Transportation Asset Management Plan

Alaska Department of

Transportation & Public Facilities

April 2018

Message from the Commissioner:

The Alaska Department of Transportation and Public Facilities (DOT&PF) must not only construct today's improvements, but also preserve our existing assets for future generations. We must become as skilled at optimizing the lifecycle planning and overall performance of transportation assets as we are at engineering and building them. We owe this to the future generations of Alaskans.

Private companies have been using asset management principles to improve performance, raise customer satisfaction, and maximize profit. The DOT&PF proposes to use these same principles to manage Alaska's transportation assets, striving to deliver the highest level of benefits at the least cost.

Asset Management supports our department's initiatives for One DOT&PF and Results Based Alignment, a service delivery framework by which we measure the efficiency and effectiveness of the services we deliver in support of our mission.

To create a more effective, credible, and defensible transportation program, we will link planning, programming, and budgeting based on data informed analysis, on statewide needs, and on desired outcomes

We manage a diverse range of transportation assets and facilities valued in excess of $7.0 billion. Alaskans depend on this system and have entrusted the DOT&PF to design, construct, maintain, and operate it safely and efficiently. We believe Transportation Asset Management (TAM) offers us a proven approach to effective, systematic, and accountable management of our transportation assets.

We are in the initial phase of using asset management practices for preservation of bridges and pavements—our first steps toward a mature asset management program in the future. TAM will reach success not overnight but over time, through organized and progressive steps and continued participation by all.

This TAMP tells our story.

I approve this Transportation Asset Management Plan for the State of Alaska, Department of Transportation and Public Facilities.

4/6/18

Commissioner Marc Luiken, C.M. Date

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Executive Summary

The risk-based, Transportation Asset Management Plan (TAMP) is one of a series of state plans required by federal rulemaking to achieve the Nation's transportation goals. TAM keeps Alaska moving through service and infrastructure by making good infrastructure cost less, TAM provides a long term, systematic approach to cost-effectively sustain our infrastructure. The TAMP provides a 10-year financial plan that provides the connection between the Long Range Transportation Plan (LRTP) which covers a span of more than 20 years and the State Transportation Improvement Program (STIP), with its scope of four years.

TAM supports the overall "One DOT&PF" and "Results Based Alignment" vision by strengthening Alaska Department of Transportation and Public Facilities (DOT&PF) efficiency and effectiveness at planning, designing, constructing, operating and maintaining transportation systems. This vision strengthens transparency and accountability; encourages innovation and quality of services.

The TAMP includes National Highway System (NHS) bridges and pavements only. As of July 2017, Alaska has 1,160.7 miles of Interstate and 926.9 miles of non-Interstate roads. All except for 22.1 miles are owned and operated by DOT&PF. Alaska has 417 bridges on the NHS, all owned and operated by DOT&PF.

States are required by 23 CFR 490.105 to set pavement condition targets for NHS that include its Interstate and non-Interstate inventory. Alaska's targets for Interstate pavement are 10% poor and 20% good; for non- Interstate NHS the target is 15% poor and 15% good. For bridges, the targets are 10% poor and 40% good. The cost to keep Alaska infrastructure in a state of good repair meeting those targets is estimated at an average of $275 milion annually over the next 10 years. More analysis will be completed prior to the June 30, 2019 submittal.

DOT&PF staff have led the coordination with Alaska's two Metropolitian Planning Organizations (MPOs) to evaluate the performance targets the MPOs plan to use for NHS pavements and bridges and to incorporate these targets into their transportation plans. DOT&PF staff have also worked on a process for prioritization of projects for the NHS system to help meet these targets.

The greatest risk DOT&PF faces is in obtaining the quality data necessary to forecast efficient infrastructure maintenance needs. Some other risks identified include inadequate funding, seismic activity, flooding, climate change, permafrost, changes to permafrost and aufeis impacts, providing vital lifelines to small communities, and quality control of construction projects. There may be a funding gap by preserving Alaska system at the expense of modernization, new facilities and ferries. There will be more analysis in the June 2019 TAMP.

This is DOT&PF's first TAMP and Performance Management and Asset Management practices will continue to be refined.

Section 1 Introduction

The purpose of this Transportation Asset Management Plan (TAMP) is to describe how the Alaska Department of Transportation and Public Facilities (DOT&PF) will manage NHS roads in a state of good repair by achieving national goals and state-set targets while managing risks in a financially responsible manner at minimum cost. This plan documents the development of a long-term systematic approach for sustaining the NHS Interstate pavements and bridges owned and maintained by DOT&PF. Transportation Asset Management, a cost-effective program of continuous, collaborative improvement, supports our mission to " Keep Alaska Moving through service and infrastructure," by making good infrastructure cost less.

The TAMP is one of a series of state plans required by federal rulemaking to achieve the Nation's transportation goals. State DOTs will have to develop plans for highway safety, freight and congestion. Alaska's Strategic Highway Safety Plan is being updated. Alaska has set annual safety targets for the five national safety performance measures. Alaska's Freight Plan has been completed in February 2018. Alaska does not require a congestion plan. All these plans will influence the DOT&PF's LRTP and the short term STIP.

The TAMP identifies DOT&PF methods for assessing the asset conditions, analyzing future conditions and asset management practices. Using a risk based approach, DOT&PF performs a gap analysis between desired state of good repair condition and available funding. Finally, these steps define Alaska DOT&PF investment strategies for meeting the demands of ensuring the successful management of Alaska's transportation assets.

The DOT&PF's mission and vision for Transportation Asset Management (TAM) is to support Alaska's surface transportation program through the Fixing America's Surface Transportation (FAST Act). FAST Act is the first long-term highway authorization enacted since 2005) and through the Moving Ahead for Progress in the 21st Century (MAP 21)). In 2012, MAP 21 created a streamlined and performance-based surface transportation program for the nation (https://www.fhwa.dot.gov/map21/). The FAST Act continued and strengthened the performance-based transportation program (https://www.fhwa.dot.gov/fastact/).

MAP 21 defines asset management as follows:

> *The term asset management means a strategic and systematic process of operating, maintaining and improving physical assets, with the focus of both engineering and economic analysis based on quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and*

> *replacement actions that will achieve and sustain a desired good repair over the lifecycle of the assets at a minimum practical cost.* [23 USC, Sec. 101(a)(2)]

DOT&PF will manage highway assets using asset management mission, vision and goals.

1.1 Asset Management Mission, Vision and Goals

In this section, the TAM mission, vision and its respective goals are described including a detailed discussion of pavement and bridge assets. Keeping with the DOT&PF TAM motto, "Start simple, grow smart, and show continuous improvement", only the required NHS bridges and pavement assets are included.

Mission: TAM keeps Alaska moving through service and infrastructure by making good infrastructure cost less.

Vision: TAM provides a long term, systematic approach to cost-effectively sustain our infrastructure.

TAM supports the overall "One DOT&PF" vision by strengthening our efficiency and effectiveness at planning, designing, constructing, operating and maintaining transportation; by strengthening our transparency and accountability; by encouraging innovation and quality of our service; and by promoting Results Based Alignment (RBA) of state-owned transportation assets and facilities. RBA is a service delivery framework from which DOT&PF measures the efficiency and effectiveness of the services we deliver in support of our mission.

TAM depends on quality data for more effective planning, designing, constructing, operating and maintaining all modes of transportation for informed decision-making to keep infrastructure in a state of good repair over the life cycle of the asset. The slide below shows how RBA and Asset Management are aligned to support DOT&PF's continuous improvement.

The principles and goals by which we support the DOT&PF mission are as follows**:**

1. Integration of systems – using a common language
2. Informed decision-making
3. Simple, achievable goals
4. Measurement of what matters

GOAL #1: Predictive Models to "Tell the Future"

TAM promotes performance and RBA of state-owned transportation assets and facilities through performance metrics, risk management, and evaluation of progress. We collect and analyze historical data to predict the future condition.

GOAL #2: Wise Investment Resources

TAM provides for better access to quality data and for better planning in the design, construction, operation, and maintenance of all modes of transportation.

GOAL #3: A Long-term Comprehensive Network that generates actionable information

TAM will support One DOT&PF, by maintaining strong, healthy communications internally and externally. TAM supports collaboration through our TAM structure and provides information for stakeholders and decision-makers. System integration is essential to combine data from disparate business systems into information to support decisions.

GOAL #4: Credibility

TAM will maximize the impact of every public dollar spent. We will serve the needs of Alaskans through the National Performance Measures and RBA.

GOAL #5: Transparency

TAM will improve transparency by making information readily available and accessible for stakeholders and decision makers. TAM holds DOT&PF accountable through monitoring performance metrics and evaluating progress. TAM supports innovation through alternatives analysis and trade-off analysis.

1.2 Penalties and Reporting

The federal funding participation is normally around 90% of project costs. If a state has not developed and implemented a TAMP by October 2019 the federal funding participation may not exceed 65% (23 CFR 515.15). If no effort is made to complete the plan within 18 months of the effective date of the Final Rule for bridge and pavement performance, Federal Highways Administration (FHWA) will not approve any further projects using National Highway Performance Program (NHPP) funding. FHWA may extend the deadline if states are making a good faith effort.

The National Performance Rule Making requires FHWA to assess biennially whether each state is showing significant progress in achieving targets the state has established for the NHPP. State progress would be considered significant if the actual condition is either equal to or better than the established target, or better than the baseline condition.

Under the Final Rule for pavement condition, failure to meet the minimum level for two consecutive calendar years would subject a state to the following penalties:

- Be required to obligate NHPP funds in an amount at least equal to the State's federal fiscal year (FFY) 2009 Interstate Maintenance apportionment - $31.7M. For each year after FFY 2013, the amount required to be obligated shall increase by 2 percent over the amount required to be obligated in the previous federal fiscal year, and
- Be required to transfer Surface Transportaion Program (STP) funds that are not sub-allocated based on population to the NHPP in an amount equal to 10 percent of the amount of the State's FFY 2009 Interstate Maintenance apportionment, estimated at $3.1 Million.

Under the Final Rule for bridge condition, failure to meet the minimum level for three consecutive calendar years would subject a state to the following penalties:

- Be required to obligate and set aside in an amount equal to 50 percent of funds apportioned to such State for fiscal year 2009, estimated at $13,753,843 only for eligible projects on bridges on the NHS. The requirement will remain until less than 10 percent of the total deck area bridges in the state on the NHS have been classified as Structurally Deficient.

1.3 TAM Implementation

The TAM Leadership Structure, as shown below and which is further described in Appendix A, describes how TAM is organized within the DOT&PF and Metropolitan Planning Organizations (MPOs). Appendix A further details the TAMP development for Alaska DOT&PF.

Appendix B provides additional background information on the highways in the State of Alaska.

The TAMP provides a 10-year financial plan that provides the connection between the LRTP, which covers more than 20 years, and the STIP, which covers four years.

Section 2 Pavement & Bridge Assets

The following section summarizes only those pavement and bridge assets that are on the NHS. All Alaska roads and bridges are important to consider for overall management of the transportation system, but for the purposes of this document only NHS pavement and bridges will be included. More detailed information on pavement is included in Appendix C and more information on bridges in Appendix D.

2.1 Pavement Inventory

The following summarizes Alaska's Interstate and non-Interstate NHS in centerline mile collected in summer 2016.

	Centerline Miles
Interstate (paved)	1160.7000
Paved non interstate NHS	926.9000
Unpaved non interstate NHS	264.3972
Total	**2351.9972**

The entire 1,160.7 miles of Interstate is owned and operated by Alaska DOT&PF. Of the 926.9 miles of non Interstate NHS, 22.1 miles are owned and operated by entities other than Alaska DOT&PF. Over 18.7 miles of the 22.1 miles are owned and operated by Municipality of Anchorage (MOA). The rest (3.4 miles) are intermodal links between the state system and a ferry, port or airport.

The State collects pavement and other federally required Highway Performance Monitoring System data elements for the entire NHS, regardless of ownership and therefore does not require any special agreements to be put in place for data collection to comply with 23 CFR 515.7(f). However, DOT&PF is developing an MOU and Performance Measure Target Setting Procedures document to facilitate coordination with MPOs related to sharing data, setting targets, and selecting projects in support of targets. DOT&PF will continue to coordinate with other entities that manage NHS routes as needed and notes that at only 1% of the overall system, the non-DOT&PF owned NHS is unlikely to affect national goals and state targets.

2.2 Pavement Condition Data

This performance measure uses the following metrics for asphalt pavements: International Roughness Index (IRI), cracking, and rutting. The table below lists the thresholds in the final rulemaking. Pavement Three metrics table outlines the values for each metric as good, fair and poor. The second table shows how to combine the three metrics to define an overall all condition for each HPMS section (~0.1 miles).

Pavement Three Metrics			
	IRI In/mile	%Cracking	Rutting (in)
Good	<95	<5%	<0.2
Fair	95-170	5-20%	0.2-0.4
Poor	>170	>20%	0.40

Section Overall Asphalt Condition	
Overall	3 Metric Ratings (IRI, Cracking, Rutting)
Good	All three metrics are good
Poor	2 or more metrics rated poor
Fair	All other combinations

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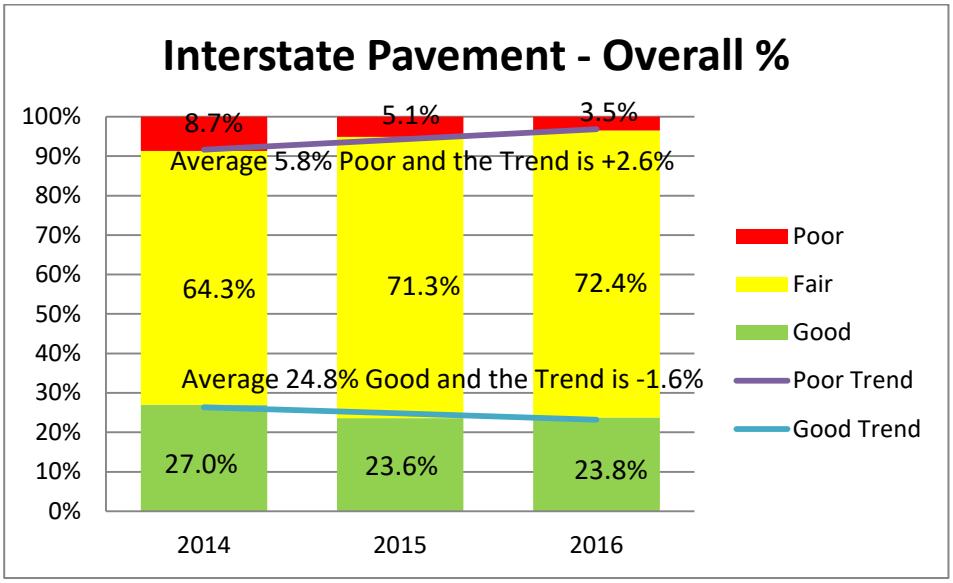
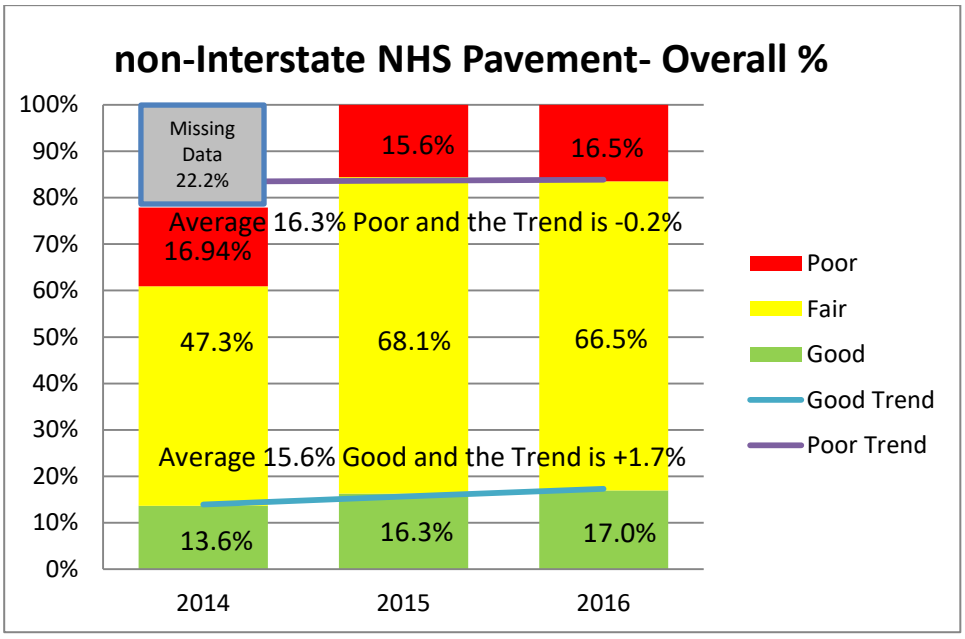
The final federal rule allows but does not require the use of Pavement Serviceablity Rate (PSR) for roads less than 40 mph; this calculation does not include cracking. The State of Alaska is not using PSR at this time on the NHS. DOT&PF may use it on remote non-NHS route when normal pavement data collection equipment can not visit.

Pavement Condition using all three metrics

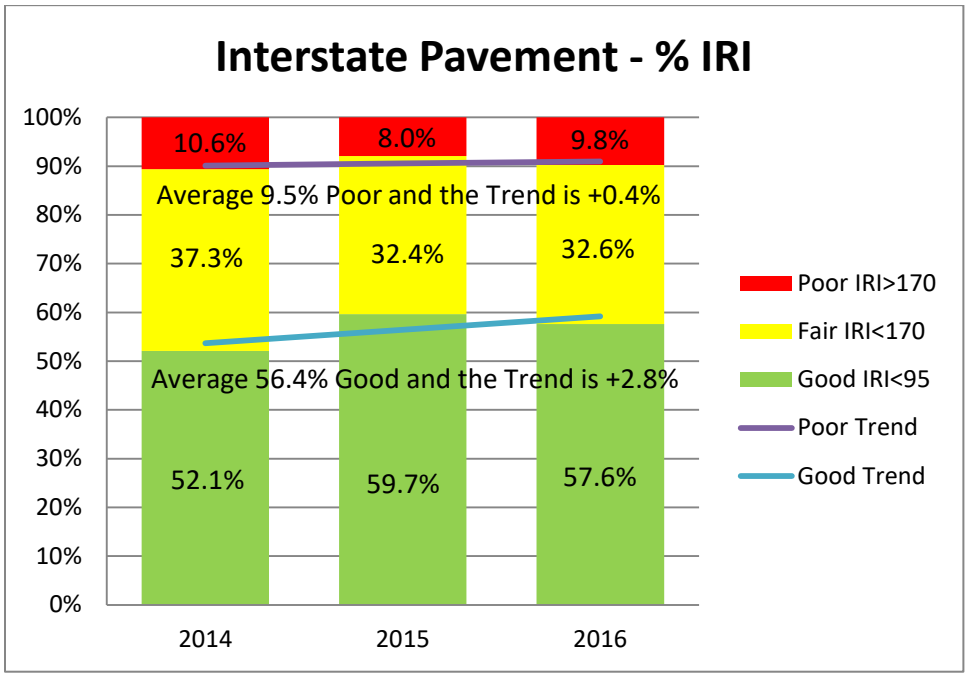
In 2016, Alaska had 1,160 miles of Interstate, all paved. The figures below show Alaska's Interstate and Non Interstate NHS Overall Pavement Condition in 2016. In 2016, 3.5% of the Interstate Overall Pavement Condition was in poor, 72.4% was in fair condition and 23.8% was in good condition. In 2016, the non Interstate NHS Overall Pavement Condition was 16,5% poor, 66.5% was in fair condition and 17% was in good condition





Pavement Condition for IRI only on Interstate

The table below show that the percent of the Interstate IRI condition in poor condition was 8.0% in 2015 and 9.8% in 2016.



Pavement Management Objectives:

- Treat pavements in good and fair condition before they deteriorate to save money over the pavement's life cycle
- Provide information to allow effective selection and design of future surface treatments, rehabilitation, and reconstruction projects.
- Accurately estimate future conditions versus funding scenarios to evaluate current pavement funding strategies.
- Display analysis results in understandable formats.

2.3 Bridge Inventory

In Alaska, the NHS included 408 bridges in 2014, 399 bridges in 2015, 394 bridges in 2016 and 411 bridges in 2017. Engineers biennually inspect bridges, and these inspections are subject to requirements established by FHWA. Bridges inventory changes year-to-year with bridge closures, bridge replacements or changes in road functional class.

2.4 Bridge Condition

The bridge performance measure uses the following metrics for bridges: Deck Rating, Superstructure Rating and Substructure Rating. The table below lists the thresholds in the final rulemaking. **The lowest rating of all three metrics becomes the overall bridge condition.**

Bridge Metrics			
	Deck	**Super**	**Sub**
Good	**9-7**	**9-7**	**9-7**
Fair	**6-5**	**6-5**	**6-5**
Poor	**<5**	**<5**	**<5**

Bridges are inspected biennially and assigned a condition rating in accordance with the National Bridge Inspection Standards (NBIS). The condition rating describes the existing, in-place status of a bridge component compared to the bridge's original, or as-new, condition using a 0-9 scale, with 9 as excellent and 0 as failed.

A bridge is structurally deficient if inspection reveals that primary load-carrying elements are in poor (or worse) condition due to deterioration and/or damage. Primary load-carrying elements include the deck (driving surface), superstructure (the components supporting the deck such as the girders), and substructure (abutments and piers). While the term "structurally deficient" can imply unsafe conditions, bridges with this classification are in safe operating condition to meet the required level of service, or the bridges are weight-restricted or lane-restricted (reduced to a single lane) to assure safe operation. When weight restrictions fall below 3 tons, the bridge is closed to traffic in accordance with federal regulations.

Closed bridges are not considered part of the performance measure. Currently, 13 non-NHS bridges in Alaska are closed.

The DOT&PF measures bridge performance by calculating the ratio (percentage) of deck area of a given condition state (good, fair, or poor/structurally deficient) compared to the total bridge deck area on the NHS. The percentage of structurally deficient deck

area on the NHS became a congressionally-mandated performance measure with the enactment of MAP-21. Data from 2014, 2015 and 2016 includes bridges. Previously, culverts of 20 feet in diameter or larger have not been counted in the NBI bridge deficient deck area. MAP-21 rulemaking required these culverts be included in the NBI bridge deficient deck area calculation.

The calculation includes the following.

Length = corresponding value of NBI Item 49 – Structure Length for every applicable bridge

Width = corresponding value of NBI Item 52 – Deck Width or value of Item 32 Approach Roadway Width for culverts where the roadway is on a fill [i.e., traffic does not directly run on the top slab (or wearing surface) of the culvert] and the headwalls do not affect the flow of traffic for every applicable bridge.

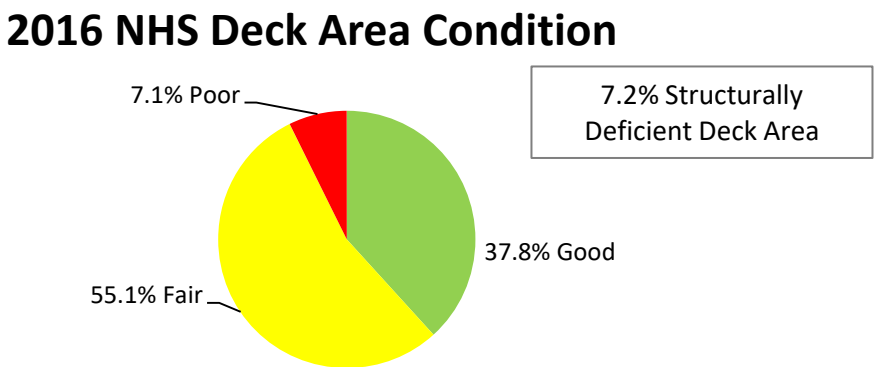
The NBI bridge deficient deck area is the sum of the two below.

1) Bridge Deck Area = Structure Length * Deck Width Out to Out
2) Culvert Deck Area = Structure Length * Approach Roadway

Item 1 includes culverts, typically box culverts, where traffic is driving on the top of the culvert. Item 2 includes culverts where traffic is driving on fill carrying “on” and “off” ramps from NHS routes in accordance with the final rule.

Condition Rating	Performance Target Description
Good	Maintenance Candidate
Fair	Preservation Candidate NBI Standard = 5 or 6
Poor	Rehabilitation or Replacement Candidate

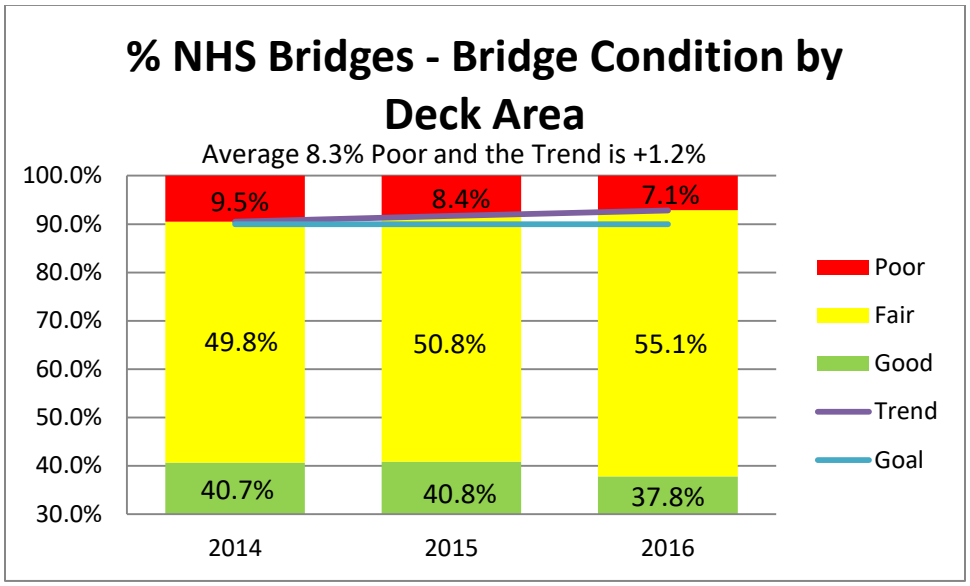
The chart below shows bridge condition reported in 2016 from data collected in 2015:



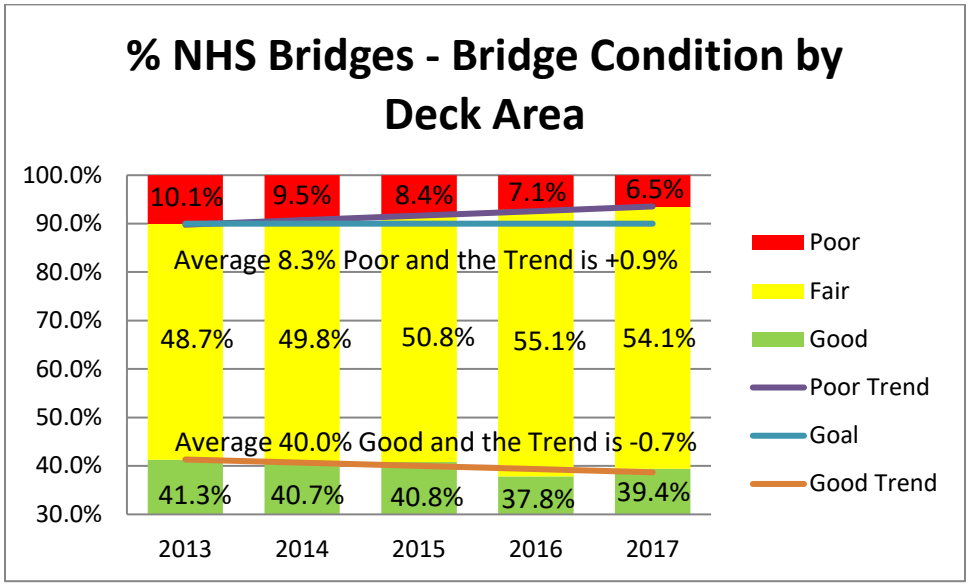
DOT&PF's percentage for poor (7.1%) is different from structurally deficient percentage (7.2%) because one Alaska bridge (Ruby Creek) when inspected is not structurally deficient but water flows over during high water events. Since this bridge is too low for its flow, this overtopping or structural evaluation criterion can place a good or fair bridge into the structurally deficient category. The difference in Alaska is 0.1%. Although the difference is mimimal, this explains the apparent inconsistency in what we report.

MAP-21 contains a performance measure limiting structurally deficient bridge deck area to no more than 10% of all bridges on the NHS. Over the most recent three years, Alaska has met this criteria and has an improving downward trend of 1.2% annually.

The following figure depicts the percentage of bridges in good, fair, and poor condition over the past three years. Bridge deck area in poor condition decreased from 9.5% to 7.2% consistent with the structurally deficient bridge data presented above. While this decrease in bridges in poor condition is encouraging, it is somewhat offset by the decrease in bridges in good condition and the overall increase in bridges in fair condition. This trend could be an indication of the need for more investment in preservation treatments aimed at maintaining bridges in good or better condition.



The following tables show the last five years of bridge condition data for the NHS and non NHS.



Bridge Management Objectives:

- Design and construct bridges to last with minimal maintenance.
- Seal decks and expansion joints to protect bridges from road-salt laden runoff.
- Perform maintenance such as cleaning gutters and deck drains, removing debris from bottom chords and bearing seats, and removing drift from piers.
- Invest in preservative treatments for bridges in good and fair condition to slow deterioration. Preservative treatments might include deck seals, joint seals, and repainting structural steel elements.
- Provide information to allow effective selection and design of future maintenance, preservation (i.e. deck treatments), rehabilitation, and reconstruction projects.
- Accurately estimate future conditions versus funding scenarios to evaluate current bridge funding strategies.
- Display analysis results in understandable format.

Section 3 Performance Management

This section includes the DOT&PF process for assessing the asset conditions, and analyzing future conditions. DOT&PF, based on asset condition, calculates the funding needed by conducting Life Cycle Planning using several scenerios. Using a risk based approach, a Gap analysis is performed between desired state of good repair condition and available funding. The amount of funding available is determined by developing a financial plan in Section 4. Finally, these steps define investment strategies in Section 5 for meeting the demands of ensuring the successful management of transportation assets. This section also describes some of the implementation activities at DOT&PF.

Appendix E contains more details on the Gap analysis process required by 23 CFR 515.7(a).

3.1 Federal Performance Measures

The Final Rule includes national goals and targets for pavements and bridges. The national goals are set through federal rulemaking and have penalties if not achieved. Targets are set by the federal DOT in coordination with partnering agencies.

National Goals

23 CFR 315(b) requires that the percentage of Poor IRI on Alaska's interstate not exceed 10%. Again, from section 2, the percent of the Interstate IRI condition in poor condition was 9.36% in 2014 and 7.95% in 2015. The State of Alaska meets the 90% fair or better national goal at this time.

23 CFR 490.411(a) requires that the state maintain bridges so that the percentage of the deck area of bridges classified as structurally deficient does not exceed 10.0%. The deck area percentage for the last three years has improved from 9.5% deficient to 7.2%, a trend of -1.2%. The State of Alaska meets the national goal of less than 10% poor.

Targets

Federal rulemaking 23 CFR 490.105 requires that performance targets be set for both Interstate and non-Interstate NHS.

Performance Measures	2-year Target	4-year Target	10-year Target
Poor Pavement Condition on the Interstate	10%	10%	10%
Good Pavement Condition on the Interstate	20%	20%	20%
Poor Pavement Condition on the NHS (excluding the Interstate)	15%	15%	15%
Good Pavement Condition on the NHS (excluding the Interstate)	15%	15%	15%

Performance Measures	2-year Target	4-year Target	10-year Target
Poor Condition of Bridges on the NHS	10%	10%	10%
Good Condition of Bridges on the NHS	40%	40%	40%

Having an upper limit on "good" pavements may seem counter-intuitive, but the purpose of this upper limit is to allow for cost-effective management; to manage the road system cost effectively, the upper limit for good pavements should not be more than 20%. With only three years of data using the new metrics, it is hard to base the targets on historical data.

Federal rulemaking 23 CFR 490.105 requires performance targets set for bridges on the NHS. Since bridges are complex structures and require time for project development and design, the State of Alaska will strive to keep poor bridges below 7.5% but the official target will be 10%.

Since DOT&PF is trying to manage the road system cost effectively, the upper limit for good bridges should not be more than 40%.

These targets will be the state of good repair for NHS bridge and pavement assets for the entire ten year period-performance year 2018 to 2027.

3.2 State Performance Measures using Results Based Alignment

Alaska has set performance measures through the RBA initiative. Interstate and NHS assets will match the federal performance measures goals and targets in Section 3.1. RBA also includes targets for the the non-NHS bridges and pavement.

Modernize and Preserve Pavement and Bridges

Performance Measures	2 year Target	4 year Target
Poor Pavement Condition on the non NHS	<15%	<15%
Good Pavement Condition on the non NHS	<15%	<15%
Poor Condition of Bridges on the non NHS	<10%	<10%
Good Condition of Bridges on the non NHS	<40%	<40%

3.3 Performance Gap Identification

DOT&PF is meeting pavement and bridge targets and expects to be able to continue to do so; however, there are trade-offs related to funding availability and remaining performance gaps both on and off the NHS. For example, as funding is focused on preservation and rehabilitation of pavement and bridges, it will be more difficult to fund modernization focused improvements that the public desires to see (both on and off the NHS). This gap is discussed in the LRTP 2036. Additionally, funding is needed for the non-NHS, Marine Highway System ferry purchases, Dalton Highway gravel road preservation, geo-technical assets, culverts and other highway related appurtenances, and other improvements that will not contribute toward meeting targets. DOT&PF will have to consider alternatives and trade-offs when making funding decisions related to meeting targets and closing or minimizing these performance gaps.

The DOT&PF's Long Range Transportation Plan called *Let's Keep Moving* 2016 (LRTP 2036) predicts increases in both population and travel demand that will lead to customer service expectations for new and expanded facilities. The risk analysis indicates that user expectations will increase over time, outpacing forecasts of financial resources, including assessments of what the public is willing to fund. As user expectations increase over time, DOT&PF faces a growing backlog of unfunded expenditures that are necessary to maintain and modernize the system to meet transportation needs; according to the LRTP, this trend has a high risk to the State and the public we serve.

A more urban population has expectations for pedestrian and bicycle facilities and other transportation amenities. These expectations would require unplanned maintenance of the system and higher operating expenditures. The LRTP 2036 describes additional needs and expectations for bicycle and pedestrian facilities. Currently, DOT&PF does not have an inventory program for pedestrian and bicycle facilities similar to the federally mandated Highway Performance Monitoring System for roads in Alaska. These assets are not included in this TAMP but are expected to be included in future publications.

In contrast, population in rural areas is predicted to continue a decline, and the cost of providing services to these areas to increase. Rural transportation projects have high mobilization and materials cost that are often disproportionate in relation to urban area projects. These communities also are in need of transportation in and out of their communities, which is typically by air or ferry. The Alaska Marine Highway System competes with other surface transportation projects for NHPP and STP funds.

The LRTP 2036 also indicates that changing climate patterns pose a high, and almost certain, risk to the transportation system. For example, melting permafrost causes major heaving to roads that requires frequent reconstruction and expensive mitigation measures and earthquakes pose seismic risks to bridges and require pre-emptive mitigation. These risks affect system performance and are discussed in the LRTP 2036 and in the Risk Management section of this document.

3.4 Performance Gap Analysis

There is most likely a gap between customer expectations and DOT&PF's ability to fund modernization type projects. This gap needs to be considered while asset management works to preserve the existing system. DOT&PF performs a Gap analysis by forecasting the infrastructure condition based on what the agency can afford. All of this is done while evaluating agency risks.

"Performance Gap" is defined in 23 CFR 515.5 to mean both the gaps between the current asset condition and a state DOT's target for asset condition, and the gaps in system performance effectiveness that are best addressed by improving the physical assets.

To begin to identify performance gaps, the current state of assets was determined by reviewing historical data and trends. External factors that could affect the future state such as an change in volume of heavy truck traffic or increase water flow around and through infrastructure were then examined. Looking at bridge structural deficiency and pavement IRI revealed that our condition is relatively flat.

Future state needs and visioning will not only address condition targets but will also help identify performance gaps. Asset managers identify items that can improve performance while minimizing cost.

There are other federal performance measures that affect bridges and pavement. Safety targets were set in July 2017 for fatalities, fatality rate, major injuries and major injury rate and non-motorized fatalities. All modernization or expansion projects use safety data for funding prioritization. The Highway Safety Improvement Program (HSIP) for 2018 contains eight safety projects that will also improve pavement or bridge conditions.

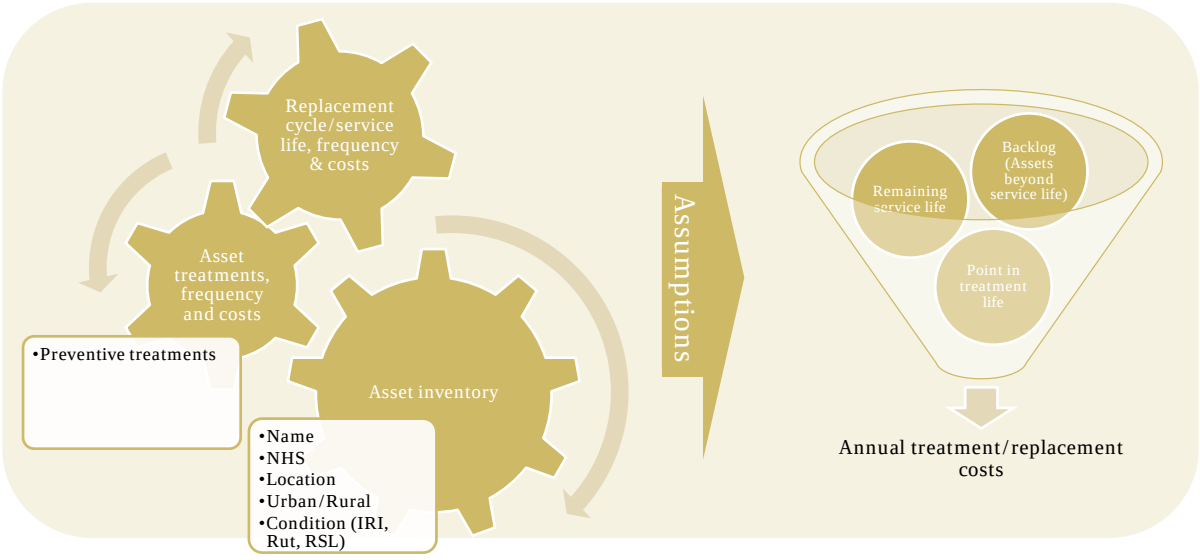
Alaska's freight transportation system is performing reasonably well today. Alaska's Freight Plan analysis identified the following performance risks that are expected to increase in coming years: congested truck routes and intermodal connectors; limited route and modal service choices, especially for rural communities; unreliability or unavailability of services due to seasonal effects, aging infrastructure, or other disruptions; overall cost of goods; and missing infrastructure links and facility improvements that are needed to serve new industries and population growth.

Measures for travel time and freight reliability represent a new data source for DOT&PF. No state targets have been adopted, but DOT&PF is working to incorporate this data into project selection criteria.

DOT&PF preservation projects also include a review of any safety deficiencies which can be corrected.

3.5 Life Cycle Planning: Analysis and Management

The initial asset management plan may exclude one or more analyses (23 CFR 515.11(b)) necessary for asset management processes. The initial Alaska TAMP submitted to FHWA on April 30, 2018 will exclude 1) life cycle planning, 2) risk management and 3) financial plan. The process for conducting the final Alaska TAMP including life-cycle planning described in 515.7(b) is in Appendix F. Life Cycle planning and risk management will be submitted to FHWA division office on June 30, 2019.



Lifecycle Management Needs: Paved Roads

The draft LRTP states that addressing NHS pavement needs will require $253 million annually for 23 years. Non-NHS needs will require $195 million per year for 23 years. This amounts to $448 million annually for all pavement needs.

This TAMP is focused on NHS only (see the major rehabilitation/reconstruction section for further discussion about investment strategies). In contrast, the Pavement Recommendation Report from 2016 states that $369.1 million will be needed for both NHS and non-NHS. The LRTP relied on remaining service life estimates, which may have been conservative. As we improve our Pavement Management System and forecasting, more accurate estimates will be available for planning purposes. Based on the LRTP and 2017 Pavement Recommendations completed by APTech, DOT&PF will need to invest $208 million in FFY18 to meet its targets and state of good repair.

Lifecycle Management Needs: Bridges

The LRTP estimated $25 million is needed annually to meet the NHS bridge structural deficifency target of 7.5% and $11 million is needed to satisfy the target for non NHS bridges. To achieve zero structurally deficient bridges in the state inventory would require $46 million annually. It is estimated that DOT&PF will need to invest $8 million for bridge maintenance and preservation in FFY18 to help meet its targets and state of good repair.

Bridge and pavement estimates will be updated in the June 30, 2019 TAMP.

3.6 Asset Management Implementation

DOT&PF implementation of Asset Management started with a FHWA Asset Management Readiness workshop in May 2010. DOT&PF then held a Kickoff Meeting in March 2013 and hired Cambridge Systematics to review the current state of data and systems. DOT&PF decided to start with Pavement and Bridges first—in the spirit of our motto: *Start Simple, Grow Smart and show Continuous Improvement.* Appendix E details the Asset Management implementation process.

Asset Management staff used action items from the 2010 FHWA Report combined with a May 2013 Enterprise Work Plan to create an implementation plan. This implementation plan had several versions but none has been formally adopted by the Executive Team. DOT&PF included these action items into the October 1, 2016 Baseline Report to FHWA.

A team of multi-division staff assisted in developing an RFP to procure a contractor for Pavement and Maintenance Management. DOT&PF selected AgileAssets for the contract, which is managed by Asset management staff with a technical co-project manager from Information Systems and Services Division. The staff lead for pavement and maintenance is the Statewide Pavement Manager and a Northern Region Maintenance and Operations District Superintendent respectively. The “go live” date

for the Pavement Management system is tentatively set for April 2018. This launch date is dependent on meeting State security office requirements. DOT&PF hired APTech to develop deterioration and quantitative modeling to be inputt into the AgileAsset Pavement Management System. Headquarters and regional staff provided input into this model. DOT&PF will start using the testing version to develop 2018 pavement recommendations if there are additional delays in the software launch.

Pavement Management staff are updating the new pavement management system with project cost data to assist in the life cycle planning. This will be used to help program the most cost-effective projects. The process is described in a DOT&PF Policy & Procedure (P&P) on pavement management system use and selecting maintenance, preservation and rehabilitation projects.

Bridge Management staff are updating their Bridge Management System version that complies with federal requirements. The system will contain bridge project costs and deterioration modeling to assist in the life cycle planning. This will be used to help program the most cost effective projects. The process is described in a P&P for bridge management system use and selecting maintenance, preservation and rehabilitation projects.

The pavement and the bridge management systems will provide data to business intelligence software (Cognos Analytics) to track condition and performance of assets against their respective targets and national goals. Both systems will produce the best available data as required by 23 CFR 515.7(g).

The Planning and Programming Development staff coordinated with the MPOs to evaluate performance targets used for NHS pavements and bridges within the MPOs and incorporate these targets into MPO transportation plans. Planning and Program Development staff have also worked on a process for prioritization of projects for the NHS system

3.7 Risk Management

Risk is the positive or negative effects of uncertainty or variability upon agency objectives. Risk management is the processes and framework for identifying, analyzing, evaluation and addressing risks to the assets and system performance. Using the processes developed in Appendix G as required by 23 CFR 515.7(c), DOT&PF will identify, assess, evaluate and prioritize the asset management risks and summarize how DOT&PF will deal with these risks or opportunities.

The greatest risk to DOT&PF is having the quality forecasting data necessary to identify transportation needs and cost efficiencies. The asset management objectives that are affected by risk are having the quality, transparent data systems to predict the future and support decision making. Without trusted data and accurate projections, DOT&PF

will not be able to perform asset management to make wise resource investment decisions that make good infrastructure cost less.

Some cost efficiency measure DOT&PF actively implements now is to design and construct bridges to last with minimal maintenance and has dedicated funding for preventive maintenance.

Some other risks identified include inadequate funding, seismic activity, flooding, climate change, permafrost, changes to permafrost and aufeis impacts, providing vital lifelines to many small communities, and quality control of construction projects.

DOT&PF will organize a Risk Management Team to reaffirm agency risks and to develop strategies to mitigate risks.

DOT&PF will futher develop this Risk Management section and Appendix G for inclusion in the TAMP due June 30, 2019.

Section 4 Financial Plan

Transportation funding in Alaska is a combination of federal funds, state General Funds, and Alaska Marine Highway System revenues. Of these, the Federal Highway Program funds represent the majority of the available funds. State funds are used as federal match money.

The FAST Act provides Alaska with a stable source of funding for transportation infrastructure for the next five years. That said, the current and forecasted levels of funding are still lower than those required to meet all identified needs and will therefore require making some difficult decisions in the future. Appendix H contains more details on this Financial Plan process as required by 23 CFR 515.7(d).

The following table shows the estimated funding available for the next 10 years. FAST Act includes only six years of federal funding levels from FFY15-20. DOT&PF used a 2.5% growth rate to estimate federal funding past FFY20.

	NHPP	NHPP Freight	NHPP Exempt	Total estimated NHPP available
FFY18	$264,304,838	$13,651,074	$8,201,405	$286,157,317
FFY19	$269,590,935	$13,924,095	$8,365,433	$291,880,463
FFY20	$274,982,753	$14,202,577	$8,532,742	$297,718,073
FFY21	$280,482,409	$14,486,629	$8,703,397	$303,672,434
FFY22	$286,092,057	$14,776,362	$8,877,465	$309,745,883
FFY23	$291,813,898	$15,071,889	$9,055,014	$315,940,800
FFY24	$297,650,176	$15,373,327	$9,236,114	$322,259,616
FFY25	$303,603,179	$15,680,793	$9,420,836	$328,704,809
FFY26	$309,675,243	$15,994,409	$9,609,253	$335,278,905
FFY27	$315,868,748	$16,314,297	$9,801,438	$341,984,483
FFY28	$322,186,123	$16,640,583	$9,997,467	$348,824,173

4.2 Value of Assets

DOT&PF uses straight-line depreciation as the standard method for valuation of infrastructure assets. Many state transportation boards use the Government Accounting Standards Board 34, but the Alaska Department of Administration prescribed the straight-line depreciation method for our use.

DOT&PF financial statements dated June 30, 2016 show that the infrastructure assets valued at $7,103,135,005. The book value after depreciation is $2,711,316,381. The infrastructure assets can be broken down as follows:

- Airports Runways $1,703,674,968;
- Bridges $342,048,901;
- Marine Structures $89,628,604; and
- Roadways $4,967,782,533.

Section 5.0 Investment Strategies

This section describes the investment strategies needed to achieve and sustain a state of good repair of NHS bridges and pavements based on lifecycle planning. A state of good repair correlates to preserving the assets and meeting the condition and performance targets and national goals described in Section 3. Funding categories based on the asset analysis and forecast will ensure timely treatment is applied at the appropriate level of service to minimize the cost of the asset over its life cycle.

The STIP will identify the appropriate funding work type category for a proposed project.

The policies and goals laid out in LRTP 2036 and the life cycle planning, risk management, and financial planning processes described in this TAMP document contribute to the investment strategies used to achieve national goals, statewide targets, and a state of good repair.

- *Continue to invest at historical funding levels:* As described in earlier sections of this document, Alaska's NHS routes currently meet national goals as well as recently set statewide targets. This suggests that historical investments have been sufficient and that investment of similar funding levels will continue to keep Alaska's NHS system in a state of good repair. As more data becomes available, the Department may further target funding allocations by work types. Additionally, the Department will continue to monitor whether this funding level remains sufficient or needs adjusting.

- *Implement LRTP 2036 goals and policies:* The LRTP includes eight policy areas for which investment of limited resources is needed. The Department's investment strategies will consider all of the following policy areas with an understanding that available funding resources will need to be balanced to target an appropriate level of investment in each area.

Policy Area	Goal Description
New Facilities	Develop new capacity and connections that cost-effectively address transportation system performance
Modernization	Make the existing transportation system better and safer through transportation system improvements that support productivity, improve reliability, and reduce safety risks to improve performance of the system
System Preservation	Manage the Alaska Transportation System to meet infrastructure condition performance targets and acceptable levels of service for all modes of transportation
System Management and Operations	Manage and operate the system to improve operational efficiency and safety
Economic Development	Promote and support economic development by ensuring safe, efficient, and reliable access to local, national, and international markets for Alaska's people, goods, and resources, and for freight-related activity critical to the State's economy
Safety and Security	Improve transportation system safety and security
Livability, Community, and the Environment	Incorporate livability, community, and environmental considerations in planning, delivering, operating, and maintaining the Alaska Transportation System
Transportation System Performance	Ensure broad understanding of the level, source, and use of transportation funds available to DOT&PF; provide and communicate the linkages between this document, area transportation plans, asset management, other plans, program development, and transportation system performance

LRTP 2036: Exhibit 7, page 12

- *Select projects using a data-informed approach:*
    - Asset management systems (such as Pavement and Bridge Management Systems) and processes will primarily be used to select preservation focused projects, with the intent of achieving the system preservation policies and actions included in the LRTP 2036, as well as the pavement and bridge condition performance measure areas.
    - A more nuanced approach will be used to select projects on the NHS that are intended to achieve the remaining policy areas and actions, and

performance measure areas, such as modernization and safety. For the 2018-21 STIP, a data informed approach was used to guide decisions for programming NHS projects. This process is outlined in Appendix I. This process will be further refined and may include multiple sets of criteria and standards related to the various policy areas and/or national performance measures for which a project will primarily contribute.

- *Show how projects contribute to performance management in the published STIP document*: Projects that are intended to support national goals, statewide targets, and a state of good repair will be identified in the STIP. Projects will be linked to the following performance management areas: safety, pavement condition, bridge condition, travel time, freight travel time, and air quality Project work types (system preservation, reconstruction, etc.) included in the STIP document will also aid in linking programmed projects to both performance management goals and LRTP policy areas.

The financial plan includes federal funding sources from 2018 through 2027. This 10-year investment plan is for Interstate and non-Interstate NHS only. The estimated apportionment assumes an annual increase of 2% per year beginning in FFY 2012. Appendix I details the process used to develop Alaska investment stategies as required by 23 CFR 515.7(e) and (f). Values will be updated in the June 2019 TAMP.

Section 6 Improvement Plan

In 2013, DOT&PF was described as being in the “awakening” stage of Asset Management maturity (AASHTO TAM Guide, 2011), where a basic set of capabilities are in place for a few types of assets, but are not yet integrated into Department-wide decisionmaking. DOT&PF is working toward advancing to the “structured” stage for both bridge and pavement assets. The following section describes activities that DOT&PF is pursuing and hope to have incorporated in a later TAMP.

6.1 Cross Asset Allocation

There are generally two major types of asset management functions performed by a state DOT; asset specific or cross asset, i.e., pertaining to two or more assets. DOT&PF is working on completing our asset specific process by establishing a new Pavement Management System and enhancing our current Bridge Management System. The enhanced Bridge Management System will provide modeling and forecasting capabilities instead of solely an inventory and condition database.

After these systems are completed and the business processes are developed, we will develop multiple asset evaluation processes and then cross asset evaluation. All these analyses support overall asset management decisions that lead to desired outcomes, promote wise investment of resources, and promote credibility and transparency of investment decisions. The following types of asset management decisions benefit from cross asset processes:

- **Programming** – Conducting tradeoff analysis in order to allocate funds to program areas, and establish performance targets
- **Strategy** – Evaluating activities within asset groups (e.g. maintenance)
- **Project** – Prioritizing assets and/or projects
- **Project Development** – Designing projects and evaluating project alternatives (e.g., conducting life cycle cost analysis)
- **Policy** – Evaluating TAM policy issues (e.g., understanding the implications of increasing truck weight limits)

The research project for the TAM Information System identified several specific data queries that would help with asset management decisions. The focus on cross asset processes is intended to provide the ability to use trusted data and analysis tools to quickly run queries and to use the results to make informed decisions (TAM Information System Task 9 page1-7).

6.2 Single Asset Analysis and Future Improvements

PAVEMENT ASSET MANAGEMENT PRACTICES

DOT&PF is developing a Pavement Management System. The Pavement Management System is estimated “go live” in April 2018. Previously, a consultant conducted annual analyses of road segments that require maintenance or preservation using the following alternative actions: Do Nothing; Surface Seal; Overlay; Mill & Overlay; Reclaim Base & Overlay; Reclaim Base & Surface Seal; Rut fill with Surface Seal. We are developing a P&P that describes pavement data use and pavement preservation project selection.

The LRTP our 23-year pavement need represent $10.3 billion, which includes $1.2 billion to address the backlog. Divided by 23 years, the annual funding need for NHS pavement is $253 million. This includes maintenance, preservation, rehabilitation and reconstruction needs. The annual non-NHS pavement need is $195 million, for a total of $448 Million annually for all pavement needs . The model assumes that the backlog will be addressed over the first 10 years of the model. The average annual need is $450 million and includes the funding needed to address the backlog. This model provides only a planning-level estimate of pavement needs for the LRTP since the new Pavement Management System has not yet been implemented.

Maintenance staff maintain all DOT&PF maintained roadways in support of asset management. Because the pavement deterioration models include the effects of the surface maintenance it is considered a critical component of a pavement’s life-cycle costs. Maintenance work is shared between contractors and in-house staff and includes crack sealing, patching potholes, and preservation activites such as chip seals. Without this work, the pavement deterioration models would predict a short life expectancy; therefore it is critical to maintain or increase the current level of effort in the maintenance budget.

BRIDGE ASSET MANAGEMENT PRACTICES

DOT&PF uses AASHTOWare Bridge Management System (AASHTO BrM previously know as PONTIS) for their inventory and inspection results. The previous version of the Bridge Management System did not perform bridge deterioration modeling. The newest version the Department is adopting will have this capability. LRTP Once the new version of the AASHTO BrM is fully implemented, its asset management capabilities will provide deterioration modeling and life cycle planning capabilities. We will be able to compare actual bridge costs to bridge condition to perform life cycle analysis. In the meantime we have used the modeling performed by the LRTP and performed some in-house analysis. Bridge asset management, national goals, and state-established targets are required on the NHS only, but again we still need to keep non-NHS bridges at a condition that our customers expect.

GEOTECHNICAL ASSET MANAGEMENT

DOT&PF has developed a Geotechnical Asset Management (GAM) Program as a research project, encompassing three asset classes: rock slopes, unstable slopes and embankments; retaining walls and material sites. These assets play a vital role in providing raw materials to build our roads and airports, as well as in physically supporting our core transportation assets and structures.

Accomplishments of GAM Program research and development include the following:

- Baseline asset inventories;
- Condition index and condition state classification systems;
- Inspections to establish baseline conditions of assets in NHS;
- GAM life cycle cost analytical framework:
    - Cost models
    - Treatment models
    - Deterioration models
    - Risk models
- Database incorporated into GIS platform;
- Tools for tracking performance over time
- Geotechnical Asset Management Plan

DOT&PF has elected not to establish performance targets for these asset classes and include the GAM Plan in the initial TAMP submittal to FHWA. DOT&PF does not expect to pursue programmatic maintenance or preservation activities on geotechnical assets at this time. The data and reporting information in the GAM Program is being incorporated into new project selection criteria. The approach under this initial TAMP is to address geotechnical asset classes within the scopes of capital projects.

Geotechnical asset inventories, associated databases, condition inspection schedules, and tracking of work activity costs associated with geotechnical asset classes will be maintained.

Future improvements include:

- Strengthening information systems and improving data
    - The Transportation Asset Management Information System (TAMIS) integrates data into established methods for making asset management decisions. Information from 24 different data systems are included in the TAMIS, which will help to identify gaps. TAMIS is a collection of systems and business processes that support decisionmaking. ESRI Road and Highways and Cognos Analytics are two systems used to integrate stand alone systems.
    - The AASHTOWARE software package enables data management for cost estimation, proposal preparation, letting bids, construction and material management. AASHTOWARE will help to standardize project management processes
- Continuing to improve system maturity by linking the capital investments back to the condition data for improved calculation of asset lifecycle cost
- Evaluating adding additional assets upon approval of Executive Leadership
    - Geotechnical Assets
        - Unstable slopes
        - Rock slopes
        - Retaining walls
        - Material sites
    - Culverts less than 20’ and other drainage structures
    - Tunnels
    - American Disability Act compliance infrastructure inventories

Appendix A

TAM Leadership Structure

The TAM leadership structure (Figure A.1) shows the initial organizational framework for Asset Management within the DOT&PF. Alaska's first TAM Coordinator began in 2011. The first direction from executive management was to establish "enterprise"-wide Asset Management for the entire Department that included all modes. Executive leadership changed, and the new direction was to "start simple and grow smart and show continuous improvement" and include only the bridges and pavement on the National Highway System (NHS). Once we are proficient at establishing Asset Management and Lifecycle Planning for our NHS bridges and pavement, we will add this decision-making process to other assets in order of importance.

Figure A.1: 2012 TAM Leadership Structure

In 2014, the TAM Coordinator created the TAM Working Group and the Subject Matter Experts Group (Figure A.2). During this time, the groups focused on Asset Management systems and developing a Transportation Asset Management Plan for

DOT&PF. In June 2015, the Department unveiled their Results Based Alignment Initiative, which includes a Performance Management framework.

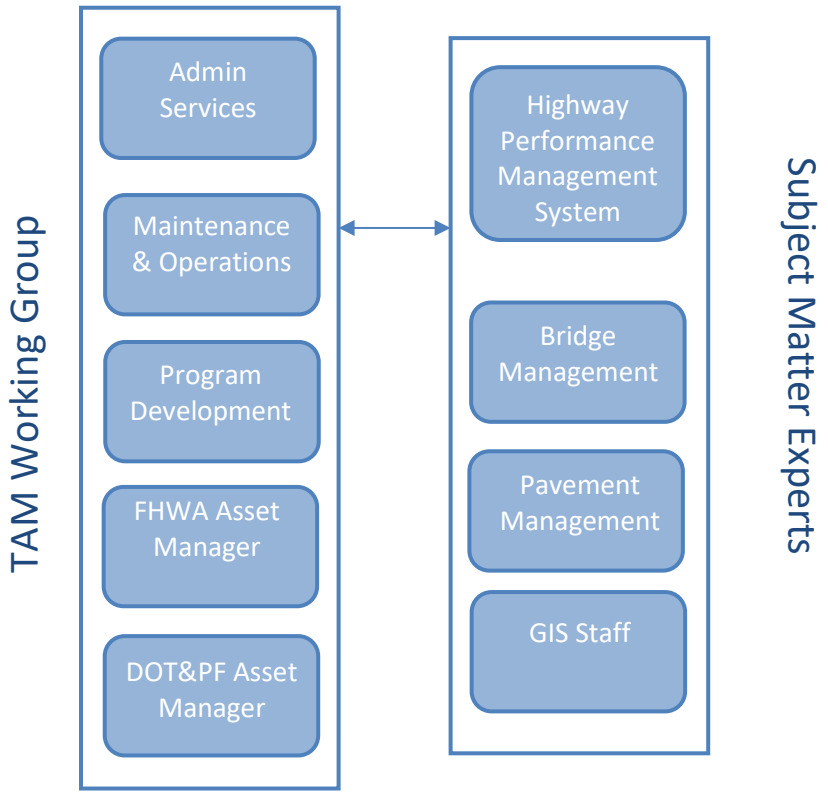


Figure A.2 TAM Working Group & Subject Matter Experts

After FHWA published the final rulemaking, DOT&PF established a TAM leadership structure similar to the original AASHTO-recommended structure but changed the executive leadership to the Commissioner only. The Steering Committee includes the rest of the executive team. The Development Team added Regional M&O and Preconstruction staff.

Figure A.3 shows the structure of the organizational framework for Asset Management within the Department. It shows an interactive relationship between all the teams. It is particularly important to note that all of the teams both give and receive information. The Steering Committee is the “conduit” for information flow from the technical teams to

the Executive Leadership. This interaction assures strong consistency and communication throughout the entire framework.

Figure A.3 Current TAM Leadership Structure

The Asset Management framework provides a rationale and structure for certain workflows, meetings, and working relationships that may or may not already exist but are necessary for the agency to effectively accomplish its mission. Therefore, the organizational leadership structure for TAM is meant to be dynamic in nature, where individuals come together to collaborate.

Each team has a leader and a facilitator. The teams are composed of Department-wide subject matter experts in their specific fields and Federal Highway Administration (FHWA) Alaska Division representatives. The leaders of each team, except for the Communications Team, are also members of the Steering Committee, where they bring recommendations from their teams to discuss and make decisions. These decisions are then communicated to the Executive Leadership. Members of the TAM Development Team serve as each team's facilitator, TAM Champions and

Communication Team Leader. The Development Team members help guide the TAM process and assist the Steering Committee in discussions and decision-making. The AASHTO Guide (2011) refers to the Development Team as a "nurturing group" (page 2-4). It is envisioned that once the TAM process has become an "everyday thing," the TAM Development team will no longer exist and the team members will be integrated into their respective teams.

TAMP Development within Alaska DOT&PF

The TAM teams worked together to provide comments on FHWA rulemaking for performance measures and TAMP. The two MPOs were involved as members of the Planning and Programming Team. The review included only the highway mode. The Safety Team was involved in the TAM review. The planning and the financial office for capital programs are in the same office. The Chief Financial Officer has been involved throughout the TAMP drafting.

The TAM Coordinator, with input for the TAM teams, provided an initial draft TAMP in April 2017. Five workshops were held from April to May 2017 to review the draft TAMP and solicit comments. The TAM Coordinator, Alaska FHWA Division office, two DOT&PF planning staff and MPOs attended training in Phoenix in September 2017. In November 2017, FHWA released additional guidance on financial plans, risk management and life cycle planning. Using the training and the new guidance, the TAM Coordinator with assistance from Teams issued Draft 2 TAMP with Appendices A-I in January 2018. The TAM Coordinator held another series of outreach meetings. Comments on Draft 2 were due February 28, 2018. Comments were coordinated by each team facilitator and forwarded to the TAM Coordinator for incorporation into a final version. TAM Coordinator received comments for FHWA Division Office with assistance from the FHWA Resource Center.

TAM Process

The TAM Process is the approach to Asset Management within the Department. In 2013, the Department's Transportation Asset Management maturity level was characterized as "awakening" (TAM Guide, 2011), which means that a basic set of capabilities were in place for a few types of assets, but not yet integrated into Department-level decision-making. Through the process of drafting our TAM Plan we have moved to a "structured" level, which is defined as shared understanding, motivation, and coordination in developing processes and tools.

Figure A.4 shows the continuous collaborative improvement process that is a strategic, integrated, and systematic approach to Asset Management.

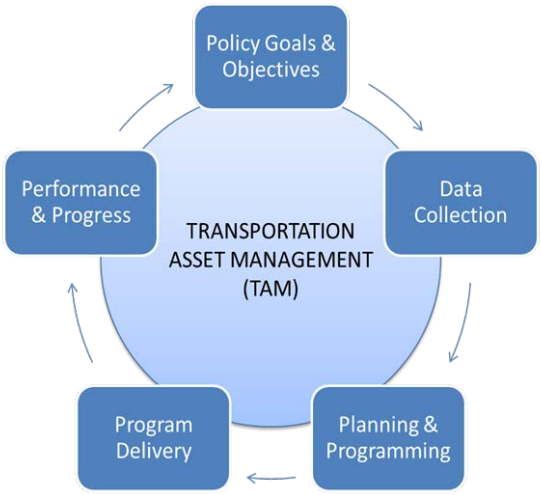


Figure A.4 TAM Process

TAM Policy Goals & Objectives: In this step, policy goals and objectives are clearly defined, based on the DOT&PF's Mission and Strategic Plan.

TAM Data Collection: In the next step, DOT&PF identifies information and data collection needs and communicate that information with the Data Integration team.

TAM Planning & Programming: Next, DOT&PF optimizes planning and programming processes to improve program delivery and identify gaps and establish investment strategies through a financial plan.

TAM Program Delivery: Planning and programming are followed by the development of measurable performance-based standards and forecasting processes.

TAM Performance & Progress: Finally, DOT&PF monitors performance and reports on progress toward our goals and objectives.

TAM Teams

Executive Leadership

Purpose: Set DOT&PF strategic direction, mission, and vision

Roles and Responsibilities: Resolve TAM policy and organizational questions/issues; provide Leadership of TAM

Members: Commissioner

- Marc Luiken, Commissioner

Steering Committee

Purpose: Provide active oversight of the TAMP development and implementation processes

Roles and Responsibilities:

- Take ownership of the TAM implementation process;
- Set the TAM implementation objectives;
- Assist & advise the TAMP Development Team in securing the necessary data and staff;
- Solve resourcing and support problems;
- Meet & Coordinate regularly;
- Set Technical Teams priorities;
- Provide feedback to Executive Leadership.

Members: Division and Regional Directors

- Kenneth Fisher, Chief Engineer Team Leader
- Ryan Anderson, Northern Region Director
- David Kemp, Central Region Director
- Lance Mearig, Southcoast Region Director
- Amanda Holland, Administrative Services Director
- Mike Vigue, Program Development Director
- Mark Davis, Strategic Planning Director

Development Team

Purpose: The Development Team helps guide the TAM process and assists the Steering Committee. The group is made up of the technical team facilitators and other subject matter experts. It is envisioned that once the TAM process has become an "everyday thing," the TAM Development team will no longer exist and the team members will be integrated into their respective teams.

Members:

- Carolyn Morehouse, TAM Coordinator, Technical Team facilitator
- Sarah Schacher, Northern Region Preconstruction Engineer
- Wolfgang Junge, Central Region Preconstruction Engineer
- Pat Carroll, Southcoast Preconstruction Engineer
- Jason Sakalaskas, Northern Region Maintenance
- Bob Anderson, Central Region Maintenance
- Marcus Zimmerman, Southcoast Maintenance
- Diana Rotkis, TAM Champion
- Meadow Bailey, Statewide Information Officer, Communication Team Leader
- Jill Sullivan, Data Integration Team Facilitator
- Marie Heidemann, Planning & Programming Team Facilitator
- John Lohrey, FHWA AK Division Office TAM Champion

Communications Team

Purpose: Communicate and Market TAM.

Roles and Responsibilities: Communicate and market the TAM principles and process internally and externally.

Members: Public Information Offices and Legislative Liaison.

- Meadow Bailey, Information Officer
- Shannon McCarthy Administration Office Manager
- Jill Reese, Information Officer
- Mike Lesmann, Legislative Liaison.

Data Integration Team

Purpose: Identify cross-organizational information and data needs for effective TAM.

Roles and Responsibilities: Implement data collection and manage continuous improvement of TAMIS (Transportation Asset Management Information Systems).

Members: TAM Data and System administrators for all business units and Information Technology.

- Mark Davis, Team Leader David Oliver, GIS Lead
- Ana Enge Project Manager
- Jill Sullivan, Trans Planner, Data Workgroup Facilitator*Travel Time Lead
- Drew Pavey, Pavement Management Data/GIS Support and Central Region Materials Engineering Assistant II
- Paul Wistrand, FHWA AK Division Small Programs Manager
- Chris Kotyk, ISSD, Analyst Programmer

Planning & Programming Team

Purpose: Prioritize, plan, and program projects based on performance-based standards.

Roles and Responsibilities: Use the forecasting processes to prioritize projects and funding.

Members: Director of Admin Services, Planning and Programming staff, Modal Planners, Regional Planners and MPOs

- Mike Vigue, Team Leader
- Marie Heidemann, Team Facilitator
- Mike Crabb, Division Operations Manager
- Judy Chapman, NR Planner
- Todd VanHove, CR Planner
- Verne Skagerberg, SR Planner
- Craig Lyon, AMATs lyonch@ci.anchorage.ak.us
- Jackson Fox, FMATS jackson.fox@fmats.us
- Margaret Carpenter-CMAQ Lead*
- Eric Taylor-Freight Lead*
- Aaron M Jongenelen, AMATS liaison
- Randi Motsko, FMATS liaison

*Brought in on Freight and Congestion Mitigation and Air Quality Improvement (CMAQ) performance measure discussions

Technical Team (Highway)

Purpose: Identify which assets will be measured; the levels of service at which the assets will be maintained; and the data collection process to determine maintenance required for optimization of asset lifecycles.

Roles and Responsibilities: Contribute as identified to the continuous collaborative process.

Highways Technical Team Members

- Kenneth Fisher, Team Leader
- Carolyn Morehouse, Team Facilitator
- Al Fletcher, FHWA
- Sarah Schacher, Northern Region Preconstruction Engineer
- Wolfgang Junge, Central Region Preconstruction Engineer
- Pat Carroll, Southcoast Preconstruction Engineer
- Jason Sakalaskas, Northern Region Maintenance
- Bob Anderson, Central Region Maintenance
- Marcus Zimmerman, Southcoast Maintenance
- Richard Pratt, Chief Bridge Engineer

Pavement Sub-Team

- Jim Horn, Statewide Pavement Manager
- Newt Bingham, CR Materials Engineer
- Bob Trousil, SCR Materials Engineer
- Jeff Currey, NR Materials Engineer
- Steve Saboundjian, Statewide Pavement Design Engineer
- Barry Benko, GAM Program Manager
- Vacant, HPMS Manager

Bridge Sub Team

- Pete Forsling, FHWA Rep - Bridges
- Larry Owen, Bridge Management Engineer
- Janelle White, Asset Management/Research Engineer

Safety Sub Team

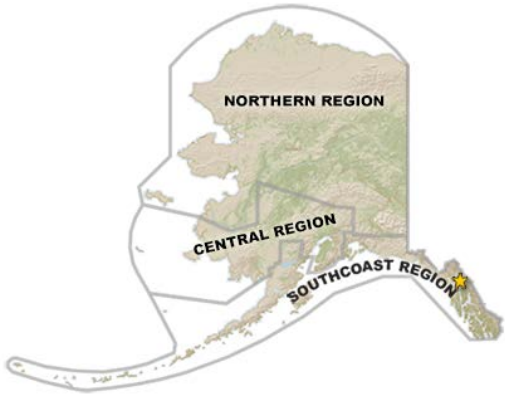
- Clint Farr, Crash Data Planner
- Matt Walker, Statewide Traffic & Safety Engineer
- Tammy Kramer, Safety Office
- Miles Brookes, Safety Research Analyst

Appendix B

Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) designs, constructs, operates, and maintains the State's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors. These include more than 5,000 centerline miles of paved and gravel highways; more than 300 aviation facilities, including 260 airports; 43 small harbors; and a ferry system covering 3,500 nautical miles and serving 33 coastal communities.

DOT&PF is divided into three administrative regions. The Northern Region, headquartered in Fairbanks, is the largest, most geographically diverse region and maintains the most centerline miles of highway, including all of the Alaska, Richardson, Taylor, Denali, and Dalton Highways and portions of the Parks and Glenn Highways. The Dalton Highway is a key transportation to oil production on the North Slope and has unpaved segments. The area includes one Metropolitan Planning Organization (MPO) called the Fairbanks Metropolitan Area Transportation System (FMATS). This planning area encompasses the urbanized portion of the Fairbanks North Star Borough, including the cities of Fairbanks and North Pole.



The Central Region, headquartered in Anchorage, includes the State's most urban areas, as well as some of the most remote villages on the Kuskokwim Delta, and the Alaska Peninsula. Central Region maintains the Seward and Sterling Highways, as well as parts of the Parks and Glenn Highways. This area has the highest traffic volumes in the state and the fastest growing population area in the state. The area includes one MPO called the Anchorage Metropolitan Area Transportation System (AMATS).

The Southcoast Region, headquartered in Juneau, serves the southern coastal communities of Alaska. Most of the communities in Southcoast region are not connected by road and depend on air or ferry service to connect to other communities and the Interstate System. The Southcoast Region was formerly called the Southeast Region.

The transportation system in Alaska is not complete, and there are many plans for its further development into a more integrated network. This is different from the rest of the country, where the system is complete and most new construction is to address congested bottlenecks and corridors.

Alaska's long-range transportation plan, "*Let's Keep Moving 2036"* provides a comprehensive analysis of Alaska's transportation baseline and future needs for all modes of transport. A key objective for the analysis was to evaluate the different types of needs that DOT&PF must address for transportation facilities and services.

DOT&PF's asset management motto is "Start Simple, Grow Smart, Show Continuous Improvement," this TAM Plan will focus on Bridges and Pavements on the National Highway System. We hope to add other assets such as road embankments, retaining walls, and culverts in subsequent versions.

Asset Overview – Highways

HIGHWAYS

Alaska's highway network includes pavements crossing many challenging conditions from the Dalton Highway on the Arctic tundra to the Tongass rain forest in the Southeast "Panhandle." In some areas, temperature differences equal to 160ºF require special engineering skills in design, construction, and maintenance.

The National Highway System (NHS) consists of roadways important for the nation's economy, defense, and mobility. The Alaska Highway System (AHS) includes existing or planned surface facilities that are of statewide significance as established in regulation at 17 AAC 05.170. The Alaska GIS mapping tool is useful for locating NHS and AHS roadways. The map can be found here: http://dot.alaska.gov/stwdplng/fclass/nhs_ahs_map.shtml

It is useful to divide the road network into three categories of roadways: Interstate, non-Interstate NHS, and non-NHS.

- Interstate routes connect the principal metropolitan areas, cities and industrial centers; important routes into, through, and around urban areas; and routes that serve the national defense and connect at suitable border points with Canada. Interstate routes are part of the NHS. Alaska is exempt from geometric design standards associated with Interstate system. Alaska interstate is mostly two lane rural road as opposed to a multi-lane, access control, divided highway.
- Non-Interstate NHS. This is the remaining NHS network other than the Interstate routes.
- Non- NHS roadways are the remaining routes that are managed by the state DOT&PF, other state agencies, local governments and federal agencies.

What is a Road Lane?

There are some discrepancies between federal and state data systems that cause internal and external confusion. Federal reporting for bridges requires the inclusion of auxiliary lanes, but pavement condition reporting through Highway Performance Management System (HPMS) specifically excludes auxiliary lanes. HPMS reports "Centerline miles" that count only the route length and do not include multiple lanes.

Maintenance & Operations staff manages the roadway using "lane miles," which are the number of centerline miles multiplied by the number of lanes. Auxiliary Lanes include

acceleration/deacceleration lanes and turning lanes. Auxiliary lanes and shoulders are sometimes included by maintenance because these need periodic maintenance. It is important to identify the type of road mileage under discussion.

For example, a seven-mile divided highway segment of Egan Drive in Juneau has two lanes in each direction. HPMS would report that as seven centerline miles, whereas Maintenance would count that as 28 road miles, not including the auxiliary lanes and shoulders which would significantly increase the pavement surface requiring maintenance and from which snow may need to be cleared.

In the past, federal HPMS reporting required data collected on only one direction of a highway. For example data would be collected on the Northbound only right hand lane to represent both north and southbound lanes. In practice, the two directions could have different conditions. In addition, only the right-lane pavement conditions are reported in HPMS. That means that on a four-lane highway, only the far right lane in one direction gets counted. The new data collection will include both directions. This data will be used by the Department and FHWA to evaluate Alaska's pavement conditions, so understanding what lane miles means is important. All other roads in Alaska that DOT&PF maintains are non-NHS and are not included in the TAMP.

TAM Progress

The 2013 Enterprise Transportation Asset Management Synthesis and Work Plan by Paul Thompson is being used as a guide for implementing action items. The work plan suggested organizational structures, including stakeholders, policy documents, asset inventories and condition assessment, levels of service used as prioritization methods, decision support capabilities, and suggestions for the TAMP.

Transportation Asset Management Information Systems

From 2013 – 2014 the Transportation Asset Management Information Systems (TAMIS) project conducted an assessment of existing business practices and information, data systems and tools related to asset management. The TAMIS project outcomes included the following recommendations:

- Create a system that all DOT employees can easily use
- Strengthen the ability of data programs to support core business function
- Improve data quality throughout the organization
- Protect data as an agency asset
- Limit risks associated with the loss of data and information

The outcomes of the TAMIS guided MMS and PMS system procurement, design and implementation.

Asset Management Coordination

Asset management staff, pavement and bridge subject matter experts, data systems staff, planning and a FHWA representative have been meeting since 2013 to gather data, guide new systems, write the TAMP, and provide input for asset management implementation.

DOT&PF hired Cambridge Systematics in Feb 2013 to determine the state of agency data and systems in preparation for asset management needs. Cambridge conducted a number of projects: (1) they evaluated current information systems; (2) they created a framework for where the Department wants to go; (3) they performed a Gap analysis; and (4) they conducted a proof of concept on March 2015. The final deliverable was a framework that described how to build TAMIS and what business processes needed to be changed.

During this project, we discovered that Alaska had no data governance or data business rules, which made data and system integration difficult. Cambridge recommended the creation of the new ISSD Director to act as the Chief Information Officer. The

Cambridge deliverables included a draft Data and IT Policy and Procedure, a data governance manual, and a data registry tool. Cambridge also conducted a proof of concept to show what data integration could look like.

In December 2017, the State of Alaska consolidated information technology, which slowed the data progress. We lost our ISSD Director position. The division operations manager is stepping into a leadership position. A Data Work Group has a representative from each division and is led by ISSD's Operations Manager. The Data and Information System Policy and Procedure became effective in November but needs a revision to update to new organizational structure.

Data and Information System Governance is critical to improving data quality and timeliness and it supports the goal of collecting data once and using it multiple times.

Alaska is one of the only states that started TAM implementation without a Pavement Management System. Previously, we hired a contractor to collect and analyze the data and recommend so-called "worst first" sections. We did not track treatment and costs. Since maintenance and equipment costs are key to overall pavement costs, we also were interested in replacing the Maintenance and Equipment Management systems. Through the competitive RFP process, Agile Assets was selected to develop an Asset Management System for DOT&PF that includes pavement, equipment and maintenance modules. The tentative "go live" date for all three systems is in April 2018 when this TAMP is due to FHWA Division Office.

The Bridge Section began an update of the Bridge Management Software (BrM) in April 2017 so that deterioration modeling required by the new regulations and asset management framework can be completed. Historical annual bridge inspections data that document the condition of each bridge by deck, substructure, and superstructure condition were updated into the new BrM. We will be inputting historical cost data as time permits. There have been implementation issues that affect all AASHTOWare users. We are working through these issues.

The implementation plan includes completed tasks, ongoing actions and actions which need to be completed:

A list of the completed tasks:

- Participation as observer state in FHWA TAMP Development Pilot Project-April 2014
- TAMIS Proof of Concept – completed June 2015
- Recommendation for Data Governance Manual for Data Integration Manual September 2015. Working to update with Data Work Group.
- Recommendation for TAMIS – Detailed Action/Implementation Plan September 2015
- Update of Data Catalogue by Cambridge September 2015.
- Internal Communications Plan July 2013
- FHWA contractor led Gap analysis completed January 2018
- Comment on all federal rulemaking completed May 2017
- NHI TAM training help May 2015
- Target Setting completed December 2017
- ESRI Roads & Highways Implementation Complete
- Geotechnical Asset Management Plan Research Project Plan complete
- New RFP for highway centerline, roadway features
- Submission of Pavement Data Manual including detailed procedures for data capture, quality control, and criteria December 2017
- New Data and Information System Governance Policy & Procedure effective November 2017

Actions pending final approval include:

- Update of Data Governance Manual Framework for Data Integration Manual
- Overall update of TAM Policy drafted September 2013

- Update of Long Range Transportation Plan

Actions ongoing include:

- Development of project selection prioritization based on data and performance goals. Establish regional and statewide performance goals for the selection of projects in the STIP
- Create a statewide GIS server storing Asset Management information
- Capture project as-built plans into GIS Engineering Automation Group
- Conduct asset-level analysis for pavement information via new Pavement Management System
- Conduct asset-level analysis of bridge information
- Finalize External Communications Plan draft January 2014
- Update P&P 07.05.020: Highway Pavement Maintenance & Rehabilitation Policy
- Develop Alaska-specific Deterioration Modeling for Pavement (actions, cost, and effects) need PMS
- Develop Alaska-specific Quantitative Forecast Modeling for Pavement need PMS
- Develop Alaska-specific Deterioration Modeling for bridges (to include: actions, cost, and effects)
- Develop Alaska-specific Forecast Modeling for bridges
- Develop reports to support trend line analysis for performance indicators, include inventory and condition assessment.

Actions not started:

- Develop software to estimate asset value, perform scaling, weighting, and valuation computations
- Update P&P 02.01.017: PETS (provide some additional detail about the types of condition and performance indicators to be presented
- Develop project needs identification criteria specific to each asset type. These may include “must levels” for pavement condition, bridge action feasibility criteria, and desired levels of service.

- Establish the method of setting priorities among investment candidates. Establish performance targets. Describe the statewide process that is not specific to any asset class
- Develop Long Term Goals of the Transportation System that addresses pavements, bridges, safety, and mobility
- Create Investment Candidate File Requirement, including processes for contents, maintenance, adding candidates and its role in the STIP and other decision documents.
- Update P&P 07.05.060 for bridges
- Develop an Access Management Policy
- Expand existing condition data items: level of service documentation, performance assessment, and additional defect types for both pavement and bridges
- Evaluate other assets.

Baseline Report

DOT&PF submitted a Performance Measure Baseline Report on October 1, 2016. The report included an overview of the Asset Management Plan, of improvements need in data quality and connections, of coordination for the pavement management system, of coordination with MPO's, of ongoing actions including deterioration modeling and forecasting, and of collection of existing condition data.

Since most of the regulations were not published, this report was inaccurate. Another baseline report will be completed for all federal performance measures due October 1, 2018.

Appendix C:

ASSET OVERVIEW – PAVEMENT

NHS Inventory

Table C.1 below includes the centerline mileage inventory of Interstate and non-Interstate National Highway System in the State.

All in centerline lines	Total	Alaska DOT&PF	Municipality of Anchorage	Other entities
Interstate	**1160.7**	1160.7	0	0
Non Interstate NHS (paved)	**926.9**	905.8	18.7	3.4
Non Interstate NHS (unpaved)	**264.4**	264.4	0	0

Table C.1 Centerline Miles Total

All 1,160.7 centerline miles of Interstate are owned and operated by Alaska Department of Transportation and Public Facilities (DOT&PF). DOT&PF owns and operates the 926.9 miles of non-interstate National Highway System (NHS) except for 22.1 miles that are owned and operated by other entities. Over eighteen miles of those 22.1 miles are owned and operated by Municipality of Anchorage (MOA). The rest (3.4 miles) are intermodal links between the state road system and a ferry, port or airport. Alaska is unique to the rest of the United States because some of the Alaska non-Interstate NHS is unpaved.

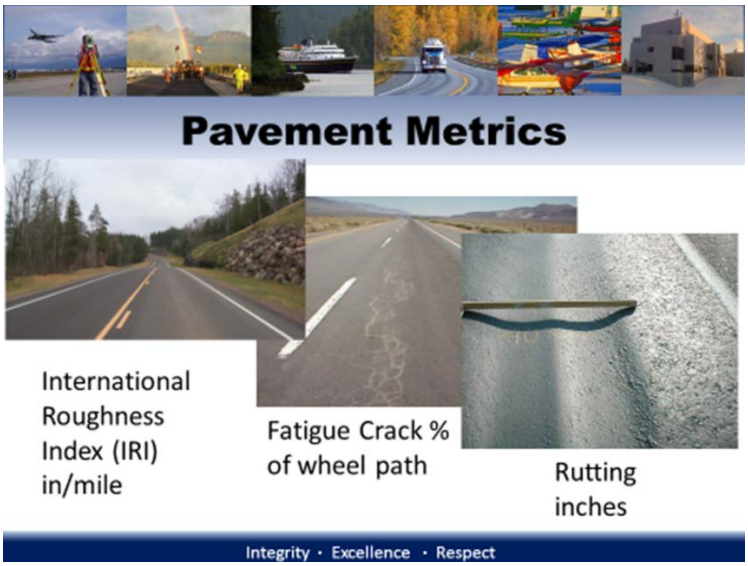
DOT&PF collects pavement condition and other federally required Highway Performance Monitoring System (HPMS) data elements so no cooperation is needed to exchange data with other entities for the NHS. DOT&PF nominate projects for inclusion in the State Transportation Improvement Plan as needed. We are confident that this small number of non-DOT&PF owned NHS centerline mileage will not affect the state's overall condition.

The spreadsheet below lists the NHS owned/operated by other entities beside DOT&PF as of June 15, 2017.

CDS Route	Road Name	Begin Milepoint	End Milepoint	Length	Management Responsibility	National Highway System (NHS)	Census Incorporated Places
068510	MARINE WAY	0	0.3139	0.3139	CITY OR MUNICIPAL HIGHWAY AG	NHS IM FERRY TERMINAL	KODIAK CITY
068511	MARINE HIGHWAY ACCESS	0	0.0394	0.0394	CITY OR MUNICIPAL HIGHWAY AG	NHS IM FERRY TERMINAL	KODIAK CITY
110011	HOMER FERRY TERMINAL ROA	0	0.0336	0.0336	CITY OR MUNICIPAL HIGHWAY AG	NHS IM FERRY TERMINAL	HOMER CITY
174500	FRONT STREET	0.8301	1.2064	0.3763	CITY OR MUNICIPAL HIGHWAY AG	NHS IM PORT TERMINAL	NENANA CITY
174501	NENANA STREET	0.068	0.49	0.422	CITY OR MUNICIPAL HIGHWAY AG	NHS IM PORT TERMINAL	NENANA CITY
174502	SIXTH STREET	0	0.1075	0.1075	CITY OR MUNICIPAL HIGHWAY AG	NHS IM PORT TERMINAL	NENANA CITY
174503	DOCK ROAD	0	0.1626	0.1626	CITY OR MUNICIPAL HIGHWAY AG	NHS IM PORT TERMINAL	NENANA CITY
133200	OLD SEWARD HIGHWAY	6.2718	7.2715	0.9997	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
133724	ABBOTT ROAD	2.7609	3.3592	0.5983	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
133899	TUDOR ROAD	0.2017	0.2127	0.011	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
133950S1	BRAGAW STREET	0	1.5166	1.5166	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134130	DOWLING ROAD	0	0.9858	0.9858	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134140	LAKE OTIS PARKWAY	0	5.9133	5.9133	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134344	OCEAN DOCK ROAD	0	0.1886	0.1886	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134500	DEBARR ROAD	0	0.5496	0.5496	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134503	15TH AVENUE	1.0891	2.1857	1.0966	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134750	NORTHERN LIGHTS BOULEVAR	0	3.7098	3.7098	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134750	NORTHERN LIGHTS BOULEVAR	6.706	7.2084	0.5024	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134770	36TH AVENUE	0.4992	2.4923	1.9931	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
134780	PROVIDENCE DRIVE	0	0.5836	0.5836	COUNTY HIGHWAY AGENCY	NHS NOT INTERMODAL	ANCHORAGE MUNICIPALITY
293326	CHURCH/2ND STREET	0	0.5054	0.5054	COUNTY HIGHWAY AGENCY	NHS IM FERRY TERMINAL	WRANGELL CITY AND BOROUGH
293338	WRANGELL AVENUE	0	0.0697	0.0697	COUNTY HIGHWAY AGENCY	NHS IM FERRY TERMINAL	WRANGELL CITY AND BOROUGH
296324	YANDUKIN DRIVE	0	0.9754	0.9754	COUNTY HIGHWAY AGENCY	NHS IM AIRPORT TERMINAL	JUNEAU CITY AND BOROUGH
296325	SHELL SIMMONS DRIVE	0.196	0.45	0.254	COUNTY HIGHWAY AGENCY	NHS IM AIRPORT TERMINAL	JUNEAU CITY AND BOROUGH
296327	YANDUKIN DRIVE WYE TO EGA	0	0.159	0.159	COUNTY HIGHWAY AGENCY	NHS IM AIRPORT TERMINAL	JUNEAU CITY AND BOROUGH

Federal Performance Measure

The Federal performance measure uses the following metrics for asphalt pavements: International Roughness Index (IRI); fatigue cracking; and rutting. As required by FHWA, DOT&PF collects pavement condition data on NHS paved roads annually for rutting and roughness and for longitudinal, transverse, and fatigue cracking. Alaska has collected many years of rutting and roughness data but began collecting automated full extent cracking data beginning in 2014. The starting point will be to use the federal overall pavement rating to classify pavement condition until Alaska develops its own index that better represents Alaska pavement conditions and treatment thresholds. FHWA final rules allows the use of Present Serviceability Rating (PSR) in lieu of IRI for roads with speed limits less than 40 mph. DOT&PF has used PSR for HPMS reporting only for a few remote locations where automated data collection equipment cannot be transported. DOT&PF does not intend to use PSR on NHS routes.



Tables C.2 and C.3below lists the condition thresholds in the final federal rulemaking. FHWA final rules allows the use of Pavement Serviceability rate for roads less than 40 mph; this calculation does not include cracking. DOT&PF is not using Pavement Serviceability at this time but may look into it for the future.

Pavement's Three Metrics			
	IRI	%Crack	Rut (in)
Good	<95	<5%	<0.2
Fair	95-170	5-20%	0.2-0.4
Poor	>170	>20%	0.40

Table C.2 Pavement's Three Metrics

Section Overall Asphalt Condition	
Overall	3 Metric Ratings (IRI, Cracking, Rutting)
Good	All three metrics are good
Poor	2 or more metrics rated poor
Fair	All other combinations

Table C.3 Section Overall Asphalt Condition

Pavement Condition using all three metrics

In 2016, Alaska had 1,160 miles of Interstate, all paved. Figure C.1 below shows Alaska's Interstate Overall Asphalt Condition in 2016. In 2016, 3.5% of the Interstate Overall Pavement Condition was poor, 72.4% was in fair condition, and 23.8% was in good condition.

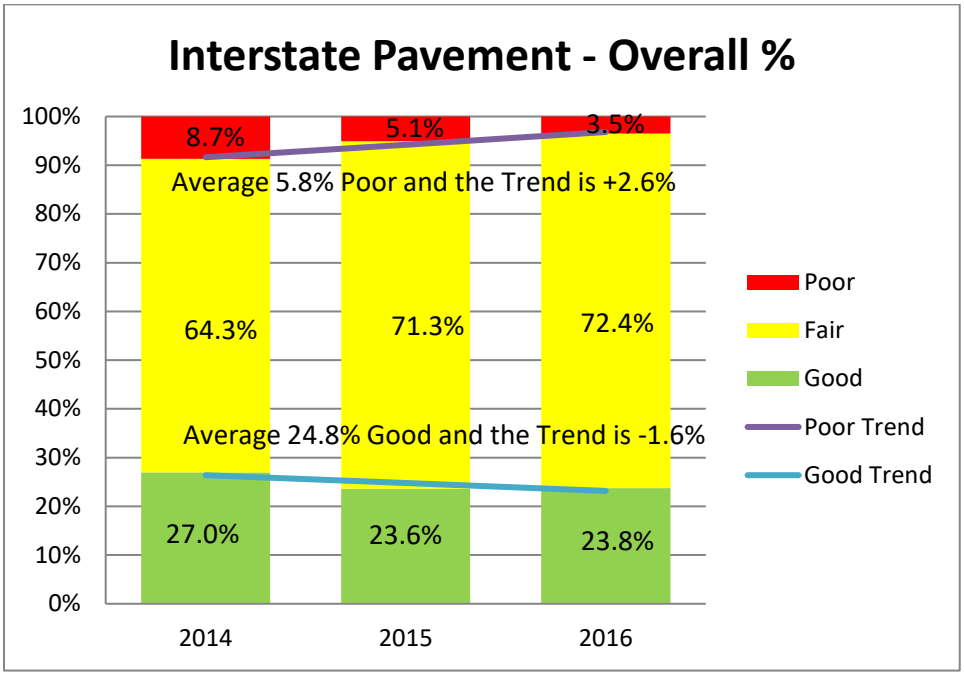


Figure C.1 Overall Interstate Pavement Condition

Alaska has 1,191.303 miles of Non-Interstate NHS in 2016. Most of these miles (926.9058 miles) are paved. Figure C.2 shows Alaska's non-Interstate NHS Overall Asphalt Condition in 2016. In 2016, 15.61% of the Interstate Overall Pavement Condition was poor, 16.29% was in good condition.

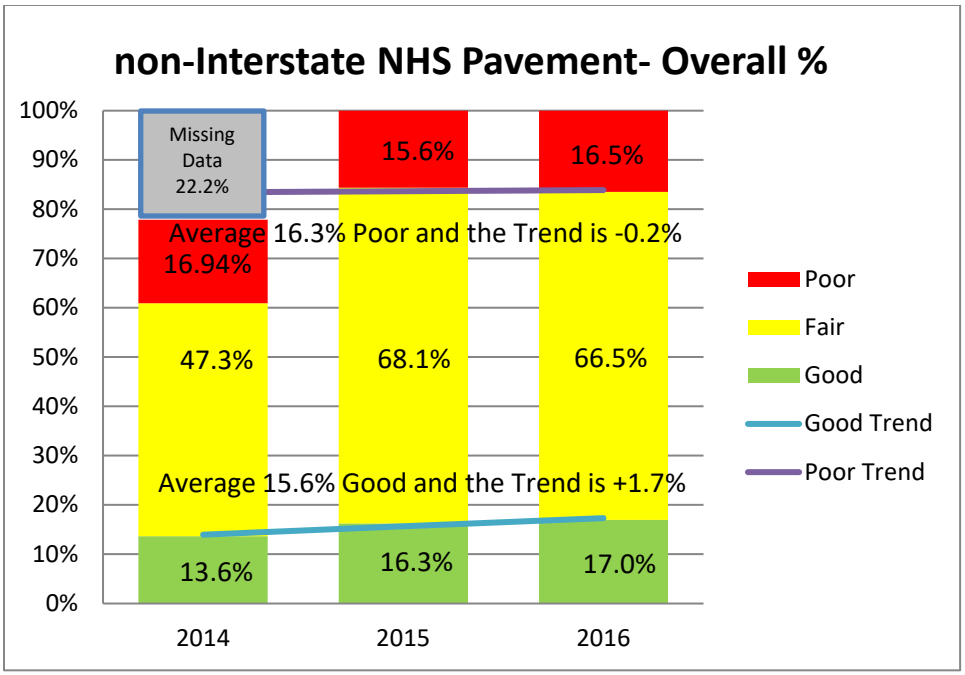


Figure C.2 Non-Interstate NHS Pavement

Pavement Condition for IRI only on Interstate

Figure C.3 shows that the percent of the Interstate IRI condition in poor condition was 8% in 2015 and 9.8% in 2016.

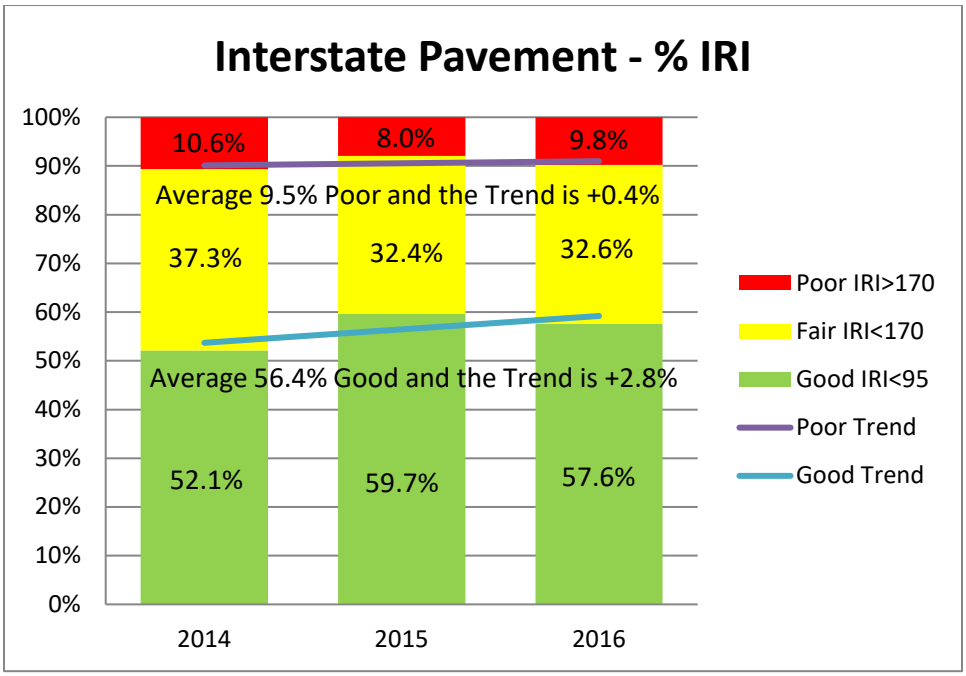


Figure C.3 Interstate Pavement Condition

Pavement Management Objectives:

- Treat pavements in good and fair condition before they deteriorate to save money over the pavement's life cycle
- Provide information to allow effective selection and design of future surface treatments, rehabilitation, and reconstruction projects.
- Accurately estimate future conditions versus funding scenarios to evaluate current pavement funding strategies.
- Display analysis results in understandable formats.

The missing data from 2014 and 2015 make it impractical to calculate the trend for non-NHS overall pavement condition from 2014 through 2016 (Figure C.4).

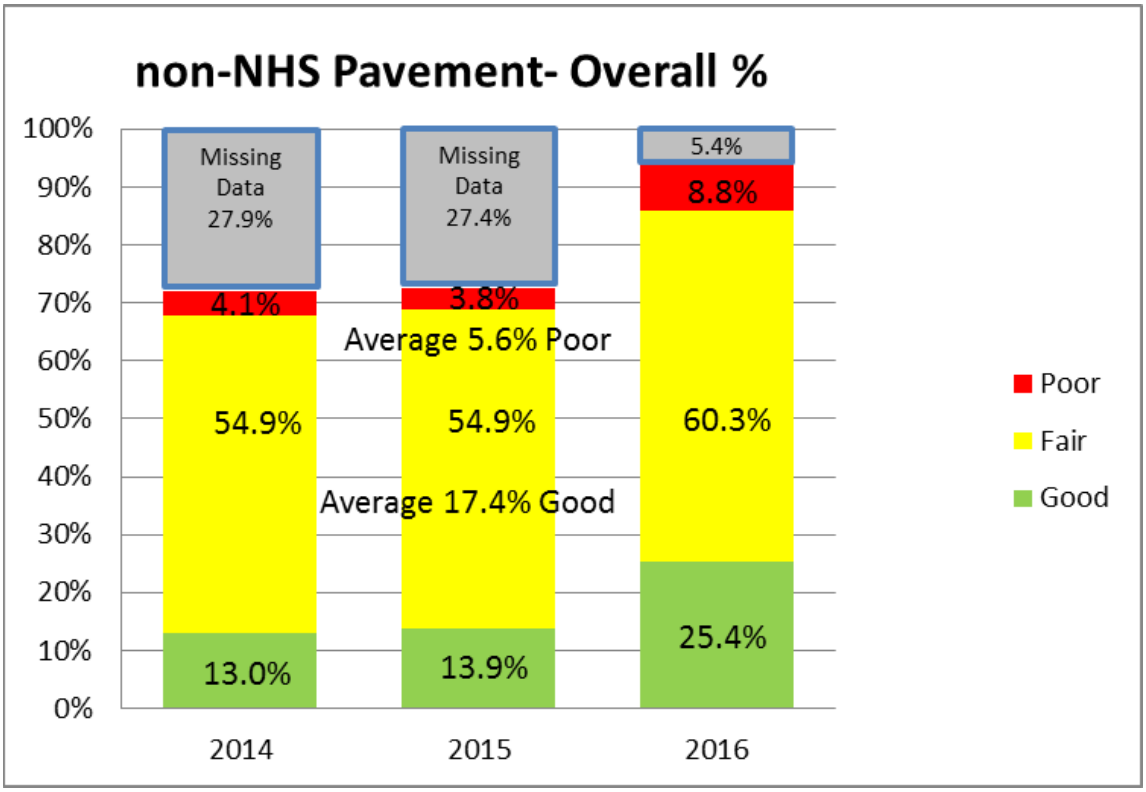


Figure C.4 Non-NHS Pavement Condition

Pavement Management System Implementation

When MAP-21 was signed into law, DOT&PF did not have a pavement management system that could forecast pavement conditions or track where money was historically

spent on the road network relative to its condition. DOT&PF investigated what we needed to do to implement asset management and comply with the new regulations. We procured the Agile Assets Pavement Management System (PMS) on May 2016. We have been working to implement the system. We are also replacing our Maintenance Management System (MMS) and Equipment Management System (EMS) with the Agile Assets modules. The "go live" date for Pavement and Equipment is tentatively April 2018. Maintenance Management System "go live" is tentatively November 2018. These systems will give us more accurate data on where we are spending money and which maintenance and preservations treatments are most effective. DOT&PF is also implementing AASHTOWare Preconstruction and Site Manage Modules. Once the AASHTOWare system implementation and startup are complete, we will work on taking our construction costs, year completed and pavement details from this system automatically.

The TAM Technical Team and the Pavement Sub Team have been meeting since 2013. These teams have been integral in designing a PMS that meets Alaska needs and complies with the federal rulemaking. Our FHWA Division office has provided support in many areas during our PMS implementation and has financially supported the PMS and MMS development, as well as financially supporting and assisting in organizing a Peer Exchange with North Carolina Department of Transportation (NCDOT). NCDOT has many years experience using Agile Assets for Pavement analysis. This two-day Peer Exchange was held in Anchorage in February 2017.

From the North Carolina Peer Exchange, the following items are best practices that Alaska should consider.

1) Supply data for overall project selection & Prioritization
2) Optimize Preservation and Reconstruction projects
3) Check out North Carolina Pavement Index to come up with an overall rating
4) Perform a Statewide Analysis then allocate $ to regions to meet needs in a 5-year plan
5) Evaluate what we *need* to inventory

6) Create some Gravel Road Performance Metrics –check out RBA?
7) Provide *raw* data. Photos consume huge amounts of data. NC keeps only three years of photos.
8) Don't conduct GPS on the bridges repeatedly again-will have moving bridges.
9) Refine the performance of the current three modules (PMS, EMS, MMS) before adding more.
10) Work on Truth seeking/Tweaking Models
11) Use Jasper reports instead of user access to system. NC tracks what people are asking for and then with write a JASPER report to get it.
12) Get university involved for modeling and number crunching
13) Use Agile Cross Allocation Model
14) Check the Agile Bridge Matrix for inaccuracy. Contact Matt Culley and Dave Muller for more information (not applicable since we are using AASHTOWare)
15) Use "Ride-along" checklists for litter, lighting, smoothness, use to recalibrate customer service sample
16) Figure out your Organization
17) Go to Agile User Conference
18) Set up and maintain MMS/PMS manual
19) Involve GIS personnel
20) Work on procedures, Work on moving forward. Fix historical when time permits
21) Improve software to better capture data on small auxiliary lanes
22) Add whole typical section
23) Draft line work to GIS for publishing
24) Support is continuously needed, No data is better than bad data.

The DOT&PF Pavement Sub Team developed pavement treatment "decision trees" to input into the Agile System. The team researched and evaluated other states frameworks, using Washington State DOT's decision tree as an outline. Washington's tree uses IRI as the first level of classification. The reasoning here is that if the pavement IRI is greater than 170, typically there are some base/embankment failures that preservation techniques will not prevent. The next level was fatigue cracking under

the reasoning that fatigue cracking greater than 20% in the wheel base could indicate base/embankment issues. The last item was rutting. Rutting can be improved by resurfacing and is the last “limb” of the tree for pavement treatment options.

Due to the permafrost and other embankment conditions, we added Base Stability Index to the decision trees. The index comes from Northern Region Maintenance staff and the rating is classified as A, B, C. Level A indicates a good stable embankment, Level B represents “fair” and Level C is a “poor condition.” Any missing data from M&O defaults to a Level of Service A. DOT&PF will be working on correlating this rating to the Geotechnical Asset Data to see if there are connections. Eventually, the Geotechnical Asset embankment data would be “brought” into the PMS. Any changes to the base from construction projects would be “passed back” to the Geotechnical Asset Management Inventory.

The intent of PMS is to maintain the network at a desirable performance level with a minimum cost. With the exception of unstable foundation areas such as permafrost or soft foundations, PMS uses measured surface condition and pavement performance models to select an appropriate action for each mile of paved roadway. In the areas of unstable foundations there is limited to no accurate performance models, so annual field condition inspections are needed. These annual field inspections primarily identify areas of safety concerns which require repair. Through tracking of annual maintenance costs in the MMS system we will be able to identify high cost maintenance locations and perform benefit costs analysis to verify what repair methods are most efficient in these unstable foundation area (Routine annual patching, more frequent low cost short life overlays, or reconstruction). That information will be tracked in the PMS.

This is an area that we will be continuously improving, as DOT&PF gains more experience with the PMS and use it for decision-making. DOT&PF will also look at developing our own Pavement Index more reflective of unique Alaska conditions and effective treatment triggers.

DOT&PF contracted with Applied Pavement Technologies (APTech) to develop Alaska specific pavement deterioration models to input into the AgileAssets Pavement Module. The Pavement Team and Pavement Management Engineer is guiding this deterioration model development. The models will be a work-in-progress as the data improves and as we learn more about how the treatments affect the condition over time.

Alaska Pavement Index to be Developed

Up to 2013, DOT&PF used the Pavement Serviceability Rating (PSR) as an index only to assess pavement health. PSR computations were completed using rutting and IRI only. The department initially tried to develop a Alaska specific index but become too complex for this initial undertaking. But in the future, DOT&PF will be developing a new pavement index (Alaska Pavement Condition Index – APCI) to measure pavement using the rutting and IRI data but will incorporate the cracking data. The APCI will provide insight on Alaska's pavement health and assist with project selection and maintenance activities. DOT&PF will be developing a pavement index to further analyze pavement condition and provide the appropriate condition triggers for maintenance, preservation, rehabilitation and reconstruction. DOT&PF will be developing this as we mature with our new pavement management system and hope to have this completed by the next TAMP revision.

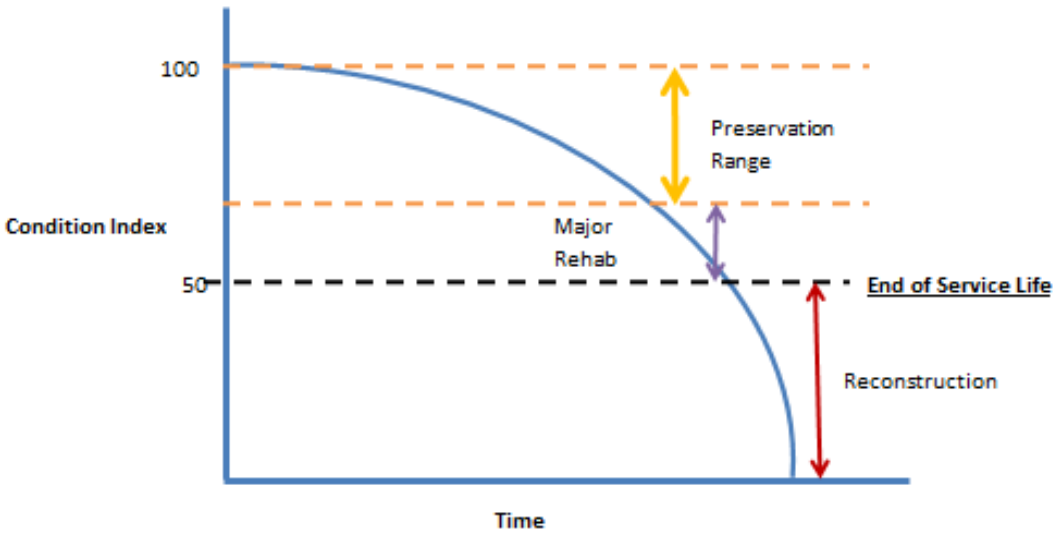
Road condition needs to be determined for the five index categories: IRI, Rut Depth, Fatigue Cracking, Longitudinal Cracking, and Transverse Cracking. Longitudinal and traverse cracking provide additional information on the condition and will help define treatment triggers and options that Fatigue cracking alone cannot define. These triggers should be set within the PMS for Regional sub-regions, i.e. in Northern Region transverse cracking triggers will be different for sub-regions of Valdez and Deadhorse.

The following table includes the first draft of our framework for Alaska pavement condition. Again, this is not in use currently but in development.

Condition	LOS	IRI	Ruts (inches)	Fatigue (FAT) Crack SF/0.1 mile	Fatigue (FAT) Crack (%wheel path)	Longitudinal (Long) Crack	Pavement Index (IRI+Rutting+ FAT and Long Cracks)
Excellent	A	<60	<0.2	0	0	0	90 to 100
Good	B	≥ 60 to <95	≥0.2 to <0.4	>0 to ≤50	>0 to <2.5	>0 to ≤100	80 to 89
Fair	C	≥ 95 to <120	≥0.4 to <0.5	≥50 to <150	≥2.5 to > 7.5	>100 to ≤250	70 to 79
Mediocre	D	≥ 120 to <170	≥0.5 to <0.75	≥150 to <400	≥7.5 to > 20%	>250 to ≤400	60 to 69
Poor	F	≥170	≥0.75	>400	>20%	>400	< 60

Table C.4 Pavement Condition Framework

Triggers need to be determined for different treatment categories: Preservation treatments include routine maintenance through minor rehabilitation-everything from crack sealing to mill/fill and thin overlays. Major rehabilitation includes full depth reclamation, base stabilization, and regular structural overlays. It is recommended that reconstruction be triggered upon a road's reaching or passing end of service life. See Figure C.5.



Condition formulae: Based upon an assumed trigger for this demonstration but is adjustable for any trigger.

Figure C.5 Condition Index Model

DOT&PF Maintenance and Operations staff have been assessing pavement condition using level of service-A though F. Table C.5 below are illustrations that Alaska DOT&PF Maintenance and Operations uses to correlate pavement condition with Level of Service.

Level of Service	Performance Target Description	Illustration
A (Excellent Pavement condition)	The structure, smoothness, and durability of the pavement surface are excellent. The surface is free of potholes and exhibits little or no cracking. Past repairs like patches and crack seals are in excellent condition. There are small or no drop-offs at pavement edges. Pavement condition has not degraded.	
B (Good Pavement condition)	The pavement is in overall good structural condition and offers a satisfactory ride. Pavement exhibits sound material quality. Occurrences of distress such as cracking, potholes, rutting, and pavement materials problems are infrequent and minor. Past repairs are in good condition with limited need for rework. Pavement edge drop-offs are infrequent.	
C (Fair Pavement Condition)	Pavement shows moderate problems with structural deterioration like cracking, pot-holes and past repairs that are affecting the ride quality. Pavement is showing oxidation of surface, flushing/bleeding, or loss of material through raveling.	

Level of Service	Performance Target Description	Illustration
D (Poor Pavement Condition)	Pavement deterioration is significant, with up to half of the pavement area exhibiting one or more types of serious distress: structural deterioration like large numbers of cracks or potholes and or repairs, ride quality from rutting or surface roughness or large sections of pavement edge drop-offs. Surface condition may affect speed and vehicle handling.	
F (Failing Pavement Condition)	Pavement is deteriorated over more than half its area. The integrity of the pavement and the ride quality it offers are degraded by extensive damage like potholes, cracking, rutting or surface roughness from failing pavement or repairs. Extensive edges and drop-offs. Speed and vehicle handling likely affected.	

Table C.5 M&O Pavement Condition Level of Service

DOT&PF is working to correlate the M&O level of service with federal pavement condition data. Table C.6 below reflects the current correlation and will be conducting further analysis to strengthen the relationship with the pavement index.

Federal Overall Condition	State Level of Service	Treatment Types
Good	**A&B**	**Maintenance, Preservation (minor rehab)**
Fair	**C&D**	**Preservation (Rehabilitation)**
Poor	**F**	**Reconstruction**

Table C.6 Pavement Condition

Historical Data for Interstate and Non-Interstate NHS

The pavement trends are flat from 2000 through 2013 for IRI. The graphs below (Figure C.5) illustrate Alaska's historical data for IRI:

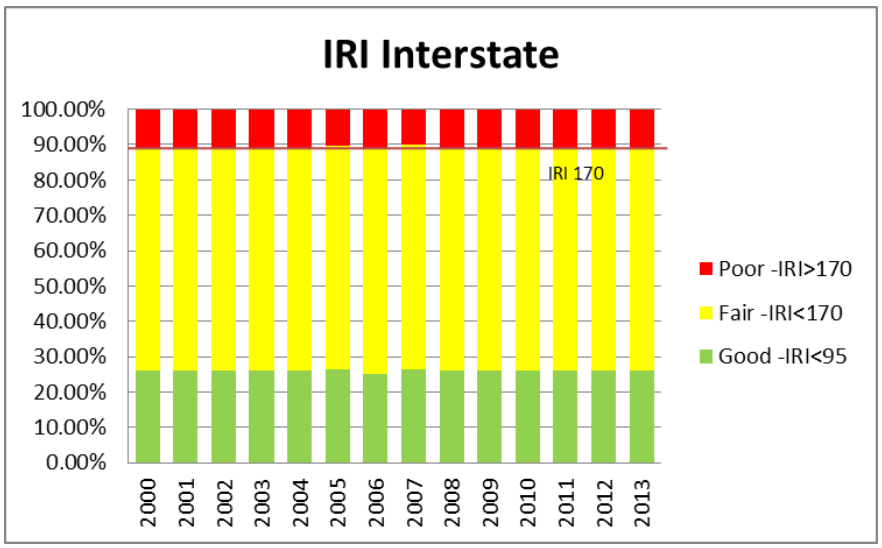


Figure C.5 Pavement Trend IRI Interstate

The general trend for IRI on the Interstate is 11% poor from 2000 through 2013. The general trend for IRI on non-Interstate NHS roads is 21% poor from 2000 through 2013 (Figure C.6).

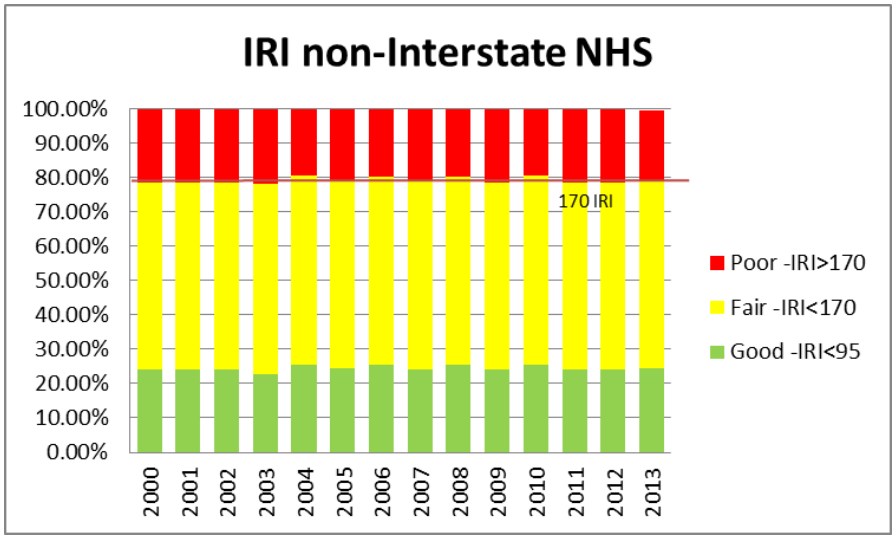


Figure C.6 Pavement Trend IRI Non-Interstate

Historical Data for Non-NHS

The non-NHS data is not required to be part of the TAMP and is included in this appendix for information only (Figure C.7). DOT&PF does not plan to officially include non-NHS data in the TAMP submitted to FHWA.

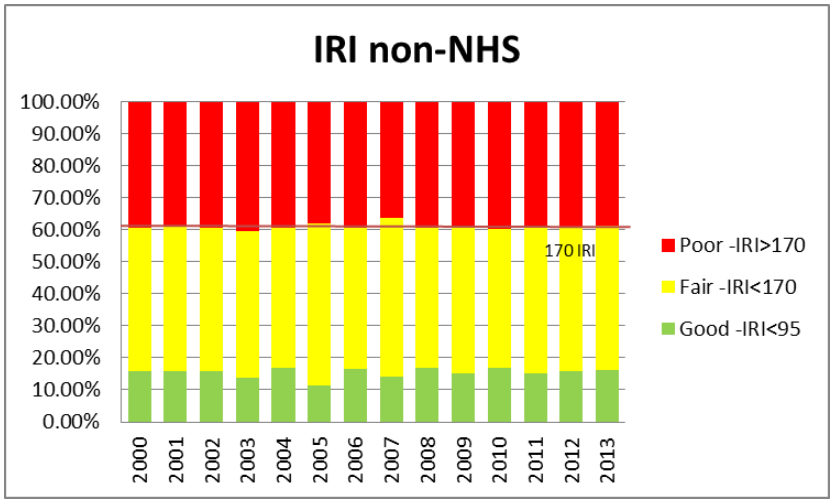


Figure C.7 Non-NHS Pavement IRI

The general trend for IRI on non-NHS roads is 39% poor from 2000 through 2013 but IRI is not the best indicator for condition of low speed urban roads, which include some of the non-NHS. We analyzed the non-NHS using the same Federal regulations even through non-NHS is not required for inclusion in this TAMP.

The missing data from 2014 and 2015 make it impractical to calculate the trend for non-NHS overall pavement condition from 2014 through 2016 (Figure C.8). Overall we had an adequate level of performance for 2016 that would meet our federal NHS targets: less than 10% poor and not more than 20% good. We will continue to track the non-NHS since these routes are included in our PMS, which uses the federal performance measures and same modeling and decision trees.

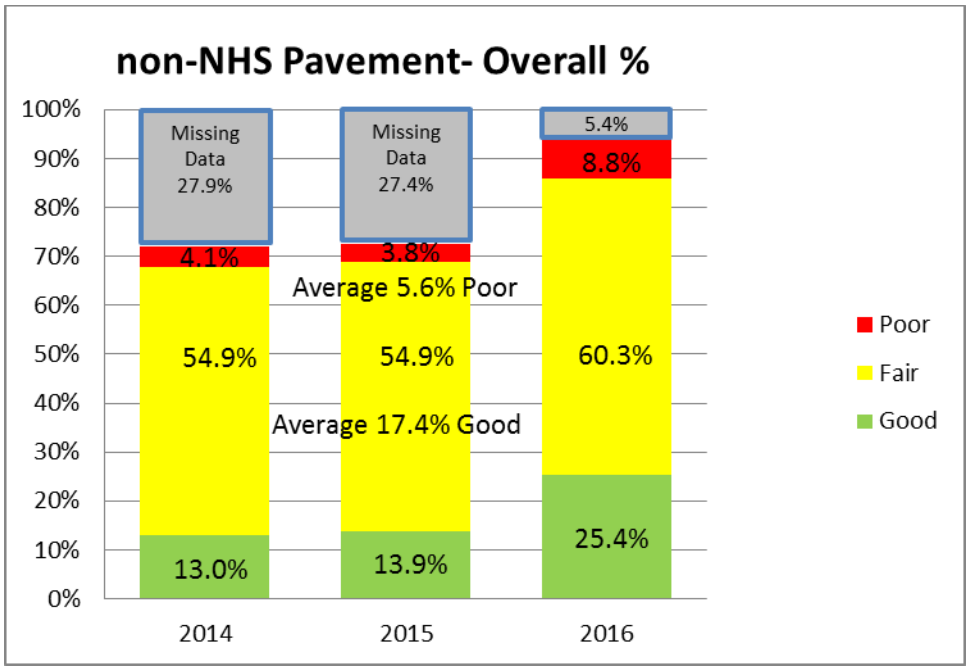


Figure C.8 Non-NHS Pavement Trend

Performance Gap Identification

Pavement

The goal of pavement management is to meet the pavement condition threshold. Implementation of the pavement preservation program will help to improve pavement condition.

Pavement Asset Management Goals

As part of the DOT&PF's asset management approach, maintenance staff actively performs preventative maintenance on all DOT&PF maintained roadways. The pavement deterioration models include the effects of the surface maintenance performed by the department; therefore, maintenance is considered a critical component of a pavement's life-cycle costs. Maintenance work is a combination of work by contractors and by in-house staff and includes crack sealing, patches, and chip seals. Without this work the pavement would have a short life expectancy; therefore it is critical to maintain the current level of effort in the maintenance budget.

Pavement Preservation

Pavement preservation is a program of activities aimed at preserving the nation's highway system, enhancing pavement performance, extending pavement life, and meeting customer needs[1]. It includes the activities undertaken to provide and maintain serviceable roadways, including routine maintenance (such as crack filling), preventive maintenance (crack sealing, chip sealing, or micro-surfacing), and minor (light) rehabilitation (such as mill and fill). It excludes structural improvements (such as an overlay), capacity improvements, major rehabilitation, or reconstruction[2].

The DOT&PF's pavement preservation program includes the following actions:

- Review the road system
- select the road
- determine the cause of the problem
- select the appropriate treatment
- identify the right time to apply the treatment.

DOT&PF is currently in the process of implementing a new PMS, which will be able to provide more accurate inventory and condition information in addition to modeling capabilities. This information will then be used to provide optimized treatment decisions. In the meantime, the model in the LRTP provides a planning-level estimate of the needs.

DOT&PF has developed a Pavement Policy and Procedure that links the recommendations from the pavement professionals and the PMSs identifying which projects are resurfacing or thin overlay. A pavement preservation report is prepared that links the optimal locations for a resurfacing or minor rehabilitation project. Maintenance preservation activities will be sent from the PMS to a Maintenance

[1] https://www.fhwa.dot.gov/infrastructure/asstmgmt/roadmap.pdf
[2] http://www.fhwa.dot.gov/pavement/preservation/091205.cfm

Management System for scheduling pavement maintenance activities based on pavement age.

DOT&PF has developed project selection criteria for projects to preserve the existing infrastructure, but many of these pavements' conditions cannot be improved without subsurface improvements. The LRTP includes Lifecycle Management Treatment Cycles. The treatments were identified separately for each region and separated into urban and rural areas, given the differences in treatments, frequencies and costs. All costs include design costs, but no additions (such as new turn lanes). Treatment cycles are presented below in Figure 4-HB7, Figure 4-HB8, and Figure 4-HB9. In summary, the Northern Region uses a 20-year pavement design life for both urban and rural segments. The Central Region has a 15-year pavement design life for urban roads and 20-year design life for rural roads. The Southcoast Region uses a 25-year design life for urban roads and a 40-year design life for rural.

Historical Costs per Region

Since DOT&PF has not had a pavement management system or any project cost tracking system it has proved difficult to determine what types of project at what cost have led to our current pavement conditions. The regions have reviewed their project histories, and we have developed Table C.7.

Region	2011	2012	2013	2014	2015	2016	2017
Southcoast	$21,731K	$28,738K	$34,040K	$65,117K	$10,999K	$27,902K	$47,638K
Central	$33,544K	$50,535K	$58,770K	$89,035K	$103,569K	$86,060K	$66,764K
Northern	$41,650K	$55,700K	$23,500K	$44,000K	$49,500K	$86,060K	$35,500K
Total							

Historical Costs are rounded to $1000s

Table C.7 Regional Pavement Costs

The following tables are the treatment times and unit costs per region from the draft LRTP. The unit costs and the timing will be adjusted based on analysis from the new PMS.

Treatment		Crack Sealing	Patching	Overlay	Crack Sealing	Patching	Rehab
Timing (Years)	Urban	5	7	10	15	17	20
	Rural	5	7	10	15	17	20
Cost ($/Ln-mi)	Urban	4,200	15,250	185,000	4,200	15,250	410,000
	Rural	4,200	15,250	185,000	4,200	15,250	410,000

Table C.8 Northern Region Lifecycle Management Treatment Cycle

Treatment		Crack Sealing	Patching	Crack Sealing	Overlay	Crack Sealing	Patching	Crack Sealing	Rehab
Timing (Years)	Urban	3	4		7	10	11		14
	Rural	3	5	8	10	13	15	18	20
Cost ($/Ln-mi)	Urban	3,380	1,040	3,380	325,000	3,380	1,040	3,380	650,000
	Rural	3,380	1,040	3,380	325,000	3,380	1,040	3,380	650,000

Table C.9 Central Region Lifecycle Management Treatment Cycle

Treatment		Crack Seal	Patch	Chip seal	Crack Seal	Overlay	Crack Seal	Patch	Chip seal	Crack Seal	Rehab
Timing (Years)	Urban	3	4		10	15	17	18		19	25
	Rural	5	10	20	23	25	28	30	35	37	40
Cost ($/Ln-mi)	Urban	2,600	896		2,600	268,662	2,600	896	77,613	2,600	597,026
	Rural	2,600	896	77,613	2,600	268,662	2,600	896	77,613	2,600	597,026

Table C.10 Southeast Region Lifecycle Management Treatment Cycle

Major Rehabilitation/Reconstruction

Figure C.9 is taken from the LRTP. Since the PMS is not operation, we will use these graphs for pavement lifecycle management. Lifecycle will be updated as we gather additional data.

The backlog of needs that DOT&PF can improve via preservation is $426 million. In addition to the pavement preservation funds, the backlog over a period of ten years totals an annual need of $253 million.

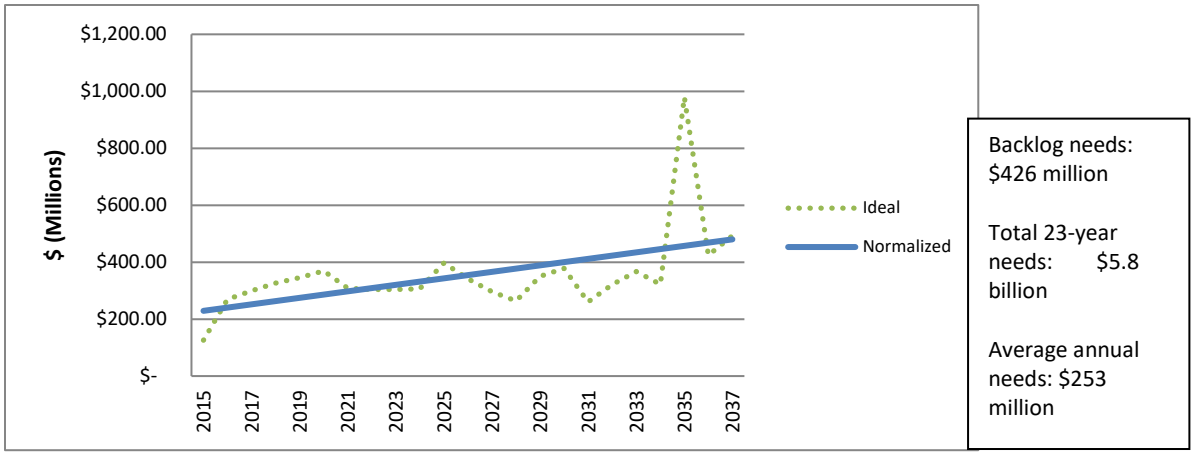


Figure C.9 Total Lifecycle Management Needs for NHS
(Year of Expenditure Dollars)

To combat rutting and optimize life-cycle costs on certain roadways, Alaska DOT&PF has started to use hard aggregate treatment on various roads in the Central and Southeast regions. As defined in the new hard aggregate policy, implemented on August 2, 2013, the department's policy requires the use of hard aggregate in the wearing surface of high-volume roadways (≥ 5,000 AADT/lane) exhibiting studded-tire wear. Therefore, the DOT&PF developed hard aggregate treatment cycles, timing, and costs for high volume roadways (≥ 5,000 AADT/lane) in both the Central and Southcoast region. The effectiveness of this hard aggregate policy is being reviewed yearly as roadway data is collected for verification of rutting rate reduction. A new life cycle cost analysis will be conducted to consider the additional costs of using the imported hard aggregate once accurate trends are determined. Figure C.10 below compares the rut conditions using hard aggregate vs standard aggregate for two projects.

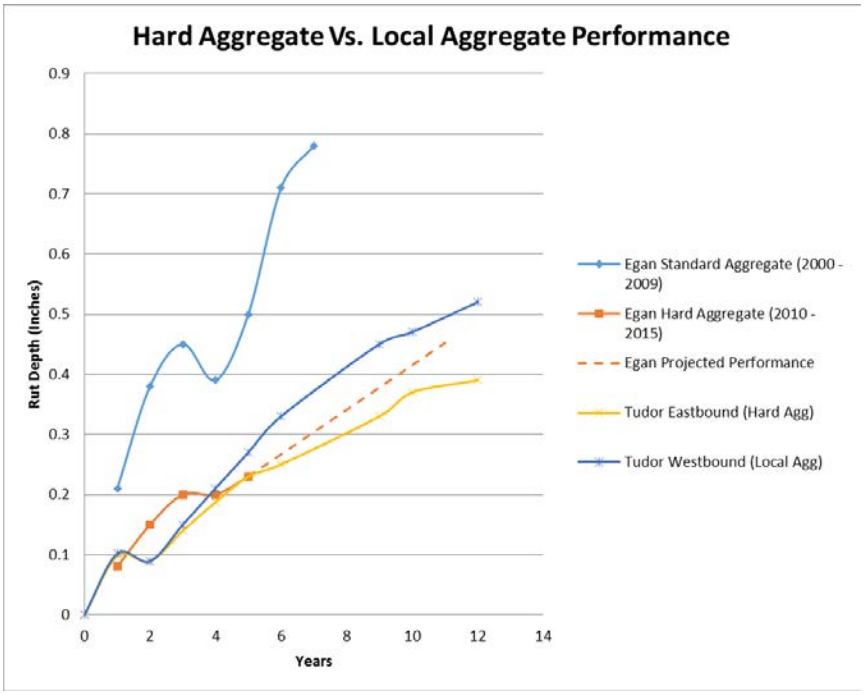


Figure C.10 Rut Conditions

Tudor Road Project Cost with Local Aggregate Asphalt Mix = $7,500,000 provides 11 year life to ½" rut, cost per year = approx. $682,000/ year

Tudor Road Project Cost with Hard Aggregate Asphalt mix = $9,200,000 provides 18 year to ½" rut, cost per year = approx. $507,000 / year.

External Factors

External factors are the outside forces, some which are beyond an agency's control which can impact the ability to achieve its strategic goals. Each factor impacts the pavement program differently. External factors were identified and considered during pavement target setting.

In summary, we came up with 20 external factors that can influence pavement condition forecasting. We anticipate the pavement condition to remain steady based on no

changes in funding. The external factors that may influence our pavement negatively are poor drainage, water-higher precipitation based on extreme weather events, and changing temperatures that increase the number of freeze thaw cycles. Alaska is experiencing warming temperatures and increased precipitation during events and thawing of permafrost. We know how to design for permafrost, as long as it remains frozen to support our roads. But when the temperatures rise, the permafrost melts and the road base will fail. This is an area that we need to pay close attention to because it is changing rapidly and our treatment selection needs to change to adapt as needed.

Factors	Expected Condition Outcome with factor increase	Current Experience with Factor	Notes	2018-2021 Condition Forecast
Pavement Loading				
Overloaded Vehicles/Axel configuration and wheel load/Repetition of Loads			**Forecast:** No change **Weight: High** Pavement Design, certain vehicles exempt for permitting. **Spring Thaw with loaded vehicles**	
Rutting - Studded tires/poor sub base see above			**Forecast:** Decrease with new non studded tire options **Weight: High for rutting**	
Traffic Volume (Heavy Trucks %)			**Forecast:** No Change **Weight: Medium**	
Tire Pressure			**Forecast:** No Change **Weight: Low** High Tire pressure buses	
Environmental, Hydraulic and Base Considerations				
Poor Drainage			**Forecast:** Increase **Weight: Low**	

Factors	Expected Condition Outcome with factor increase	Current Experience with Factor	Notes	2018-2021 Condition Forecast
Freeze/Thaw			**Forecast:** Increase **Weight: Low** Extreme Temperature differential Transverse Cracks	
Temperature			**Forecast:** Increase **Weight: Low** Low Temp cause cracks; high temp lose stiffness	
Susceptible Foundation (permafrost)/ Subgrade type			**Forecast:** No change **Weight: Low** Wheel load on thin pavements causes deformation of subbase	
High Precipitation			**Forecast:** Increase **Weight: Medium** Groundwater <1 m pavement. Water intrusion. Caused by Extreme Weather Events	
Construction Quality-substandard material			**Forecast:** No change **Weight: Low** In some areas, quality material is hard to get. Localized	
Inadequate design or change in conditions			**Forecast:** No change **Weight: Low**	
Load Factors			**Forecast:** No Change **Weight: Medium** If we move to actual loads instead of axels our load factors would be more accurate and could produce more efficient designs	
Design Mix			**Forecast:** Increase **Weight: High** Continued IR use will improve embankment quality and pavement life. Hard Aggregate policy extends pavement life. Rut treatment research	
Geometric Considerations				
Unsafe Curves, steep			**Forecast:** No Change **Weight: Low**	

Factors	Expected Condition Outcome with factor increase	Current Experience with Factor	Notes	2018-2021 Condition Forecast
hills stopping Vehicles at creep speeds			Low Speed. Turning and stop conditions. Elevated grade. Change localized areas	
Intersections (stops/starts)			**Forecast:** No Change **Weight: Low** Low Speed. Turning and stop conditions. Urban areas	
Other Factors				
Funding			**Forecast:** No Change **Weight: High**	
Aging Infrastructure			**Forecast:** No change **Weight: High**	
Maintenance			**Forecast:** Increase **Weight: High** Programmatic M&O activities are eligible for federal funding	
Rough Roads			**Forecast:** Increase **Weight: Low** Rough roads (high IRI) damage vehicles, fatigue cracks, breakdown base. Localized	
New Cracking Data			**Forecast:** Increase **Weight: Medium** New Cracking data	

Pavement Condition

For many years the state of Alaska collected highway distress data only on rut depth and smoothness of the pavement (referred to as IRI – International Roughness Index). With only two types of distress data available, an index once used by Federal Highways to report the condition of the nations' highways to congress in the mid-1990's, was used. The index was called the Pavement Serviceability Rating (PSR) and was derived mathematically using rut depth and IRI values:

The equation to calculate the PSR for road sections with less than ½" rut depths is

PSR = 5e (-0.0041) (IRI)

If rutting is greater than ½" then the following equation, PSR = 5e (-0.0041) (IRI) – (0.7) (rut depth) is used.

The mathematically derived PSR above provided a simple index for the public and upper level decision makers to view the condition of roadways without needing to understand the complexities of distresses and the collected values. Today, technology has improved the collection and reporting of pavement distresses allowing for graphics, tables and analysis not imagined in the early 1990's. The State of Alaska uses this new technology to collect data on 5 distress types; rut depth, IRI, and fatigue, longitudinal, and transverse cracking.

This is not the same PSR allowed under final federal regulations.

The Highway Performance Monitoring System (HPMS) began using the Present Serviceability Rating (PSR) to subjectively rate the condition of a roadway when automated systems were not available or used on roadways where the speed limit was

45 MPH or slower. The technology used for collecting the data, at that time, was deemed inaccurate at those lower speeds. The technology used today provides accurate data at highway speeds down to 15 MPH.

The Present Serviceability Rating used with HPMS is subjective following these guidelines:

PSR Value Description

4.0 – 5.0 Only new (or nearly new) superior pavements are likely to be smooth enough and distress free (sufficiently free of cracks and patches) to qualify for this category. Most pavements constructed or resurfaced during the data year would normally be rated in this category.

3.0 – 4.0 Pavements in this category, although not quite as smooth as those described above, give a first class ride and exhibit few, if any, visible signs of surface deterioration. Flexible pavements may be beginning to show evidence of rutting and fine random cracks. Rigid pavements may be beginning to show evidence of slight surface deterioration, such as minor cracks and spalling.

2.0 – 3.0 The riding qualities of pavements in this category are noticeably inferior to those of new pavements, and may be barely tolerable for high-speed traffic. Surface defects of flexible pavements may include rutting, map cracking, and extensive patching. Rigid pavements in this group may have a few joint failures, faulting and/or cracking, and some pumping.

1.0 – 2.0 Pavements in this category have deteriorated to such an Extent that they affect the speed of free-flow traffic. Flexible pavement may have large potholes and

deep cracks. Distress includes raveling, cracking, rutting and occurs over 50 percent of the surface. Rigid pavement distress includes joint spalling, patching, cracking, scaling, and may include pumping and faulting.

0.1 – 1.0 Pavements in this category are in an extremely deteriorated condition. The facility is passable only at reduced speeds, and with considerable ride discomfort. Large potholes and deep cracks exist. Distress occurs over 75 percent or more of the surface.

Appendix D:

Asset Overview – Bridges

Inventory

As of last report to FHWA on March 15, 2017, the Alaska DOT&PF Bridge Program manages 999 bridges (including large culverts) on public roads in Alaska. 817 are owned by the Department, 22 are owned by other state agencies, and 160 are owned by local governments. The Department also inspects 42 ramps to ferry docks; three tunnels; and 84 culverts (single culvert diameter 20' or greater, or multiple culverts spaced not greater than one-half the diameter of the smaller and a combined length along centerline of the roadway greater than 20'). Fourteen of these bridges are closed to the public.

There are three classes of bridges, based the functional class of the road the bridges serve.

- NHS-Bridges that are on the NHS;
- Non-NHS Bridges that are on the non-NHS but functionally classified as arterials; and
- Off-System bridges that are on roads functionally classified as collectors or local roads.

Since Map-21 included principle arterials in the NHS, most bridges are either NHS or off system. In other states, off-system bridges are an important class since local roads and collectors are not eligible for federal aid. However, in Alaska there is an exemption so all routes may be eligible for federal aid. This makes the federal aid program attractive to local governments for funding repairs of these off-system bridges.

Of those 1001 structures, 408 bridges in 2014 and 399 Bridges in 2015 and 394 bridges in 2016 and 411 in 2017 are on the National Highway System Eight of these bridges

are owned by other entities. We are confident that these eight bridges will not affect the overall state target or national goals.

Inspection Program

Department engineers classify the condition of Alaska bridges according to three different bridge condition categories:

1. Structurally Deficient (NBI≤4)
2. Functionally Obsolete
3. Not Deficient (NBI ≥ 5)

Bridges are inspected biennially (at least once every 24 months) by DOT&PF bridge inspectors/engineers. Inspectors document the condition of the bridge. Bridge inspectors examine four main components: the substructure, the superstructure, the deck, and waterway characteristics. The substructure includes the foundation, piers and abutments of the bridge. The superstructure is the overlying framework (trusses or girders) which rest on the piers and abutments. The deck is the portion of the bridge which is visible by the driver. Inspection of waterway characteristics includes inspection of scour and any changes to the waterway since the previous inspection.

Bridges are "rated" on a National Bridge Index (NBI) using a scale of one to nine. Bridges are considered deficient if they receive an NBI rating of 5 or lower (Table D.1). Bridges are considered structurally deficient if their decks, superstructures, or substructures are found to be in poor condition. If a bridge is deemed unsafe, the bridge will be closed. If a bridge is deemed to have load carrying capacity below legal load limits, then the bridge will be load posted with a weight restriction that the bridge can safely carry.

NBI numbers are used to report the condition of deck, superstructure, or substructure. NBI ratings are a constituent of the bridge condition rating (Table D.2). If the deck, superstructure, or the substructure has an NBI rating below 4, then the bridge will require rehabilitation or replacement. The deck, superstructure, and substructure are considered critical elements of a bridge.

SCALE		DESCRIPTION
N		Not Applicable
GOOD	9	Excellent Condition
	8	Very Good Condition – no problems noted.
	7	Good Condition – some minor problems.
FAIR	6	Satisfactory Condition – structural elements show some minor deterioration.
	5	Fair Condition – all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
POOR	4	Poor Condition – advanced section loss, deterioration, spalling or scour.
	3	Serious Condition - loss of section, deterioration, spalling or scour may have seriously affected primary structure components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
	2	Critical Condition – advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
CLOSED	1	Imminent Failure Condition – major deterioration or section loss present in critical structure components 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.

Table D.1 NBI Scale

NBI Rating	Performance Target	Performance Target Description
9	Good	No work needed
7-8		Preservation Candidate
6	Fair	Preventative Maintenance Candidate
5		Repair Candidate
≤ 4	Poor	Rehabilitation or replacement candidate

Table D.2 NBI Rating

The Deck Area Bridge Condition Performance measure uses the following calculation:

$$100 \times \frac{\text{Total Deck Area of Good or Fair or Poor bridges}}{\text{Total Deck Area of Bridges in the State}}$$

Bridges are considered functionally obsolete when a bridge does not meet the current design standards for lane width, number of lanes, shoulder widths, vertical clearances, load capacity, presence of guardrails on the approaches, or some other feature that

differs from the standard. A functionally obsolete bridge may be structurally adequate, but not in conformity with current design standards. A functionally obsolete bridge that is structurally deficient is excluded from the functionally obsolete category and categorized as structurally deficient.

Under Map-21, all state transportation agencies need to collect element condition data on NHS bridges. Superstructure element data includes each beam, stringer, truss, arch, main cable. DOT&PF will also use this more detailed information to prioritize projects. In 2017, all 999 bridges were submitted with element-level data.

Bridge element data is being collected for the deck, superstructure and substructure as well as culverts, bridge rail, joints, bearings and wearing surfaces[1]. Depending on the bridge type, different element reporting is used. The deck is the structural system that supports traffic and does not include non-structural wearing surfaces such as timber running planks and asphalt as those are sacrificial. The superstructure includes the girders, beams or truss that support the deck. The substructure is foundation of the bridge and includes abutments, piles, pier caps, pier walls, and columns that support the superstructure. The deck, superstructure and substructure includes material types for steel, prestressed concrete, reinforced concrete, timber, masonry and other. The other material type is anything that does not fit into one of the specified material types. A detailed description of the element inspection can be found in the FHWA Specificiation for the National Bridge Inventory Bridge Element report dated 01-21-2014.

Federal Performance Measures

The final rulemaking for bridge performance measure uses the following metrics for bridges: Deck Rating, Superstructure Rating and Substructure Rating. Table D.3 below lists the thresholds in the final rulemaking. **The lowest rating of all three metrics becomes the overall bridge condition.**

[1] http://www.fhwa.dot.gov/bridge/nbi/131216_a1.pdf

Bridge			
	Deck	Super	Sub
Good	9-7	9-7	9-7
Fair	6-5	6-5	6-5
Poor	<5	<5	<5

Table D.3 Rulemaking Threshhold

Also, a national goal that was part of the Map-21 legislation requires structural deficiency of deck area less the 10%.Figure D.1 to D.4 summarize the bridge conditions over the last three years:

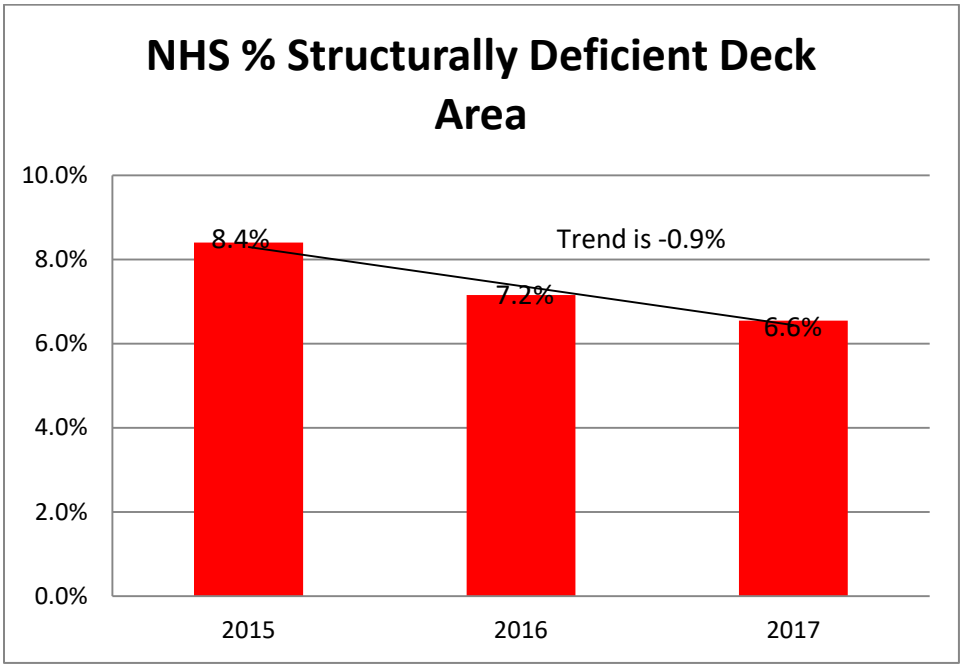


Figure D.1 Deck Area Trend

3 year Average Structurally Deficient = 7.3%

3 year Average Good = 39.3%

3 year Average Fair = 53.3%

3 year Average Poor = 7.4% (TARGET 10%)

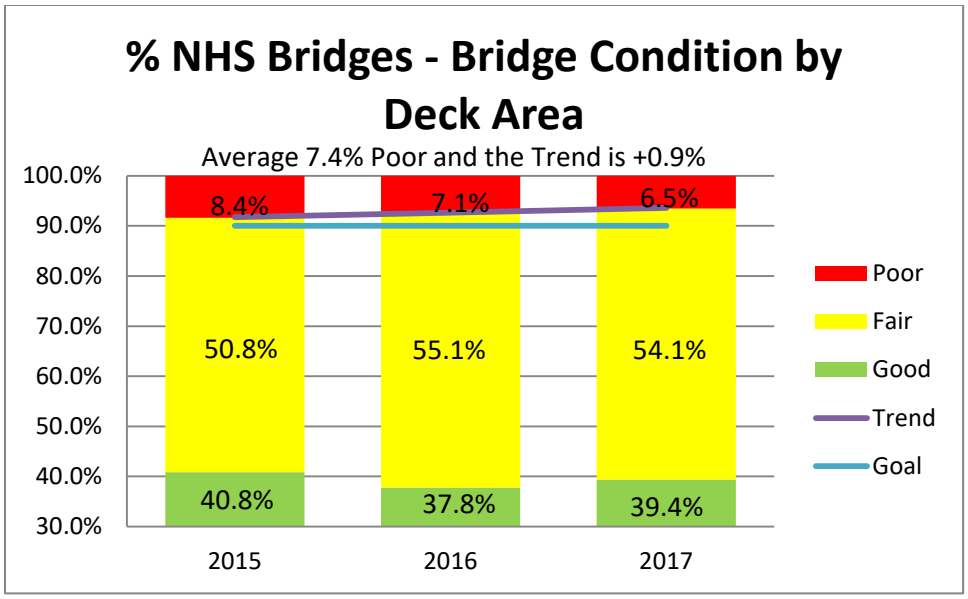


Figure D.2 Deck Condition 3-Year Trend

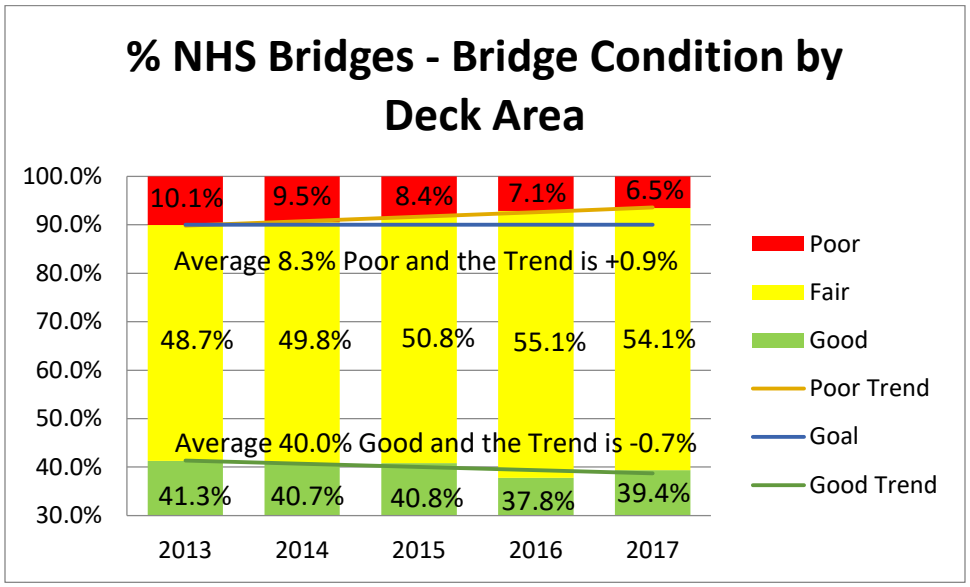


Figure D.3 Deck Condition 5-Year Trend

The 2014- 2017 data include on or off ramps, in accordance with the performance measures final rule, categorizing them as structurally decifient, functionally obsolete,or not deficient. This is good information but is not used for the federal performance measures.

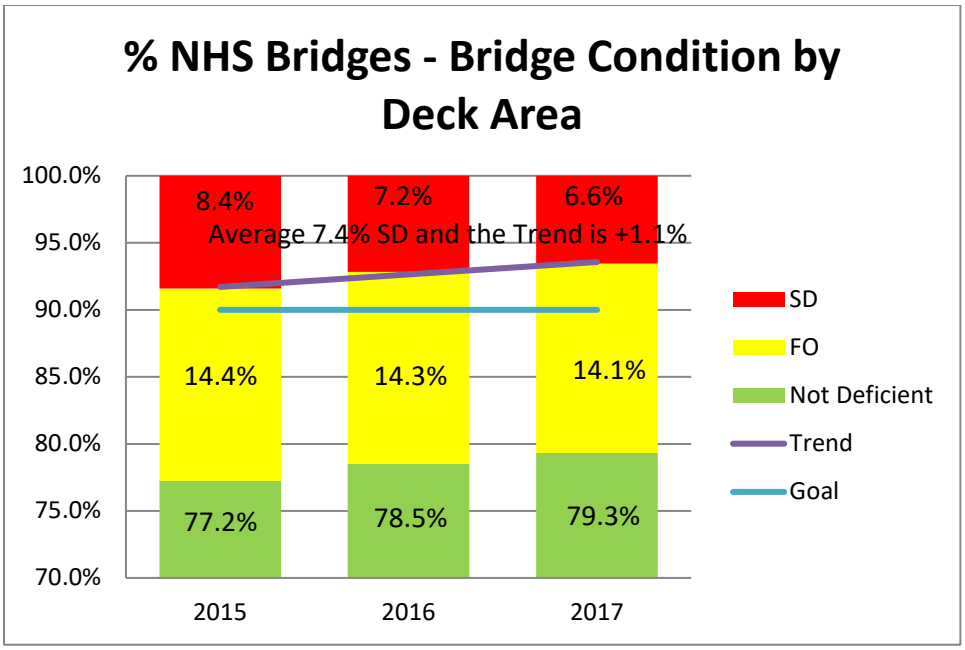


Figure D.4 Deck Condition Category Trend

3 year Average of Not Deficient + FO = 92.6%

3-year average Structurally Deficient = 7.3%

3-year average Poor = 7.4% (the MAP-21 requires less than 10%)

Percentage of non-NHS and off system Bridges – Bridge Condition by Deck Area

Non-NHS and off system bridges are not required to meet federal performance measures and are not included in the TAMP. However, we will be tracking the performance of such assets in our Bridge Management System (Figure D.5 and Figure D.6).

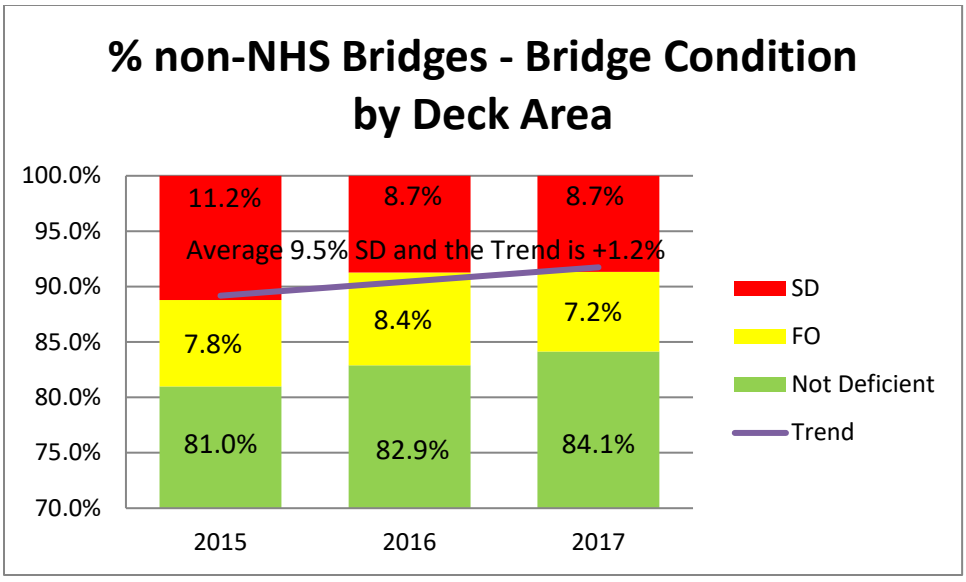


Figure D.5 Non-NHS Deck 3-Year Trend

3 year Average of Not Deficient + FO = 90.5%

3 year average Structurally Deficient = 9.5%

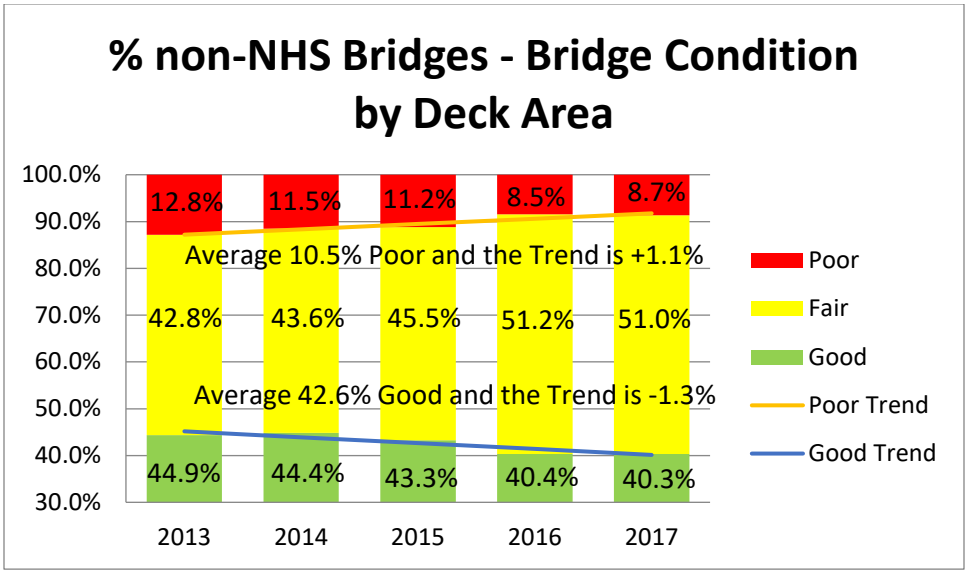


Figure D.6 Non-NHS Deck 5-Year Trend

Bridge Forecasting – Long Range Needs

Table D.4 below from the Long Range Transportation Plan forecasts the funding needed to maintain multiple scenerios. For example, if the Department had a "zero structural deficiency" policy for NHS bridges, we would need to spend ~$46 million annually. If the Department chose less than 7.5% structurally deficient deck area on

NHS bridges as its target, the expected cost to the Department would be $25.5 million annually. Targets for the non-NHS bridges are not required. However, in good practice there should be some target for budgeting purposes.

	NHS	Non-NHS	Total
SD Target: 0 Bridges each year			
Current Dollars	31,880,886	21,770,516	53,651,402
Year of Expenditure	45,968,313	31,890,129	77,858,442
SD Target: 5 Bridges each year			
Current Dollars	24,099,707	16,991,225	41,090,931
Year of Expenditure	35,271,763	25,078,891	60,350,654
SD Target: 10 Bridges each year			
Current Dollars	20,200,388	13,593,280	33,793,669
Year of Expenditure	29,676,300	20,196,571	49,872,871
SD Target: 7.5% Deck Area each year			
Current Dollars	17,355,388	7,314,022	24,669,410
Year of Expenditure	25,511,144	11,064,545	36,575,689
SD Target: 10% Deck Area each year			
Current Dollars	10,564,893	5,650,451	16,215,344
Year of Expenditure	15,640,670	8,587,831	24,228,500

Table D.4 Forecasted Funding Needs

Performance Measures

The Bridge Program publishes an annual Bridge Report which includes bridge needs. Federal performance measures require that 10% of the bridges (based on deck area) may be designated Structurally Deficient for all NHS bridges.

Alaska DOT&PF's goal is to maintain NHS bridges designated as Structurally Deficient at or below 10%, which means 90% of NHS bridges would be in fair or better condition. Non-NHS bridges will have a goal of 80% fair or better. Off System bridges too will have a goal of 80% fair or better.

The goal coincides with the Alaska DOT&PF's Strategic Plan to provide for the safe and efficient movement of people and goods.

It is important to keep the deck, joints and paint in good condition since generally that is what will keep the super-structure and bearings in good condition.

Good pavement condition on Bridges can help protect the deckand super-structure from water and chemical infiltration.

Bridge Gap Assessment

The State's bridge inventory continues to age. As of 2013 at least half of the public bridges in the state are 36 years old or older. Almost 15% are 50 years old or older. In all, one third of Alaska's bridges are past the midpoint of their 50- to 75-year design life. It is critical to address the existing inventory of structurally deficient bridges.

The majority of publicly owned bridges in Alaska have been constructed using steel girders, followed by pre-stressed concrete bridges, then timber bridges, which typically compose the older and shorter spans. Because of their relatively low maintenance requirements and relatively low cost, pre-stressed concrete girders are the preferred choice for new construction.

As part of continuous improvement, the bridge section proposes a route-based analysis for project selection by reviewing NHS routes such as the Alaska Highway or the Parks Highway and the sufficiency ratings for each bridge along that route. Maintaining a high-level sufficiency rating on important routes would be a strategy to maintain a high level of access and connectivity. The route analysis strategy is not currently being used by DOT&PF for project selection but could be analyzed further using the Bridge Management System.

BRIDGE ASSET MANAGEMENT GOALS

- Have a maximum 7.5% structural deficiency in bridges in the NHS system
- Replace one to three structurally deficient bridge every year
- Continue the Seismic Bridge Retrofit program
- Introduce a Bridge Preservation Program that is managed through the statewide bridge section
- Coordinate statewide preservation efforts with t with regional field office planners
- Coordinate statewide Bridge preservation program with regional maintenance crews to plan a systematic maintenance strategy with federal participation.
- Prioritize maintenance work recommendations in Bridge Inspection Reports by assigning high, medium or low priority where; high – ideally repair within a year, medium – ideally repair within two years and low – repairs can wait more then two years.

Bridge Asset Management Objectives:

- Design and construct bridges to last with minimal maintenance.
- Seal decks and expansion joints to protect bridges from road-salt laden runoff.
- Perform maintenance such as cleaning gutters and deck drains, removing debris from bottom chords and bearing seats and removing drift from piers.
- Invest in preservative treatments for bridges in good and fair condition to retard deterioration. Preservative treatments might include deck seals, joint seals, and repainting structural steel elements.
- Provide information to allow effective selection and design of future maintenance, preservation (i.e. deck treatments), rehabilitation, and reconstruction projects.

BRIDGE PRESERVATION

Bridge Preservation[2] is defined as the actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore function of existing bridges; keep bridges in good condition; and extend their life. Preservation actions may be preventative or condition-driven (Source: FHWA Bridge Preservation Expert Task Group).

Effective Bridge Preservation actions are intended to delay the need for costly reconstruction or replacement actions by applying preservation strategies and actions on bridges while they are still in good or fair condition and before the onset of serious deterioration.

Preventative activities may include bridge washing, sealing deck joints, facilitating drainage, sealing concrete, painting steel, removing channel debris, protecting against scour, and lubricating bearings.

For more information on Bridge Rehabilitation and Preservation techniques: http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf

MAJOR REHABILITATION/RECONSTRUCTION

DOT&PF identifies and programs bridge rehabilitation and replacement projects in several different ways. Bridge project strategy is identified using life cycle costs analysis.

1. Highway Projects per the Alaska Highway Preconstruction Manual
    a. Bridge maintenance work is allowed for Preventive Maintenance projects.
    b. Specific bridge criteria is presented for projects that resurfacing, restoration or rehabilitation (of an existing roadway on the same alignment,

[2] http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf

modified alignment or relocated alignment. These are refered to as 3R projects.rojects.

c. New road and Major realignment projects.

2. Bridge Prioritization List is a function of:

a. Structurally Deficient bridges;

b. NBI values for deck, superstructure, and substructure

c. Normalized traffic volume;

d. NHS or Non-NHS;

e. Functional Class

f. Available detour length

3. Other:

a. Local agency nominates a project

b. State Maintenance & Operations staff requests a project to address either load limits or on-going high maintenance costs

c. Legislature writes legislation that results in a bridge project

d. Extreme events (earthquake, flood, etc.) result in need for replacement.

The Long Range Transportation Plan includes predictions for bridge life cycle management (Figure D.5).

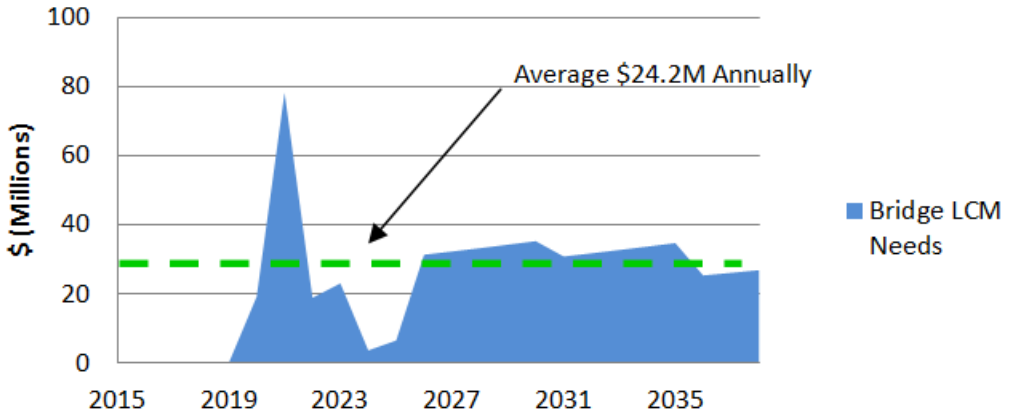


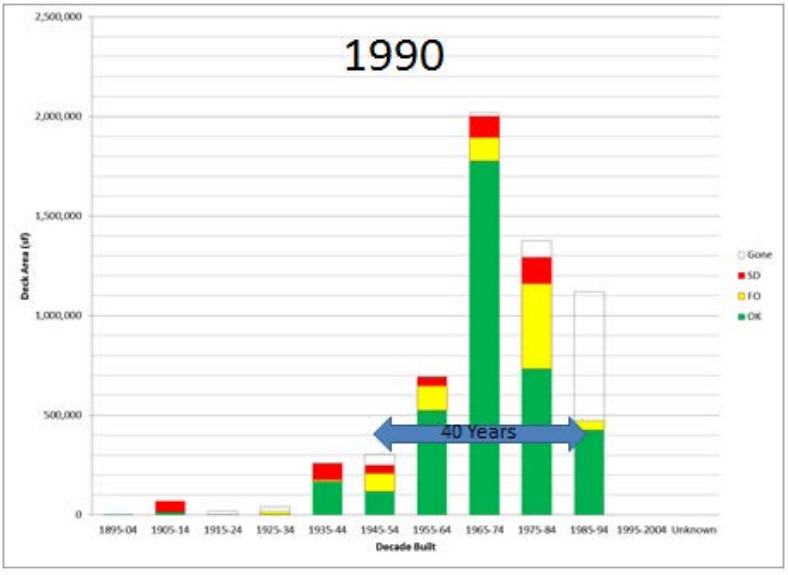
Figure D.5 Forecasted Annual Need Bridge

The average annual need is $24.2 million per year for the next ten years. The target for the Long Range Transportation Plan is to have no more than five bridges being structurally deficient to a target of no more than 10% of the deck area being structurally deficient (for both NHS and non-NHS bridges). This resulted in a significant reduction in the overall bridge needs, even after accounting for an inflationary increase in unit costs and the minor increase in overall deck area.

System Preservation Needs: Bridges

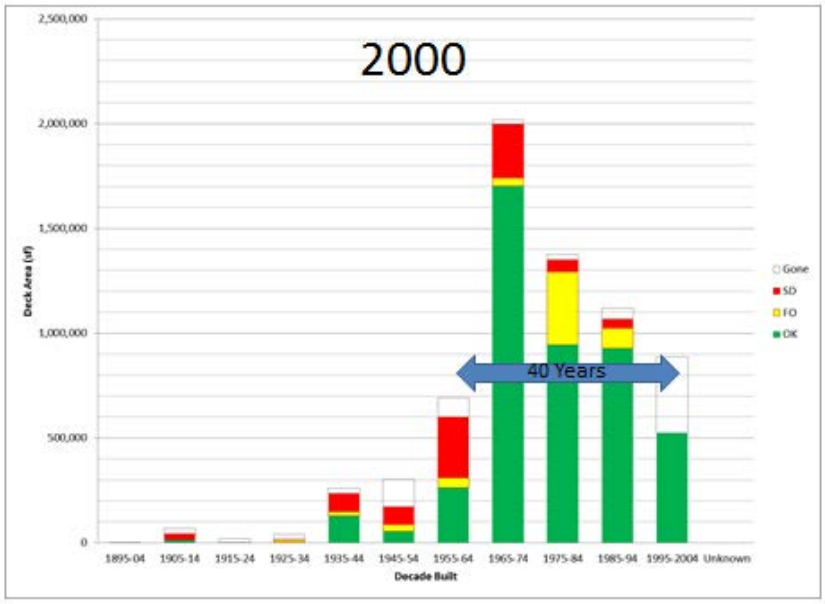
In September 2013, Paul Thompson providing a two-day training session to DOT&PF Bridge and TAM staff on bridge deterioration modeling and forecasting. The first step was to use the bridge management data to calculate a deterioration curve for each bridge. Similar bridges curves would be compared and mathematically create a forecasting curve for bridges of a certain type and environment.

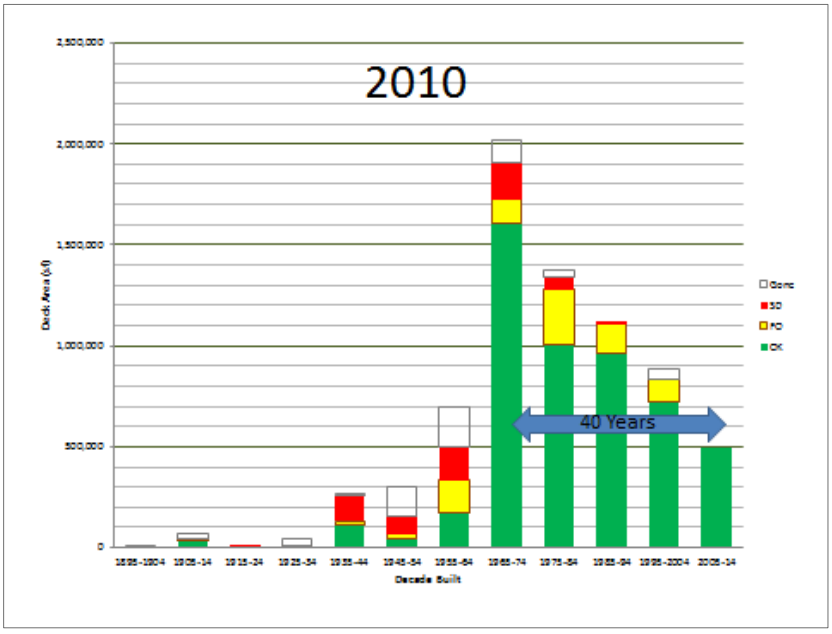
At this time Bridge Management software was BrM Version 5.2.1 (PONTIS). This version of the software did not have the ability to perform the deterioration curves or forecasting. Those capabilities would be coming in the next software version. Because the system could not do this, TAM staff manually began deterioration calculated for bridges on the Parks Highway and other bridges in cooperation with the Long Range Transportation Plan consultants. The curves created by the bridge system data showed odd results. An example is that timber bridges and pre-stressed concrete have similar deterioration curves.



FHWA Division Office proposed grouping the bridges together in 10-year increments based on the year the bridge was put into service starting with

1895-1904 and tracking the total deck area. The concern of the FHWA Division office is that most of the bridges were constructed in the 1970s during the construction of the Alaska Pipeline, so there will be a demand to replace these bridges toward the end of the design life of these bridges. The graphs are included as of 1990, 2000, and 2010. Based on these graphs, a surplus of bridges built from 1955 through 1974 will need replacement.

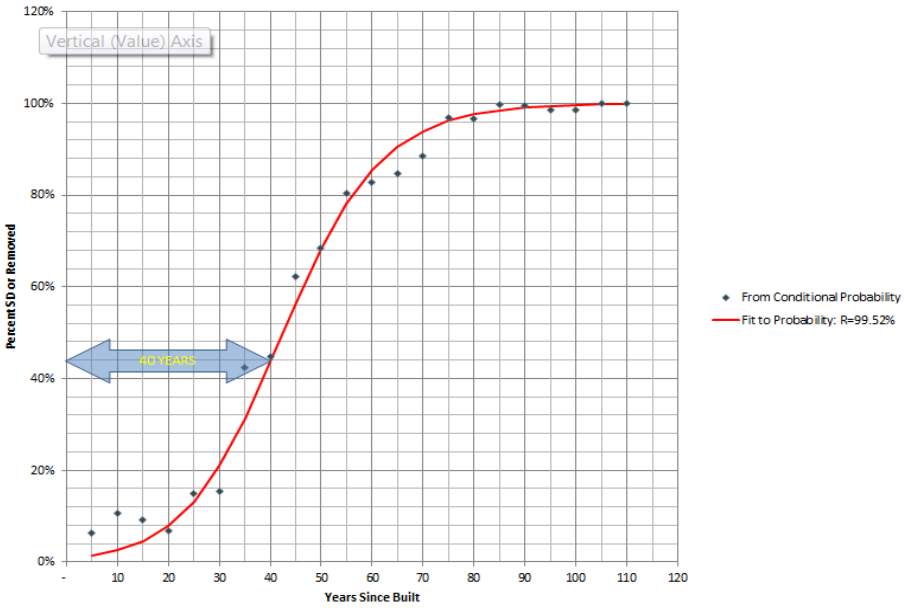




In 1990, the total deck area of structurally deficient bridges was about 9.1%. The percentage of structurally deficient deck area increased to 13.9% in 2000. The percentage of structurally deficient deck area decreased to 8.1% by 2010.

The design life for bridges built before 1995 is 50 years. The design life for bridges built after 1995 is 75 years. About one-third of the bridges in the state are past the mid-point of their 75-year design life.

Sixty percent of the structurally deficient bridges are over 40 years old. The trend is for bridges to deteriorate faster when they are 40 to 50 years old.



The Long Range Transportation Plan included cost data by bridge type. The typical life span of a new pre-stressed reinforced concrete bridge structure is 75 years, and the goal is to have maintenance free bridges. The typical lifespan of a new steel bridge is 50 years, and a timber structure would have a typical lifespan of 40 years. The repair and rehabilitation costs are shown for each region and for each bridge type.

	Materials	Unit Cost ($/sqm of Deck)	
		Repair	Rehab
Northern	Conc	$49.74	$390.26
	Steel	$49.74	$390.26
	Wood	$16.58	$139.94
Central	Conc	$68.34	$652.46
	Steel	$127.45	$1290.41
	Wood	$74.86	$389.87
Southcoast	Conc	$50.04	N/A
	Steel	$89.72	N/A
	Wood	$71.76	N/A
Overall Rehabilitation/Replacement Cost			$4,305

Table D.5 Bridge Life Cycle Planning Treatment Unit Costs

Performance Target Scenarios

As noted above, the performance target for bridges was revised to a target of no more than 10% of the deck area being structurally deficient (for both NHS and non-NHS bridges). This target was determined through conversations with Alaska DOT&PF Staff and as part of TAM team workshop with MPOs in August 2017. The workshop identified and evaluated external factors that would influence future conditions and affect the targets. As part of the Long Range Transportation Plan, the consultant team ran different target scenarios to understand the funding that would be required if Alaska DOT&PF wanted to change the performance target. The following figure presents three different target scenarios and accompanying needs in each scenario.

Bridge Lifecycle

The following tables were developed as part of the Long Range Tranpsortation Plan (LRTP) and will be implemented as part of the Bridge Management System (BrM).

Year	Life stage	LRTP Estimated NBI	Bridge Estimated NBI
0	new bridge constructed	9	9
10-15	bridge preservation (i.e. deck repair)	5	6-5
25	deck rehabilitation	4	4
40+	rehabilitate bridge sub or super structure	3	3
75	replace bridge	2	3

Table D.6 Concrete Alaska DOT&PF Bridges

Year	Life stage	LRTP Estimated NBI	Bridge Estimated NBI
0	new bridge constructed	9	9
10	bridge preservation (i.e. deck repair)	5	6-5
20	deck rehabilitation	4	4
30+	rehabilitate bridge	3	3
75	replace bridge	2	3

Table D.7 Steel Alaska DOT&PF Bridges

- Bridge preservation – bridge painting every 25 years.
- Bridge life cycles differ in dry areas as compared to wet areas.

Year	Life stage	LRTP Estimated NBI	Bridge Estimated NBI
0	new bridge constructed	9	9
8-10	bridge preservation (i.e. deck repair)	5	5
20	deck rehabilitation	4	4
40+	rehabilitate bridge sub or super structure	3	3
60	replace bridge	2	3

Table D.8 Timber Alaska DOT&PF Bridges

External Influences in Bridge Condition

Decrease in Condition Rating = Increase in Poor / Structurally Deficient Bridges

Factors	Expected Condition Outcome with factor increase	Current Experience with Factor	Notes	2018 Condition Forecast
Bridge Attributes				
Fracture Critical	↓	↓	**Forecast: Increasing pressure** **Weight: Medium** Inspection fracture critical bridges have increased costs which contribute to the overall long-term cost of the bridge. Widening, modifications or repairs to fracture critical bridges are more involved and have increased costs. In a remote site, a fracture critical bridge may seem like a preferred option until future inspection or repair costs are included.	↓
Vulnerable Foundation (Shallow Pile Embedment, Brittle 3-Rail Piles, etc.)	↓	↓	**Forecast: Increasing pressure** **Weight: Medium** A vulnerable foundation does not affect the condition, but the potential for issues after a seismic event is significantly higher. An increase in vulnerable foundations results in increased costs due to increases in required inspections and scrutiny by FHWA. As DOT or local agencies acquire bridges due to development or land exchanges, many bridges are not designed or constructed to code standards, which results in an increase in vulnerable foundations.	↓
Load Posting (Reduction below legal loads)	↓	↓	**Forecast: Increasing pressure** **Weight: High** Load postings are installed as a result of bridge condition deterioration. More posted bridges mean that the condition of bridges is deteriorating. Bridges deteriorate with time. As DOT or local agencies acquire bridges due to development or land exchanges, many bridges are not designed or constructed to code standards, which results in posting.	↓
Permits (Overweight Vehicles, Above Legal Loads)	↓	↓	**Forecast: Increasing pressure** **Weight: High** As commerce and development increase so does overweight vehicle permits. More permits means the condition of bridges is deteriorating.	↓
Seismic Retrofit	↓	↔	**Forecast: Neutral pressure** **Weight: Medium**	↔

			The need for seismic retrofit does not affect the condition, but the potential for issues after a seismic event is significantly higher. Many bridges have been retrofitted, so it is not expected that this number will increase.	
Liquefaction Vulnerability			**Forecast: Increasing pressure** **Weight: High** As DOT or local agencies acquire bridges due to development or land exchanges, many bridges are not designed or constructed to code standards, which results in an increase in liquefaction vulnerability.	
Lead Paint			**Forecast: Neutral pressure** **Weight: Medium** Lead paint does not affect the condition, but it does affect the repainting costs of older bridges due to containment costs. As bridges are repainted the number of bridges with lead paint is expected to decrease.	
Hydraulic Considerations				
Scour Critical			**Forecast: Increasing pressure** **Weight: High** More scour critical bridges result in increased costs due to increases in required inspections and scrutiny by FHWA.	
Channel Infilling / Aggradation			**Forecast: Neutral pressure** **Weight: Low** As the channel infills, material has to be removed from the channel to maintain flow.	
River Ice Jams			**Forecast: Neutral pressure** **Weight: Medium** Exceedingly high flow as a result of an ice jam may result in overtopping of the bridge, erosion of approach fill or in an extreme case knocking the bridge off of the foundation.	
Aufeis Flow (water flowing on ice			**Forecast: Neutral pressure** **Weight: Medium** Aufeis flow is water flowing on top of ice that can refreeze increasing the thickness of the ice and thereby blocking the channel.	
Fish Culvert			**Forecast: Neutral pressure** **Weight: Medium** Ongoing need to improve fish passage conditions where blockages have been identified.	
Tsunami Risk			**Forecast: Increasing pressure** **Weight: Medium** Exceedingly high flow as a result of an earthquake may result in overtopping of	

			the bridge or knocking the bridge off of the foundation.	
Log / Debris Jams			**Forecast: Increasing pressure** **Weight: Medium** Exceedingly high flow as a result of a log / debris jam may result in overtopping of the bridge, erosion of approach fill or in an extreme case knocking the bridge off of the foundation.	

Factors	Expected Condition Outcome with factor increase	Current Experience with Factor	Notes	2018 Condition Forecast
Geometric Considerations				
Over-height Collisions (Superstructure)			**Forecast: Neutral pressure** **Weight: High** As bridges are replaced and vertical clearance restrictions removed (trusses), vertical under clearances are increased (overpasses), or more advanced warnings are installed at lower vertical clearance bridges, as most recently occurred at Eklutna Overcrossing #1374.	
Pier Collisions (substructure - vehicle or marine craft)			**Forecast: Neutral pressure** **Weight: Low** Many overpass abutments and piers are protected by traffic safety features. The condition of the bridge with a collision would worsen until repaired. However, the repaired areas are often the source of future spalling and deterioration.	
Navigation Clearance			**Forecast: Increasing pressure** **Weight: Low** As bridges are replaced, navigation clearances are increased (overpasses). Navigation Clearance does not affect the condition, but an increase in clearance may result in lower collision risk at an increase initial installation cost.	
Animal Crossing			**Forecast: Increasing pressure** **Weight: Low** More animal crossings are being installed to decrease collisions between animals and cars. Animal crossings do not affect the condition, but they do increase the long-term maintenance costs of the inventory.	

Pedestrian Crossing			**Forecast: Increasing pressure** **Weight: Low** As bridges are replaced there is an increased demand for pedestrian facilities both over and under the bridge. Pedestrian crossings do not affect the condition, but they do increase the initial installation costs as well as the long-term maintenance costs of the inventory.	
Other Factors				
Funding			**Forecast: Increasing pressure** **Weight: High** Funding levels fluctuate from year to year, but overall the condition of our bridges has not significantly changed as a result of current funding levels.	
Aging Infrastructure			**Forecast: Increasing pressure** **Weight: High** Bridge condition deteriorates with time unless preventative, preservation, or maintenance activities are performed regularly.	
Railing Collisions			**Forecast: Increasing pressure** **Weight: Medium** Minor railing conditions that result in damage to railing or posts do not affect the condition of the bridge. Significant collisions that result in damage to the deck have a negative impact on condition until repaired. The repaired areas are often the source of future spalling and deterioration.	
Detour Length			**Forecast: Neutral pressure** **Weight: Medium** Detour length does not affect the condition, but it does increase the initial installation costs as a result of the requirement for detour bridge during construction. There is also an impact to the public and commerce for a bridge with a large detour length being posted or closed due to damage or deterioration.	
Remote Location			**Forecast: Neutral pressure** **Weight: Low** Remote location does not affect the condition, but it does increase the initial installation costs, long-term inspection costs, and long-term maintenance costs of the inventory.	

Evacuation Routes			**Forecast: Increasing pressure** **Weight: Medium** An evacuation route does not affect the condition, but it does increase the initial installation costs as a result of additional requirements to maintain during construction. There is also an impact to the public and commerce for an evacuation route bridge to be posted or closed due to damage or deterioration.	
Coast Guard Permitting			**Forecast: Increasing pressure** **Weight: Medium** Permitting does not affect the condition, but it does increase the lead time involved with bridge replacement, rehabilitation or retrofit work.	
Historic Bridge			**Forecast: Increasing pressure** **Weight: Medium** Being historic does not affect a bridge's condition, but it does increase the lead time involved with bridge replacement, rehabilitation or retrofit work due to increased paperwork and documentation requirements.	
Mobilization Cost			**Forecast: Increasing pressure** **Weight: Medium** Mobilization cost does not affect the condition, but it can increase the cost when equipment not regularly used in Alaska has to be mobilized from the lower 48 even to an urban area, much less a remote location.	
Climate Change			**Forecast: Increasing pressure** **Weight: Medium** Changing conditions may influence design selection processes	
Extreme Events			**Forecast: Increasing pressure** **Weight: Medium** Projects may be delayed as a result of earthquake damage, road washouts or other damage that leads to a bridge's needing to be repaired prior to another project.	

Appendix E:

GAP Analysis for National Highway System Bridge and Pavements

This Appendix describes the process that DOT&PF uses for conducting performance gaps [GAP 515.7(a)]. The *Definitions* section of the Final Rule (23 CFR 515.5) defines –"Performance Gap " to mean both the gaps between the current asset condition and State DOT targets for asset condition and the gaps in system performance effectiveness that are best addressed by improving the physical assets.

First, DOT&PF identified our current state by reviewing historical data and trends. Looking at bridge structural deficiency and pavement IRI, we see that the condition of our assets is relatively flat. DOT&PF looked at the three to five years of bridge and pavement conditions using the federal rulemaking standard for good, fair, and poor conditions. Department and MPO staff identified external factors that could improve or worsen physical conditions. Using knowledge gathered from the NHI Effective Target Setting training in March 2017, future 4-year targets were set. The intent is to intend to keep that performance target flat from historical levels because it is an acceptable condition performance level for the NHS assets and that target represents a state of good repair for our system. Using asset management principles and our asset systems,

DOT&PF strives to minimize costs to keep those assets at that target condition in order to focus on other assets and new expansion needs. DOT&PF recognizes that in recent past years a significant amount of project off-set and de-obligation funding was re-invested to the NHS in preparation for federal transportation performance management. DOT&PF is hopeful that this past work helps to set the stage, but recognizes that the investment level to get here may also have been higher than what is sustainable moving forward.

DOT&PF is meeting pavement and bridge targets and expects to be able to continue to do so; however, there are trade-offs related to funding availability and remaining performance gaps both on and off the NHS. For example, as funding is focused on preservation and rehabilitation of pavement and bridges, it will be more difficult to fund modernization improvements that the public desires to see (both on and off the NHS) and that may address critical safety and capacity issues. Additionally, funding is needed for the non-NHS, marine highway ferry purchases, Dalton Highway gravel road preservation, ADA compliance upgrades, geo-technical assets, culverts and other highway related appurtenances, and other improvements that may not contribute toward meeting pavement and bridge condition targets. The Department will have to consider alternatives and trade-offs when making funding decisions related to meeting targets and closing or minimizing these performance gaps.

The LRTP 2036 predicts population growth, and the growth of travel demand would lead to customer service expectations for new and expanded facilities to keep pace with the population. The risk analysis indicates that user expectations will change and increase over time, outpacing forecasts of financial resources, including assessments of what the public is willing to fund. A more urban population has expectations for pedestrian and bicycle facilities and other transportation amenities. These expectations would require unplanned maintenance of the system and higher operating expenditures. The plan describes additional needs and expectations for bicycle and pedestrian facilities. According to the LRTP 2036, this user expectation trend has a high risk to the State and the public we serve.

In contrast, population is predicted to continue to decline in rural areas, as the cost of providing services in these areas continues to increase. Rural transportation projects have high mobilization and materials cost that are often disproportionate in relation to urban area projects. These communities also are in need of transportation in and out of their communities, which is typically by air or ferry. The Alaska Marine Highway System competes with other surface transportation projects for NHPP and STP funds.

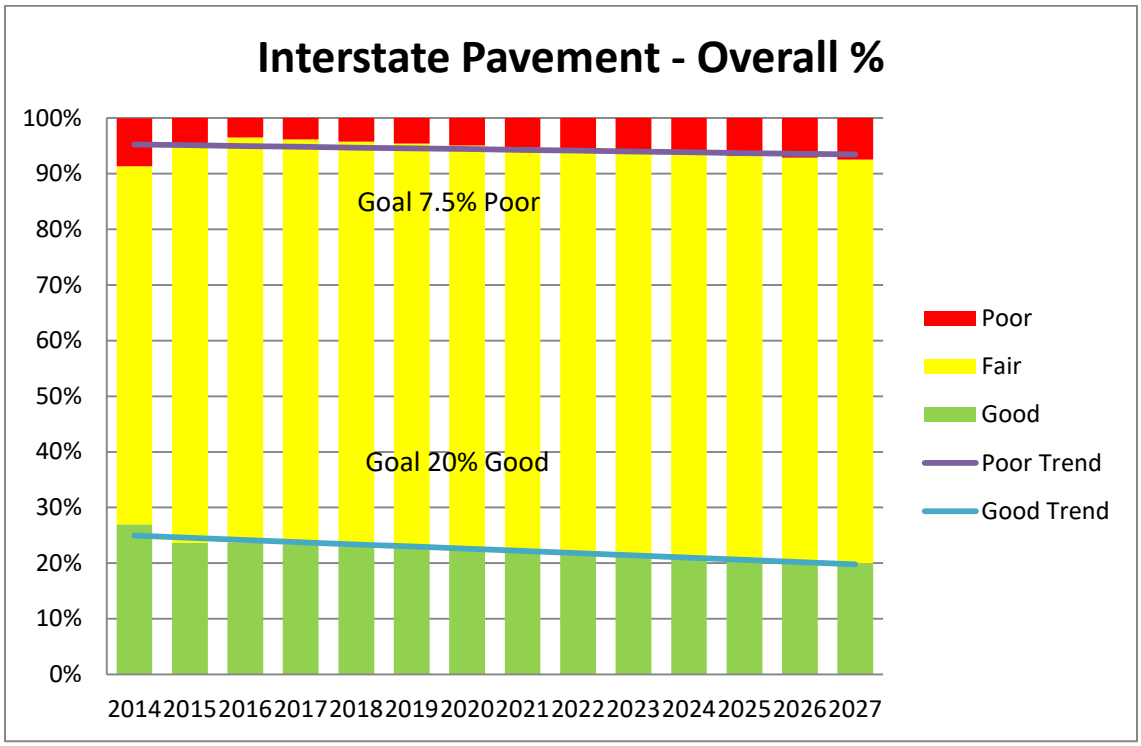
The LRTP 2036 also indicates that changing climate patterns pose a high, and almost certain, risk to the transportation system. For example, melting permafrost causes major heaving to roads that requires frequent reconstruction and expensive mitigation measures and earthquakes pose seismic risks to bridges and require pre-emptive mitigation to reduce seismic risk. These risks affect system performance and require significant resources for mitigation. They are discussed in more detail in the LRTP 2036 and in the Risk Management section of this document.

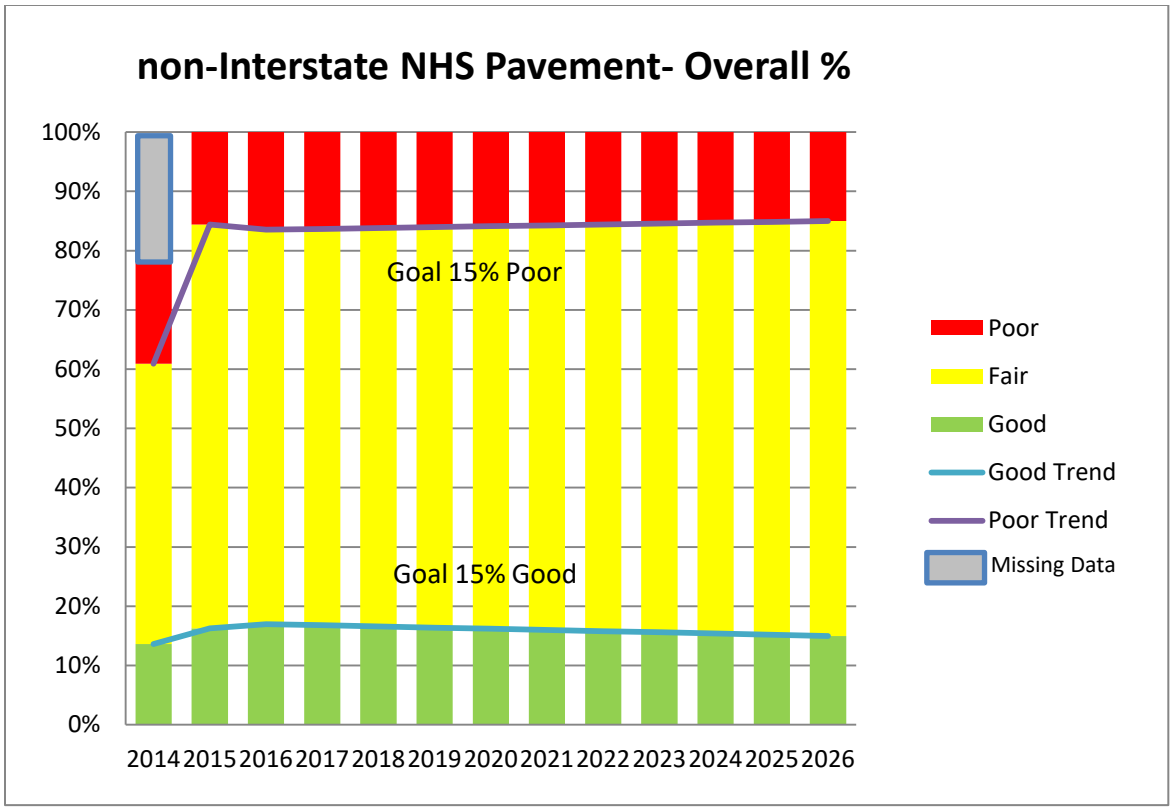
The LRTP and this TAMP recognize that the Department must distribute limited funding resources among these multiple priorities. Projects may be categorized as new construction, modernization, or system preservation. Pavement and bridge management systems will be used to determine preservation priorities while project selection criteria will be used to select modernization, and to a limited extent, new construction projects. Modernization of the transportation system to address safety, capacity, and other user expectations represents a significant performance gap that will likely always exist and require resources. For modernization projects on the NHS, the Department will use the strategies listed in the Investment Strategy section and appendix of this document. Additionally, the Department is beginning to use Planning and Environmental Linkage (PEL) studies to help identify performance gaps and refine alternatives to most cost effectively modernize the transportation system. Finally, as travel time and freight travel time data is analyzed and targets are set, more refined performance gap information will need to be integrated into project selection and funding decisions.

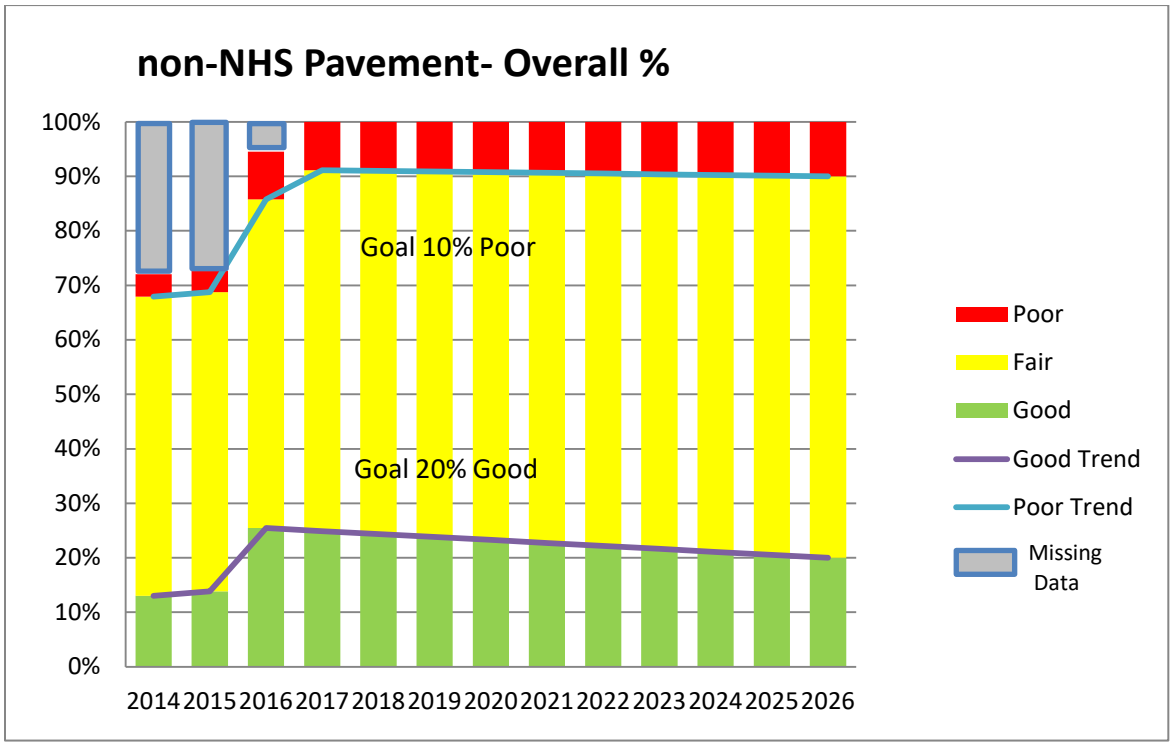
Regarding bridges, the Department does not currently have a bridge condition gap, but needs to continue programming reconstruction and rehabilitation of bridges to keep bridges at less than 10% poor. Asset Managers strive to meet the target by using 7.5% poor as their action level. Bridge staff submit a prioritized list to the field planning staff for consideration when the bridges require major rehabilitation.

The Bridge section has completed simple retrofits to improve bridge performance during a seismic event. Approximately 25% of the total bridges in Alaska need improvement to perform better in a seismic event. Bridge Asset managers provide regional planners with a list of bridges that do not meet seismic standards. The %Good and % Poor targets are based on historical data.

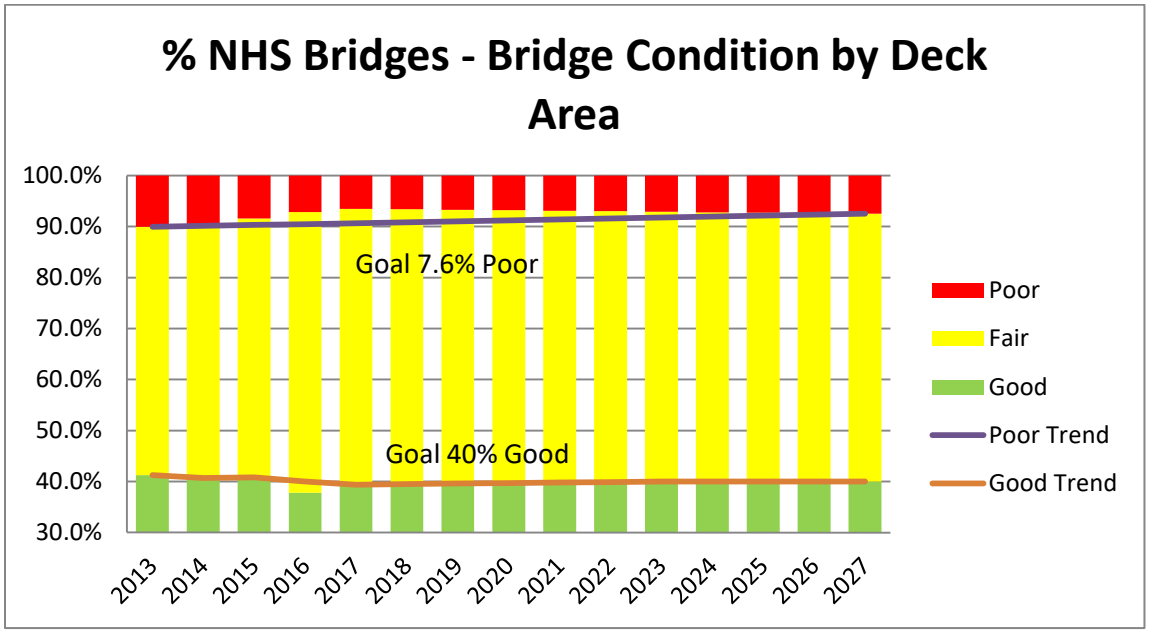
GAP ANALYSIS – Pavement 10-year Forecast

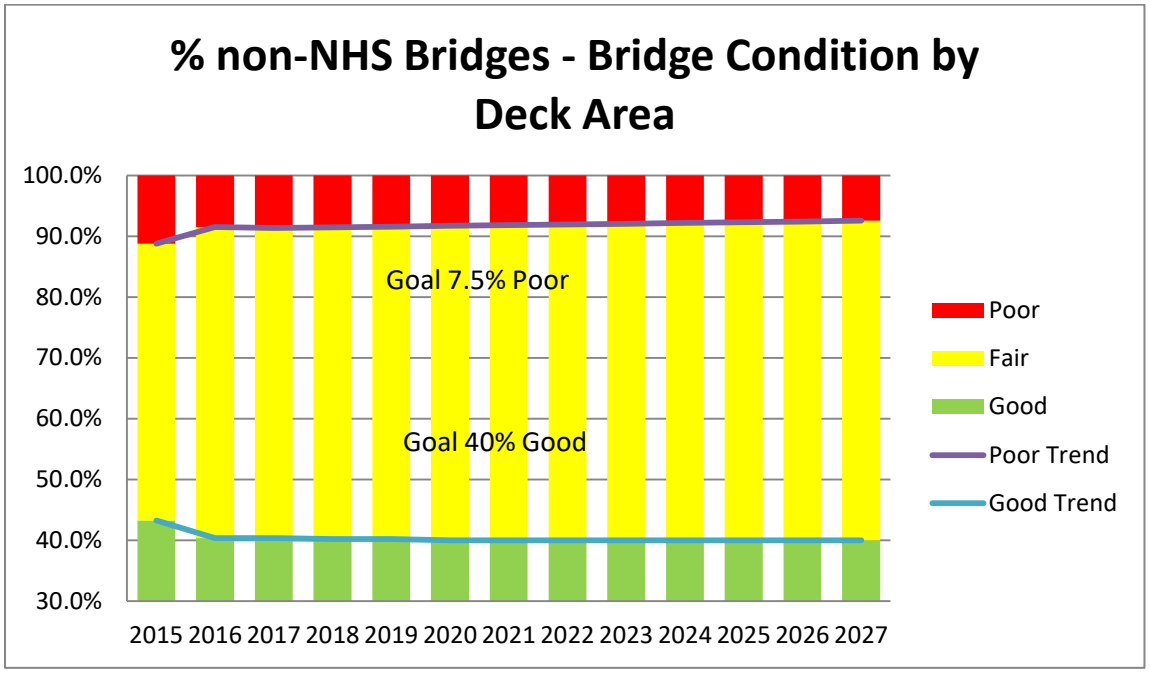



non-Interstate NHS Pavement- Overall %
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
Goal 15% Poor
Goal 15% Good
Poor
Fair
Good
Good Trend
Poor Trend
Missing Data


non-NHS Pavement- Overall %
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026
Goal 10% Poor
Goal 20% Good
Poor
Fair
Good
Good Trend
Poor Trend
Missing Data

GAP Analysis – Bridge 10-year Forecast





Appendix F:

Life Cycle Planning

This section describes the process DOT&PF will use to conduct Lifecycle Planning Analysis. The TAMP due June 30, 2019 will include this analysis.

Background

In May 2013, the Alaska Department of Transportation and Public Facilities (DOT&PF) was described as being in the "awakening" stage of Asset Management maturity (AASHTO TAM Guide, 2011), where a basic set of capabilities are in place for a few types of assets, but these are not yet integrated into department-level decision making. Without pavement and bridge management systems that track project costs and deterioration modeling, one could argue that not even the basic capabilities were in place. DOT&PF is working on improving both the pavement and bridge management systems to perform the basic analysis required for Life Cycle Planning and be compliant with the federal regulations. As of April 2018, neither the pavement system nor the bridge system is fully capable of performing the required analysis. With the implementation of the new systems and defined business process, DOT&PF will increase the current Transportation Asset Management maturity level from "awakening" to "structured."

Lifecycle Planning processes are documented procedures to determine the benefit cost over the life cycle of assets to evaluate alternative strategies, including no action decisions. This process will estimate the cost of managing National Highway System bridges and pavement over their whole life with consideration for minimizing cost while preserving the condition. The process includes consideration of future changes in demand, in environmental conditions, and in innovative treatments.

Objectives

DOT&PF is just beginning to perform Life Cycle Planning. Staying with the TAM motto to start simple and grow smart, our objectives are:

- Move away from “worst first” strategy and focus on cost effective preservation and when it makes sense for remote, rural communities;
- Determine the funding needed in each work type to meet our established targets which is our state of good repair;
- Use deterioration rate to predict the future;
- Reduce the cost of annual preservation without negatively impacting asset condition using management system outputs and profession judgment;
- Educate internal and external stakeholders on why lifecycle planning is the most efficient use of public funds and how budget cuts affect asset condition over time;
- Develop a plan for every NHS bridge and road segment using age, condition and demand as the primary criteria.

Process

The Federal Highway Administration published guidance in November 2017 called *Using a Life Cycle Planning Process to Support Asset Management.* DOT&PF has developed our process using the five step model described in this guidance.

Step 1. Select the asset classes and Networks to be analyzed.

DOT&PF will perform Lifecycle Planning on NHS Bridges and Pavement. The targets established are our “State of Good Repair” (SOGR) and there is no differential between urban or rural. The funding hierarchy prioritizes Interstate over non-Interstate NHS. In

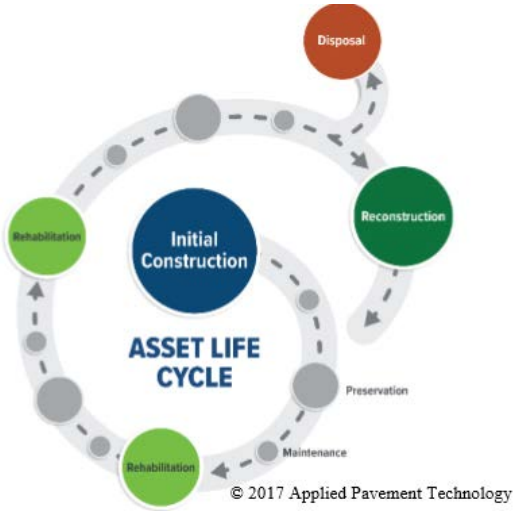
the future, we will also analyze non-NHS pavement and bridges using the same general process.

Step 2. Define Life Cycle Planning Strategies

The Pavement Management System has an Alaska specific deterioration model. We are using the default AASHTOWare Bridge Management System software deterioration model for our bridges. As we work with both systems, we anticipate making changes to both models as needed. Both systems will make recommendations for the following work types:

- Routine Maintenance
- Preservation
- Major Rehabilitation
- Reconstruction.

We will perform life cycle cost planning on New Construction or New Connections when adding a brand new road, to show the benefits to the State of Alaska versus the costs overtime to the public.



The historical unit costs for each treatment were entered into the management systems. These unit costs will be updated as current construction project and maintenance work orders are completed and entered into the systems. Using the management systems,

we will develop a strategy for minimizing the life cycle costs for the bridges and pavements on the NHS.

We will use the management systems to apply engineering-economic analysis to evaluate and compare different strategies to maintain our state of good repair. Since we do not have historical data, we will be relying on the professional judgment of our Technical Team and Pavement Sub-Team to guide our analysis and to develop lifecycle decisions. Eventually, the deterioration rates will forecast future conditions based on funding and investment strategies.

The Pavement Management System (PMS) includes a set of defined procedures for collecting, analyzing, maintaining and reporting pavement data. Treatment selection is based on asphalt pavement decision trees. Deterioration models provide predictive capability to forecast future pavement needs. Until the pavement management system is fully functioning, we will use information from the Long Range Transportation Plan (LRTP) as a starting point.

Table F.1 to F.3 include preservation timing and unit costs per region from the draft LRTP. The units cost and the timing will be adjusted based on analysis from the new PMS.

Treatment		Crack Sealing	Patching	Overlay	Crack Sealing	Patching	Rehab
Timing (Years)	Urban	5	7	10	15	17	20
	Rural	5	7	10	15	17	20
Cost ($/Ln-mi)	Urban	4,200	15,250	185,000	4,200	15,250	410,000
	Rural	4,200	15,250	185,000	4,200	15,250	410,000

Table F.1 Northern Region Lifecycle Management Treatment Cycle

Treatment		Crack Seal	Patch	Crack Seal	Overlay	Crack Seal	Patch	Crack Sealg	Rehab
Timing (Years)	Urban	3	4		7	10	11		14
	Rural	3	5	8	10	13	15	18	20
Cost ($/Ln-mi)	Urban	3,380	1,040	3,380	325,000	3,380	1,040	3,380	650,000
	Rural	3,380	1,040	3,380	325,000	3,380	1,040	3,380	650,000

Table F.2 Central Region Lifecycle Management Treatment Cycle

Treatment		Crack Seal	Patch	Chip seal	Crack Seal	Overlay	Crack Seal	Patch	Chip seal	Crack Seal	Rehab
Timing (Years)	Urban	3	4		10	15	17	18		19	25
	Rural	5	10	20	23	25	28	30	35	37	40
Cost ($/Ln-mi)	Urban	2,600	896		2,600	268,662	2,600	896	77,613	2,600	597,026
	Rural	2,600	896	77,613	2,600	268,662	2,600	896	77,613	2,600	597,026

Table F.3 Southeast Region Lifecycle Management Treatment Cycle

The LRTP included cost data by bridge type. The typical life span of a new pre-stressed reinforced concrete bridge structure is 75 years, and the goal is to have maintenance free bridges. The typical lifespan of a new steel bridge is 50 years, and a timber structure would have a typical lifespan of 40 years. The repair and rehabilitation costs are shown for each region and for each bridge type in Table F.4.

	Materials	Unit Cost ($/sqm of Deck)	
		Repair	Rehab
Northern	Conc	$49.74	$390.26
	Steel	$49.74	$390.26
	Wood	$16.58	$139.94
Central	Conc	$68.34	$652.46
	Steel	$127.45	$1290.41
	Wood	$74.86	$389.87
Southcoast	Conc	$50.04	N/A
	Steel	$89.72	N/A
	Wood	$71.76	N/A
Overall Rehabilitation/Replacement Cost			$4,305

Table F.4 Bridge Life Cycle Management Treatment Cycle

The following tables show the anticipated treatment shown in the LRTP compared with the timing recommended by our Bridge Management group. There are slight variations.

We will be using the bridge recommended timing for our analysis. The bridge group added the preservation practice of painting every 25 years. It should be noted that bridge cycles differ in dry areas and wet areas.

CONCRETE			
Year	**Life stage**	**LRTP Estimated NBI**	**Bridge Estimated NBI**
0	new bridge constructed	10	9
10-15	bridge preservation (i.e. deck repair)	5	6-5
25	deck rehabilitation	4	4
40+	rehabilitate bridge sub or super structure	3	3
75	replace bridge	2	3

Table F.5 LRTP Treatment Forecast Concrete

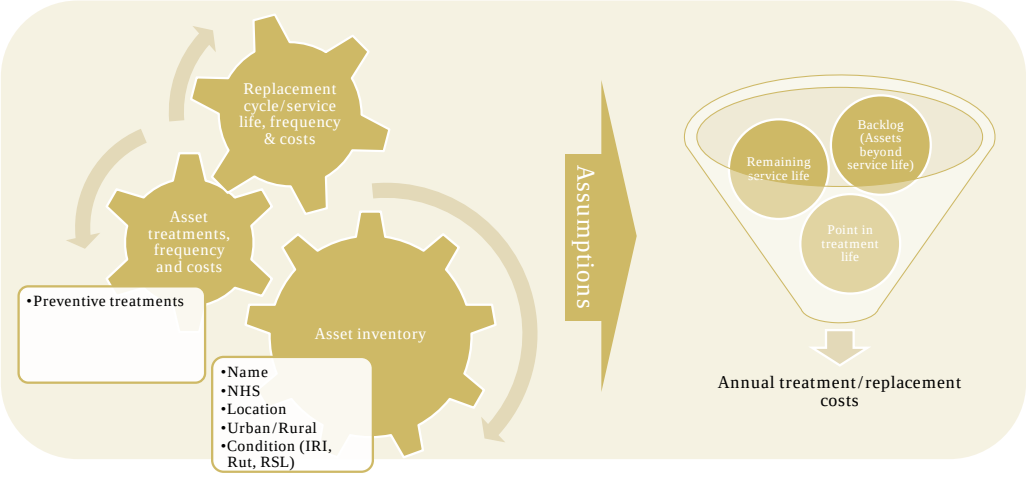
STEEL			
Year	**Life stage**	**LRTP Estimated NBI**	**Bridge Estimated NBI**
0	new bridge constructed	10	9
10	bridge preservation (i.e. deck repair)	5	6-5
20	deck rehabilitation	4	4
30+	rehabilitate bridge	3	3
75	replace bridge	2	3

Table F.6 LRTP Treatment Forecast Steel

TIMBER			
Year	**Life stage**	**LRTP Estimated NBI**	**Bridge Estimated NBI**
0	new bridge constructed	10	9
8-10	bridge preservation (i.e. deck repair)	5	5
20	deck rehabilitation	4	4
40+	rehabilitate bridge sub or super structure	3	3
60	replace bridge	2	3

Table F.7 LRTP Treatment Forecast Timber

Long Range Transportation Plan's Life Cycle Planning



Lifecycle Management Needs: Paved Roads

The LRTP includes a lifecycle management model. This model was prepared as a part of the *Let's Get Moving 2030* plan and updated to account for condition and roadway changes as well as for changes to the treatments used by DOT&PF and their associated costs. This model uses Remaining Service Life (RSL) estimates, a simple but conservative way to evaluate pavement life cycle and to calculate the optimum time for certain treatments to be applied to the pavement. Each treatment has an associated cost based on lane miles, which are used to calculate the overall system needs over the 23-year forecast period.

In 2015, Alaska hired Applied Pavement Technologies (APTech) to develop a model within our Pavement Management System to improve forecasting. Until the pavement management system is complete, DOT&PF will use the pavement-need forecasting that was completed in the LRTP. The lifecycle management needs were determined by using the RSL. RSL assumes pavement will decrease consistently each year and is determined as the minimum service life based on IRI and rutting information. The calculations based on RSL (which do not include cracking) indicate that 22% of the segments have an RSL of zero and therefore are in need of immediate repair (backlog of needs).

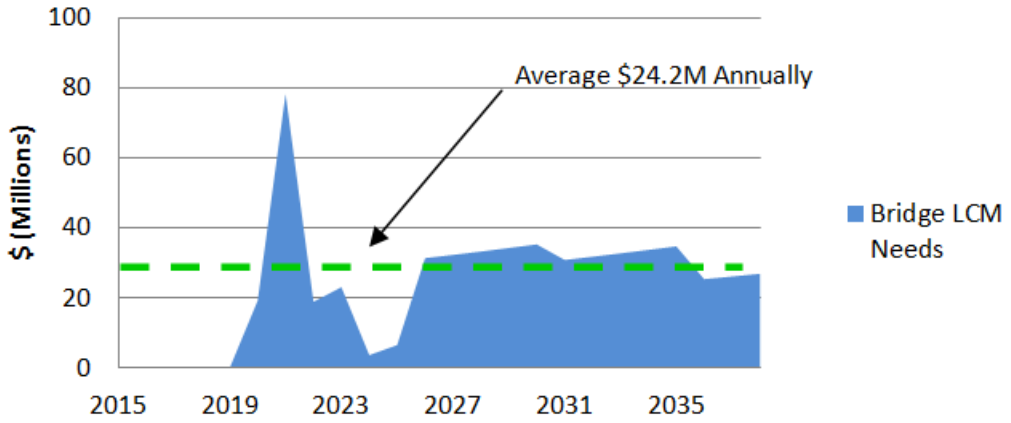
	Northern	Central	South East	State Totals
0 Years	27%	17%	18%	22%
1-5 Years	22%	30%	8%	23%
6-10 Years	18%	25%	11%	20%
11+ Years	33%	28%	63%	36%

Table F.8 Remaining Service Life Percentages-ALL PAVED ROADS

The percentages shown in Table F.8 above represent the total needs for all paved highways owned by Alaska DOT&PF in year-of-expenditure dollars, based on year-by-year calculations of the model (using a 3% inflation factor), and then normalized to calculate needs for future planning. The total 23-year need is $10.3 billion, which includes $1.2 billion to address the backlog. The model assumes that the backlog will be addressed over the first ten years of the model. The average annual need is $450 million and includes the funding needed to address the backlog. As mentioned previously, since the new Pavement Management System has not yet been fully implemented, the purpose of this model is to provide only a planning-level estimate of the pavement needs for the LRTP.

The annual need for the NHS only is $253 million for pavement.

The LRTP includes predictions for bridge life cycle management.



The average annual need is $24.2 million per year for the next 10 years. The target for the LRTP is to have no more than five bridges being structurally deficient to a target of

no more than 10% of the deck area being structurally deficient (for both NHS and non-NHS bridges). This resulted in a significant reduction in the overall bridge needs, even after accounting for an inflationary increase in unit costs and the minor increase in overall deck area.

As identified above, the performance target for bridges was revised to a target of no more than 10% of the deck area being structurally deficient (for both NHS and non-NHS bridges). This target was determined through conversations with DOT&PF staff and as part of TAM team workshop with MPOs in August 2017. The workshop identified and evaluated external factors that would influence future conditions and effect the targets. As part of the Long Range Transportation plan, the consultant team ran different target scenarios to understand the funding that would be required if Alaska DOT&PF wanted to change the performance target. The following table presents three different target scenarios and accompanying needs in each scenario.

	NHS	**Non-NHS**	**Total**
SD Target: 0 Bridges each year			
Current Dollars	31,880,886	21,770,516	53,651,402
Year of Expenditure	**45,968,313**	31,890,129	77,858,442
SD Target: 5 Bridges each year			
Current Dollars	24,099,707	16,991,225	41,090,931
Year of Expenditure	35,271,763	25,078,891	60,350,654
SD Target: 10 Bridges each year			
Current Dollars	20,200,388	13,593,280	33,793,669
Year of Expenditure	29,676,300	20,196,571	49,872,871
SD Target: 7.5% Deck Area each year			
Current Dollars	17,355,388	7,314,022	24,669,410
Year of Expenditure	**25,511,144**	11,064,545	36,575,689
SD Target: 10% Deck Area each year			

	NHS	Non-NHS	Total
Current Dollars	10,564,893	5,650,451	16,215,344
Year of Expenditure	15,640,670	8,587,831	24,228,500

Table F.9 LRTP Needs Matrix

Step 3. Set Lifecycle Planning Scenario Inputs

Since 2002, DOT&PF has focused on "worst first." This worst first strategy has resulted in a good overall condition of our Interstate and non-Interstate NHS network pavement and a low percentage of poor bridges and Interstate good IRI. DOT&PF is in an excellent position to maintain good infrastructure for longer using preservation strategies.

Using the Pavement Management System (PMS) and the Bridge Management System (BrM), we will run at least three scenarios as listed below

Level 1 = No investment. This will show the condition will deteriorate with no investment.

Level 2 = No financial constraints. All pavement and bridges gets the recommended work based on age and condition.

Level 3 = Financial Constraints based on budgeting to meet targets. Must meet the minimum condition Interstate IRI, Structural Deficiency & both Good and Poor target in this scenario – must meet those performance measures and state determined targets. This level could have several iterations based on political or environmental factors.

Step 4: Develop Life Cycle Planning Scenarios

Using the Lifecycle Cost planning strategies in Step 2 and the scenario inputs in Step 3, the management systems will be used to develop a Life cycle Planning scenario that meets the desired state of good repair (which again is equal to our targets) for a 10-year period.

We will re-run this scenario if additional funding becomes available or if other priorities require federal funding that will reduce the funding available for NHS bridges and pavements. An example would be a large new road connection or a ferry purchase.

Step 5: Provide Input to Financial Planning

DOT&PF asset management staff will provide 10-year funding scenario need to meet performance measures to DOT&PF Planning and Programming Staff to use when developing the Statewide Transportation Improvement Plan. The Planning staff will evaluate the expected level of funding compared with the funding needed for maintaining performance measures. If there are scenario changes needed due to funding, political or environmental changes, new scenarios will be run. The Financial planning will be completed for the TAMP due June 30, 2019.

Cross Asset Analysis

DOT&PF will be working to meet the performance measures and will not be completing any Cross Asset Analysis for this TAMP. As DOT&PF gains experience with a preservation program and adding other assets for lifecycle planning, a cross asset analysis procedure will be developed for the next version of the TAMP due in 2022. DOT&PF will evaluate any gaps with the new PMS and upgraded BrM system. DOT&PF will be working to incorporate risk into the lifecycle planning scenarios. DOT&PF strives to continuously improve but we must start simple to grow smart.

Appendix G:

Risk Management Analysis

Risk management is a systematic process that involves the identification, assessment, planning, and management of threats and opportunities faced by programs, processes, and projects. To develop a 10-year Transportation Asset Management plan with investment strategies to sustain a state of good repair, the Alaska Department of Transportation and Public Facilities (DOT&PF) must identify and evaluate risks to those identified investment strategies.

Process for Risk Management

DOT&PF used the following guidance to conduct a preliminary risk management assessment https://flh.fhwa.dot.gov/resources/construction/forms/wfl/documents/Risk-Management-Guidance.pdf.

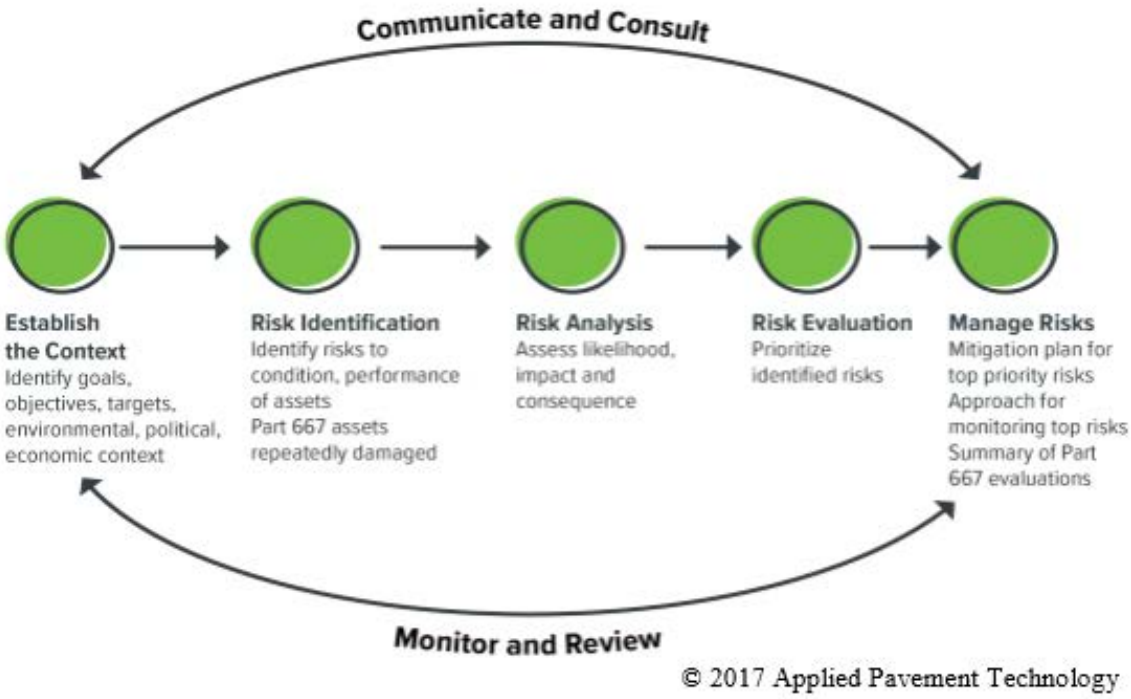
DOT&PF will hire a contractor or use internal staff to facilitate a Risk Workshop as described in the Federal Highway Administration November 2017 *Incorporating Risk Management into Transportation Asset Management Plans.* Results from this workshop will be placed in this Appendix in the June 30, 2019 submittal to FHWA.

The team will consist of Finance, Pavement Management Engineer, Bridge Management Engineer, GIS Expert, Regional M&O Chiefs, Environmental Manager; Construction Representative, Safety Engineer, TAM Coordinator and Planning. DOT&PF will use the AASHTO Guide for Enterprise Risk Management as a reference for establishing risks and identifying likelihood and magnitude.

The group will review the limited historical condition and investment data; the asset management goals and targets; financial forecasts and assumptions; information of major environmental and political influences that might affect the TAMP; key

assumptions around pavement and bridge forecasts; research studies on future environmental conditions.

The workshop will go through the Risk Management Process. The figure below has been adapted from the Federal Highway Administration's November 2017 *Incorporating Risk Management into Transportation Asset Management Plans.* DOT&PF will follow the seven steps in the risk management process.



Step 1. Establishing the context

We base risk from the Information in the Long Range Transportation Plan (LRTP) that has been used in several sections of the TAMP. The LRTP established the Transportation Stakeholders Group.

The Transportation Stakeholders Group was asked to consider various scenarios to plan for. The elements ranged from system preservation to travel demand and finance.

The group was asked to consider policies they would recommend and future risk areas for the plan's policy. Risk areas include:

- Safety and cost
- Uncertainty
- Ramifications
- Capacity
- Culture
- Staffing Levels
- Reliability
- Public Opinion
- Benefit.

The asset management objectives that are affected by risk are having the quality, transparent data systems to predict the future and support decision making. Without trusted data and accurate projections we will not be able to perform asset management to wise resource investment making good infrastructure cost less.

Some opportunities DOT&PF takes part in designing and constructing bridges to last with minimal maintenance and has dedicated funding for preventive maintenance.

Step 2 Identifying Agency Risk

The LRTP discusses Risk Management. The Asset management staff used this analysis and other research to identify both programmatic and project risks. This section will be updated when the Risk Workshop is completed by June 30, 2019 TAMP submittal due date.

MANAGEMENT SYSTEM/DATA RISK

The pavement and bridge management systems are still being implemented. There is still no final data governance or corresponding data manual. These areas are actively being worked on and expect to be in place by April 2018. This date has slipped in the past but we expect it to be operational for several months before the June 2019 TAMP due date.

FUNDING RISK

The greatest known risks to Alaska's system are, first, the lack of adequate funding to preserve and maintain the existing infrastructure and, second, the inability to expand the system to meet future needs. The LRTP identifies $426 million per year needed for the backlog for pavement on NHS roads and $24.4 million per year needed to have less than 7.5% NHS bridges that have deck area structural deficient. Reductions in federal funding will have a large impact on the roads and bridges in the state of Alaska.

Unstable and declining state and federal funds may result in a growing backlog of maintenance needs and lack of funding for new facilities. These financial risks to transportation are highly likely to result in the following:

- Need for periodic infusions of capital to the Alaska Marine Highway System from the State General Fund to maintain older vessels or replace older vessels with new ones
- Elimination of market-driven supply to rural Alaska (i.e., bypass mail, essential air service, other commercial services)
- Lack of federal funding to connect rural low volume local roads to main system

SEISMIC ACTIVITY

Alaska is the most seismically active state in the United States. The earth's most active seismic feature, the circum-Pacific seismic belt, brushes Alaska and the Aleutian Islands where more earthquakes occur than in the other 49 states[1] combined.

In 1995 the Department implemented a seismic retrofit program for bridges using hazard data from the U.S. Geological Survey. This data together with seismic vulnerability assessment of bridges and determination of priority highway routes has resulted in the prioritization of bridges for seismic retrofit. The Department retrofits bridges in an attempt to prevent collapse during an earthquake. Phase one of the

[1] http://earthquake.usgs.gov/earthquakes/states/alaska/history.php

program addresses the most critical bridge deficiencies that can be accomplished for the least cost. Phase two of the program is intended to address vulnerabilities in the bridge columns and foundations, which are typically much more expensive to correct. The program is currently funded at $6 Million over three years.

CLIMATE CHANGE

Over the past 60 years[2], the temperatures across Alaska have increased an average of 3º F. Winter warming is greater, rising by an average of 6º F. The rate of warming in Alaska is twice the national average over the same period of time. Average annual temperatures are projected to increase an additional 4 to 6º F by the end of the 21st century.

Alaska's diverse climates can be classified into five general climate regions (maritime, west coast, south central, interior, and arctic). The regions correspond to different climate-related impacts on temperature and precipitation.

Climate change includes changes in the timing, frequency, form and intensity of precipitation which may cause related and increasing natural processes. Climate change[3] impacts also include:

- Melting/warming permafrost
- Increased storm frequencies and intensity
- Increased coastal erosion due to lack of sea ice
- Increased river and shore erosion
- Sea level rise
- Increasing temperatures
- Debris flows
- Avalanches
- Floods
- Aufeis

For DOT&PF this means that construction costs will be higher to maintain frozen permafrost as temperatures rise and maintenance and operations costs will increase if

[2] Alaska Climate Trend Vulnerability Study - DOT
[3] Information from:http://www.climatechange.alaska.gov/docs/afe09/9_Coffey.pdf

the warming trend continues. The 2015 Dalton Highway [4] had major flooding due to ice build-up that caused water to flow over the highway, and spring breakup caused another round of flooding that washed sections of the gravel road away. This flooding caused road closures and resulted in $17 Million in emergency repair costs.

FLOODING

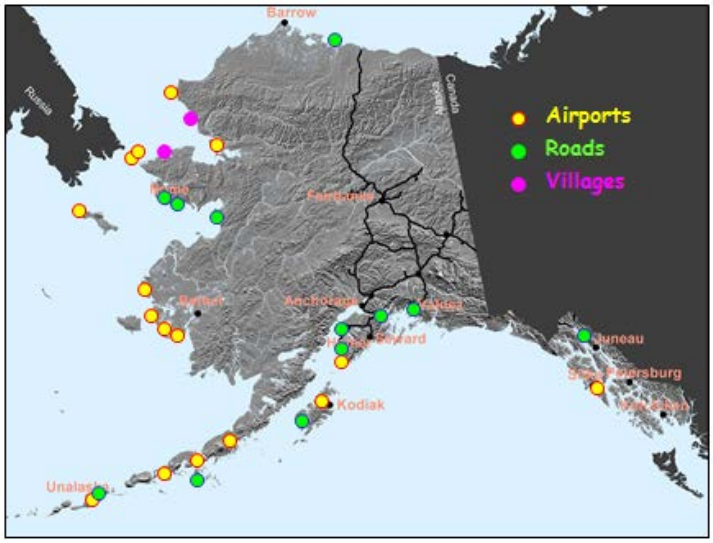
Bridges are designed to a 50-year design flood and a 100-year design flood for floodway areas. Bridges are designed so that they do not create a backwater situation. The capacity of the hydraulic feature is designed to protect the asset and existing infrastructure. Some rivers have large braided channels with existing bridges, and the river can change direction. Maintenance crews work hard to maintain the river in its current location. Some risk is accepted by the Department for certain infrastructure.

COASTAL EROSION

Alaska has 20 coastal airports and 12 coastal highways[5]. Facilities in coastal areas include roads, airports, harbors and docks. Coastal areas are vulnerable because they could be affected by land-based changes in patterns of precipitation and temperature as well as increases in sea level and the number of storm-driven tides.[6] Diminishing sea ice has reduced the natural coastal protection along Alaska's northwestern coast. Coastal erosion is causing some shorelines to retreat at rates averaging tens of feet per year.[7]

[4] http://www.dot.alaska.gov/nreg/dalton-updates/2015response.shtml
[5] http://www.dot.alaska.gov/creg/dot-cadastral/Design_Engineering/Engineering_Design_Meetings/QUARTERLY%20DESIGN%20MEETINGS/Quarterly%20Design%20Meeting%20%2316%20(9-19-06)/Intro%20to%20Coastal%20Eng%20S1%204-10-06%20.ppt

[6] http://alaska.usgs.gov/science/doi_landscape/ely.html
[7] http://www.epa.gov/climatechange/impacts-adaptation/alaska.html



PERMAFROST/AUFEIS IMPACTS

Permafrost thawing and cycles of freezing and thawing can cause extensive damage to highways, railroads, airstrips, and other transportation infrastructure in Alaska.

Aufeis is a sheet-like mass of layered ice that forms from successive ground water during freezing temperatures. Aufeis can cause flooding in areas outside the channel.

EMERGENCY FUNDING

Emergency Relief (ER) funding is available through the Federal Highway Administration to restore essential travel, minimize the extent of damage, or protect remaining facilities. Eighty-seven projects required emergency funding in Alaska from 1998 through 2015. Repair projects were required in the following categories:

Earthquake Repairs	16%	$24.8 million
Storm Repairs	32%	$50.0 million
Flood Repairs	52%	$83.2 million
		$158.0 million

Fifty percent of emergency funding is spent on projects in recurring places. Some of these reoccurring projects include:

Richardson Highway	3 projects
Copper River	4 projects
Haines Storm Damage	4 projects
Kenai Flooding	10 projects
Nome Flooding & Storm	14 projects

The number of projects by cost category:

	# of projects	Total $ in each category
$250,000 or less	31	$3.5 million
$1.0 million or less	22	$12.2 million
$10.0 million or less	36	$86.7 million
Over $10.0 million	4	$53.7 million
		$156.1 million

The major emergency event in Alaska is flooding: $83 million or 53% of emergency funding was used for flooding. $50 million or 32% was used for emergencies from storms, and $24 million or 16% was spent on emergencies resulting from earthquakes.

Sum of FED ER $		Column I								
Row Labels	IRIS #	2004	2005	2011	2012	2013	2014	2015	2016	Grand Total
COMPLETED										
CASCADE FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z554560000						100,534.80			100,534.80
CHULITNA FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z556430000						6,648.91			6,648.91
KALIFORNSKY BEACH ROAD MP 11 EMERGENCY CULVERT REPAIR AK1	Z523330000							1,228,170.29		1,228,170.29
KENAI PEN FLOOD OCT 02, PERMANENT REPAIRS, PH II	Z569380000	58,222.00	#########							158,288.99
KODIAK FLOOD REPAIR 2009, FHWA	Z523280000			1,825,045.90	(295,356.80)			(17,193.39)		1,512,495.71
NOR REG ER: NOME REPAIRS NOVEMBER 2011	Z616960000						11,447,685.78			11,447,685.78
SEWARD FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z555230000							134,315.64		134,315.64
SOLDOTNA FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z554500000						207,908.51			207,908.51
TUNUNAK DISASTER REPAIRS	Z523170000						45,485.00		(33,904.50)	11,580.50
CONSTRUCTION										
HOMER/ANCHOR POINT FY12 EMER REPAIRS FHWA AK12-2	Z555110000							8,052.50		8,052.50
NOR REG ER: DALTON HWY MP 390-414 FLOODING MARCH - MAY 201	Z607560000							2,000,000.00	1,316,893.00	3,316,893.00
NOR REG ER: NOME-COUNCIL RD MP 15-33 EMERG REPAIRS NOV 201	Z640950000								2,761,372.00	2,761,372.00
NOR REG ER: STORMS SEPT 2012 (PARKS HWY MP 240 REPAIRS 2013)	Z622830000					1,561,636.00				1,561,636.00
PALMER FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z555050000							161,084.97		161,084.97
TALKEETNA FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z554520000						4,633.64			4,633.64
WILLOW FLOOD 2012 EMER REPAIRS FHWA AK12-2	Z555180000						13,792.16			13,792.16
DESIGN										
KENAI PENINSULA SEPTEMBER 2012 FLOODING, PERMANENT REPAIRS	Z579310000						181,940.00			181,940.00
MAT-SU SEPTEMBER 2012 FLOODING, PERMANENT REPAIRS	Z571820000						245,619.00			245,619.00
NOR REG ER: NOME SEA STORM PERMANENT REPAIRS NOV 2011	Z619680000					572,019.36				572,019.36
SOUTHCENTRAL SEPTEMBER 2012 FLOODING, PERMANENT REPAIRS	Z563990000						227,425.00			227,425.00
Grand Total		58,222.00	#########	1,825,045.90	(295,356.80)	2,133,655.36	12,481,672.80	3,514,430.01	4,044,360.50	23,862,096.76

VITAL LIFELINES

Roads: Several roads in Alaska are considered economic lifelines for the development of the State of Alaska. These include the Dalton Highway, Parks Highway, Glenn Highway, Denali Highway, Richardson Highway, and the Alaska Highway.

Local lifelines are also important because many places do not have detour routes. Many locations in Alaska have one roadway to emergency services.

Ports: Alaska DOT&PF and the Army Corps of Engineers (USACE) co-sponsored the Alaska Deep Arctic Ports Study to evaluate potential deep water port locations. The arctic coast is experiencing increased vessel traffic, and new transportation routes were scoped. The City of Nome was identified as the preferred site. Non-federal sponsorship was transferred to from DOT&PF to City of Nome. USACE headquarters suspended the project in 2015 for insufficient economic justification, citing suspension of oil exploration activities in the Arctic by Royal Dutch Shell

QUALITY CONTROL

Construction work completed needs to follow plans and specifications to improve the longevity of our infrastructure. Design must account for long-term performance.

VULNERABLE ASSETS

The FHWA put together a Climate Change & Extreme Weather Vulnerability Assessment Framework so that results would be incorporated into decision-making. The Department compiled a list of assets vulnerable to climate change and extreme weather events. The list includes areas which Maintenance and Operations have routinely had to respond to during landslides, avalanches, flooding, aufeis, or extreme rain events. The Alaska Vulnerable NHS assets are listed below

IDENTIFYING EXTREME WEATHER VULNERABILITIES

Please complete the information below. State Dot's should identify current and anticipated problem locations for severe rain/flooding, extreme heat, storm surge or similar types of extreme events. **NOTE: This exercise is not limited to coastal states or areas.**

State:
Alaska

Vulnerable NHS asset (include facility name with beginning/end points)	Briefly describe type of vulnerability (recurring flooding, landslides, etc.)	Is there an operational plan in place for when this asset is compromised?	Plan to address the vulnerability, if known
Haines Hwy - 19 & 19.5 and 23 Mile / Haines	Landslide/Debris Flow	M&O responds with personnel and equipment to clear highway and debris basins adjacent to highway. When a large event happens, rental equipment is needed and additional M&O staff are mobilized from nearby stations.	We currently have a plan, however, no funding available to implement plan. Raise the Hwy and install box culverts big enough for our loaders to fit in. Engineer Hwy for material flows under the highway.
Egan Dr. - 1.17 thru 1.04 Mile / Juneau	Avalanche	No formal plan in place for this specific location. State and local government will combine efforts and respond according to standard avalanche mitigation and clearing protocols.	Last event was in 1962. M&O recently hired an avalanche forecaster that is shared between Juneau and Skagway.
Klondike Hwy 9 mile / Skagway	Avalanche	Yes, M&O has an avalanche mitigation program and equipment to handle an event.	M&O recently hired an avalanche forecaster that is shared between Juneau and Skagway.
Klondike Hwy 14 mile / Skagway	Avalanche	Yes, M&O has a avalanche mitigation program and equipment to handle an event.	M&O recently hired an avalanche forecaster that is shared between Juneau and Skagway.
Parks Hwy Mile 52 - 163.2 North	Recurring Flooding	M&O crews respond and road is closed until cleared	Plan to divert (ROW)
Glenn Hwy Mile 42 - 118.8 North	Rock slides Recurring flooding	M&O crews respond and road is closed until cleared	Plan to divert (ROW)

Vulnerable NHS asset (include facility name with beginning/end points)	Briefly describe type of vulnerability (recurring flooding, landslides, etc.)	Is there an operational plan in place for when this asset is compromised?	Plan to address the vulnerability, if known
Seward Hwy Mile 3 - 8 South	Recurring Flooding	M&O crews respond and road is closed until cleared	No current correction plan
Sterling Hwy Milepost 57 Anchor Point	Culvert Flooding ice & Debris	M&O crews respond and road is closed until cleared	No current correction plan
N end Dalton Hwy, ~MP 379-414	Aufeis/Breakup/Flooding-Road Washout	M&O crews respond. Close Rd-No Detour. Fly or rolligon supplies to Prudhoe Bay	Raise grade (projects), Hydro study
Richardson Hwy, Lowe Canyon MP 12-17	Flooding-Road Washout Avalanche/Dam Flooding	M&O crews respond. Close Rd-No Detour. Barge and/or fly supplies to Valdez. Also utilize the AMHS to help support needs	None, ICS for Emergency Response Avalanche Control Severe
Nenana Canyon, Parks Hwy MP 239-242	Extreme Rain could trigger rockfall/landslide Flooding-Nenana River erosion/Washout Rd	M&O crews respond. Close Rd-Detour 100's of miles	Temporary rockfall stabilization in current project-needs permanent solution. Closure would be Severe
Yukon River Bridge, Dalton Hwy MY 56	Extreme Rain-could trigger landslide like 2012	Crisis. No Detour, all commerce north cut-off until bridge replaced. Possible barge/hovercraft crossing. TAPS	Alt Bridge Location Study (in progress), Ongoing slope monitor. Loss of bridge would be Catastrophic
Richardson Hwy MP 113 Slide	Extreme Rain to Accelerate Slide	Close Rd until Detour established around damage. M&O would respond and utilize rental equipment as needed	Realignment project needed
Richardson Hwy, near Valdez MP 4-5	Flooding/Lowe River Erosion	Close Rd-No Detour. Barge/fly supplies Valdez and utilize AMHS to support needs. M&O would respond and utilize rental equipment as needed	Grade raise project needed

Risk "If-then" statements

The guidance recommends taking every risk identified and writing an "if-then" statement. If *X* happens then Y will occur. DOT&PF has taken risks identified and turned them into an "if-then" statement.

If we have problems with the bridge or pavement management systems, *then* we will not be able to forecast our future conditions or transmit the necessary data needed for life cycle planning and investment scenarios.

If the funding to meet out targets decreases, *then* we will not meet our targets or we will need to fund existing infrastructure instead of providing community connections via new infrastructure.

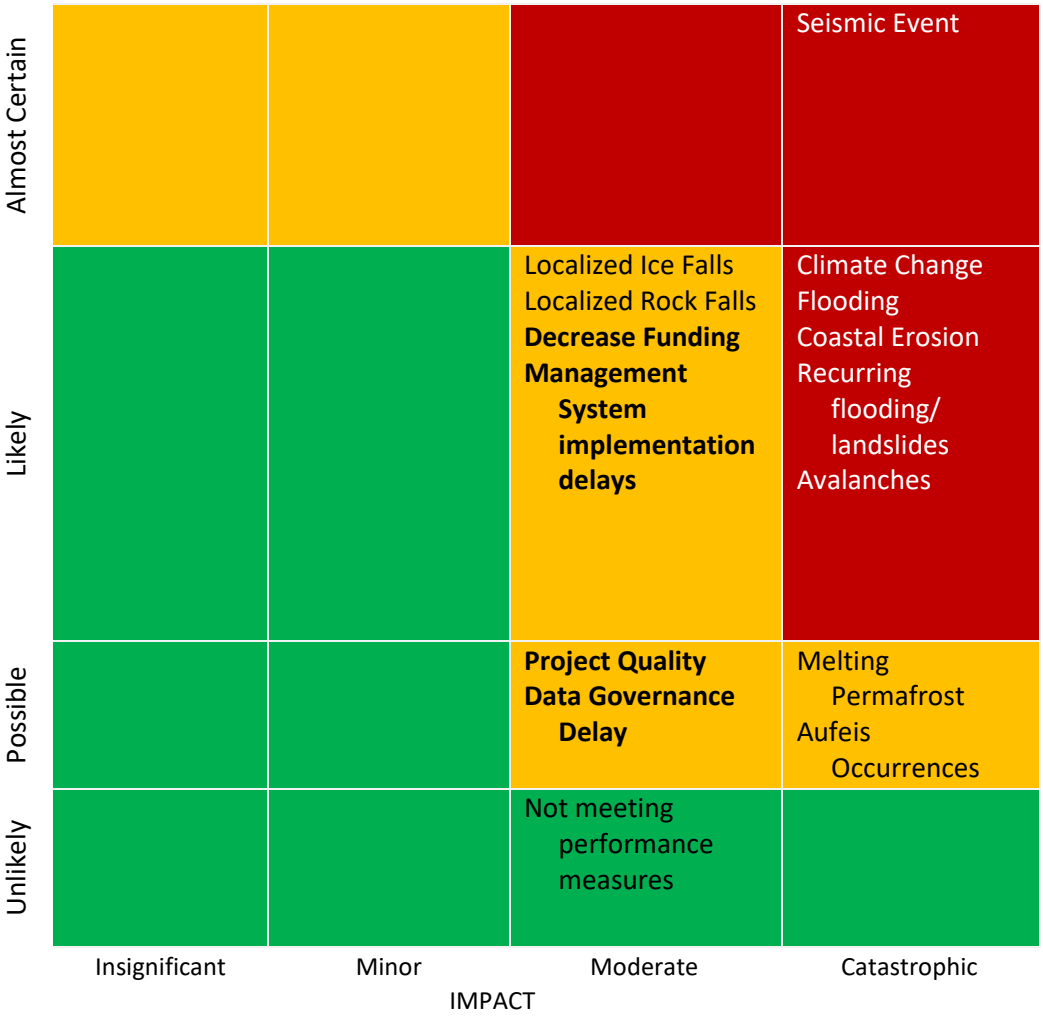
If we do not fund infrastructure to withstand seismic activities, *then* when a seismic event happens areas, people may be hurt infrastructure if it fails. Communities may be isolated and not able to travel and get resources in and out of communities.

If we do not prepare adequately for climate change, *then* we will waste funding by constructing new facilities that cannot adapt or we will be increasing emergency funding. Either is an inefficient use of public dollars.

If we do not identify and plan for vulnerable assets, *then* excessive damage to the roadway (increasing costs) and unsafe conditions may occur.

Step 3 Analyze the Risks

The next step is to analyze the likelihood and impact of each risk statement from each risk listed in the risk registry in Step 2. This most common way of presenting this is using a matrix. Each risk is evaluated to determine the likelihood of it occurring and how bad would it be if it occurred. The matrix below includes all risks in the risk registry.



Step 4 Evaluate and Prioritize Risks

Using the matrix in Step 3, DOT&PF prioritize risks based on Risk Tolerance. DOT&PF can respond to risk in one of four ways: 1) Mitigate; 2) Transfer; 3) Avoid; or 4) Accept.

To mitigate is to try to minimize either the probability of the risks happening or the impact. *To transfer* is when to transfer the risk to a third party to manage it. It does not eliminate the risk; it only transfers the responsibility of managing the risk. *To avoid* is when to try to eliminate the risk or its impact. And *to accept* is to account for the impact of the risk.

Step 5 Mitigation Strategies for Risk

RISK REGISTRY

Program Area/Activity	Impact	Mitigation Response Strategy	Step 3
Funding Data/Management Systems	Decrease Funding	Reduce spending on expansion	
	Performance Measures -pavement -bridge	1. Implementing Pavement Management System and the Bridge Management System	
Climate Change	Flooding	1. Statewide coordination of Hydrologists 2. Design new bridges to 50 year flood event and floodway areas to a 100 year flood event	
	Coastal Flooding/Erosion	Accept	
	Ice Falls	1. Developed hazard index and mitigation strategies	
	Avalanches	1.Forecasters, M&O avalanche projects 2.Pooled fund research project	
	Rock Falls	1. Developed Geotechnical Asset Management Plan	
	Permafrost/aufeis	1. Research Project assessing areas of concern for aufeis. 2. Have map of historical permafrost linked to conditions	
Seismic	Reduced bridge integrity	1.Bridge Seismic Retrofit Program 2.Upgrade new bridges to current seismic standard 3. Stay up to date on current seismic practices	
Vulnerable Assets	Recurring flooding/landslides	1.Most plans have been prepared, but funding is not available to implement plan	

The following provides details on specific programs to mitigate risks. By the June 2019 TAMP, all risks that have mitigation solutions plans will be detailed here.

Seismic Bridge Retrofit Program

The Department implemented a seismic retrofit program for Alaska bridges in 1995, using seismic hazard data from the U.S. Geological Survey. Together with a seismic vulnerability assessment of Alaska bridges and a determination of priority routes, this data has resulted in the prioritization of bridges for seismic retrofit.

Consistent with national standards adopted by the American Association of State Highway Transportation Officials (AASHTO) and the FHWA, the Department retrofits bridges in an attempt to prevent collapse during an earthquake. Public safety is the foremost consideration. The Department designs new bridges to the "no collapse" standard contained in the current AASHTO specifications. The 2012-2015 State Transportation Improvement Plan programmed $6 million over three years to implement the Seismic Bridge Retrofit program. This program is continuing at the funding level.

For more information on this program, review the 2013 annual bridge report at: http://www.dot.alaska.gov/stwddes/desbridge/assets/pdf/2013bridgereport.pdf

Geotechnical

The Geotechnical Asset Management program is an important element of the overall implementation of best transportation asset management practices for the Alaska DOT&PF. This program defines the role that geotechnical assets take in both primary roles like rock slopes, and in supporting roles such as embankments supporting pavement structure. The research for this project will take the Department many steps forward in understanding the characteristics of geotechnical assets as to the length of service life, condition during service, appropriate service levels and performance measures, incorporation of risk management, determination of life cycle costs, identification of critical data elements required, and development of the means to store and use the data in support of a decision-support framework for managing our

transportation system. The results of the GAM research can be particularly valuable for addressing asset management plan requirements under 23 CFR Part 515, such as 1) developing mitigation plans for top-priority risks and identifying monitoring approaches; and 2) providing a summary of evaluations of evaluations of facilities repeatedly damaged by adverse events. Further, as geotechnical assets represent a critical and costly aspect of risk management needs for the Department, it is recommended that the Department leverage the federal funding allowances in 23 CFR Part 119, for applications to risk reduction measures targeting geotechnical assets.

Steps 6 and 7 Monitor, communicate and consult about the risks and carry out risk plan

DOT&PF will hire a contractor to further develop our Risk Mitigation Plan for top priority risks. The DOT&PF will monitor this plan annually and update the Risk registry using the same process every four years with the submittal of the TAMP.

Risk Mitigation Plan for top priority Risks

Contractor will put together a Risk Mitigation Plan for June 2019 version.

Appendix H:

Financial Plan

Background

Federal rulemaking published October 2016 requires state DOTs to prepare a 10-year Financial Plans as part of their Transportation Asset Management Plans. Both MAP21 and the regulations state that the TAMP is one of a series of plans required as part of the Performance management. The TAMP is the connection between long-term planning (Long Range Transportation Plan) and the short-term planning (Statewide Transportation Improvement Plan).

The Department of Transportation and Public Facilities (DOT&PF) used Federal Highway Administration's November 2017 guidance document *Developing TAMP Financial Plans.* The DOT&PF also participated in a GAP analysis completed by a FHWA contractor in January 2018 and participated in an Asset Management Workshop on Life Cycle Planning, Risk Management and Financial Plan to Support the Implementation of Asset Management Plans on March 29, 2018.

This Appendix describes the process the DOT&PF completed to develop the TAMP Financial Plan.

Step 1. Identify Available Income

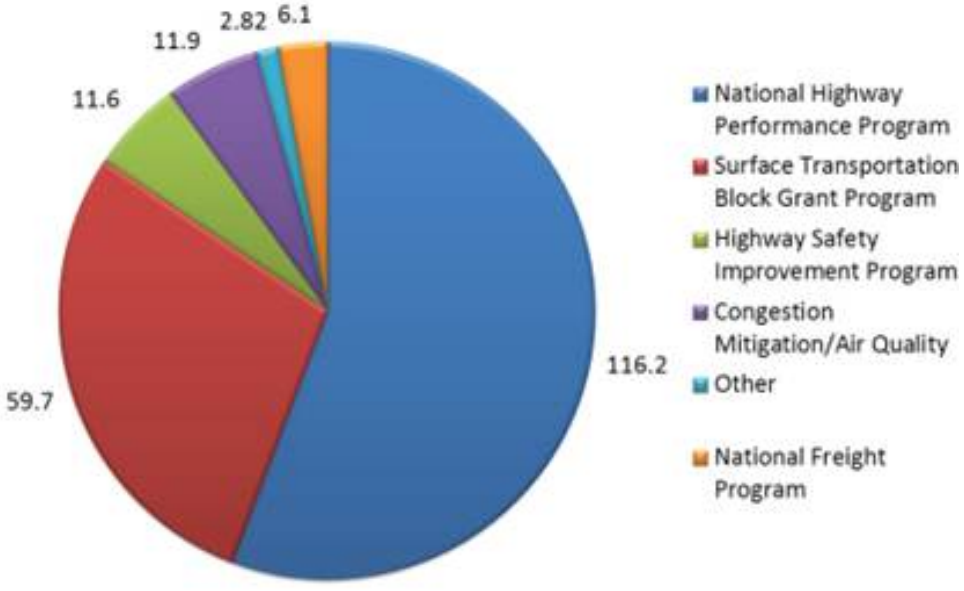
Transportation funding in Alaska is a combination of federal funds, state general funds, and Alaska Marine Highway System revenues. Of these, the federal highway program funds form the majority of the available funds. Uncertainty over federal funds has been a major source of concern for state DOTs around the country, but more so for Alaska DOT, which is heavily reliant on those funds. After more than a decade without a reliable source for transportation funding, the U.S. Congress finally passed a long term transportation bill with associated funding. The Fixing America's Surface Transportation

(FAST) Act, signed into law December 4, 2015, authorizes federal highway, highway safety, transit, and rail programs for five years.

Virtually all of the highway funding that DOT&PF uses comes from Federal Highway Administration. The spending plan is described in the Statewide Transportation Improvement Plan (STIP), a 'blueprint' for federally funded surface transportation projects and programs for the next four years. The projects in the STIP are the mainstay of the state's commitment to create an efficient and reliable transportation system.

State-funded projects are not included in the STIP but can be found in the legislature's approved budget for each state fiscal year. These are normally state-funded bonds that are connected to infrastructure that supports resource development.

The FAST Act is good news for Alaska, providing a stable source of funding for transportation infrastructure for the next five years. That said, the current and forecast levels of funding are still lower than those required to meet all identified needs and will therefore require making some difficult decisions in the future, similar to the last decade.

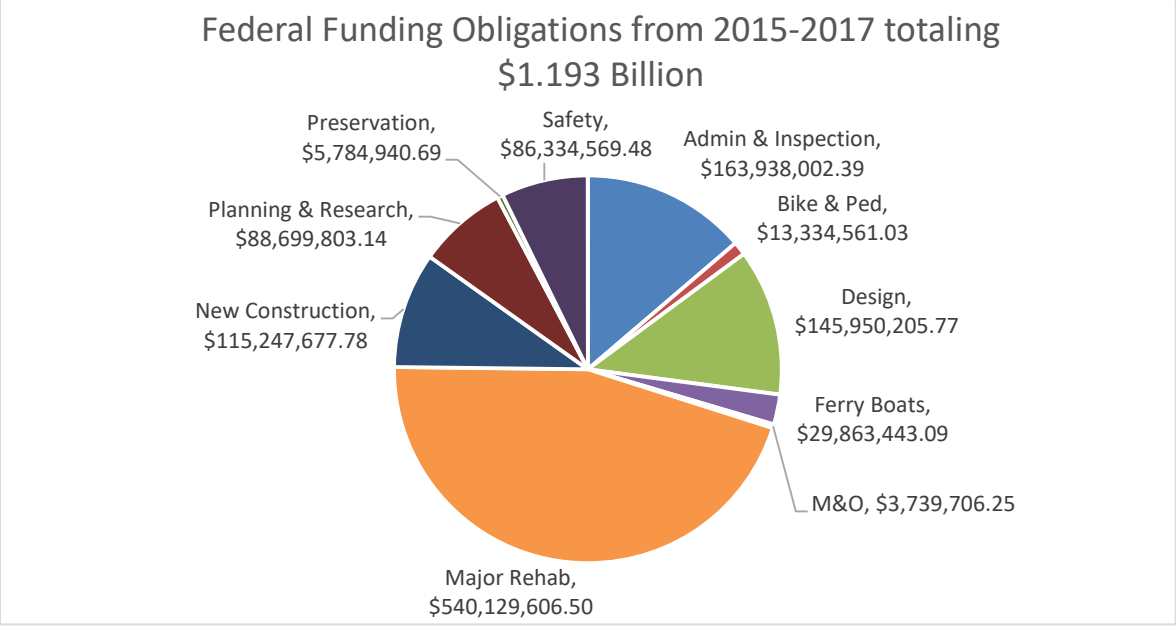


FAST ACT Funding for Alaska FY 2016-2020 in Millions.

DOT&PF uses preventative maintenance funding to maintain pavement and bridge condition meeting our targets and national goals. DOT&PF projects in the STIP reconstruct, replace or major rehabilitate bridges and pavements. In the future, DOT&PF will evaluate investment in bridges and pavements by other funding sources such as Freight and Highway Safety Improvement Program.

	NHPP	NHPP Freight	NHPP Exempt	Total estimated NHPP available
FFY18	$264,304,838	$13,651,074	$8,201,405	$286,157,317
FFY19	$269,590,935	$13,924,095	$8,365,433	$291,880,463
FFY20	$274,982,753	$14,202,577	$8,532,742	$297,718,073
FFY21	$280,482,409	$14,486,629	$8,703,397	$303,672,434
FFY22	$286,092,057	$14,776,362	$8,877,465	$309,745,883
FFY23	$291,813,898	$15,071,889	$9,055,014	$315,940,800
FFY24	$297,650,176	$15,373,327	$9,236,114	$322,259,616
FFY25	$303,603,179	$15,680,793	$9,420,836	$328,704,809
FFY26	$309,675,243	$15,994,409	$9,609,253	$335,278,905
FFY27	$315,868,748	$16,314,297	$9,801,438	$341,984,483
FFY28	$322,186,123	$16,640,583	$9,997,467	$348,824,173

The following graph shows how the DOT&PF has obligated its funds for the previous three years (2015-2017).



The greatest known risk to Alaska's transportation network is the lack of adequate funding needed to preserve and maintain existing infrastructure while expanding the system to meet needs. Local governments rely on federal funding for their local roads since any road in Alaska is eligible for federal participation on projects. Other than Hawaii, the other 48 states can only use federal funding on the National Highway System. There is a lack of local funding for improvements on collector and local roads. Local communities look to the state to use federal funding on local roads. We do not use State Transportation Program Funds on the National Highway System so we are only including the National Highway Preservation Program funding which the state matches.

Programmed in Current draft STIP

Fund Code	Fund Code Definition		2018	2019	2020	2021
Federal FC						
CMAQ-F	Congestion Mitigation/Air Quality Flexible		$ 1,464,576	$ 1,100,696	$ 1,100,696	$ 1,555,546
CMAQ-M	CMAQ Mandatory		$ 15,724,913	$ 11,443,125	$ 10,016,123	$ 10,068,667
DBE	Disadvantaged Business Enterprise Program		$ 170,000	$ 170,000	$ 170,000	$ 170,000
NHPP	National Highway Performance Program		$ 295,263,412	$ 293,188,093	$ 324,719,772	$ 312,450,480
OJT	On The Job Training		$ 55,000	$ 55,000	$ 55,000	$ 55,000
PLNG	Planning Funds		$ 6,778,023	$ 6,778,023	$ 6,778,023	$ 6,778,023
RES	Research (HPR) 25%		$ 2,390,220	$ 2,399,317	$ 2,226,474	$ 2,226,474
RHE	Rail Hazard Elimination		$ 1,180,000	$ 1,200,000	$ 1,230,000	$ 1,230,000
RTP	Recreational Trails Program		$ 1,332,654	$ 1,332,654	$ 1,332,654	$ 1,332,654
S148	Safety Sanction		$ 22,560,000	$ 23,010,000	$ 23,490,000	$ 23,490,000
SA	Safety		$ 31,808,500	$ 32,388,500	$ 33,048,500	$ 33,048,500
STP	Surface Transportation Program		$ 147,051,185	$ 163,127,722	$ 145,014,229	$ 170,486,639
TAP	Transportation Alternatives Program	*	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000
URPL	Metropolitan Planning		$ 2,067,000	$ 2,067,000	$ 2,067,000	$ 2,067,000
Total			**$ 531,845,483**	**$ 542,260,130**	**$ 555,248,471**	**$ 568,958,983**
Estimated Highway Formula Apportionment (FAST Act)			**$ 530,336,370**	**$ 542,306,359**	**$ 555,294,332**	**$ 569,176,690**
Other Federal						
FBF	Ferry Boat Formula	*	$ 27,908,805	$ 11,240,000	$ 20,900,000	$ 4,940,000
FLAP	Federal Lands Access Program		$ 11,515,850	$ 405,817		
Total			**$ 39,424,655**	**$ 11,645,817**	**$ 20,900,000**	**$ 4,940,000**
AC/ACC						
AC	Advance Construction Projects		$ 420,525,272	$ 271,790,515	$ 300,816,652	$ 321,235,846
ACC	Advanced Construction Conversion/Payback		$ (156,060,097)	$ (230,146,582)	$ (244,733,049)	$ (253,819,872)
Total			**$ 264,465,175**	**$ 41,643,933**	**$ 56,083,603**	**$ 67,415,974**
Illustrative						
ILLU	Illustrative - Fund Place Holder			$ 3,400,000		
Total			**$ -**	**$ 3,400,000**	**$ -**	**$ -**
Emergency Repairs						
ER	Emergency Repair Funds		$ -	$ -	$ -	$ -
Total			**$ -**	**$ -**	**$ -**	**$ -**
State						
BOND	General Obligation Bonds		$ 17,997,443		$ 8,480,391	
CST	Cruise Ship Tax		$ 1,691,500	$ -	$ -	$ -
OSF	Other State Funds		$ 22,000,000	$ 2,725,000	$ 10,000,000	
Total			**$ 41,688,943**	**$ 2,725,000**	**$ 18,480,391**	**$ -**
Match						
3PF	Third Party Funds		$ 20,144,226	$ 16,117,692	$ 14,580,051	$ 14,615,832
SM	State Match		$ 66,589,340	$ 61,239,748	$ 59,541,727	$ 59,703,046
Total			**$ 86,733,566**	**$ 77,357,440**	**$ 74,121,778**	**$ 74,318,878**
Transit						
5307	FTA Urban Formula		$ 400,000	$ 200,000	$ 200,000	$ 200,000
5307RR	FTA Urban Rail Setaside		$ 10,420,000	$ 11,795,000	$ 12,070,000	$ 15,240,000
5310	Transit Elderly/Disabled		$ 230,500	$ 230,500	$ 230,500	$ 230,500
5311	Transit Rural Cap & Ops		$ 8,323,545	$ 8,323,545	$ 8,323,545	$ 8,323,545
5337GR	Sec. 5337 State of Good Repair		$ 24,200,000	$ 23,950,000	$ 24,250,000	$ 21,550,000
5339	Bus and Bus Facilities		$ 2,158,130	$ 1,750,000	$ 1,750,000	$ 1,750,000
Total			**$ 45,732,175**	**$ 46,249,045**	**$ 46,824,045**	**$ 47,294,045**
Estimated FTA Funding Available (Includes Prior Year Funds)			**$ 50,195,672**	**$ 50,195,672**	**$ 50,195,672**	**$ 50,195,672**
Earmark						
EMRK	Earmark Funds		$ 52,730,736	$ 56,129,669	$ 8,618,141	
Total			**$ 52,730,736**	**$ 56,129,669**	**$ 8,618,141**	**$ -**
Grand Total			**$ 1,062,620,733**	**$ 781,411,034**	**$ 780,276,429**	**$ 762,927,880**

Step 2 Estimating the Funding Needs

The Long Range Transportation Plan includes needs from a number of borough/municipal and regional plans that identify projects priorities for the development of the transportation system. Since the plans were prepared between 2001 and 2015, each plan's costs were inflated to present the needs in current dollars. An inflation factor of 3 percent per year was used to bring the plan costs up to 2018 dollars. Highway needs total over $6 billion and translate to at least $265 million per year for 23 years. This is for the entire system National Highway System and non NHS. It includes new road connections, mobility, ferry system and preservation of existing assets.

Bridge needs total over $27 million and translate to at least $1.35 million per year.

DOT&PF will estimate the pavement and bridge needs for a tem year period using the management systems once they are operational.

Step 3 Quantify the Funding GAP

DOT&PF does not anticipate having a funding gap to meet state targets and federal goals. DOT&PF targets are the state of good repair and we will fund the pavement and bridge on NHS as forecasted by the management systems and using professional judgement. DOT&PF does anticipate a funding gap to fund our other priorities such as community connections and ferry system needs. Results Based Alignment and Project Selection Criteria will enable us to manage this shift from worst first for existing infrastructure and expansion without performing a Life cycle Cost Analysis.

Step 4 Selecting an Investment Strategy

DOT&PF will select an investment Strategy using the following process:

- Review the Risk Management strategies, Life Cycle Cost scenarios, and funding distributions that cover the state of good repair or federal performance targets and national goals.
- Prioritize preservation before more costly rehabilitation and reconstruction projects.
- Anticipate funding gaps to reach goals. We plan to use innovative techniques for pavement preservation especially to respond to high level of rutting on our roads.
- Improve efficiency to free up money for additional preservation or other priorities.
- Communicate this funding level to external and internal stakeholders who have the opportunity to comment on this funding level.
- Develop an agency self-assessment to implement the investment strategies and any risks to that implementation. Risks may include changes in management, organization structure does not support asset management objectives and performance management or life cycle planning, knowledge or technology gaps or proven inaccurate assumptions.

Appendix I:

Investment Strategies

"Investment Strategy" is defined in 23 CFR 515.5 as a set of strategies that result from evaluating various levels of funding to achieve state DOT targets for asset condition and system performance effectiveness at a minimum practicable cost while managing risks.

The policies and goals laid out in the Long Range Transportation Plan: *Let's Keep Moving 2036* (LRTP 2036) and the life cycle planning, risk management, and financial planning processes described in this TAMP document contribute to the investment strategies DOT&PF will be used to achieve national goals, statewide targets, and a state of good repair.

- *Continue to invest at historical funding levels:* As described in earlier sections of this document, Alaska's NHS routes currently meet national goals as well as recently set statewide targets. This suggests that historical investments have been sufficient and that investment of similar funding levels will continue to keep Alaska's NHS system in a state of good repair. As more data becomes available, the Department may further target funding allocations by work types. Additionally, the Department will continue to monitor whether this funding level remains sufficient or needs adjusting.
- *Implement LRTP 2036 goals and policies:* The LRTP includes eight policy areas for which investment of limited resources is needed. The Department's investment strategies will consider all of the following policy areas with an understanding that available funding resources will need to be balanced to target an appropriate level of investment in each area.

Policy Area	Goal Description
New Facilities	Develop new capacity and connections that cost-effectively address transportation system performance
Modernization	Make the existing transportation system better and safer through transportation system improvements that support productivity, improve reliability, and reduce safety risks to improve performance of the system
System Preservation	Manage the Alaska Transportation System to meet infrastructure condition performance targets and acceptable levels of service for all modes of transportation
System Management and Operations	Manage and operate the system to improve operational efficiency and safety
Economic Development	Promote and support economic development by ensuring safe, efficient, and reliable access to local, national, and international markets for Alaska's people, goods, and resources, and for freight-related activity critical to the State's economy
Safety and Security	Improve transportation system safety and security
Livability, Community, and the Environment	Incorporate livability, community, and environmental considerations in planning, delivering, operating, and maintaining the Alaska Transportation System
Transportation System Performance	Ensure broad understanding of the level, source, and use of transportation funds available to DOT&PF; provide and communicate the linkages between this document, area transportation plans, asset management, other plans, program development, and transportation system performance

LRTP 2036: Exhibit 7, page 12

- *Select projects using a data-informed approach:*
    - Asset management systems (such as Pavement and Bridge Management Systems) and processes will primarily be used to select preservation focused projects, with the intent of achieving the system preservation policies and actions included in the LRTP 2036, as well as the pavement and bridge condition performance measure areas.
    - A more nuanced approach will be used to select projects on the NHS that are intended to achieve the remaining policy areas and actions, and performance measure areas, such as modernization, freight and safety. For the 2018-21 STIP, a data informed approach was used to guide

decisions for programming NHS projects. This process is outlined below. Moving forward, this process will be further refined and may include multiple sets of criteria and standards, related to the various policy areas and/or national performance measures for which a project will primarily contribute.

2018-2021 STIP, NHS Project Evaluation Process

NHS Evaluation Standards and Criteria were developed for the following four areas: Safety, Pavement Condition, Bridge Condition, and Traffic.

Projects may also have been awarded additional points for Unique Benefits not otherwise rated. Examples include geo-technical concerns, leveraging of other funds, environmental readiness, and projects located within safety corridors.

A programming meeting was held in November 2017 and included representatives from Program Development & Statewide Planning and Pre-Construction. Projects were discussed in priority order, pertaining to their scores. Unique benefits points for projects were reviewed, discussed, and revised as necessary.

High scoring projects were generally programmed according to their project development schedule, while mid-low scoring projects were programmed in subsequent years. Regardless of score, priority was afforded to projects in the development phases to keep the projects progressing towards construction (i.e. Design and ROW). Additionally all projects were allowed flexibility to move up or down the priority list according to professional judgement given that the scoring process and data analysis tools are still in early development stages.

Future process improvements may include additional evaluation standards to capture some of the common unique benefits categories; revision of criteria, including the safety evaluation criteria; consideration of multiple tiers of NHS evaluation standards and criteria to allow projects to compete against like projects and to allow criteria to be tailored to the policy area and or performance measure being targeted; and alternative considerations given to existing projects vs. new projects.

- *Show how projects contribute to performance management in the published STIP document*: Projects that are intended to support national goals, statewide targets, and a state of good repair will be identified in the STIP. Projects will be linked to the following performance management areas: safety, pavement condition, bridge condition, travel time, freight travel time, and air quality Project work

types (system preservation, reconstruction, etc.) included in the STIP document will also aid in linking programmed projects to both performance management goals and LRTP policy areas.

Process for development of investment strategies:

- Review of existing ADOT&PF goals, policies, and actions, particularly the LRTP 2036.
- Review of internal processes related to programming decisions.
- Review and analysis of existing pavement and bridge condition relative to national goals and statewide targets.
- Review of recent historic funding availability and programming decisions.
- March 29, 2018 Asset Management Workshop on Life Cycle Planning, Risk Management, and Financial Plans to Support the Implementation of Asset Management Plans that helped put all information together.
- Remaining process – Upon completion of life-cycle planning, risk analysis, and financial plan, determine whether additional or more refined investment strategies are necessary.