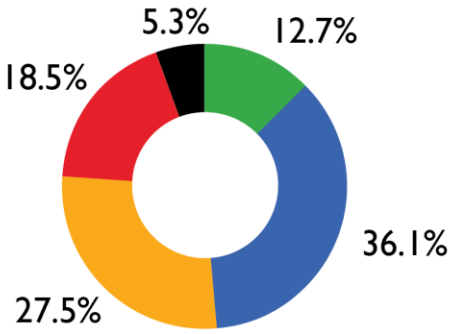
Excellent Good Fair Poor Not Rated

Towns and Villages

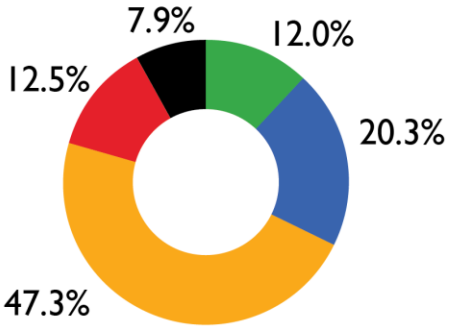
Total FAE Miles 52

Weighted Average Rating 6.5

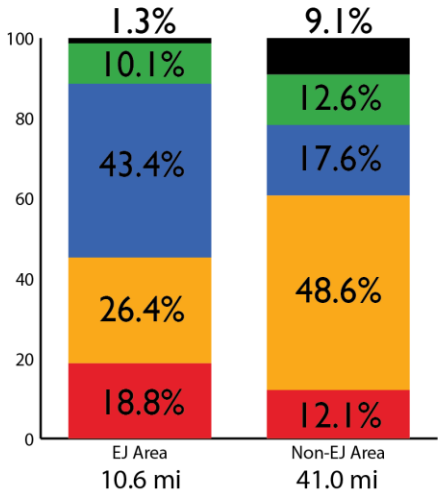


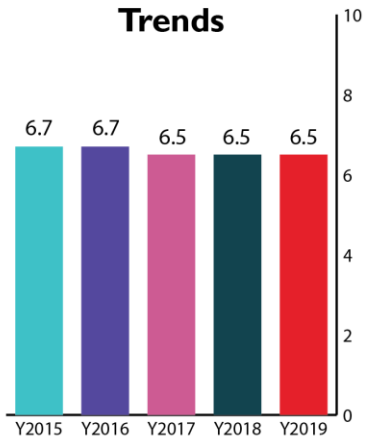


Minor Arterials



Collectors



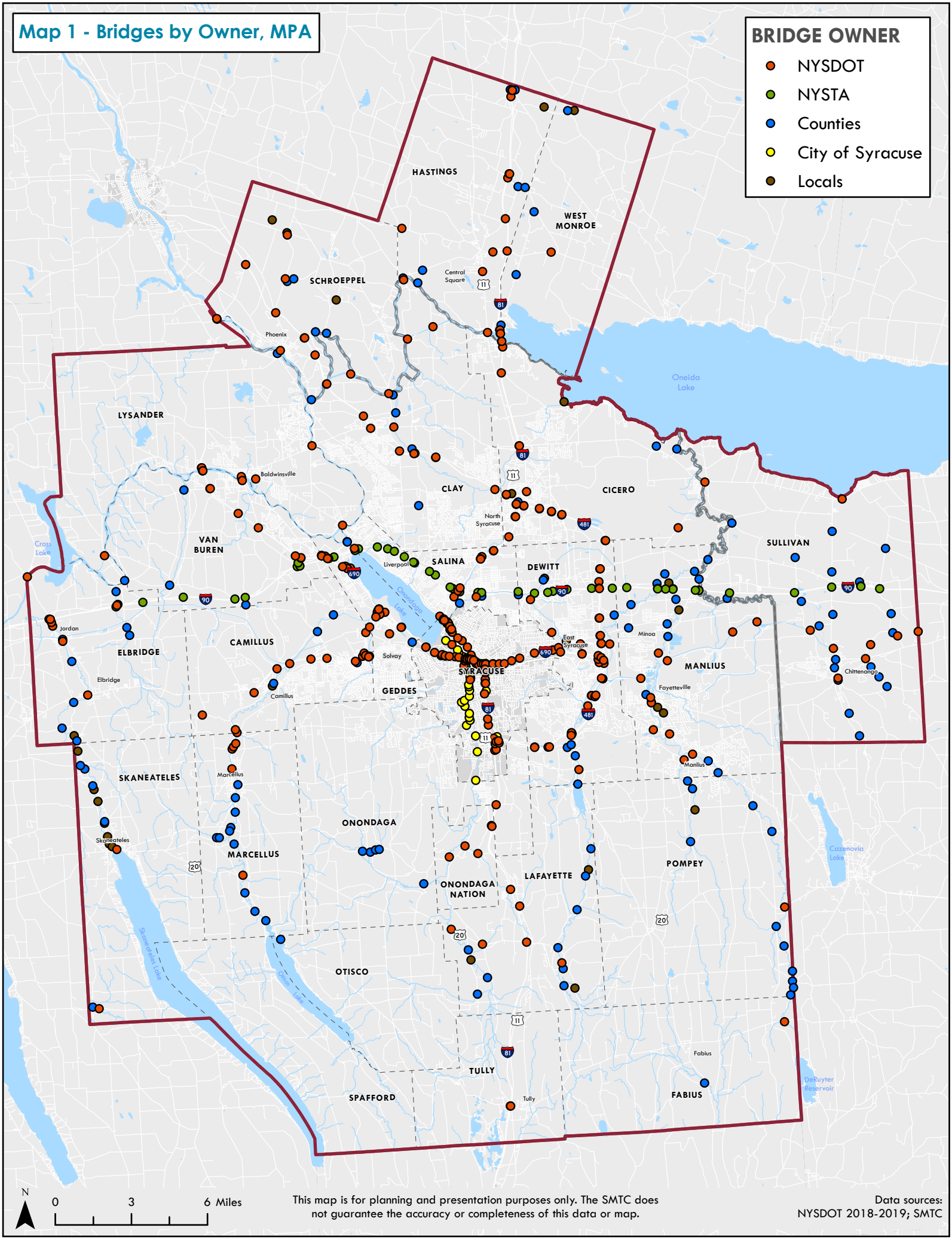


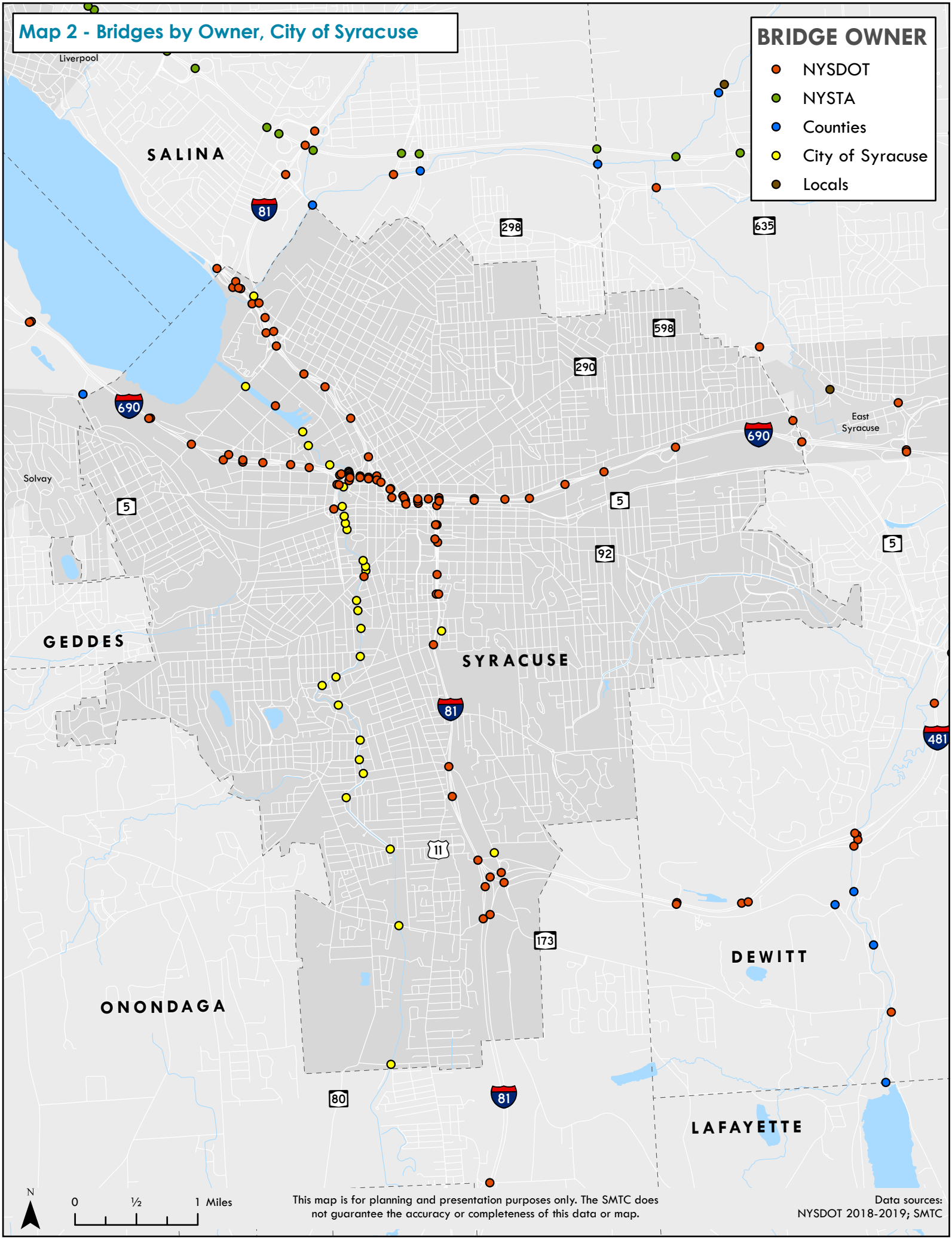
Excellent Good Fair Poor Not Rated

Conclusion

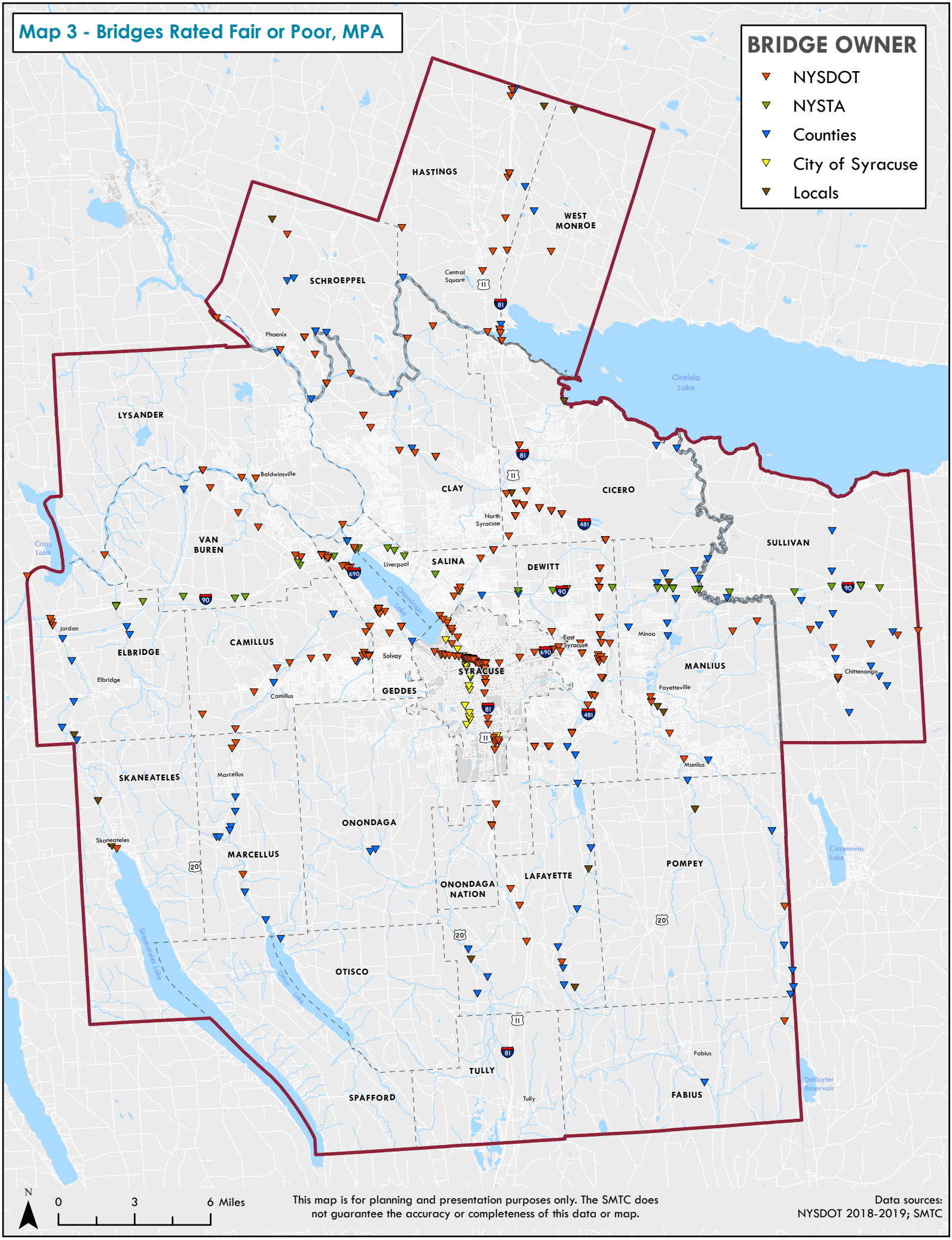
Overall, the goal of this report is to illustrate and analyze data collected on bridge and pavement conditions over the past rating cycle. This uniform dataset serves as a useful tool to the SMTC's member agencies and provided a window into the tangible return on infrastructure investment. By collecting and publishing this data, the SMTC hopes to continue to elucidate the importance of ongoing maintenance efforts. As mentioned in this report, a large portion of capital project funds are spent on highway and bridge projects in our MPA. The data in this report helps plan for ways to preserve and maintain the bridges and pavement of our infrastructure system, especially with limited increases in funding for capital improvements.

Appendix A - Maps


Map 1 - Bridges by Owner, MPA
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
HASTINGS
WEST MONROE
SCHROEPPEL
Central Square
Phoenix
Oneida Lake
LYSANDER
Baldwinsville
CLAY
CICERO
North Syracuse
VAN BUREN
Cross Lake
Liverpool
SALINA
DEWITT
SULLIVAN
Onondaga Lake
Jordan
ELBRIDGE
Elbridge
CAMILLUS
Camillus
Solvay
East Syracuse
Minoa
SYRACUSE
GEDDES
MANLIUS
Fayetteville
Chittenango
Manlius
SKANEATELES
Marcellus
Skaneateles
MARCELLUS
ONONDAGA
ONONDAGA NATION
LAFAYETTE
POMPEY
Cazenovia Lake
Skaneateles Lake
Otisco Lake
OTISCO
TULLY
Tully
Fabius
FABIUS
SPAFFORD
DeRuyter Reservoir
N
0
3
6 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC


Map 2 - Bridges by Owner, City of Syracuse
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
Liverpool
SALINA
81
298
635
598
290
690
East Syracuse
Solvay
5
92
GEDDES
SYRACUSE
481
11
173
DEWITT
ONONDAGA
80
LAFAYETTE
N
0
½
1 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC

Map 3 - Bridges Rated Fair or Poor, MPA



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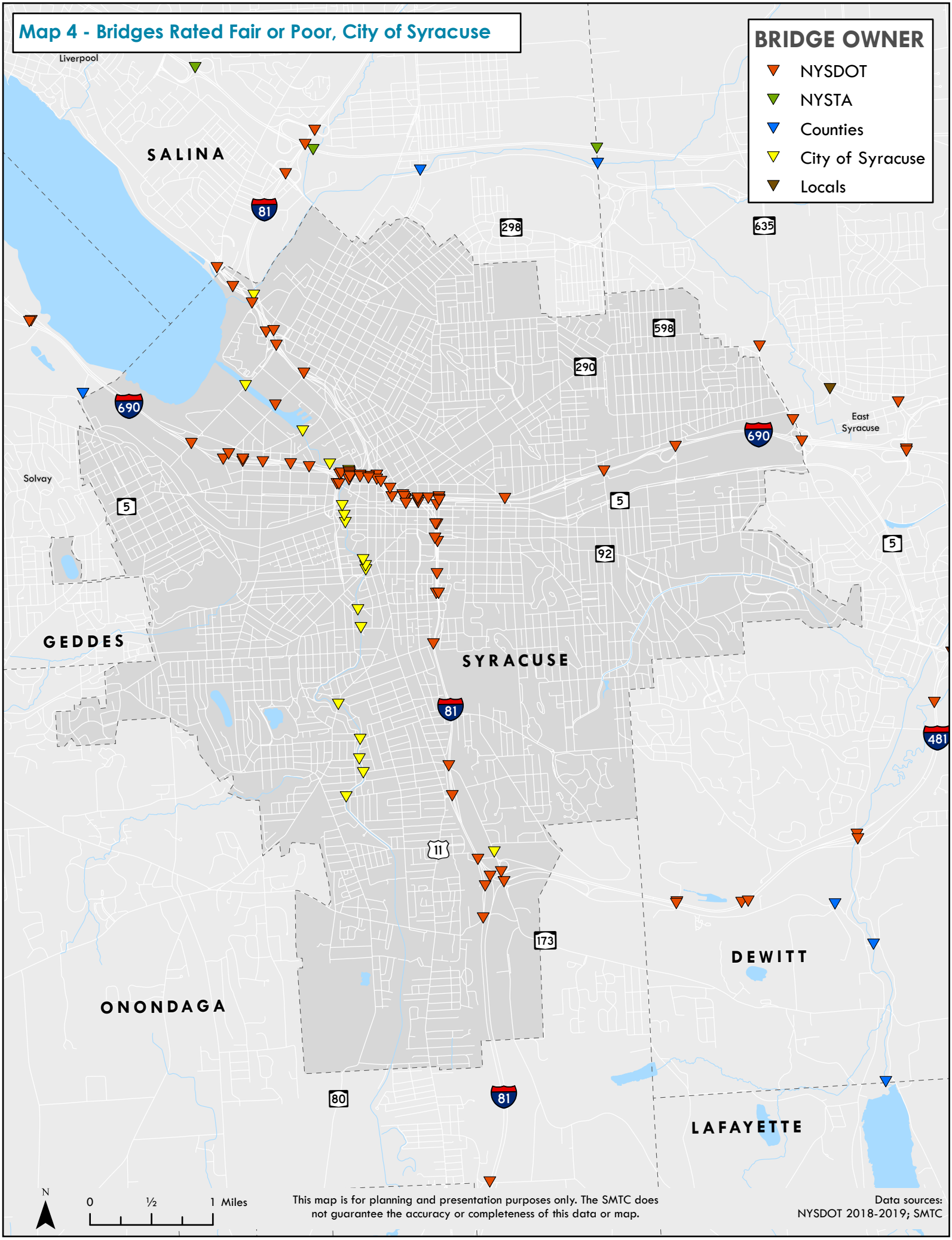
Data sources: NYSDOT 2018-2019; SMTC


Map 4 - Bridges Rated Fair or Poor, City of Syracuse
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
Liverpool
SALINA
Solvay
GEDDES
SYRACUSE
East Syracuse
DEWITT
ONONDAGA
LAFAYETTE
81
298
635
598
290
690
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1 Miles
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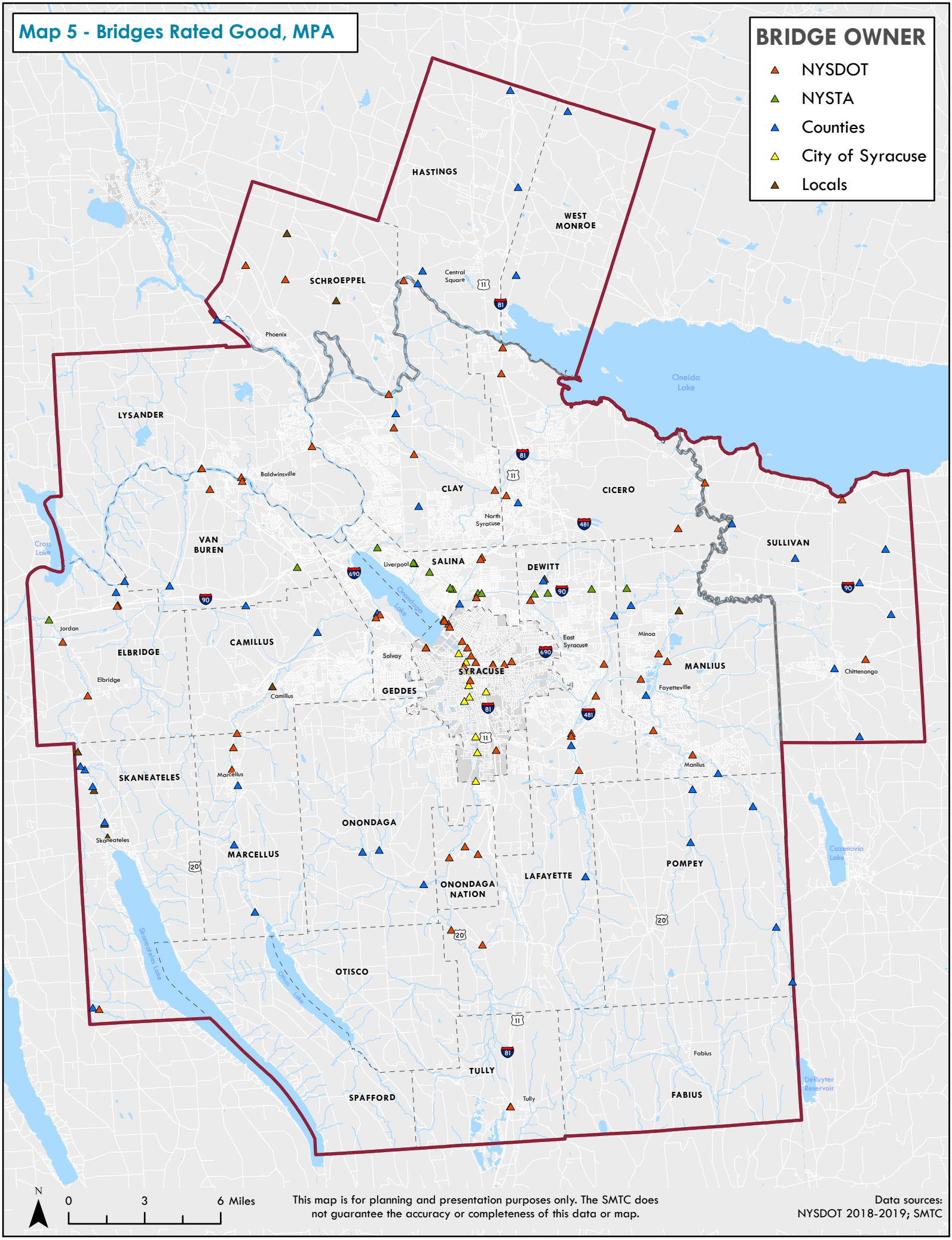
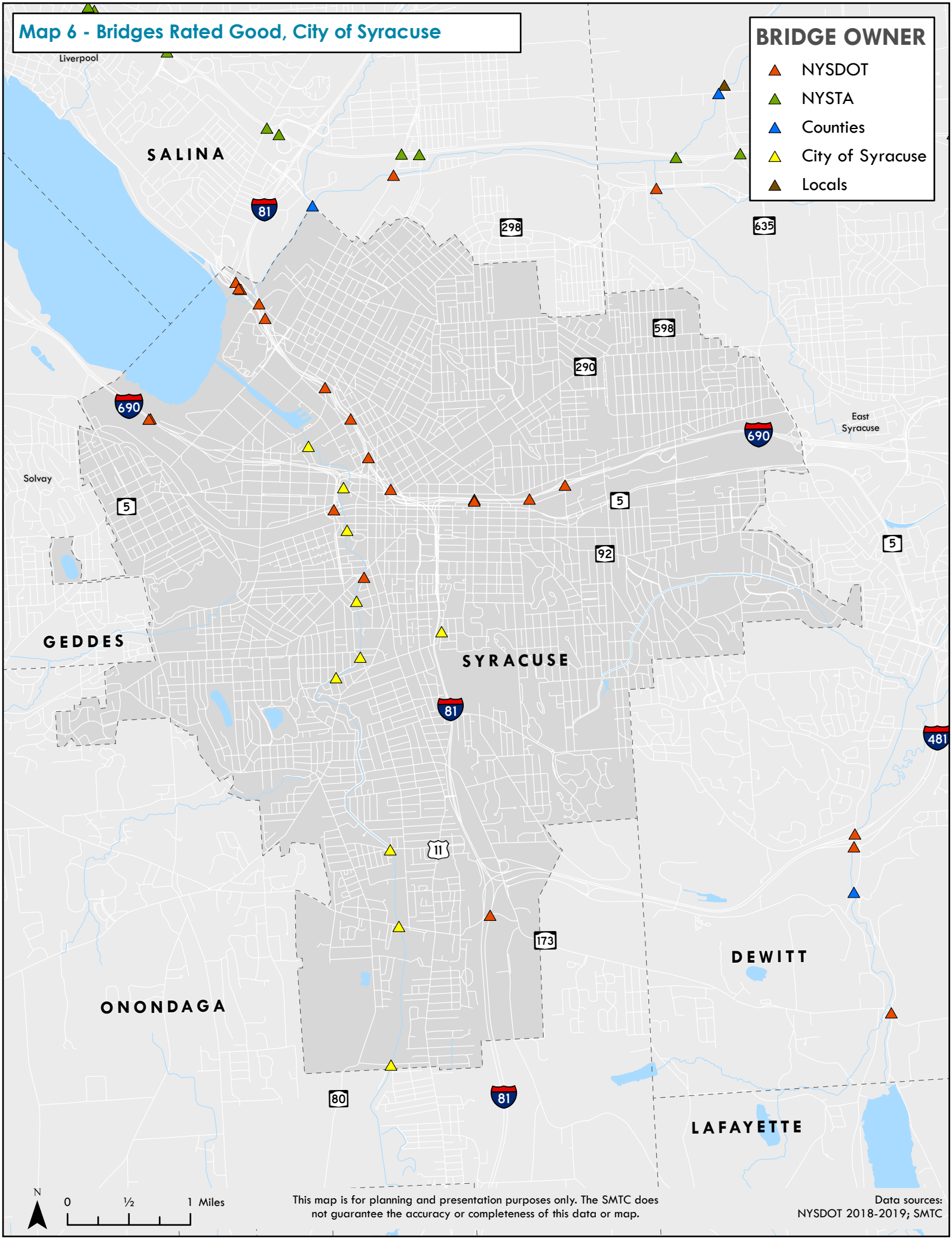
Data sources: NYSDOT 2018-2019; SMTC


Map 5 - Bridges Rated Good, MPA
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
HASTINGS
WEST MONROE
SCHROEPPEL
Central Square
Phoenix
Oneida Lake
LYSANDER
Baldwinsville
CLAY
CICERO
North Syracuse
VAN BUREN
Cross Lake
Liverpool
SALINA
DEWITT
SULLIVAN
Onondaga Lake
Jordan
ELBRIDGE
Elbridge
CAMILLUS
Camillus
Solvay
East Syracuse
SYRACUSE
Minoa
MANLIUS
Fayetteville
Chittenango
GEDDES
SKANEATELES
Skaneateles
Marcellus
ONONDAGA
MARCELLUS
Manlius
POMPEY
Cazenovia Lake
LAFAYETTE
ONONDAGA NATION
Skaneateles Lake
Otisco Lake
OTISCO
TULLY
Fabius
DeRuyter Reservoir
SPAFFORD
Tully
FABIUS
N
0
3
6 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC


Map 6 - Bridges Rated Good, City of Syracuse
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
Liverpool
SALINA
Solvay
GEDDES
SYRACUSE
East Syracuse
DEWITT
ONONDAGA
LAFAYETTE
81
298
635
598
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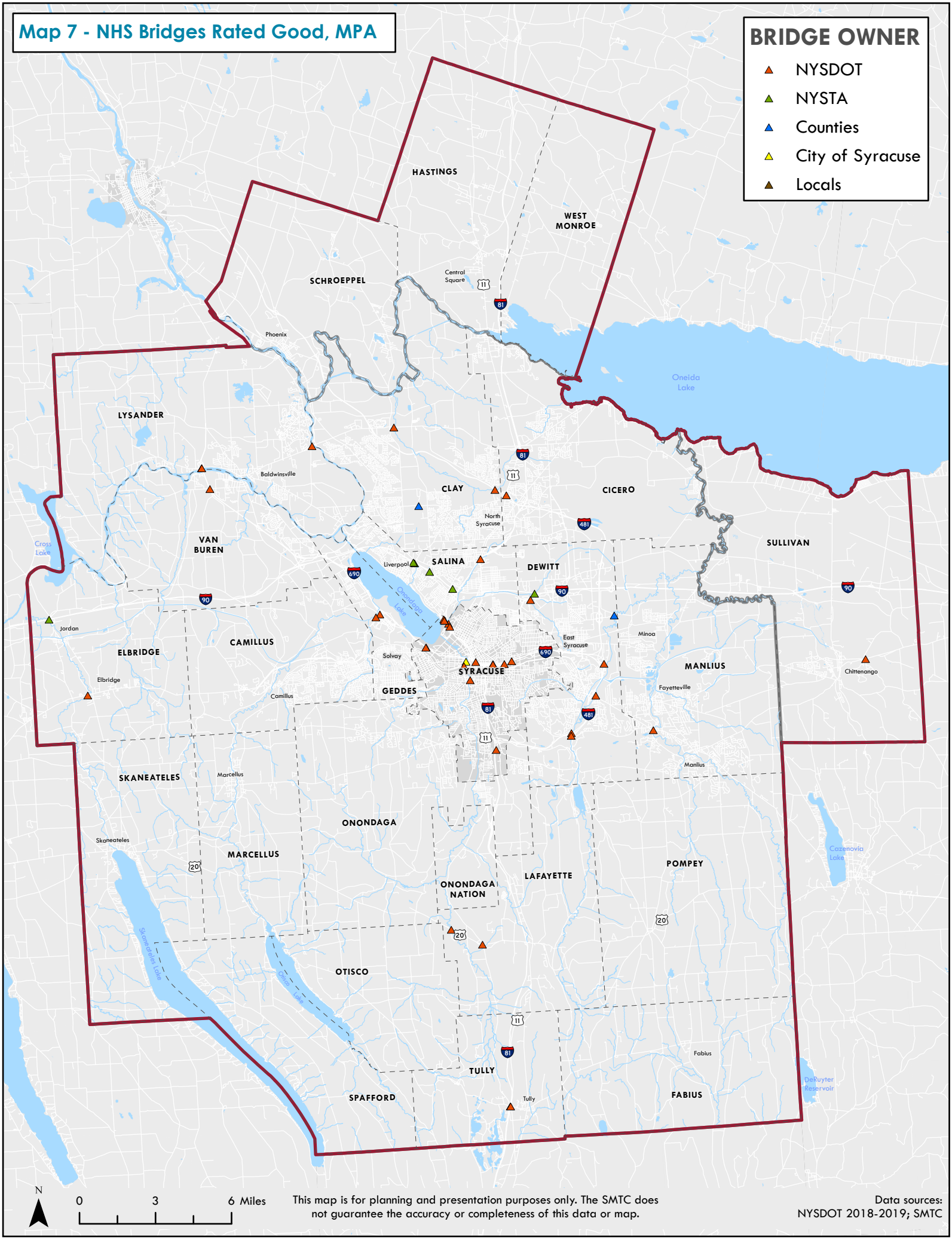
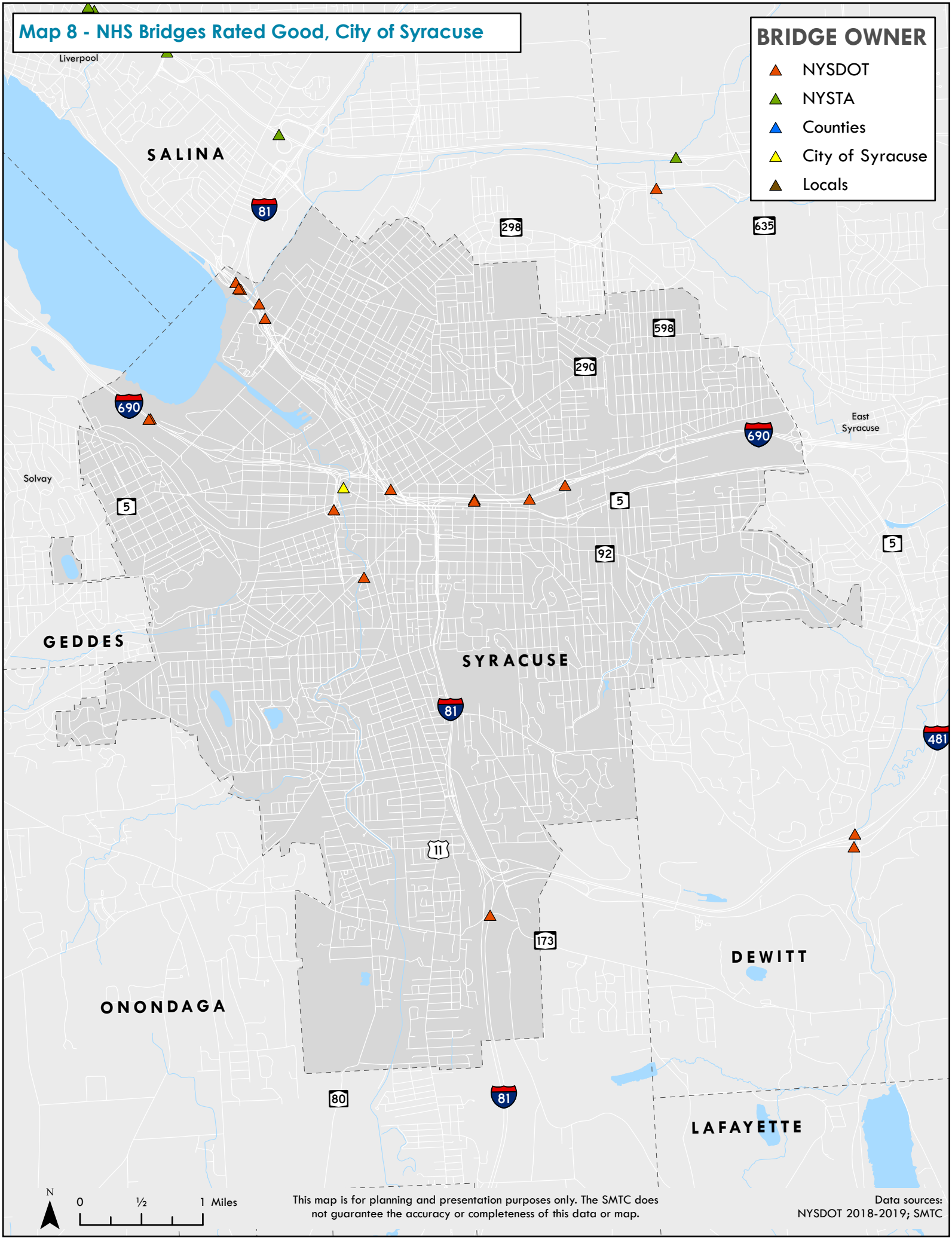
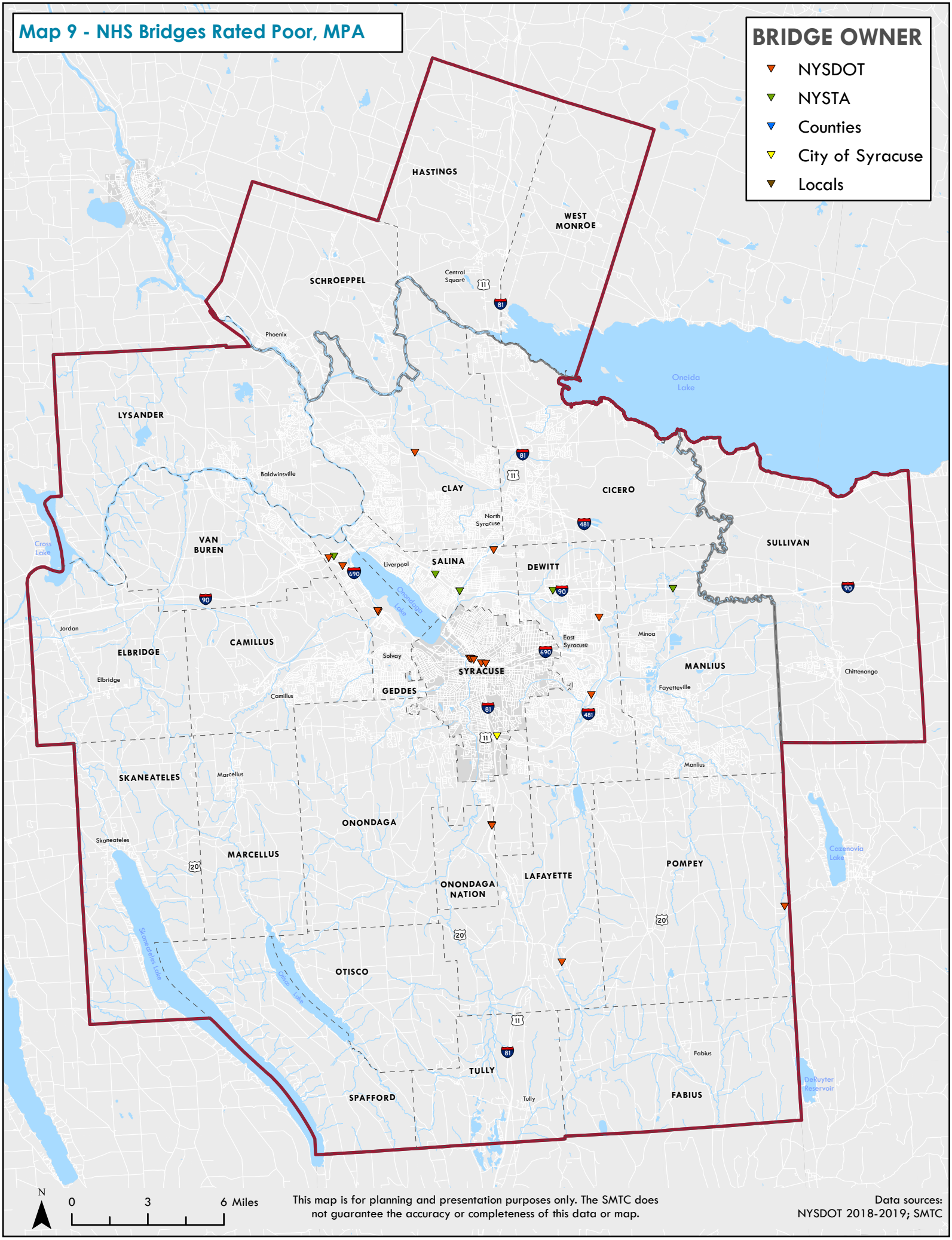
1 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC


Map 7 - NHS Bridges Rated Good, MPA
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
HASTINGS
WEST MONROE
SCHROEPPEL
Central Square
Phoenix
Oneida Lake
LYSANDER
Baldwinsville
CLAY
CICERO
North Syracuse
VAN BUREN
Cross Lake
Liverpool
SALINA
DEWITT
SULLIVAN
Onondaga Lake
Jordan
ELBRIDGE
Elbridge
CAMILLUS
Camillus
Solvay
East Syracuse
Minoa
SYRACUSE
GEDDES
MANLIUS
Fayetteville
Chittenango
SKANEATELES
Marcellus
Manlius
ONONDAGA
Skaneateles
MARCELLUS
POMPEY
Cazenovia Lake
LAFAYETTE
ONONDAGA NATION
Skaneateles Lake
Otisco Lake
OTISCO
TULLY
Fabius
SPAFFORD
Tully
FABIUS
DeRuyter Reservoir
N
0
3
6 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC

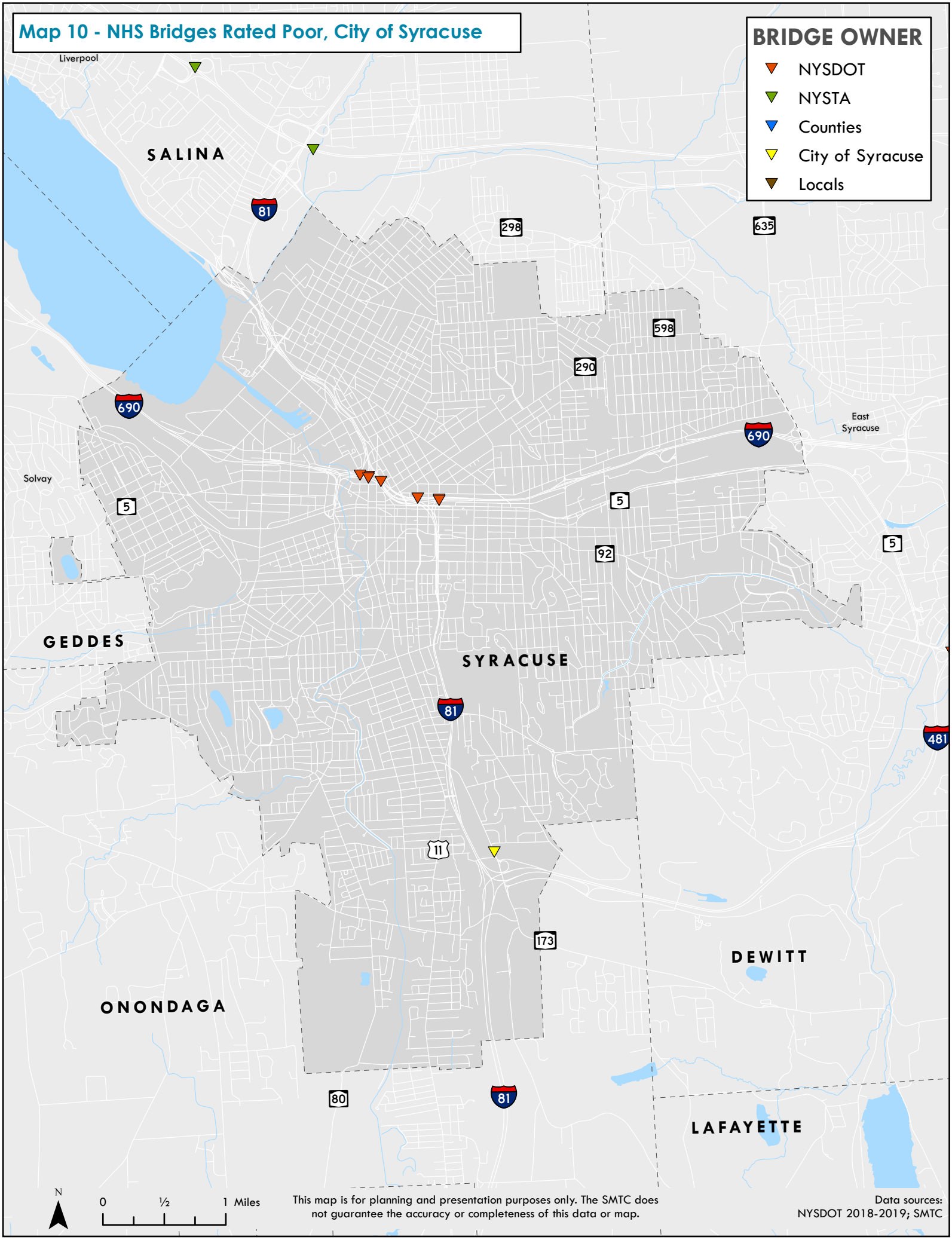

Map 8 - NHS Bridges Rated Good, City of Syracuse
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
Liverpool
SALINA
81
298
635
598
290
690
East Syracuse
Solvay
5
92
GEDDES
SYRACUSE
481
11
173
DEWITT
ONONDAGA
80
LAFAYETTE
N
0
½
1 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC

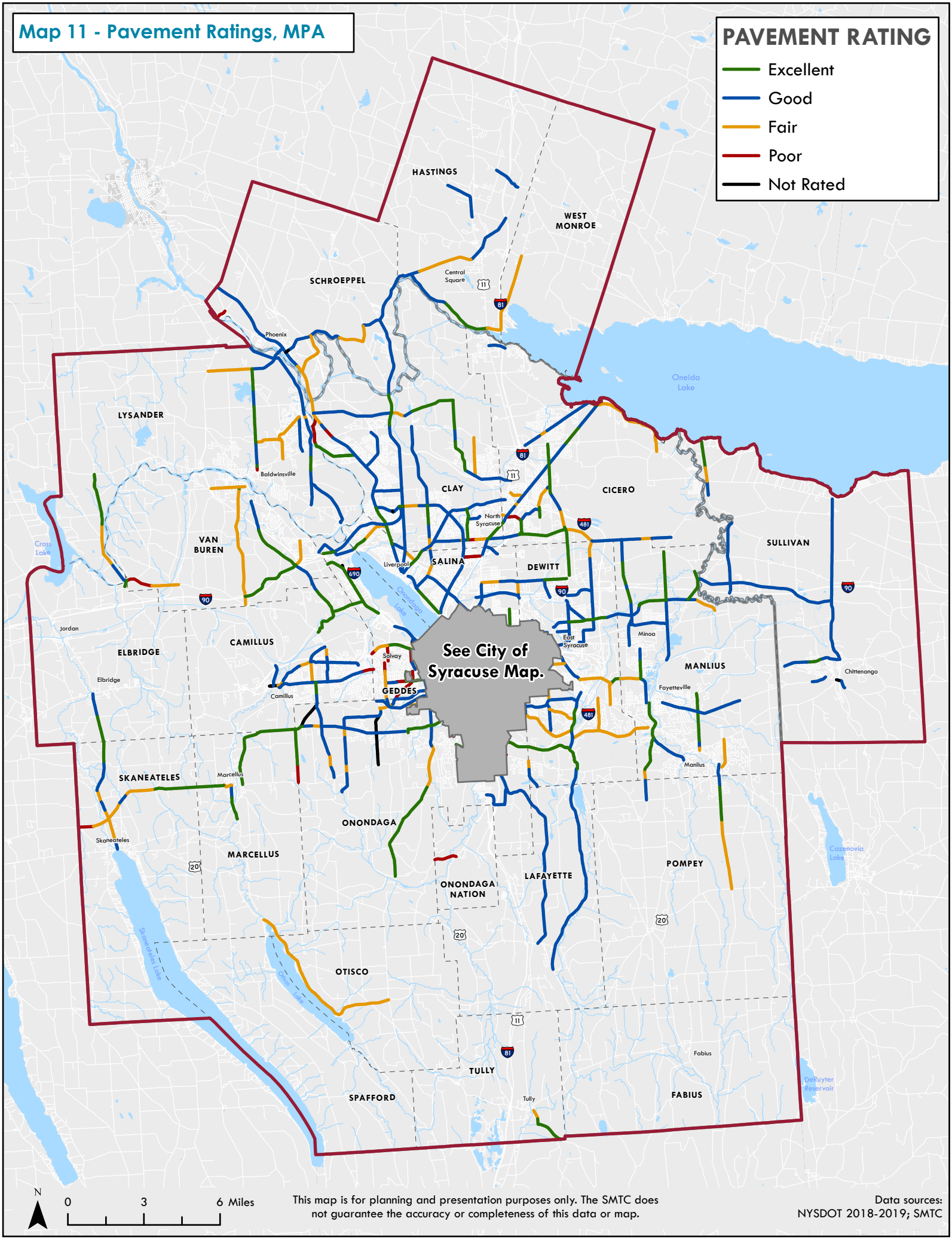
Map 9 - NHS Bridges Rated Poor, MPA

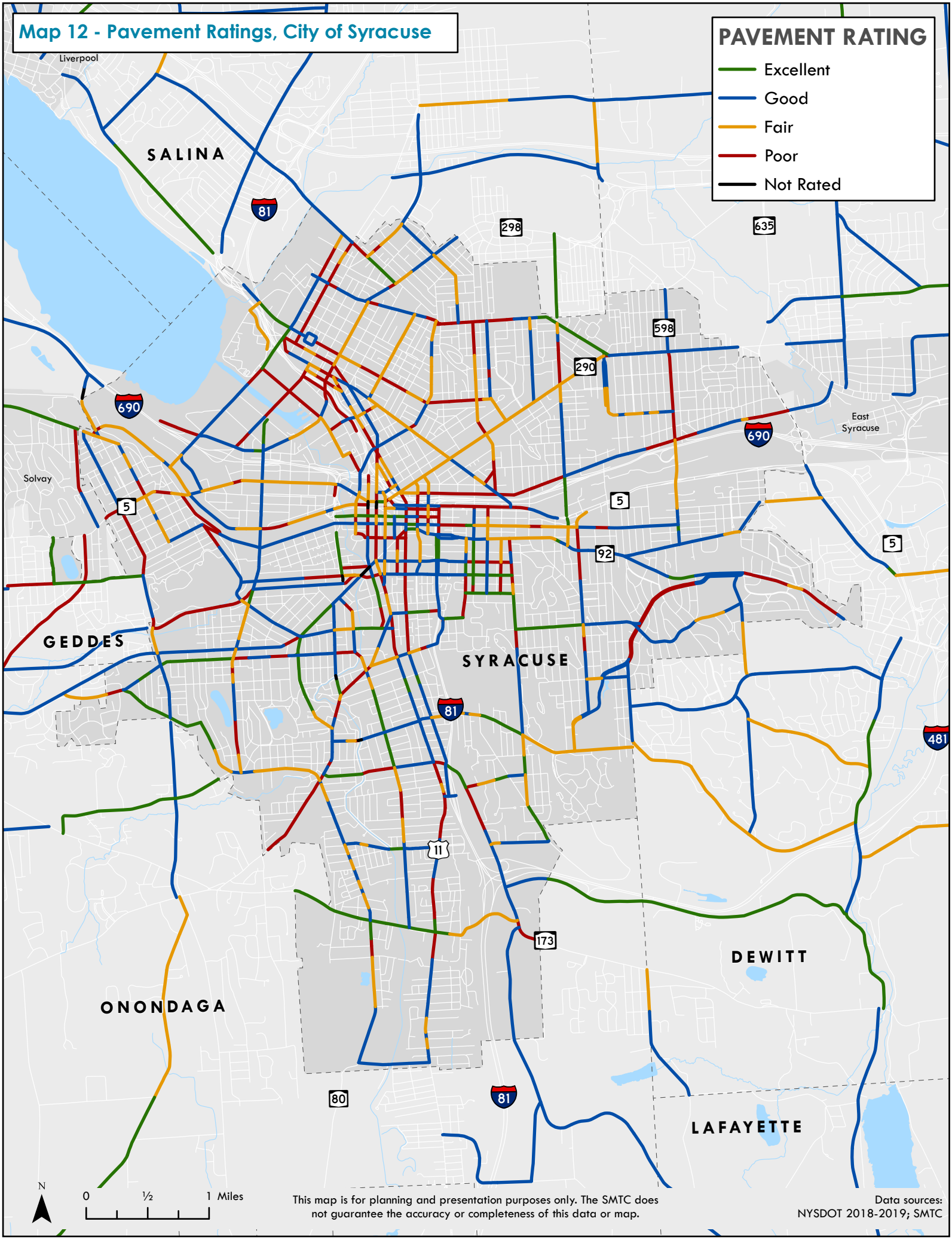


This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.

Data sources: NYSDOT 2018-2019; SMTC


Map 10 - NHS Bridges Rated Poor, City of Syracuse
BRIDGE OWNER
NYSDOT
NYSTA
Counties
City of Syracuse
Locals
Liverpool
SALINA
81
298
635
598
290
690
East Syracuse
Solvay
5
92
GEDDES
SYRACUSE
481
11
173
DEWITT
ONONDAGA
80
LAFAYETTE
N
0
½
1 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC


Map 11 - Pavement Ratings, MPA
PAVEMENT RATING
Excellent
Good
Fair
Poor
Not Rated
HASTINGS
WEST MONROE
SCHROEPPEL
Central Square
Phoenix
Oneida Lake
LYSANDER
Baldwinsville
CLAY
CICERO
North Syracuse
VAN BUREN
Cross Lake
Liverpool
SALINA
DEWITT
SULLIVAN
Onondaga Lake
Jordan
ELBRIDGE
Elbridge
CAMILLUS
Camillus
Solvay
East Syracuse
Minoa
See City of Syracuse Map.
GEDDES
MANLIUS
Fayetteville
Chittenango
Manlius
SKANEATELES
Marcellus
Skaneateles
ONONDAGA
MARCELLUS
ONONDAGA NATION
LAFAYETTE
POMPEY
Cazenovia Lake
Skaneateles Lake
Otisco Lake
OTISCO
TULLY
Fabius
SPAFFORD
Tully
FABIUS
DeRuyter Reservoir
N
0
3
6 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC


Map 12 - Pavement Ratings, City of Syracuse
PAVEMENT RATING
Excellent
Good
Fair
Poor
Not Rated
Liverpool
SALINA
81
298
635
598
290
690
East Syracuse
Solvay
5
92
GEDDES
SYRACUSE
481
11
173
DEWITT
ONONDAGA
80
LAFAYETTE
N
0
½
1 Miles
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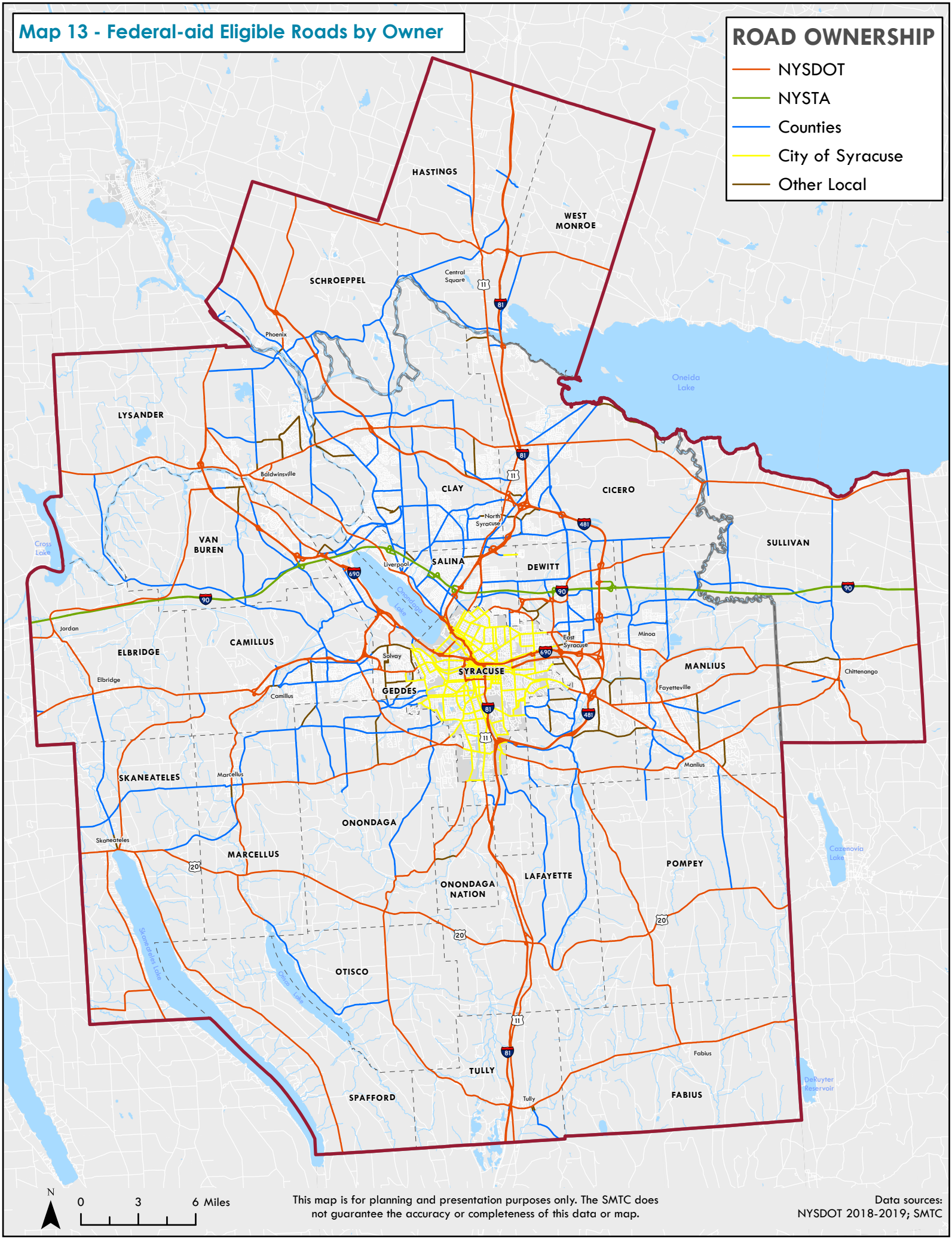
Data sources: NYSDOT 2018-2019; SMTC

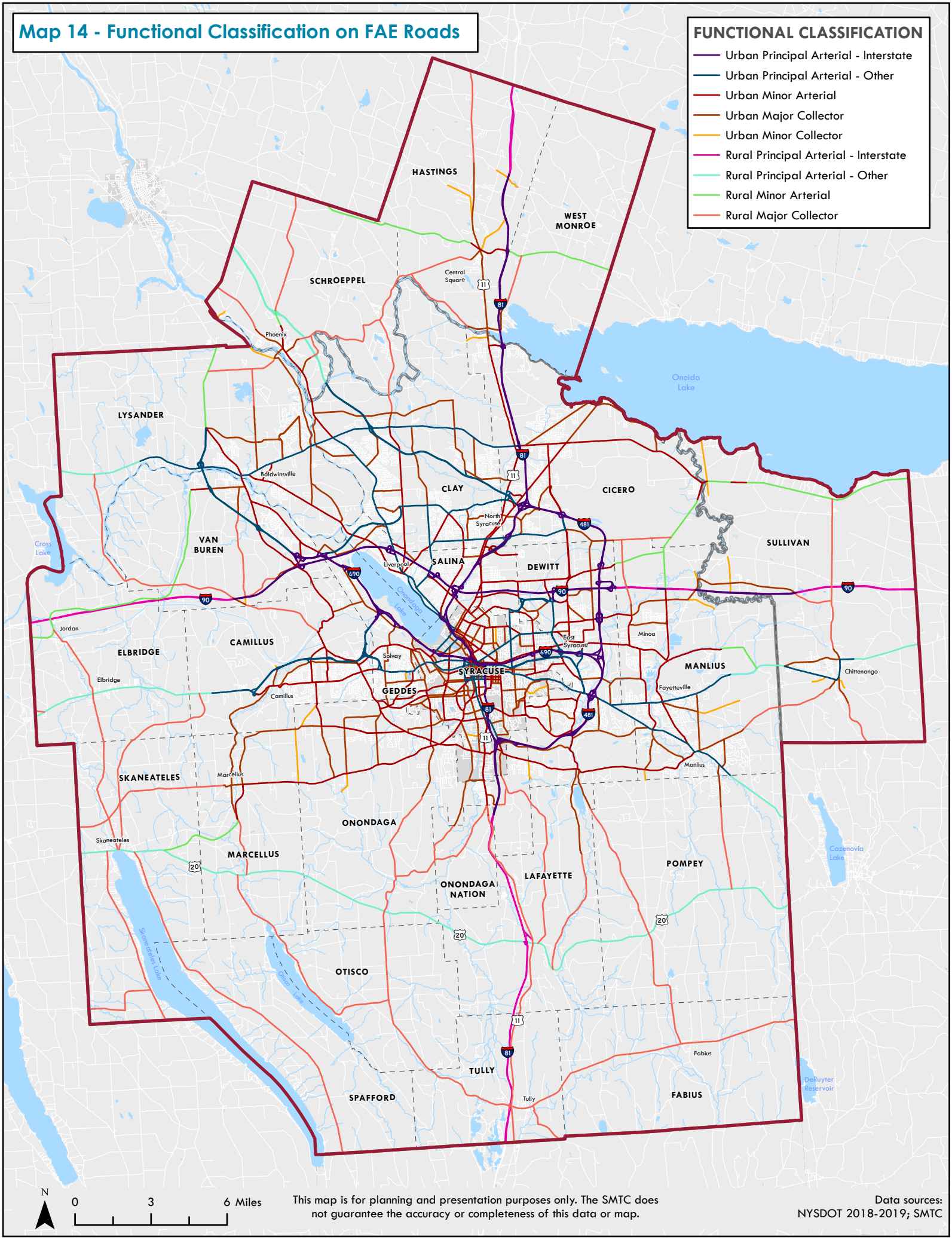
Map 13 - Federal-aid Eligible Roads by Owner



This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.

Data sources: NYSDOT 2018-2019; SMTC

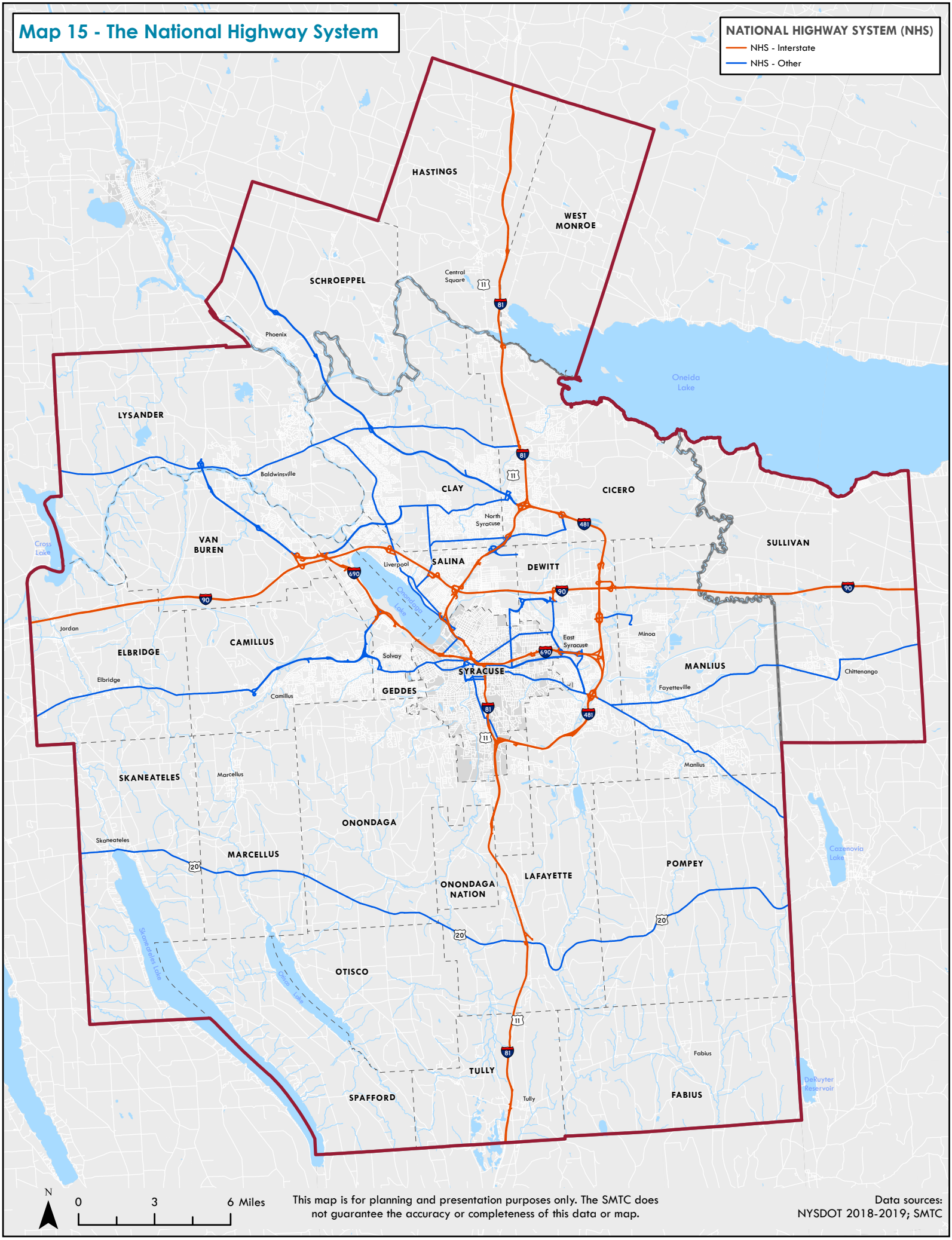
Map 14 - Functional Classification on FAE Roads



This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.

Data sources: NYSDOT 2018-2019; SMTC

Map 15 - The National Highway System



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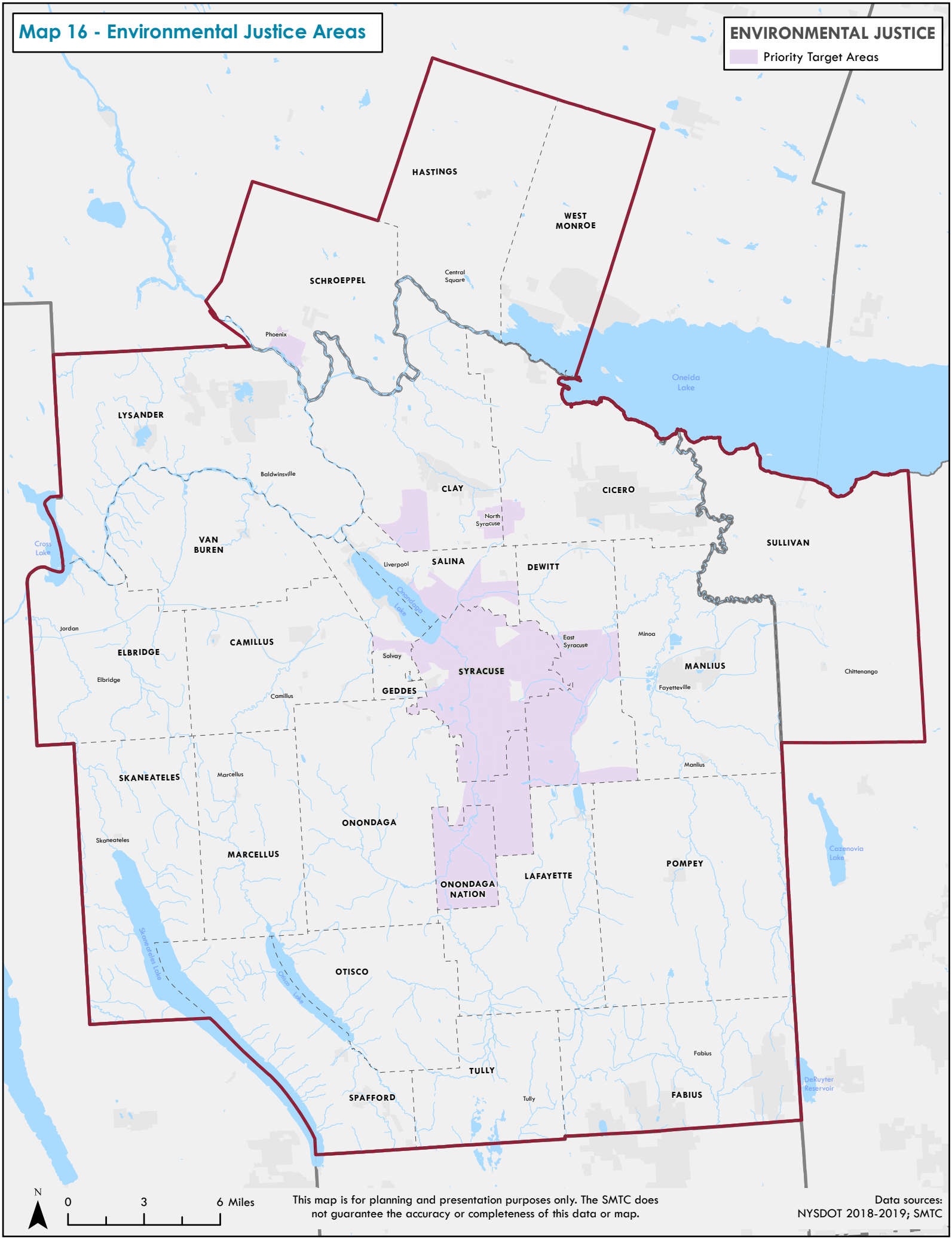
Map 16 - Environmental Justice Areas
ENVIRONMENTAL JUSTICE
Priority Target Areas
HASTINGS
WEST MONROE
SCHROEPPEL
Central Square
Phoenix
Oneida Lake
LYSANDER
Baldwinsville
CLAY
CICERO
North Syracuse
SULLIVAN
VAN BUREN
Cross Lake
Liverpool
SALINA
DEWITT
Onondaga Lake
Jordan
CAMILLUS
ELBRIDGE
Elbridge
Solvay
East Syracuse
Minoa
SYRACUSE
MANLIUS
Fayetteville
Chittenango
GEDDES
Camillus
Manlius
SKANEATELES
Marcellus
ONONDAGA
Skaneateles
MARCELLUS
POMPEY
Cazenovia Lake
LAFAYETTE
ONONDAGA NATION
Skaneateles Lake
Otisco Lake
OTISCO
Fabius
TULLY
DeRuyter Reservoir
SPAFFORD
Tully
FABIUS
N
0
3
6 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: NYSDOT 2018-2019; SMTC

Appendix B - City of Syracuse Supplemental Pavement Rating Documentation

City of Syracuse Supplemental Pavement Rating

2019-2020 Unified Planning Work Program

SMTC

Syracuse Metropolitan Transportation Council

City of Syracuse
Supplemental Pavement Rating Documentation

A Chapter of the Upcoming Bridge and Pavement Condition Management System Report

December 2019

2019-2020 Unified Planning Work Program

This document was prepared with financial assistance from the Federal Highway Administration and the Federal Transit Administration of the U.S. Department of Transportation through the New York State Department of Transportation. The Syracuse Metropolitan Transportation Council is solely responsible for its contents.

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Syracuse, NY 13202
(315) 422-5716
www.smtcmpo.org

Contents

Introduction

Each program year, the Syracuse Metropolitan Transportation Council publishes a Bridge and Pavement Condition Management System (BPCMS) report to serve as a comprehensive clearinghouse for condition information on selected bridges and pavements throughout the Metropolitan Planning Area (MPA). Throughout its history, the BPCMS has contained different types of information varying in scope, depending on the needs of member agencies, federal regulations, and data collection methods. Most recently, the Pavement section of the report has included condition information on all federal-aid eligible roads in the MPA.

This year, in addition to compiling data on federal-aid eligible roads, the SMTC undertook a new effort – providing ratings on the entirety of the City of Syracuse's road system. In keeping with past data collection efforts by the City, roads were rated on a block-by-block basis. The City indicated that having consistent pavement ratings will allow the Department of Public Works and other City entities to make data-driven decisions for street repair, reconstruction, and preventative maintenance.

Rating Scale

The SMTC rates pavement using the NYSDOT's *Surface Score* rating scale, which is a windshield survey providing ratings ranging from 1 (impassible) to 10 (new pavement). The ratings on this scale are given based on the frequency and severity of surface cracking. The survey is completed at posted speed limits while within the vehicle, no additional testing is conducted as a part of the Surface Score Analysis. The *Surface Score* process also includes a provision for a roadway's *dominant distress*, but that information is not recorded as a part of the SMTC's data collection effort for the City.

The *Surface Score* categorizes ratings based on the 1-10 values. Roads with a score of 9 or 10 are considered Excellent, 7-8 are considered Good, 6 is considered Fair, and 1-5 are considered Poor. SMTC staff have attended several trainings with NYSDOT staff to rate pavement using this scale. In addition to the 1-10 values, the SMTC applies a value of "0," or Unrated, to a very small percentage of roads. In most instances, Unrated roads are either under construction at the time of rating, or consist of materials not suited for pavement rating, such as brick or concrete bridge deck.

Rating	Condition Description
9-10 Excellent	No or slight pavement distress.
7-8 Good	Minor to moderate distress occurring infrequently to occasionally.
6 Fair	Moderate to severe distress occurring occasionally to frequently.
1-5 Poor	Severe or very severe distress occurring frequently. Travel may be impaired.

Figure 1 – An overview of the Surface Score. *Source: NYSDOT Pavement Rating Manual.*

In the past, City staff collected pavement ratings on a partial basis, approximately 25% per year. Research by SMTC staff suggests that a 1-10 scale loosely based on the *Surface Score* was the basis of this rating operation. However, a review of past and more recent data collected by the SMTC on federal-aid eligible roads indicated inconsistencies between the two scales. Although the NYSDOT scale has values of 1 through 10, in practice, ratings of 4-10 are used most often with 3 only reserved for severe deterioration. A score of 1 would indicate an impassible road, and a rating of 2 is applied to a road which cannot be passed at posted speed without damage to the vehicle. When reviewing older datasets, SMTC staff discovered ratings of 1 and 2, and extensive use of 3 in the City's data,

which suggests that although the City's rating scale may have originated with the *Surface Score*, the two scales drifted apart over time.

Rating Process

In prior years, SMTC staff collected ratings using a paper-based system. Routes were specifically designed to traverse federal-aid eligible roads in a certain order, and their surface score recorded. Ratings were then transferred to a Microsoft Access database, which in turn could be joined to a geographic information system (GIS) using a unique identifier for each segment. This method worked well for the approximately 120 centerline miles that the SMTC was rating prior to this year. However, with initial estimates of over 400 for total City-owned mileage, a new electronic system was introduced for the data collection process.

SMTC staff consulted with other metropolitan planning organizations (MPOs) across New York State for information. Staff at several other MPOs conduct pavement rating surveys for their member agencies using a variety of different techniques. Mobile data collection techniques have advanced significantly in recent years, pioneered by ESRI, the leading producer of GIS software. Whereas some MPOs were collecting data in the field using a laptop computer installed with desktop GIS software, a similar process is now possible using smaller electronic devices, such as tablets or smartphones. Improved GPS receivers allow for Bluetooth communication with these devices, improving positional accuracy of data. Other MPOs also indicated that staff compiled photologs of pavement conditions as a part of their survey using GPS-enabled cameras.

To facilitate the data collection effort, the SMTC purchased two iPads, two Bad Elf Pro GPS units, and two GoPro Hero 7 Black cameras, as well as various accessories. Two of each were purchased to allow two teams to collect data simultaneously. The purpose of each of these pieces of equipment are described below.

- An *Apple iPad* was used as the main instrument of data collection. The iPad was installed with ESRI's Collector application, which allowed for mobile data collection in the field. Collector allows a user to use the application in an offline mode, so mobile cellular data was not needed for the SMTC's operation. A base map of the City of Syracuse was loaded into the application, as well as the most recent ratings available on the federal-aid system. The application allowed for a point to be placed in order to indicate a rating; staff placed a new point on every block to facilitate block-by-block data collection. Previously-placed points were visible so that progress could be monitored.
- The *Bad Elf GPS Pro+* was connected via Bluetooth to the iPad in order to obtain better positional accuracy. SMTC staff needed confidence that points representing a rating were placed on the proper block segment. In practice, the Bad Elf unit provided an approximate locational accuracy of 10-15 feet, which allowed for greater confidence in the placement of the ratings on the map.
- The *GoPro Hero 7 Black* camera is equipped with GPS capabilities. The camera was affixed to the hood of the surveying vehicle and was programmed to capture a photo every ten seconds. The location of these photos were later mapped using GIS software.

Figure 2 – Data collection tools used by the SMTC. From left: GoPro Hero 7 Black, Apple iPad with ESRI Collector, Bad Elf GPS Pro+.

From Rating to Maps and Spreadsheets

The BPCMS not only stores pavement rating data, but also provides an analysis of the information collected. GIS software allows for the mapping and analysis of datasets with a spatial component, such as the pavement ratings. Over the course of the data collection process, no additional information was gathered besides a location and a rating. In order for meaningful conclusions to arise from the data, ancillary information about the road on which a rating was collected is needed.

The SMTC has access to numerous sources of road information. Nearly all these sources maintain data in a line format, as roads in a GIS are traditionally visualized as centerline. In order to successfully merge the point data collected from the rating process with the existing conditions in the line data, a GIS process called a *spatial join* was performed. In a spatial join, attributes from one geographic feature are joined to another geographic feature through a spatial relationship. In this situation, when a rating point intersects a road segment line, identifying information from the point (the rating) will be added to the data already attributed to the line. Since rating data points were collected with varying degrees of locational accuracy throughout the City and did not always fall directly on the road centerline, a join tolerance was established to ensure that each point successfully connected with the appropriate line segment. A series of trials were performed to find the optimal join tolerance for this process, which yielded a result of 15 meters. Therefore, any point within approximately 45 feet of any given GIS centerline was joined to that centerline. Only one rating can be attributed to a given road segment. If, during the process of the spatial join, one of the road centerline segments contained more than one rating point of different values, SMTC staff chose the most applicable rating for that segment. This process also resulted in the splitting of some segments or the creation of new segments.

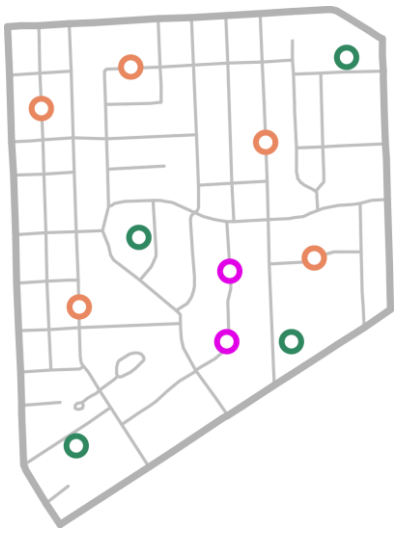


Figure 3 - A visualization of the spatial join *technique. Data associated with the orange points would transfer to the gray road network due to their spatial relationship. Data associated with the green points would fail to associate, and data from the purple points would cause a data conflict. Source: SMTC.*

Ultimately, the SMTC utilized its own road network file to provide additional information on road segments. The SMTC's file contains several fields which will be beneficial to analysis, and since it is maintained locally and reviewed regularly, has a greater degree of accuracy than some statewide files.

Although the SMTC has confidence in its road network file, it is not authoritative or the system of record for road ownership and is intended for planning purposes only. As such, road ownership and maintenance stems from multiple different sources, and is not completely verified. The SMTC's file contains road centerline data for more than just public highways, such as private roads that were not intended for pavement rating. Without an authoritative, central repository of data on road ownership and maintenance, additional sources and professional judgement were used to determine roads which are City-owned and/or maintained, and thus fit for inclusion in the pavement survey.

In addition to providing geographic analyses for pavement ratings, there are advantages to maintaining data in non-spatial formats for those without GIS software. Instead of noting location

through a map, non-spatial formats require descriptions of segment start and endpoints. The SMTC's road file, as a primarily spatial file, does not inherently have this capability.

Research on older files yielded spreadsheets from 2014 which contained both an identifier field and road segment information such as road name and segment termini. This identifier field is also present in the SMTC's file, which allows for the relay of information from one file to another. However, road names and segment start and endpoints did not always match the spatial data – in these instances, the spatial data is considered the more reliable of the two.

Results

Figures 4 and 5 below illustrate pavement ratings by category and mileage for the City of Syracuse. Mileage totals are given as linear centerline miles, not lane miles – a single rating is applied to a mile of pavement, regardless of the number of lanes or pavement width. Mileage totals are not engineering- or survey-grade, and should be considered for planning purposes only. The SMTC is constantly updating the roads database to better and more accurately depict conditions on the ground, and therefore, small deviations in road measurements from year-to-year are to be expected.

Category	Miles	Percent
Excellent	47.079	11.99%
Good	152.120	38.73%
Fair	101.049	25.73%
Poor	89.394	22.76%
Unrated	3.145	0.80%
Total Miles	392.787	100%
Weighted Average Rating		6.6 (Fair)

Figure 4 – Pavement ratings by centerline miles in the City of Syracuse.

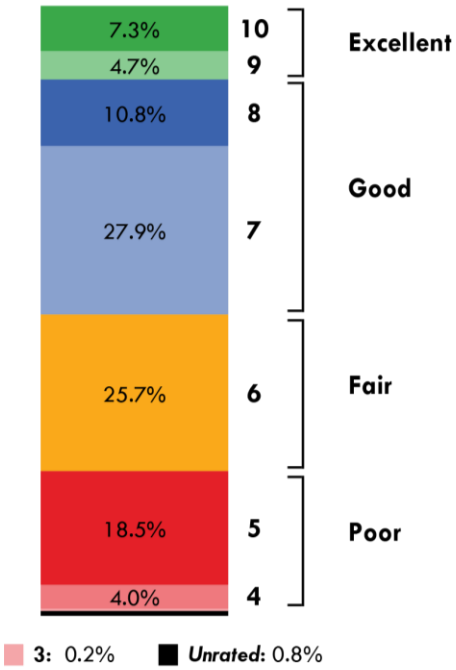


Figure 5 – Percentages by individual score.

Federal-aid eligibility on roadways is based on functional classification. There are ten functional classification codes used to describe the road network. Functional classification is the process by which streets and highways are grouped into classes or systems according to the character of service they are intended to provide. Arterials generally have higher design standards than other roads, often with multiple lanes and some degree of access control. Collectors provide a lower degree of mobility than arterials and are designed for travel at lower speeds and for shorter distances. Collectors are typically two-lane roads that collect and distribute traffic from the arterial system. Roads which do not fall into one of these categories are classified as Local. Local, when used in this sense, has no bearing on the ownership of the road – only its functional classification.

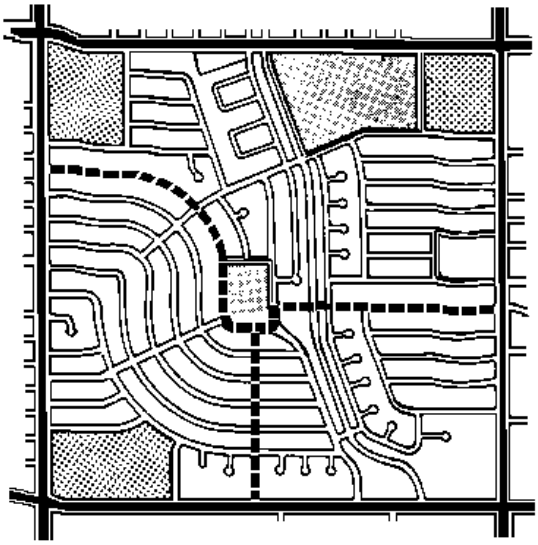


Figure 6 - An illustration of the relationship between functional classifications. The thick lines represent arterials, the dotted lines are collectors, and the hollow lines are locals. Source: FHWA.

Additionally, roads are classified as urban or rural, largely based on urban area boundaries from the US Census. All roads in the City of Syracuse have an urban classification. All urban roads with a functional classification other than Local are considered federal-aid eligible. Figure 7 illustrates rating category by functional classification in the City of Syracuse, and Figure 8 shows rating categories on the federal-aid eligible system. Note that the federal-aid system is only approximately one third of the City's entire network.

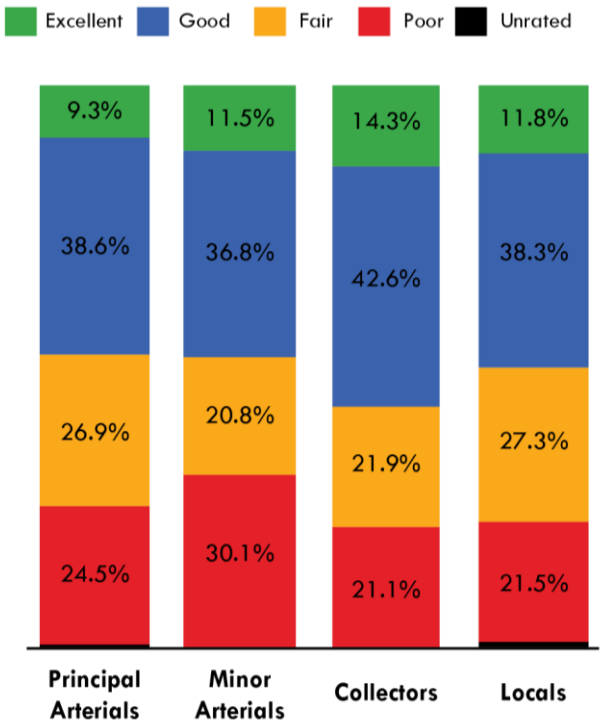


Figure 7 – Percent of pavement centerline miles in each rating category by functional classification.

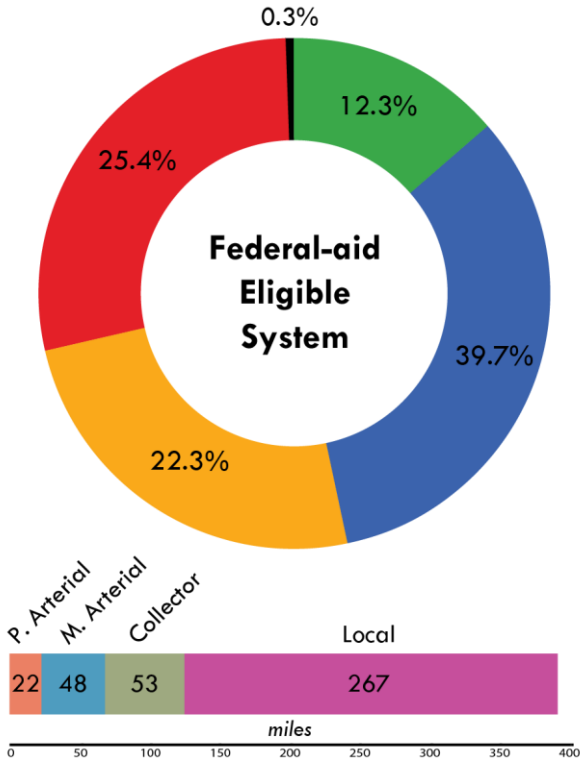


Figure 8 – Percent of pavement centerline miles in each rating category on the federal-aid system, and number of miles on the road network in each functional class.

As a reference, Map 1 at the end of this document shows pavement ratings for the City. Additional maps can be provided upon request.

In addition to this document, the SMTC is publishing the pavement ratings collected onto a web-based application using the ESRI ArcGIS Online platform. City officials and members of the public will be able to visit the web application and select any road segment, and find the rating, additional information, and a picture of the pavement on that segment at the time of data collection. It is anticipated that this web tool will launch in early 2020.

Figure 9 – An example of the type of photo collected as a part of the rating process.

National Transportation Performance Measures and Other Data Collection Methods

While the SMTC and NYSDOT have used the *Surface Score* method of pavement rating in the past, there are other, more intensive data collection methods that are also in use. The Federal Highway Administration published a final rule establishing performance measures for State Departments of Transportation to manage pavement performance on the National Highway System. These performance measures are defined using the terms *Good*, *Fair*, and *Poor*, but these terms are not analogous to the Good, Fair, and Poor used in the *Surface Score* scale. As this data becomes available, the SMTC intends to report it, and care should be taken to not confuse the two different scales utilized in these different data collection methods.

Recommendations

The purpose of this data collection effort undertaken by the SMTC was to assist the Department of Public Works and other City agencies with making data-driven decisions for street repair, reconstruction, and preventative maintenance. Having a complete dataset from 2019 also allowed a baseline to be established for future years to help monitor pavement conditions and deterioration. However, these efforts and associated analyses could be supplemented with the availability of additional information and resources. Thus, the following suggestions are given to initiate dialogue.

An authoritative system of record for roadways in the City.

Some of the issues which prevent a more accurate and fuller analysis stem from the lack of an authoritative system of record with roadway information and attributes. A description of each road owned by the city, separated into segments, with attributes such as pavement width, shoulder width, pavement type, number of lanes, type of striping, snow storage width, presence of curbing, and presence of median could provide for more in-depth analysis of pavement conditions. As additional ratings are collected in future years, relationships between pavement type and condition, pavement width and paving cost, and the effect of curbing could all be examined with this type of data.

Investigation of different paving techniques and practices, and development of an asset management system.

An effort to collect information from other municipalities or infrastructure think tanks on pavement repair and conditions could, along with the ratings collected, create an effective asset management system. Building a model which

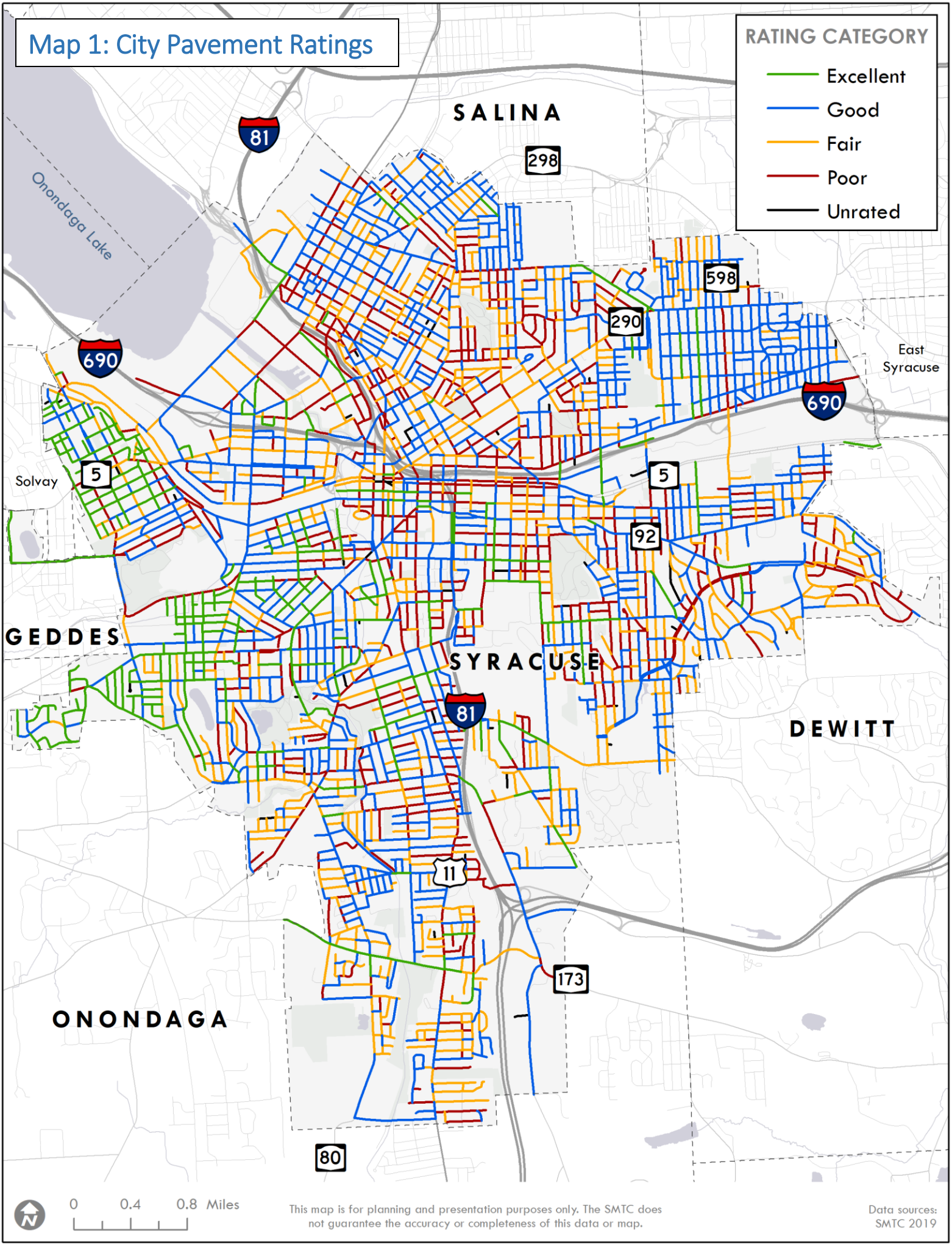
investigates different paving techniques and practices and their effects on total cost could help indicate better choices and provide options for doing more with less. The Cornell Local Roads Program is an excellent resource which should, at a minimum, be consulted.

Location-based identification of roadways.

Currently, information received from the City cannot easily be displayed in geographic form. Listings of completed and planned work, when paired with both ratings and geographic locations on a map can quickly and efficiently illustrate successes and shortcomings to constituents and officials. A permanent unique identifier for each roadway segment or a comprehensive linear referencing system would unlock the potential in existing data.

A GIS for the City.

Perhaps the best way to incorporate many of these suggestions and recommendations would be a buildout of a GIS network for the City of Syracuse's assets. An authoritative road centerline file (with appropriate attributes) which could link to existing and historic DPW data would be a huge asset to both the City as a whole and to this pavement rating project and analysis. A number of cities across the country have been able to incorporate GIS into their record keeping and decision making, and such a buildout would complement the City's commitment to data-driven problem solving.


Map 1: City Pavement Ratings
RATING CATEGORY
Excellent
Good
Fair
Poor
Unrated
SALINA
Onondaga Lake
81
298
598
290
690
East Syracuse
690
Solvay
5
5
92
GEDDES
SYRACUSE
81
DEWITT
11
173
ONONDAGA
80
0
0.4
0.8 Miles
This map is for planning and presentation purposes only. The SMTC does not guarantee the accuracy or completeness of this data or map.
Data sources: SMTC 2019