

# Wyoming Department of Transportation (WYDOT)



## Transportation Asset Management Plan

2018



Mark Gordon  
Governor

# WYOMING Department of Transportation

"Providing a safe, high quality, and efficient transportation system"

5300 Bishop Boulevard, Cheyenne, Wyoming 82009-3340



K. Luke Reiner  
Director

June 24, 2019

Bryan Cawley, Division Administrator  
Federal Highway Administration  
2617 E. Lincolnway, Suite D  
Cheyenne, WY 82001-5671

Dear Mr. Cawley:

In compliance with the Moving Ahead for Progress in the 21<sup>st</sup> Century Act (MAP-21), as codified in 23 U.S.C. 119, the Wyoming Department of Transportation (WYDOT) is proud to submit our final certified Transportation Asset Management Plan (TAMP) to the Federal Highway Administration (FHWA).

If you have any questions or comments, please let us know.

Sincerely,

K. Luke Reiner  
Director, WYDOT

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## I. ENABLING LEGISLATION

The Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) Act (passed in July 2012) requires states accepting federal funds to create a Transportation Asset Management Plan (TAMP)—a risk-based asset management plan that establishes asset groups and performance targets for each group. Compared to past transportation legislation, MAP-21 requires more performance analysis and overall administration; however, MAP-21 reduced category-specific funding areas (from 13 to six), allowing more flexibility in how states direct available funding. The Fixing America's Surface Transportation (FAST) Act (passed in December 2015) added a seventh funding area but did not change the TAMP and performance requirements previously defined in MAP-21.

As part of MAP-21, the National Highway Performance Program (NHPP) mandates that states develop a risk-based asset management plan for the roads on the National Highway System (NHS). Plans must include the following six elements:

- 1) Inventory and condition of pavement and bridge assets on the NHS,
- 2) Asset management objectives and measures,
- 3) Performance-gap analysis between goals and condition,
- 4) Life-cycle cost and risk-based management analyses,
- 5) Financial plan for the future, and
- 6) Investment strategy.

In addition to the preceding requirements, the TAMP must address risk to the transportation system.

If a state fails to meet the minimum conditions for pavement or bridges outlined in MAP-21, the following requirements for funding distribution shall be imposed:

*(f) INTERSTATE SYSTEM AND NHS BRIDGE CONDITIONS.—*

*(1) CONDITION OF INTERSTATE SYSTEM.—*

*(A) PENALTY.—If a State reports that the condition of the Interstate System, excluding bridges on the Interstate System, has fallen below the minimum condition level established by the Secretary under section 150(c)(3), the State shall be required, during the following fiscal year—*

*(i) to obligate, from the amounts apportioned to the State under section 104(b)(1), an amount that is not less than the amount of funds apportioned to the State for fiscal year 2009 under the Interstate maintenance program for the purposes described in this section (as in effect on the day before the date of enactment of the MAP-21), except that for each year after fiscal year 2013, the amount required to be obligated under this clause shall be increased by 2 percent over the amount required to be obligated in the previous fiscal year; and*

*(ii) to transfer, from the amounts apportioned to the State under section 104(b)(2) (other than amounts sub allocated to metropolitan areas and other areas of the State under section 133(d)) to the apportionment of the State under section 104(b)(1), an amount equal to 10 percent of the amount of funds apportioned to the State for fiscal year 2009 under the Interstate maintenance program for the purposes described in this section (as in effect on the day before the date of enactment of the MAP-21).*

*(B) RESTORATION.—The obligation requirement for the Interstate System in a State required by subparagraph (A) for a fiscal year shall remain in effect for each subsequent fiscal year until such time as the condition of the Interstate System in the State exceeds the minimum condition level established by the Secretary.*

(2) *CONDITION OF NHS BRIDGES.*—

(A) *PENALTY.*—*If the Secretary determines that, for the 3-year-period preceding the date of the determination, more than 10 percent of the total deck area of bridges in the State on the National Highway System is located on bridges that have been classified as structurally deficient, an amount equal to 50 percent of funds apportioned to such State for fiscal year 2009 to carry out section 144 (as in effect the day before enactment of MAP-21) shall be set aside from amounts apportioned to a State for a fiscal year under section 104(b)(1) only for eligible projects on bridges on the National Highway System.*

(B) *RESTORATION.*—*The set-aside requirement for bridges on the National Highway System in a State under subparagraph (A) for a fiscal year shall remain in effect for each subsequent fiscal year until such time as less than 10 percent of the total deck area of bridges in the State on the National Highway System is located on bridges that have been classified as structurally deficient, as determined by the Secretary.* [§1106; 23 USC 119(f)]

## II. WYOMING DEPARTMENT OF TRANSPORTATION MISSION, VISION, AND GOALS FOR ASSET MANAGEMENT

The Wyoming Department of Transportation's (WYDOT's) mission is to "Provide a safe, high quality, and efficient transportation system" in Wyoming. To help define its mission, WYDOT established the following six goals:

- 1) Improve safety on the state transportation system,
- 2) Serve our customers,
- 3) Take care of all physical aspects of the state transportation system,
- 4) Improve agency efficiency and effectiveness,
- 5) Develop and care for our people, and
- 6) Exercise good stewardship of our resources.

WYDOT's mission statement and goals support the MAP-21 asset management approach for transportation improvements and funding distribution. Wyoming considers the six elements of MAP-21 directly related to WYDOT's mission and goals and essential for properly managing physical infrastructure. WYDOT's TAMP especially focuses on the goal to "Take care of all physical aspects of the state transportation system" through emphasizing the maintenance of existing pavement and bridge conditions. The annually produced *Wyoming Transportation Facts Book* contains information on current conditions (available through the following link).

[http://www.dot.state.wy.us/home/administration/strategic\\_performance/fact\\_book.html](http://www.dot.state.wy.us/home/administration/strategic_performance/fact_book.html)

WYDOT uses a Balanced Score Card (BSC) to gauge its effectiveness and document targets and measures for the bridge and pavement conditions on the interstates, NHS, and non-NHS. For WYDOT's fourth BSC goal, "Take care of all physical aspects of the transportation system," WYDOT addresses the MAP-21 elements of (1) listing asset inventory and conditions, (2) stating asset management objectives and measures, and (3) providing a performance-gap analysis (see Appendix C for the complete BSC). Through this TAMP, WYDOT will provide inventory and measurement of the system, list pavement and bridge asset conditions, generate goals, and offer a performance-gap analysis between goals and conditions.

Further, WYDOT demonstrates the MAP-21 element of life-cycle cost analysis through its goal to “Improve agency efficiency and effectiveness” using life-cycle cost analysis and recognizing annual maintenance costs to infrastructure. Finally, WYDOT meets Congress’ requirements to have processes for financial plans, investment strategies, risk, and resilience through WYDOT’s goal to “Exercise good stewardship of our resources.” WYDOT strives to ensure that the financial future is accurately predicted with a funding split to maintain our assets in proper condition. WYDOT recognizes the risks that are inherent with future predictions and analyzes reasonable alternatives.

## DEFINING ASSET MANAGEMENT

### AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) DEFINITION OF ASSET MANAGEMENT

*“Asset Management is a strategic and systematic process of operating, maintaining, upgrading and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based upon quality information and well defined objective.”* (NCHRP Report 632, National Cooperative Highway Research Program, 2009)

### MAP-21 DEFINITION OF ASSET MANAGEMENT

*“The term “asset management” means a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost.”* [23 USC, Sec. 101 (a) (2)].

### WYDOT AND ASSET MANAGEMENT

The objective for WYDOT’s asset management program is to maintain the overall transportation system’s condition at the highest possible level given finite funding. WYDOT’s asset management strategy consists of using existing pavement, bridge, and safety management system software to analyze each system individually; determine the best point to apply a rehabilitation treatment in each asset’s life cycle; then run multiple scenarios, using various funding and rehabilitation strategies, to determine the best mix of preservation projects for Wyoming’s transportation network. The investment strategies outlined in this plan establish a methodology for resource allocation that generates the greatest return on investment, promotes system-wide asset sustainability, and facilitates progress towards the achievement of national performance goals. The seven MAP-21 national performance goals relate to infrastructure management, safety enhancements, congestion mitigation, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays.

WYDOT has adopted an asset management strategy due to an ageing transportation system combined with inflation that has reduced WYDOT’s effective funding level (see Section V for more information on how WYDOT reached this conclusion). By applying the correct treatments at an optimal time, WYDOT can meet its objective.

WYDOT performs asset management activities on many asset classes not currently included in this TAMP. The next, most probable, addition to WYDOT’s TAMP will be the Safety Management System. Safety-related items have a significant impact on WYDOT’s project costs while contributing to the overall safety of the traveling public. The construction and maintenance of safety-related assets accounts for approximately 10 percent of all expenditures currently programmed in the State Transportation Improvement Program (STIP). The Traffic and Maintenance programs currently maintain inventories of these assets. WYDOT is refining data collection methods and ensuring that the asset inventories are as complete as possible to increase their maturity levels.

*The objective of WYDOT’s asset management system is to minimize the life-cycle cost of the infrastructure while maximizing its value with constrained fiscal funding.*

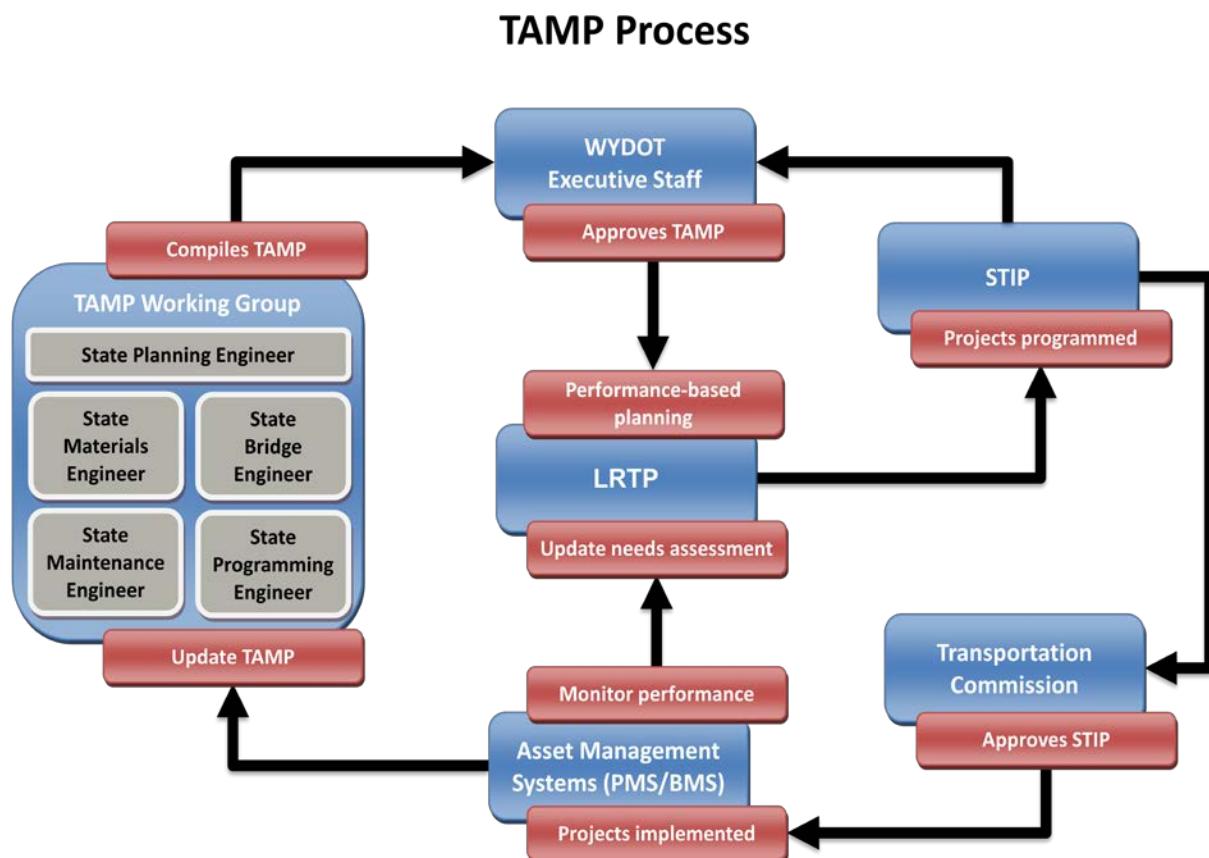
WYDOT's program managers coordinate and compile the TAMP and the future revisions. The structure for constructing the plan is as follows (see Table 1):

*Table 1: TAMP Working Group*

TAMP Working Group	Role in Compiling the TAMP
<b>State Planning Engineer</b>	Serves as executive of the TAMP working group
<b>State Materials Engineer</b>	Compiles Section IV, Statewide Pavement Condition and Programs
<b>State Bridge Engineer</b>	Compiles Section V, Statewide Bridge Condition and Programs
<b>State Maintenance Engineer</b>	Documents the life-cycle cost of the assets
<b>State Programming Engineer</b>	Compiles Section VI and VII, Financial Plan and Investment Plan and generates the draft document.
<b>WYDOT executive staff provides guidance and approves the TAMP</b>	

The TAMP is a “living” document that WYDOT will review and update regularly in coordination with the implementation of WYDOT’s management systems. Figure 1 below is an overview of the WYDOT TAMP process.

*Figure 1: TAMP Process*



### III. STATEWIDE PAVEMENT INVENTORY, CONDITIONS, AND PROGRAMS

The Pavement Management Section in the Materials Program manages the inventory and condition of WYDOT-maintained roads using the Pavement Management System (PMS). The PMS uses a highly specialized asset management software package with Agile Assets. This software module allows data storage and various pavement section analyses in the pavement management module (see Section V for more information on the PMS).

WYDOT divides the road network into three roadway categories (described below):

**INTERSTATES:** High speed, typically four-lane, divided and controlled access roadways that carry the highest traffic volumes and the most freight load.

**NON-INTERSTATE NHS:** Federally designated roadways that are functionally classified as principal arterials and expressways but not as interstates.

**NON-NHS:** The remaining roadways that the state manages.

#### PAVEMENT INVENTORY AND CONDITION ASSESSMENT

*WYDOT manages 6,530 centerline miles of the state-owned highway network.*

The Wyoming state-owned highway network consists of 6,806 centerline miles, including NHS mileage owned or controlled by either the federal or local governments, of which WYDOT manages only 6,530 centerline miles (approximately 1,700 pavement management sections). WYDOT owns roads such as interstate ramps, service roads, frontage roads, and turnouts that are not measured as part of the state-owned highway system or actively managed. The non-interstate NHS roads owned by either the federal or local governments are measured for performance under WYDOT's pavement data collection contract but are not managed by the PMS. This information is shared in coordination with other NHS owners. No other sub-groups are excluded in the PMS analysis.

To assess pavement conditions using the PMS, WYDOT uses construction history and pavement type to group pavement into pavement management sections. WYDOT identifies each section by location, direction (if interstate), and functional classification and analyzes each section based on current and projected condition. Both contracted and in-house data collection feed the PMS and allow determination of each pavement section's ride quality, rut depth, cracking level, faulting (concrete slab rocking), and skid resistance. The contracted and in-house data collections comply with the *Data Quality Control Plan* published by the Materials Section.

#### PAVEMENT MANAGEMENT OBJECTIVES AND MEASURES

##### PAVEMENT MANAGEMENT OBJECTIVES

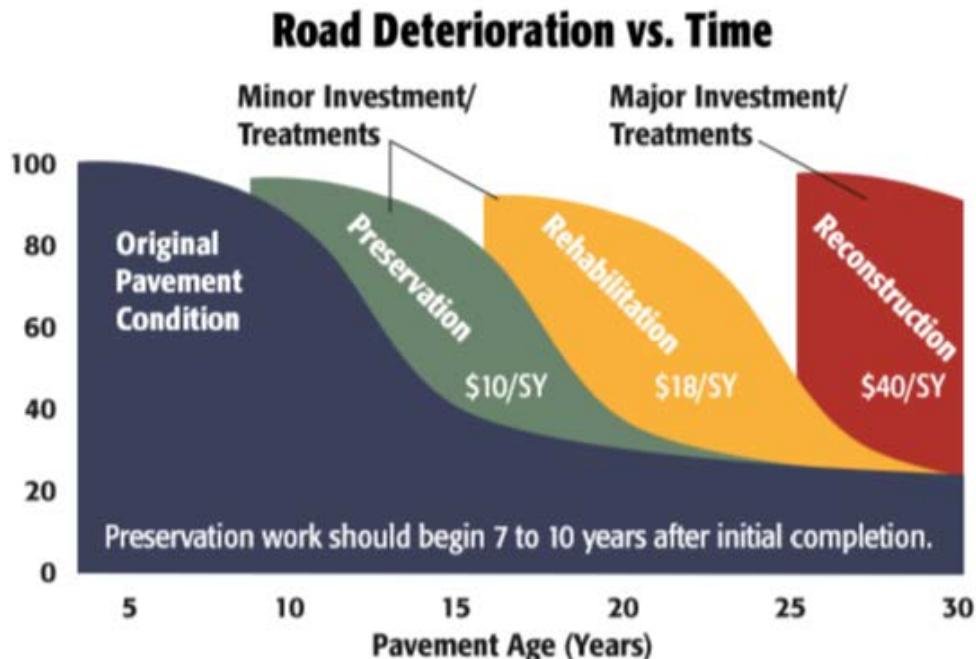
The following pavement management objectives are fully functional in the PMS:

- 1) Providing information to allow effective selection and design of future rehabilitation projects,
- 2) Estimating future conditions versus funding scenarios accurately to evaluate current pavement funding strategies, and
- 3) Displaying analysis results in understandable formats to allow WYDOT executive staff and Wyoming's legislators to easily interpret the information.

Data is stored and available for decision makers and pavement designers to access when necessary. Project selections are based on WYDOT's PMS as part of its asset management program, which recommends projects for each district. This preservation strategy maximizes future network condition based on anticipated funding levels.

The goal of an asset management program is to maintain existing pavements through timely rehabilitation and limit the roads reaching “Poor” condition that require more costly repairs. As the following chart (Figure 2) shows, repair costs are lower when applied early in a pavement’s life. Preventive repairs are not as effective once a road has deteriorated into the “Fair” or “Poor” rating; therefore, a blend of strategies will optimize the health of the highway network.

Figure 2: Pavement Performance Model



WYDOT’s asset management program was developed through an analysis of over 300 computer simulations or scenarios in the Agile Assets pavement module, which predicts the future condition of the highway network. Based on the optimal scenario that provides the best condition results in future years, each year a minimum number of project miles must be completed using preventive, minor and major rehabilitation strategies for each of the three roadway categories.

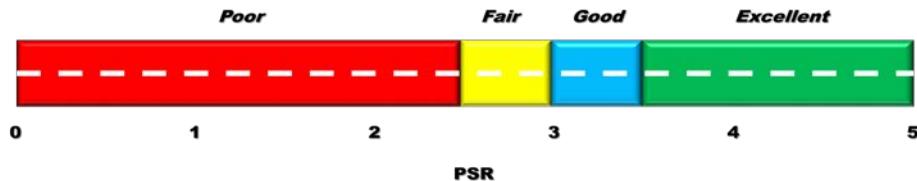
#### PAVEMENT MANAGEMENT MEASURES

Condition ratings are currently based on a composite index called the Pavement Serviceability Rating (PSR), which combines ride quality, rut depth (for asphalt pavements), and cracking into a single index.

WYDOT evaluates surfacing conditions using PSR values from 0 to 5 that provide a relative comparison between road sections. Highways are classified as Excellent, Good, Fair, or Poor based on the PSR index.

Although the predominant influence on the PSR is ride quality, the measure was designed to include multiple performance characteristics and allow any individual characteristic to create a “Poor” rating if that characteristic reaches a defined threshold. For example, if the ride quality rating is “Good,” and the cracking rating is “Good,” but the rut depth is excessive (rut depth is 0.5 inches), the section will be rated as “Poor” due to safety (hydroplaning) concerns.

*Pavement Serviceability Rating (PSR) is WYDOT’s pavement health measure and it is currently the main driver for project selection.*

*Figure 3: PSR Index**Table 2: PSR Classifications and Values*

Classification	Values
Excellent	$\text{PSR} \geq 3.5$
Good	$3.5 > \text{PSR} \geq 3.0$
Fair	$3.0 > \text{PSR} \geq 2.5$
Poor	$2.5 > \text{PSR}$

*Figure 4: Pavement Conditions***POOR CONDITION****FAIR CONDITION****GOOD CONDITION****EXCELLENT CONDITION**

WYDOT's PMS uses 10 PSR pavement performance models for various highway systems, pavement types, and traffic-level categories. These models predict the annual change in PSR for each section as existing conditions are projected into the future. When rehabilitation is applied to a given section, the PSR is reset to a pre-determined, post-construction level until the collection of new data. The various future rehabilitations affect the models in a wide range of ways, such as creating a steeper deterioration rate for short-term rehabilitation strategies and lengthening the curve for more robust strategies. WYDOT's PMS includes a feature to compare actual data condition points to the performance models. In most cases, the model is conservative compared to the actual data points (i.e. the data points lie underneath the curve). These models are set up this way to account for annual maintenance that is not directly shown in the pavement module. All curves use the general form of steepening rates of deterioration with age. The performance models are described in greater detail in WYDOT's annual *Pavement Management System Analysis Report*.

The statewide pavement condition is described (graphically) at: <https://apps.wvoroad.info/itsm/map.html>. Table 3 summarizes Pavement Inventory Mileage, by ownership.

*Table 3: 2018 Pavement Inventory*

Wyoming Pavement Inventory (Ownership based on Centerline Miles)							
	District 1	District 2	District 3	District 4	District 5	Yellowstone	Total
<b>NHS</b>							
Interstate	247	241	187	238	-	-	913
Non-Interstate NHS	111	515	392	315	758	-	2,091
Non-WYDOT NHS	-	-	55	-	1	6	62
<b>Total NHS</b>	<b>358</b>	<b>757</b>	<b>634</b>	<b>553</b>	<b>759</b>	<b>6</b>	<b>3,066</b>
<b>Non-NHS</b>							
State	773	795	815	745	612	-	3,740
<b>Total Non-NHS</b>	<b>773</b>	<b>795</b>	<b>815</b>	<b>745</b>	<b>612</b>	<b>-</b>	<b>3,740</b>
<b>TOTALS</b>	<b>1,131</b>	<b>1,552</b>	<b>1,449</b>	<b>1,297</b>	<b>1,371</b>	<b>6</b>	<b>6,806</b>

The *Pavement Management System Analysis Report* contains three sections addressing (1) network-level analysis, (2) inventory, and (3) project-level analysis. A further discussion of these sections is found below.

**NETWORK-LEVEL ANALYSIS** determines current and projected segment information that the Agile Assets pavement module produces. This analysis accounts for the current STIP and budget projections—including inflation, preservation treatment type, current road conditions, and performance modeling—to create projections for proposed work for a 20-year projection. The information is presented in charts, maps, and graphs.

**INVENTORY** provides a general overview of each management section detailing pavement condition, traffic level, construction history, and STIP status. Pavement management sections are also identified for surface friction and distress and asphalt rutting concerns.

**PROJECT-LEVEL ANALYSIS** sets funding recommendations for each WYDOT district according to WYDOT's asset management philosophy. This analysis lists the recommended pavement funding strategy for optimizing funds for the treatment candidates in each district to aid district managers in selecting projects for the STIP. These candidates are a projected condition for the last year of the STIP and are determined by creating an unlimited budget to bring forward all recommended treatments. The recommended pavement funding strategy suggests mileage counts for each district and functional classifications that should be met on a rolling average for the six-year STIP. These values are determined based on percentages of traffic and each district's total miles and total miles of suggested treatment candidates.

## HIGHWAY PERFORMANCE MONITORING SYSTEM

The Federal Highway Administration's (FHWA's) new annual submittal requirements have been consuming a large part of WYDOT's activities and ongoing analysis efforts. For pavements, WYDOT is developing new analytics that will represent the exact conditions that FHWA is requiring for the Highway Performance Monitoring System (HPMS) based on tenth-mile segments. This new analytics system will also develop a new way of managing the existing pavement sections. WYDOT will be able to manage the existing sections and suggest treatments based on optimizing the overall conditions from the target ranges set in the HPMS. To meet the federal requirements, WYDOT began collecting annual data on the Interstate System, and biennial data on the non-interstate NHS in 2018. WYDOT is collecting condition data on the non-NHS every third year due to funding constraints.

As WYDOT continues to develop the new analytics, the target values for pavement conditions will be determined and be an exact representation of projections for HPMS reporting. Highways will be classified as "Good," "Fair," or "Poor" and will have a broader range of "Good" and "Fair" categories than WYDOT's current analytics. WYDOT remains optimistic about the upcoming changes and believes this system will prove beneficial and effective for future analyses and management purposes.

## PAVEMENT PERFORMANCE-GAP ANALYSIS

### STATE PAVEMENT TARGETS (BASED ON MAP-21 METHODOLOGY)

WYDOT continuously analyzes pavement conditions to provide the best data for selecting construction projects in the STIP. WYDOT has historically set targets internally based on the PSR rating system; however, these targets have little correlation to FHWA's MAP-21 and FAST Act targets. With the comparisons that WYDOT has done regarding the current PSR target setting methodology and the MAP-21 standards, new relative targets based on the MAP-21 required state of good repair have been set. WYDOT will set the new targets as follows: strive to keep 40 percent of pavement miles on the Interstate System in "Good" condition with no more than 5 percent of pavement miles in "Poor" condition and work to keep 40 percent of pavement miles on the non-interstate NHS in "Good" condition with no more than 10 percent of pavement miles in "Poor" condition. Targets for the non-NHS will be set when the pavement management module in Agile Assets is updated. WYDOT will continue to monitor and develop the new analysis system to refine these targets.

### PAVEMENT CONDITION GOALS

FHWA has set a minimum requirement for state DOTs to maintain no more than 5 percent of a state's pavements on the Interstate System in "Poor" condition using a unique condition measure defined by FHWA.

The current target PSR values of 75 percent for interstate, 60 percent for non-interstate NHS, and 45 percent for non-NHS are reflected in WYDOT's BSC.

### CURRENT PAVEMENT CONDITIONS

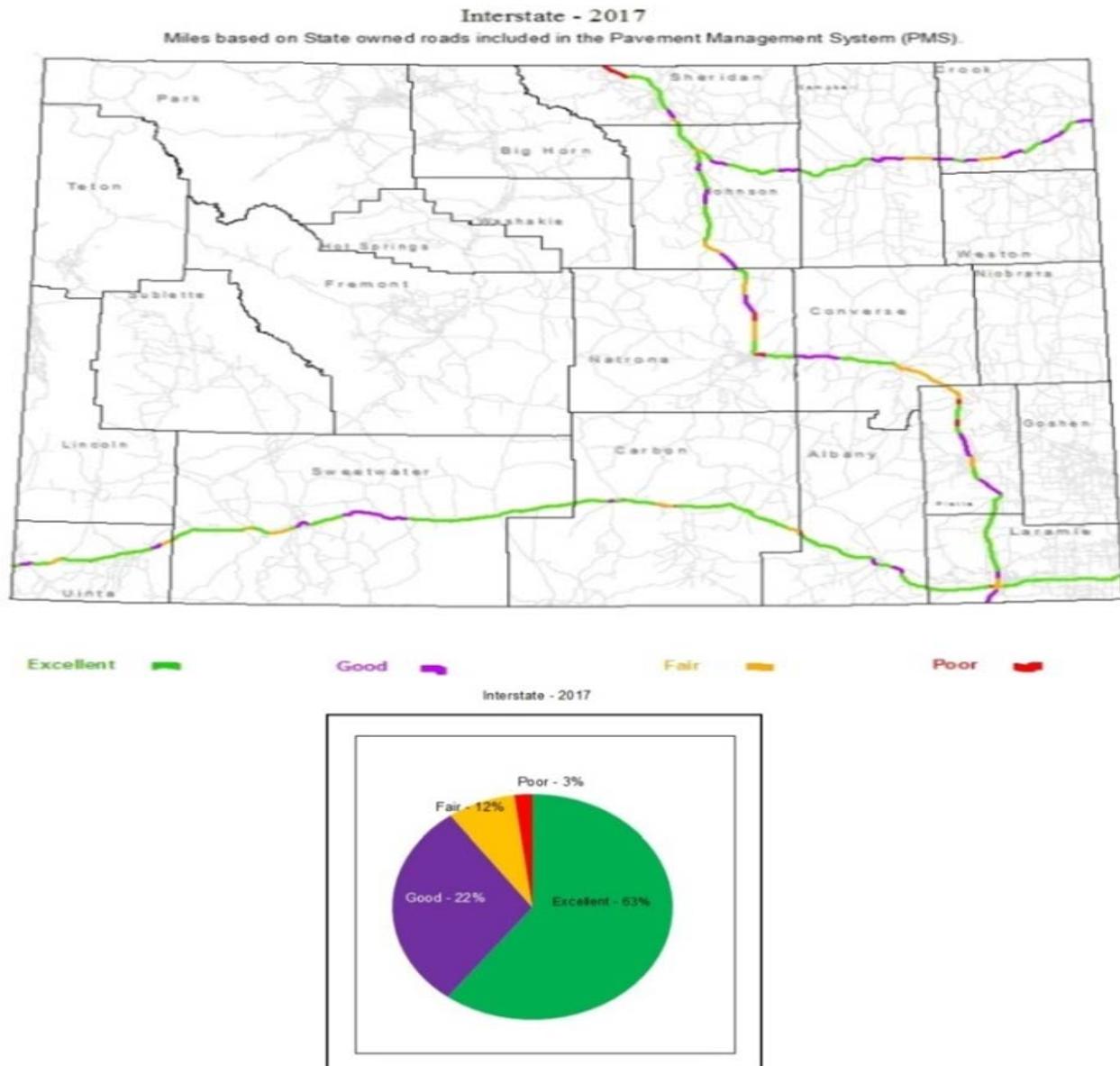
Based on outputs from the PMS, the percentage of the interstate currently shown in "Poor" condition is 3 percent, and this is predicted to increase to 5 percent by 2024.

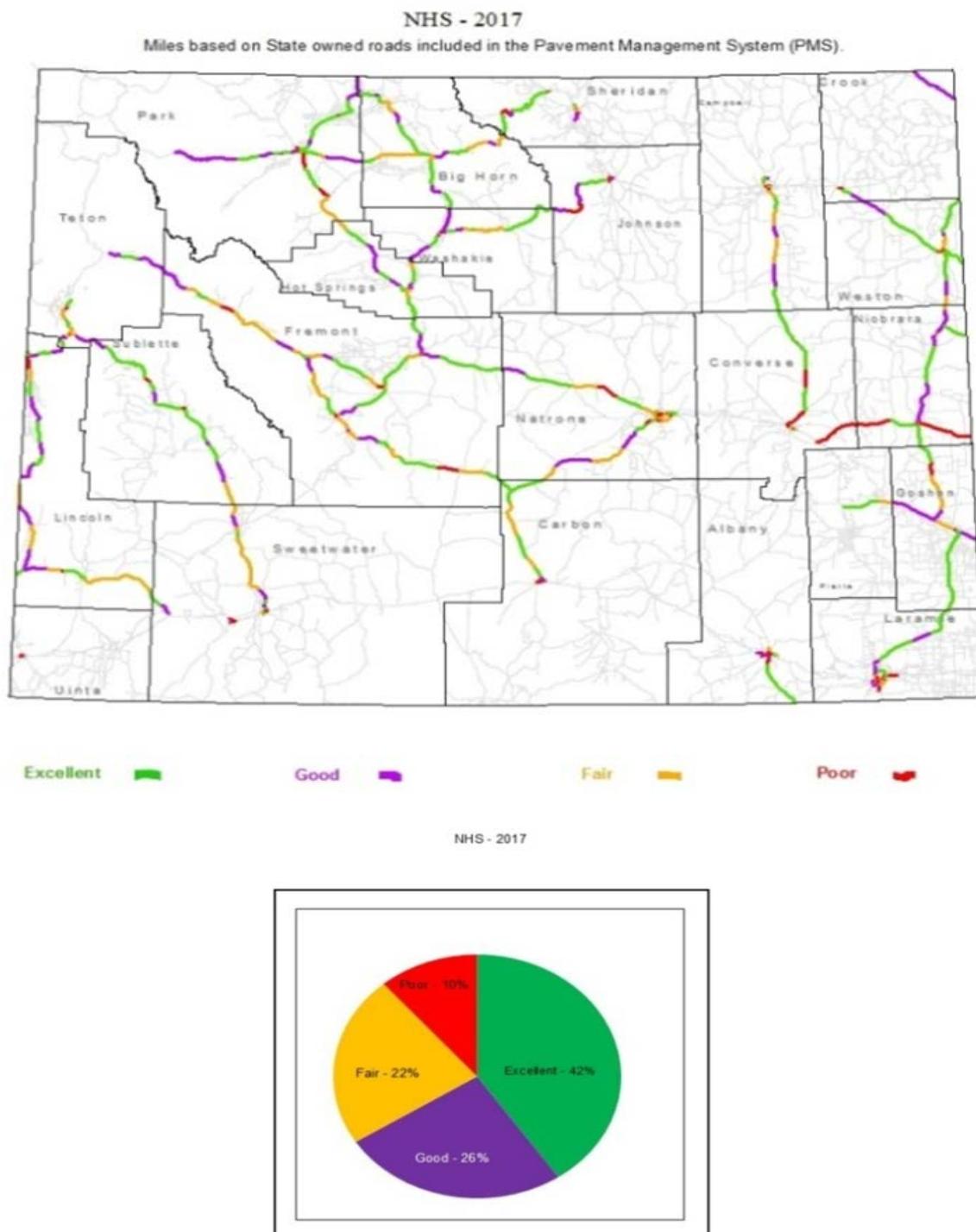
Current condition averages for the three roadway systems (interstate, non-interstate NHS, and non-NHS) can be found in Table 4 and Figure 5 on the following pages:

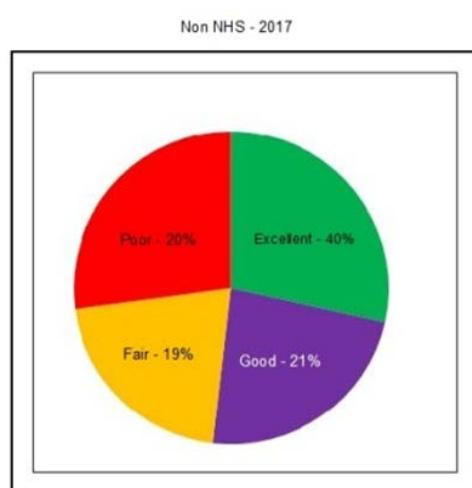
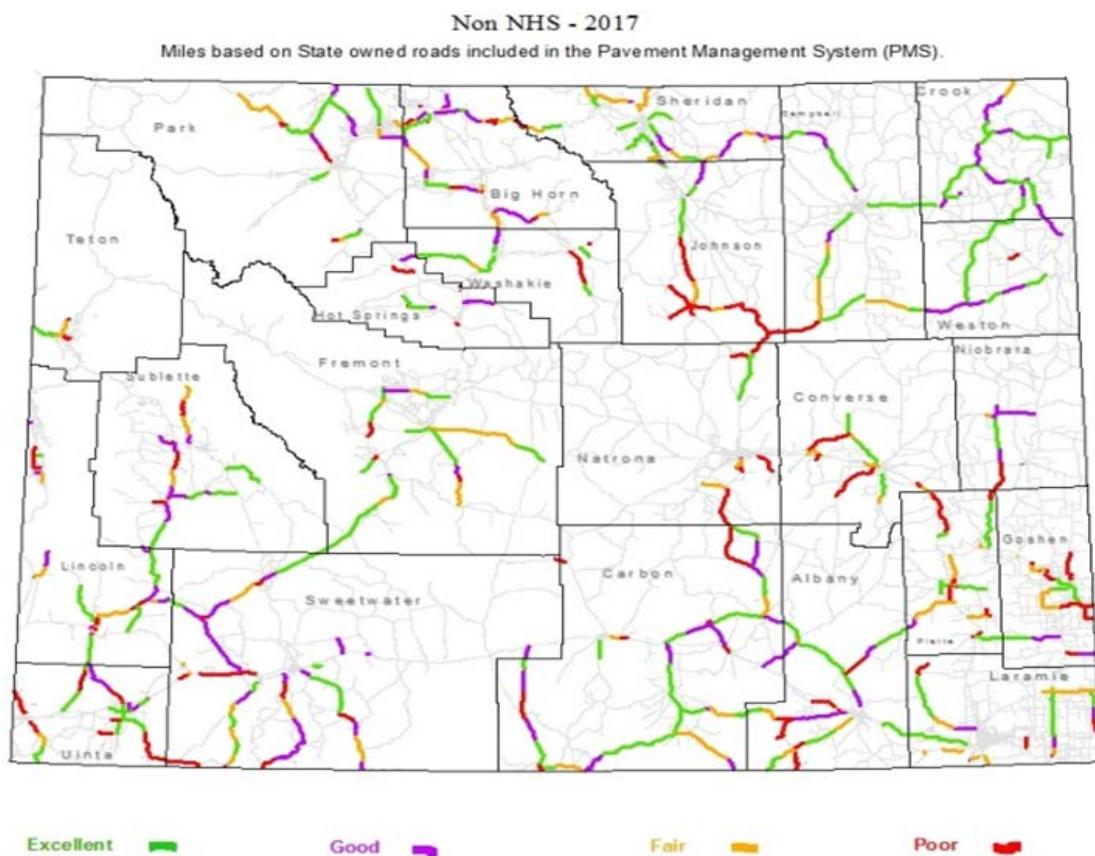
*Table 4: Current Pavement Condition Averages (Percentages)*

	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
Interstate	<b>63%</b>	<b>22%</b>	<b>12%</b>	<b>3%</b>
Non-Interstate NHS	<b>42%</b>	<b>26%</b>	<b>22%</b>	<b>10%</b>
Non-NHS	<b>40%</b>	<b>21%</b>	<b>19%</b>	<b>20%</b>
Overall	<b>44%</b>	<b>22%</b>	<b>18%</b>	<b>16%</b>

\*Note: Pavement Condition averages do not include locally owned NHS pavement data.

*Figure 5: Current Pavement Conditions (Maps)*





## PERFORMANCE-GAP ANALYSIS

The graphs presented below (Figures 6 through 8) represent the “Excellent” and “Good” pavement conditions projected at a 4 percent annual inflation rate and show the target values by system.

Figure 6: Interstate Pavement Condition Targets vs. Projections

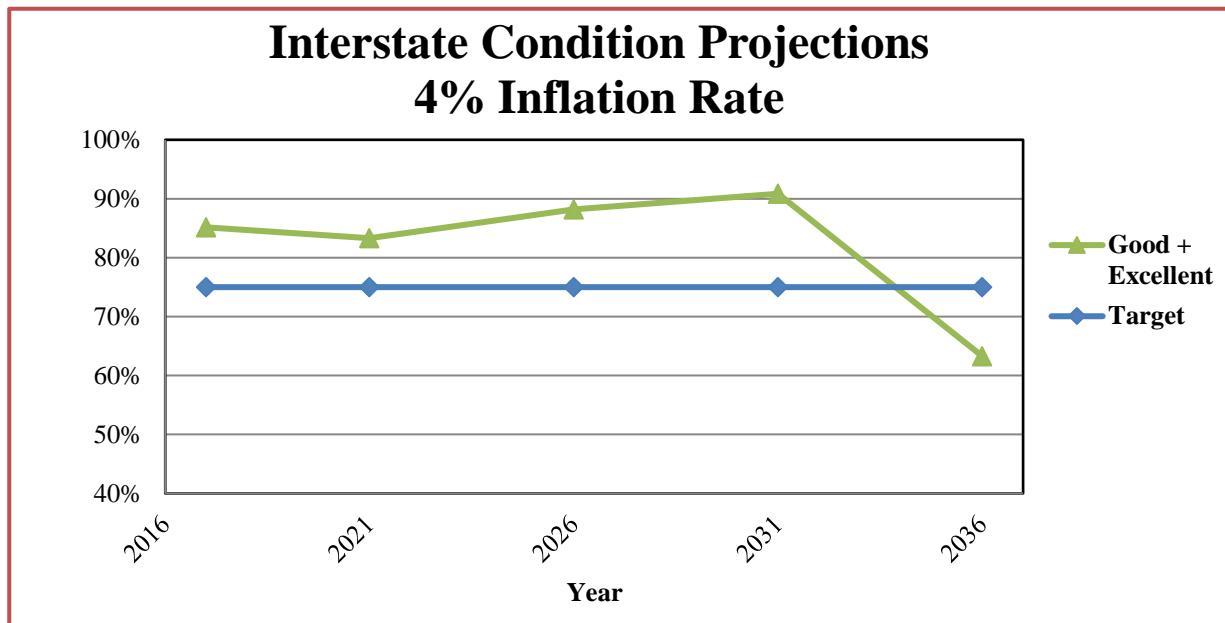


Figure 7: Non-Interstate NHS Pavement Condition Targets vs. Projections

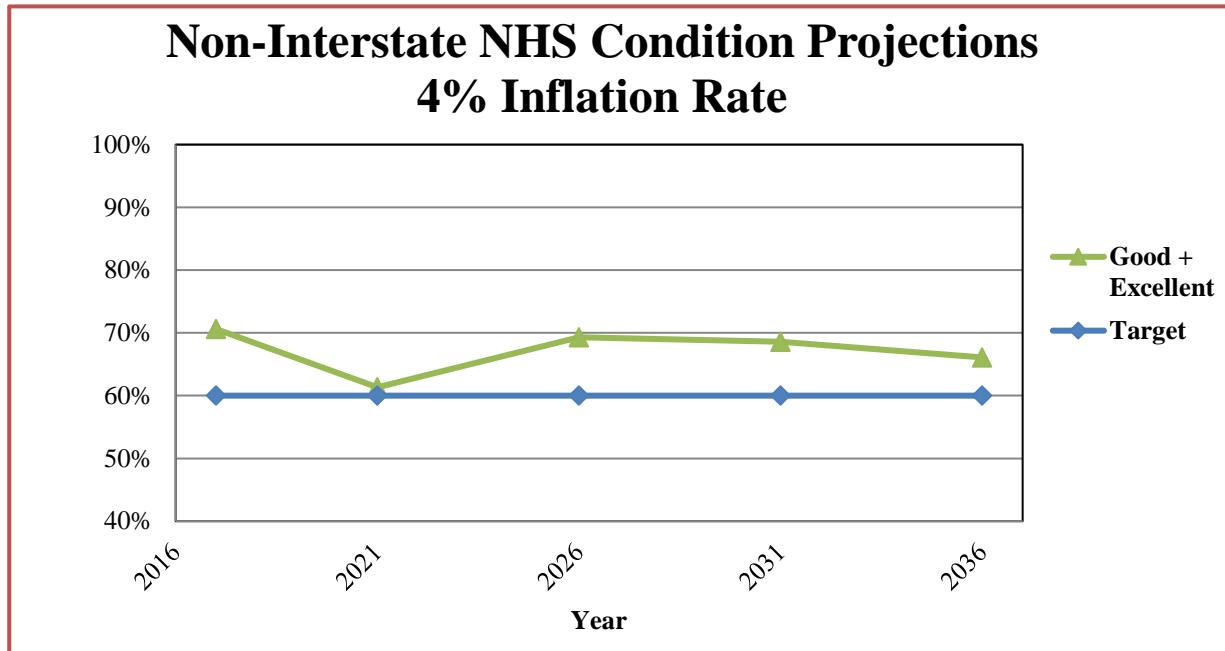
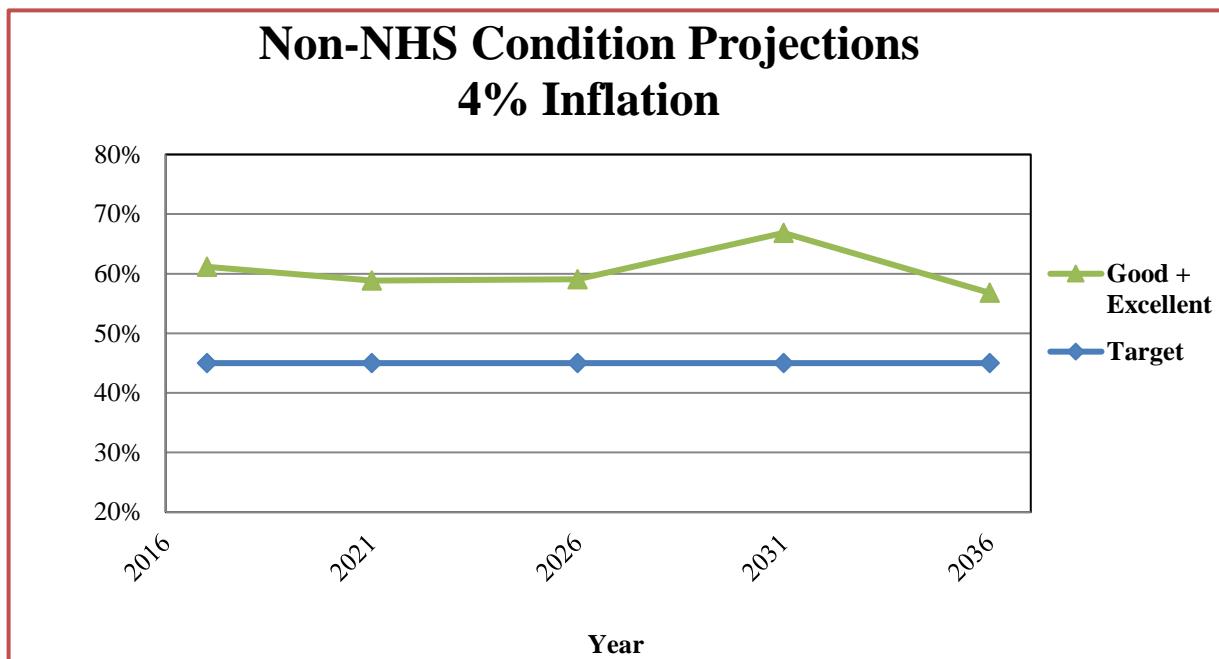


Figure 8: Non-NHS Pavement Condition Targets vs. Projections



## PAVEMENT LIFE-CYCLE COST

Life-cycle cost (LCC) is incorporated in WYDOT's pavement management performance modeling software by calculating future conditions (for more information on the components of life-cycle cost, see Section V). Historic condition versus age data forms the backbone of WYDOT's pavement performance models. WYDOT measures the condition of each management segment biennially and continuously maintains a detailed construction treatment history. Grouping similar pavement types and traffic levels provides a detailed set of data points used to create deterioration curve models. The pavement module in Agile Assets uses these models to calculate annual changes in condition for future years based on a system-wide, incremental cost methodology. The system allows entry of annual budget amounts for various future treatment types. Further, the system uses average costs per square yard for the different treatment types; the costs are continually reviewed for accuracy. With regard to lowest LCC, WYDOT has determined preventive treatments provide the lowest cost per added life. Pavement treatments are selected to optimize the total life of Wyoming's road sections while giving consideration to minimizing construction activity and the corresponding inconvenience to the driving public.

Table 5: Current Pavement Costs Used for Modeling

Current Pavement Costs Used for Modeling	
1S Preventive Rehabilitation (micro seal, chip seal, isolated slab replacement)	\$10/square yard
2S Minor Rehabilitation (2"-3" pavement resurfacing, dowel bar retrofit)	\$18/square yard
2S Minor Rehabilitation (2"-4" pavement resurfacing, dowel bar retrofit on I-80)	\$27/square yard
3S Major Rehabilitation (>4" pavement resurfacing on I-80, >3" pavement resurfacing on other State owned routes, full depth reclamation and overlay, and crack and seat/overlay)	\$40/square yard

WYDOT's basic optimization approach allows for major rehabilitation work on extremely poor, higher traffic roadways; for minor rehabilitation work on "Poor" and "Fair" roadways; and for preventive maintenance work on roadways in "Good" to "Excellent" condition. In each district, a minimum number of miles per year must be completed using preventative maintenance and minor and major rehabilitation strategies set up in the recommended asset management funding strategy. The management system selects project candidates using decision trees and benefit-cost analysis (BCA).

## MAINTENANCE

*WYDOT's maintenance work provides the just-in-time repairs required to ensure a serviceable system exists and is critical in providing the lowest life-cycle costs.*

As part of WYDOT's asset management approach, maintenance crews actively perform routine repairs on all WYDOT-maintained roadways. The pavement deterioration models include the effects of the surface maintenance that WYDOT performs; therefore, maintenance is considered a critical component of a pavement's life-cycle costs. Maintenance work is performed by contract and in-house and includes crack sealing, short patches (patches less than a pavement management segment in length), chip seals, and slab repair and replacement. Without this work, pavements would have shorter life expectancies, and the PMS pavement deterioration models would need to be modified to show steeper deterioration curves; consequently, maintaining the current level of the maintenance budget is critical. The current annual maintenance (average life-cycle) costs for pavements are shown in Table 6.

*Table 6: Annual Maintenance Costs for Pavements*

Roadway Category	Annual Maintenance Costs
Interstate	<b>\$ 7.3 million per year</b>
Non-Interstate NHS	<b>\$ 10.1 million per year</b>
Non-NHS	<b>\$13.3 million per year</b>

## DETERIORATION RATE

Traffic demand and vehicle mix (truck/car ratio) influence the deterioration rate and future condition of highway infrastructure. Higher traffic volumes, particularly trucks, can dramatically increase pavement and bridge deterioration rates. Accelerated deterioration caused by increased traffic volumes affects the funding level needed to maintain the system and can affect future rehabilitation strategy selection. A lack of sufficient funding can cause increased deterioration rates and worsening pavement conditions that will have lasting, long-term effects.

To understand current and future demands on Wyoming's systems, accurately estimated current and projected traffic levels and vehicle types are important. WYDOT's Planning Program has approximately 125 permanent automated traffic counter installations throughout the state that continuously gather about 170 daily traffic counts. Traffic surveys collect and analyze this data and continue to monitor and predict future traffic growth. Over the past several years, traffic counts have remained fairly static throughout the state with very little growth except in a few limited areas—specifically the oil and gas fields in the vicinity of Sublette County and the Highway 59 corridor from Douglas to Gillette.

The Pinedale anticline area saw significant traffic increases in the early 2000s during the development of the Jonah field and other natural gas fields. Increases in total vehicular traffic and significant increases in truck traffic were reported. Traffic levels decreased after the completion of field development, but never returned to previous levels. The oil and gas field development now occurring in Converse County (north of Douglas) is expected to follow the

same trend—a sharp increase in traffic as the field is developed followed by a moderate to slight decline once development is completed.

Interstate 80 passes through Wyoming carrying traffic from California to New York while serving as a major truck route for the United States. The percentage of truck traffic on Wyoming's portion of I-80 is among the highest in the nation—with truck traffic at 47 percent of all traffic. Traffic volumes on Wyoming's portion of I-80 average 7,500 to 26,000 vehicles per day. Traffic on I-80 has increased by 1.6 percent annually for the past 20 years while truck traffic has increased by 1.8 percent annually. The increase in truck traffic has significantly impacted I-80 pavement deterioration rates and has created a substantial drain on funding, as noted in the previous section.

## FINANCIAL ASSESSMENT

Pavement Management's goal is to maintain current conditions within all functional classifications, but current funding levels are insufficient to accomplish this goal for pavements. The PMS projected that at past spending levels all road systems would deteriorate, so in 2012 WYDOT increased asset management funding to \$125 million. Wyoming increased the gas tax by 10 cents per gallon in the summer of 2013 and is using a portion of the additional tax revenue to increase the pavement work performed each year at an annual funding level of \$160 million. With anticipated

*WYDOT continues to seek additional funding of \$69 million annually to maintain pavements in current conditions and replace bridges on a 100-year service life.*

funding splits spread between functional classifications into future years, WYDOT's PMS estimates near stable pavement conditions over the next 20 years for non-interstate NHS, but deteriorating conditions on the interstate highways and non-NHS routes. The Interstate System is not being ignored; rather, the substantially higher number of trucks, especially on I-80, causes a deterioration rate that is much steeper than the other systems. There are insufficient funds to keep 914 centerline miles of interstate in the same condition without completely sacrificing the other WYDOT-maintained system's 5,616 centerline miles of pavement. Additionally, there is a significantly high deterioration rate on the non-NHS routes due to insufficient funds related to ownership.

*The PMS analytics projected that continued use of past spending strategies would cause all road systems to deteriorate rapidly.*

## PAVEMENT WORK TYPES

WYDOT has adopted a preservation strategy of asset management that involves "completing the right treatment at the right time", an approach which focuses on improving or preserving the condition of existing assets, as opposed to system expansion. Mileage goals are set by treatment type for each of the districts, and credit is received for the total mileage of candidate rehabilitation sections completed on a six-year rolling average. The candidate list produced by the Pavement Management Department within WYDOT's Materials Program suggests the recommended roadway sections and treatment required, which is used to facilitate project selection for the last year of the Statewide Transportation Improvement Plan (STIP). WYDOT's pavement work types are described in further detail for each of the treatment types as follows.

**PAVEMENT MAINTENANCE ("M" TREATMENTS)** While WYDOT's maintenance dollars are not directly incorporated in the funding strategies that the PMS produces (Pavement Candidate List), the PMS Performance Models do account for undetermined maintenance that could potentially occur, and the effects of which are incorporated into the deterioration models reflecting WYDOT's long-term pavement investment needs. For purposes of mileage goal calculations, pavement maintenance typically receives a 1S credit designation, determined by the Materials Program, according to the treatment that is applied to the surface of the roadway. In order to receive credit for pavement maintenance work, the Districts provide a list of chip seals, patching locations and slab replacements to the Materials Program annually for review if 1S credit is desired. Chip seals must cover entire PMS section

lengths and will provide full length credit for application to 1S candidates, and 50% length credit when applied to 2S or 3S candidates. Patching provides a 50% credit of patched length if applied to 2S and 3S candidates. If patching length exceeds 50% of PMS section length on a 2S or 3S candidate, 50% PMS length credit will be allowed. Slab replacement will provide 50% section length credit on a 1S candidate if all broken slabs within the PMS section are replaced and grinding on all new slabs occurs. Slab replacement will provide 25% section length credit to 2S and 3S candidates. All candidates without a required treatment do not receive the 1S credit.

**PAVEMENT PREVENTATIVE REHABILITATION/PRESERVATION (“1S” TREATMENTS)** The effects of pavement preventative rehabilitation treatments vary according to the surfacing type (bituminous versus concrete), as well as by the existing age of the pavements and the type of treatment applied; however, in general it is assumed that maintenance and preservation (1S) treatments (including contract patching and crack sealing) will extend the expected life of the pavements by approximately 4 years for asphalt, and approximately 5-7 years for concrete. These treatments include micro-surfacing, chip seals, thin overlays of less than 2" (0 - 1.9" PMP placed), mill and replacement of plant mix wearing course, isolated slab replacement and grind/texture of concrete.

**MINOR PAVEMENT REHABILITATION (“2S” TREATMENTS)** WYDOT’s minor pavement rehabilitation 2S treatment is designed to extend the life of the pavement for approximately 8 years for asphalt, and approximately 10-13 years for concrete. These 2S treatments include surface prep (mill, level, or combo), 2" - 4" pavement resurfacing and seal coat on Interstate 80, 2" - 3" pavement surfacing and seal cost on all other State owned routes, isolated slab replacement with dowel bar retrofit, and grind/texture of concrete.

**MAJOR PAVEMENT REHABILITATION (“3S” TREATMENTS)** WYDOT’s major pavement rehabilitations 3S Treatment is designed for approximately 10 years for asphalts, and approximately 15-20 years for concrete. This treatment includes anything greater than 4" of pavement resurfacing and seal coat on Interstate 80, greater than 3" pavement resurfacing and seal coat on all other State owned routes, full depth reclamation (FDR) and overlay, and crack and seat on existing concrete with pavement leveling, overlay, and seal coat.

**PAVEMENT CONSTRUCTION (NEW CONSTRUCTION)/RECONSTRUCTION** WYDOT’s New Construction and Reconstruction projects are not recommended by the PMS. WYDOT performs these types of construction projects more for mobility purposes not related to preserving the existing pavement on the ground. Reconstruction is defined as roadways that are rebuilt primarily along existing alignment. Reconstruction normally involves full-depth base and pavement replacement. Other work that would fall into the category of reconstruction would be adding lanes adjacent to an existing alignment, changing the fundamental character of the roadway (e.g. converting a two-lane highway to a multi-lane divided arterial) or reconfiguring intersections and interchanges.

## RISKS TO WYDOT PAVEMENTS

FHWA’s Report 4, *Risk-Based Transportation Asset Management: Managing Risks to Networks, Corridors, and Critical Structures*, suggests that the act of classifying routes by importance based on economic generators, traffic counts, or near population centers is a form of risk management. WYDOT makes trade-offs in its management of pavement condition based on interstate, non-interstate NHS, and non-NHS recognizing that more risk is being taken on the lower trafficked non-NHS roads and, therefore, allows their overall condition to be lower than the others.

A secondary risk of the asset management strategy is based on the concept that it is less expensive to keep good pavements in “Good” condition. This translates into the accepted risk that some roads in “Poor” condition will technically remain poor and will often continue to deteriorate and become rougher (i.e. having deepening ruts and increased cracking). All of the current funding scenarios use an optimized system that will incorporate a mixture of treatments in order to maximize the benefit to cost for the interstate, non-interstate NHS, and non-NHS systems.

Due to existing funding constraints, WYDOT’s approach to monitoring risk is reactive. Although some areas with higher than usual natural and environmental risks receive additional monitoring, WYDOT is unable to address a significant percentage of existing risks with preventative measures and still maintain a functioning transportation system. Generally, WYDOT finds that reacting quickly and effectively to failures after they happen is a more effective use of funding than attempting to prevent failures from happening. For example, WYDOT cannot afford to preemptively stabilize all possible rock fall slopes or landslide areas within the state. In turn, WYDOT responds

effectively and efficiently after an event has occurred in an effort to minimize the inconvenience of and length of time a road is closed.

The transportation system in Wyoming is dispersed over a large geographical area with little redundancy in routing or capacity. Due to funding limitations, WYDOT is presently unable to maintain the existing transportation system in its existing condition; consequently, WYDOT has moved from a highway improvement program to an asset management program in an effort to slow the decline of the state's transportation system.

## IV. STATEWIDE BRIDGE INVENTORY, CONDITIONS, AND PROGRAMS

Bridges are structures erected over a depression or an obstruction (such as a waterway, highway, or railway) having a passageway for carrying traffic and an opening, measured along the center of the roadway, of 20 feet or more. This definition includes multiple pipe culvert installations where the clear distance between openings is less than half of the smaller opening.

Each bridge is composed of three components: (1) deck (National Bridge Inventory [NBI] Item 58), (2) superstructure (NBI Item 59), and (3) substructure (NBI Item 60).

### BRIDGE INVENTORY AND CONDITION ASSESSMENT

WYDOT generates inspection reports for bridges that summarize inventory data and bridge condition assessments. The Code of Federal Regulations (23 CFR 650, Subpart C) requires the inspection—on a minimum twenty-four month cycle—of all public structures defined as bridges in the state by qualified bridge inspectors. WYDOT policy requires the annual inspection of load posted bridges both on and off system, which also includes NHS segments not owned by WYDOT. The data for bridges within NHS segments not owned by WYDOT is shared with the other owners with an exception for bridges owned by the federal government within national parks. These bridges are inspected by the federal government and WYDOT retrieves the data from the federal tapes. Additionally, bridges having certain levels or types of deterioration or with specific details that may affect the safe usage of the structure receive special inspections designed to closely monitor their unique condition. Bridge inspectors use the FHWA *Bridge Inspection Reference Manual* (BIRM) and AASHTO *Manual for Bridge Evaluation* as guides.

Qualified bridge inspection team leaders are required to be present at each inspection. Inspectors collect inventory data and assess the conditions of bridge components (namely decks, superstructures, substructures, and culverts) in accordance with the FHWA *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (Coding Guide). Also, inspectors assess the conditions of bridge elements (such as slabs, girders, abutments, piers, culverts, etc.) in accordance with the AASHTO *Manual for Bridge Element Inspection* (MBEI).

### BRIDGE MANAGEMENT OBJECTIVES AND MEASURES

The Bridge Program uses the Bridge Management System (BMS) to identify needs and best allocate funds to meet WYDOT goals. Once the BMS identifies needs, preservation, repair, rehabilitation, and replacement targets and candidate lists are developed for each district and provided for use in developing projects.

#### BRIDGE MANAGEMENT OBJECTIVES

The WYDOT Bridge Program uses a comprehensive BMS to assist with managing the state's bridges by utilizing historical data along with current in-service conditions to achieve the following objectives:

- Quantify current needs and forecast future needs;
- Develop preservation, repair, rehabilitation, or replacement candidate lists and targets;

- Prioritize needs; and
- Select projects based on given budget scenarios.

The BMS is a set of tools comprised of:

- AASHTOWare™ Bridge Management software BrM (*formerly Pontis*),
- Wolfram Mathematica software,
- Oracle database,
- WYDOT Bridge Program developed BRASS™ Suite of Programs, and
- Customized spreadsheets and reports.

## BRIDGE MANAGEMENT MEASURES

Bridge inspectors assess each bridge element across four condition states (CS1 - Good, CS2 - Fair, CS3 - Poor, and CS4 - Severe) in accordance with the MBEI. Each element may be classified under more than one of the four condition states based on the unit of measure used for the element. For example, if a girder, measuring a total of 80-linear feet, is examined and 20-linear feet have experienced some deterioration and the remaining 60-linear feet have not experienced deterioration, the inspector could assess that the girder fits into two condition states—20-linear feet are in “Fair” condition and the remaining 60-linear feet are in “Good” condition.

Using the bridge element conditions as a basis, an inspector provides an overall condition rating for each bridge component based on a rating scale of 9 (Excellent) to 0 (Failed) in accordance with the Coding Guide. The inspector provides a separate component condition rating for a culvert (NBI Item 62).

Each bridge is given a performance rating based on the National Highway Performance Program (NHPP) guidelines. The rating is based on the minimum condition of the three bridge components (NBI Items 58, 59, and 60). For culverts, the performance rating is based on the culvert condition rating (NBI Item 62). Component condition ratings of 9 through 7 are considered “Good”; component condition ratings of 6 and 5 are considered “Fair”; and component condition ratings of 4 or less are considered “Poor.” WYDOT’s BMS is based on the NHPP performance ratings.

*Table 7: NHPP Performance Condition Ratings*

Classification	Component Condition Ratings
Good	9-7
Fair	6-5
Poor	≤4

Bridges may be classified as structurally deficient (SD) based on an assessment of their physical condition. This federal classification indicates that bridge components have experienced a level of deterioration that could reduce the structure’s ability to carry design loads. Classifying a bridge as structurally deficient **does not** imply that it is likely to collapse or is unsafe. A structurally deficient classification may indicate that maintenance or rehabilitation of various components is necessary to improve its condition. Tables 8 through 9 and Figures 9 through 12 show the percentage of structures (based on square footage of deck area) that are classified as structurally deficient. (Data was derived from the Federal Tape Submittals for 2008 to 2018 to create the graphs, and the data from the Federal Tape Submittals for 2018 was used to create the tables.)

## BRIDGE PERFORMANCE-GAP ANALYSIS

### BRIDGE GOALS

New targets based on the MAP-21 required state of good repair have been set for bridge conditions. WYDOT’s goal is to maintain state-owned bridges, on and off of the NHS, so at least 10 percent of them are designated as “Good” and less than 10 percent are designated as “Poor” in accordance with NHPP performance ratings. To meet FHWA’s

performance measures, WYDOT's goal is to have less than 10 percent of all bridges on the NHS, based on deck area, designated as structurally deficient.

### CURRENT BRIDGE CONDITIONS

The following tables show the current bridge inventory. Table 8 shows a listing of Wyoming's bridge assets by sub-groups on the NHS and ownership has been summarized by District. Tables 9 and 10 show the current bridge condition ratings. Figures 9 through 16 show the bridge condition projections as compared to the target measures.

*Table 8: Wyoming Bridge Inventory*

Wyoming Bridge Inventory (Number of Bridges – B and Culverts - C)						
	District 1	District 2	District 3	District 4	District 5	Total
<b>NHS</b>						
Interstate	209 - B 28 - C	223 - B 10 - C	138 - B 7 - C	293 - B 17 - C	0 - B 0 - C	863 - B 62 - C
Non-Interstate NHS	16 - B 10 - C	76 - B 23 - C	65 - B 15 - C	31 - B 13 - C	130 - B 34 - C	318 - B 95 - C
Non-WYDOT NHS	0 - B 4 - C	0 - B 0 - B	0 - B 0 - C	0 - B 0 - C	0 - B 0 - C	0 - B 4 - C
Total NHS	<b>225 - B 42 - C</b>	<b>299 - B 33 - C</b>	<b>203 - B 22 - C</b>	<b>324 - B 30 - C</b>	<b>130 - B 34 - C</b>	<b>1,181 - B 161 - C</b>
<b>Non-NHS</b>						
State	73 - B 32 - C	114 - B 25 - C	88 - B 31 - C	120 - B 43 - C	76 - B 20 - C	471 - B 151 - C
Total Non-NHS	<b>73 - B 32 - C</b>	<b>114 - B 25 - C</b>	<b>88 - B 31 - C</b>	<b>120 - B 43 - C</b>	<b>76 - B 20 - C</b>	<b>471 - B 151 - C</b>
<b>TOTALS</b>	<b>298 - B 74 - C</b>	<b>413 - B 58 - C</b>	<b>291 - B 53 - C</b>	<b>444 - B 73 - C</b>	<b>206 - B 54 - C</b>	<b>1,652 - B 312 - C</b>

*Table 9: 2018 NHPP Performance Ratings*

2018 NHPP PERFORMANCE RATINGS (Based on Deck Area)							
	Total Deck Area	Good		Fair		Poor	
		Area	%	Area	%	Area	%
<b>NHS</b>							
Interstate	5,274,653	1,140,891	21.6%	3,737,300	70.9%	396,534	7.5%
Non-Interstate NHS	2,904,792	665,529	22.9%	1,974,302	68.0%	264,961	9.1%
Non-WYDOT NHS	19,177	1,509	7.9%	17,668	92.1%	0	0.0%
Total NHS	<b>8,198,622</b>	<b>1,807,929</b>	<b>22.1%</b>	<b>5,729,270</b>	<b>69.9%</b>	<b>661,495</b>	<b>8.1%</b>
<b>Non-NHS</b>							
State	3,247,497	892,839	27.5%	2,085,031	64.2%	269,627	8.3%
Total Non-NHS	<b>3,247,497</b>	<b>892,839</b>	<b>27.5%</b>	<b>2,085,031</b>	<b>64.2%</b>	<b>269,627</b>	<b>8.3%</b>
<b>TOTALS</b>	<b>11,446,119</b>	<b>2,700,768</b>	<b>23.6%</b>	<b>7,814,301</b>	<b>68.3%</b>	<b>931,122</b>	<b>8.1%</b>

Table 10: 2018 SD Structures

2018 SD STRUCTURES (Based on SF Deck Area)			
	Total Deck Area	Structurally Deficient	% Deficient
<b>NHS</b>			
Interstate	5,274,653	396,534	7.5%
Non-Interstate NHS	2,904,792	264,961	9.1%
Non-WYDOT NHS	19,177	0	0.0%
<b>Total NHS</b>	<b>8,198,622</b>	<b>661,495</b>	<b>8.1%</b>
<b>Non-NHS</b>			
State	3,247,497	269,627	8.3%
<b>Total Non-NHS</b>	<b>3,247,497</b>	<b>269,627</b>	<b>8.3%</b>
<b>TOTALS</b>	<b>11,446,119</b>	<b>931,122</b>	<b>8.1%</b>

## PERFORMANCE-GAP ANALYSIS

Figure 9: All NHS Structures NHPP Performance Ratings

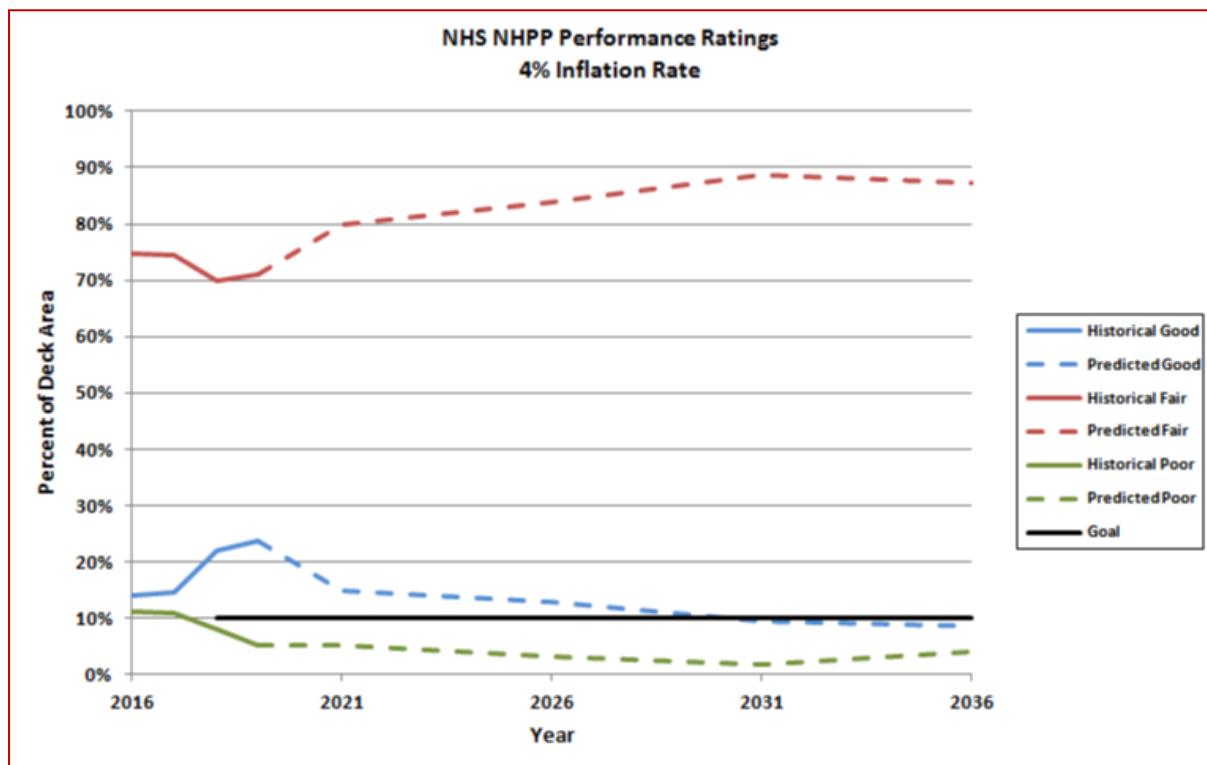


Figure 10: Interstate Structures NHPP Performance Ratings

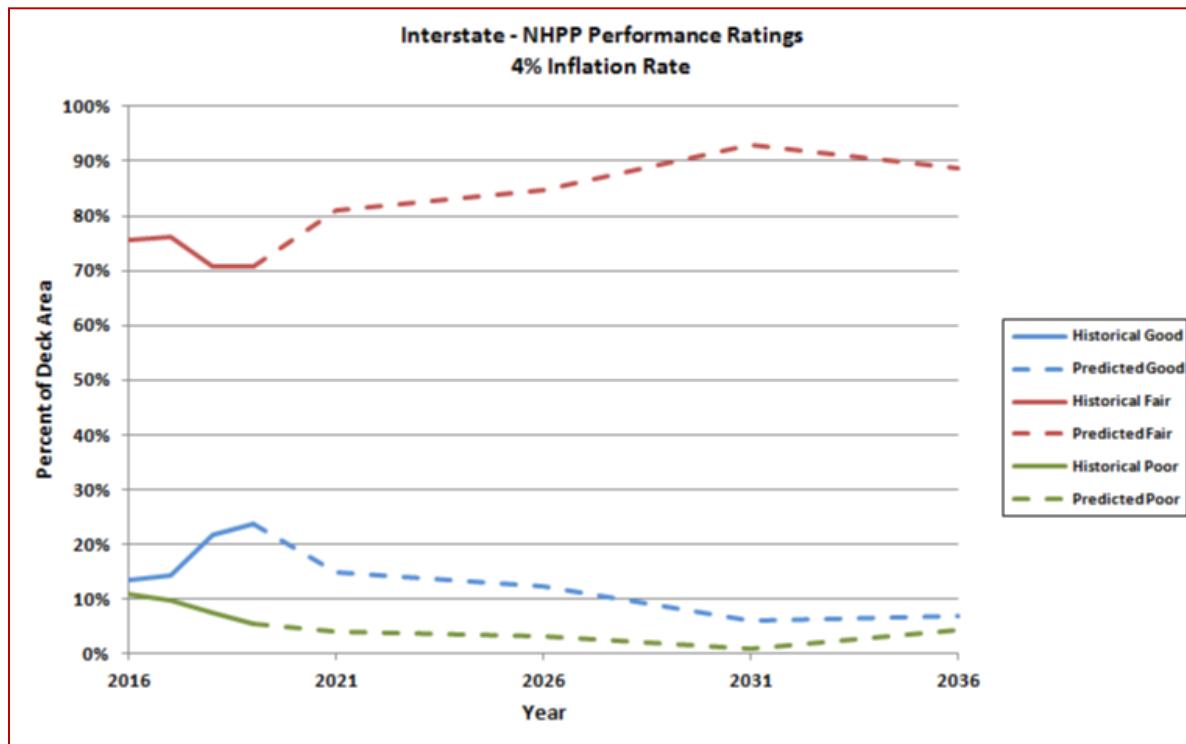


Figure 11: Non-Interstate NHS Structures NHPP Performance Ratings

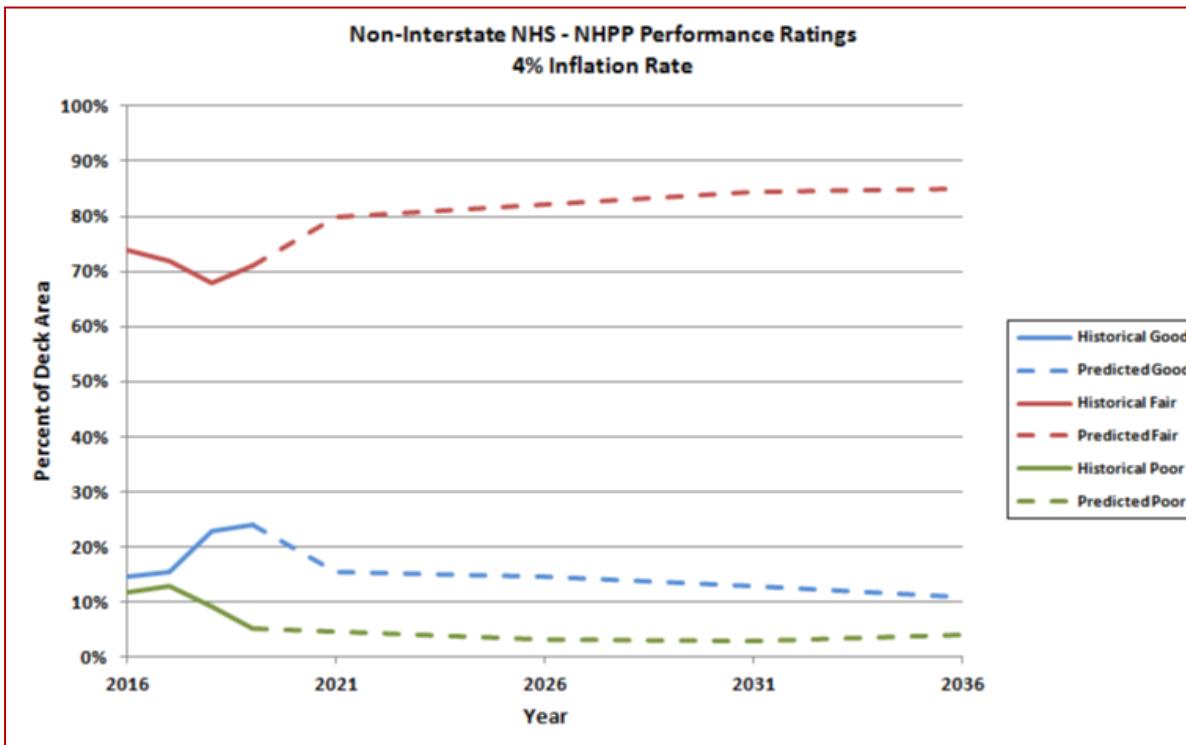


Figure 12: Non-NHS Structures NHPP Performance Ratings

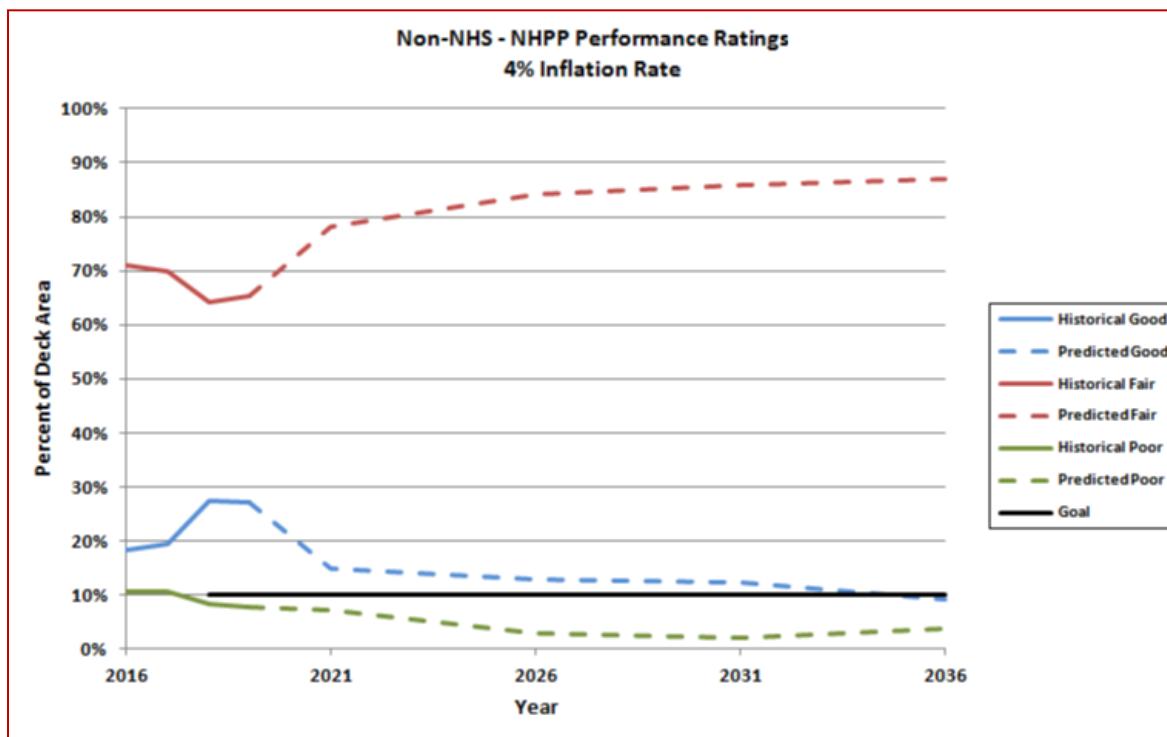


Figure 13: All NHS Structures SD History vs. MAP-21 Targets

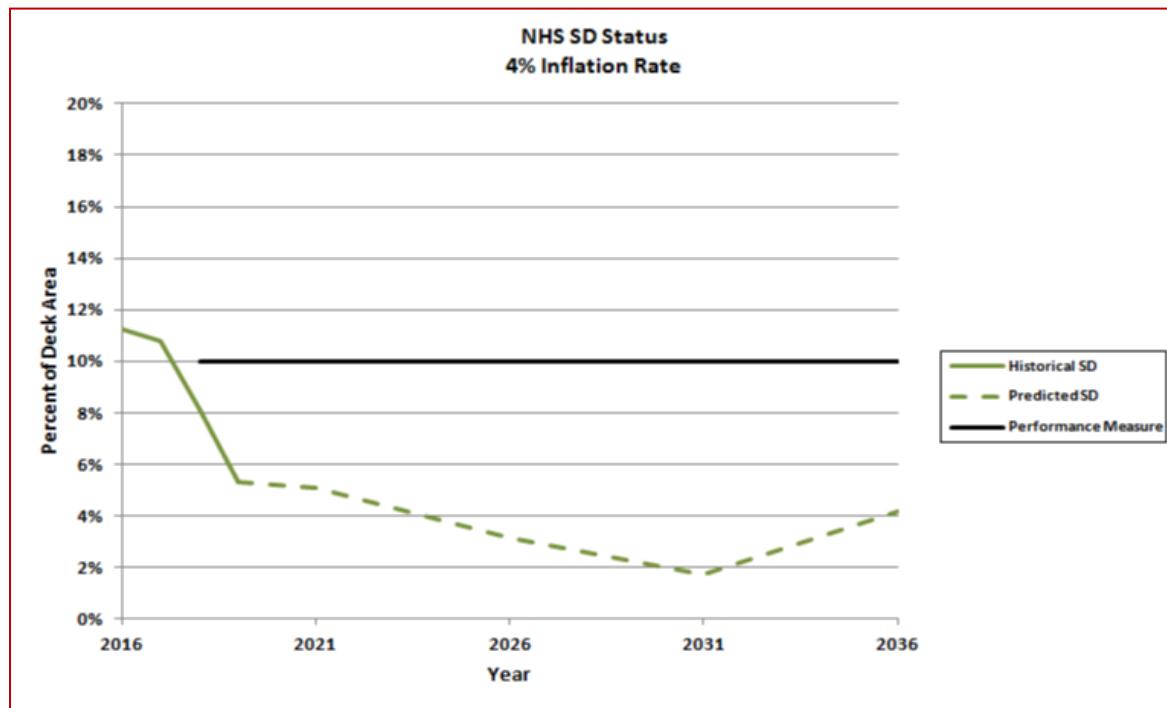


Figure 14: Interstate Structures SD History

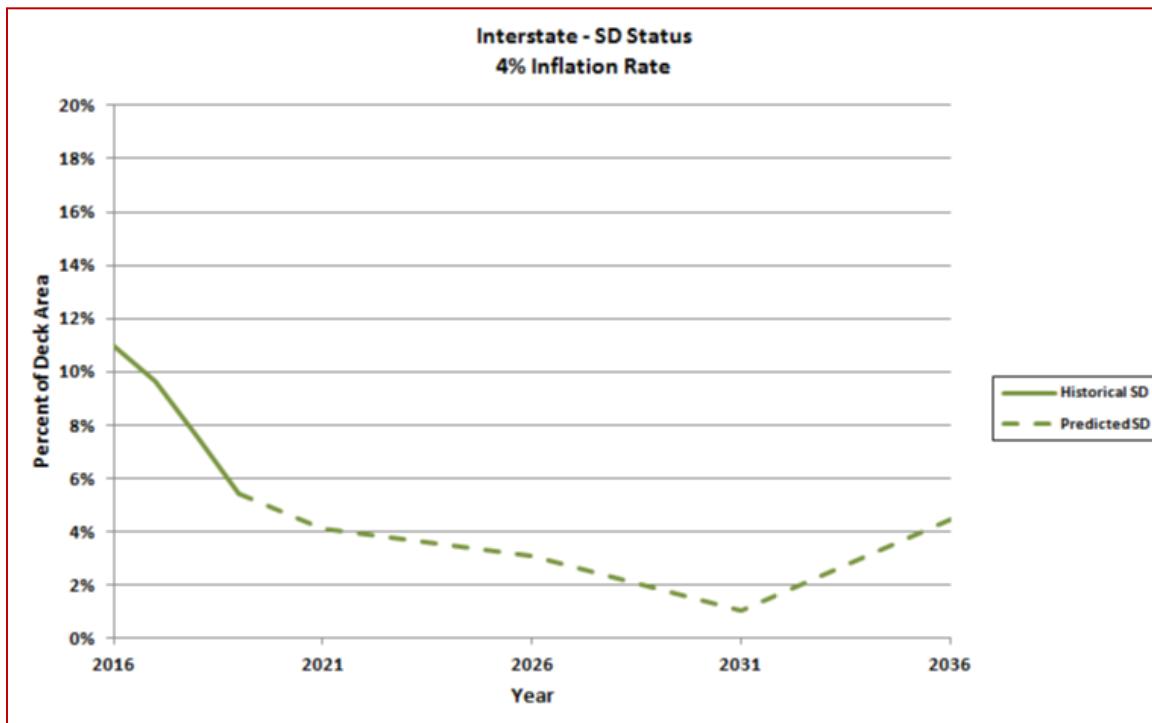
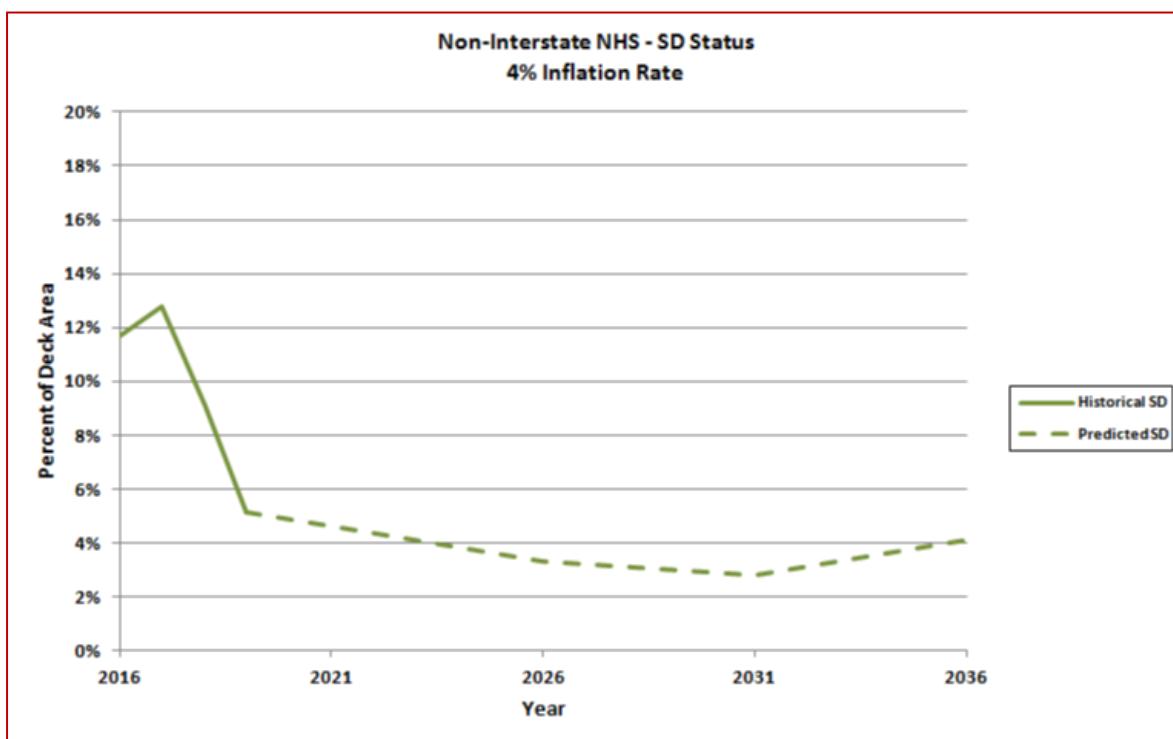
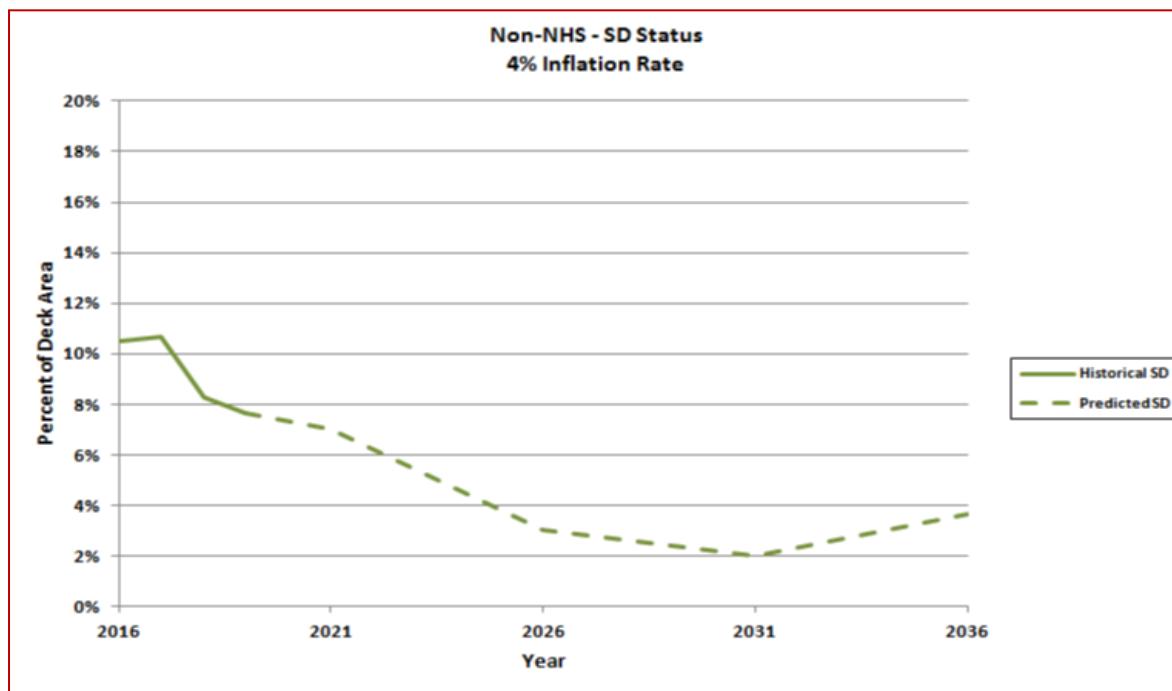


Figure 15: Non-Interstate NHS Structures SD History



*Figure 16: Non-NHS Structures SD History*



## BRIDGE LIFE-CYCLE COST ANALYSIS

WYDOT continues to develop its BMS to assist with its Preservation, Repair, Rehabilitation, and Replacement (PRR&R) program. WYDOT has developed deterioration, cost, and improvement models utilizing historical WYDOT data in addition to an optimization algorithm. These three types of models are used in conjunction with the optimization algorithm to determine the best PRR&R actions and associated allocation of funds to best meet various performance measures and given budget scenarios and reduce network-level LCC. Currently, the BMS does not take into account user or risk-related costs; however, these costs may be incorporated in the future. Bridge sized box culverts and pipes are excluded from the BMS analysis, since when they need work, replacement is usually the only option.

### DETERIORATION MODELS

These models simulate deterioration of various bridge components. The models were developed by analyzing historical WYDOT inspection data, namely deck, superstructure, substructure, and culvert NBI condition ratings. These NBI ratings compare existing in-place conditions to original as-constructed conditions and provide a way of quantifying levels of deterioration. WYDOT recognizes that inspection data is subjective and there are many uncertainties pertaining to deterioration; therefore, these models were developed using a probabilistic approach rather than a deterministic one. This type of approach allows the BMS to recognize levels of uncertainty or risk. Probable distributions of the durations in which NBI condition ratings remained unchanged were used to build the final stochastic deterioration models. These models are continually evaluated, refined, and updated as necessary.

### COST MODELS

These models estimate costs associated with typical PRR&R actions. The models were developed by analyzing historical WYDOT preservation, repair, rehabilitation, and new construction cost data. WYDOT recognizes the

variability and associated risks related to cost estimation; consequently, these models were also developed using a probabilistic approach and are also continually evaluated, refined, and updated as necessary.

*Table 11: 2018 BMS Cost Model*

<b>2018 Modeling Costs (Based on Deck Area)</b>			
<i>NBI Condition Rating</i>	<i>Deck Unit Cost /SF</i>	<i>Superstructure Unit Cost/SF</i>	<i>Substructure Unit Cost/SF</i>
8	\$19	\$0	\$0
7	\$19	\$0	\$0
6	\$19	\$0	\$0
5	\$27	\$4	\$4
4	\$40	\$6	\$6
3	\$62	\$8	\$8
2	\$84	\$9	\$9
1	\$84	\$108	\$108

*Table 12: 2018 New Construction Costs*

<b>2018 New Construction Costs</b>		
<i>Structure Type</i>	<i>Unit Cost/SF</i>	<i>Unit Cost/Perimeter FT/FT</i>
Bridge	\$155	N/A
Culvert	N/A	\$80

## IMPROVEMENT MODEL

These models simulate the effects associated with typical PRR&R actions. The models were developed by analyzing historical WYDOT rehabilitation data, namely PRR&R actions and associated NBI condition ratings before and after application of said actions. These models are continually evaluated, refined, and updated as necessary.

## OPTIMIZATION

The optimization algorithm compares deterioration without PRR&R actions to improvements with PRR&R actions and their associated costs. The algorithm then sets targets (percentage of the budget that should be allocated) for specific PRR&R actions. A list of candidates is then provided to each district for use in developing projects to meet the PRR&R targets that the BMS sets.

## BRIDGE WORK TYPES

WYDOT Bridge Program will initially focus PRRR&R actions on structures that have been classified as Structurally Deficient (SD); however, as the SD square footage begins to fall, the bridge work will concentrate more on preventative maintenance and preservation measures. Examples of WYDOT's bridge work types are listed below.

**BRIDGE MAINTENANCE** Bridge maintenance activities include: deck cleaning, minor pothole patching, expansion joint cleaning, minor expansion joint repair, minor bridge rail painting, drainage system cleaning, superstructure cleaning, minor damage repair, or other specific work required to maintain functional capacity in response to conditions or events that temporarily affect the operational performance of a structure. These activities

typically do not contribute a preservation value per se, but are of critical importance in sustaining the operational efficiency of the transportation system. Maintenance work is not incorporated in the funding strategies developed by the BMS. WYDOT does not have bridge maintenance costs programmed into its BMS investment plan as these activities are typically performed by field maintenance personnel.

**BRIDGE PRESERVATION** WYDOT's Bridge Preservation Work activities include, but are not limited to: asphalt overlays with waterproof membranes, berm, riprap or slope paving repair, superstructure and substructure painting, concrete/cracks sealing, culvert repair, debris removal from channel, drainage system repair, expansion joint repair/replacement, epoxy deck overlays, epoxy injection of concrete cracks, concrete repair, painting bridge rail, scour countermeasure installations, spot painting of steel girders, bearings, cross frames, etc., rigid deck overlays, bridge deck repair, bridge deck replacement, approach slab repair/replacement, substructure repair, superstructure repair, bearing device modifications, Preservation work is incorporated in the funding strategies developed by the BMS.

**BRIDGE REHABILITATION** Bridge Rehabilitation Work activities include: bridge widening, strengthening of superstructures and substructures. Often these activities can be included in Bridge Preservation Work activities. In addition, Bridge Rehabilitation Work activities are not predicted and not included in the BMS funding model. Rehabilitation work is not incorporated in the funding strategies developed by the BMS.

**BRIDGE REPLACEMENT** Bridge Replacement Work activities include: removal and replacement of existing structures, and roadway work required to tie-in the new structure. Replacement work, other than condition based, is not directly incorporated in the funding strategies developed by the BMS.

**BRIDGE CONSTRUCTION** Bridge Construction Work activities include: construction of new structures along alignments without existing structures and roadway work required to tie-in the new structures. New bridge construction work is not incorporated in the funding strategies developed by the BMS.

## RISKS TO WYDOT BRIDGES

WYDOT recognizes that there are numerous risks associated with bridges. Bridges may be located in seismic zones, over waterways that are prone to flooding, or on foundations susceptible to scour. Bridges may also contain fracture critical members or have fatigue prone details. As bridges age, their serviceability and structural integrity may be reduced due to deterioration. Failure of key elements (such as protective coating systems, expansion joints, and bearings) along with bridge deck cracking may rapidly reduce structural integrity making it necessary to load post or close the bridge. Bridges with substandard vertical and horizontal clearances may also be at risk from impacts of oversize loads. These risks, along with many others, are identified and assessed through WYDOT's bridge inspection program. Appropriate actions are taken when inspections identify items or areas of concern.

Network-level risk is generally associated with the BMS (for more information on the different levels of risk, see Section IX). The BMS deterioration and cost models were developed by analyzing historical WYDOT inspection and cost data. WYDOT recognizes that inspection data is subjective. There are many uncertainties pertaining to deterioration, and there is variability and associated risks related to cost estimation. Thus, a decision was made to develop these models using a probabilistic approach rather than a deterministic one, allowing the BMS to recognize levels of uncertainty or risk. Also, there is risk associated with the BMS optimization algorithm. This algorithm uses deterioration, cost, and improvement models to set targets (percentage of the budget that should be allocated) for specific preservation, repair, rehabilitation, and replacement actions. A list of candidates is then provided to each district for use in developing projects to meet the targets set by the BMS. There is a risk that the optimization and selection of specific bridges may be inadequate. Therefore, the BMS models and optimization algorithm are continually evaluated, refined, and updated as necessary, and performance measures are tracked in order to ensure the BMS is performing as expected.

Currently, there is sufficient bridge funding to meet WYDOT's bridge targets and FHWA performance measures for the next twenty years without making trade-offs in regards to bridges on interstate, non-interstate NHS, or non-NHS routes.

## V. LIFE-CYCLE COST ANALYSIS

As defined in MAP-21, Life-Cycle Cost Analysis (LCCA) is the cost of managing an asset class or asset subgroup for its whole life (from initial construction to the end of its service life).

As defined in the *AASHTO Transportation Asset Management Guide* (January 2011), Life-Cycle Cost (LCC) equals the net present value (or equivalent, uniform annual cost) of the sequence of monetary costs and benefits in a life-cycle activity profile. In the context of a LCCA, LCC should be defined by the types of costs it includes, for example, whether un-programmed maintenance, user costs, or both are included as well as inflationary assumptions about the cost stream.

To establish a framework for LCCA within WYDOT, identifying the four areas of LCCA (costs, risk, funding, and valuation) and how WYDOT is addressing these areas is important. The four areas are described below.

### COSTS

**THE PAVEMENT MANAGEMENT SYSTEM (PMS)** produces recommended budget amounts based on performance targets and other input parameters, including total roadway miles, total traffic, and the total of all pavement needs within the district without funding limitation. Trade-offs are conducted at the project level between functional classifications (e.g. principal arterial, minor arterial, and so on). The PMS runs preliminary analyses and provides network-level performance parametrics based on a range of funding levels.

**THE BRIDGE MANAGEMENT SYSTEM (BMS)** uses deterioration, cost, and improvement models in conjunction with an optimization algorithm to determine the actions to take and associated funding allocation that best meet given performance measures and budget scenarios. The models use a probabilistic versus deterministic approach and were developed using historical WYDOT data. Funding allocation is conducted at a project level in order to select specific bridges.

Performance versus cost data is extracted from the pavement and bridge management systems at the network level to feed LCCA trade-off analysis and to assist decision makers in determining how funding should be allocated—given financial constraints—between programs, asset classes, and goals.

### RISK

The Federal Highway Administration's report, *Risk-Based Transportation Asset Management: Evaluating Threats, Capitalizing on Opportunities*, suggests risk exists at three levels: (1) agency, (2) program, and (3) project. (See Section IX for a further discussion of risks to the Wyoming transportation system.)

**AGENCY RISK**, the highest risk level, is the lack of adequate funding to preserve and maintain the existing infrastructure and the inability to expand the existing system to meet future needs.

**PROGRAM RISK**, the next risk level, is common to clusters of projects, programs, or entire business units. These risks are usually addressed by or mitigated during the project design and development process and fall into one or more of three broad categories: (1) natural, (2) environmental, and (3) man-made (these risks are discussed in more detail in Section IX).

**PROJECT RISK**, the third and lowest risk level, is involved in bringing individual projects to contract. Numerous risks exist during an individual project's design and development process that can prevent a project from going to contract as scheduled.

## FUNDING

In 2008, WYDOT recognized that, based on funding constraints and rising construction costs, the mix of projects within the STIP would result in an unacceptable condition of the transportation system. WYDOT reached the same conclusion in 2015 concerning bridges—the bridge projects in the STIP would not meet WYDOT and FHWA bridge performance measures. These realizations were catalysts for changing the management strategy from a highway improvement program to an asset management program.

The anticipated average annual funding increases for the next 10 years are not expected to keep up with inflation. Approximately two-thirds of these funds are expected to come from federal highway funding and one-third from state funding (pavement condition projections are shown below in Figure 17).

For bridges to meet performance measures, WYDOT found it necessary to increase the amount allocated to preservation, repair, and rehabilitation. WYDOT used the BMS to examine several funding scenarios and decided to increase funding for bridges to \$20 million. The increased funding level and BMS implementation are expected to be sufficient for meeting MAP-21 and WYDOT bridge targets for the next 20 years (bridge condition projections are shown in Figure 18 on the following page).

*Figure 17: Percentage of Pavement Mileage in Poor Condition and Pavement Preservation Effects*

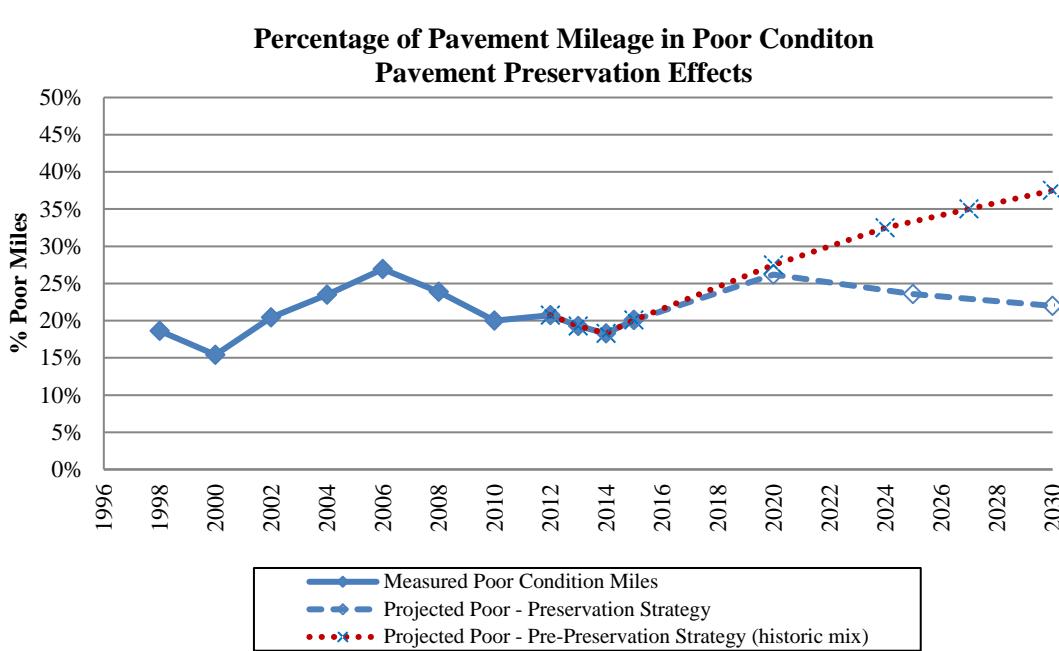
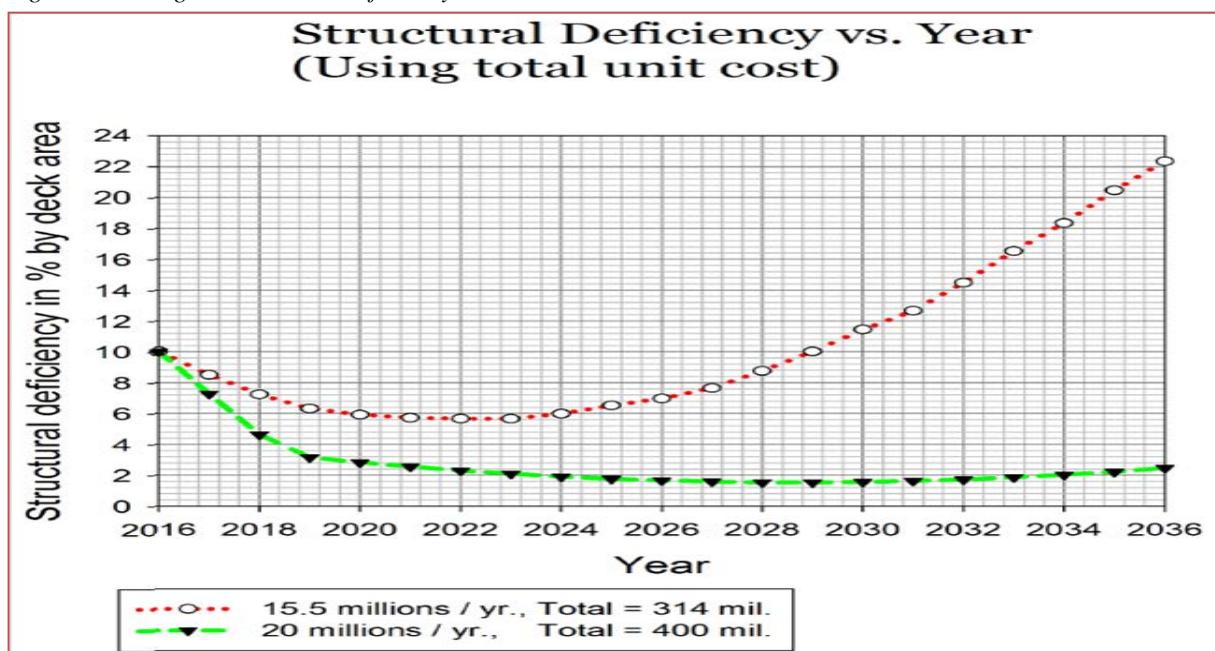


Figure 18: Bridge's Structural Deficiency vs. Year



Note: The \$20 million is for actual bridge preservation, repair, and rehabilitation work, and does not include traffic control or mobilization costs.

## VALUATION

WYDOT uses the modified Governmental Accounting Standards Board 34 (GASB 34) standard method for calculating the valuation of Wyoming's infrastructure assets; however, GASB 34 values are based on historical acquisition and construction costs and do not reflect current market valuation or replacement costs. While WYDOT reports GASB 34 information to FHWA, as required by law, WYDOT's management systems use actual or expected costs for calculating LCCAs.

## VI. PERFORMANCE-GAP ANALYSIS

### PERFORMANCE TARGETS

For the purpose of asset management, WYDOT considers a State of Good Repair (SOGR) to be a condition in which its physical infrastructure assets (both individually and system-wide) are functioning according to design standards and expected service life, and sustained through a systematic program of maintenance, preservation, and replacement, in order to provide a safe, high quality and efficient transportation system. WYDOT's targets for pavement and bridge conditions are found in Sections III, Statewide Pavement Condition and Programs, and Section IV, Statewide Bridge Condition and Program. These targets are fiscally constrained based on a trade-off analysis of what the management systems could maximize while still balancing other needs in the other goal areas. The method of measurement is also covered in these sections.

The targets are not to maintain the system in the existing condition forever. As the investment plan was developed, WYDOT made difficult decisions about the minimum levels of service the transportation system users need for a safe, high-quality, and efficient transportation system. WYDOT has a relatively fixed funding stream that is not

indexed to inflation. In the short-term of less than five years, the system should be able to maintain the existing condition, but the impact of inflation begins to compound in the mid- to long-term projections.

Pavement measures and projections are covered in detail in Section III of this document. Charts within that section show future projections and their relationship to the target for each management class. The deterioration of the interstate pavements beyond 10 years was considered an acceptable trade-off.

Bridge measures and conditions are covered in detail in Section IV of this document. Per the Federal Tape Submittal for 2018, bridge conditions are within the targets set by MAP-21 and WYDOT. Based on current funding levels and implementation of the BMS, these targets are expected to be met for the next 20 years.

Most projects that maintain or improve systems take many years from inception, through design, and being let to contract; therefore, evaluating the measures and setting targets annually is not effective or practical. Currently, WYDOT evaluates and sets targets every four years, but they may be evaluated more often depending on changes to funding levels.

The current investment plan allots adequate funds to maintain the pavement and bridge targets for the next 10 years; consequently, no gaps exist between the desired targets and projected conditions.

## EFFECTIVENESS

Effectiveness goals, in Wyoming's case, can be described as what is needed to "Provide a safe, high-quality, and efficient transportation system." WYDOT performs a biennial public survey to gather information about the public's perception of our operations and the transportation infrastructure's condition. From this survey, and other inputs, WYDOT determines acceptable target levels. Public input was the basis, along with existing funding constraints, for allowing Wyoming's interstate pavement condition to deteriorate from 83 percent in "Good" or "Excellent" condition down to 75 percent in "Good" or "Excellent" condition.

Current funding levels and PRR&R actions are expected to be sufficient to continue meeting bridge targets set by MAP-21 and WYDOT for the next 20 years. Eventually, preservation, repair, and rehabilitation actions will no longer be cost effective or possible, and bridges will need to be replaced. Currently, \$10 million is allocated for bridge replacements. This equates to a greater than 300-year service life. Current design specifications are based on a 75-year design life. Additional funding for bridge replacements will be necessary in order to establish a replacement cycle based on a 100-year service life.

WYDOT's effectiveness goal is to maintain the condition of Wyoming's transportation infrastructure at its current level. WYDOT continues to seek additional funding (\$69 million annually) to maintain pavements in current conditions and replace bridges based on a 100-year service life.

## VII. FINANCIAL PLAN: STIP

WYDOT uses a corridor-based system for high-level analysis of Wyoming's transportation network. The major connecting routes (Rawlins to Jackson or Evanston to Pine Bluffs, for example) are analyzed as contiguous routes to determine the deficiencies and needs of each individual sub-segment that makes up the corridor. This analysis is used to determine the items in a given segment that may be causing an impediment to the safe, efficient flow of traffic in the state. A corridor-based system revolves around the idea of creating a uniform and consistent experience when traveling from one location to another. Asset management is used to optimize individual rehabilitation strategies (contracted improvement projects) to the corridor analysis based on the physical needs of the corridor. Through an extensive public involvement process—with input from engineering studies, asset management, long range corridor plans, and the approval of the Transportation Commission—contract improvement projects are combined to create the STIP. This document forms the framework to track whether future investments meet the previously established goals.

Good management practices recognize that decision makers must be given the information, resources, and authority to perform to the standards that the organization sets while also being held accountable for meeting those standards with limited resources and multiple worthy transportation needs vying for the same limited funding. These transportation needs can be defined as the difference (gap) between the infrastructure's desired condition state and its actual condition state. At some level, trade-offs must be made between multiple needs, for example, somehow the cost and benefit of replacing a bridge approach slab must be weighed against the cost and benefit of refurbishing a rest area.

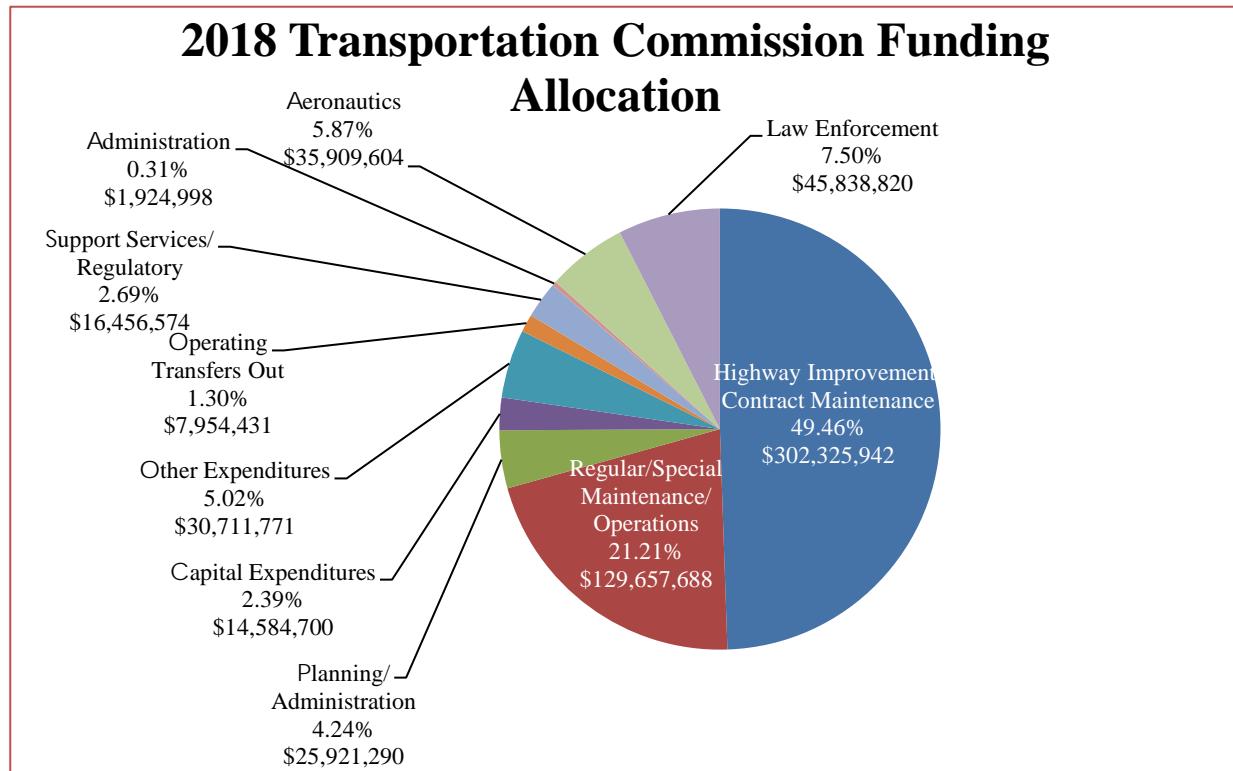
The district engineers perform the trade-off analysis between individual projects. Using their public information program, annual meetings with local governments, and input from program managers, the district engineers choose the projects that move into the fiscally constrained STIP. The district engineers are held accountable for ensuring the projected condition of bridges, pavements, and safety within their districts are met while working within pre-determined funding constraints.

## ANTICIPATED FUNDING EXPENDITURES FOR 2018

In 2018, WYDOT expects to expend \$302 million (almost 50 percent of available funding) on highway improvements and contract maintenance. After costs for project modifications, state infrastructure bank reimbursements, preliminary engineering, right of way, utilities, and other dedicated programs are deducted, approximately \$267 million remains for actual highway construction funding. For the years 2018 through 2023, WYDOT anticipates annual highway construction funding to average \$275.7 million. (See Appendix A for the complete Programming Investment Summary for all asset categories.)

The following chart (Figure 19) graphically illustrates how WYDOT expects to use the 2018 Transportation Commission allocation of revenue (\$631,285,818).

*Figure 19: 2018 Transportation Commission Funding Allocation*



## EXPECTED FUTURE FUNDING LEVELS

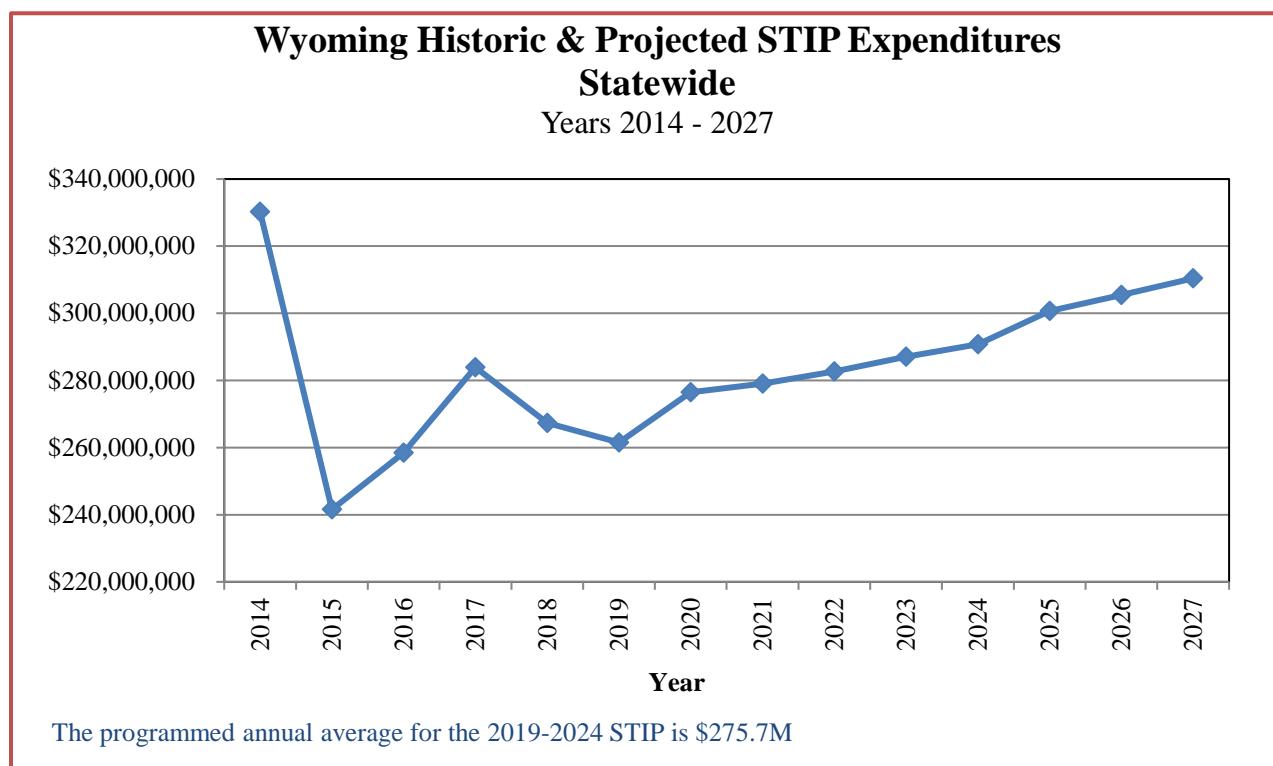
The STIP is a six-year, fiscally constrained program that documents WYDOT's investment plan used for managing Wyoming's transportation assets. Actual funding levels may vary due to changes in Congressional and state appropriations. While WYDOT anticipates relatively steady funding levels over the next 10-year period, all assumptions, calculations, and projections in the STIP and TAMP are based on the continuation of current funding levels from the state and federal government.

*WYDOT expects funding levels to increase 1% per year; however, with inflation estimates at 4%, real spending ability will decrease.*

Because both the nature of projects and funding is dynamic and subject to many sources of change, the STIP is inherently fluid. WYDOT uses recommendations from the PMS, BMS, and Safety Management System to assist in programming projects to meet performance measures. Challenges WYDOT faces include funding changes, increased construction costs, right of way acquisition, environmental issues, and cost volatility for construction materials. WYDOT attempts to account for cost volatility by calculating an annual inflation rate when generating project costs.

Roughly two-thirds of all highway projects are funded with federal highway funds while one-third is funded by state funds.

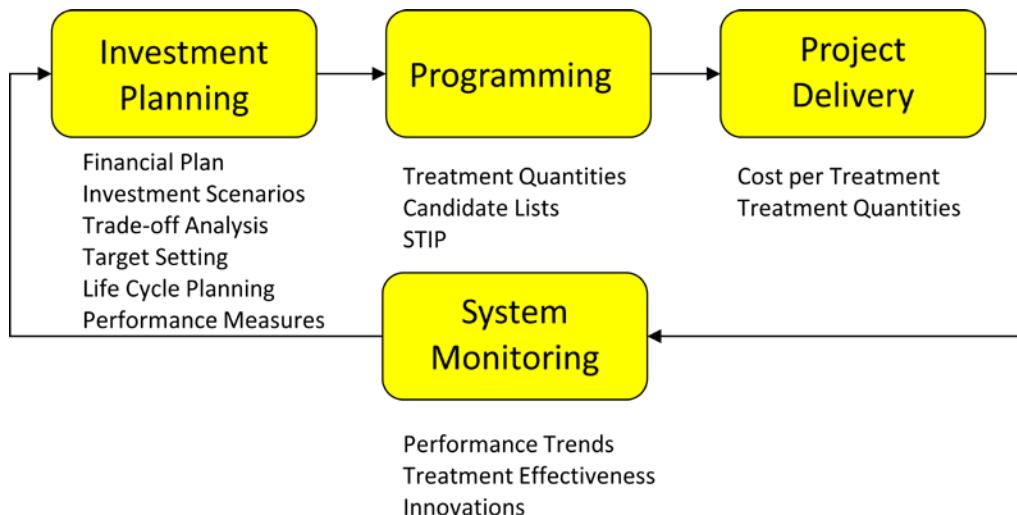
Figure 20: Wyoming Historic & Projected STIP Expenditures Statewide (2014-2027)



## VIII. INVESTMENT PLAN

A graphical representation of WYDOT's investment planning process is presented below in Figure 21.

*Figure 21: WYDOT's Investment Planning Process*



### INVESTMENT PLANNING

The investment planning process identifies the funding allocation and likely overall focus for each program given the state's funding constraints. The investment plan describes the necessary trade-offs across system program areas and provides a system-level understanding of the size and mix of investments in a given area.

WYDOT concentrates infrastructure spending on pavement, bridge, and safety, and these areas each have measures assigned both internally and at the federal level. A measure can be defined as the yardstick used to compare against other similar assets. These measures give an indication of the public's ability to achieve a proposed level of mobility and safety while traveling the state. Most projects that maintain or improve these systems take many years from inception, through design, to construction; therefore, evaluating the measures and setting targets annually is not useful or practical.

Target setting for these systems is centralized in Cheyenne and directed by the Assistant Chief Engineer for Engineering and Planning. The process begins with the Programming Section providing historical data and a future financial plan for funding splits between the districts encompassing district-specific, statewide, and earmarked projects. The district engineers use this data to provide input for the funding splits. The management systems calculate the predicted versus actual conditions as part of the historical review.

The Assistant Chief Engineer provides the management systems with guidance on current spending trends and scenarios to evaluate before setting targets. (See Appendix A for a Programming Investment Summary for all asset categories.)

WYDOT recognizes that the investment strategy to maintain Wyoming's transportation system at an optimal level utilizes most of its resources. Other risks can influence the way the resources are managed. These risks have been identified in the Risk Management Plan Process section of this document as well as proposed mitigation strategies should these risks impact the performance of Wyoming's transportation system.

## PROGRAMMING

The programming function involves gathering the recommended management system treatments into short-term projects listed in the STIP. Programming also serves as a means to document the specific commitments WYDOT has made. These projects are explicitly linked to the system-level investment plan.

The management systems use the funding guidance and targets to create a mix of treatment types broken down by system and district. Treatment types and quantities are calculated to provide the optimal life cycle for the asset or highest critical crash reduction based on the available (allocated) funding.

To meet future performance targets, assets must be moved from one projected (condition state) performance level to a higher level. Strictly tracking projects based on miles of pavement, square feet of bridge deck, or number of critical crashes is crucial. Targets are set based on the current condition, which is quantified by width, length, or roadside feature. If a road or bridge is widened (for example, from two lanes to four), the management systems only give credit for improving the original width, and the additional lanes are not considered pavement or bridge improvements; instead, they are considered a mobility enhancement (credit). Performance is not based on dollars spent, but on work performed and the resulting changes to the existing system.

The management systems produce a list of candidate projects to assist the district engineers in project selection, along with guidance on mileage, square footage, and treatment types needed to achieve the targets that the Assistant Chief Engineer previously set. Scenarios have shown that as long as the district engineers select projects from the candidate list for the mileages and square footages indicated they will achieve the projected targets.

The district engineers use the treatment type requirements, budget, and candidate lists to construct their fiscally constrained STIP. They take the difference between their district's treatment requirements and budget and apply trade-off analysis to determine the best areas to spend any remaining funds. These funds are extremely limited, estimated to vary between \$5 and \$10 million annually for each district. The district engineer, for example, must decide whether the bridge approach slab or the rest area should receive part of the remaining limited funding.

Funding is distributed to the various asset categories based on the asset management system recommendations. As projects progress through the design process and then construction, the asset categories are tracked and updated as changes occur. This tracking is done to monitor and update the asset management recommendations. If funding is increased for a given asset category, a like amount of funding has to be removed from the other asset categories. Currently, WYDOT anticipates spending an average of \$160 million on pavements and \$35 million on bridges annually. During the next 10 years, inflation and investment analysis may require some changes to the trade-offs between asset categories and their funding levels.

## PROJECT DELIVERY

The district engineers are held accountable for applying the needed treatment. The Programming Section tracks the treatment types and quantities that each district programs into the STIP. The Programming Section provides the Engineer with a report that compares the previously determined required treatment quantities to the actual work programmed in the STIP. Often a district engineer will cluster treatment types in one or two years of the six-year STIP to more effectively use the limited resources to meet their targets, so the report is by cumulative treatment amounts. The trade-off that the district engineers perform may also cause them to apply additional funds to an asset (such as adding lanes on a bridge).

The Programming Section works with the management systems to track the estimated cost per treatment. Multiplying this cost by the treatment quantity needed to reach the desired asset condition results in an estimated required budget allocation. If the cost estimate for a treatment is too low compared to actual cost, the district engineer may not have adequate resources to meet the targets; while if the estimate is too high, it may tie up funds that could be better spent on other assets.

System disruptions such as mobility needs, disasters, modal shifts, or other risks can sometimes throw off the project delivery schedule. A deliberate process is used when a district is forced into underperforming in the treatments. The preferred option is to over-perform in the years leading up to or immediately after the disruption. The management systems show that delays of a few years, while not optimal, still result in positive, low life-cycle costs. There can be cases where the disruptions are long term enough that the lowest life-cycle cost options are not achievable. In this case, new targets would have to be set.

## SYSTEMS MONITORING

Management systems track treatments over time to ensure they are providing the benefits projected and adjust treatments if necessary. This may show construction techniques or project selections need to be modified to achieve the projected benefits. Management systems also track performance trends to assist in maintenance of the management systems.

Innovation should be leveraged in the systems monitoring step, which would directly impact WYDOT's project delivery cycle. If less costly treatments can be found that achieve the life-cycle benefits, this would impact target setting, effectively lowering the cost per treatment. This innovation would free up funds to begin addressing other currently underfunded transportation needs the district engineers face.

*Currently 83.9% of WYDOT's construction funding is being spent on pavement, maintenance, bridge, and safety.*

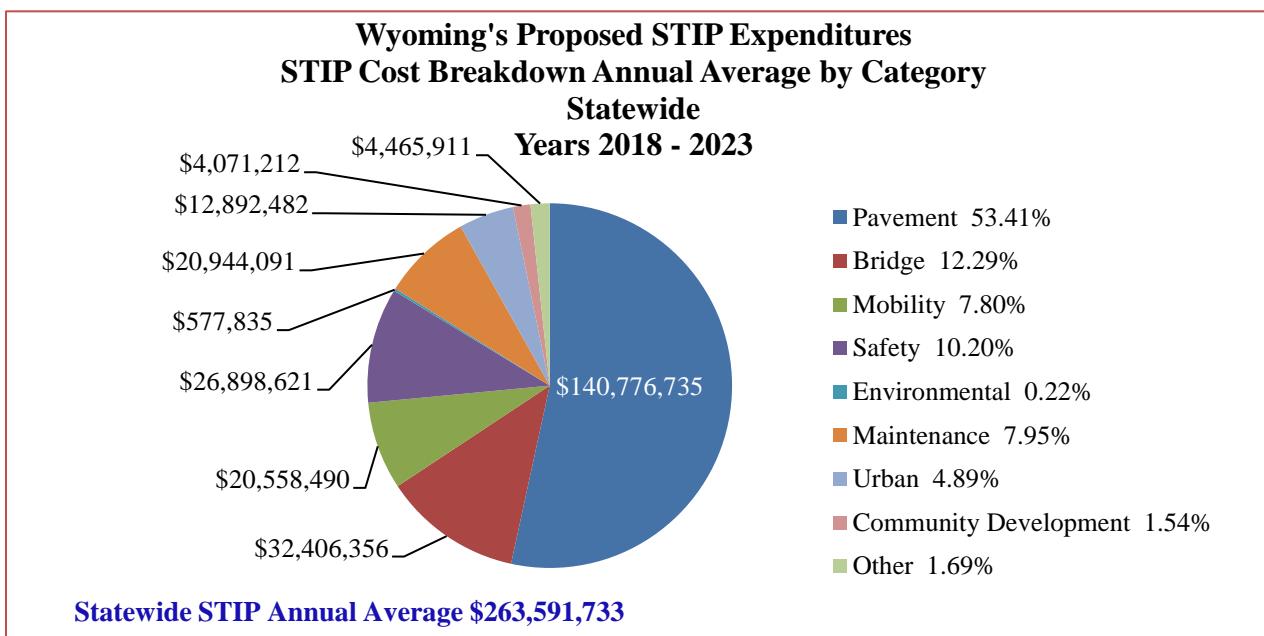
WYDOT tracks the planned and actual expenditure of construction funds by calculating the percentage of each project falling into each of the nine asset categories consisting of the following:

*Table 13: Asset Categories*

<b>1</b>	<b>Pavement</b>	All roadway surfacing that is not the result of a mobility improvement.
<b>2</b>	<b>Bridge</b>	All bridges that are on or off of the state owned highway system.
<b>3</b>	<b>Mobility</b>	Items include additional lanes, intersection improvements for traffic flow, turning lanes, etc.
<b>4</b>	<b>Safety</b>	These are items that affect the safety of the transportation system (such as guardrail, side slopes, signs, etc.)
<b>5</b>	<b>Environmental Sustainability</b>	Air quality improvements, wetland banking, animal-vehicle crash mitigation, archeological and historical preservation, etc.
<b>6</b>	<b>Maintenance</b>	Items for the general maintenance of the roadways (such as fencing, sign, or guardrail replacement; crack sealing; pothole patching; snow removal, etc.)
<b>7</b>	<b>Urban</b>	Transportation-related items within an urban boundary
<b>8</b>	<b>Community Development</b>	Items that enhance community livability (such as sidewalks, ADA upgrades, pathways, etc.)
<b>9</b>	<b>Other</b>	Other non-defined items

The calculated STIP expenditures for each of the nine asset categories for STIP years 2018 through 2023 are presented in Figure 22 on the next page.

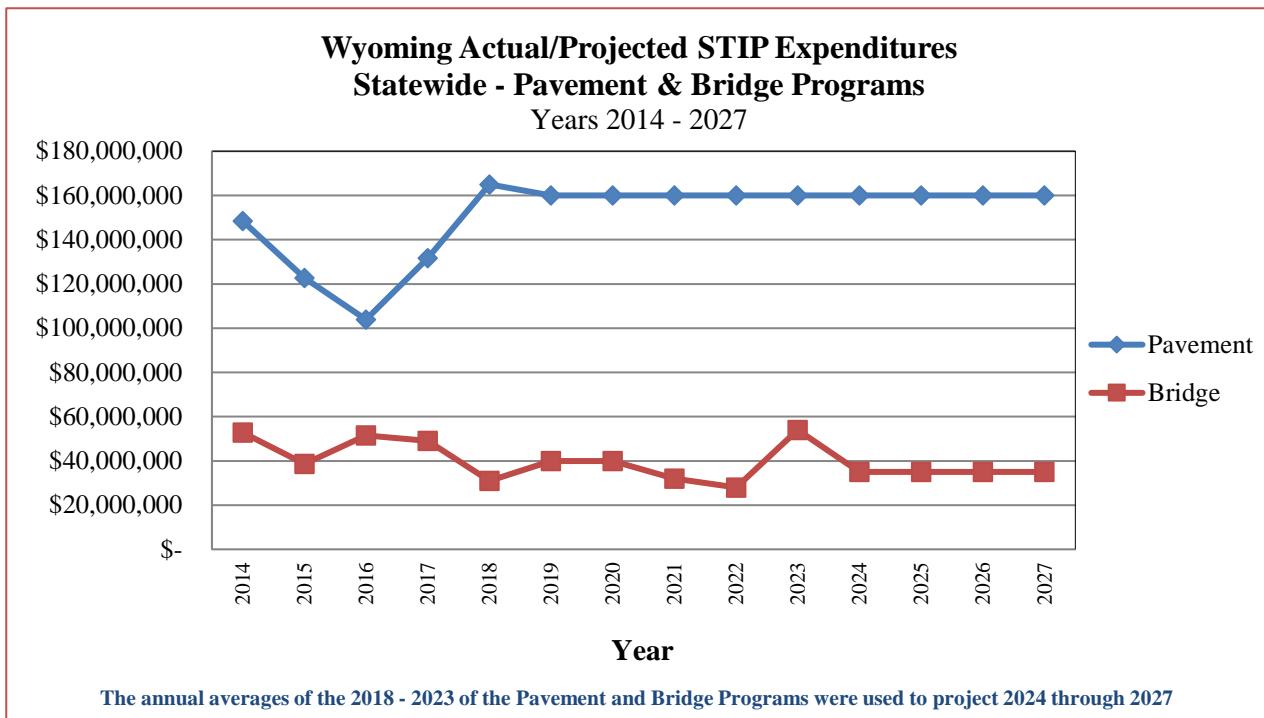
Figure 22: Wyoming's Proposed STIP Expenditures (2018-2023)



## ANNUAL PAVEMENT AND BRIDGE EXPENDITURES

Shown below are the annual historic and projected annual expenditures for the STIP pavement and bridge categories.

Figure 23: Wyoming Annual Actual/Projected Pavement and Bridge Program Expenditures (2014-2027)



## VALUATION OF EXISTING ASSETS

WYDOT uses the modified GASB 34 standard method for infrastructure asset valuation. The official WYDOT Financial Statements (dated September 30, 2017) show WYDOT's Infrastructure Assets valued at \$5,309,165,477 and Infrastructure Work in Progress (W.I.P.) valued at \$403,010,116. The Infrastructure Assets can be broken down into land (right of way) \$69,246,068; bridges \$862,740,302; roadways \$4,313,635,372; communication systems \$59,249,007; and permanent easements \$4,294,728.

## IX. RISKS TO THE WYOMING TRANSPORTATION SYSTEM

Risk can be defined as:

*A probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through preemptive action.*

Risk-based asset management considers the prospect of hazards and uncertainty while taking pre-emptive action to mitigate potential failures. FHWA's series of reports on risk, produced in 2012 and 2013, guide risk evaluation in asset management. Report 1, *Risk-Based Transportation Asset Management: Evaluating Threats, Capitalizing on Opportunities*, suggests three levels of risk exist: (1) agency risk, (2) program risk, and (3) project risk.

### AGENCY RISK

The greatest known risk to Wyoming's transportation network is agency risk: the lack of adequate funding to preserve and maintain the existing infrastructure and an inability to expand the system to meet future needs. WYDOT continues to seek additional funding (\$69 million annually) to maintain pavements in current conditions and replace bridges based on a 100-year service life. The additional \$69 million does not include any funding needed to meet safety needs.

*Currently, the biggest risk to Wyoming's highways is a possible future reduction in federal funding due to trust fund shortfalls.*

In 2013, WYDOT began receiving dedicated state funding from a ten cent per gallon fuel tax increase (approximately \$44.2 million a year), which was offset by a reduction in previously received general funding. The new fuel tax funding is being split, based on traffic levels, between highways on and off the NHS. Based on the 2018 to 2023 revenue projections, WYDOT anticipates letting \$275.7 million annually in highway construction and maintenance projects.

The FAST Act provides stable funding with one-time transfers through 2020; however, due to the increased outlays, the trust fund is projected to face shortfalls between \$19 billion and \$23 billion from 2021 to 2026. These shortfalls may cause FHWA to decrease each state's annual obligation authority. For a more detailed analysis of the expected Highway Trust Fund (HTF) shortfalls, see the CBO's March 2016 Baseline projections at:

<https://www.cbo.gov/sites/default/files/51300-2016-03-HighwayTrustFund.pdf>.

Assets, such as bridges (with a 75-year or more life cycle) and pavements (with a 20- to 30-year life cycle), need a constant funding stream for many years. With the impending shortfall in the HTF in 2021, a 30 percent funding shortfall remains the highest long-term risk to the assets WYDOT maintains.

WYDOT has analyzed the impact of a 30 percent reduction in federal funding with no corresponding increase in state funding to offset the loss. The result is that WYDOT's overall construction budget would be reduced by an average of 18 percent annually in total dollars; therefore, the \$275.7 million currently projected annual expenditure

(after 2018) for construction projects would drop to approximately \$226 million. If Wyoming actually experiences a 30 percent drop in federal funding, then reduced levels of service would need to be evaluated and used to set new, lower performance goals.

A \$44 million annual drop in funding from a decrease in the HTF funding levels cannot be made up by moving funds from other asset categories. All other asset categories (categories other than pavement, bridge, maintenance, and safety) contain funding of just over \$50 million dollars, and most of those funds are expenditures directed by Congress, which WYDOT is unable to use for other purposes. For example, most of the environmental sustainability asset category consists of Congestion Mitigation and Air Quality (CMAQ) funds and the community development asset category includes the Transportation Alternatives Program (TAP) funds; these funds cannot be used on pavement or bridges. A “bare bones” expectation is that 80 percent of a \$44 million funding reduction would have to be cut from pavement and bridges.

Wyoming’s ability to make up for a future reduction of federal funding with state funding is remote due to its small population and the rapid decline in tax revenues related to its top revenue generator: mineral extraction. In 2015, state tax revenues began dropping precipitously due to this industry’s economic difficulties.

Another consideration affecting the agency risk of inadequate funding is inflation. Long-range projections predict future funding levels will be flat with any funding increases projected to be well below the rate of inflation. WYDOT has compared the region’s Construction Price Index with other factors and is currently using a 4 percent annual inflation rate for future cost projections. While in the short-term this has little impact, long-term projections (10 years or more into the future) show a growing funding shortfall compared to the expected pavement maintenance and bridge preservation, repair, and rehabilitation needs.

## PROGRAM RISK

WYDOT considers program risk to be an event that prevents the traveling public, commerce, or both from successfully moving from one location to another across Wyoming’s transportation systems. Using this definition, WYDOT considers three broad categories of risk: (1) natural, (2) environmental, and (3) man-made. These programmatic risk categories are described below:

**NATURAL RISKS** consist of earthquakes, avalanches, landslides, and rock falls. These risks tend to disrupt the traveling public for longer periods and are very random and unpredictable. Natural risks are considered and mitigated during each project’s design phase using industry and national design standards. Historical data is also considered and is used to determine the frequency or likelihood of re-occurrence.

**ENVIRONMENTAL RISKS** in Wyoming consist of wind, blizzards, and flooding or storm water runoff. These risks can disrupt the traveling public for long periods of time, but they are usually shorter-lived events that disrupt traffic for a short time. Environmental risks tend to occur more often (cyclically) than natural risks. These risks are predictable in that their occurrence is considered in the cost-benefit analysis of each project’s design; for example, structures are designed (sized) to pass a flood of a given design frequency (25-year, 50-year, or 100-year flood) and the possibility of a larger flood occurring during the structure’s life is considered an acceptable risk.

**MAN-MADE RISKS** consist of road closures caused by accidents, fires, fuel spillage, or other errors in judgment made by the driving public and commercial carriers. Historically, these road closures have been relatively short and/or relatively easy to route traffic around. Local emergency response agencies have historically managed such incidents. Man-made events rarely cause significant damage to the transportation infrastructure.

## PROJECT RISK

The third level is project risk, which pertains to bringing individual projects to contract. There are a number of risks that can prevent a project from successfully going to contract as scheduled. These risks include, but are not limited

to, right of way acquisition, environmental clearances and permits, NEPA compliance, construction funding constraints, and project cost increases. Project risks are only considered to the extent that their accumulated effect may impact the STIP.

## WYDOT RISK ANALYSIS

WYDOT is using the TAMP to describe program-level risks and the threats and opportunities that occur at the system level. Available funding is the main driver affecting WYDOT's ability to provide a low-risk transportation experience in Wyoming. Using asset management principles, WYDOT is attempting to optimize the condition of the transportation system using limited available funding.

Using analytical software, like the previously described PMS, and in-house expertise and inspection processes, WYDOT uses programmatic risk analysis to minimize potential deterioration of the transportation network by emphasizing preventative efforts.

## RISK MANAGEMENT PLAN DEVELOPMENT PROCESS

MAP-21 and the FAST Act require states to develop and implement a risk-based asset management plan (23 CFR 515.7(c)) for the NHS to improve or preserve its condition and performance. The TAMP final rule defines risk management as the processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and NHS system performance. WYDOT decided to address this process at the programmatic level.

During the development of WYDOT's risk management plan, it was agreed there are four general types of risk: (1) operational, (2) strategic, (3) environmental, and (4) financial.

**OPERATIONAL RISKS** include asset and maintenance failures, staff turnover, and internal procedural breakdowns.

**STRATEGIC RISKS** include public opinion, stakeholder demands, and changing standards and regulations.

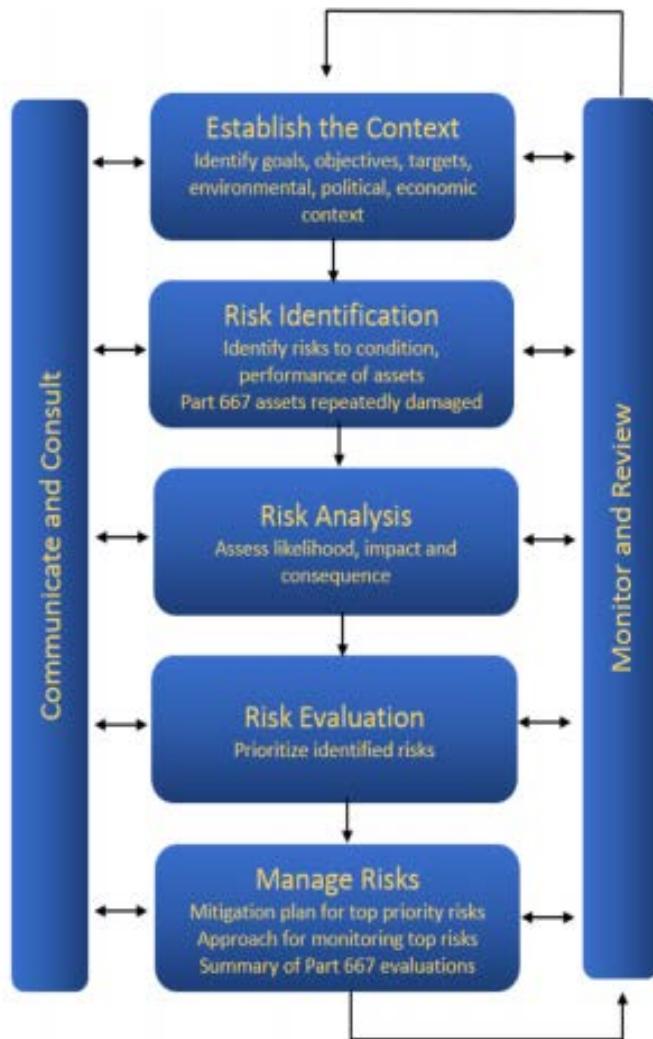
**ENVIRONMENTAL RISKS** include rock slides, landslides, flooding, and seismic events.

**FINANCIAL RISKS** are not limited to a lack of funding, but also include budget uncertainty, price increases, and economic downturns.

While developing the risk management plan, WYDOT executives, program managers, and planning and administration staff used the framework illustrated in Figure 24 to identify, assess, evaluate, and prioritize program-level risks during a risk management workshop.

During the risk management workshop, the subject matter experts (SMEs) participated in individual brainstorming exercises to identify program-level risks. The workshop participants then gathered into small groups to discuss, refine, and document the risks they previously identified. Once this was completed, all participants collectively analyzed and clarified the identified risks. Participants then used the risk matrix (Figure 25) to rate each risk.

Figure 24: WYDOT Risk Management Plan Development Framework



Ratings from 9 to 10 were considered “Very High Risk,” ratings of 8 were considered “High Risk,” ratings from 6 to 7 were considered “Medium Risk,” and ratings from 2 to 5 were considered “Low Risk.”

The participants’ individual ratings were entered into a spreadsheet (as seen in Table 14) that calculated an average rating for each identified risk.

Figure 25: Risk Matrix

Risk Matrix								
Risk Matrix with Impact and Likelihood Definitions			Likelihood					
			Rare	Unlikely	Likely	Very Likely		
			1	2	3	4		
Impact	Catastrophic	Potential for multiple deaths & injuries, substantial public & private cost.	5	Medium	Medium	High	Very High	Very High
	Major	Potential for multiple injuries, substantial public or private cost and/or foils agency objectives.	4	Low	Medium	Medium	High	Very High
	Moderate	Potential for injury, property damage, increased agency cost and/or impedes agency objectives.	3	Low	Medium	Medium	Medium	High
	Minor	Potential for moderate agency cost and impact to agency objectives.	2	Low	Low	Low	Medium	Medium
	Insignificant	Potential impact low and manageable with normal agency practices.	1	Low	Low	Low	Low	Medium

The workshop participants then prioritized the risks and identified WYDOT's top-priority risks. A total of sixteen risks were identified with eight identified as top-priority (as seen in Table 15).

The participants then discussed possible mitigation approaches for the eight top-priority risks. The different approaches that were considered include:

**TREAT** the risk by taking an action and providing an explanation as to how the risk is currently being or will be treated.

**TOLERATE** the risk. Accept and monitor the risk because it cannot be feasibly addressed.

**TERMINATE** the risk by ending the practice that causes it.

**TRANSFER** the risk on to contractors or design consultants.

**TAKE ADVANTAGE** of the risk by capitalizing on it.

Table 14: Ratings Sheet

Risk Event Impact	Likelihood of Occurrence	Risk Rating	Risk Level
<b>Insignificant = 1</b>	Rare = 1	Rating = 2	Low Risk
<b>Minor = 2</b>	Rare = 1	Rating = 3	Low Risk
<b>Moderate = 2</b>	Rare = 1	Rating = 4	Low Risk
<b>Major = 4</b>	Rare = 1	Rating = 5	Low Risk
<b>Catastrophic = 5</b>	Rare = 1	Rating = 6	Medium Risk
<b>Insignificant = 1</b>	Unlikely = 2	Rating = 3	Low Risk
<b>Minor = 2</b>	Unlikely = 2	Rating = 4	Low Risk
<b>Moderate = 2</b>	Unlikely = 2	Rating = 5	Low Risk
<b>Major = 4</b>	Unlikely = 2	Rating = 6	Medium Risk
<b>Catastrophic = 5</b>	Unlikely = 2	Rating = 7	Medium Risk
<b>Insignificant = 1</b>	Likely = 3	Rating = 4	Low Risk
<b>Minor = 2</b>	Likely = 3	Rating = 5	Low Risk
<b>Moderate = 2</b>	Likely = 3	Rating = 6	Medium Risk
<b>Major = 4</b>	Likely = 3	Rating = 7	Medium Risk
<b>Catastrophic = 5</b>	Likely = 3	Rating = 8	High Risk
<b>Insignificant = 1</b>	Very Likely = 4	Rating = 5	Low Risk
<b>Minor = 2</b>	Very Likely = 4	Rating = 6	Medium Risk
<b>Moderate = 2</b>	Very Likely = 4	Rating = 7	Medium Risk
<b>Major = 4</b>	Very Likely = 4	Rating = 8	High Risk
<b>Catastrophic = 5</b>	Very Likely = 4	Rating = 9	Very High Risk
<b>Insignificant = 1</b>	Almost Certain = 5	Rating = 6	Medium Risk
<b>Minor = 2</b>	Almost Certain = 5	Rating = 7	Medium Risk
<b>Moderate = 2</b>	Almost Certain = 5	Rating = 8	High Risk
<b>Major = 4</b>	Almost Certain = 5	Rating = 9	Very High Risk
<b>Catastrophic = 5</b>	Almost Certain = 5	Rating = 10	Very High Risk

*Table 15: Workshop Results (Risk Management Priorities)*

<b>Identified Risks</b>	<b>Average Rating</b>
<i>Lack of Funding</i>	<b>7.85</b>
<i>Prolonged Preservation Strategy</i>	<b>6.69</b>
<i>Natural Disasters</i>	<b>6.31</b>
<i>Workforce</i>	<b>6.23</b>
<i>Mobility Demand Changes</i>	<b>6.23</b>
<i>Political Influence</i>	<b>6.23</b>
<i>Changing Requirements/Standards</i>	<b>6.08</b>
<i>Competing Priorities</i>	<b>6.08</b>
Environmental Restrictions	<b>6.00</b>
Lack of Contractors	<b>5.92</b>
Automated Vehicles	<b>5.85</b>
BMS/PMS Models	<b>5.46</b>
Supply Availability	<b>5.38</b>
Weight Limit Changes	<b>5.23</b>
New Technology/Trade-offs	<b>4.92</b>
Inaccuracy of Public Perception	<b>4.92</b>

The participants decided that the risks of lack of funding, natural disasters, political influence, and changing requirements and standards would be tolerated; whereas, the risks of prolonged preservation strategy, workforce, mobility demand changes, and competing priorities could be treated. Mitigation strategies were identified for the treatable risks, and the parties responsible for each of the treated top-priority risks were identified. A Risk Register for the treatable risks is shown in the Risk Management Register (Table 16).

Table 16: Risk Management Register

RISK MANAGEMENT REGISTER		
Treated Top-Priority Risks	Mitigation Strategies	Responsible Parties
<b>Prolonged Preservation Strategy</b>	<ul style="list-style-type: none"> <li>○ Analyze annually planned versus actual project selection with system management plans.</li> <li>○ Determine results of meeting or not meeting the model deterioration curves.</li> </ul>	State Programming Engineer
	<p>Utilize Trade-off Committee to determine if the proper percentage of preservation funding should be used for replacement/reconstruction.</p> <ul style="list-style-type: none"> <li>○ Determine proper preservation levels and set-aside funding for improvements per year.</li> <li>○ Set aside a portion of funding for modal improvements.</li> <li>○ Due to limited funding, do a limited number of improvements system-wide per year.</li> </ul>	Assistant Chief Engineer, Engineering and Planning
	<ul style="list-style-type: none"> <li>○ Communicate the benefits of preservation first and the impacts of not optimizing the use of resources to the public.</li> <li>○ Ensure there are sufficient funds to maintain any improvements into the future.</li> </ul>	State Planning Engineer
	Use the Long Range Transportation Plan (LRTP) to assist the legislature in determining funding levels to meet system requirements.	System Planning Engineer
<b>Workforce</b>	<p>Standing Committee on Training is the key committee for technical and behavioral training made available to all WYDOT personnel.</p> <ul style="list-style-type: none"> <li>○ WYDOT University provides personal and professional training opportunities through instructor-led training and facilitation, district-wide opportunities, classroom training, computer lab, and the WYDOT eLearning library.</li> <li>○ On-the-job training (OJT)</li> </ul>	Assistant Chief Engineer, Engineering and Planning
	<p>Continue developing succession planning, defining critical positions, and improving knowledge transfer throughout WYDOT.</p> <ul style="list-style-type: none"> <li>○ Develop contingency plans for decreased staffing levels that explore reallocating staff and contracting alternatives.</li> <li>○ Explore how other states are addressing succession and knowledge transfer.</li> </ul>	Support Services Administrator
	Update recruitment strategies to reflect changing workforce needs.	Human Resource Manager

<b>Mobility Demand Changes</b>	Create an objective process to determine which mobility projects provide the greatest long-term benefit, realign management system models, and optimize strategies if economic drivers change.	State Planning Engineer
	Place more emphasis on corridor plans for mobility planning, and review the LRTP and verify needs are aligned.	State Planning Engineer
	Monitor traffic counts and truck counts.	System Planning Engineer
	Monitor Bureau of Land Management (BLM)/Forest Service Environmental Impact Statements (EIS).	System Planning Engineer
	Monitor automated/connected vehicles.	System Planning Engineer
<b>Competing Priorities</b>	Document and formalize repeatable and defensible methods for prioritizing competing projects.	System Planning Engineer
	Continue addressing scope growth (creep) by implementing control measures through training and other processes.	State Programming Engineer
	Foster two-way communication with the public to better understand the public's needs and to educate the public on WYDOT's investment strategies (why specific treatments are chosen).	State Programming Engineer
	Analyze annually planned versus actual project selection with system management plans. Determine results of meeting or not meeting the model deterioration curves.	State Planning Engineer
	Utilize Trade-off Committee to determine if the proper percentage of preservation funding should be used for replacement/reconstruction. <ul style="list-style-type: none"> <li>○ Determine proper preservation levels and set aside funding for improvements per year.</li> <li>○ Set aside a portion of funding for modal improvements.</li> <li>○ Due to limited funding, do a limited number of improvements system-wide per year.</li> </ul>	State Programming Engineer

## X. EVALUATION OF EMERGENCY EVENTS

WYDOT conducted a statewide evaluation of the state's existing roads, highways, and bridges eligible for funding under Title 23 of the United States Code to meet the MAP-21 Evaluation of Emergency Events requirement and to better equip WYDOT to potentially mitigate natural and environmental risks. (Emergencies that did not affect the state's transportation system or use Title 23 funding were not considered in this evaluation.) To comply with these regulations, WYDOT formulated a standardized process. In this section, WYDOT will outline these steps and provide documentation of the research conducted, points of contact, and sources of information. Specifically, 23 CFR 667.1 state that:

*"Each State, acting through its department of transportation (State DOT), shall conduct statewide*

*evaluations to determine if there are reasonable alternatives to roads, highways, and bridges that have required repair and reconstruction activities on two or more occasions due to emergency events.”*

23 CFR 667.3 defines an emergency event as, “*a natural disaster or catastrophic failure resulting in an emergency declared by the Governor of the State or an emergency or disaster declared by the President of the United States.*”

## RESEARCH CONDUCTED

Based on WYDOT’s research, there have been fourteen Governor and/or Presidential Declarations of Emergency or Disaster Declarations issued since January 1, 1997, in Wyoming that may have affected NHS highways and bridges. WYDOT researched the 14 events to determine specific locations of damage and the extent of damage inflicted on NHS highways and bridges.

The second step included methodically geo-locating the infrastructure directly affected by these emergency events. By using various state databases, WYDOT ran a series of queries and generated a list of all projects with emergency repair, damage repair, or emergency shown in the description or intent pertaining to the project. With the help of the local FHWA office, WYDOT obtained a query within the Federal Management Information System (FMIS) showing all projects with emergency relief (ER) designations.

Through an iterative process of cross referencing these queries with the locations of infrastructure damaged by these emergency events, WYDOT composed a summary table shown in Appendix B. Based on the process that WYDOT formulated and implemented when conducting an evaluation of emergency events, three locations have been identified that required repair, reconstruction, or both on two occasions due to emergency events since January of 1997. There are two separate bridges over the Little Wind River where the damage to the rip-rap has been repaired on two separate occasions. The rip-rap is a sacrificial element to protect the abutments, and it would be cost prohibitive and environmentally unsound to prevent future damage to the rip-rap. The Wind River Canyon is the third location that has had repairs made to it on two separate occasions, which is a designated scenic highway canyon with Class 1 water in areas up to 2,500 feet deep with exposed rock and very steep slopes. During flooding events, large rock falls or erosion occurs. Protecting the entire eleven miles of canyon is cost prohibitive. These sacrificial elements are excluded from other asset funding strategies, and are not programmed into the investment summary.

## POINTS OF CONTACT

To complete the preliminary research to determine the historical occurrences of Presidential Disaster Declarations and current and historical Wyoming State Executive Orders – Declarations of Emergency, WYDOT corresponded with multiple agencies and referenced public information on their websites, including the Governor’s Office, Wyoming State Library, Wyoming Secretary of State, Wyoming State Archives, Wyoming Legislative Service Office, and the Wyoming Office of Homeland Security. Through the numerous discussions with both state personnel and internally, WYDOT is confident that all available information pertaining to emergencies declared by the Governor of Wyoming and all emergencies or disasters declared by the President of the United States have been obtained.

## RESOURCES

Based on this research, WYDOT has narrowed down the resources to three links, including the national Federal Emergency Management Agency (FEMA) database and two links to Wyoming State Governor Executive Orders. The links are shown below:

### NATIONAL FEMA DATABASE SHOWING PRESIDENTIAL DISASTER DECLARATIONS FOR WYOMING:

<https://www.fema.gov/disasters/grid/state-tribal-government/74>

**WYOMING STATE EXECUTIVE ORDERS ISSUED BY THE CURRENT GOVERNOR OF WYOMING:**

<http://governor.wyo.gov/documents/executive-orders>

**WYOMING STATE LIBRARY LINK SHOWING WYOMING STATE EXECUTIVE ORDERS ISSUED BY THE GOVERNOR (CURRENT AND HISTORICAL):**

<http://will.state.wy.us/sis/wydocs/execorders.html>

## RESILIENCE

Presidential Policy Directive 21 (PPD-21): Critical Infrastructure Security and Resilience defines resilience as the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions—deliberate attacks, accidents, or naturally occurring threats or incidents.

Critical infrastructure must be secure and able to withstand and rapidly recover from all hazards. Achieving this resilience requires integration with the national preparedness system across prevention, protection, mitigation, response, and recovery.

The 2013 National Infrastructure Protection Plan calls for resiliency to:

- Identify, deter, detect, disrupt, and prepare for threats and hazards to the nation's critical infrastructure;
- Reduce vulnerabilities of critical assets, systems, and networks; and
- Mitigate the potential consequences to critical infrastructure of incidents or adverse events that do occur.

Wyoming's highway network was not defined as a critical infrastructure as defined in the PATRIOT Act and PPD-21; however, WYDOT recognizes that the fundamentals of resiliency apply to all levels of infrastructure and an individual failure may result in severe local economic hardship.

Nearly all of the threats and hazards to the highways in Wyoming are believed to occur naturally (are not man-made), and normally are broken into two categories: (1) extreme weather (environmental risks) and (2) geological (natural risks). Extreme weather includes flooding, blizzards, high wind, and snow slides. Geological events include earthquakes, ground subsidence, landslides, and rock falls. Pavements do not currently have resiliency measures for natural or man-made events due to the rapid methods of temporary repair that are currently available. Resilience in bridges is covered by the risk analysis performed during the design process, including seismic ability and scour potential.

## XI. ASSET MANAGEMENT PROCESS ENHANCEMENT

Wyoming inaugurated an enterprise resource program in 2006. One of the primary selection criteria was to facilitate an asset management process. Soon after that, the state planning engineer was appointed the primary asset management program manager. The Planning Program reorganized to include an asset management coordinator in the Programming Section. WYDOT has made a concerted effort since 2006 to understand and move forward in its goal of optimizing the project selection process by heavily engaging in a transportation asset management plan at the state and national level through training and presentations.

The Investment Plan section of this document points out that WYDOT spends almost 76 percent of the contract construction budget on three asset categories: (1) pavement, (2) bridge, and (3) safety. Safety infrastructure has an effect on reducing fatalities and serious injuries, another of WYDOT's goals. Although this document does not address the infrastructure deterioration and improvement plan for safety-related items, WYDOT is developing a network-level Safety Management System. The WYDOT Safety Management System, currently under development, is a data driven strategic approach to improving highway safety. WYDOT is currently working on incorporating additional safety treatments and benefit-cost calculations within the Safety Management System.

## XII. APPENDIX A: PROGRAMMING INVESTMENT SUMMARY

Revenue Sources	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
State Revenues	300,421,236	303,571,396	317,212,248	320,713,051	323,093,354	326,034,604	328,976,676	347,485,805	349,858,523	352,799,612
Federal Revenues	313,979,903	300,064,457	310,949,073	310,949,073	314,252,148	317,594,859	320,977,683	324,401,102	327,865,600	331,371,673
Local Revenues	16,884,679	15,150,151	15,152,929	15,152,929	15,152,929	15,152,929	15,152,929	15,152,929	15,152,929	15,152,929
<b>TOTAL REVENUES</b>	<b>631,285,818</b>	<b>618,786,004</b>	<b>643,314,250</b>	<b>646,815,053</b>	<b>652,498,431</b>	<b>658,782,392</b>	<b>665,107,288</b>	<b>687,039,836</b>	<b>692,877,053</b>	<b>699,324,214</b>

Funding Expenditures	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
<b>Highway Improvement/ Contract Maintenance Program</b>	<b>322,325,942</b>	<b>316,479,443</b>	<b>331,505,090</b>	<b>334,055,972</b>	<b>337,673,877</b>	<b>342,077,219</b>	<b>345,809,012</b>	<b>355,674,279</b>	<b>360,429,517</b>	<b>365,441,345</b>
Regular-Special Maintenance/Operations	129,657,688	128,732,887	136,831,663	137,608,206	139,029,722	134,575,003	139,067,233	142,280,463	143,148,915	141,887,152
Planning/Administration	25,921,290	26,035,696	26,538,433	26,818,586	27,210,719	27,580,364	28,017,361	28,416,933	28,835,515	29,231,785
Capital Expenditures	14,584,700	12,182,100	12,982,100	12,182,100	12,182,100	16,182,100	12,182,100	18,682,100	18,682,100	18,682,100
Other Expenditures	30,711,771	27,802,203	27,850,357	26,642,886	26,839,637	26,848,712	28,455,291	28,395,554	27,327,694	27,532,656
Operating Transfers Out	7,954,431	8,055,980	8,108,914	8,214,048	8,269,121	8,377,971	8,435,268	8,547,968	8,617,704	8,734,696
Support Services/Regulatory	16,456,574	16,947,273	16,947,273	17,452,691	17,452,691	17,973,271	17,973,271	18,509,470	19,061,754	19,630,608
Administration	1,924,998	1,982,748	1,982,748	2,042,230	2,042,230	2,103,497	2,103,497	2,166,602	2,231,600	2,298,548
Aeronautics	35,909,604	34,558,655	34,558,655	34,558,655	34,558,655	34,558,655	34,558,655	34,558,655	34,558,655	34,558,655
Law Enforcement	45,838,820	46,009,019	46,009,019	47,239,678	47,239,678	48,505,601	48,505,601	49,807,811	49,983,600	51,326,669
<b>TOTAL EXPENDITURES</b>	<b>631,285,818</b>	<b>618,786,004</b>	<b>643,314,250</b>	<b>646,815,053</b>	<b>652,498,431</b>	<b>658,782,392</b>	<b>665,107,288</b>	<b>687,039,836</b>	<b>692,877,053</b>	<b>699,324,214</b>

Projected STIP Expenditures	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
<b>Highway Improvement/ Contract Maintenance Prgm</b>	<b>322,325,942</b>	<b>316,479,443</b>	<b>331,505,090</b>	<b>334,055,92</b>	<b>337,673,87</b>	<b>342,077,219</b>	<b>345,809,012</b>	<b>355,674,279</b>	<b>360,429,517</b>	<b>365,441,345</b>
Project Modifications	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)	(5,000,000)
State Infrastructure Bank (SIB) Reimbursements	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,00)	(10,000,000)
PE/ROW/Utilities/Misc	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,00000)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,000)
Indirect Cost Allocation Plan (ICAP)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,00)	(20,000,000)
<b>Projected STIP Expenditures</b>	<b>267,325,942</b>	<b>261,479,443</b>	<b>276,505,090</b>	<b>279,055,92</b>	<b>282,673,87</b>	<b>287,077,219</b>	<b>290,809,012</b>	<b>300,674,279</b>	<b>305,429,517</b>	<b>310,441,345</b>

**Notes:**

- 1) The chart on page 33 removes the ICAP, taking the 2018 Highway Improvement/Contract Maintenance Program from \$322M to \$30M.  
 2) \$38M is reserved out of the Highway Improvement/Contract Maintenance Program for dedicated programs.

## PROGRAMMING INVESTMENT SUMMARY FOR ASSET MANAGEMENT

(Amounts shown in \$ millions)

Asset Funding Strategies	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Bridge Maintenance	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Bridge Preservation	\$26	\$29	\$22	\$24	\$24	\$31	\$25	\$25	\$25	\$25
Bridge Repair/Rehabilitation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Bridge Replacement (Construction/Reconstruction)	\$5	\$11	\$18	\$8	\$4	\$23	\$10	\$10	\$10	\$10
Signs, Retaining Walls, etc.	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5
Pavement Maintenance	\$10	\$10	\$10	\$10	\$10	\$9	\$9	\$10	\$9	\$9
Pavement Preservation (1S)	\$10	\$10	\$10	\$10	\$10	\$10	\$10	\$10	\$10	\$10
Pavement Rehabilitation (2S + 3S)	\$125	\$140	\$140	\$135	\$135	\$141	\$141	\$135	\$141	\$141
Pavement Construction (New Construction)/Reconstruction	\$20	\$0	\$0	\$5	\$5	\$0	\$0	\$5	\$0	\$0
Dedicated Programs	\$38	\$38	\$38	\$38	\$38	\$38	\$38	\$38	\$38	\$38
Other Asset Categories	\$28	\$18	\$34	\$44	\$52	\$30	\$53	\$63	\$67	\$72
<b>Total Construction Program Funding Available to Manage Assets</b>	<b>\$267</b>	<b>\$261</b>	<b>\$277</b>	<b>\$279</b>	<b>\$283</b>	<b>\$287</b>	<b>\$291</b>	<b>\$301</b>	<b>\$305</b>	<b>\$310</b>

**Notes:**

1) Funds to other agencies includes Industrial Road Program, Recreational Trail, Enhancements, Congestion Mitigation Air Quality, Transportation Alternatives, State Urban Programs, etc.

### XIII. APPENDIX B: EVALUATION OF EMERGENCY EVENTS

Event Code: Type	Date(s) of Major Disaster Declaration/ Incident Period	Results	Associated Projects Including Repairs and Locations	Locations Requiring Repair and Reconstruction Activities on Two or More Occasions Due to Emergency Events	Project Total Cost	Total Public Assistance Grants - Dollars Obligated	Notes (Potential Projects/Missing Governor Emergency Declarations)
<b>Executive Order 1997-2:</b> Mud slides in Teton County	Governor Geringer: May 29, 1997  Disaster Declaration not issued by President	No information given.	None	N/A	None		No relevant projects in 1997 or 1998
<b>FEMA-1268-DR:</b> Severe winter storm	Governor Geringer: October 5, 1998  President Clinton: February 17, 1999  Incident period: October 5-9, 1998	Federal disaster funds available for Wyoming to help communities in Niobrara recover from the effects of a severe winter storm; declaration authorizes the payment of 75 percent of the approved costs for restoring public facilities damaged as a result of the storm that produced freezing temperatures, snow, ice, and high winds over the period of October 5-9, 1998; funding will also be provided for the state on a cost-shared basis for approved projects that reduce future disaster risk	None	N/A	None	\$721,772 (including \$43,722 for emergency work)	No relevant projects in 1998 or 1999
<b>FEMA-1351-DR:</b> Winter storm	Governor Geringer: November 9, 2000  President Clinton: December 13, 2000  Incident period: October 31-November 20, 2000	The Declaration covers damage to public property from the storm that occurred from October 31-November 20 for Crook, Goshen, Platte, and Weston Counties; federal funds will be available to the state and affected local governments in the four counties to pay 75 percent of the eligible cost for repairing or replacing damaged public facilities; funding will also be provided for the state on a cost-shared basis for approved projects that reduce future disaster risk	None	N/A	None	\$682,635 (including \$4,604 for emergency work)	No relevant projects in 2000 or 2001 and the three projects noted (0802183, 0806183, and 0806173) deal with emergency bridge repairs in Sweetwater and Laramie Counties; not in Crook, Goshen, Platte, and Weston Counties
<b>FEMA-1599-DR:</b> Tornado	No information given; The head of the US Dept of Homeland Security's FEMA announced that President Bush has ordered federal disaster aid for Wyoming  President Bush: August 22, 2005  Incident period: August 12, 2005	Federal disaster aid for Wyoming, requested by President, to help meet the recovery needs of tornado victims in Campbell County; funding will be available to the state on a cost-shared basis for approved projects that reduce future disaster risks	None	N/A	None	\$474,304 (total individual and households program - dollars approved)	Missing Governor Executive Order/no relevant projects in 2005 and the two projects noted in 2006 (0806194 and DR50001) dealt with emergency bridge repairs in Laramie and Fremont County; not in Campbell County

Event Code/Type	Date(s) of Major Disaster Declaration/Incident Period	Results	Associated Projects Including Repairs and Locations	Locations Requiring Repair and Reconstruction Activities on Two or More Occasions Due to Emergency Events	Project Total Cost	Total Public Assistance Grants - Dollars Obligated	Notes (Potential Projects/Missing Governor Emergency Declarations)
FEMA-1923-DR: Flooding	Governor Freudenthal: June 30, 2010  President Obama: July 14, 2010  Incident period: June 4-18, 2010	Public Assistance requested by Governor available to State, etc. on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the flooding in Fremont County and portions of the Wind River Indian Reservation that lie within Fremont County and Hazard Mitigation statewide	<p><b>CN10099</b> (CR 20 - RM 2.200), FR CO/MORTIMORE LN/ STR #EOA, bridge replacement</p> <p><b>CN10100</b> (CR 20 - RM 2.000), FR CO/MORTIMORE LANE/#DJL, erosion control</p> <p><b>N151025</b> (ML15B - RM 16.130), LAND-DVR/STR CXM, erosion repair</p> <p><b>N151024</b> (ML15B - RM 5.140), LAND-DVR/STR BSM, erosion repair</p> <p><b>N151026</b> (ML15B - RM 0.170), LAND-FTWK/STR DIY, erosion repair</p> <p><b>N203067</b> (ML20B - RM 102.930), RIVE-SHOS/STR BTS &amp; DBH, erosion repair</p> <p><b>CN10097</b> (CR 334), FR CO/CO RD #334/17 MILE WEST, temporary bridge</p>	None	<p><b>CN10099:</b> \$1,099,646</p> <p><b>CN10100:</b> \$15,782</p> <p><b>N151025:</b> \$120,878</p> <p><b>N151024:</b> \$111,664</p> <p><b>N151026:</b> \$67,165</p> <p><b>N203067:</b> \$218,862</p> <p><b>CN10097:</b> \$840,712</p>	\$3,004,023 (including \$1,728,655 for emergency work)	<b>CN10099:</b> let 2/16/2012 <b>CN10100:</b> let 2/16/2012 <b>N151025:</b> let 6/16/2011 <b>N151024:</b> let 6/16/2011 <b>N151026:</b> let 8/18/2011 <b>N203067:</b> let 8/18/2011 <b>CN10097:</b> let 7/15/2010
Executive Order 2011-4: Flood conditions or predicting severe weather conditions  FEMA-4007-DR: Severe storms, flooding, and landslides	Governor Mead: May 27, 2011  President Obama: July 22, 2011  Incident period: May 18-July 8, 2011	Public Assistance requested by Governor available to State, etc. on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe storms, flooding, and landslides in Albany, Big Horn, Carbon, Crook, Fremont, Goshen, Johnson, Lincoln, Platte, Sheridan, Sublette, Teton, Uinta, Washakie, and Weston Counties, and the Wind River Indian Reservation	<p><b>DR50911</b> (ML34B - RM 114.430 to 128.000), ER/Sho/Tmop/Wind River, rock fall/scaling</p> <p><b>P351029</b> (ML35B - RM 73.400 to 73.450), Lovl-Burg/ emergency slide repair</p> <p><b>DR50915</b> (ML37B - RM 20.440 to 21.500), ER/Shell Canyon, rock fall/scaling;</p> <p><b>DR50926</b> (ML37B - RM 26.900), ER/Grey-Burg/Shell Falls Slide/emergency slide repair</p> <p><b>DR41305</b> (ML37B - RM 75.600), ER/Burg-Dayt/ US 14, landslide</p> <p><b>0607037</b> (ML607B - RM 184.860 to 197.500), ER/Dvlt Jct-Sund/Oudin Hill, traffic control/slide repair</p> <p><b>DR41320</b> (ML607B - RM 187.800), ER/Moor-Sund/Logcabin Slide/ slide repair</p>	<p><b>0607037: RM 184.860 to 197.500 and DR41320 - RM 187.800</b> (point location located within roadway segment), <b>slide repair work</b></p>	<p><b>DR50911:</b> \$559,837</p> <p><b>P351029:</b> \$257,350</p> <p><b>DR50915:</b> \$448,047</p> <p><b>DR50926:</b> \$201,513</p> <p><b>DR41305:</b> \$264,116</p> <p><b>0607037:</b> \$740,794</p> <p><b>DR41320:</b> \$78,667</p>	\$5,554,880 (including \$1,667,953 for emergency work)	<b>DR50911:</b> let 9/29/2011 <b>P351029:</b> let 5/6/2011 <b>DR50915:</b> let 9/29/2011 <b>DR50926:</b> let 9/29/2011 <b>DR41305:</b> let 9/29/2011 <b>0607037:</b> let 9/29/2011 <b>DR41320:</b> let 9/29/2011
Executive Order 2014-2 (replaced 2014-1): Declaration of Emergency/currently experiencing flood conditions or predicting severe weather conditions	Governor Mead: April 5, 2014  Disaster Declaration not issued by President		<p><b>DR33142</b> (ML11B - RM 77.2 to 80.83), US 189/Names Hill Cleanup, flood damage and erosion repair</p> <p><b>DR41810</b> (ML302B - RM 13), Sher-UCRS/Tift Slide, slide repair</p>	None	<p><b>DR33142:</b> \$592,725;</p> <p><b>DR41810:</b> \$1,253,566</p>		<b>DR33142:</b> let 2/20/2014 <b>DR41810:</b> let 7/24/2014

Event Code: Type	Date(s) of Major Disaster Declaration/Incident Period	Results	Associated Projects Including Repairs and Locations	Locations Requiring Repair and Reconstruction Activities on Two or More Occasions Due to Emergency Events	Project Total Cost	Total Public Assistance Grants - Dollars Obligated	Notes (Potential Projects/Missing Governor Emergency Declarations)
<b>Executive Order 2015-1:</b> Currently experiencing flood conditions or predicting severe weather conditions  <b>Disaster Declaration #14368/#14369, FEMA-4227-DR:</b> Severe storms and flooding	Governor Mead: June 2015  President Obama: July 7, 2015  Incident period: May 24-June 6, 2015	Work being completed in Lusk (bridge work currently using STIP funding)	<b>DR51575</b> (ML34B - RM 116.800 to 126.820), Wind River Canyon/ landslide repair  <b>DR23431</b> (ML85B - RM 150.010), ER/Lusk/bridge repair, install acrow bridge  <b>DR23462</b> (ML1401B - RM 132.650, ML85B - RM 173.740 and RM 185.550), erosion repair work  <b>DR23463</b> (ML1401B - RM 99.770 to 133.340, ML39B - RM 41.380 to 43.000, ML40B - RM 30.000 to 40.884, ML85B - RM 149.770 to 187.000), drainage repair work	<b>DR51575:</b> <b>RM 118,000 to 125,000</b> and <b>DR50911</b> - RM 114.430 to 128.000 (roadway segment overlap), <b>slide repair and rockfall/scaling work;</b>  <b>DR23431:</b> <b>RM 150,010</b> , <b>DR23462 - RM 173,740</b> and <b>RM 185,550</b> , and <b>DR23463</b> - RM 149.770 to 187.000 (three point locations located within roadway segment), <b>bridge repair, erosion repair and drainage repair work;</b>  <b>DR23462:</b> <b>RM 132,650</b> and <b>DR23463</b> - RM 99.770 to 133.340 (point location located within roadway segment), <b>erosion repair and drainage repair work</b>	<b>DR51575:</b> \$899,832  <b>DR23431:</b> \$2,566,894  <b>DR23462:</b> \$789,147  <b>DR23463:</b> \$531,442	\$2,561,407 ( <b>including \$426,876 for emergency work</b> )	<b>DR51575:</b> let 9/16/2016  <b>DR23431:</b> let 1/25/2016  <b>DR23462:</b> let 5/22/2017  <b>DR23463:</b> let 5/22/2017
<b>Executive Order 2016-3</b> (replaced 2016-2): Declaration of Emergency/currently experiencing flood conditions or predicting severe weather conditions, including spring rains, snow melt runoff, main stream and tributary river flooding, flash flooding, mudslides, and landslides	Governor Mead: May 2016  Disaster Declaration not issued by President		<b>DR51724</b> (ML20B - RM 102.930), ER/Hudson-Riverton/structures DBH, LFP/flood repair  <b>DR51725</b> (ML703B - RM 7.680), ER/north of Ethete/flood repair  <b>DR51726</b> (ML20B - RM 90.590), ER/town of Hudson/structure DDV/flood repair  <b>DR51728</b> (ML15B - RM 16.130), ER/north of Fort Washakie/structure CXM/flood repair  <b>DR51730</b> (ML703B - RM 0.300), ER/Lander-Ethete/structure MKW/flood repair  <b>DR51732</b> (ML20B - RM 104.130), Hudson-Riverton/structure BTS/flood repair  <b>DR51739</b> (ML14B - RM 62.180), south of Lander/Johnny Lee Corner/slide repair  <b>DR51740</b> (ML14B - RM 53.750 to 53.850), ER/south of Lander/Backslopes slide/slide repair  <b>DR51741</b> (ML14B - RM 58.600), ER/Farson-Lander/Wooden bin wall/flood repair  <b>DR51742</b> (ML20B - RM 84.580), ER/Lander-Riverton/Rifle Range slide/slide repair  <b>DR51743</b> (ML701B - RM 2.040), south of Lander/Sinks Canyon/Concrete vault slide/slide repair  <b>DR51776</b> (ML14B - RM 55.450), ER/Fremont county/landslide cleanup/slide repair	<b>DR51728:</b> <b>RM 16,130</b> and <b>N151025</b> - RM 16.130 (Structure CXM, bridge over the Little Wind River), <b>erosion and flood repairs.</b> Damage in both events was to the rip-rap, which is considered a sacrificial element to protect the abutments. It would be cost prohibitive and environmentally unsound to prevent future damage to the rip-rap.  <b>DR51724:</b> <b>RM 102,930</b> and <b>N203067</b> - RM 102.930 (Structure DBH, bridge over the Little Wind River), <b>channel scour and flood repairs.</b> Damage in both events was to the rip-rap, which is considered a sacrificial element to protect the abutments. It would be cost prohibitive and environmentally unsound to prevent future damage to the rip-rap.	<b>DR51724:</b> \$91,157  <b>DR51725:</b> \$59,356  <b>DR51726:</b> \$86,834  <b>DR51728:</b> \$114,497  <b>DR51730:</b> \$87,297  <b>DR51732:</b> \$263,692  <b>DR51739:</b> \$432,779  <b>DR51740:</b> \$609,604  <b>DR51741:</b> \$164,637  <b>DR51742:</b> \$772,844  <b>DR51743:</b> \$130,173  <b>DR51776:</b> \$689,471	<b>\$477,767 (ER11 Obligations)</b>	<b>DR51724:</b> let 2/16/2018  <b>DR51725:</b> let 2/16/2018  <b>DR51726:</b> let 2/16/2018  <b>DR51728:</b> let 2/16/2018  <b>DR51730:</b> let 2/16/2018  <b>DR51732:</b> let 2/16/2018  <b>DR51739:</b> STIP year 2018  <b>DR51740:</b> STIP year 2018  <b>DR51741:</b> Maintenance will perform work 1/4/2018  <b>DR51742:</b> STIP year 2018  <b>DR51743:</b> STIP year 2018  <b>DR51776:</b> STIP year 2018

Event Code/Type	Date(s) of Major Disaster Declaration/Incident Period	Results	Associated Projects Including Repairs and Locations	Locations Requiring Repair and Reconstruction Activities on Two or More Occasions Due to Emergency Events	Project Total Cost	Total Public Assistance Grants - Dollars Obligated	Notes (Potential Projects/Missing Governor Emergency Declarations)
<b>Executive Order 2017-1:</b> Currently experiencing severe winter storm conditions, including damaging high winds, power outages, excessive snow, rain, areal flooding, rapid snow melt runoff, along with the potential for main stream and tributary river flooding to include flash flooding, mudslides, snow avalanches and landslides  <b>FEMA-4306-DR:</b> Wyoming severe winter storm and straight-line winds	Governor Mead: February 10, 2017  President Trump: March 21, 2017  Incident period: February 6-7, 2017		<p>This declaration made Public Assistance requested by the Governor available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe winter storm and straight-line winds in Teton County. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.</p> <p><b>DR34562</b> (ML10B - RM 139.220 to 139.500), ER/Alpine-Hoback Junction/Twin Pines slide/slide repair</p> <p><b>DR34759</b> (ML10B - RM 126.800), ER/Alpine-Hoback Junction/Snake River/slide repair; <b>DR34585</b> (ML1202B - RM 10.700 and RM 12.500), ER/Ham's Fork Rd/Red Barn slide RM 10.700/Embankment failure RM 12.500/slide repair</p> <p><b>DR34696</b> (ML1202B - RM 16.700), ER/Ham's Fork Rd/Lake Naughton slide/slide repair</p> <p><b>DR34586</b> (ML12B - RM 46.500), ER/Kemmerer-Cokeville/slide repair</p> <p><b>DR34584</b> (ML13B - RM 133.700), ER/Daniel Junction-Bondurant/Spud slide/slide repair</p> <p><b>DR34621</b> (ML13B - RM 147.600 and RM 149.600), ER/Daniel-Hoback Junctions/Black Powder turnaround/Hoback River erosion/slide repair</p> <p><b>DR42900</b> (ML35B - RM 85.130), ER/Lovell-Burgess Junction/slide repair</p> <p><b>DR42937</b> (ML37B - RM 81.500), ER/Dayton-Burgess Junction/White Cross/slide repair</p> <p><b>DR42891</b> (ML90I - RM 5.100), ER/I-90 eastbound/slide repair</p> <p><b>DR42892</b> (ML90I - RM 6.800), ER/I-90 eastbound/slide repair</p>	<p><b>DR51890:</b> <b>RM 118,000, 122,400 and 125,800</b></p> <p><b>DR51886:</b> RM 116.000 to 127.000</p> <p><b>DR51575:</b> RM 116.800 to 126.820 (Wind River Canyon), <b>slope failure, rock fall mitigation and landslide repair.</b> Wind River Canyon is a designated scenic highway canyon with a class I water, in areas up to 2500 feet deep with exposed rock and very steep slopes. During flooding events large rockfall or erosion occur. It is cost prohibitive to protect the entire 11 miles of canyon.</p>	<p><b>DR34562:</b> \$2,003,672</p> <p><b>DR34759:</b> \$414,810</p> <p><b>DR34585:</b> \$135,825</p> <p><b>DR34696:</b> \$430,000</p> <p><b>DR34586:</b> \$228,163</p> <p><b>DR34584:</b> \$367,152</p> <p><b>DR34621:</b> \$50,141</p> <p><b>DR42900:</b> \$216,000</p> <p><b>DR42937:</b> \$240,000</p> <p><b>DR42891:</b> \$23,739</p> <p><b>DR42892:</b> \$22,318</p> <p><b>DR42894:</b> \$796,150</p> <p><b>DR51885:</b> \$165,515</p>	<p>\$2,392,046 (including \$438,314 for emergency work)</p>	<p><b>DR34562:</b> Let 8/18/2017</p> <p><b>DR34759:</b> STIP year 2018</p> <p><b>DR34585:</b> STIP year 2018</p> <p><b>DR34696:</b> STIP year 2018</p> <p><b>DR34586:</b> STIP year 2018</p> <p><b>DR34584:</b> STIP year 2018</p> <p><b>DR34621:</b> STIP year 2018</p> <p><b>DR42900:</b> STIP year 2018</p> <p><b>DR42937:</b> STIP year 2018</p> <p><b>DR42891:</b> STIP year 2018</p> <p><b>DR42892:</b> STIP year 2018</p> <p><b>DR42894:</b> STIP year 2018</p> <p><b>DR51885:</b> STIP year 2018</p>
<b>Executive Order 2017-1:</b> Currently experiencing severe winter storm conditions, including damaging high winds, power outages, excessive snow, rain, areal flooding, rapid snow melt runoff, along with the potential for main stream and tributary river flooding to include flash flooding, mudslides, snow avalanches and landslides  <b>FEMA-4327-DR:</b> Wyoming flooding	Governor Mead: June 28, 2017  President Trump: August 5, 2017  Incident Period: June 7-22, 2017		<p>This declaration made Public Assistance requested by the Governor available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the flooding in Fremont and Park Counties and the Wind River Reservation within Fremont County. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.</p> <p><b>DR42894</b> (ML90I - RM 12.900), ER/I-90 eastbound/slide repair</p> <p><b>DR51885</b> (ML1507B - RM 26.000 to 26.100), ER/Chief Joseph/Park Co./slide repair</p> <p><b>DR51839</b> (ML1507B - RM 46.000), ER/Chief Joseph/Park Co./drainage repair</p> <p><b>DR51892</b> (ML30B - RM 102.000 to 104.500), ER/Diversion Dam area-Riverton/flood repairs</p> <p><b>DR51938</b> (ML30B - RM 2.700), ER/Moran Junction-Dubois/Togwotee Pass/rip rap replacement/debris</p> <p><b>DR51866</b> (ML30B - RM 9.500), ER/Moran Junction-Dubois/Togwotee Pass/Teton Co./drainage repair</p> <p><b>DR51873</b> (ML30B - RM 40.100), ER/Moran Junction-Dubois/Togwotee Pass/back slope failure, drainage</p> <p><b>DR51886</b> (ML34B - RM 116.000 to 127.000), ER/Shoshoni-Thermopolis/Wind River Canyon/rock fall mitigation</p> <p><b>DR51890</b> (ML34B - RM 118.000, 122,400 and 125,800), ER/Shoshoni-Thermopolis/Wind River Canyon/slope failure</p>		<p><b>DR51839:</b> \$5,916</p> <p><b>DR51892:</b> \$1,769,100</p> <p><b>DR51938:</b> \$137,505</p> <p><b>DR51866:</b> \$23,167</p> <p><b>DR51873:</b> \$751,426</p> <p><b>DR51886:</b> \$40,539</p> <p><b>DR51890:</b> \$576,529</p>	<p>\$1,572,810 (including \$450,010 for emergency work)</p>	<p><b>DR51839:</b> STIP year 2018</p> <p><b>DR51892:</b> STIP year 2018</p> <p><b>DR51938:</b> STIP year 2018</p> <p><b>DR51866:</b> STIP year 2018</p> <p><b>DR51873:</b> STIP year 2018</p> <p><b>DR51886:</b> STIP year 2018</p> <p><b>DR51890:</b> STIP year 2018</p>

## XIV. APPENDIX C: WYDOT BALANCED SCORECARD

GOAL	INDEX	INDEX RATING CURRENT YEAR	TARGET (2020) Excellent & 3-Yr Avg (14,15,16)	STRATEGIC OBJECTIVE	INDIVIDUAL MEASURE CURRENT YEAR	TARGET (2020) Excellent & 3-Yr Avg (14,15,16)
Improve Safety on the State Transportation System	Safety Index Rating	5.0 - 2018 4.5 - 2017	Excellent: 5.0 3 Yr Avg: 3.0	<i>Improve safety for ALL users of the state transportation system through education, engineering, enforcement, collaborative partnerships, and innovation.</i>		
	<u>Measures included in Safety Index:</u> - Critical Crashes (Fatal+Serious Injury Crashes) - Seat Belt Usage			Critical Crashes	356 - 2018 422 - 2017	Excellent: 380 3 Yr Avg: 465
				Seat Belt Usage	86.3% - 2018 85% - 2017	Excellent: 82% 3 Yr Avg: 80%
Serve our customers	Customer Satisfaction Index Rating	3.0 - 2018 2.5 - 2016	Excellent: 5.0 3 Yr Avg: 2.8	<i>Foster a service oriented culture characterized by a commitment to excellent customer service to all stakeholders and strong relationships with other agencies, industry partners, and local and tribal government. Continue to enhance communication and tell our story in a way that influences national policy and demonstrates WYDOT's added value to communities.</i>		
	<u>Measures included in Customer Satisfaction index:</u> - Customer Satisfaction Survey (CSS) Questions: Overall Satisfaction with WYDOT Snow Removal Driver Services WHP Communication - Outreach Assessments (NEW) (Government, Industry, Constituent) - System Reliability Measure (NEW) (% of year system is open/traversable)			CSS Result - Overall satisfaction with WYDOT's stewardship of the statewide transportation system.	85% - 2018 84% - 2016	Excellent: 82% 3 Yr Avg: 80%
				CSS Result - Agreement that main highways are plowed promptly when it snows.	72% - 2018 73% - 2016	
				CSS Result - Agreement that plowing and sanding of the main highways is done thoroughly.	69% - 2018 68% - 2016	
				CSS Result - Satisfaction with courtesy of drivers license staff.	86% - 2018 87% - 2016	
				CSS Result - Satisfaction with promptness of drivers license staff.	78% - 2018 78% - 2016	
				CSS Result - "I believe WHP personnel treat people with courtesy and respect."	77% - 2018 77% - 2016	
				CSS Result - "I believe WHP respond to situations in an appropriate manner."	78% - 2018 79% - 2016	
				CSS Result - Satisfaction with how WYDOT communicates with the public.	82% - 2018 83% - 2016	
				Outreach Assessments - <i>not yet developed</i>		
				System Reliability - % of year state transportation system open to ALL vehicles	99.8% - 2018 99.6% - 2017	Excellent: 99.95% 2 Yr Avg: 99.7%

				System Reliability - % of year state transportation system open to light, high profile vehicles (commercial vehicles)	99.3% - 2018 99.1% - 2017	<i>Not included in index rating</i>
<b>Take care of all physical aspects of the state transportation system</b>	<b>Transportation Asset Index Rating</b>	3.5 - 2018 3.7 - 2017	Excellent: 5.0 3 Yr Avg: 2.9	<i>Efficiently manage or improve the operations of the transportation infrastructure through strategic investment. Increase the sustainability of assets through training, asset management and innovative solutions.</i>		
	<u>Measures included in Asset index:</u> - Pavement and Bridge Conditions: % of Pavement Good to Exc. - Interstate % of Pavement Good to Exc. - NHS % of Pavement Good to Exc. - Non NHS - Bridge Conditions: % of Bridges Poor - NHS % of Bridges Poor - Non NHS - % of WYDOT Owned Buildings Adequate+ (occ., unocc., rest, emp. hous., site) - % of WYDOT Owned Assets Fair+ (NEW) (DMS, tele., wyoL, signs, equip., fleet)			% Pavement Good to Excellent Condition  % Bridges Good to Excellent Condition  % WYDOT Owned Buildings Adequate to Good  % of WYDOT Owned Assets Fair + - <i>in progress</i>	63% - 2018 66% - 2017  52% - 2018 53% - 2017  NA - 2018 95% - 2017	Excellent: 70% 3 Yr Avg: 66%  Excellent: 51% 3 Yr Avg: 50%  Excellent: 96% 2 Yr Avg: 95%
<b>Improve agency efficiency and effectiveness</b>	<b>Agency Performance Index</b>	4.0 - 2017/18 3.0 - 2015/16	Excellent: 5.0 3 Yr Avg: 3.0	<i>Continue to build upon our existing successes and achievements, using technology, process improvements, and system enhancements to realize efficiencies and improve decision making. Involve employees in the strengthening of intra and inter agency relationships, to extend our reach and advance WYDOT's mission. Build the capacity to identify, assess, and mitigate risk across the Agency.</i>		
	<u>Included in Efficacy index:</u> - Safety Index Rating - Customer Satisfaction Index Rating - Transportation Asset Index Rating - Employee Satisfaction Index Rating - Financial Stewardship Index Rating			Safety Index Rating  Customer Satisfaction Index Rating  Transportation Asset Index Rating  Employee Satisfaction Index Rating  Financial Stewardship Index Rating	4.8 - 2017/18 3.3 - 2016/15  3.0 - 2017/18 2.5 - 2016/15  3.6 - 2017/18 3.2 - 2016/15  2.0 - 2017/18 3.7 - 2016/15  4.5 - 2017/18 3.3 - 2016/15	Excellent: 5.0 3 Yr Avg: 3.0  Excellent: 5.0 3 Yr Avg: 2.8  Excellent: 5.0 3 Yr Avg: 2.9  Excellent: 5.0 3 Yr Avg: 3.0  Excellent: 5.0 3 Yr Avg: 2.9
<b>Develop and care for our people</b>	<b>Employee Satisfaction Index Rating</b>	2.0 - 2017 3.7 - 2015	Excellent: 5.0 3 Yr Avg: 3.0	<i>Continue WYDOT's tradition as a workplace of choice and attracting multi-generational talent. Foster diversity, collaboration, and engagement among employees. Develop policies and practices around succession planning, workplace flexibility, and learning and development.</i>		

	<u>Measures included in Employee Satisf. index:</u> - WYDOT Turnover Rate - Employee Injuries - Employee Satisfaction Surv. (ESS) Questions: Overall Satisfaction (% favorable) Recommend WYDOT to work Prep. for Advance. - Employee (NEW) Prep. for Advance. - Supervisor (NEW)			WYDOT Turnover Rate  Employee Injuries  Employee Satisfaction Survey Results - Overall Satisfaction  Employee Satisfaction Survey Results - "I would recommend WYDOT as a good place to work."  Employee Satisfaction Survey Results - "My Supervisor is active in preparing me for career development opportunities."  Employee Satisfaction Survey Results - "I have prepared my employees for advancement opportunities within WYDOT."	17.7% - 2018 15.9% - 2017 11.0% - 2015  129 - 2018 123 - 2017 123 - 2015  59% - 2017 70% - 2015  58% - 2017 72% - 2015  48% - 2017  83% - 2017	Excellent: 8% 3 Yr Avg: 11%  Excellent: 107 3 Yr Avg: 139  Excellent: 73% 3 Yr Avg: 66%
<b>Exercise good stewardship of our resources</b>	<b>Financial Stewardship Index Rating</b> Excellent: 4.0 - 2018 4.3 - 2017	5.0 3 Yr Avg: 2.9	<p><b><i>Effectively manage federal and state taxpayer funds to maximize the state transportation system. Efficiently deliver projects and services on time and on budget. Continue to develop technology platforms that protect against cyber threats and improve financial performance.</i></b></p>			
	<u>Measures included in Financial index:</u> - Budget Variance (overhead) - % of Planned Projects On Time (in FY) - % of Overruns on Hwy Cons. Proj. (in FY) - Funding Stability Measure (NEW)			Budget Variance (overhead)  % of Highway Projects on Time (on/under schedule)  % Overruns on Highway Construction Projects  Funding Stability Measure - <i>not yet developed</i>	-40% - 2018 -37% - 2017  88% - 2018 96% - 2017  -.4% - 2018 -1.5% - 2017	Excellent: -19% 3 Yr Avg: -11%  Excellent: 97% 3 Yr Avg: 89%  Excellent: -1.9% 3 Yr Avg: .4%