

## 2.7 System Efficiency and Preservation

### Overview

Across the state and nation much of the transportation network is reaching the end of its designed life span. This means that the roads, bridges, and other infrastructure we rely on is quickly deteriorating and as time passes the effects of this will become more apparent with bridge closures and crumbling pavement. The amount of resources needed to preserve this infrastructure is greater than ever before with substantially higher traffic volumes, heavier trucks, and extensive sprawling developments; yet the revenues available are historically low and projected to decrease further.

With these considerations, a goal of the 2040 LRTP is to leverage existing revenues to best address the needs of the transportation system through proper asset management and the implementation of low cost operational improvements. This plan, therefore, includes an important focus on system efficiency and preservation in terms of:

- Bridge and Highway Maintenance
- Traffic Signal Systems
- Intelligent Transportation Systems
- Multimodal Infrastructure

### Baseline Perspectives

#### Bridge and Highway Maintenance

PennDOT maintains an overall “Asset Management Plan Philosophy” that aims to ensure that correct treatments are being performed at the correct time for candidate bridge projects selected for preservation, rehabilitation, or replacement, and for candidate highway projects selected for betterment or resurfacing. This type of proactive approach will help to target the right solution in the right area, verify that the state’s financial guidance requirements are being fulfilled, and improve project compatibility and success through the Linking Planning and NEPA screening process and the TIP.

*Within the Erie LRTP, System Efficiency and Preservation overlaps with Federal Planning Factor #7: “Promote efficient system management and operation”; and Federal Planning Factor #8: “Emphasize preservation of the existing transportation system.”*

*At the state level, a sound asset management approach is central to many of PennDOT’s efforts such as combating the state’s structurally deficient bridge concerns, providing upkeep for thousands of miles of existing highway pavement, capitalizing on technological efficiencies, and generally following a Smart Transportation focus to “leverage and preserve existing investment.”*



### PennDOT-SD Bridge Goals:

1. Program the highest risk SD bridges based on risk assessments
2. Reduce the SD backlog and approach national averages for SD bridge population
3. Invest in timely preservation activities to keep non-SD bridges in good repair
4. Maintain SD bridge levels once the established SD goals have been reached



### Structurally Deficient Bridges

PennDOT defines a Structurally Deficient (SD) bridge as a bridge where one or more major components are in poor condition. Major components include the deck, superstructure, and substructure. As part of developing this 2040 LRTP, PennDOT District 10 guidance for Erie County included the following:

- Percent of SD Bridges by Deck Area (Target 17.75%): PennDOT's overall goal is to reduce the percentage of state-owned SD bridges statewide to 8.9% (based on bridge deck area) by Year 2033. The District goal is to reduce the percentage of SD bridge deck area by 0.45% per year for 25 years, with an ending target of 17.75% in 2033.
- Percent of \$ Spent on SD Bridges (Target 85%): PennDOT intends to measure the amount of Bridge Improvement dollars that is directed to improving SD bridges. To ensure their SD bridge reduction goal, at least 85% of bridge improvement spending (not including bridge preservation dollars) is to be directed to SD bridge improvements.

As of the end of 2010, Erie County performed better than the statewide average in terms of the percent of state-owned SD bridges and local SD bridges:

- Approximately 8% of all Erie County state-owned bridges are structurally deficient (48 out of 572), compared to 21% statewide (5,310 out of 25,325).
- Approximately 29% of all Erie County local bridges are structurally deficient (34 out of 116), compared to 34% statewide (2,164 out of 6,318).
- Erie County requires a reduction of approximately 22 state-owned and 19 local SD bridges by 2033 to achieve PennDOT's SD bridge targets.
- Erie County requires a reduction of more than 75,000 square feet of state-owned and 45,000 square feet of local SD bridge deck area by 2033 to achieve PennDOT's SD bridge targets.
- Substantial bridge preservation investments are also needed to mitigate the "Annual Rate of SD On" (i.e., the rate at which non-SD bridges deteriorate and become newly-added SD bridges each year). PennDOT's 2010 bridge data for Erie County estimates that SD-Prevention efforts alone require between \$1.87 and \$3.72 million annually.

Selection and prioritization of candidate bridge projects is performed internally by PennDOT for bridges on the state system, and by the Erie MPO for those owned by the local municipalities. These are ongoing processes that are finalized at the programming level. For planning purposes, funding for these projects will be allocated to respective State and Local Bridge Line Item Reserves in the 2040 LRTP to be drawn down as priority projects are identified during the TIP update. Expenditures will focus on reducing the

Exhibit 2.7.1 – Erie County SD Bridge Summary (based on Bridge Count)

Category	Interstate	NHS	Non-NHS ADT > 2000	Non-NHS ADT < 2000	Total State Br > 8'	Total Local Br > 20'
2010 Total Bridges (#)	137	64	181	190	572	116
2010 SD Bridges (#)	3	5	25	15	48	34
2010 SD Bridges (%)	2.2%	7.8%	13.8%	7.9%	8.4%	29.3%
2033 SD Bridges Target (#)	1	2	14	10	27	15
2033 SD Bridges Target (%)	0.5%	3.1%	7.5%	5.5%	4.7%	12.9%

Exhibit 2.7.2 – Erie County SD Bridge Summary (based on Deck Area)

Category	Interstate	NHS	Non-NHS ADT > 2000	Non-NHS ADT < 2000	Total State Br > 8'	Total Local Br > 20'
2010 Total Deck Area (SF)	882,800	365,500	504,800	427,000	2,180,100	248,200
2010 SD Deck Area (SF)	62,200	3,100	61,100	22,200	148,600	84,200
2010 SD Deck Area (%)	7.0%	0.8%	12.1%	5.2%	6.8%	33.9%
2033 SD Deck Area Target (SF)	19,422	1,462	30,288	23,058	74,230	38,223
2033 SD Deck Area Target (%)	2.2%	0.4%	6.0%	5.4%	3.4%	15.4%



### PennDOT Highway Pavement Goals:

1. Reduce the miles of Poor IRI
2. Eliminate out-of-cycle pavements
3. Reduce the backlog of reconstruction needs for pavements past their design service life
4. Reduce the backlog of resurfacing needs for pavement surfaces where fair and poor OPI are present, and as conditions warrant
5. Perform reconstruction, resurfacing, and routine maintenance in accordance with prescribed schedules, if the condition warrants a treatment
6. Maintain and preserve OPI for Good and Excellent pavements



SD bridge backlog, while also slowing the “Annual Rate of SD On” through appropriate and ongoing bridge preservation efforts.

### *Highway Pavement*

PennDOT assesses pavement surface conditions using a variety of metrics that include International Roughness Index (IRI) and Overall Pavement Index (OPI). IRI is a world-wide standard to measure pavement roughness in terms of the number of inches per mile that a laser, mounted in a specialized van, jumps as it is driven along a highway – the lower the IRI, the smoother the ride. OPI is a more comprehensive, Pennsylvania-specific assessment. OPI estimates existing pavement performance using IRI as input alongside initial pavement distresses such as cracking, edge deterioration, rutting, and other signs of deterioration – the higher the OPI, the better the surface condition of the road. Scores for either of the two metrics are grouped into ranges to define pavement conditions as Poor, Fair, Good, or Excellent.

As part of developing this 2040 LRTP, PennDOT District 10 guidance for Erie County included IRI-based pavement smoothness targets (as a percentage of the network-tested mileage) as listed in *Exhibit 2.7.3*. As of the end of 2010, tested conditions indicated that most “Excellent / Good” targets within Erie County were met, with the exception of a 17% deficit for lower volume roads (Non-NHS w/ ADT<2000). All route types, however, failed to meet their corresponding “Poor” targets. As such, addressing existing deficient routes through line-item maintenance programs (e.g., Interstate Maintenance, statewide maintenance & betterment, local federal aid routes, etc.) is recommended.

Exhibit 2.7.3 – Erie County 2010 Pavement Smoothness Targets (% of Miles Tested)

Route Type	IRI Rating	Target	2010 Current	Target Met
Interstate	Excellent / Good	86.40%	95.41%	Yes
	Poor	0.00%	0.42%	No
Other NHS	Excellent / Good	74.70%	78.19%	Yes
	Poor	3.33%	6.60%	No
Non-NHS w/ ADT > 2000	Excellent / Good	82.80%	88.03%	Yes
	Poor	1.00%	3.28%	No
Non-NHS w/ ADT < 2000	Excellent / Good	59.40%	42.16%	No
	Poor	13.00%	26.71%	No

Exhibit 2.7.4 – Erie County 2010 Pavement Smoothness Summary

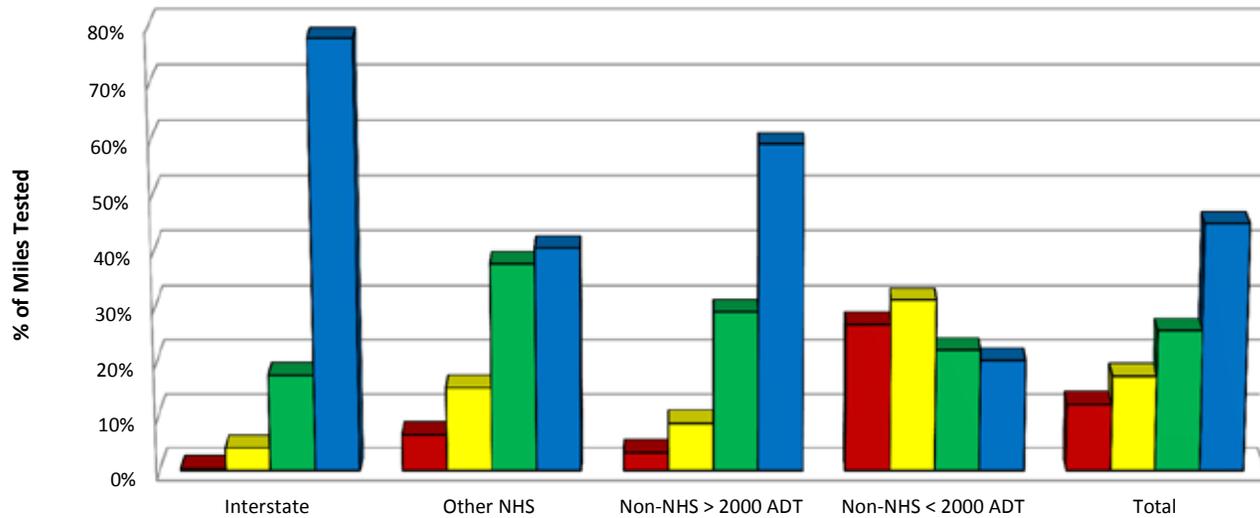
Business Plan Network	Tested	Excellent	Good	Fair	Poor
Interstate	144	112	25	6	1
Other NHS	114	46	43	17	8
Non-NHS > 2000 ADT	308	182	89	27	10
Non-NHS < 2000 ADT	349	70	77	109	93
<b>Total</b>	<b>915</b>	<b>411</b>	<b>234</b>	<b>159</b>	<b>111</b>



Exhibit 2.7.5 – Erie County 2010 Pavement Smoothness Summary (% Miles per IRI Rating)

Business Plan Network	Tested	Excellent	Good	Fair	Poor
Interstate	100%	78%	18%	4%	0%
Other NHS	100%	41%	38%	15%	7%
Non-NHS > 2000 ADT	100%	59%	29%	9%	3%
Non-NHS < 2000 ADT	100%	20%	22%	31%	27%
<b>Total</b>	<b>100%</b>	<b>45%</b>	<b>26%</b>	<b>17%</b>	<b>12%</b>

Exhibit 2.7.6 - Erie County 2010 Pavement Smoothness Summary (% of Miles Tested)



	Interstate	Other NHS	Non-NHS > 2000 ADT	Non-NHS < 2000 ADT	Total
■ Poor	0%	7%	3%	27%	12%
■ Fair	4%	15%	9%	31%	17%
■ Good	18%	38%	29%	22%	26%
■ Excellent	78%	41%	59%	20%	45%

## Traffic Signal Systems

Approximately 353 traffic signals and 27 flashing beacons operate throughout Erie County. Well over half of these signals (approximately 202) are located within the City of Erie, and a majority of the remainder can be found in the immediately adjacent urbanized areas (*Exhibits 2.7.7 and 2.7.8*).

In general, the traffic signal infrastructure throughout Erie County is outdated and requires substantial investments to help reduce delay and improve operating efficiencies and mobility:

- Only 25% of the county’s signals currently operate as part of a coordinated traffic signal system (*Exhibit 2.7.7*). Several of these existing systems are fairly small (3-4 signals each), do not span gaps that would otherwise allow for larger, more continuous systems, or could benefit from improved communications capabilities.
- Notable coordinated system gaps exist along major corridors such as 12th Street, 26th Street, and Peach Street.
- Critical intersections such as the Bayfront Parkway at State Street, or Peach Street at West 38th Street, may benefit from additional turn arrows and corresponding signal phasing modifications.
- Approximately 15% of the county’s signals operate with aged or electromechanical equipment in need of upgrade, replacement, or in some cases removal.
- Some of the oldest equipment in the county is located along the State Street corridor through the center of downtown Erie. Several signals along the West 38th Street corridor, particularly east of State Street, are also in need of improvements.
- The age, poor condition, and outdated technology of the emergency vehicle traffic signal preemption system impacts emergency response time (Reference Chapter 2.4).
- The 2004 Downtown Erie Access and Circulation Study identified 33 intersections out of sample of the City of Erie’s signals as candidates for traffic signal removal, and projected that a third of all signals in the City may be candidates for removal. The study also noted that the removal of these signals would provide a total savings of over \$490,000 per year.

It should be noted that as part of the Travel Demand Model for the 2040 LRTP, model capabilities with regard to signal operations were greatly enhanced. The county’s TDM will now explicitly account for the intersection approach and turning movement delays that occur at each traffic signal based on a realistic set of traffic signal timing, phasing, and related operating assumptions. As such, the TDM will be able to better reflect and

quantify the potential benefits or impacts of adding, removing, or modifying traffic signals or traffic signal operations throughout the transportation network. Such capabilities will allow the County and its partner agencies to take a more comprehensive preliminary look at the overall effects of traffic signal system modifications that may address any of the issues or concerns identified above.

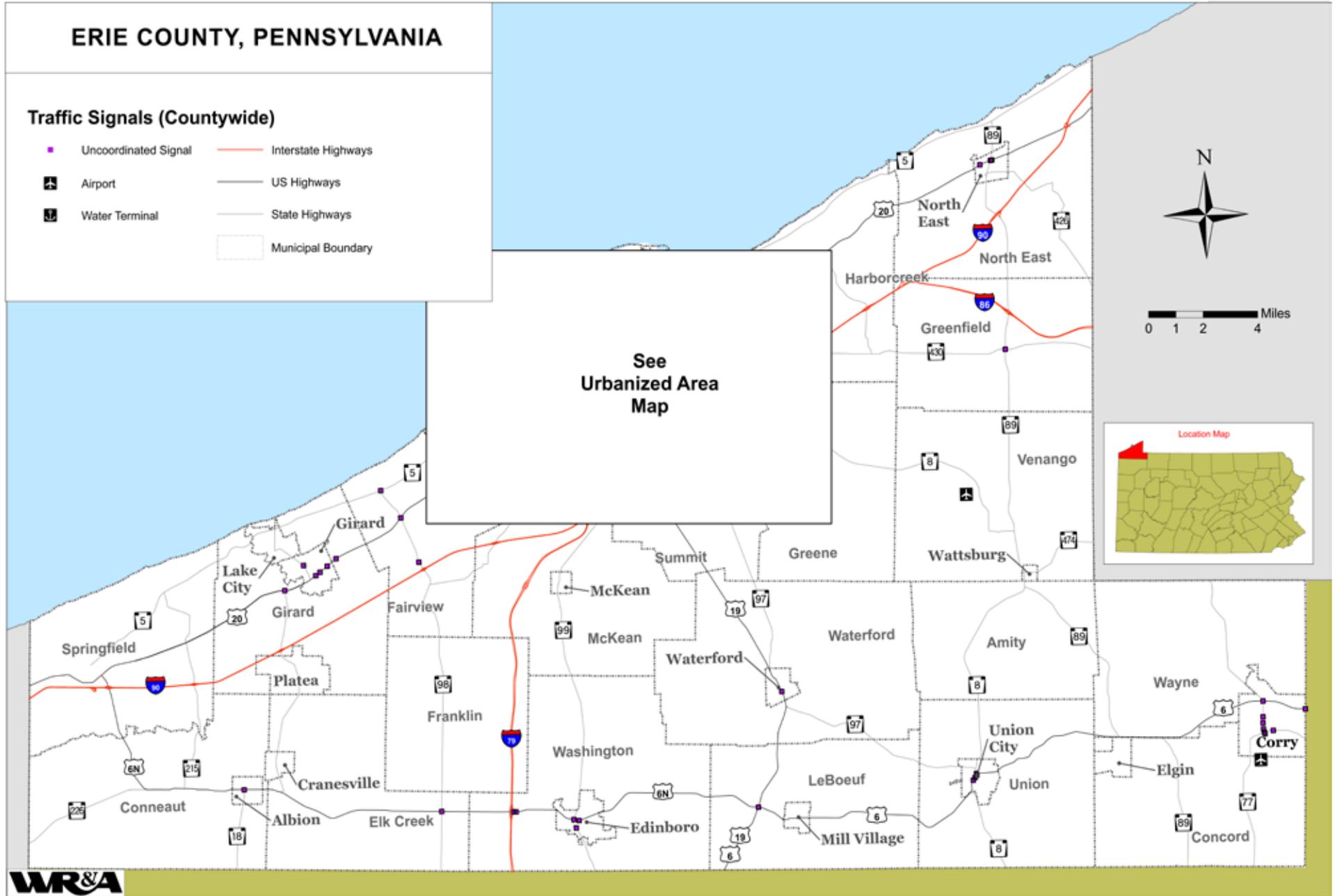
*Exhibit 2.7.7 - Countywide Coordinated Signal Systems*

Coordinated System (ID # and Description)	# Signals
East 38th Street and Bayfront Connector	4
Broad Street and Bayfront Connector	4
Bayfront Parkway (6th St to 10th St)	3
East 12th Street (French St to Bayfront Connector)	10
Parade Street (6th St to 12th St)	4
Bayfront Parkway and State Street	3
West 12th Street (Weschler Ave to State St)	11
PA 5 / West 12th St (York Town Ctr to Pittsburgh Ave)	3
PA 5 / West 12th St (Powell Ave to Quality Mkt)	2
US 20 / West Ridge Rd and Asbury Rd	4
US 20 / West 26th St (Colonial Ave to Peninsula Dr)	5
US 20 / West 26th St (Geist Rd to French St)	14
US 19 / Peach Street (Liberty St to Chestnut St)	4
West 38th Street (Cherry St to Glenwood Park Ave)	3
Interchange Rd (I-79 to Peach St @ Kuntz Rd)	7
US 19 / Peach Street (Oliver Rd to Avon Dr)	10
PA 97 / Perry Hwy (Bloomfield Pkwy to Robison Rd)	5

See corresponding map *Exhibit 2.7.8*



Exhibit 2.7.8 - Erie County Traffic Signal Map (Countywide)





## *Intelligent Transportation Systems*

In many ways, the concept of Intelligent Transportation Systems (ITS) reflects a trend in which technology will take precedence over adding capacity as a means to better manage the existing transportation system. ITS considerations and potential benefits throughout Erie County span a variety of categories covered within the 2040 LRTP, but all essentially have the common goal of helping the system to operate more efficiently.



ITS-related initiatives encompass a broad variety of enhancements that may include:

- Coordinated traffic signal system and emergency preemption improvements such as those detailed previously.
- Traffic monitoring and surveillance technologies such as Closed Circuit Television Cameras (CCTV), signal or ramp detection devices, or automated traffic count stations.
- Motorist information technologies such as general traveler information services, PA 511 enhancements, Dynamic Message Signs (DMS), or Roadway Weather Information Systems (RWIS).
- Transit oriented technologies such as Automated Vehicle Location Systems (AVL) or Automated Information Traveler Systems (AITS).
- Any number of other technology-based improvements that may benefit various other aspects of the multimodal transportation system (e.g., automated payment systems, computer-based matching for ride-sharing systems, truck-related weigh station technologies, etc.).

To date, many of these types of ITS-related initiatives have been (or are planned to be) implemented by PennDOT under the 2007 Regional Operations Plan (ROP) for Pennsylvania's Northwest Region. Such improvements are valuable in their ability to provide benefits during regular day-to-day travel or congestion, as well as more targeted benefits for special events, incident management, weather impacts, heavy truck travel and tourist information.

## *Multimodal Infrastructure*

In addition to the specific highway, bridge, traffic signal, and ITS-related issues identified above, it is also important to apply the same type of system efficiency and preservation considerations to the remainder of the multimodal transportation system. Many applicable issues or ideas are detailed throughout the mode-specific content of Chapter 2.5. Notable examples include required maintenance and improvements vital to the County's extensive bicycle and pedestrian network, the "e"'s transit operation facilities, critical airport facilities and equipment, existing rail corridors, or docks, equipment, and related infrastructure at the Port of Erie.

## Future Planning Perspectives

From a system efficiency and preservation perspective, future planning efforts specific to Erie County should apply a “fix it first” mentality, while also aiming to improve and create opportunities for the transportation assets that exist today. Maintenance, upkeep, and improved management and operations will be vital to all modes of travel well into the future, and possibly more so as the existing assets continue to age throughout their design lives. General components of this approach will include:

**Bridge Maintenance:** The Erie MPO should continue to work with PennDOT and local municipalities to select, prioritize, and program appropriate bridge improvement projects with a focus on PennDOT’s general SD Bridge goals. Specific targets address various reductions in SD bridge deck area, at least 85% of bridge improvement spending directed to SD bridges, plus additional SD-Prevention expenditures annually.

**Highway Maintenance:** The Erie MPO should continue to work with PennDOT and local municipalities to select, prioritize, and program appropriate highway maintenance projects with a focus on PennDOT’s general highway pavement goals. Specific focus should be given to reducing the percentage of roadway segment miles having “Poor” IRI ratings, which currently includes a relatively high proportion of lower volume roadways throughout the County. Appropriate use of line-items should continue for Interstate Maintenance and other statewide maintenance & betterment projects, as well as potential new programs for locally owned federal aid routes.

**Traffic Signal Systems:** The Erie MPO should focus on the operational improvement potential of updating traffic signals and coordinated signal systems countywide. Improvements should consider appropriate prioritization of critical corridors or intersections, replacement of exceptionally aged equipment, and modernization of the area’s emergency preemption system. The MPO should also highlight the advantages of improving the system along established emergency detour routes, and the economic benefits of an expanded traffic signal removal program.

**Intelligent Transportation Systems:** The Erie MPO should continue to encourage and explore opportunities for the appropriate expansion and implementation of ITS capabilities. These efforts should work in conjunction with PennDOT and the Northwest ROP to help improve day-to-day travel and congestion, while also targeting improvements to handle special events, incident management, weather impacts, heavy truck travel, or tourist information.

**Multimodal Infrastructure:** The Erie MPO should incorporate an asset management philosophy into all modes of travel that make up the overall transportation network. Such an approach will be critical to maintaining the vast network of roadway, rail, and shipping assets that already exist, which in turn will be critical to the implementation of major concepts and initiatives such as the expansion of transit services, the Erie Inland Port, or additional development at the Port of Erie.

*The success of the plan in helping to prioritize and ensure system efficiency and preservation will be measured by ranking projects based upon:*

- **AADT** – Estimated daily traffic volume at the project location.
- **Route Significance** – Whether the project is located along the National Highway System, PA Byway, or other identified route of significance.
- **Maintenance Scope** – Extent to which the project will address transportation system maintenance at a single or isolated location, along a corridor, or area-wide.
- **Operations Scope** – Extent to which the project will address transportation system operations at a single or isolated location, along a corridor, or area-wide.
- **Existing Deficiency** – Whether the project will address one or more deficiencies (e.g., Poor IRI, SD-Bridge, ADA ramps, signal delay, drainage, etc.).

