2040 Long Range Transportation Plan - Needs Assessment: System Preservation – Pavement, Bridges, and Transit Costs and Benefits

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Table of Contents

List of Appendices

1.0 Introduction

The System Preservation Needs Assessment aims to ensure that a significant percentage of roadways will meet pavement and structure standards and that transit system performance will not be jeopardized by fleet age. Measures may include countywide maintenance schedule adherence for roads and bridges, countywide fleet replacement schedule adherence for transit.

Well-maintained highways and bridges are critical not only to Hillsborough County, but also to the United States, since people rely on this infrastructure for economic and recreational purposes, national security, and movement of people and goods.

From the 1960s through the 1980s, most Federal and State funding went to building new roadways and bridges. That investment is now in jeopardy because of increased traffic volume, aging infrastructure, and limited budgets. Federal, State, and local governments are now shifting their emphasis from new construction to system preservation and maintenance.

One strategy is pavement preservation which extends the pavement's serviceable condition over a period of time, improves safety, and meets motorist expectations. Important to pavement preservation is the application of the appropriate treatment to the appropriate road at the appropriate time. Pavement preservation includes preventive maintenance, minor rehabilitation, and routine maintenance. It does not include major structural rehabilitation.

Each year the process of planning, preparing, and approving operating budgets becomes more difficult. Funding for road and street maintenance has been an area often cut or reduced by elected officials as they work to lower or minimize tax increases in their community and balance the budget during difficult economic years. Sometimes officials cut submitted budgets for maintenance of publicly-owned infrastructure which can impact roads, streets, and highways and related pavement.

A FDOT presentation on Pavement Management at the Design Expo of June 2012 discussed the importance of preserving roadways in timely fashion. The long term objective is to preserve the highway system, an essential system that moves goods and people, and the short term objective is to ensure the roadway pavement meets standards. Pavement conditions should be maintained by addressing these three factors:

- Safety – Wheelpath rutting, friction
- Preservation – Cracking, potholes, raveling, patching, depressions
- Ride – Rippling, faulting, public complaints

Consequences for failing to provide adequate annual funding for pavement maintenance include:

- Pavements begin aging and deteriorating the day they are constructed or applied.
- On average, most asphalt pavements have a cost-effective useful life of 15 years. Some will have a cost-effective life of only 10 to 15 years, while others will last longer depending on design, structure, traffic volumes, traffic weights, and climate.
- Cities and communities need to resurface 6.6 percent of their streets annually to keep up with the average rate of deterioration and have pavements on a 15-year cycle.
- One dollar spent using proper preventive maintenance during a pavement's first five years of life can save three to four dollars over the pavement's next 10 to 15 years of life.
- There are many time proven and cost-effective preventive maintenance activities that can be used during a pavement's first five years of life to extend its useful life from 15 to 25 years.

2.0 Data Collection

2.1 Pavement and Bridges

Meetings with transportation agency stakeholders provided data on pavement and bridge maintenance, available funding and shortfalls, for the Cities of Plant City, Tampa, and Temple Terrace; Hillsborough County, and the Florida Department of Transportation (FDOT) District Seven (D7);

Consistent with federally required asset management planning, FDOT places primary emphasis on safety and preservation, providing adequate funding in its long range revenue forecast to meet established goals and objectives in these important areas before allocating funds to capacity programs. FDOT has included sufficient funding in its 2040 Revenue Forecast to meet the following statewide objectives and policies:

- Resurfacing program: Ensure that 80% of state highway system pavement meets Department standards;
- Bridge program: Ensure that 90% of FDOT-maintained bridges meet Department standards while keeping all FDOT-maintained bridges open to the public safe;
- Operations and maintenance program: Achieve 100% of acceptable maintenance condition standard on the state highway system;

FDOT has reserved funds in its 2040 Revenue Forecast to carry out its responsibilities and achieve its objectives for the non-capacity programs on the state highway system in each district and metropolitan area. About $106 billion (49% of total revenues) is forecast for the non-capacity programs, as shown in **Table 1**.

Table 1.Statewide Non-Capacity Program Estimates: State and Federal Funds from the 2040 Revenue Forecast

Major Programs	5-Year Period (Fiscal Years) Millions of dollars					27-Year Total[2]
	20014-15[1]	2016-20[1]	2021-25	2026-30	2031-40	2014-2040
Safety	245	631	625	626	1,252	3,378
Resurfacing	1,211	3,593	3,649	3,900	8,071	20,425
Bridge	529	1,593	1,373	1,452	3,044	7,991
Product Support	2,527	4,913	5,932	6,479	14,239	34,089
Operations and Maintenance	2,033	5,228	5,607	6,295	14,470	33,633
Administration	299	855	1,037	1,153	2,672	6,016
Total Non-Capacity Programs	**6,844**	**16,813**	**18,224**	**19,904**	**43,748**	**105,532**
Other[3]	364	1,111	1,330	1,474	3,252	7,531
Statewide Total Forecast	**16,505**	**34,829**	**37,516**	**40,266**	**86,715**	**215,830**

[1] Based on the FDOT Adopted Work Program for 2014 through 2018.
[2] Columns and rows sometimes do not equal the totals due to rounding.
[3] "Other" is primarily for debt service.

Hillsborough County has a total of 11,931 lane miles, maintained by the following agencies or jurisdictions:

FDOT – 1,896
Hillsborough County – 6,920
City of Plant City – 150
City of Tampa – 2,800
City of Temple Terrace – 165

With FDOT fully funded for their resurfacing needs, the local transportation agency stakeholders were interviewed to assess their programs for funding and shortfalls. Each year agencies are underfunded, roads will continue to degrade and others added to the list, increasing the backlog of miles of pavement in need of preservation.

Hillsborough County Public Works Department reported that their roadway resurfacing program was underfunded. It was estimated that the County needs approximately $24 million each year to maintain the pavement in unincorporated Hillsborough County. In 2014, the funding allocated to the county's resurfacing program was $5 million, with an existing backlog of $80 million.

The City of Tampa shared that they need $18 million each year to reach the goal of bringing city maintained roadways up to a desired pavement condition index of 55. The approximately $8 million allocated each year has created a $60 million backlog and creates about a 40-year pavement cycle.

The City of Plant City reported needing $4 million each year to maintain the roadway pavement, yet are allocated $1 million each year. This has led to a current backlog in 2014 of $11 million. Without properly maintaining the roadways, heavily traveled roads actually need full reconstruction on a shorter cycle than if there was funding to mill and resurface.

In the City of Temple Terrace, many of the roadways are maintained by the state or Hillsborough County, yet for those roadways maintained by the City, they require $650,000 per year. The resurfacing funds allocated each year is approximately $400,000.

2.2 Transit Preservation

For the transit system preservation task, the analysis focused on maintaining the existing vehicle fleet size through the horizon year of 2040 and ensuring its continued safety and functionality. In order to perform the analysis, the Hillsborough Area Regional Transit (HART) Agency's fleet plan was requested. The most current fleet plan, dated December 2013, was provided by HART. HART will develop a Transit Asset Management Plan and Public Transportation Agency Safety Plan consistent with the requirements of MAP-21 in the coming year. HART's current fleet plan details the transit vehicle replacement schedule by year and type of vehicle through the Transit Development Plan (TDP) horizon year of 2023. In addition, the fleet plan details the fleet capital cost projections through 2023. The fleet cost projections include unit costs for vehicles as well as expected sources of funding revenues.

3.0 Performance Measures Methodology

The performance measures used in this analysis consist of the following:

Pavement Preservation: The initial focus was on using the pavement condition index (PCI). The PCI is an indicator of overall pavement health, and is used to identify pavement requiring maintenance and rehabilitation However, not all stakeholders in Hillsborough County use the PCI.

The Needs Assessment analysis then refocused on the number of lane miles to be maintained within Hillsborough County, the annual cost for optimum maintenance, the current funding resources identified by stakeholders, and the amount of funding necessary to improve pavement conditions.

Bridges: It was determined that the amount needed to fund bridge maintenance will be used for safety purposes.

Transit: average fleet age and the number of new vehicles required to maintain the current fleet size. For both average fleet age and number of new vehicles required, the fleet replacement plan provided by HART was utilized. Since HART's fleet replacement plan runs through the TDP horizon year of 2023, forecasting out to the LRTP horizon year of 2040 was necessary. As a result, the fleet replacement plan was forecasted to 2040 using HART's assumed replacement rate (12 years) and fleet size assumptions. For this analysis, average fleet age is defined as the cumulative age of the transit fleet divided by the total number of fleet vehicles. Furthermore, number of new vehicles required is defined as the sum of the yearly vehicle replacements through 2040.

4.0 Investment Levels & Benefit Analysis

4.1 Pavement Preservation

Three investment levels (high, medium, and low) were initially developed for the pavement preservation task and are summarized in **Table 2**. Each investment level, its annual costs, and annual benefits are defined as follows:

- Low: The low investment level is based on all stakeholders current annual funding level. The current investment indicates a funding shortfall to resurface the County's roadways.
- Medium: The medium investment level is based on stakeholders input and represents the annual funding needed to improve the pavement condition beyond its present condition to a more acceptable standard.
- High: The high investment level is based on FDOT's 17-year standard for resurfacing and means that all roads in the county (local, collector, arterials, etc) would be resurfaced every 17 years.
- A fourth investment level, Medium Plus, was added after further input from stakeholders. If the preferred funding were allocated, the benefit to each agency can be described as follows:
    - Hillsborough County at $24 million/year would resurface roads on an average of about 20 years, with primary roads every 15-17 years and local roads averaging every 25 years.
    - The City of Tampa would resurface roads about every 14 years if they were funded at $18 million each year.
    - Plant City, if funded at $4 million/year would resurface most roads every 20 years, but as often as every 10 years on the highest volume roads.
    - Temple Terrace's recommended pavement management requires $650,000/year.
    - The backlog from recent years of deferred maintenance totals $151 million, as a one-time catch-up amount.

Table 2.Summary of Pavement Preservation Investment Levels

Investment Level	Annual Cost for Resurfacing	Total Cost for Resurfacing (20 years)	Lane miles resurfaced annually	Percentage of roads resurfaced annually	Percent to goal of 17 year cycle	Resurfacing cycle
Low	$25,600,000 Based on current annual funding; currently there is a funding shortfall to maintain roads.	$512,000,000	146 - 197	2%	33% to goal	Every 50 years
Medium	$53,700,000 Annual funding required to improve the pavement condition.	$1,074,000,000	350 - 458	4%	66% to goal	Every 25 years
Medium Plus	$46,650,000 Annual funding needed + $151 million one-time backlog	$933,000,000 + backlog = $1,084,000	VARIES BY JURISDICTION			14-25 years
High	$83,833,035 Annual funding required to meet FDOT standard of resurfacing every 17 years.	$1,676,660,700	715	6%	100% to goal	Every 17 years

4.2 Bridge Preservation

It is assumed that bridge maintenance is essential. Current spending on bridge maintenance in this county, as shown in the five-year work programs and capital improvement programs of Hillsborough County, the three cities, and FDOT District 7, comes to an average of $31 Million annually. Stakeholders indicated that the current funding does not adequately address all of the needs for bridge major repairs and/or replacements, on some bridges for which Tampa and Hillsborough County are responsible.

The list of bridges that need replacement in Hillsborough County is documented in the *History of Hillsborough County Public Works Bridge Replacement Program* dated February 2013. The report includes a list of the bridges that need to be replaced in the next 15 years, with an estimated 2013 construction cost. The total cost to replace these bridges is approximately $90 million.

Five additional bridges in the City of Tampa were identified based on data from City of Tampa Capital Improvement Program, and the latest available inspection reports for those bridges which included evaluation and sufficiency ratings. For the City of Tampa bridges, an estimate cost of $2 Million was assumed for each bridge. The construction cost for most of the bridges within the County is $1.1 to $1.6 Million plus a percentage for product delivery. The total for City of Tampa bridge replacement is $10 Million. **Appendix A** includes a list of bridges for Hillsborough County and City of Tampa that need replacement, for a total cost of $100 million.

Low investment scenario. This scenario reflects a continuation of current spending levels, for a twenty-year total expenditure of $620 million.

Medium and high investment scenarios. For the bridge preservation task, it was assumed that safety is paramount and that the additional major repair/replacement expenditures for Hillsborough County and Tampa bridges, as discussed above, will be made. Therefore, the twenty-year total expenditure for the medium scenario is $720 million, and no additional investments are identified for the high scenario.

4.3 Transit Preservation

Three investment levels (high, medium, and low) were developed for the transit preservation task and are summarized in **Tables 3** through **5**. All use HART's current fleet replacement plan as a starting point. Each investment level, its annual costs, and annual benefits are defined as follows:

- Low investment scenario. Currently, HART's fleet replacement plan indicates a funding shortfall to achieve the prescribed 12 year replacement schedule. For this scenario, the fleet replacement schedule was adjusted to reconcile with available funding. Specifically, the revenue sources identified in the HART's Fleet Plan were extended out to the horizon year 2040. The total funding available was compared against the total cost for vehicle replacement through 2040. The fleet replacement rate was subsequently adjusted until the funding requirements matched or were reasonably less than the expected revenue. Capital cost estimates for this scenario were estimated by applying the unit costs provided by HART to the yearly new vehicle purchases in 2021 through 2040.

Under the low investment scenario, there is a fleet capital requirement of 187 low floor 40ft (CNG) and low floor 30ft fixed route vehicles from 2021 through 2040 with a total capital cost of $100,843,178 (or $5,042,159 annually). The result is in an average fleet age of 13 years in 2040.

As transit vehicles age, the likelihood of mechanical failures increases. Based on a survey of transit agencies conducted on behalf of FTA, the relationship between vehicle age and the number of road calls was established. Road calls are defined as an in-service vehicle failure resulting in a disruption of service. The resulting analysis from the FTA study established a relationship curve associating the number of road calls per vehicle revenue mile with the average fleet age. Utilizing the aforementioned relationship curve, the number of potential road calls was estimated for this scenario. With an average fleet age of 13 years, approximately eight road calls per weekday may be expected. The results of the analysis are shown in **Table 3**.

Table 3: Low Investment Scenario Summary

Investment Program	Statistics	Total
	Total capital required for fleet plan	$100,843,178
	Average fleet age (2040)	13 years
	Number of new vehicles	187
	Road calls per year	2,193
	Road calls each weekday	8

- Medium investment scenario. For this scenario, the mid-range funding requirement between the Low and High investment levels was used as a basis for determining the investment threshold. This reasonably accounts for additional funding, such as grant opportunities, which may become available over the planning horizon. The fleet replacement rate was subsequently adjusted until the funding requirements reasonably matched the median funding requirement value. Capital cost estimates for this scenario were estimated by applying the unit costs provided by HART to the yearly new vehicle purchases in 2021 through 2040.

Under the medium investment scenario, there is a fleet capital requirement of 246 low floor 40ft (CNG) and low floor 30ft fixed route vehicles from 2021 through 2040 with a total capital cost of $128,628,520 (or $6,331,426 annually). The result is in an average fleet age of 8 years in 2040. As transit vehicles age, the likelihood of mechanical failures increases. With an average fleet age of eight years, approximately 6 road calls per weekday may be expected. The results of the analysis are shown in **Table 4** below.

Table 4: Medium Investment Scenario Summary

Investment Program	Statistics	Total
	Total capital required for fleet plan	$128,628,520
	Average fleet age (2040)	8 years
	Number of new vehicles	246
	Road calls per year	1,579
	Road calls each weekday	6

- High investment scenario. The current fleet replacement plan indicates that fixed route vehicles are scheduled for replacement every twelve years. This replacement schedule represents the most aggressive replacement rate possible. In other words, it adheres to FTA's minimum vehicle life requirement of 12 years. Therefore, this scenario was selected as the high investment level. Capital cost estimates for this scenario were estimated by applying the unit costs provided by HART to the yearly new vehicle purchases in 2021 through 2040.

Under the high investment scenario, there is a fleet capital requirement of 272 low floor 40ft (CNG) and low floor 30ft fixed route vehicles from 2021 through 2040 with a total capital cost of $168,086,862 (or $8,404,343 annually). The result is an average fleet age of five years in 2040. As transit vehicles age, the likelihood of mechanical failures increases. With an average fleet age of five years, approximately five road calls per weekday may be expected. The results of the analysis are shown in **Table 5** below.

Table 5: High Investment Scenario Summary

Investment Program	Statistics	Total
	Total capital required for fleet plan	$168,086,862
	Average fleet age (2040)	5 years
	Number of new vehicles	272
	Road calls per year	1,316
	Road calls each weekday	5

5.0 Summary

Maintaining roads, bridges, and basic transit service in Hillsborough County is an expensive undertaking, but the benefits are tangible.

Preserving the county's transportation system at the current spending levels would cost $1.27 billion over 20 years, in 2014 dollars. That level of investment results in:

- Roads resurfaced every 50 years; 150-200 lane-miles annually
- Basic bridge maintenance
- HART fleet average age 13 years, 8-9 breakdowns/weekday typical

Increasing the investment in the county's transportation system would cost $1.96 billion over 20 years, in 2014 dollars. That level of investment results in:

- Roads resurfaced every 25 years; 350-450 lane-miles annually
- Basic bridge maintenance AND replace aged bridges
- HART fleet average age 8 years, 6 breakdowns/weekday typical

Increasing the investment in system preservation even more would meet most of the maintenance needs and would cost $2.50 billion over 20 years, in 2014 dollars. That level of investment results in:

- Roads resurfaced every 17 years (FDOT highway standard); 715 lane-miles annually
- Basic bridge maintenance AND replace aged bridges
- HART fleet average age 5 years, 5 breakdowns/weekday typical

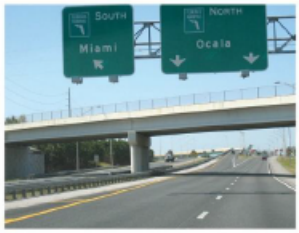
Appendix A: Hillsborough County and City of Tampa Bridges Identified for Replacement

Bridge Name	Bridge ID	2013 Construction Cost*	Contingency**	Total
Caruthers Road over Turkey Creek	104801	$780,800	$195,200	$976,000
E. Keysville Road over Alafia River West Branch	104802	$1,160,250	$290,063	$1,450,313
CR 672 over Hurrah Creek	104701	$2,328,260	$582,065	$2,910,325
Grange Hall Loop over Little Manatee River	104700	$4,185,000	$1,046,250	$5,231,250
CR 579 over Little Manatee River	104704	$2,620,750	$655,188	$3,275,938
CR 579 over Little Manatee River South Fork	104703	$2,671,229	$667,807	$3,339,036
CR 587 (West Shore Boulevard)	105909	$1,108,951	$277,238	$1,386,189
Old Mulberry Road	104426	$2,364,338	$591,085	$2,955,423
70th Street S	104105	$1,367,789	$341,947	$1,709,736
Balm Riverview Road	104351	$1,466,148	$366,537	$1,832,685
Old Bing Bend Road	100271	$4,052,881	$1,013,220	$5,066,102
CR 39 (230' North of CR 672)	100254	$3,692,872	$923,218	$4,616,090
W. Waters Avenue	104258	$1,662,096	$415,524	$2,077,620
Sligh Avenue	105602	$6,865,364	$1,716,341	$8,581,706
CR 582 (Tarpon Springs Road)	104247	$1,307,064	$326,766	$1,633,830
N. Pebble Beach Boulevard	104316	$1,329,016	$332,254	$1,661,270
Fletcher Avenue	100276	$11,525,276	$2,881,319	$14,406,596
Morris Bridge Road	104405	$1,222,516	$305,629	$1,528,145
Morris Bridge Road	104101	$1,952,365	$488,091	$2,440,457
Columbus Drive	105905	$2,675,700	$668,925	$3,344,625
CR 39 (1.4 mi S of CR 640)	104356	$1,885,782	$471,446	$2,357,228
CR 39 (2.2 mi S of CR 640)	104355	$1,988,383	$497,096	$2,485,479
78th Street	100246	$1,904,260	$476,065	$2,380,325
Morris Bridge Road	100026	$5,292,000	$1,323,000	$6,615,000
4th Street SW	104321	$4,346,420	$1,086,605	$5,433,026
Borein Street Bridge	105501			$2,000,000
Columbus Drive over Hillsborough River	105504			$2,000,000
Cass Street Bridge	105502			$2,000,000
Laurel Street	105503			$2,000,000
Platt Street	105500			$2,000,000
			Total	**$99,694,389**

*Includes Consultant Fees
** Contingency 25

Appendix B: Statewide Performance Measures

Following are excerpts of the 2014 Florida Multimodal Mobility Performance Measures Source Book that relate to the performance measures discussed in this technical memorandum.



Roadways

Over 91% of Florida Interstate roadways meet MAP-21 good condition criteria

2014 MAP-21 Performance Report

Overview: The Department has a long-standing commitment to ensuring that at least 80% of pavements on the State Highway System (SHS) meet Department standards for non-deficiency. One of the MAP-21 Program's performance goals is to maintain the pavements (including the traveled surface of bridges) on the National Highway System (NHS) in good condition.

MAP-21 Pavement Provisions:

- USDOT will establish performance measures on pavement condition and performance of the Interstate System and the remainder of the National Highway System within 18 months of enactment. [§1203; 23 USC 150(c)].
- States will set performance targets in support of those measures within one year of the USDOT final rule on performance measures. [§1203; 23 USC 150(d)].
- USDOT will establish minimum thresholds for Interstate pavement condition. [§1203; 23 USC 150(c) (3)].
- Each state will maintain minimum thresholds for Interstate pavement condition [§1106; 23 USC 119(f)].

Issues:

- The Florida portion of the NHS expanded from 4,500 miles to more than 8,000 miles under new MAP-21 definitions for that system. This creates a greater demand on state resources to collect, store, analyze, and report the additional NHS pavement data.
- The Department ensures that 80% of the pavements on the State Highway System meet Department Standards.
- Currently there is no MAP-21 guidance for reporting, field test data collected/reported according to HPMS Field Manual (2012).

2013 Florida MAP-21 NHS Pavement Condition*

NHS		Good (IRI < 95)		Fair (95 ≤ IRI ≤ 170)		Poor (IRI > 170)		Total
		Lane Miles	% Lane Miles	Lane Miles	% Lane Miles	Lane Miles	% Lane Miles	Lane Miles
SHS	Interstate	6,428	91%	594	8%	49	1%	7,071
	Non-Interstate	17,902	81%	3,555	16%	600	3%	22,057
Off SHS Total		630	42%	682	45%	187	12%	1,498
NHS Total		24,959	81%	4,831	16%	836	3%	30,626

* Mileage shown here is extrapolated from the Pavement Condition Survey rated sections and includes bridges' traveled surface.

* 1,498 lane miles of roads on the NHS are not part of the State Highway System, and are not maintained by the State.

* IRI are in in/mile

MAP-21
Moving Ahead for Progress in the 21st Century

Florida Department of Transportation

Bridges

Over 95% of state-maintained bridges meet standards and all state bridges open to the public are safe

2014 MAP-21 Performance Report

Overview: Florida is committed to keeping state highway bridges in a good and safe condition. The Department maintains 6,703 bridges and inspected 2,546 other bridges owned by other state and local jurisdictions last year. The Department takes a proactive maintenance approach which has proven cost-effective. Preventative maintenance and repairs are performed to prevent bridges from deteriorating to a level at which the repair cost would be much greater. This approach ensures that our bridges meet or exceed their design life, resulting in a lower frequency of large capital bridge replacement costs.

MAP-21 Provisions: States must maintain minimum thresholds for National Highway System (NHS) bridges (no more than 10% of total NHS bridge deck area may be on structurally deficient bridges). [§1106; 23 USC 119(f)].

Issues:

- The specific data elements and ranges to be used for categorizing bridges as good, fair or poor are still being discussed among states.
- The Florida portion of the National Highway System expanded from 4,500 miles to more than 8,000 miles as MAP-21 redefined what comprises the NHS. Less than 3% of the total deck area of NHS bridges in Florida are on structurally deficient bridges.
- Using current NBI element data, it is not possible to obtain an accurate value of equivalent deck area for culverts. Currently, 2 of 1,101 (0.2%) state maintained culverts are structurally deficient.
- Target Setting: Ensure that 90 percent of Department-maintained bridges meet standards while keeping all Department-maintained bridges open to the public safe

For More Information: See the Maintenance & Operations Annual Performance Report at FDOTPerforms.org for Florida's strategies for achieving our bridge objectives.

NHS Bridge Performance by Condition Ratings

Bridges	Number	Percent by Number	Deck Area SF	Percent by Deck Area
Good or Excellent	3,475	96.7%	88,665,082	91.5%
Fair	103	2.9%	6,097,464	6.3%
Poor	14	0.4%	2,087,304	2.2%
Total	3,592	100.0%	96,849,851	100.0%

Ratings: Excellent – 8 or 9; Good – 6 or 7; Fair – 5; Poor -4 Data include MDX and OOCEA

Does not include culverts.

MAP-21
Moving Ahead for Progress in the 21st Century

Florida Department of Transportation