NEVADA DOT
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NEVADA DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY PRESERVATION REPORT

February 2017

State of Nevada

Department of Transportation

State Highway Preservation Report

Report to the 2017 Legislature
As Required by Nevada Revised Statute 408.203 (3)

February 2017
(Biennium 2015-2016)

Nevada Revised Statute 408.203(3)

The director of the Nevada Department of Transportation shall report to the Legislature by February 1 of odd-numbered years the progress being made in the Department's 10-year plan for the resurfacing of state highways. The report must include an accounting of revenues and expenditures in the preceding two fiscal years, a list of the projects which have been completed, including mileage and cost, and an estimate of the adequacy of projected revenues for timely completion of the plan.

State of Nevada

Department of Transportation

Mission

The Department provides a better transportation system for Nevada through unified and dedicated efforts.

Vision

The Department is the nation's leader in delivering transportation solutions, improving Nevada's quality of life.

Values

The efforts of Department employees to attain the Department goals will be governed by the following Department's Core Values:

Integrity – Doing the right thing
Honesty – Being truthful in our actions and our words
Respect – Treating others with dignity
Commitment – Putting the needs of the Department first
Accountability – Being responsible for our actions

Goals

The fulfillment of the Mission of the Department is to be attained within the guidelines of the Department's seven Strategic Plan Goals. They are:

To optimize safety
To be in touch with and responsive to our customers
To innovate
To be the employer of choice
To deliver timely and beneficial projects and programs
To effectively preserve and manage our assets
To efficiently operate the transportation system

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EXECUTIVE SUMMARY

The Nevada Department of Transportation (NDOT) publishes the *State Highway Preservation Report* biennially to summarize the work performed and anticipated workload required to preserve the state-maintained roadway network and bridge infrastructure assets. This report provides the Nevada Legislature with 2015-2016 information that can be used to determine whether future revenues are adequate to maintain and preserve the infrastructure assets at a feasible and acceptable level.

NDOT is responsible for maintaining 5,397 centerline miles of roads and 1,163 bridges. Although the state-maintained roadway network consists of only 13% of the roads in Nevada, the network is overwhelmingly important as 51% of all automobile traffic and 74% of all heavy truck traffic travel on these roads.

The shortage of highway preservation funding is not new or even unique to Nevada. Transportation infrastructure funding, including highway preservation funding, is in short supply nationwide. The only dedicated highway revenue source in Nevada is fuel tax, which was last increased in 1992. The Nevada Legislature has recognized the need to invest in transportation and passed legislation that generated additional highway revenue from sources such as property taxes and room taxes. A safe, efficient, and reliable roadway network is important, and it promotes the general welfare of all the people in the State of Nevada. Adequate preservation funding is necessary since deteriorated roads and bridges can impede the general economic and social progress of the State. Investment in infrastructure will boost market economy, advance travel and trade, and provide a legacy from which future generations can prosper.

Pavement preservation and bridge preservation for fiscal years 2015 and 2016 were both analyzed and presented in this report. Major findings and conclusions are summarized in Pavement Preservation Synopsis and Bridge Preservation Synopsis.

PAVEMENT PRESERVATION SYNOPSIS

NDOT's Pavement Management System (PMS) is used to maintain and improve the condition of the entire state-maintained roadway network. This network consists of a 5,397 mile inventory that is classified into five separate road prioritization categories. Each road prioritization category consists of pavements that share similar rates of deterioration and require similar timing for maintenance and rehabilitation repair work. The pavement in each road prioritization category is objectively rated and quantified using the Present Serviceability Index (PSI) pavement condition rating system. This rating system is divided into six sections that correspond to pavement in very good, good, fair, mediocre, poor, and very poor or failed condition.

Various maintenance and rehabilitation repair strategies are constructed to improve pavement condition. Maintenance repair strategies include work such as chip seals, filling potholes, and patching. Rehabilitation repair strategies include work such as asphalt overlays and recycling methods. The cost and construction timing for the various repair strategies are significantly different and contingent on the pavement condition at the time of the repair. There is a significant cost saving when pavement is proactively rehabilitated in fair condition as compared to reactively reconstructed in very poor condition. Repair work costs as much as six times more for major reconstruction when pavement is in very poor or failed condition as compared to the less invasive rehabilitation techniques that can be used when pavement is in fair or better condition.

A $216.1M expenditure was invested for maintenance and rehabilitation repair work in fiscal years 2015 and 2016. This expenditure included $130.8M investment of state funds, $85.2M investment of federal funds, and $0.1M investment of funds from other sources. More than $187M of repair work was contracted out to private contractors and $29M of repair work was performed by NDOT Maintenance personnel. The $187M of contracted repair work restored 450 total miles of pavement to acceptable condition levels. Of the 450 total miles of improved pavement, maintenance repair work was performed on 348 miles and rehabilitation repair work was constructed on 102 miles.

The PSI pavement condition rating system was used to determine if long-term pavement preservation expenditures were adequate enough to maintain or improve the roadway network to acceptable condition levels. Results show that long-term funding

has not been adequate. It is anticipated that the overall average condition of the state-maintained roadway network will deteriorate from fair condition into mediocre condition within the near future.

The current pavement condition goal to maintain a minimum of 95% of roads in fair or better condition in each road prioritization category remained in place during the analysis of the pavement condition data. The pavement condition goal was established in 2015 in order to provide a measure of the effectiveness of the maintenance and rehabilitation repair work constructed on state roads. Only road prioritization categories 1 and 3 currently exceed the established pavement condition goal. The goal was not met for road prioritization categories 2, 4 and 5 roads.

The backlog of pavement rehabilitation work was calculated for the roadway network. The amount of funds necessary to eliminate the total backlog of pavement rehabilitation work was estimated at $450.2M. Included in the $450.2M backlog is 866 miles of deficient pavement with estimated costs for repair work that range from $0.5M to $1.3M per mile. The backlog was determined using the established condition goal to maintain a minimum of 95% of roads in fair or better condition.

An estimate of the adequacy of projected revenues for the timely completion of the resurfacing plan was ascertained. Projected revenues were not adequate and an additional expenditure of $137M is required each year in addition to the long-term average expenditure of $127M per year. Projected revenue of $264M is required each year to maintain the roadway network at 2015 PSI pavement condition levels. The $264M per year expenditure does not include the funds necessary to reduce the $450.2M backlog of pavement rehabilitation work.

The progress in the 10-year plan for resurfacing of state highways was examined and three different budget scenarios were investigated. The investigation included the comparison of the predicted percentage of roads in fair or better condition for years 2017 through 2027 with three different budget scenarios of $127M, $264M, and $309M per year expenditures for pavement preservation repair work.

- The first budget scenario included an average $127M per year expenditure for pavement preservation repair work since this budget is the actual average expenditure for pavement preservation work from 2009 through 2016. The $127M

per year budget scenario would result in the average percentage of roads in fair or better condition to deteriorate from 79% in the year 2016 to less than 50% of roads in fair or better condition by the year 2027. Moreover, the $450.2M backlog of pavement rehabilitation work would substantially increase over time.

- The second budget scenario consisted of an average $264M per year expenditure for pavement preservation repair work. The $264M per year budget scenario would result in a stagnant pavement condition of 76% of roads in fair or better condition for years 2017 through 2027. Furthermore, the backlog of rehabilitation work would not be reduced or eliminated.
- The third budget scenario contained an average $309M per year expenditure for pavement preservation repair work through the year 2027. The $309M per year budget scenario would incrementally improve the condition of the entire roadway network from 76% to 95% of roads in fair or better condition. Additionally, the backlog of pavement rehabilitation work would be completely eliminated. FIGURE E1 illustrates the comparison of the predicted percentage of roads in fair or better condition with three different funding options including $127M, $264M, and $309M per year expenditures for pavement preservation repair work.

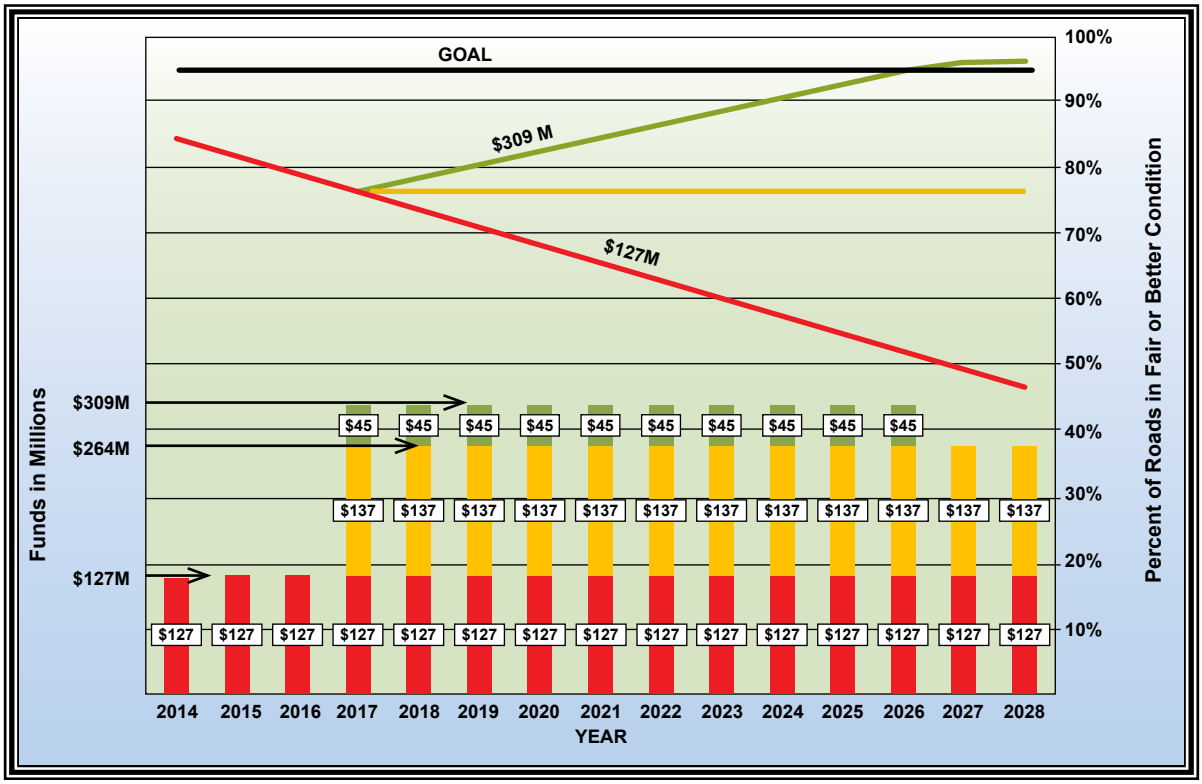


FIGURE E1. Future State-maintained Roadway Network Funding Options

BRIDGE PRESERVATION SYNOPSIS

The Nevada Department of Transportation is responsible for inspecting and reporting the condition of all the bridges open to the public in Nevada, except bridges on federal lands. There are currently 2,008 public bridges in NDOT bridge inventory. NDOT maintains 1,163 bridges; county and city governments maintain 771 bridges; other local agencies maintain 49 bridges; private entities maintain 11 bridges; railroad maintains 7 bridges; and other state agencies maintain 7 bridges. The bridge inventory data, together with other factors, allow NDOT to identify preservation priorities and monitor the state's effort to maintain bridges in a structurally sound, functional, and safe condition.

The Sufficiency Rating is a numerical rating used to assess the overall condition of a bridge and assists in the prioritization of bridge preservation efforts. Generally, bridges with Sufficiency Ratings more than 80 are considered "good", ratings of between 50 and 80 can be considered "fair", and ratings less than 50 are considered "poor". Of the 1,163 bridges maintained by NDOT, only 5 or 0.4% have a Sufficiency Rating less than 50 and are considered to be in poor condition.

Structures with low condition or load ratings may be classified as Structurally Deficient. Structurally Deficient bridges are not necessarily unsafe or dangerous. Rather, these bridges become a priority for corrective measures, and may be posted to restrict the weight of vehicles using them. If a deficiency is determined to be severe, or the load carrying capacity is extremely low, the bridge would be closed to protect the travelling public. Of the bridges maintained by NDOT, only 12 or 1% are considered to be Structurally Deficient.

Currently, Nevada bridge conditions compare very favorably to the bridge conditions in many other states, even though more than half of NDOT's bridges are more than 40 years old. However, since older bridges generally have a useful service life of about 50 years, many of NDOT's bridges will require more rehabilitation and replacement in the near future.

When bridges deteriorate and require closure, the resulting detours can be very disruptive to traffic. In both rural and urban bridge closures, the user costs due to travel delays or additional crashes will often be quite significant until the bridge is reconstructed or repaired. User costs due to delay or crashes can be in the hundreds of thousands of dollars per day. The importance of bridge maintenance and rehabilitation cannot be overemphasized.

The Nevada Department of Transportation spent a total of approximately $17 million in fiscal years 2015 and 2016 on bridge preservation while spending on bridge preservation for the previous two years was approximately $33 million total. The decreased spending on bridge corrective maintenance, rehabilitation, seismic retrofit, and replacement for the last two fiscal years increased the backlog of bridge work by over $14 million. Levels of future bridge preservation funding are expected to remain below the current need of approximately $18 million a year.

While the anticipated level of bridge preservation funding will increase the backlog of bridge work, a much greater funding deficiency is likely to occur because of the age of NDOT's bridges. Many of NDOT's bridges are approaching the end of their useful life and the need for bridge preservation funds is expected to increase greatly over the next decade. The majority of the increase in bridge preservation funds needed is an increase in the replacement of old bridges.

Since NDOT already has 439 bridges over 50 years old, the current practice of replacing approximately 2 bridges a year is a replacement rate of less than 0.5% of the bridges over 50 years old. A replacement rate of 2% a year is necessary to replace the bridges over 50 years old bridges before they reach 100 years old. If a 2% annual replacement rate is reached in ten years and is maintained for another ten years, the number of bridges over 50 years old will begin to stabilize. Twenty years from now, NDOT would have approximately 590 bridges over 50 years old and would be replacing 12 bridges each year.

NDOT's current backlog of bridge preservation work is approximately $133 million. Under the current funding plan, the $133 million backlog is expected to gradually increase to $330 million in FY 2027. Increased spending in bridge corrective maintenance, rehabilitation, and replacement is necessary to preserve NDOT's bridge assets and to avoid costly bridge closures and emergency bridge replacements.

If bridge preservation spending is increased to match the forecast costs shown in FIGURE E2, the current backlog of bridge work can be maintained. If the funding is gradually increased as shown over the next ten years, the forecast bridge preservation cost is expected to level off at approximately $48 million per year.

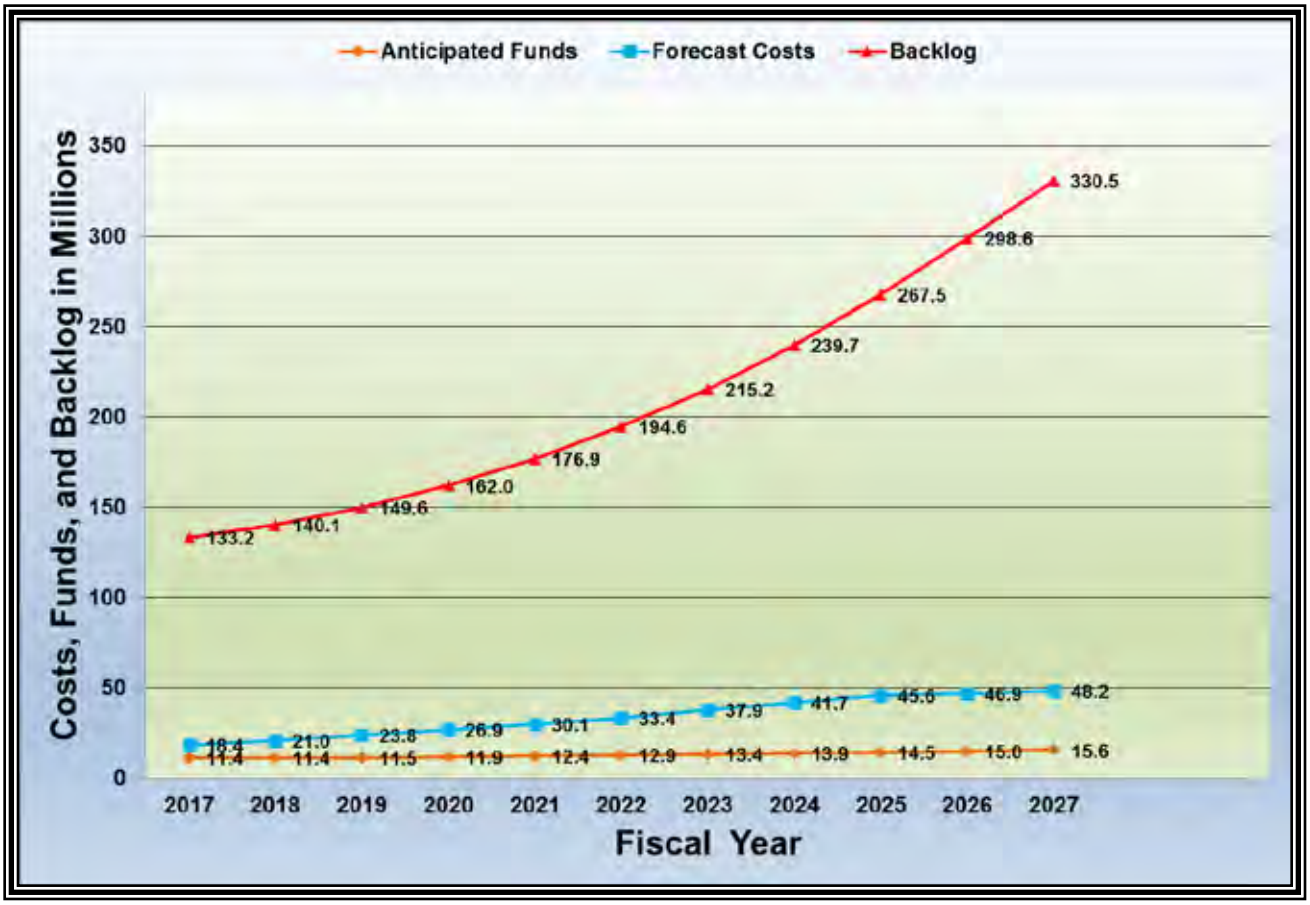


FIGURE E2. Anticipated Costs, Funds and Backlog of Bridge Preservation Work

PAVEMENT PRESERVATION

INTRODUCTION

This report summarizes the Nevada Department of Transportation's (NDOT's) effort to preserve the state-maintained roadway network. This roadway network consists of only 13% of the roads in Nevada. However, the roadway network is overwhelmingly vital and considered to be one of the state's most valuable assets. Approximately 51% of all traffic and 74% of all heavy trucks travel on state-maintained roads. The following discussion will explain how NDOT uses its available pavement preservation funds to maintain and rehabilitate the roadway network for the benefit of all Nevadans.

THE PAVEMENT MANAGEMENT SYSTEM

The Pavement Management System (PMS) includes the entire inventory of the state's existing pavement assets and condition. The primary objective of the PMS is to maintain and improve the condition of the roadway network while maximizing pavement performance through the practical use of available funds. NDOT's management of the pavement inventory allows maintenance and rehabilitation repair work to be prioritized in an objective and systematic manner. The PMS improves the efficiency of decision making, provides assessment on the consequences of decisions through comparative analysis, and ensures consistency of network and project level activities and results.

ROADWAY NETWORK INVENTORY

The state-maintained roadway network consists of 5,397 centerline miles of roads. Centerline miles are miles that indicate the length of the road, regardless of the number of lanes within each mile. In order to effectively manage 5,397 miles of roads, the roadway network is classified into five separate road prioritization categories. These road categories are based on heavy truck equivalent single axle loads (ESALs), average daily traffic (ADT), and federal guidelines for highway classification descriptions. The roads within each category have similar in-place pavement thicknesses, similar rates of deterioration, and similar timing for maintenance and rehabilitation repair work.

TABLE 1 lists the five separate road prioritization categories and corresponding descriptions. Also listed are several examples of easily recognized roads throughout the state to assist with relating these roads to the assigned categories and descriptions. In addition, FIGURE 1 is a map that highlights the state-maintained roadway network inventory identified by NDOT's five road prioritization categories.

TABLE 1. NDOT's Road Prioritization Categories

Road Prioritization Category	[1]Description	Examples
1	Controlled Access Roads	IR015, Clark County IR580, Washoe County IR080, Elko County
2	ESAL > 540 or ADT > 10,000	SR146, St. Rose Parkway, Clark County US050, Lincoln Highway, Carson City SR227, Fifth Street, Elko County
3	540 ≥ ESAL > 405 or 1,600 < ADT ≤ 10,000	SR157, Kyle Canyon Road, Clark County SR028, Lake Tahoe Area, Douglas County SR225, West Urban Limits of Elko, Elko County
4	405 ≥ ESAL > 270 or 400 < ADT ≤ 1,600	SR158, Deer Creek Road, Clark County SR206, Foothill Road/Genoa Lane, Douglas County SR228, Jiggs Road, Elko County
5	ADT ≤ 400	SR156, Lee Canyon Road, Clark County SR121, Dixie Valley Road, Churchill County SR229, Secret Pass Road, Elko County

[1]ESAL is an acronym for "Equivalent Single Axle Load." This engineering concept is the basis for the method used to quantify the standard loading of trucks and count the heavy trucks that travel on roads. ADT is an acronym for "Average Daily Traffic." The PMS includes the ADT data, as provided by NDOT's Traffic Division, for every road in the state-maintained roadway network.

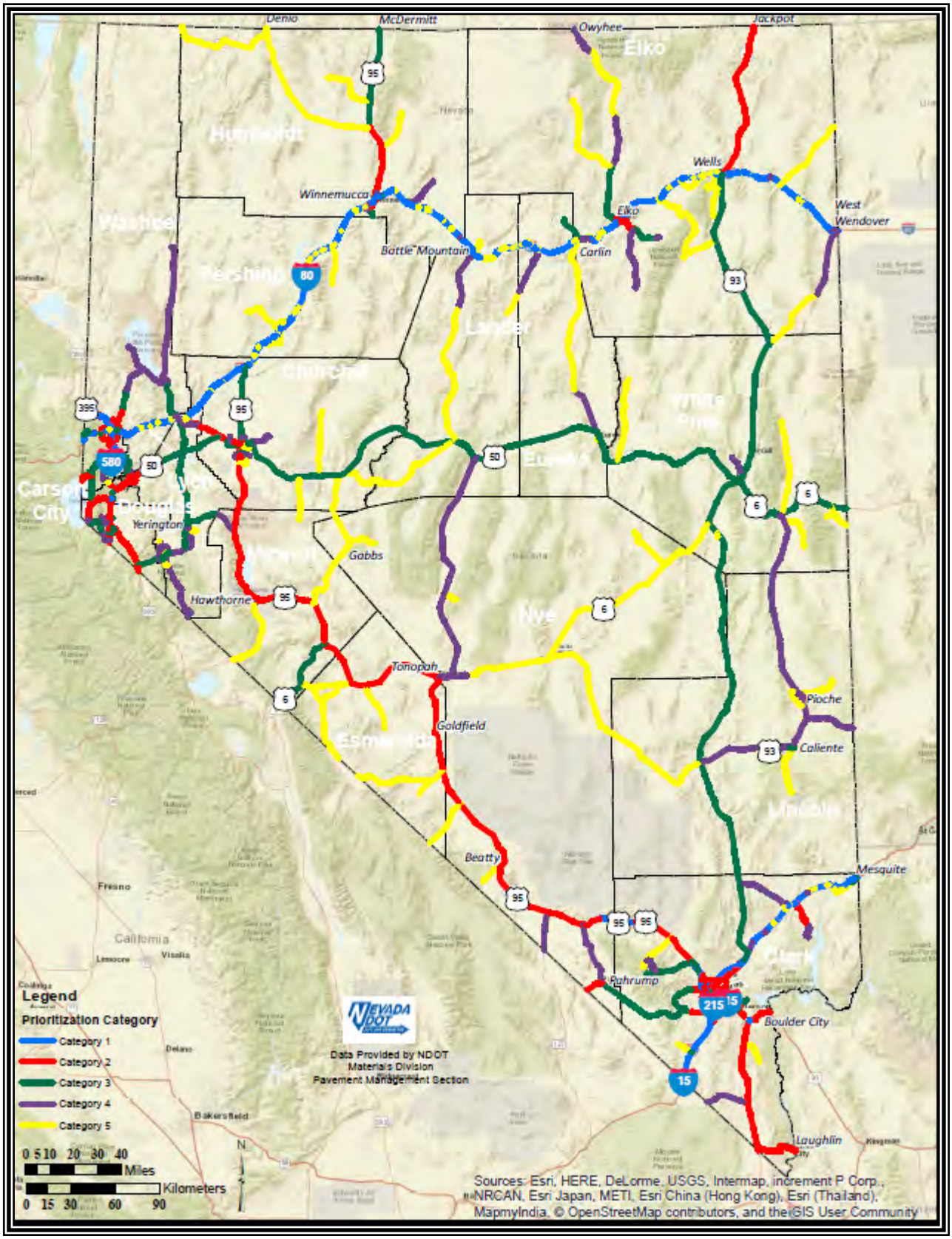


FIGURE 1. Roadway Network Inventory Identified by Road Prioritization Categories

There are numerous methods used to classify roads. The United States Department of Transportation (USDOT) classifies roads for national purposes, and every state department of transportation classifies road inventory using methods that complement each unique PMS. TABLE 2 compares the USDOT's method for classifying roads with NDOT's method for classifying roads as described in TABLE 1. This comparison was developed so that individuals familiar with national classification terminology can correlate the associated NDOT road prioritization categories.

TABLE 2. Comparison of the USDOT and NDOT Road Classification Systems

USDOT's Functional Classification Category	Description	Examples	NDOT's Road Prioritization Category
1	Interstate	Interstates are the highest classification of arterials and were designed and constructed with mobility and long-distance travel in mind.	1
2	Principal Arterial – Other Freeways and Expressways	The roads in this classification have directional travel lanes and are usually separated by some type of physical barrier. Access and egress points are limited to on-ramp and off-ramp locations, or a very limited number of at-grade intersections.	1 and 2
3	Principal Arterial - Other	The roads in this classification serve major centers of metropolitan areas, provide a high degree of mobility, and can also provide mobility through rural areas.	2
4	Minor Arterial	Minor arterials link cities, larger towns, and other traffic generators such as resorts.	3 and 4
5	Major Collector	Major collector roads provide service to any county seat not on an arterial route, to the larger towns not directly served by higher systems, and to traffic generators of equivalent intra-county importance such as shipping points, parks, important mining, agricultural areas, and more.	4 and 5
6	Minor Collector	Minor collectors distribute and channel trips between local roads and arterials, usually over a distance of less than three-quarters of a mile.	*Not Applicable
7	Local	Local roads are not intended for use in long distance travel, except at the origin or destination end of the trip, due to their provision of direct access to abutting land.	*Not Applicable

*Nevada's state-maintained roadway network serves the broad expanse within the state's boundaries. Several USDOT classifications are developed to describe local county and city roads that are limited for use in long distance travel and do not encompass the types of roads for which NDOT is responsible.

PAVEMENT CONDITION RATING SYSTEM

The concept that pavement should provide a smooth, comfortable, and safe ride for travelers requires a pavement condition rating system that includes all attributes important to travelers. These attributes include travelers' responses to motion and appearance as demonstrated by a smooth riding surface that is without cracking, rutting, patching, or potholes. A pavement condition rating system has been developed that objectively measures all the attributes that are important to travelers. This rating system is called the Present Serviceability Index (PSI).

The PSI pavement condition rating system is calculated using pavement roughness measurements and mathematical formulas that quantify pavement distresses such as cracking, raveling, rutting, and potholes. These measurements and formulas are combined and standardized into an objective rating scale numbered from zero to five. Pavement rated from four to five is interpreted as pavement in new or very good condition with a smooth surface that is without distress or irregularities. Pavement rated less than two is interpreted as pavement in very poor or failed condition which has the roughest of surface conditions that is no longer navigable at the posted speed limit. The PSI pavement condition rating system is used to quantify the pavement condition for each road within the state-maintained roadway network.

FIGURE 2 demonstrates how the PSI pavement condition rating system is divided into six condition levels that correspond to pavement in very good, good, fair, mediocre, poor, and very poor or failed condition. Descriptions include photographs of what pavement would typically look like in each condition as well as a discussion of the various stages of disrepair as pavement deteriorates over time.

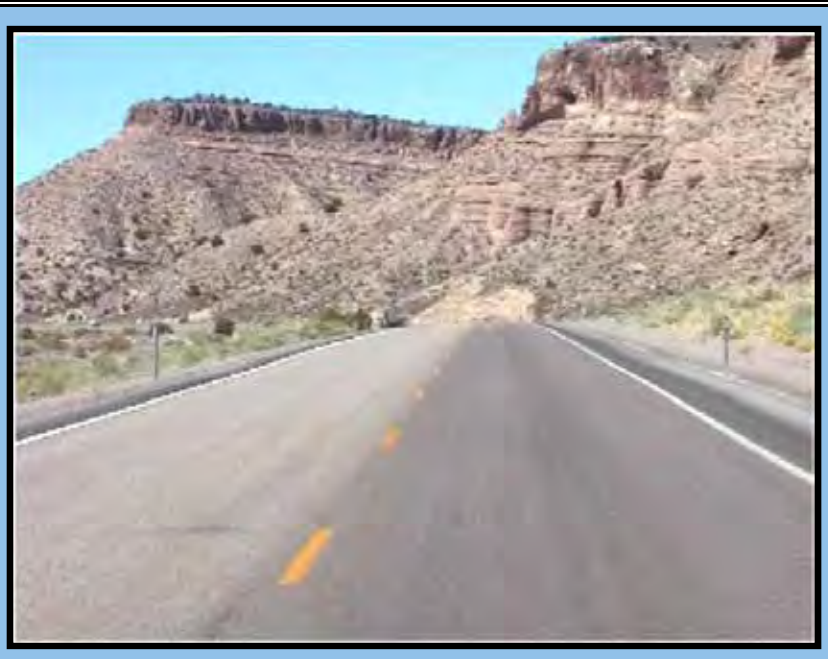
Pavement Condition	PSI Rating Scale	Description of Pavement Condition
Very Good	5.00 to 4.00	 Pavement in very good condition has an excellent, very smooth ride quality and is without any pavement distress. Pavement is in new condition.
Good	3.99 to 3.50	 Pavement in good condition has a very smooth ride quality and begins to show minor distresses that are typically environmental rather than load related. Distresses include minor non-wheelpath longitudinal and transverse cracks as well as minor surface raveling. Pavement in good condition can especially benefit from preventive maintenance such as crack sealing and surface treatments such as chip, slurry, and scrub seals. Surface treatments impede pavement deterioration and protect the pavement structure from water infiltration and weathering.

FIGURE 2. PSI Rating System and Corresponding Pavement Condition

Pavement Condition	PSI Rating Scale	Description of Pavement Condition
Fair	**3.49 to 3.00**	 Pavement in fair condition has a good ride quality except noticeable environmental distress has developed. Non-wheelpath longitudinal and transverse cracks are frequent. There is light surface oxidation and weathering. Structural distress in the wheelpath in the form of ruts and fatigue cracks begin to occur. Pavement in fair condition is a candidate for a surface treatment such as micro-surfacing or double chip seal, and possibly a two inch overlay. An overlay applied on pavement in this condition will prevent the formation of more severe structural distress.
Mediocre	**2.99 to 2.50**	 Pavement in mediocre condition has a barely acceptable ride quality and has accumulated significant environmental and structural distresses. Pavement has non-wheelpath longitudinal cracking and transverse cracks so closely spaced that block cracks develop. Ruts and fatigue cracks in wheelpath are present. Pavement in mediocre condition is candidate for three inch or thicker overlays and may require patching before the new overlay is placed. Pavement structural deterioration is evident.

FIGURE 2. PSI Rating System and Corresponding Pavement Condition (Continued)

Pavement Condition	PSI Rating Scale	Description of Pavement Condition
Poor	2.49 to 2.00	 Pavement in poor condition has a poor ride quality and has accumulated large amounts of environmental and structural-related distresses. The non-wheelpath longitudinal and transverse cracks are severe. The surface is weathered, rutted, and fatigue cracks are widespread. Lower volume roads are candidates for thick overlays or cold in-place recycling (CIR) and overlay repair. Higher volume roads will require reconstruction such as a full-depth recycling and overlay repair.
Very Poor or Failed	< 2.00	 Pavement in very poor condition has a very poor ride quality and has accumulated significant environmental and structural distresses. The surface is pitted and there are wide non-wheelpath longitudinal and transverse cracks. Networked, spalled fatigue cracks and deep ruts are prevalent. The deterioration is so advanced potholes are frequent. The road is no longer navigable at the posted speed limit. Pavement in this condition requires constant maintenance activity such as patching and filling potholes. Citizen complaints are common. This pavement always requires full-depth reconstruction and recycling the road may not be an option.

FIGURE 2. PSI Rating System and Corresponding Pavement Condition (Continued)

PAVEMENT MAINTENANCE AND REHABILITATION STRATEGIES

Pavement service life is a function of many parameters. The parameters of most consequence are the smoothness of the road and the amount of heavy truck loads that the pavement is expected to experience. New pavement has excellent characteristics such as a very smooth ride without any surface distress or defects. Relatively little funding is necessary for new pavement maintenance. However, the smooth ride will gradually become rough due to cracks, distress, or other types of defects as the pavement deteriorates. Therefore, it becomes necessary to spend an increasing amount of funds in order to maintain or rehabilitate the pavement to an acceptable condition level as the pavement deteriorates over time. The types and extents of distress or defects, along with the severity of the pavement roughness, determine what types of repair strategies are required for maintenance and rehabilitation repair work.

Pavement preservation repair strategies are designated as either maintenance or rehabilitation. Maintenance repair strategies are applied early in the pavement service life when the ride quality is in good condition, or applied when the pavement needs protection. Maintenance repair strategies do not improve the load bearing capacity of the pavement. Examples of maintenance repair strategies include fog seals, crack sealing, chip seals, slurry seals, filling potholes, and patching. Rehabilitation repair strategies are constructed when the pavement is in fair or worse condition to prevent further deterioration, and to improve the load bearing capacity of the pavement. Examples of rehabilitation repair strategies include plantmix overlays, cold in-place recycling with plantmix overlay, and full depth recycling with plantmix overlay. The effective scheduling and budgeting for pavement preservation repair strategies are important components of a successful PMS.

FIGURE 3 exhibits the construction timing for maintenance and rehabilitation repair strategies based on the PSI pavement condition rating system. Maintenance repair strategies are typically applied when a pavement has a PSI rating of 3.50 or more. Rehabilitation repair strategies are commonly constructed when a pavement has a PSI rating of 3.49 or less.

It should be noted however that these preservation repair strategies explained herein are general policies and that the construction timing for maintenance and rehabilitation

repair strategies changes for each road prioritization category. For example, due to financial constraints, it is common for Category 1 road to receive an overlay treatment around a PSI rating of 3.5, but a Category 5 road may receive a chip seal around a PSI rating of 2.5.

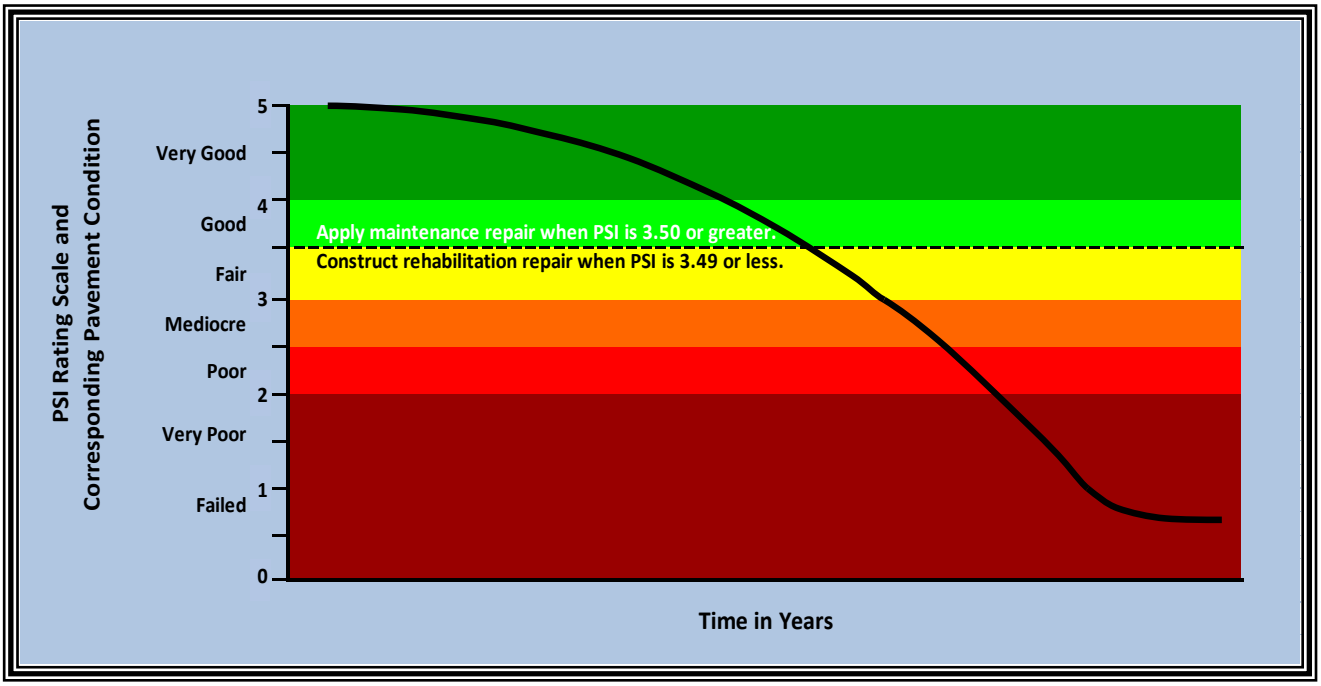


FIGURE 3. Timing for Repair Strategies Based on PSI Rating System

The funds needed for the repair work required to improve roads to acceptable condition levels when pavement is in poor or worse condition are far greater than the funds needed for the repair work when pavement is in fair or better condition. FIGURE 4 shows the timing for the cost saving between proactive pavement rehabilitation and reactive major reconstruction based on the PSI pavement condition rating system. Project expenditures will significantly increase when pavement is allowed to deteriorate from fair condition into very poor or failed condition. Repair work costs as much as six times more for major reconstruction when pavement is in very poor or failed condition as compared to the less invasive rehabilitation techniques that can be used when pavement is in fair or better condition.

NDOT proactively investigates opportunities to use resources wisely by repairing pavement in fair condition before the pavement deteriorates into worse, and thus more costly to repair condition. This philosophy of proactively constructing rehabilitation repair

strategies lowers pavement life-cycle costs and better serves the taxpaying public.

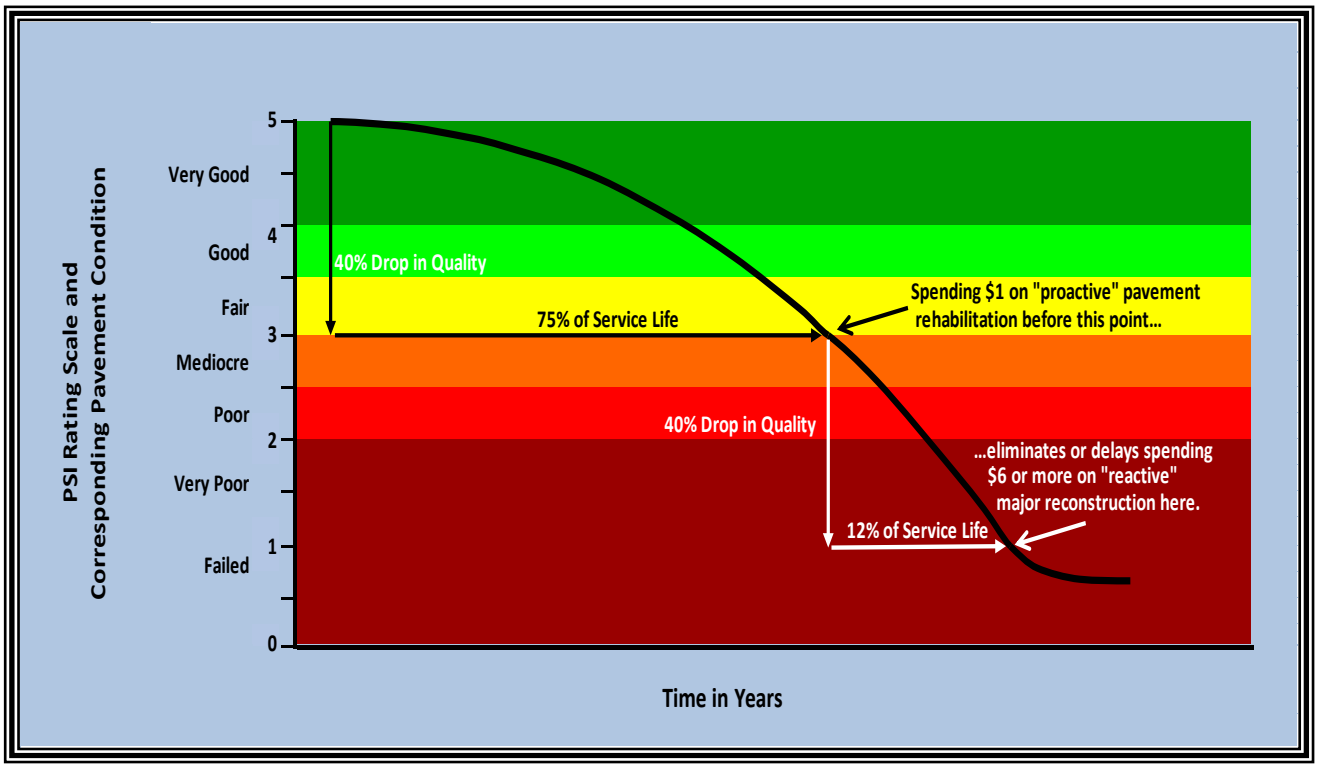


FIGURE 4. Timing for Proactive and Reactive Pavement Rehabilitation Expenditures

REVENUE AND EXPENDITURE

The pavement maintenance and rehabilitation repair work that is performed on the state-maintained roadway network is primarily funded by the federal government and State of Nevada highway-user revenue. This federal and state revenue generally consists of vehicle fuel tax and registration fees.

The vehicle fuel tax collected by the federal government is funneled into the Federal Highway Trust Fund. Thereafter, the tax is reallocated back to the states according to the provisions in the Moving Ahead for Progress in the 21st Century Act (MAP-21) and various other appropriation bills. Motor vehicle license and registration fees along with excise taxes on fuels that the state collects are deposited into the State Highway Fund. Revenue from the State Highway Fund is allocated to NDOT and used for the maintenance and rehabilitation repair work on state roads.

There were approximately $216,035,899 invested for maintenance and rehabilitation repair work on the state-maintained roadway network during fiscal years 2015 and

2016. This expenditure included a $130,768,699 investment of state funds, a $85,173,768 investment of federal funds, and a $93,432 investment of funds from other sources. Other funding sources include support by local city and public works agencies as well as private utility and telecommunication enterprise with vested interest in localized areas.

There was $186,605,994 of road repair work contracted out to private contractors and $29,429,905 of road repair work performed by NDOT Maintenance personnel. The maintenance preservation repair work was accomplished by both private road contractors and NDOT personnel. The rehabilitation repair work was solely accomplished by private road contractors. FIGURE 5 displays the funding sources and construction expenditures information that includes both maintenance and rehabilitation repair work for fiscal years 2015 and 2016.

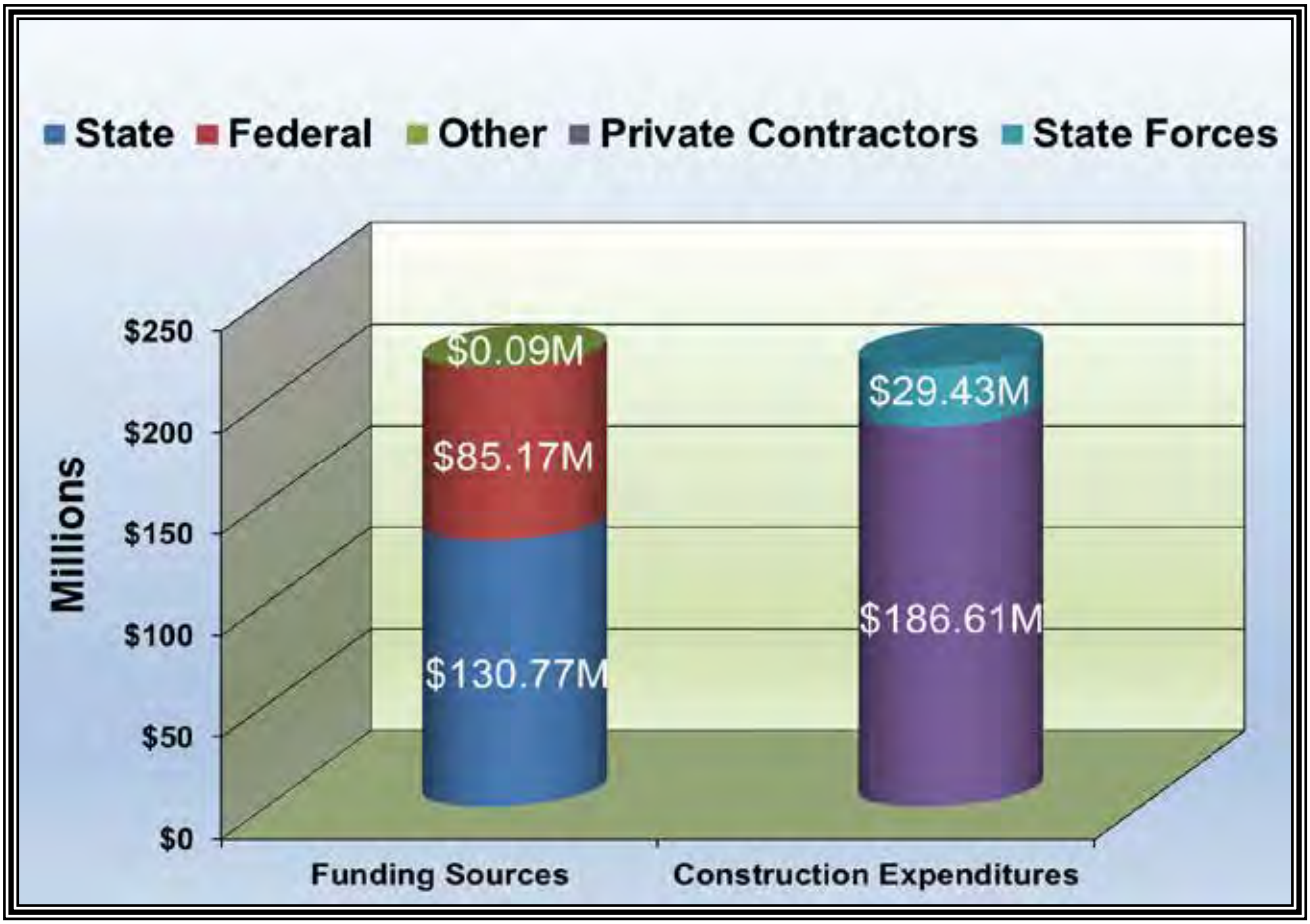


FIGURE 5. Funding Sources and Construction Expenditures

NDOT advertised $186,605,994 of contract maintenance and rehabilitation pavement

NDOT advertised $186,605,994 of contract maintenance and rehabilitation pavement repair work during fiscal years 2015 and 2016. This obligated expenditure improved 450 miles of roads to acceptable condition levels. TABLE 3 contains a financial summary of the advertised maintenance and rehabilitation repair work that was accomplished on the state-maintained roadway network during fiscal years 2015 and 2016, along with the corresponding mileage that was improved.

TABLES 4 and 5 list the specific rehabilitation projects that were advertised during fiscal years 2015 and 2016. Maps were created to show the statewide locations where the rehabilitation projects were constructed. FIGURE 6 features the locations where fiscal year 2015 rehabilitation projects were built. FIGURE 7 highlights the locations where fiscal year 2016 rehabilitation projects were completed.

TABLE 3. Advertised Pavement Repair Work for Fiscal Years 2015 and 2016

Fiscal Year	Contract Maintenance Repair Work Expenditure and Mileage	Contract Rehabilitation Repair Work Expenditure and Mileage	Total Contract Maintenance and Rehabilitation Repair Work Expenditure and Mileage
2015	$26,218,411	$52,980,852	$79,199,263
	235 Miles	30 Miles	265 Miles
2016	$12,162,908	$95,243,823	$107,406,731
	113 Miles	72 Miles	185 Miles
Biennium Total	$38,381,319	$148,224,675	$186,605,994
	348 Miles	102 Miles	450 Miles

TABLE 4. List of Rehabilitation Projects Advertised in Fiscal Year 2015

FISCAL YEAR 2015					
Contract Number	**County**	**Mileposts**	**Length in Miles**	**Road Category**	**Cost**
3577	Clark Nye	120.68 - 132.14 0.00 - 6.86	18.32	2	$20,125,992
LOCATION: US95 FROM 1.2 MILES NORTH OF FRCL 34 TO 0.9 MILES NORTH OF THE TRAILING EDGE OF I-1075, CLARK, AND NYE COUNTIES.					
SCOPE: COLD MILLING, PLACING PLANTMIX BITUMINOUS SURFACE WITH AN OPEN GRADED WEARING COURSE, AND SLOPE FLATTENING.					
3598	Carson City Washoe	8.49 - 9.28 0.00 – 5.99	6.78	1	$14,854,860
LOCATION: I-580 FROM THE SOUTHBOUND OFF RAMP AT THE NORTH CARSON STREET INTERCHANGE TO 0.86 MILES SOUTH FROM THE BOWERS INTERCHANGE, CARSON CITY AND WASHOE COUNTIES.					
SCOPE: ROADWAY REHABILITATION, WIDENING FOR AUXILIARY LANE AND SEISMIC RETROFIT.					
201351	Clark	26.505 - 31.378	4.87	2	$18,000,000
LOCATION: SR 592, FLAMINGO ROAD, FROM PARADISE TO BOULDER HIGHWAY, CLARK COUNTY.					
SCOPE: 4 1/4" MILL, 1" PBS (TYPE 3), 2" PBS (TYPE 2), AND 3/4" OG.					

FISCAL YEAR 2016					
Contract Number	**County**	**Mileposts**	**Length in Miles**	**Road Category**	**Cost**
3605	Clark	3.53 – 7.30	3.77	2	$6,764,326
LOCATION: SR593 TROPICANA AVENUE FROM EASTERN AVENUE TO BOULDER HIGHWAY, CLARK COUNTY.					
SCOPE: COLD MILLING, PLACING PLANTMIX BITUMINOUS SURFACE, AND MEDIAN ISLAND IMPROVEMENTS.					
3609	Elko	68.98 – 74.85	5.88	1	$16,838,503
LOCATION: I-80 FROM 0.05 MILES WEST OF THE WILLOW CREEK GRADE SEPARATION TO 0.82 MILES EAST OF THE EAST WELLS INTERCHANGE, ELKO COUNTY.					
SCOPE: COLD MILL, RUBBLIZATION, AND OVERLAY WITH LEVELING COURSE, PLANTMIX BITUMINOUS SURFACE, AND OPEN GRADED WEARING COURSE.					
3604	Humboldt Lander Lander	60.31 -61.38 (Cat 1) 0.00 – 9.05 (Cat 1) 4.42 -5.04 (Cat 3)	10.74	1 and 3	$13,285,468
LOCATION: I-80 FROM 1.065 MILES WEST OF HU/LA COUNTY LINE TO THE HU/LA COUNTY LINE; I-80 FROM HU/LA COUNTY LINE TO 0.930 MILES EAST OF EAST BATTLE MOUNTAIN INTERSECTION; SR304 ALLEN ROAD FROM THE CATTLEGUARD ON SOUTH SIDE TO THE CATTLEGUARD ON THE NORTH SIDE OF WEST BATTLE MOUNTAIN INTERCHANGE, HUMBOLDT AND LANDER COUNTIES.					
SCOPE: I-80: 1” MILL AND 2” FILL WITH OPEN GRADE, I-80 MP LA 3.43 TO 9.06 MILL FULL DEPTH, RUBBLIZE PCCP, 1.5” LEVELING COURSE, 4” FILL WITH OPEN GRADE, MILL AND FILL RAMPS; SR-304- 3.75” MILL, 1.5” STRESS RELIEF, 2” FILL WITH OPEN GRADE.					
3621	White Pine	66.99 – 76.34	9.35	3	$4,508,616
LOCATION: US93 NORTH OF MCGILL FROM 3.61 MILES SOUTH OF SUCCESS SUMMIT ROAD TO 5.74 MILES NORTH OF SUCCESS SUMMIT ROAD, IN WHITE PINE COUNTY.					
SCOPE: COLD MILLING AND PLACING PLANTMIX BITUMINOUS SURFACE WITH OPEN GRADED SURFACE.					
3628	Esmeralda	18.82 - 43.892	25.07	2	$24,557,204
LOCATION: US 6 FROM THE JUNCTION WITH US 95 TO 1.974 MILES WEST OF MILLERS ROADSIDE PARK, ESMERALDA COUNTY.					
SCOPE: COLDMILL, STRESS RELIEF WITH OPEN GRAD, SHOUOLDER WIDENING, PASSING LANES, SLOPE FLATTENING, AND DRAINAGE.					
3640	Carson City	0.38 – 1.99	1.61	2	$1,107,050
LOCATION: SR 529, SOUTH CARSON STREET, FROM OVERLAND STREET TO FAIRVIEW DRIVE, IN CARSON CITY.					
SCOPE: MICROSURFACING, PATCHING AND PEDESTRIAN IMPROVEMENTS.					
3619	Clark	32.997 – 37.713	4.72	2	$15,768,603
LOCATION: SR 604, LAS VEGAS BOULEVARD, FROM EAST CAREY AVENUE TO 0.24 MILES NORTH OF CRAIG ROAD.					
SCOPE: ROADWAY REHABILITATION AND CONCRETE BUS LANES.					
3607	Esmeralda	0.00 - 44.196	44.196	2	$12,414,053
LOCATION: US 95 SOUTH OF TONOPAH, 0.796 MILES SOUTH OF DRY WASH B-1478 TO 1.98 MILES SOUTH OF THE ES/NY COUNTY LINE, AT JUNCTION SILVER PEAK ROAD, AND JUNCTION LIDA ROAD.					
SCOPE: 2.5" MILL 3" PBS WITH OG, WIDEN SILVER PEAK FOR RIGHT TURN LANE AND LIDA FOR RIGHT AND LEFT TURN, 16" BASE, 6" PBS WITH OPEN GRADE.					

TABLE 5. List of Rehabilitation Projects Advertised in Fiscal Year 2016

FIGURE 6. Fiscal Year 2015 Project Locations

FIGURE 7. Fiscal Year 2016 Project Locations

COSTS OF CONSTRUCTION

The costs for maintenance and rehabilitation repair work on highways fluctuate from year to year. The periodic year-to-year fluctuations are typically due to price spikes in the costs of steel and energy. However, the costs for maintenance and rehabilitation repair work on highways always trend in the upward direction over the long-term.

NDOT recognizes that these periodic cost fluctuations complicate the project planning process and cause uncertainty in the highway construction industry. NDOT tries to mitigate this uncertainty by sharing the risk with contractors through fuel and asphalt escalation clauses in project contracts. However, sharing the risk of cost fluctuations does not eliminate the overall long-term increase in construction costs as reported by the Associated General Contractors of America (AGCA), the American Road and Transportation Builders Association, the Federal Highway Administration, and other data sources.

The Construction Cost Index (CCI) is defined as the measure of the price of labor, material, equipment, transport, and other costs associated with highway construction. Several western state construction cost indices were reviewed for years 2009 through early 2016. The data included an average of the California DOT (Caltrans), Colorado DOT (CDOT), and Utah DOT (UDOT) indices through 2014, and Caltrans and UDOT indices through 2016. The data shows a slight decline in the average CCI between 2009 and 2010, and this decline is indicative of a short-term price fluctuation. However, the data also exhibits a steady increase in the average CCI from 2010 through the first quarter of 2016. It is expected that this trend will continue into the future based on the current economic climate. FIGURE 8 indicates the average CCI data from Caltrans, CDOT, and UDOT for years 2009 through the first quarter of 2016.

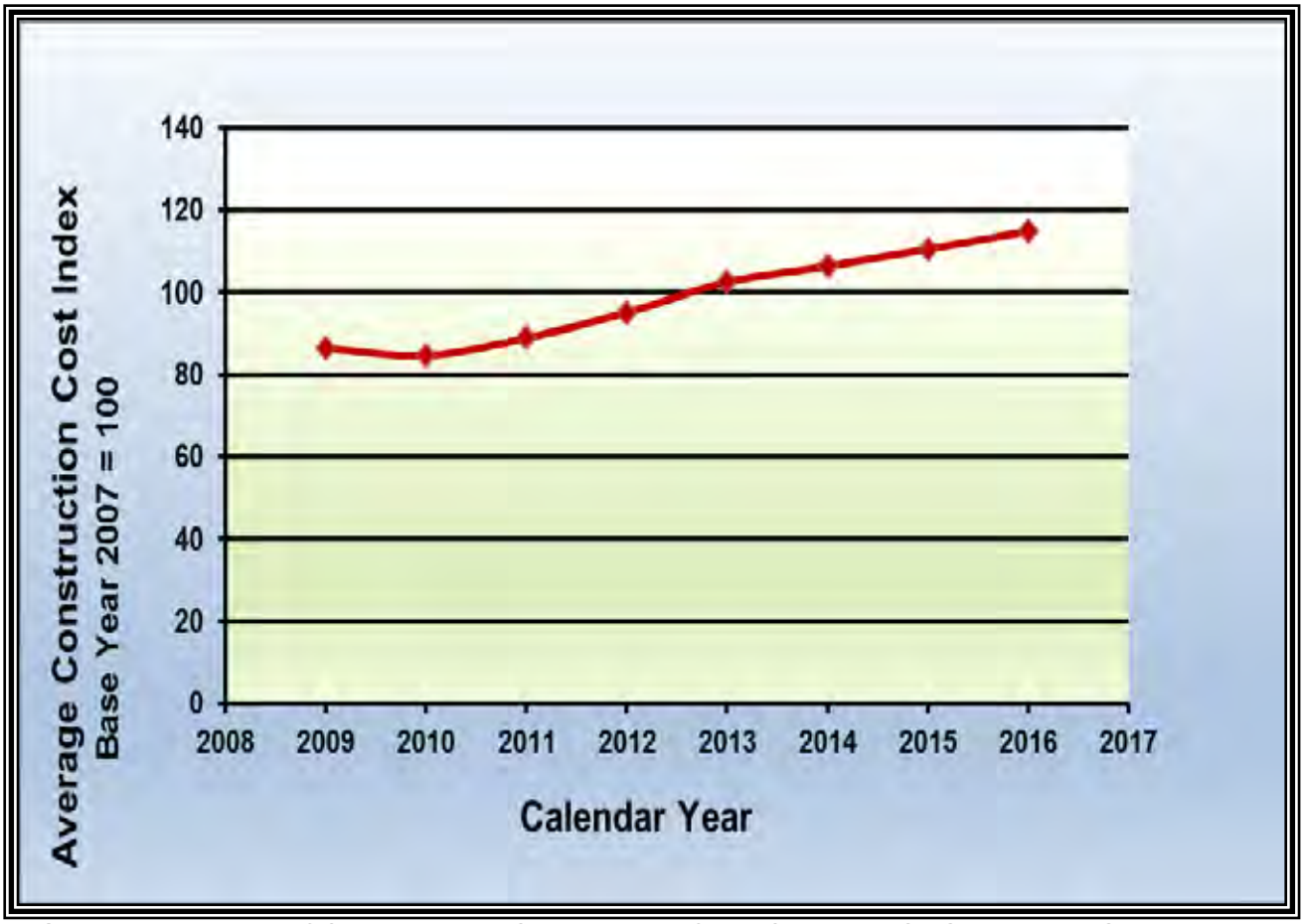


FIGURE 8. Average of Construction Cost Indices from Caltrans, CDOT, and UDOT
Sources are located on the World Wide Web:
1) http://www.dot.ca.gov/hq/esc/oe/hist_price_index.html
2) http://www.udot.utah.gov/main/uconowner. gf?n=10172725194241610 and
3) http://www.coloradodot.info/business/eema/construction-cost-index

NDOT depends primarily on the revenue from fuel tax to fund road construction projects. Since much of this tax is not indexed to inflation, the purchasing power of the revenue for road construction is approximately forty percent of what it was in 1992. The preservation of the state-maintained roadway network at acceptable condition levels becomes more challenging year after year. This challenge is due to the continuous increase in costs for road construction along with the consequences from neglecting the long-term effects of inflation.

PAVEMENT CONDITION

A safe, efficient, and reliable roadway network is a matter of regional importance and promotes the general welfare of all people that live, work, and play in the state. Nevada's pavement has ranked in the top one-half in the nation for the last several years as compared with the overall highway performance and efficiency of other states' roadway networks as reported in the *Annual Highway Report* by the *Reason Foundation*. NDOT uses the PSI pavement condition rating system to evaluate and report the condition of the roadway network. The PSI pavement condition rating system was previously discussed and graphically shown in FIGURE 2. TABLE 6 presents the PSI condition data for each road prioritization category on the state-maintained roadway network. FIGURE 9 is a map of the state's roadway network inventory identified by the PSI rating system. FIGURES 10 through 14 are maps of road prioritization categories 1 through 5 identified by the PSI rating system.

TABLE 6. *PSI Pavement Condition by Road Prioritization Category

Condition	PSI Rating Scale	PSI Condition by Road Prioritization Category Percentage (%) and Miles					
		Road Category 1	Road Category 2	Road Category 3	Road Category 4	Road Category 5	Roadway Network Totals
Very Good	5.00 to 4.00	83.0% 441	49.5% 458	31.6% 377	9.1% 75	0.8% 12	**26.7%** **1,363**
Good	3.99 to 3.50	12.2% 65	31.1% 287	47.2% 563	37.7% 312	12.8% 207	**28.2%** **1,435**
Fair	3.49 to 3.00	3.0% 16	13.6% 126	17.7% 211	34.6% 287	35.4% 573	**23.8%** **1,212**
Mediocre	2.99 to 2.50	0.8% 4	4.2% 39	2.6% 31	14.1% 117	26.4% 427	**12.1%** **618**
Poor	2.49 to 2.00	1.0% 5.39	1.0% 9	0.5% 6	3.0% 25	16.0% 259	**6.0%** **304**
Very Poor	< 2.00	0.0% 0	0.6% 5	0.5% 6	1.5% 13	8.7% 140	**3.2%** **164**
Total Miles		**532**	**924**	**1,193**	**829**	**1,619**	**5,096**

* 1) Data as reported in the 2015 PMS Data Warehouse.
2) The reported total of 5,096 miles includes hotmix asphalt pavement and excludes Portland Cement Concrete Pavement (PCCP). PCCP is not included because of its unique service life requirements and distress characteristics that vary significantly from hotmix asphalt pavement. Each PCCP pavement segment is reviewed separately. The total state-maintained roadway network mileage of 5,397 miles mentioned in the *Roadway Network Inventory* section of the report is the official mileage count that includes PCCP roads.

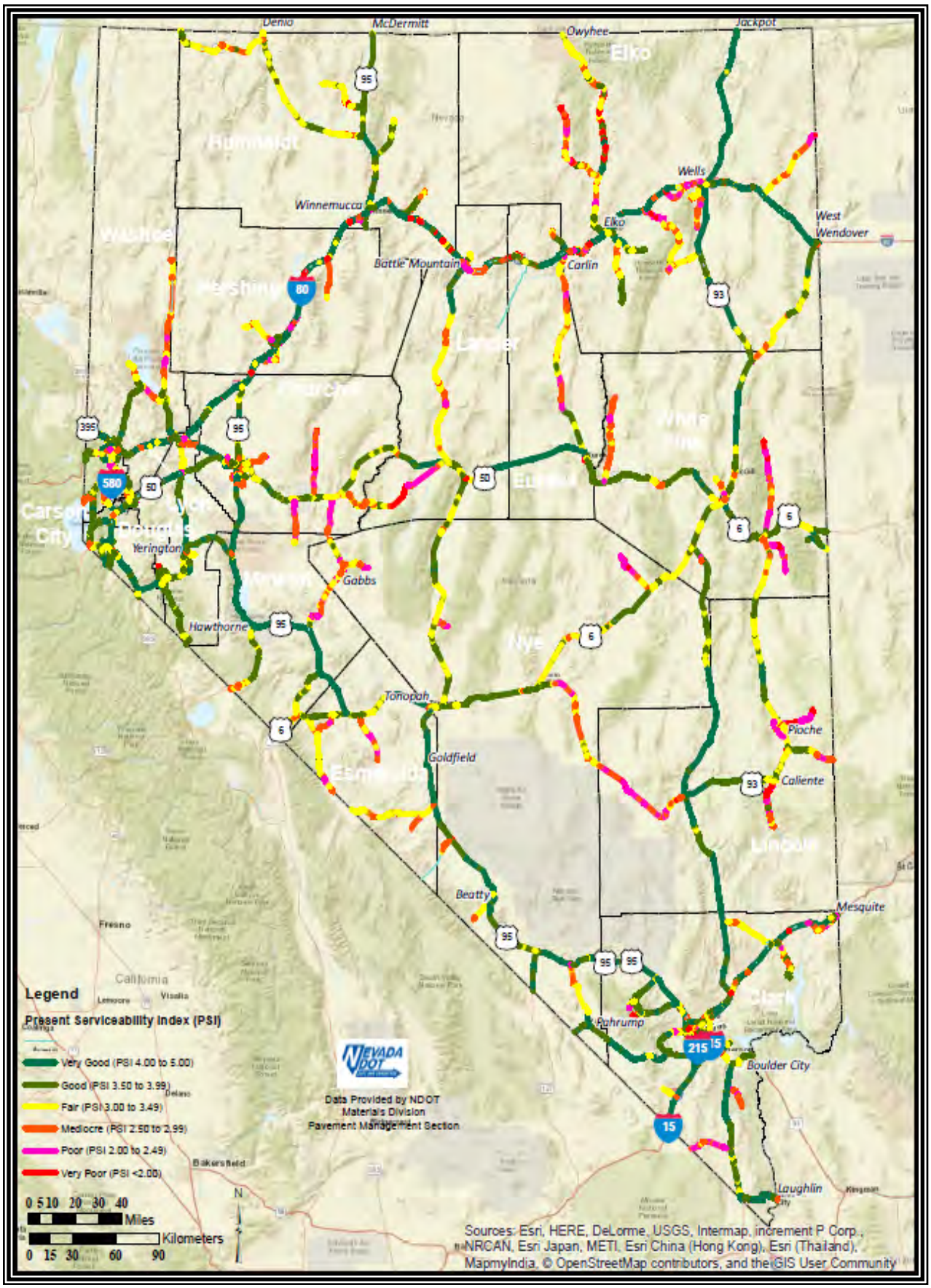


FIGURE 9. Roadway Network Inventory Identified by Present Serviceability Index (PSI)

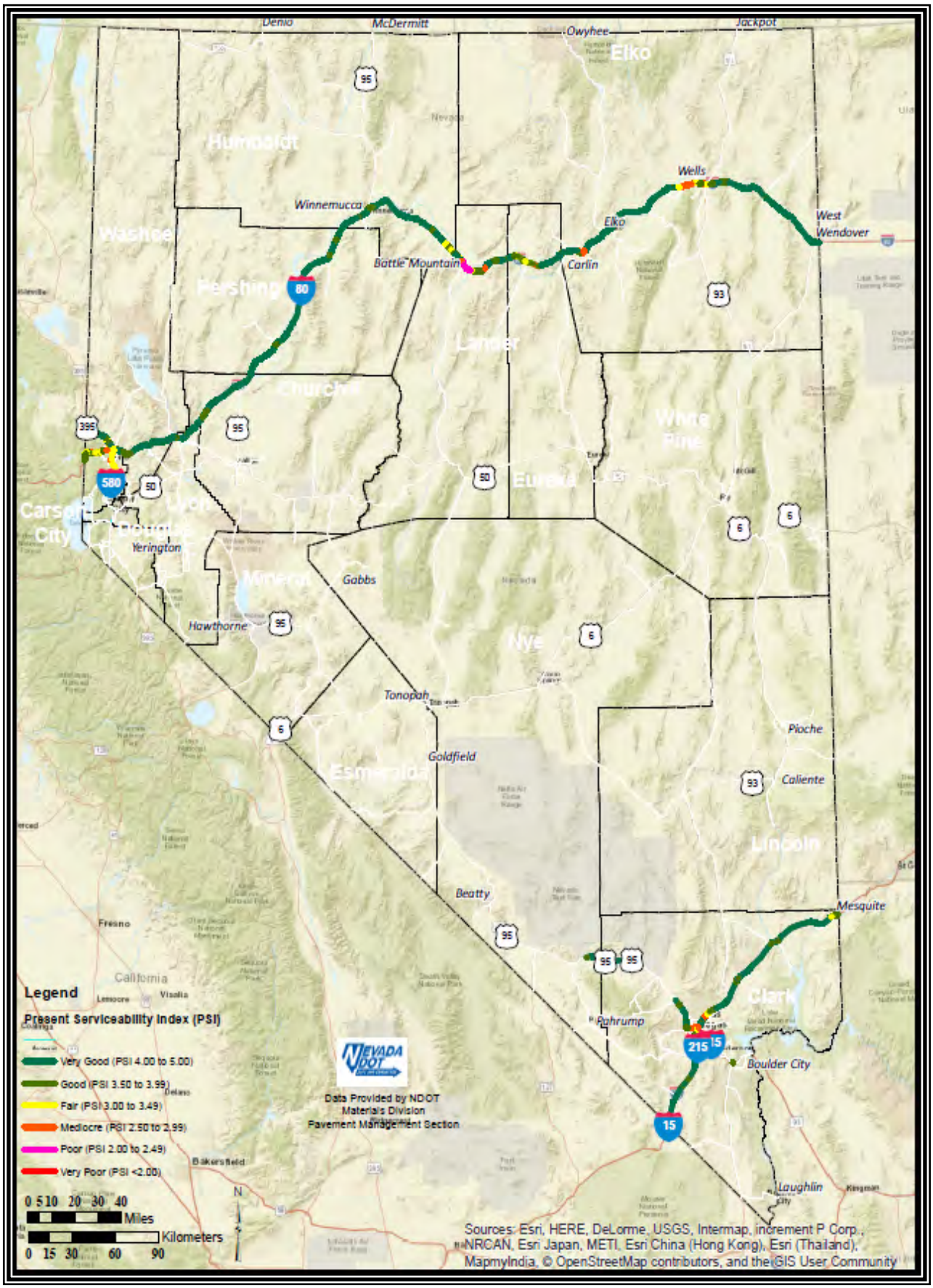


FIGURE 10. Road Prioritization Category 1 Identified by Present Serviceability Index (PSI)

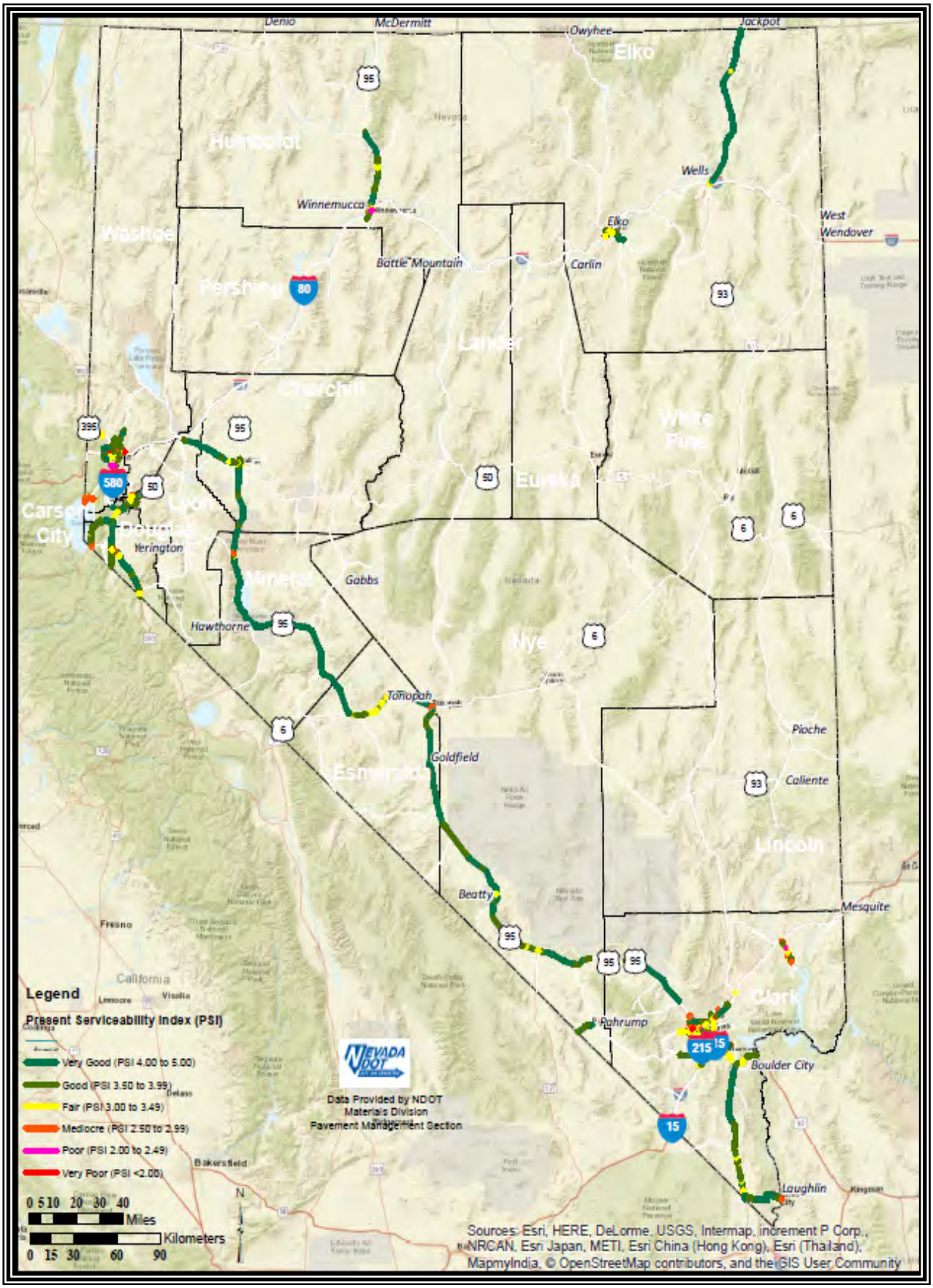


FIGURE 11. Road Prioritization Category 2 Identified by Present Serviceability Index (PSI)

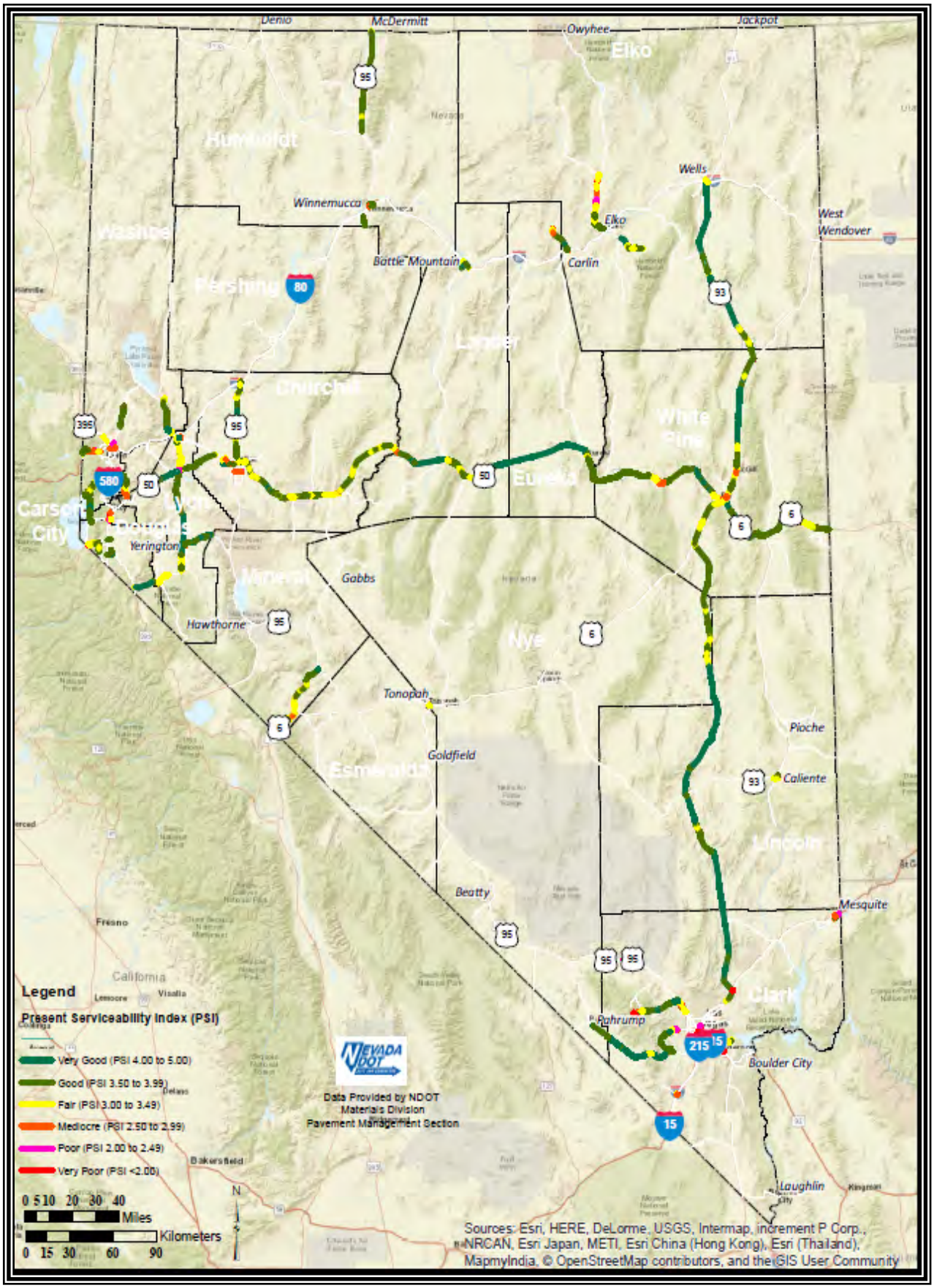


FIGURE 12. Road Prioritization Category 3 Identified by Present Serviceability Index (PSI)

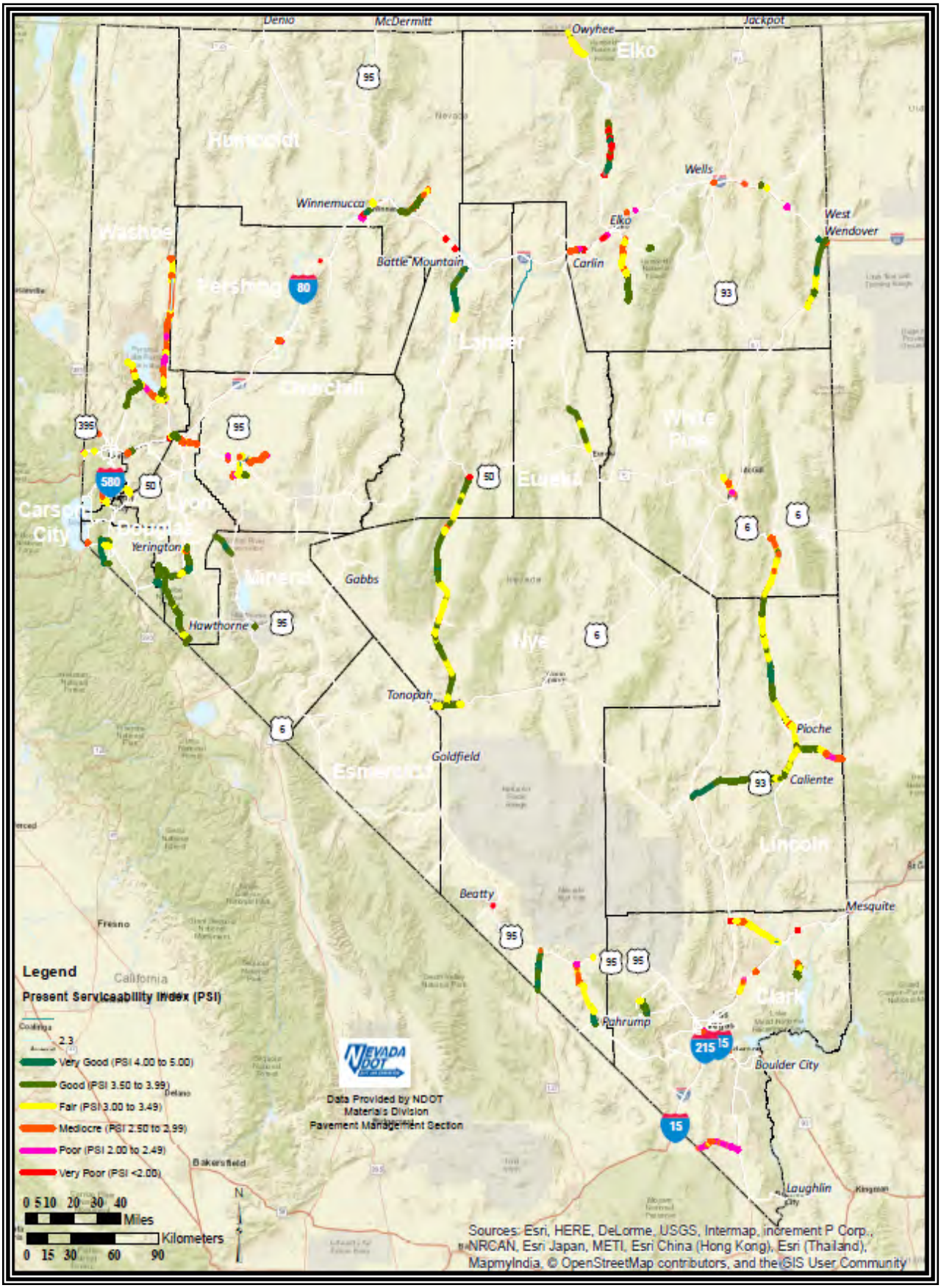


FIGURE 13. Road Prioritization Category 4 Identified by Present Serviceability Index (PSI)

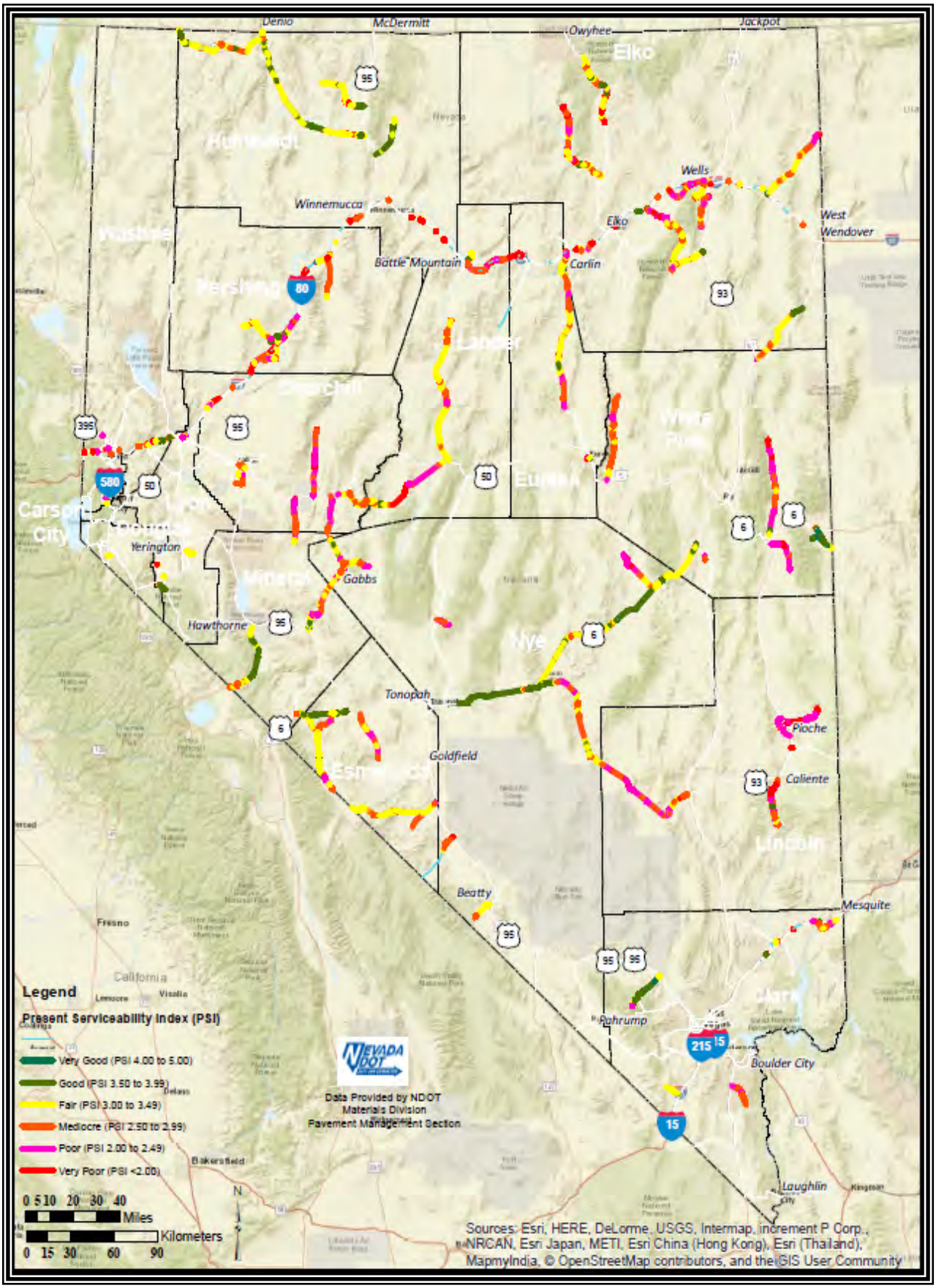


FIGURE 14. Road Prioritization Category 5 Identified by Present Serviceability Index (PSI)

NDOT partitions the state into three districts in order to effectively manage the state's pavement assets. District 1 includes the larger parts of Clark, Esmeralda, Lincoln, and Nye Counties. District 2 is comprised of most of Carson City, Churchill, Douglas, Lyon, Mineral, Pershing, Storey, and Washoe Counties. District 3 consists of the majority of Elko, Eureka, Humboldt, Lander, and White Pine Counties. TABLE 7 was developed to determine the pavement condition in each district identified by the PSI rating system. TABLE 8 was generated to evaluate the pavement condition in each county identified by the PSI rating system.

TABLE 7. District Pavement Condition Identified by Present Serviceability Index (PSI)

District	Average PSI Condition by Road Prioritization Category and Miles per District				
	Road Category 1	Road Category 2	Road Category 3	Road Category 4	Road Category 5
District 1	4.12 139 mi	3.66 518 mi	3.68 280 mi	3.38 370 mi	2.83 535 mi
District 2	4.14 163 mi	3.75 291 mi	3.55 351 mi	3.29 252 mi	2.48 269 mi
District 3	4.12 230 mi	3.97 115 mi	3.78 561 mi	3.23 207 mi	2.8 802 mi
Total All Districts	4.13 532 mi	3.73 924 mi	3.68 1192 mi	3.31 829 mi	2.74 1607 mi

TABLE 8. County Pavement Condition Identified by Present Serviceability Index (PSI)

County	Average PSI Condition by Road Prioritization Category and Miles per County				
	Road Category 1	Road Category 2	Road Category 3	Road Category 4	Road Category 5
Carson City	3.79 6	3.80 14	2.69 7	Not Applicable	Not Applicable
Churchill	4.27 28	3.97 48	3.57 140	2.75 24	2.41 97
Clark	4.11 132	3.47 286	3.49 137	2.91 68	2.63 72
Douglas	Not Applicable	3.79 56	3.51 26	3.60 19	1.17 2
Elko	4.13 124	4.10 77	3.86 109	3.12 105	2.67 254
Esmeralda	Not Applicable	4.01 97	Not Applicable	Not Applicable	3.03 131
Eureka	4.21 13	Not Applicable	3.99 54	3.54 20	2.73 69
Humboldt	4.24 55	3.71 37	3.64 49	3.03 23	3.02 166
Lander	3.48 18	Not Applicable	3.80 64	3.67 41	2.79 128
Lincoln	Not Applicable	Not Applicable	4.07 103	3.54 146	2.33 104
Lyon	4.22 16	3.87 29	3.72 104	3.60 77	2.42 17
Mineral	Not Applicable	4.21 93	3.53 35	3.80 11	3.10 62
Nye	4.25 7	3.89 110	3.81 49	3.49 138	3.13 243
Pershing	4.29 75	Not Applicable	Not Applicable	2.15 2	2.51 112
Storey	Not Applicable	Not Applicable	3.45 11	3.26 3	Not Applicable
Washoe	3.97 57	3.33 76	3.47 64	3.14 117	2.26 17
White Pine	Not Applicable	Not Applicable	3.71 241	3.20 36	2.75 134
Total All Counties	4.13 532	3.73 924	3.68 1,192	3.31 829	2.74 1,607

Past condition data were reviewed using the PSI pavement condition rating system to determine if the funds spent to perform maintenance and rehabilitation repair work were adequate to maintain or improve the average condition of the roadway network. FIGURES 15 through 20 are the results of this review. FIGURE 15 demonstrates the overall average PSI for the entire roadway network was in good condition from 2003 through 2005, transitioned from good condition to fair condition in 2006, and steadily declined from 2007 through 2014. However, the average condition trends up in 2015, but is projected to decline in 2016. It should be noted that the condition improves in 2015 not only for the overall roadway network but for each individual road prioritization category (categories 1-5) as well. This may likely be due to repair of the data collection equipment in 2014 and the collection of updated cracking data in 2015. The projected 2016 condition value is based on deterioration curves that have been formulated using past condition data. It is anticipated that the overall condition of the roadway network will transition from fair to mediocre condition within the next few years.

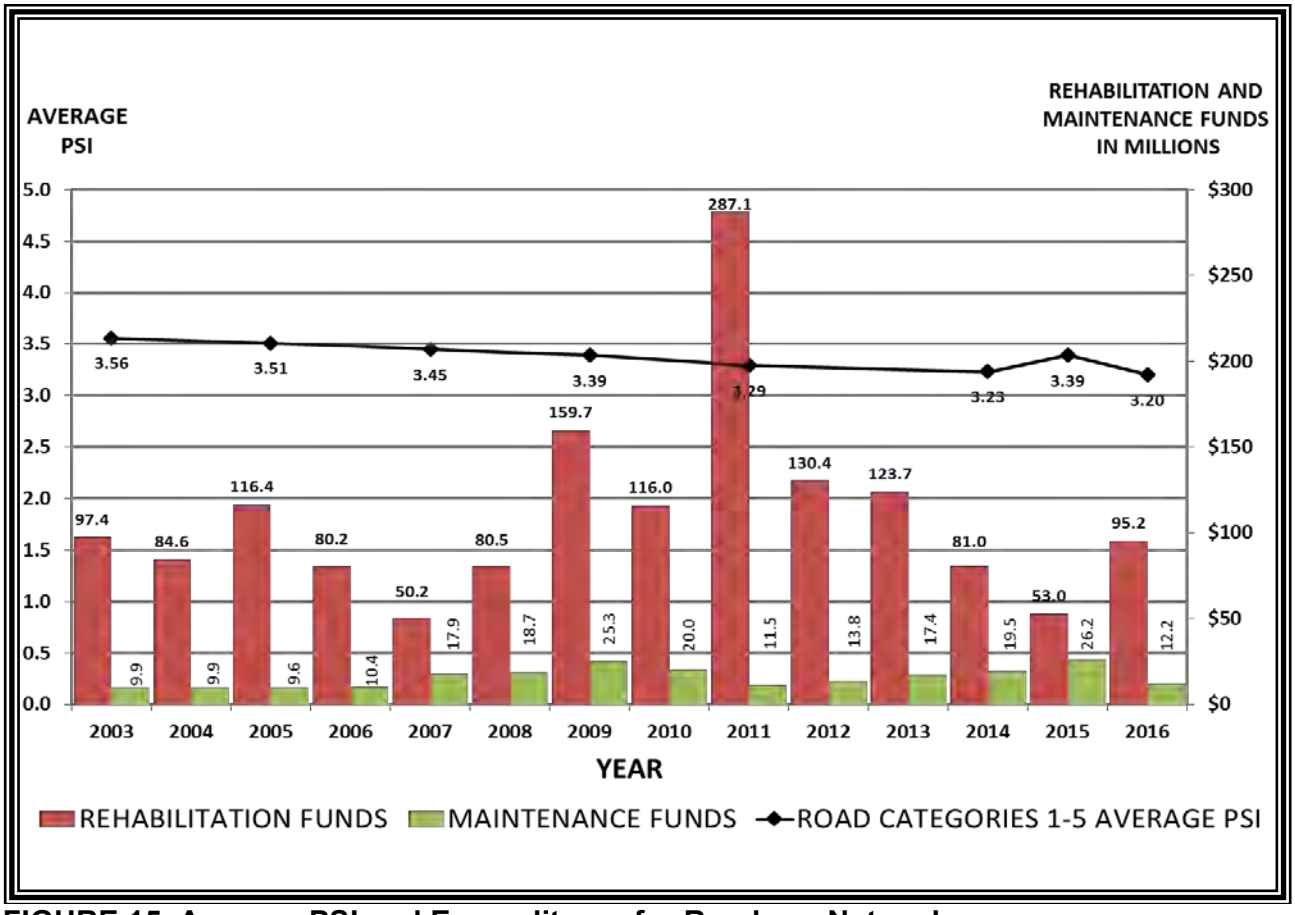


FIGURE 15. Average PSI and Expenditures for Roadway Network

FIGURE 16 illustrates the long-term average PSI for road category 1 and the rehabilitation expenditure for each year from 2003 through 2016. Category 1 roads include the controlled access highways such as I-15, I-580, and I-80. These roads are highest in priority due to interstate economic importance. NDOT spends a substantial amount of funds to maintain these roads in very good condition each year. An average of approximately $58M per year has been spent on these roads since 2003, and it appears that the condition is stable, but could transition from very good into good condition within the decade, depending upon future funding.

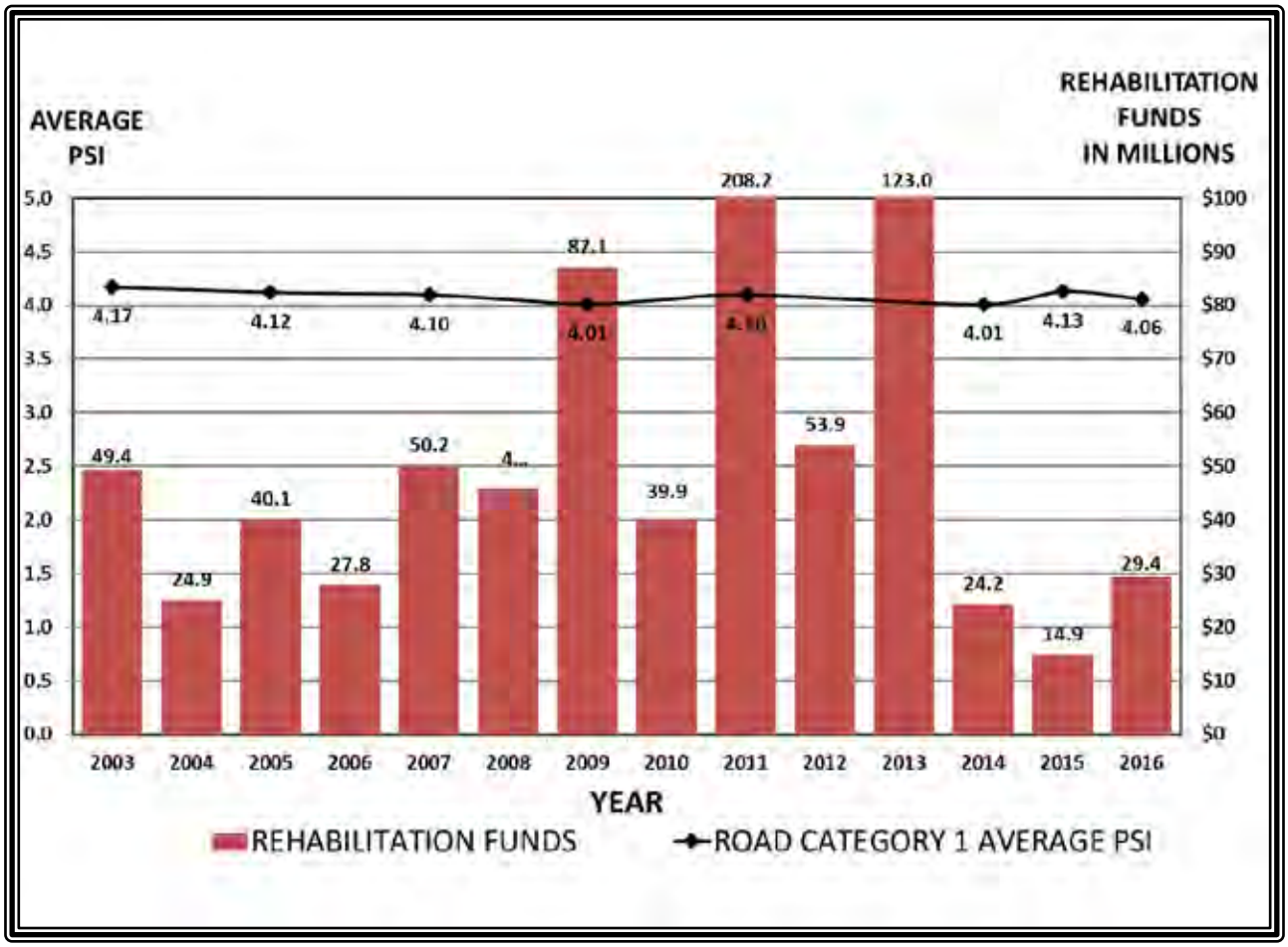


FIGURE 16. Average PSI and Expenditures for Road Category 1

FIGURE 17 shows the long-term average PSI for road category 2 and the rehabilitation expenditure for each year from 2003 through 2016. Category 2 roads include routes such as St. Rose Parkway/Lake Mead Drive, US-50 Lincoln Highway, and Fifth Street in Elko. The average PSI remained solidly in good condition for most of the reporting years. In approximately 2014, the average PSI deteriorated to a point near the threshold of changing from good condition to fair condition, but has slightly increased in 2015. The average PSI for category 2 roads is expected to deteriorate into fair condition within the next 10 years. The funding in this category averages approximately $35M per year.

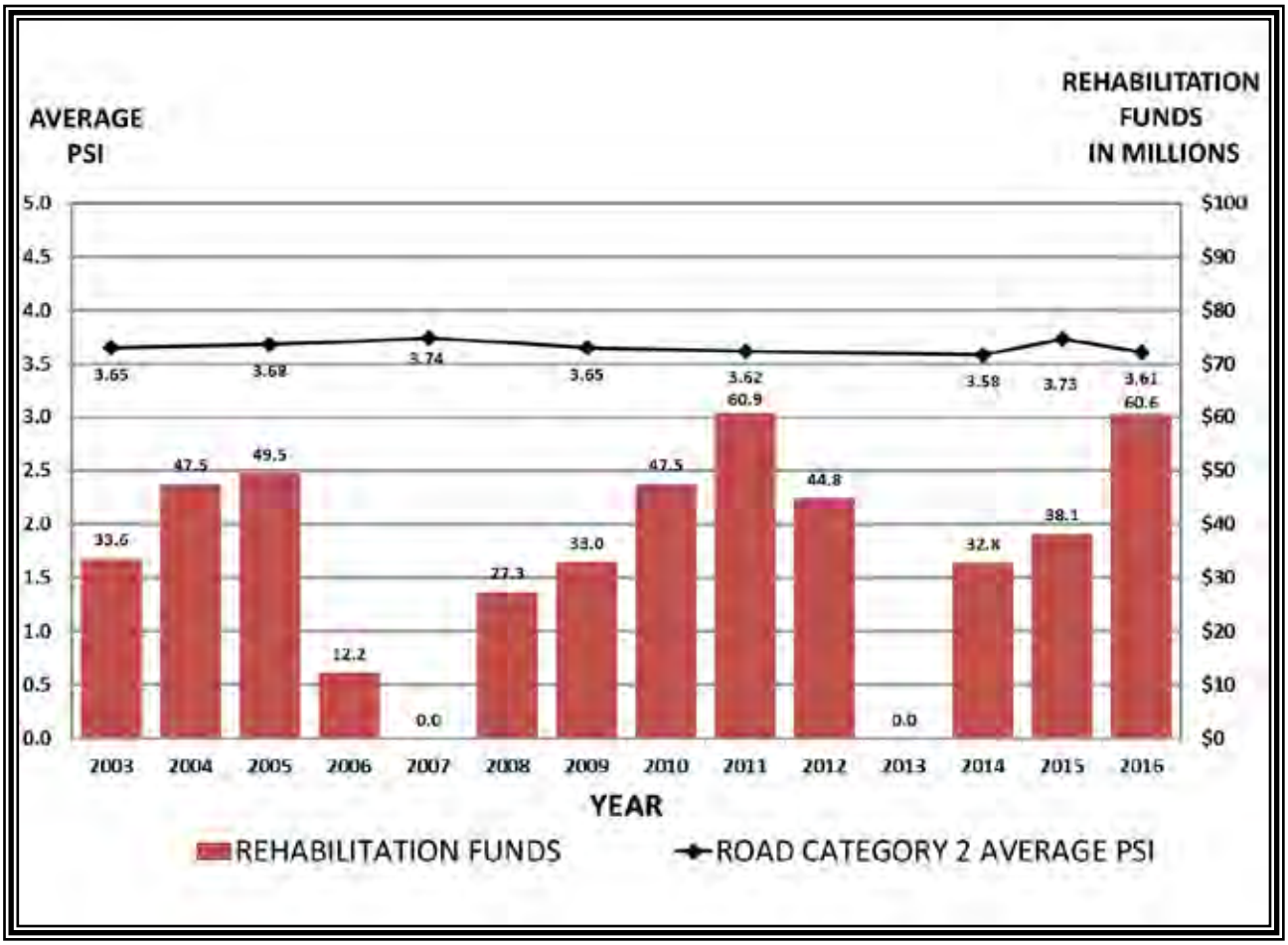


FIGURE 17. Average PSI and Expenditures for Road Category 2

FIGURE 18 displays the long-term average PSI for road category 3 and the rehabilitation expenditure for each year from 2003 through 2016. Category 3 roads include routes such as Kyle Canyon Road, SR-28 near Lake Tahoe, and SR-225 at the Elko west urban limits. The average PSI was at the high end of good condition for many years and has recently declined into the lower end of good condition. This category of roads is expected to deteriorate into fair condition within the next couple of years. Average funding for road category 3 has been approximately $13M per year.

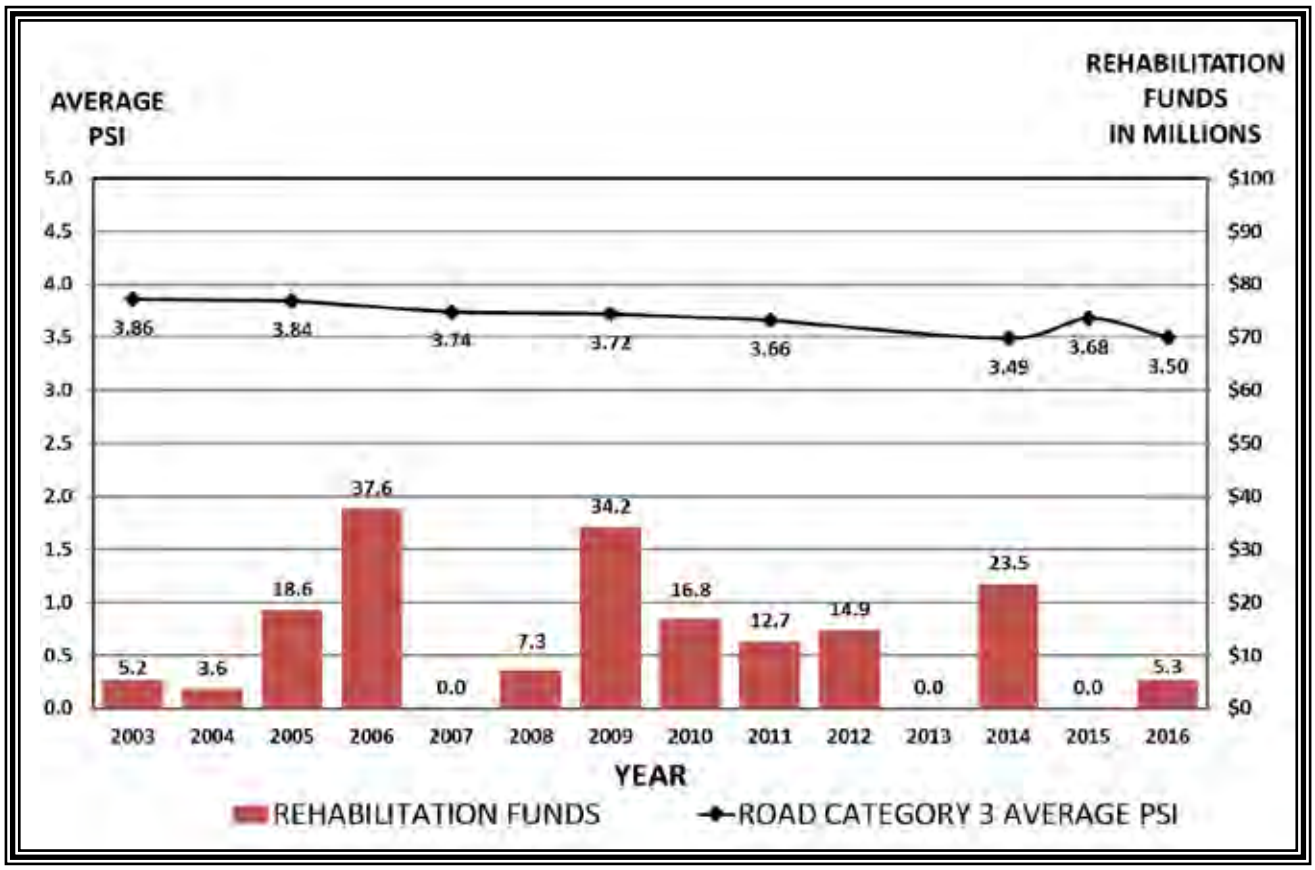


FIGURE 18. Average PSI and Expenditures for Road Category 3

FIGURE 19 demonstrates the long-term average PSI for road category 4 and the rehabilitation expenditure for each year from 2003 through 2016. Category 4 roads include routes such as Deer Creek Road, Foothill Road/Genoa Lane, and Jiggs Road. These roads were in good condition starting in 2003, then transitioned into fair condition in 2005. The average PSI has remained in fair condition from 2005 through 2015. However, it is projected that category 4 roads will decline into mediocre condition as early as 2016 since very little funding has been spent in this category throughout the years, with the exception of the almost $17M spent in 2012. Average spending in category 4 is approximately $3.25M per year.

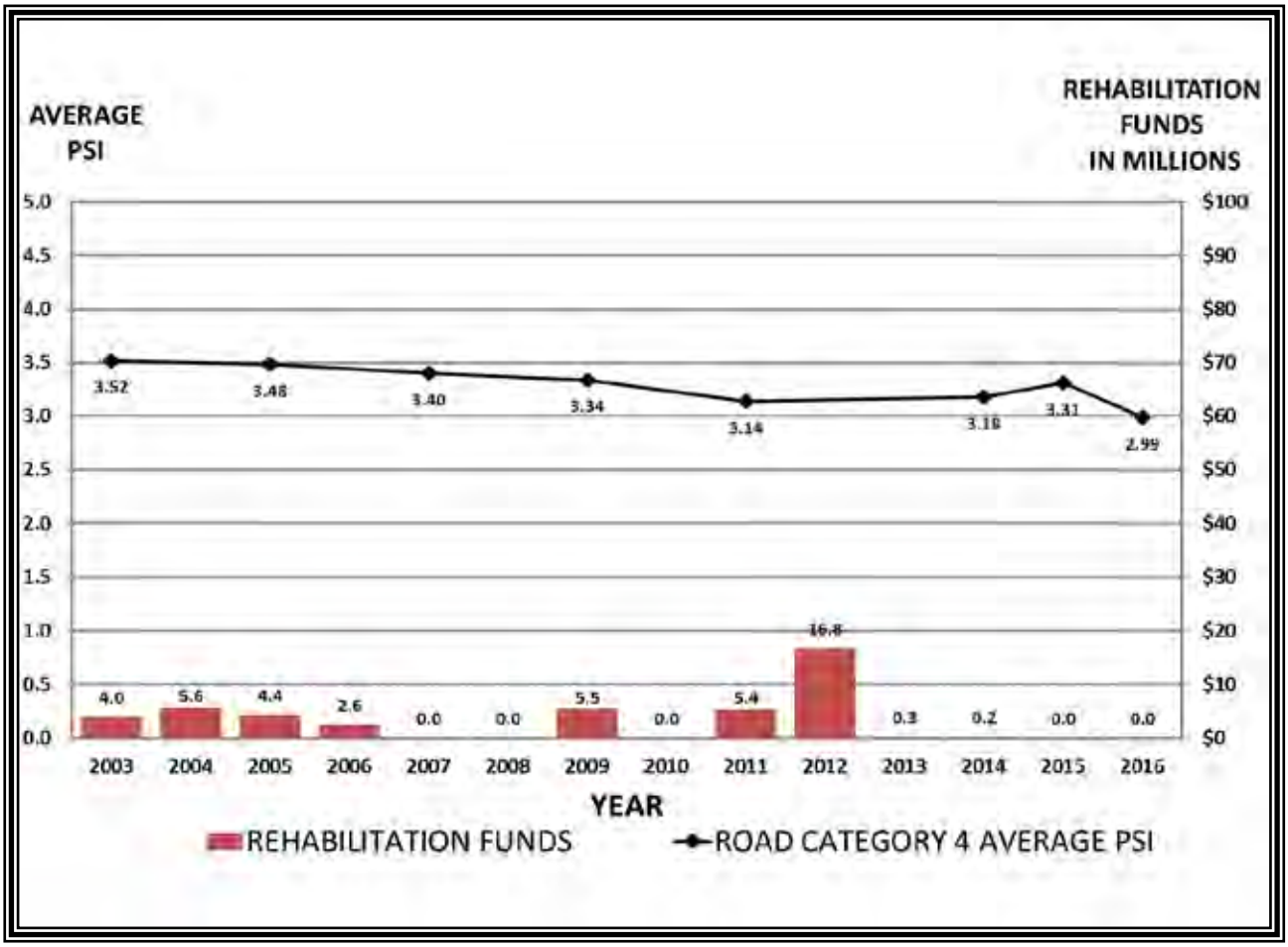


FIGURE 19. Average PSI and Expenditures for Road Category 4

FIGURE 20 presents the long-term average PSI for road category 5 and the rehabilitation expenditure for each year from 2003 through 2016. Category 5 roads include routes such as Lee Canyon Road, Dixie Valley Road, and Secret Pass Road. These roads were in fair condition in 2003, but have steadily declined to the point where the projections show an average condition in the poor range in 2016. Very little rehabilitation funds are spent in category 5, as shown below. However, the majority of the maintenance funds as shown on Figure 15 are spent on these low volume roads, and these funds help stabilize the overall condition.

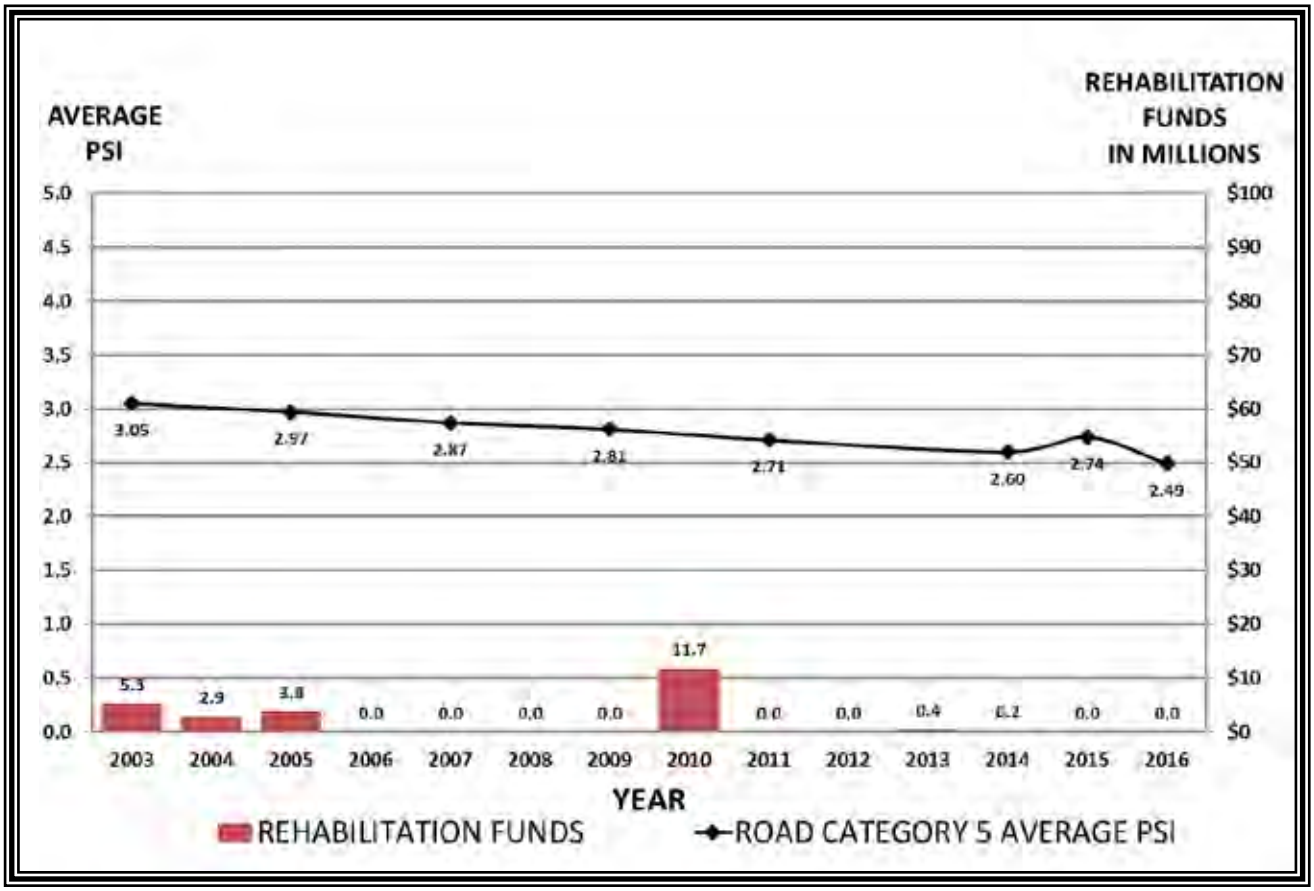


FIGURE 20. Average PSI and Expenditures for Road Category 5

PAVEMENT CONDITION GOAL

A pavement condition goal has been established to provide a measure of the effectiveness of the maintenance and rehabilitation repair work that is performed on state roads. The goal can also indicate the adequacy of funding appropriated for pavement repair work. A process was used to develop the pavement condition goal and several criteria were examined. Careful consideration was used to balance the cost of rehabilitation at varying pavement condition levels with the availability of funds. Other criteria used in the process included pavement deterioration rates, the effectiveness of maintenance repair work, traffic volume, the number of heavy trucks, and the cost to repair or replace roads in each particular road prioritization category. The pavement condition goal to maintain a minimum of 95% of roads in fair or better condition was approved for each road category. TABLE 9 lists the current status of each road category with respect to the established pavement condition goal. The data shows that category 1 and 3 roads exceed the established pavement condition goal, category 2 roads are only slightly below the goal, and a substantial amount of category 4 and 5 roads do not meet the goal.

TABLE 9. Pavement Condition Versus Established Goal by Road Category

Condition	PSI Rating Scale	PSI Condition by Road Prioritization Category Percentage (%) and Number of Miles					
		Road Category 1	Road Category 2	Road Category 3	Road Category 4	Road Category 5	Roadway Network Totals
Very Good	5.00 to 4.00	83.0% 441	49.5% 458	31.6% 377	9.1% 75	0.8% 12	**26.7%** **1,363**
Good	3.99 to 3.50	12.2% 65	31.1% 287	47.2% 563	37.7% 312	12.8% 207	**28.2%** **1,435**
Fair	3.49 to 3.00	3.0% 16	13.6% 126	17.7% 211	34.6% 287	35.4% 573	**23.8%** **1,212**
Mediocre	2.99 to 2.50	0.8% 4	4.2% 39	2.6% 31	14.1% 117	26.4% 427	**12.1%** **618**
Poor	2.49 to 2.00	1.0% 5.39	1.0% 9	0.5% 6	3.0% 25	16.0% 259	**6.0%** **304**
Very Poor	< 2.00	0.0% 0	0.6% 5	0.5% 6	1.5% 13	8.7% 140	**3.2%** **164**
Total Miles:		**532**	**924**	**1,193**	**829**	**1,619**	**5,096**
Condition Goal: Min. Percentage of Roads in Fair or Better Condition		**95%**	**95%**	**95%**	**95%**	**95%**	**----**
Current Condition: Percentage of Roads in Fair or Better Condition		**98.2%**	**94.2%**	**96.5%**	**81.3%**	**49.0%**	**----**
Does the current condition meet the condition goal?		**YES**	**NO**	**YES**	**NO**	**NO**	**----**

FIGURE 21 displays the percentage of miles per road category as identified by the PSI pavement condition rating system. The majority of the pavement in road categories 1 through 4 is in fair or better condition. The majority of pavement in road category 5 is in mediocre or worse condition.

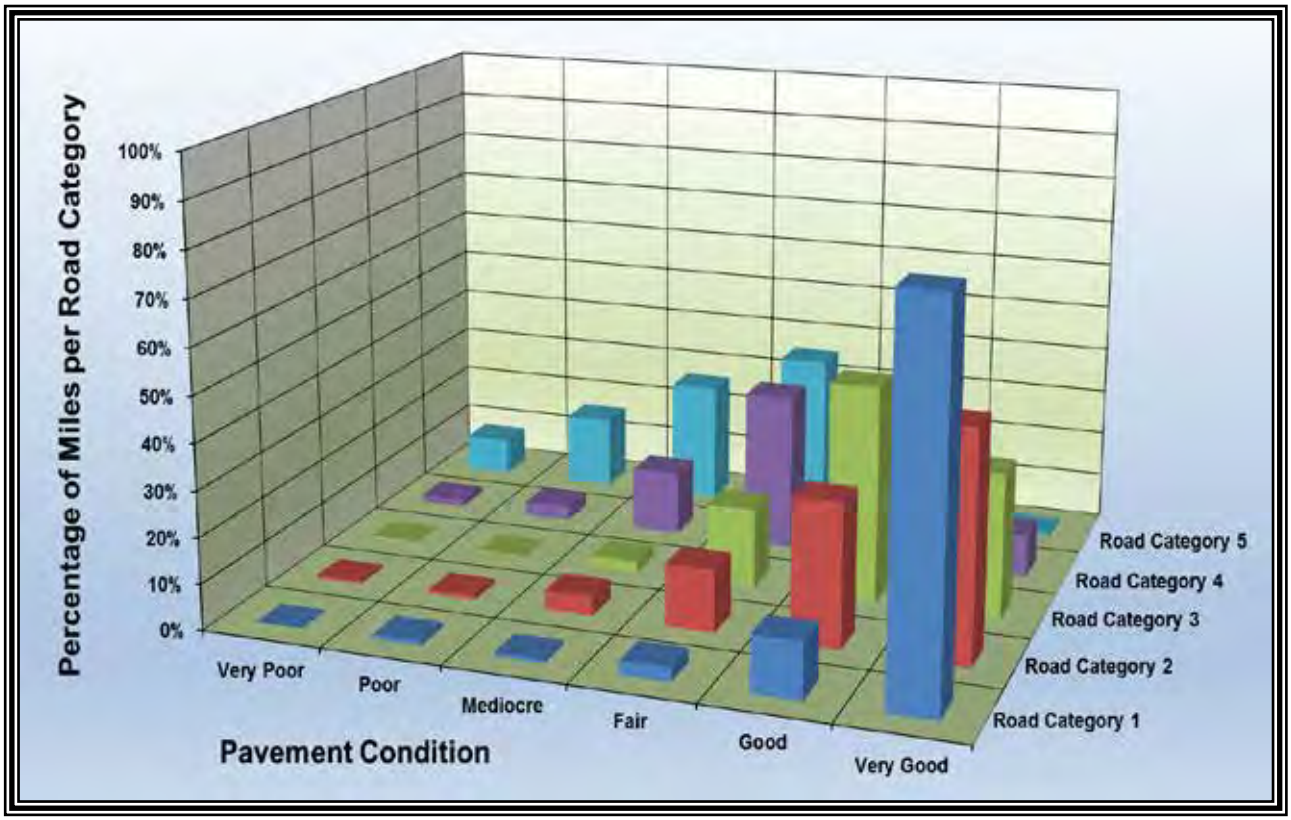


FIGURE 21. Percentage of Miles per Road Category and Pavement Condition

BACKLOG OF PAVEMENT REHABILITATION WORK

The backlog of pavement rehabilitation work has been defined as the funds necessary to rehabilitate roads to acceptable condition levels. The backlog of pavement rehabilitation work increases when funds are not spent at the optimal time in order to maintain roads at acceptable condition levels. NDOT's current practice of evaluating the condition of the roadway network based on the PSI pavement condition rating system, and the established pavement condition goal, is used to calculate a realistic estimation of the backlog.

The cost of rehabilitation work varies for each road category. Category 1 roads are more expensive to rehabilitate because of the required pavement widths and thicknesses that need to be repaired. Category 5 roads are the least expensive to rehabilitate because of narrow widths and thin pavement sections. TABLE 10 summarizes the backlog of pavement rehabilitation work for the state-maintained roadway network. The information includes the number of miles in each road category that are in less than fair condition as well as the cost of rehabilitation per mile. Road categories 2, 4 and 5 have deficient pavement that does not meet the established pavement condition goal to maintain a minimum of 95% of roads in fair or better condition. The percentage of deficient miles in road category 2 was minor but was substantial in categories 4 and 5. Overall, there are 866 miles of deficient pavement that is estimated to cost $450.2M to repair.

FIGURE 22 illustrates the $450.2M backlog of pavement rehabilitation work in percentage of miles per road category. There is 0.7% of road category 2 pavement in less than fair condition, 13.6% of category 4 and 46.1% of category 5 pavement in less than fair condition as observed by the total of the very poor, poor, and mediocre condition percentages. The $450.2M backlog of pavement rehabilitation work is expected to rise as pavement in mediocre condition deteriorates into conditions that are more costly to repair.

TABLE 10. Backlog of Pavement Rehabilitation Work

Road Prioritization Category	1	2	3	4	5
Deficient Pavement in Miles	0	7.2	0	113.5	745.4
Estimated Cost to Rehabilitate Pavement Per Mile	$2.1M	$1.3M	$0.7M	$0.6M	$0.5M
Total Cost to Rehabilitate Pavement Per Road Category	$0M	$9.4	$0M	$68.1M	$372.7
Total Backlog of Pavement Rehabilitation Work	**$450.2M**				

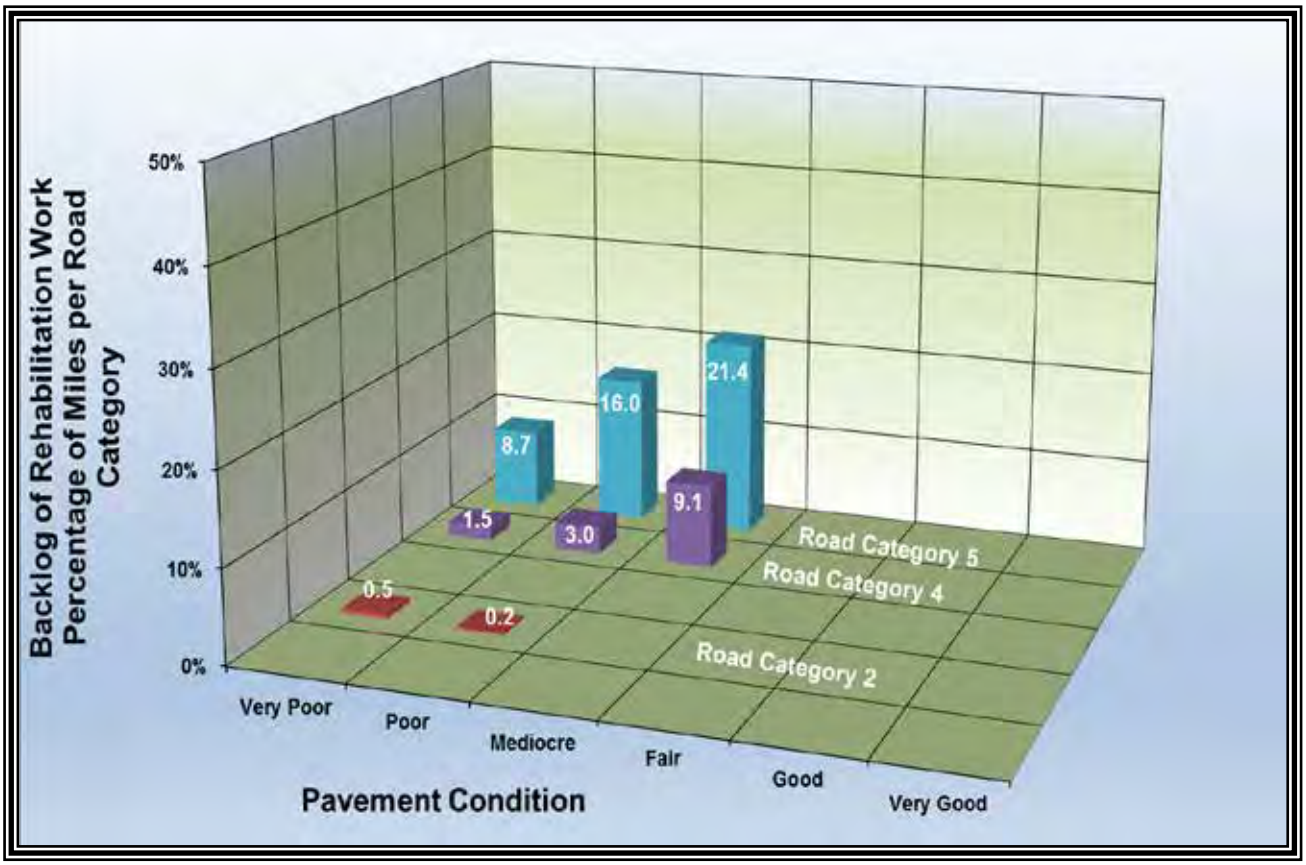


FIGURE 22. Backlog in Percentage of Miles per Road Category

ADEQUACY OF PAVEMENT PRESERVATION FUNDS

The adequacy of pavement preservation funds can be determined by comparing the current and projected funding levels for repair work to the current and projected PSI pavement condition levels. The established pavement condition goal to maintain a minimum of 95% of roads in fair or better condition is also used to determine adequacy. Adequate funding would allow for pavement to be maintained in conformance to the established pavement condition goal.

Analysis was performed on each road category to determine if there were enough funds available to maintain the pavement within conformance to the established pavement condition goal. FIGURES 16 through 20 demonstrate that funding and pavement condition levels for each road category vary from year to year. However, FIGURE 15 shows that regardless the amount of funds spent, the average PSI pavement condition for the entire roadway network has generally continued to trend downwards. Only road categories 1 and 3 pavement meet the established pavement condition goal to maintain a minimum of 95% of roads in fair or better condition. Road categories 2, 4 and 5 pavement does not meet the established goal. Funds for pavement preservation repair work must be increased if the established goal is to be met.

TABLE 11 is a summary of the average number of miles rehabilitated and scheduled for rehabilitation for years 2009 through 2020, in addition to the average funds spent and scheduled to be spent for pavement repair work each year. These averages include the actual amount of miles rehabilitated and funds spent for years 2009 through 2016, plus the projected amount of miles to be rehabilitated and corresponding funds for years 2017 through 2020. TABLE 11 also contains the estimated additional miles that need to be rehabilitated and additional funds required to maintain each road category at 2015 PSI pavement condition levels. The current average funding of $127M per year would need to be increased by $137M per year, for a total of $264M per year, in order to maintain each road category at 2015 PSI pavement condition levels. Additional funds are also needed to improve the condition of road categories 2, 4 and 5 pavement to satisfy the established pavement condition goal.

TABLE 11. Adequacy of Pavement Preservation Funds

Road Prioritization Category	1	2	3	4	5
Current Average Number of Miles Rehabilitated per Year	38	41	24	8	2
Current Average Funds per Year	$60M	$42M	$20M	$4M	$1M
Total Current Average Funds per Year	**$127M**				
Additional Average Number of Miles Requiring Rehabilitation per Year	8	21	56	38	62
Additional Average Funds Required per Year	$17M	$27M	$39M	$23M	$31M
Total Additional Average Funds Required per Year	**$137M**				

Estimated average rehabilitation funds per year for years 2009 through 2020, excluding maintenance funds.

PROGRESS IN THE 10-YEAR PLAN FOR RESURFACING OF STATE HIGHWAYS

The amount of pavement preservation repair work has been restricted for many years due to long-term financial constraints. The funds allocated for the pavement preservation budget are limited because many funds are needed for other purposes such as capacity improvement projects and other program budget obligations. There are simply not enough funds available to preserve the state-maintained roadway network in a condition that satisfies the established pavement condition goal to maintain a minimum of 95% of roads in fair or better condition.

FIGURE 23 illustrates what will happen to the condition of the state-maintained roadway network over the next ten (10) years using three different budget scenarios. An average of $127M will be used as the yearly pavement preservation budget for scenario one since this is the actual average expenditure for pavement rehabilitation work from 2009 through 2016. Budget scenario one is represented by the red line and consists of spending an average of $127M per year on pavement rehabilitation work for the next ten (10) years. At the end of 2015 (the most recent data year), about 79% of all state-maintained roads were in fair or better condition. Based upon future projections,

approximately 76% of all state-maintained roads are projected to be in fair or better condition in 2017. Spending an average of $127M per year will result in the average condition of the roads to deteriorate to less than 50% of roads in fair or better condition by the year 2027. Furthermore, the $450.2M backlog of pavement rehabilitation work would substantially increase over time.

FIGURE 23 demonstrates budget scenario two with the yellow line. There is an increased expenditure of $137M per year, in addition to the $127M per year base investment, for a total of $264M per year. Spending $264M per year on pavement rehabilitation work will result in a stagnant pavement condition level. The average condition of 76% of all roads in fair or better condition would remain the same from 2016 and beyond. Although the roadway network would not deteriorate below 2016 PSI pavement condition levels, the backlog of pavement rehabilitation work would not be reduced. Road categories 2, 4 and 5 would never meet the established pavement condition goal to maintain a minimum of 95% of roads in fair or better condition.

FIGURE 23 depicts budget scenario three with the green line. This budget scenario is the preferred PMS plan in a business environment where funding gaps are nonexistent. Increasing the $264M per year budget with an additional $45M per year through 2026, for a total of $309M per year, would gradually improve the pavement condition of the state-maintained roadway network. This budget would also eliminate the backlog of pavement rehabilitation work. This ideal budget scenario would accommodate the preservation needs of the entire roadway network and provide the funds necessary for all road categories to exceed the pavement condition goal established in TABLE 9. The blue line shows the condition of the pavement wherein 95% of roads are in fair or better condition. A budget of $309M per year would incrementally raise the percentage of roads in fair or better condition from now until 2026. Thereafter, the network pavement condition would level off and the budget could actually be reduced to $264M per year since the backlog of pavement rehabilitation work would be eliminated.

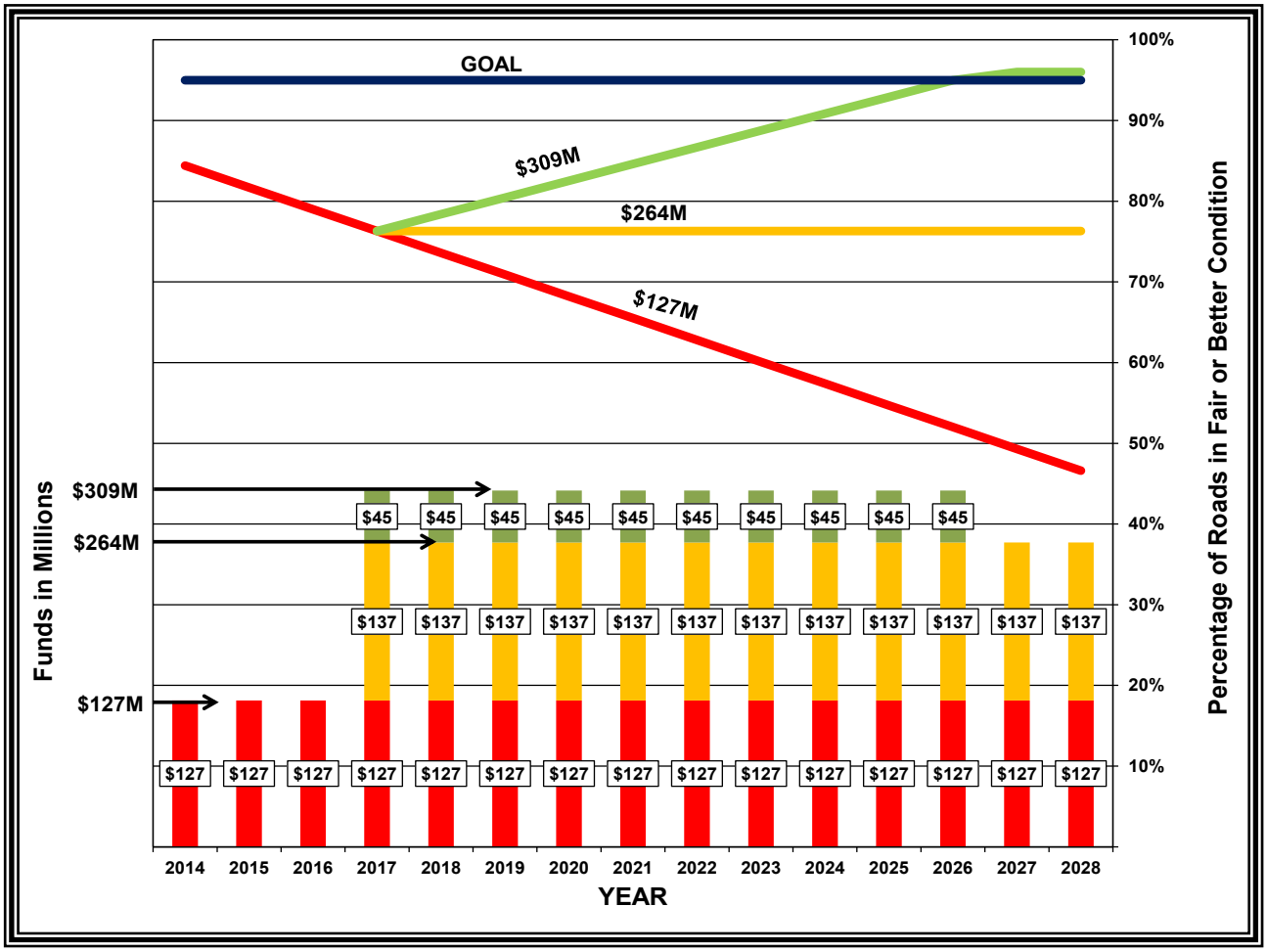


FIGURE 23. Future State-maintained Roadway Network Funding Options

PAVEMENT PRESERVATION SUMMARY

The State Highway Preservation Report is presented to Nevada Legislature with the intent to fulfill the requirements as outlined in Nevada Revised Statute 408.203(3). NDOT is accountable to report the progress made on the resurfacing plan for state highways. The following aspects of the resurfacing plan have been addressed:

- The pavement preservation revenues and expenditures for fiscal years 2015 and 2016 were presented. The revenue for the maintenance and rehabilitation repair work constructed on state highways is primarily funded by the federal government and the State of Nevada. This revenue generally consists of vehicle fuel tax and registration fees. Approximately $216,035,899 were invested for road maintenance and rehabilitation repair work during the last biennium. FIGURE 5 illustrates the funding sources and construction expenditures for the road repair work.

- TABLES 3, 4, and 5 summarized the rehabilitation and maintenance repair work that was advertised in fiscal years 2015 and 2016. The information includes lists of projects along with the associated mileage and cost for each project. The project locations and scopes of work were also reported.

- The pavement condition of the state-maintained roadway network was provided. The pavement condition was objectively measured with the Present Serviceability Index (PSI) rating system. This rating system quantifies pavement condition into one of six sections that correspond to pavement in very good, good, fair, mediocre, poor, and very poor or failed condition. The data were described using several methods including tabular format, maps, analysis by district and county distribution, and a long-term investigation displayed on column charts.

- Each road prioritization category was evaluated to determine if the goal to maintain a minimum of 95% of roads in fair or better condition was met as shown in Table 9. It was concluded that category 1 and 3 roads exceeded the established pavement condition goal, category 2 roads were only slightly below the goal, and a substantial amount of category 4 and 5 roads did not meet the goal.

- The backlog of pavement rehabilitation work was calculated based on the established goal to maintain a minimum of 95% of roads in fair or better condition. TABLE 10 lists the estimated backlog for the entire state-maintained roadway network. A total of $450.2M is required to repair 866 miles of deficient pavement.

- TABLE 11 was developed to document the adequacy of pavement preservation funds. The condition of the roadway network was predicted through 2020 based on deterioration rates and scheduled rehabilitation work. Predicted conditions forecast that the current average funding level of $127M per year is inadequate to maintain each category of road in conformance to the established goal to maintain a minimum of 95% of roads in fair or better condition. TABLE 11 also documents the additional amount of work and cost required to maintain each road category at 2015 PSI pavement condition levels. The $127M average funding per

year must be increased by an additional $137M per year, for a total of $264M per year, to simply maintain the roadway network at 2015 PSI pavement condition levels. The proposed $264M per year allocation does not include the funds necessary to reduce the backlog of pavement rehabilitation work.

- The progress in the 10-year plan for resurfacing of state highways was examined and three different budget scenarios were investigated. The first budget scenario included an average of $127M per year expenditure for rehabilitation repair work. The first budget scenario would result in the roadway network pavement condition level deteriorating from 76% to less than 50% of roads in fair or better condition by the year 2027. The second budget scenario included an average of $264M per year expenditure for rehabilitation repair work. The second budget scenario would result in a stagnant pavement condition level of 76% of roads in fair or better condition, and the backlog of rehabilitation work would not be reduced or eliminated. The third budget scenario included an average of $309M per year expenditure on rehabilitation repair work through the year 2026. This budget scenario would improve the roadway network pavement condition level to 95% of roads in fair or better condition, and completely eliminate the backlog of pavement rehabilitation work.

Supplementary information contained in the report includes:

- An explanation of the state-maintained roadway network inventory including the PMS inventory management through designated road prioritization categories 1 through 5.
- A description of the PSI pavement condition rating system that is used to objectively rank pavement conditions for many PMS purposes.
- Definitions for maintenance and rehabilitation repair strategies as well as the optimal construction timing based on the PSI pavement condition rating system.
- Commentary regarding the costs for construction of state highway pavement rehabilitation projects.

BRIDGE PRESERVATION

INTRODUCTION

This report summarizes the Nevada Department of Transportation's (NDOT) efforts to preserve the state's bridge infrastructure which was has an approximate as-constructed value of $2.1 billion. Preserving the bridge infrastructure is one of NDOT's highest priorities. Numerous resources are employed to maintain bridges in structurally sound, functional, and safe condition. Although the focus in the following discussion is on state-maintained bridges, information on bridges maintained by other agencies is also included because these bridges are also eligible for federal funds that are administered by NDOT. Moreover, NDOT is responsible for inspecting and reporting the condition of all the bridges open to the public in Nevada, except bridges on federal lands. Bridges on federal lands are inspected and maintained by the federal government.

THE BRIDGE MANAGEMENT SYSTEM

Bridges are managed using the National Bridge Inventory (NBI) data which provides an inventory of bridge condition, location, needed repairs, load limits, susceptibility to flooding, and ownership information. A separate prioritization list enables NDOT to evaluate earthquake susceptibility and risks. This data, together with other factors, allows NDOT to identify preservation priorities and monitor efforts to keep its bridges functioning in good condition.

BRIDGE INVENTORY

There are currently 2,008 public bridges in NDOT bridge inventory. A bridge is a structure spanning 20 feet or more that carries traffic over a depression or obstruction, and includes multiple box culverts and pipes. The maintenance of the bridge inventory is shared by many different organizations: NDOT maintains 1,163 bridges; county and city governments maintain 771 bridges; other local agencies maintain 49 bridges; private entities maintain 11 bridges; railroad maintains 7 bridges; and other state agencies maintain 7 bridges.

BRIDGE CONDITION REPORTING

Bridge serviceability is characterized by the use of a numerical evaluation called the

Sufficiency Rating. The Sufficiency Rating is used to assess the overall condition of a bridge and assists in the prioritization of bridge preservation efforts. Sufficiency Ratings vary from 0 to 100. A 100 Sufficiency Rating represents a bridge with no deficiencies.

The condition assessment is based upon a physical inspection of the structure. The deleterious effects of age, environment, fatigue, hydrologic scour, settling, and traffic collisions are assessed in the evaluation. Every bridge in Nevada is inspected at least once every two years. Bridges in poor condition are inspected more often. Inspection findings are factored into the determination of the bridge load, condition and Sufficiency Ratings.

The load rating denotes the strength of the bridge compared to design-truck loading. Structures with low condition or load rating may be classified as "Structurally Deficient." Structurally Deficient bridges are not necessarily unsafe or dangerous. Rather, these bridges become a priority for corrective measures, and may be posted to restrict the weight of vehicles using them. If a deficiency is determined to be severe, or the load-carrying capacity is extremely low, the bridge would be closed to protect the travelling public.

NDOT adheres to policies and procedures in accordance with the FHWA's requirements. The FHWA included the verbiage discussing Structurally Deficient bridges in a report to Congress entitled "2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance." The verbiage was as follows:

"Structurally Deficient bridges are not inherently unsafe. Bridges are considered structurally deficient if significant load-carrying elements are found to be in poor or worse condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions. That a bridge is deficient does not imply that it is likely to collapse or that it is unsafe. By conducting properly scheduled inspections, unsafe conditions may be identified; if the bridge is determined to be unsafe, the structure must be closed. A deficient bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. To remain in service, Structurally Deficient bridges often have

weight limits that restrict the gross weight of vehicles using the bridges to less than the maximum weight typically allowed by statute."

Bridges are considered Structurally Deficient if:

- Significant load-carrying elements are found to be in poor condition.
- Has insufficient load carrying capacity & may have weight limits to remain in service. (See picture below.)
- More susceptible to flooding with significant traffic impacts.

Example of Structurally Deficient Bridge

Bridge assessments also include appraisal ratings, which measure how well the bridge serves the public, or its functionality. Included in the appraisal ratings are reviews of the deck geometry, under-bridge clearances, waterway adequacy, and approach geometry. Within this appraisal evaluation, a substandard structure is termed "Functionally Obsolete." Like Structurally Deficient bridges, Functionally Obsolete bridges are able to serve the traveling public. However, Functionally Obsolete bridges may be more susceptible to congestion, collisions, or flooding because of the restrictive clearances and geometrics.

Past State Highway Preservation Reports have included a detailed description of the Functionally Obsolete designation and have included statistics about Nevada's Functionally Obsolete bridges. However, the terminology Functionally Obsolete has also lead to confusion about the safety of bridges in the past and is no longer a factor for federal bridge replacement funding. Since the Functionally Obsolete designation is not a

good indicator of bridge condition or performance, the State Highway Preservation Report will no longer discuss this designation and will focus on Structurally Deficient bridges.

There are 1,163 bridges on the state-maintained system that were reported in 2016. Based on the report, 12 or 1.0% of the bridges are Structurally Deficient. There are 845 bridges that are maintained by non-NDOT agencies that were reported in 2016. Based on the report, 19 or 2.2% of the bridges are Structurally Deficient. FIGURE 24 summarizes the substandard bridge conditions on the state and locally-maintained bridge network.

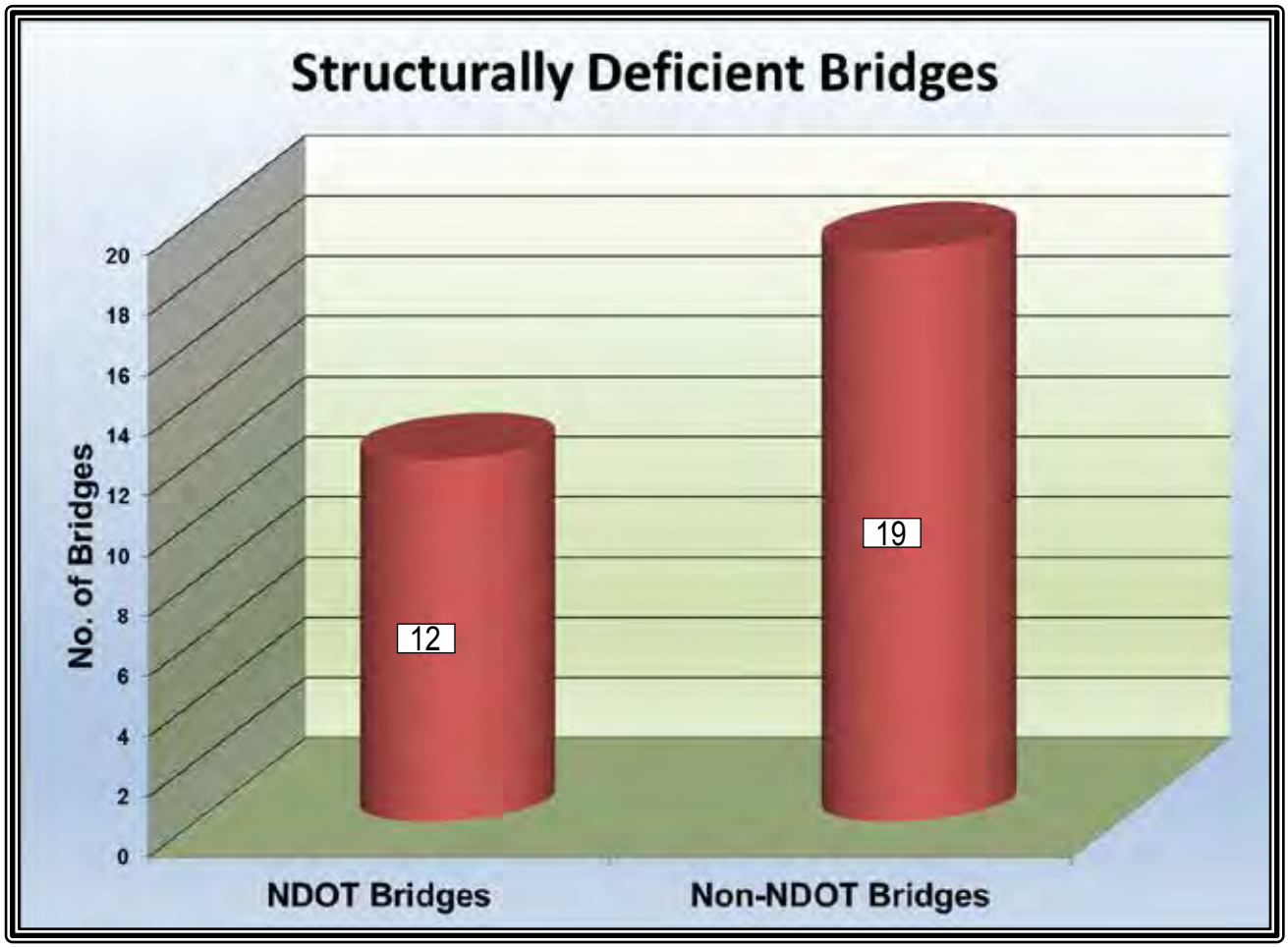


FIGURE 24. Structurally Deficient Bridges

FIGURES 25A, 25B, 25C, and 25D locate the Structurally Deficient bridges in the State's bridge inventory.

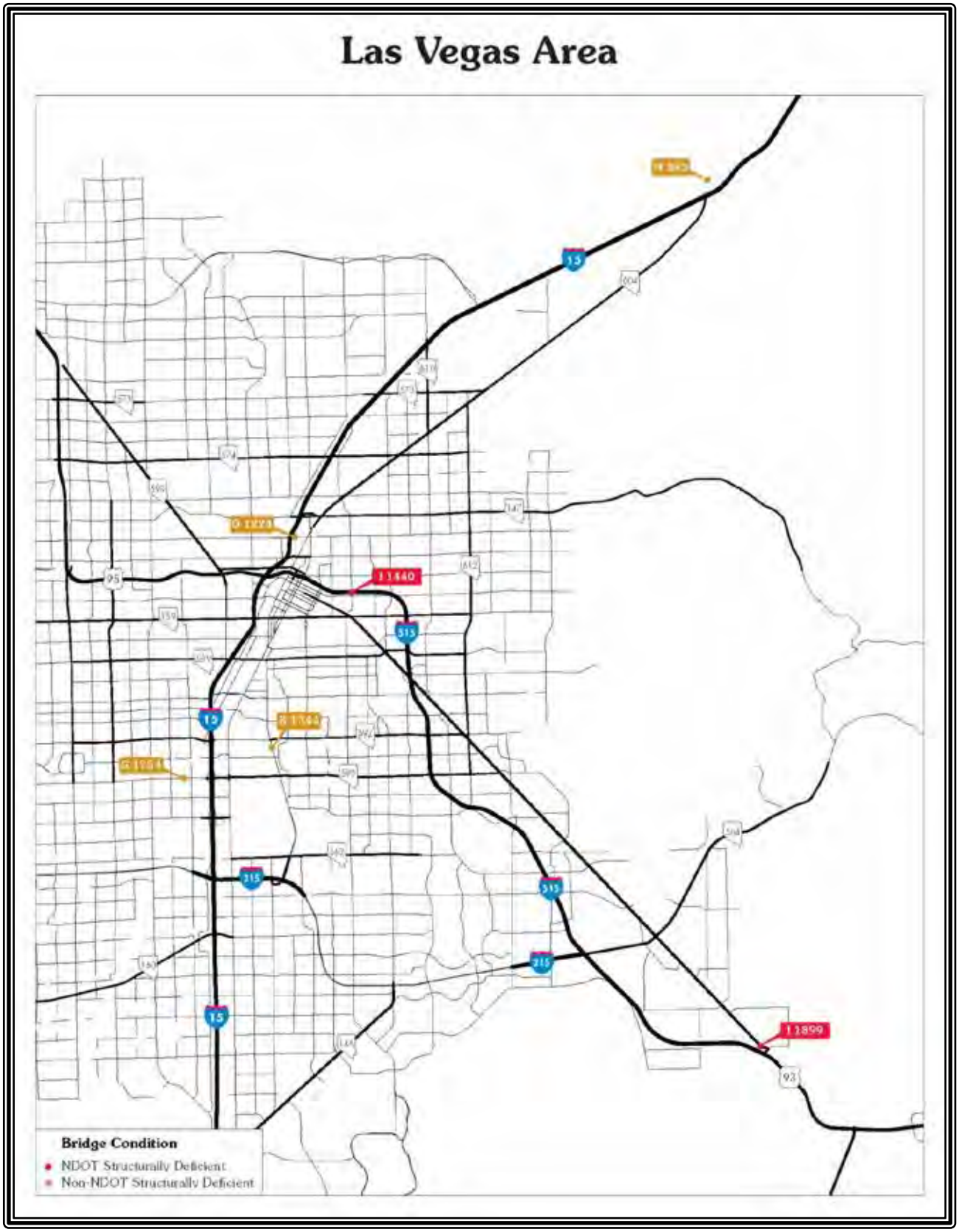


FIGURE 25A. Locations of Structurally Deficient Bridges

(Bridges categorized as Structurally Deficient may have less than desirable load carrying capacity or geometrics, but are not considered unsafe. Please refer to the discussion in the Bridge Condition Reporting Page 52-55.

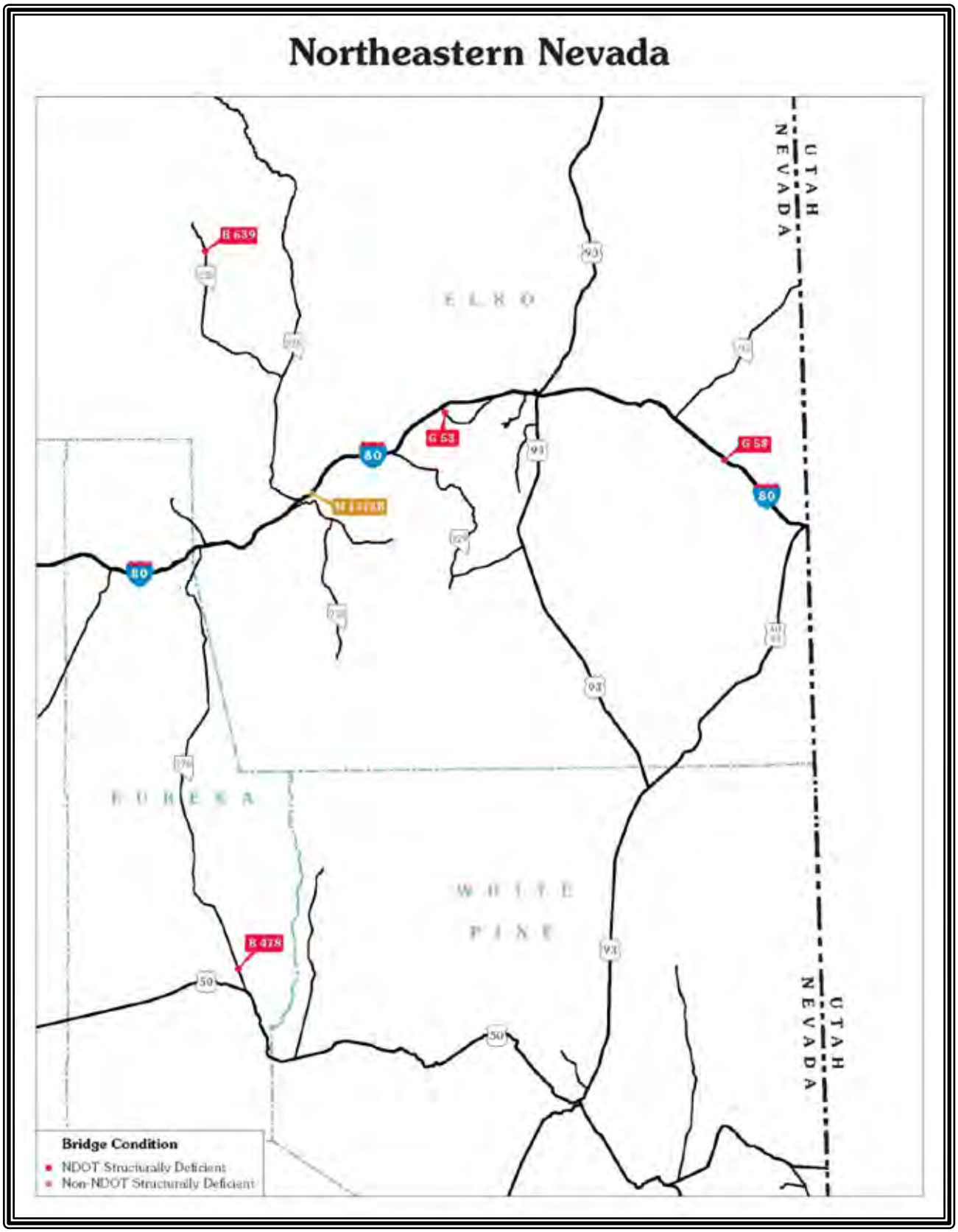


FIGURE 25B. Locations of Structurally Deficient Bridges

(Bridges categorized as Structurally Deficient may have less than desirable load carrying capacity or geometrics, but are not considered unsafe. Please refer to the discussion in the Bridge Condition Reporting Page 52-55.

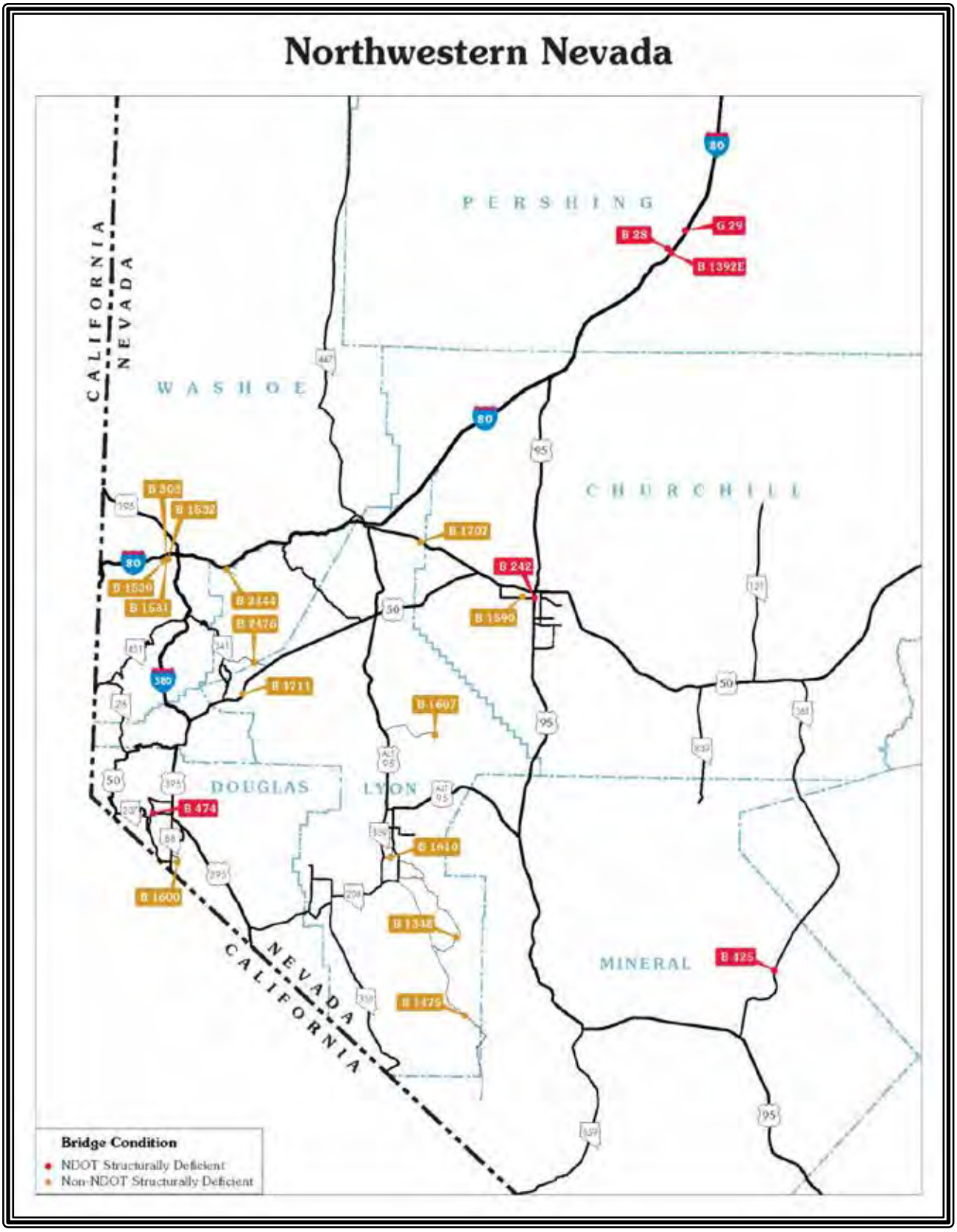


FIGURE 25C. Locations of Structurally Deficient Bridges

(Bridges categorized as Structurally Deficient may have less than desirable load carrying capacity or geometrics, but are not considered unsafe. Please refer to the discussion in the Bridge Condition Reporting Page 52-55.

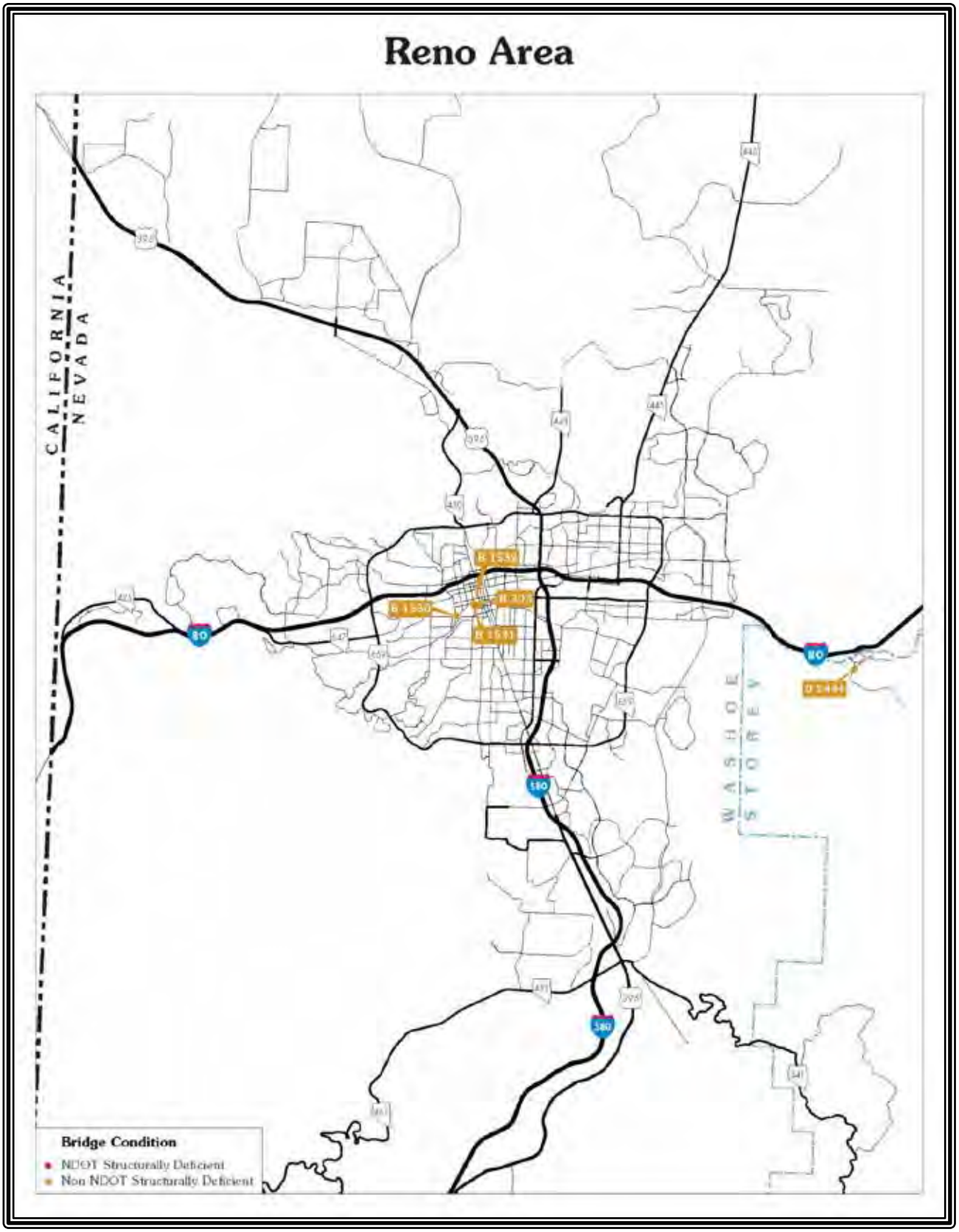


FIGURE 25D. Locations of Structurally Deficient Bridges

(Bridges categorized as Structurally Deficient may have less than desirable load carrying capacity or geometrics, but are not considered unsafe. Please refer to the discussion in the Bridge Condition Reporting Page 52-55.

In addition to the sufficiency rating, a bridge's susceptibility to seismic activity is considered when assessing its condition or "health." Nevada is the third most seismically active state in the US. Only California and Alaska are more seismically active. The central and western parts of Nevada are the most active, but southern Nevada does have the potential for damaging earthquakes. NDOT has replaced or retrofitted 150 bridge structures at a cost of over $48 million since NDOT began including seismic activity as a component in the project prioritization process. Additionally, NDOT has placed a high priority on 82 more state-owned bridges in need of seismic retrofitting. The cost to upgrade bridges in need of seismic retrofitting is estimated at $37 million.

Generally, bridges with sufficiency ratings more than 80 are considered "good", ratings of between 50 and 80 can be considered "fair", and ratings less than 50 are considered "poor". FIGURE 26 illustrates the condition of bridges in Nevada. Only 1% of the bridges in Nevada are considered to be in poor condition. NDOT goes above and beyond the requirement in inspecting bridges. Railroad crossings and pedestrian structures are not required to be inspected by the Federal Highway Administration. For the sake of public safety, NDOT inspects these bridges when they span NDOT facilities, but does not report these ratings.

Nevada bridge conditions compare very favorably to the bridge conditions in many other states, even though more than half of NDOT's bridges are over 40 years old. Older bridges generally have a service life of at least 50 years. Recently-built bridges are expected to have a design life of 75 years. This prolonged design life was achieved by improvements in material, design, and construction methods. FIGURE 27 shows the age distribution of the State's bridges grouped by decade in which the bridge was originally constructed.

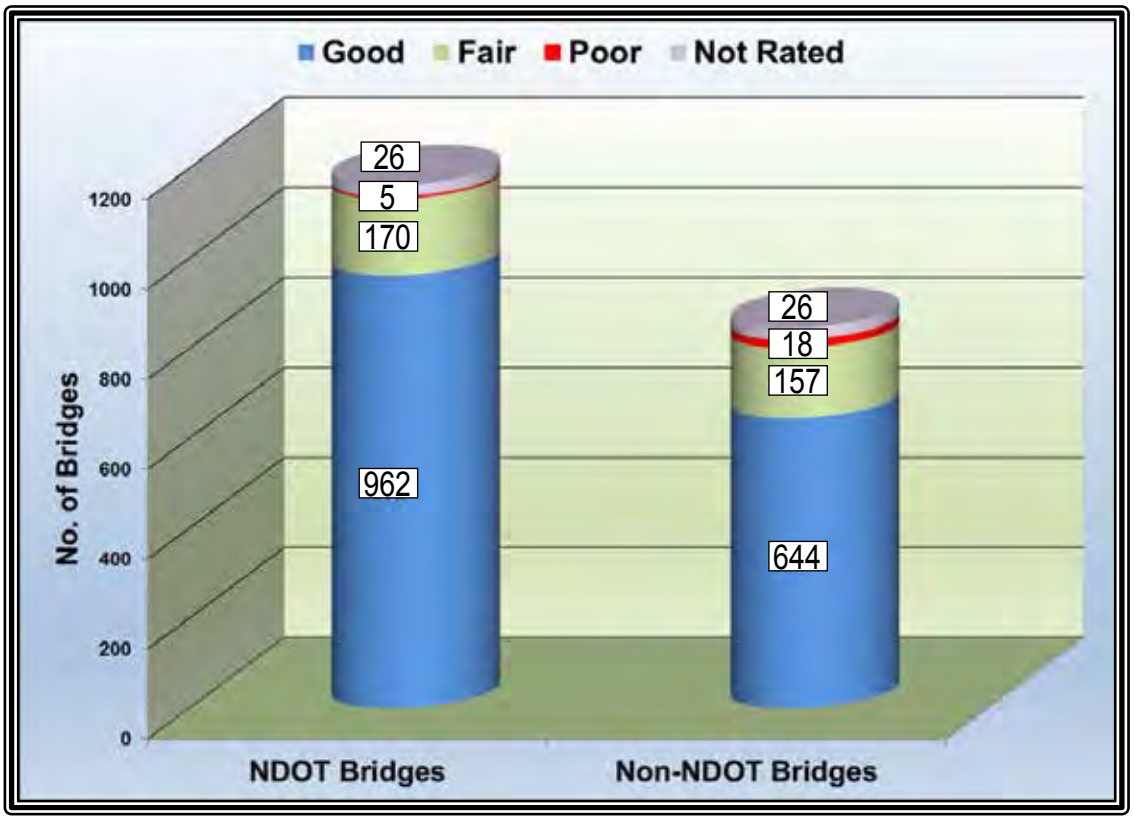


FIGURE 26. Nevada Bridge Conditions

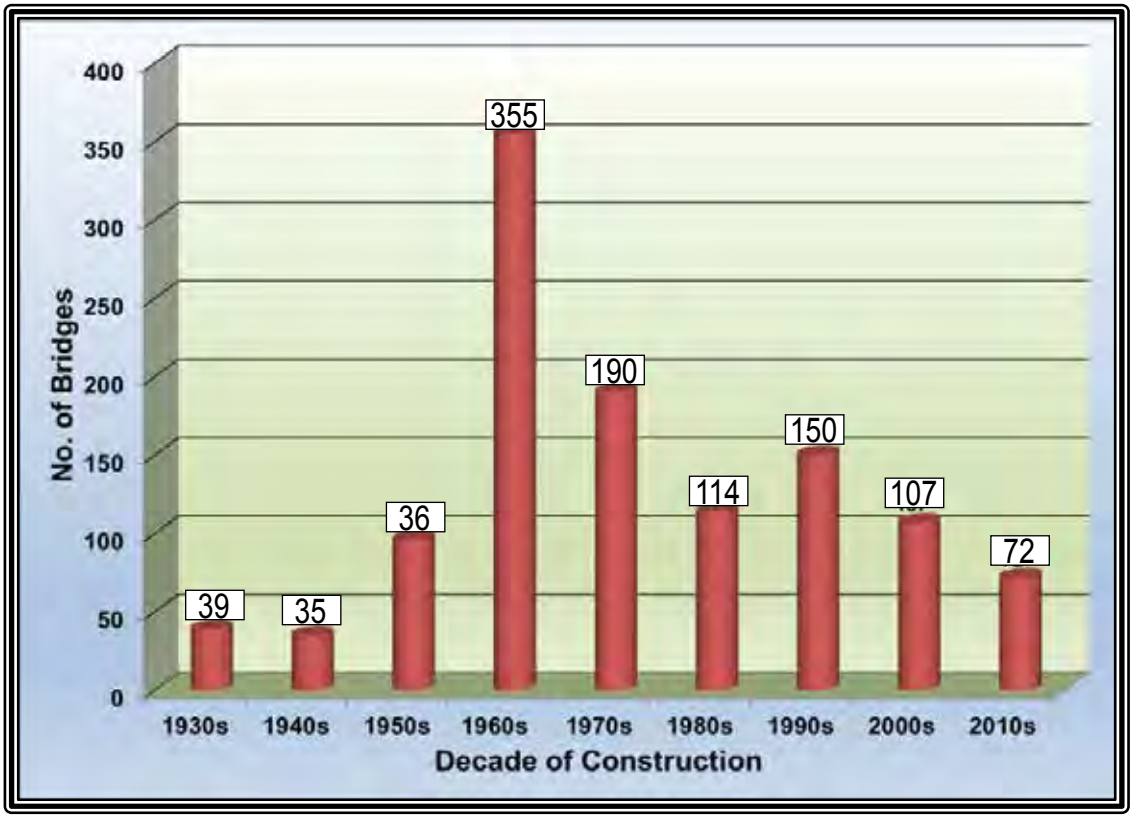


FIGURE 27. NDOT Bridges, Decade of Construction

BRIDGE CONDITION OVER TIME

FIGURE 28 illustrates NDOT-maintained bridge conditions grouped by good, fair, and poor categories over time. The number of bridges in each category has remained fairly stable since 1996. FIGURE 29 shows that the number of Structurally Deficient bridges has decreased significantly from 1996 through 2016.

FIGURE 30 demonstrates that the condition of non-NDOT maintained bridges has retained a similar proportion of good, fair, and poor bridge conditions in comparison to the total number of bridges surveyed from 1996 through 2016. These conditions slightly improved over the years despite the fact that there were over two and half times as many bridges surveyed in 2016 as compared to 1996. FIGURE 31 depicts the number of Structurally Deficient non-NDOT bridges over time.

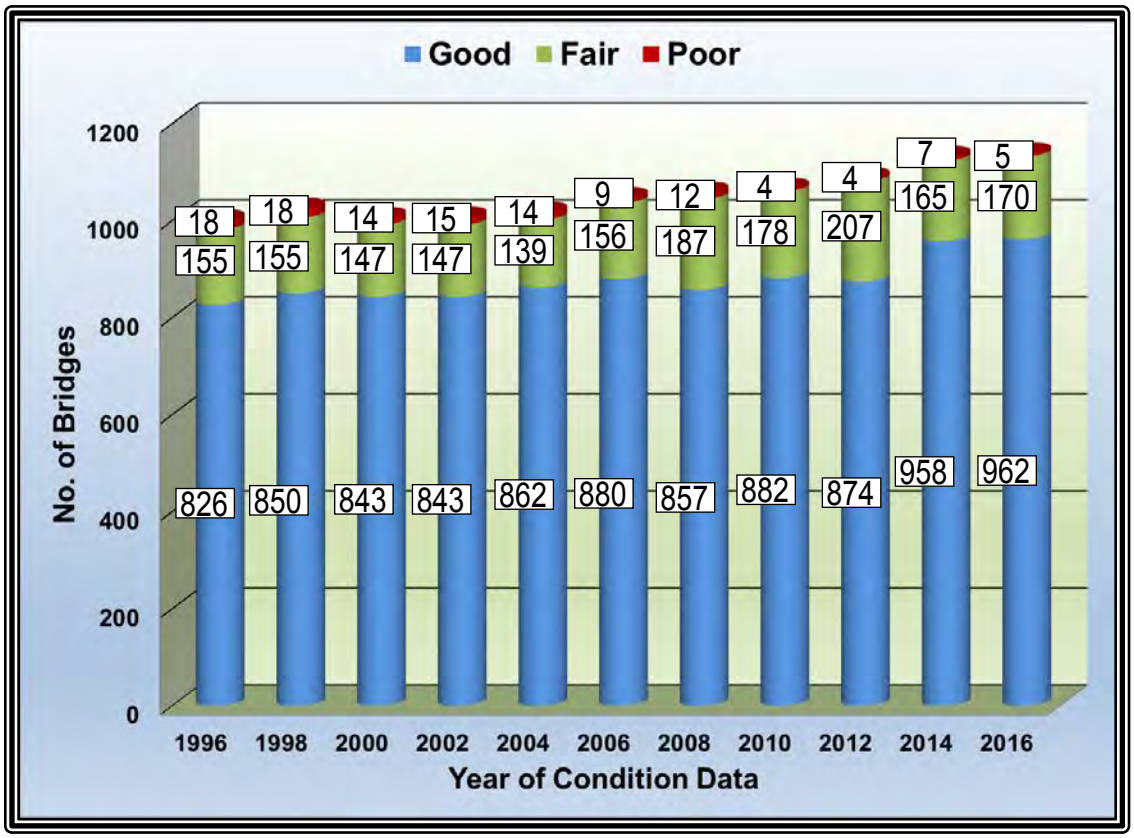


FIGURE 28. NDOT Bridge Conditions over Time

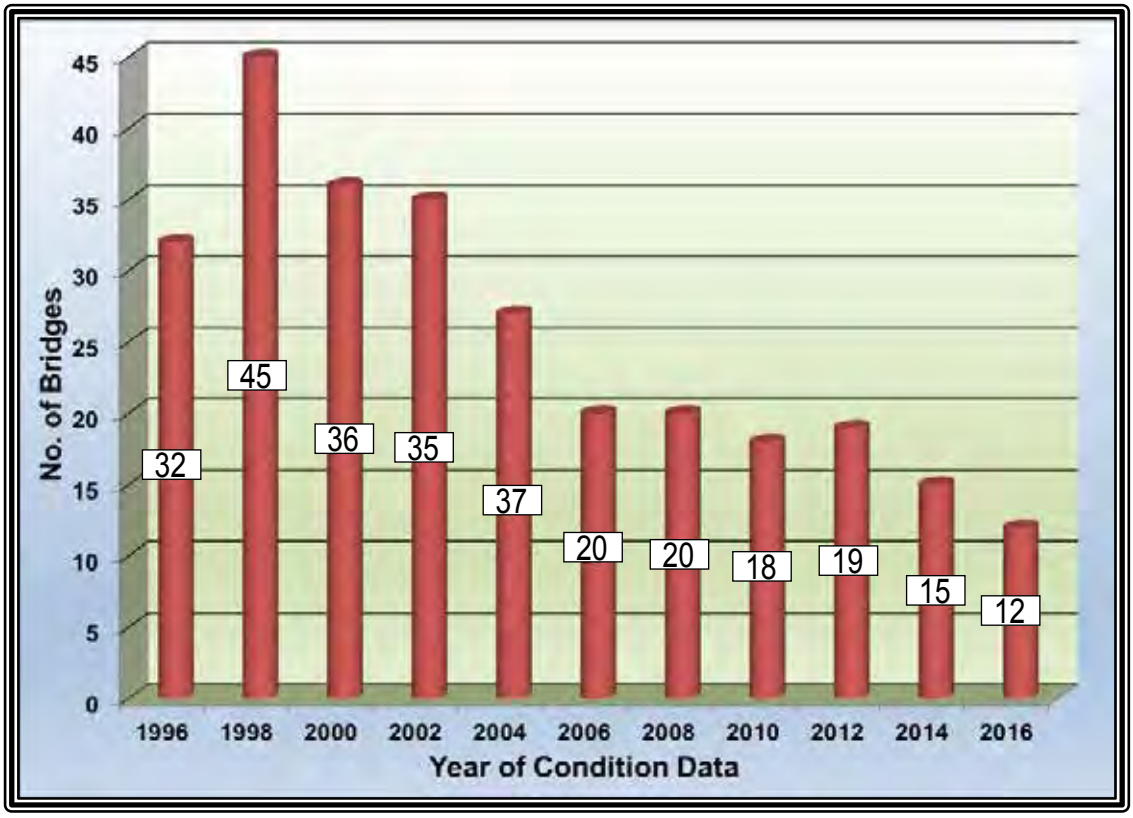


FIGURE 29. Structurally Deficient NDOT Bridges over Time

FIGURE 30. Non-NDOT Bridge Conditions over Time

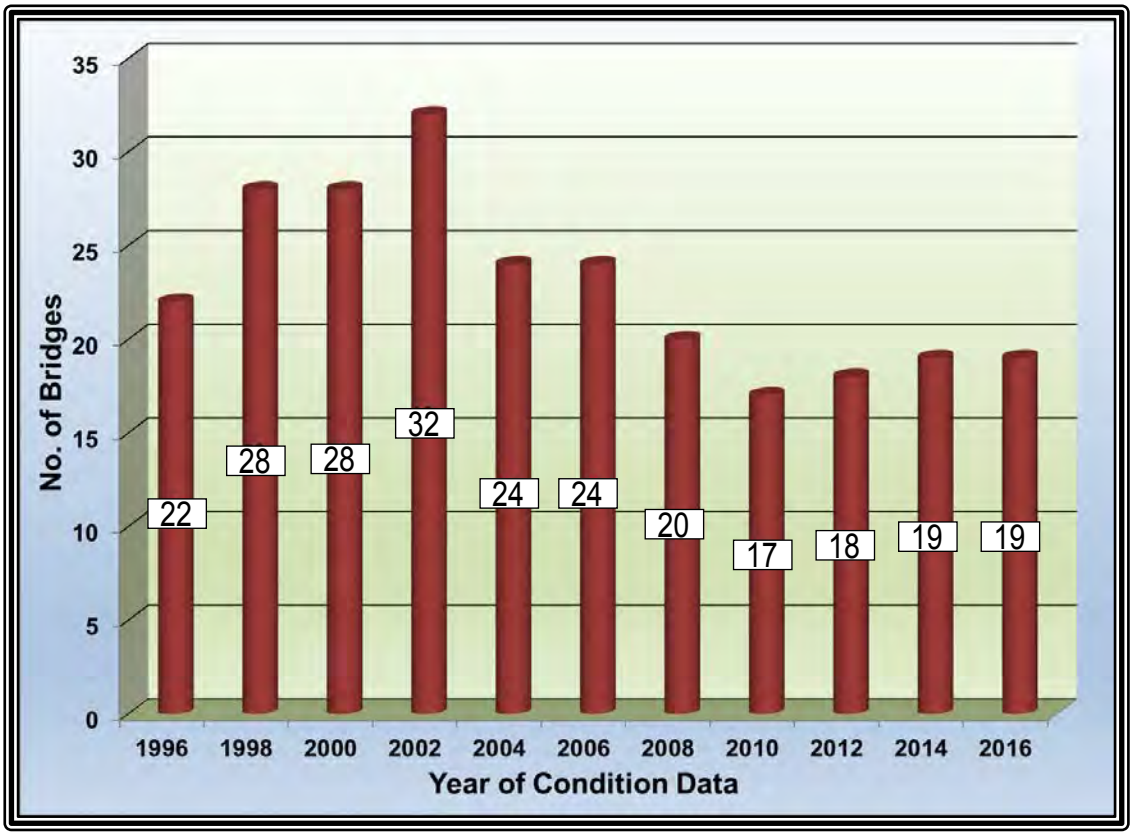


FIGURE 31. Structurally Deficient Non-NDOT Bridges over Time

THE COST OF BRIDGE CLOSURE FOR OWNERS

Structurally Deficient bridge locations are displayed in FIGURE 25A through FIGURE 25D. Currently there are no structurally deficient bridges on I-15 in Las Vegas and I-80 and US-395 in Reno. These routes connect Nevada with the rest of the country and carry hundreds of thousands of automobiles and trucks on a daily basis. Some Nevada Interstates bridges carry more than 100,000 vehicles daily in northern Nevada urban areas and approximately 250,000 vehicles daily in southern Nevada urban areas. If closure of a bridge in rural Nevada was required, the detour might add a few hundred additional miles to the travelers' journeys. A bridge closure and subsequent detours in urban areas will create extensive traffic jams and cause additional vehicle crashes. In both rural and urban bridge closures, the user costs due to travel delay or crashes will be quite significant until the bridge is reconstructed or repaired. Often, user costs due to delay or crashes can be in the hundreds of thousands of dollars per day. The importance of bridge maintenance and rehabilitation cannot be overemphasized.

The economic impacts of a bridge closure and subsequent activities are widespread. For example, the nationally-reported bridge collapse in Minneapolis, Minnesota in 2007 had an economic impact on the state totaling $17 million in 2007 and $43 million in 2008 due to user costs. The user costs were estimated at $247,000 per day due to added travel time. The Minneapolis Bridge carried 140,000 vehicles daily before the collapse. This account does not include the compensations to the deceased and injured and the law suit expenses.

PROJECT PRIORITIZATION

The bridge preservation program competes for funding with capacity improvement, operations, pavement, hydraulic, and safety projects and programs. Since available funding is never unlimited, engineers prioritize projects in such a manner that will improve the condition of the entire bridge infrastructure network while maximizing bridge performance and keeping costs to a minimum.

Bridge projects are developed and prioritized based upon bridge condition (Sufficiency Ratings and Structurally Deficient status), essentiality for public needs (NHS status, ADT, and ADTT etc.), and association of other ongoing project work at the same location (pavement rehabilitation work etc.). Seismic retrofit work is prioritized based on a bridge's earthquake vulnerability and importance. The seismic vulnerability of older state-owned bridges has been investigated. Certain bridge types, such as large culverts, do not need seismic retrofit.

STATE BRIDGE PRESERVATION FUNDING

Similar to pavement rehabilitation, bridge work is paid for with fuel taxes and vehicle registration fees. Historically, available funding has only been sufficient to offset annual preventive/corrective maintenance costs.

Federal funds are available for bridge replacement, rehabilitation, or seismic retrofits. Typically, about 80% to 85% of federal funds are spent on bridge replacement and rehabilitation and about 15% to 20% of federal funds are spent on seismic retrofit work.

Under federal funding guidelines, off-system bridges must receive more than $2 million of the available federal funds. Bridges are described as off-system when the bridges are

not located on the federal aid highway system. Off-system roads include Rural Minor Collector and Rural and Urban Local roads. Bridges are described as on-system when the bridges are located on the federal aid highway system. The Interstate, Urban Collector, and Rural Minor Arterial roads are included in the federal aid highway system. Of the 1,163 state-maintained bridges, 1,088 bridges are on-system and 75 bridges are off-system. Of the 845 county, city, other local agency, private, and other state agency bridges, 441 bridges are on-system and 404 bridges are off-system.

BIENNIAL EXPENDITURES FOR FISCAL YEARS 2015 TO 2016

TABLE 12 lists approximately $17 million worth of bridge preservation work that NDOT obligated in fiscal years 2015 and 2016.

TABLE 12. Bridge Expenditures in Fiscal Years 2015 and 2016

	Repair Strategy					
Fiscal Year	Preventive Maintenance	Corrective Maintenance	Rehabilitation	Replacement	Seismic Retrofit	Total
2015	$423,693	$2,260,041	$0	$0	$348,120	$3,031,854
2016	$449,666	$3,373,960	$6,556,186	$1,165,369	$2,461,028	$14,006,209
Biennium Total	**$873,359**	**$5,634,001**	**$6,556,186**	**$1,165,369**	**$2,809,148**	**$17,038,063**

TABLE 13 lists the numbers of bridges that NDOT rehabilitated, replaced, or seismically retrofitted in fiscal years 2015 and 2016.

TABLE 13. Numbers of Bridges Rehabilitated, Replaced, or Seismically Retrofitted in Fiscal Years 2015 and 2016

Fiscal Year	Entity		Repair Strategy			
		Federal-Aid System	Rehabilitation	Replacement	Seismic Retrofit	Total
2015	NDOT	On-System			7	7
2016	NDOT	On-System	7		7	14
		Off-System		1	4	5
	Local/Other	Off-System		1		1
Total			**7**	**2**	**18**	**27**

BACKLOG OF BRIDGE PRESERVATION WORK

Ideally, bridges maintained in fair or good condition for as long as possible will extend bridge service life and reduce the need for bridge replacement. Currently, a backlog of approximately $133 million exists for bridge preservation work. Bridge preservation includes repair strategies such as corrective maintenance, rehabilitation, and replacement work. TABLE 14 lists the backlog of currently-needed bridge repair work. Preventive maintenance needs are not included in the bridge project backlog because this work is performed using routine maintenance funds.

TABLE 14. Backlog of Bridge Work, State Bridges 2017

(Based on 2016 Condition Data)

System	Repair Strategy Required				Total
	Corrective Maintenance	Rehabilitation	Replacement	Seismic Retrofit	
Principal Arterial - Interstate	$20,336,398	$28,047,117	$9,195,325	--	$57,578,840
Principal Arterial - Non-Interstate	$ 7,584,818	$ 4,859,897	$2,088,081	--	$14,532,796
Minor Arterial	$ 3,266,776	$ 795,336	--	--	$ 4,062,112
Major Collector	$ 3,215,213	$ 1,294,749	$6,410,699	--	$10,920,660
Minor Collector & Local	$ 1,406,397	$ 1,600,578	$6,087,095	--	$ 9,094,070
System Not Identified	--	--	--	$37,000,000	$37,000,000
Total	**$35,809,602**	**$36,597,677**	**$23,781,200**	**$37,000,000**	**$133,188,479**

PRESENT FUNDING VERSUS NEEDED FUNDING

The majority of NDOT maintained bridges were built prior to the 1980s. These older bridges typically have a useful service life of about 50 years, although bridges that were built more recently are expected to have a useful service life of 75 years. It is anticipated that most bridges approaching 50 years old will require major rehabilitation or replacement relatively soon. FIGURE 32 illustrates that many NDOT maintained bridges are approaching 50 years old and may be reaching the end of their useful service life. The estimated cost to replace all of the NDOT maintained bridges that are currently over

50 years old is $680 million. Because of the large number of bridges approaching 50 years old, the estimated cost to replace all of the NDOT maintained bridges that will be over 50 years old ten years from now is $1.5 billion.

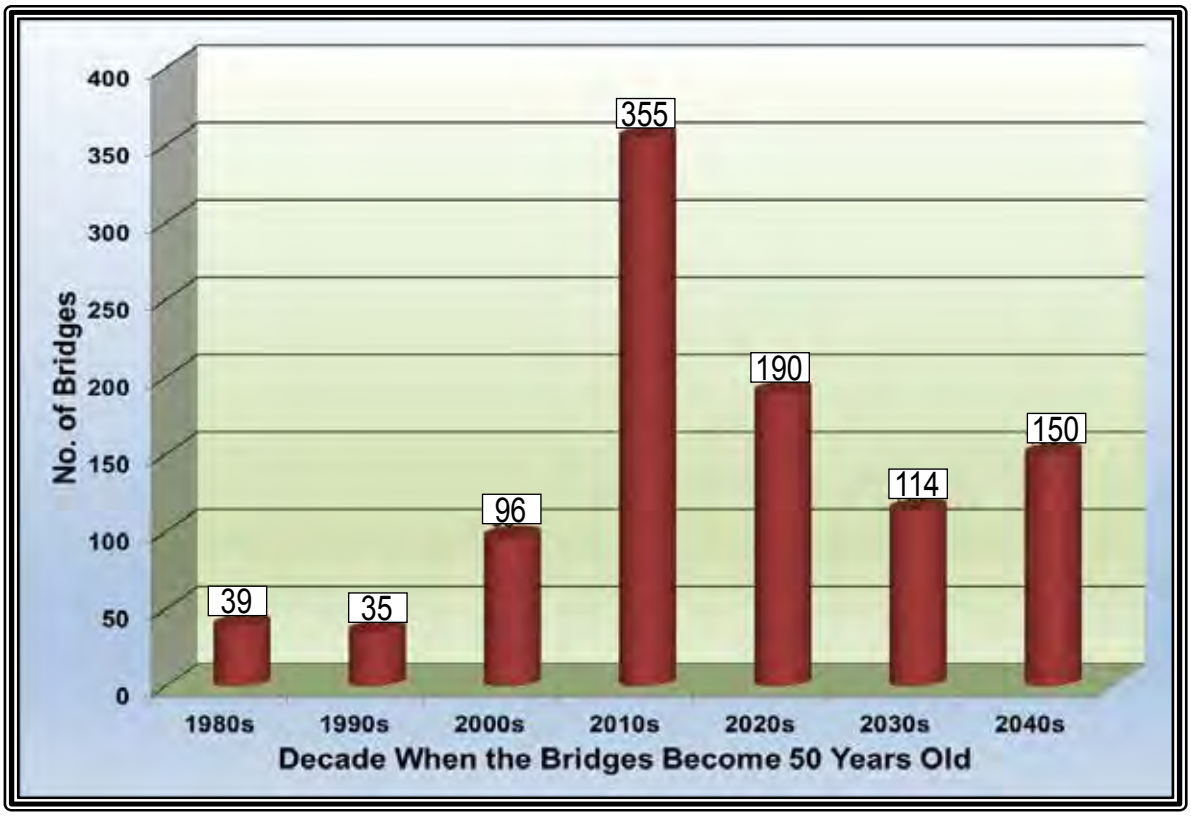


FIGURE 32. Number of 50 Year Old Bridges by Decade

Replacing all of NDOT's bridges over 50 years old is not practical to accomplish in five years or even ten years. The strategy to forecast future bridge preservation costs is to replace the bridges gradually over the next fifty years, before the bridges reach 100 years old. Replacing 2% of the bridges over 50 years old each year will allow for a gradual replacement of all the old bridges, but does not replace the bridges quickly enough to decrease the number of bridges over 50 years old. Since NDOT already has 439 bridges over 50 years old, replacing 2 bridges a year is a replacement rate of less than 0.5% which is inadequate. Gradually increasing the replacement rate to 2% over the next ten years will ultimately require replacing 11 bridges a year because NDOT will have approximately 550 bridges over 50 years old at that time. If a 2% annual replacement rate is maintained for the subsequent ten years the trends will begin to stabilize; twenty years from now NDOT would have approximately 590 bridges over 50 years old and would be replacing 12 bridges each year.

The current backlog of bridge preservation work is estimated to be approximately $133 million. The $11 million anticipated for bridge preservation work annually is not expected to be adequate to reduce or maintain the existing backlog. The current $18 million average annual need for bridge preservation work is expected to increase rapidly in the near future as the number of NDOT maintained bridges over 50 years old increases. TABLE 15 lists the bridge costs, funds and backlog for 10 years starting FY 2017 assuming the bridge preservation funding remains at the anticipated level. FIGURE 33 illustrates the anticipated costs, funds and backlog growth of the bridge preservation based on TABLE 15 data. Under the present funding plan, the current $133 million bridge backlog is expected to gradually increase to $330 million in FY 2027.

TABLE 15. Anticipated Bridge Backlog, Costs, and Funds

State-Maintained System (in millions of dollars)

Fiscal Year	Bridge Preservation Costs * (Normal Annual Deterioration Costs)			Bridge Preservation Funds ** (Funds Planned for Preservation Work)			Extra Funds Needed ***	Backlog of Bridge Work
	Corrective Maintenance, Rehabilitation, Replacement & Reconstruction	Preventive Maintenance	Total	Corrective Maintenance, Rehabilitation, Replacement & Reconstruction	Preventive Maintenance	Total		
2017	17.9	0.4	18.4	11.0	0.4	11.4	6.9	133.2
2018	20.5	0.4	21.0	11.0	0.4	11.4	9.5	140.1
2019	23.4	0.5	23.8	11.0	0.5	11.5	12.4	149.6
2020	26.4	0.5	26.9	11.4	0.5	11.9	14.9	162.0
2021	29.6	0.5	30.1	11.9	0.5	12.4	17.7	176.9
2022	32.9	0.5	33.4	12.4	0.5	12.9	20.6	194.6
2023	37.4	0.5	37.9	12.9	0.5	13.4	24.5	215.2
2024	41.1	0.5	41.7	13.4	0.5	13.9	27.8	239.7
2025	45.1	0.6	45.6	13.9	0.6	14.5	31.2	267.5
2026	46.4	0.6	46.9	14.5	0.6	15.0	31.9	298.6
2027	47.6	0.6	48.2	15.1	0.6	15.6	32.6	330.5

* Inflation assumed at 3.00% per annum.

** Revenue growth rate assumed is 4.00% per annum.

*** Funds needed to maintain current backlog

Note: Backlog of Bridge work is as of beginning of fiscal year; preservation costs are those incurred during the fiscal year; and preservation funds are those that are available during the fiscal year.

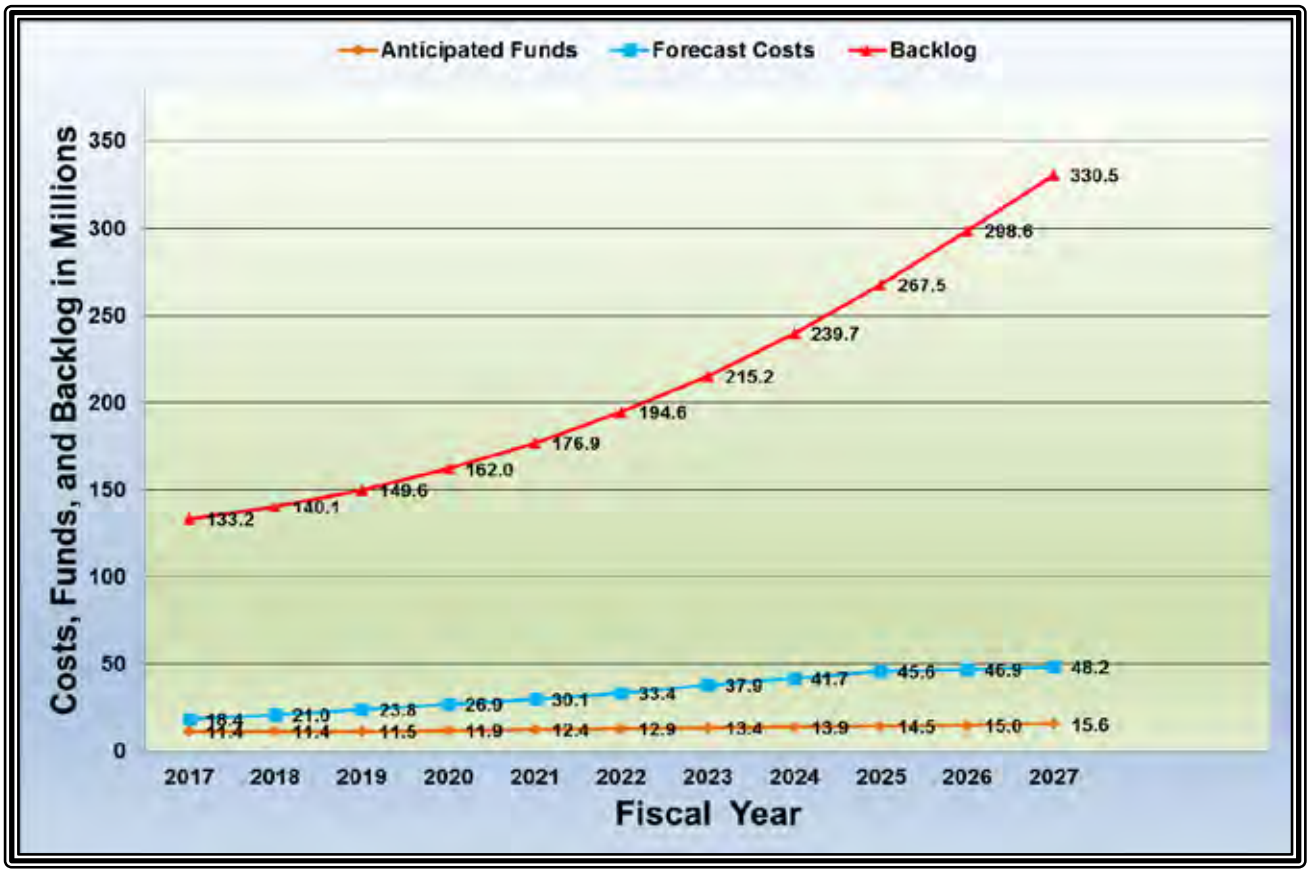


FIGURE 33. Anticipated Costs, Funds and Backlog of Bridge Preservation Work

BRIDGE PRESERVATION ACTION PLAN

NDOT's bridge preservation action plan is similar to plans detailed in previous State Highway Preservation Reports. The action plan is to preserve Nevada's public bridges in good condition by implementing the following bridge management practices:

- Replace or rehabilitate Structurally Deficient bridges before the bridges become hazardous or overly burdensome to users.
- Seismically retrofit bridges that do not meet current seismic standards.
- Apply timely corrective measures to existing structures.
- Apply effective preventive maintenance strategies to existing structures.

BRIDGE PRESERVATION SUMMARY

Nevada has enjoyed the benefit of good bridge conditions as compared to the bridge conditions in many other states for quite a while. Nevada's preservation program and favorable environment has contributed to the good results. However, NDOT's bridge

assets are aging. After a useful life of 50 years, many of NDOT's older bridges will require replacement. NDOT's current bridge replacement rate of approximately 2 bridges a year will not keep up with the large number of bridges reaching the end of their useful life. Increased spending in bridge corrective maintenance, rehabilitation, and replacement is necessary to preserve NDOT's bridge assets and to avoid costly bridge closures and emergency bridge replacements. If bridge preservation spending is increased to match the forecast costs shown in FIGURE 33, the current backlog of bridge work can be maintained. If the funding is gradually increased as shown over the next ten years, the forecast bridge preservation cost is expected to level off at approximately $48 million per year.

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2017 NEVADA STATE HIGHWAY PRESERVATION REPORT