

June 2017

LANE COUNTY ROAD & BRIDGE MAINTENANCE

Although most county road pavements and bridges have good condition ratings, current funding and preservation activities fall short of what is needed to protect these valuable assets



Office of the Performance Auditor
Report Number 2017-01

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About the Lane County Performance Auditor's Office

The Lane County Performance Auditor's Office conducts audits to help improve the performance, accountability, and transparency of Lane County government.

The County Performance Auditor reports to the Board of County Commissioners and is independent of other departments within Lane County government. An audit committee provides oversight and was established to promote the independence of the performance audit function.

The performance audit function provides the Board of County Commissioners, the County Administrator, and all levels of management with relevant timely analysis and information so the county can continuously improve its services and build public trust.

Audit Team

Shanda Miller, CIA, MPA, County Performance Auditor

Shanna Bressie, MS GIST, Audit Intern

The courtesies and cooperation extended by officials and employees of Lane County Road and Bridge Maintenance Division and the Lane County Department of Public Works during the course of this review were commendable and sincerely appreciated.

Lane County Performance Auditor's Office

125 East 8th Avenue

Eugene, OR 97401

(541) 682-6267

lanecounty.org/laneaudits

[@LaneAudits](https://twitter.com/LaneAudits)

TABLE OF CONTENTS

SUMMARY	4
BACKGROUND	5
About This Report.....	5
Roads and Bridges are Lane County’s Biggest and Most Valuable Capital Assets.....	5
Timber Harvest Receipts, State Gas Tax, and Highway User Fees Fund Road and Bridge Maintenance.....	6
Road and Bridge Maintenance Services.....	7
AUDIT RESULTS	13
PAVEMENT CONDITION	13
Pavement Preservation Programs Extend the Life of Roads and Cost Less.....	13
Currently the Pavement Condition Index Ratings are Good or Very Good for 99% of Lane County’s Road Miles.....	14
Pavement Preservation Activities Have Declined in Recent Years.....	15
Current Preventive Maintenance Efforts Fall Short of That Needed to Maintain Good Pavement Condition.....	16
Higher Rehabilitation and Reconstruction Costs Will Cost Taxpayers More in the Long-term if Pavement Condition Declines Due to Inadequate Preventive Maintenance.....	19
Decreased Customer Satisfaction and Higher Vehicle Operating Costs May Result if Pavement Condition Declines.....	19
BRIDGE CONDITION	20
Bridge Preservation Programs Extend the Life of Bridges and Cost Less.....	20
Currently 98% of Lane County’s Bridges are Rated in Fair or Better Condition, but Condition has Declined in the Past 10 Years.....	20
Routine and Preventive Bridge Maintenance Activities Have Declined in Recent Years.....	21
Current Preventive Maintenance Efforts Fall Short of That Needed to Maintain Good Bridge Condition..	21
Bridge Replacement is More Costly than Preventive Maintenance.....	22
CONCLUSION	23
Current Funding Falls Short of What is Needed to Maintain Effective Pavement and Bridge Preservation Programs.....	23
Lane County Lacks Formal Preservation Management Strategies and Lacks a Long-term Asset Management Plan for Roads and Bridges.....	24
Lane County Lacks an Effective Bridge Management System.....	25
RECOMMENDATIONS	26
SCOPE AND METHODOLOGY	27
DEPARTMENT RESPONSE	29

SUMMARY

We found county road pavements are currently rated in good or very good condition and bridges are rated in fair to very good condition. However, current funding and pavement and bridge preservation activities fall short of what is needed to protect these assets. If pavement and bridge conditions decline due to inadequate preventive maintenance, higher rehabilitation and reconstruction costs will result in the long-term. We also found Lane County lacks formal preservation management strategies and lacks a long-term asset management plan for roads and bridges.

Accomplishments

- Currently the Pavement Condition Index ratings are good or very good for 99% of Lane County's road miles and the network average PCI rating is 81
- Lane County's Pavement Condition Index ratings are better than comparable counties
- Currently 98% of Lane County's bridges are rated in fair or better condition
- These high condition ratings for roads and bridges reflects the county's history of pavement and bridge preservation efforts
- Lane County uses a pavement management system to help maintain pavement data and prioritize and plan for pavement preventive treatment projects

Challenges

- Pavement preservation activities have declined and fall short of that needed to maintain good pavement condition
- Higher rehabilitation and reconstruction costs will cost taxpayers more in the long-term if pavement condition declines due to inadequate preventive maintenance
- Bridge condition has declined in the past 10 years
- Due to budget and staffing, routine and preventive bridge maintenance activities have declined in recent years, and staff have not been able to keep up on needed bridge maintenance work to keep bridges in fair or good condition
- Current Road and Bridge Maintenance Division funding is inadequate for keeping up with preventive maintenance projects and supporting effective pavement and bridge preservation programs
- Lane County lacks formal preservation management strategies and lacks a long-term asset management plan for roads and bridges
- Lane County's bridge management system is outdated and lacks best practice features, such as tools for planning, prioritizing, and budgeting bridge maintenance and preservation projects

Recommendations

To perform adequate preventive maintenance to protect Lane County's road and bridge assets and save taxpayer money over the life of these assets, we recommend Lane County adopt formal road and bridge preservation management strategies; develop a formal multi-year asset management plan; and identify alternative revenue solutions if gaps in funding are found during the planning process (see page 26 for the detailed recommendations).

Department Response

The department response is attached at the end of the report.

BACKGROUND

About This Report

The purpose of this audit was to assess the current condition of Lane County's road pavement and bridges, and evaluate management strategies and funding needs for protecting the county's road and bridge capital assets. The County Performance Auditor identified this audit topic during a county-wide risk assessment conducted in spring 2015. In July 2016, the Board of County Commissioners approved the audit as part of the Annual Audit Plan.

Our audit scope included the Road and Bridge Maintenance Division's pavement maintenance and bridge maintenance programs, but excluded culvert and storm sewer system maintenance.

Although recent statistics show that Lane County had more total traffic fatalities between 2014 and 2015 than any other county in Oregon, this audit did not look at road safety. Lane County is currently developing a Transportation Safety Action Plan to address safety problems. This draft action plan describes road infrastructure improvements the county could incorporate into road maintenance and preservation activities to prevent crashes or reduce their severity. Road condition can be a factor in vehicle crashes. However, auditors learned a very small percentage of vehicle crashes were due to roadway conditions. Most vehicle collisions are due to driver error.

Also excluded from the scope of the audit was a review of Lane County's bridges for seismic vulnerability. Few of Lane County's bridges have been seismically upgraded to withstand a major earthquake.

Roads and Bridges are Lane County's Biggest and Most Valuable Capital Assets

Lane County's biggest and most valuable capital asset is its road infrastructure, which includes roads, road improvements, bridges, culverts, and right-of-ways. The Road and Bridge Maintenance Division is responsible for maintenance and preservation of the County's roads, bridges, and related storm sewer systems.

Lane County's road assets include asphalt concrete, chip seal, and gravel roads. The county manages 1436 miles of roads, and 1277 miles of roads paved with asphalt concrete or chip seal.

Lane County has 415 bridges, and 408 of those bridges are included on the National Bridge Inventory. The Federal Highway Administration's National Bridge Inventory includes all structures that are more than 20 feet long and used for vehicular traffic. The number of National Bridge Inventory (NBI) structures will be increasing to 426, because staff identified a number of fish passage structures that are over 20 feet long and fall under NBI guidelines.

Surface Type	Number of Road Miles
Asphalt concrete	902
Chip seal	375
Gravel	159
Total	1436

Road Type	Number of Road Miles
Principal Arterial	7
Minor Arterial	37
Major Collector	356
Minor Collector	379
Local	657
Total	1436

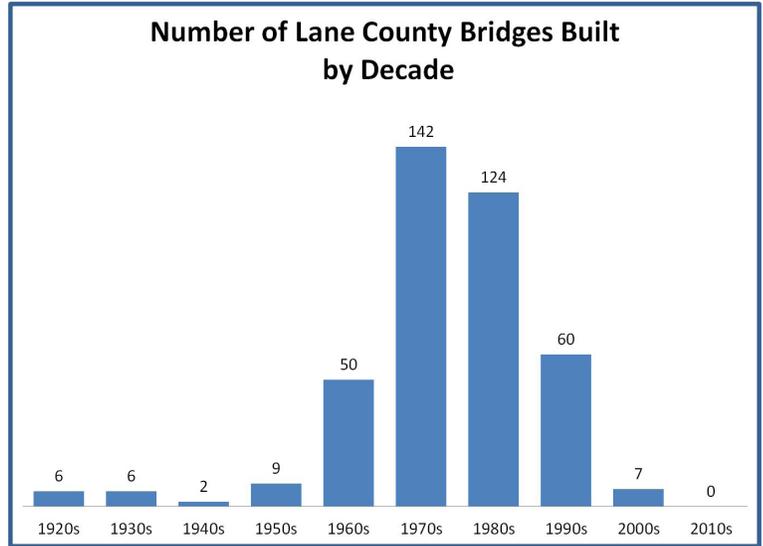
BACKGROUND

The majority of Lane County’s bridges were built in the 1970s and 1980s, and many are less than 50 years old.

Timber Harvest Receipts, State Gas Tax, and Highway User Fees Fund Road and Bridge Maintenance

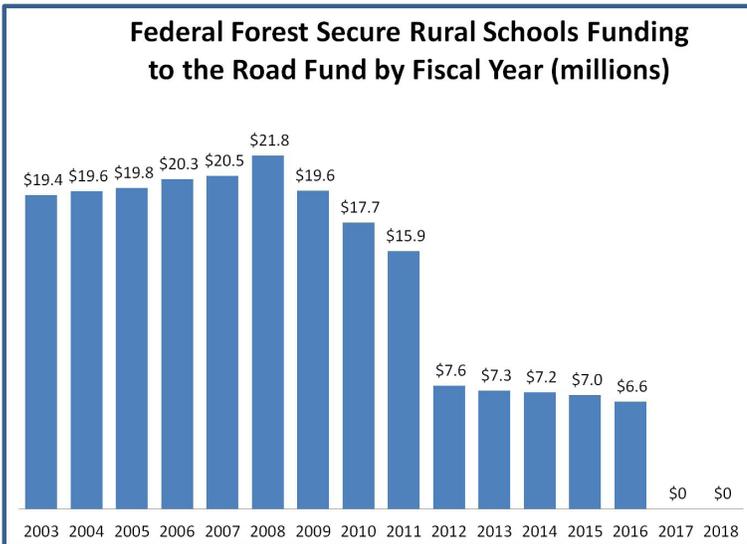
The Road and Bridge Maintenance Division is funded by Road Fund revenues. Primary Road Fund revenues include actual timber harvest receipts from federal lands, and state gas tax and highway user fees.

In the past, the Road Fund included a significant amount of timber revenue. Before Fiscal Year 2011, timber revenue made up the majority of the Division’s funding. The bulk of road maintenance funding now comes from state gas tax and highway user fees.



Total Road Fund revenues have declined significantly over the past 10 years due to the decline and end of federal Secure Rural School funding. Lane County receives about \$20 million less for the Road Fund per year in federal timber funding than it did 10 years ago. These reductions in Road Fund revenues have meant service and staffing reductions in the Road and Bridge Maintenance Division.

With forestland making up 90% of the county’s land, Lane County has historically relied on timber revenue to help fund county roads. Federal timber harvests began declining in the 1980’s. They further declined with the change in federal forest policies in the early 1990’s. The U.S. Congress helped bridge the funding gap by approving a federal timber revenue guarantee in 1993 and a new 6-year guarantee in 2000. This guarantee was commonly referred to as Secure Rural Schools. From 2007 to 2015, Congress approved extensions to Secure Rural Schools timber funding, though at decreasing amounts. Since 2015, Congress has not approved any extension of Secure Rural Schools timber payments. This means the county has returned to relying on actual timber harvest revenue.



BACKGROUND

Road and Bridge Maintenance Services

Road and Bridge Maintenance is a Division of Lane County Public Works. The Division's purpose is to effectively use public resources to proficiently maintain Lane County's infrastructure assets.

The Road and Bridge Maintenance Division is based in the Public Works Delta Complex, with satellite shops located near Cottage Grove, Dexter, Veneta, and Florence. There are five Road Maintenance Zones and a crew is assigned to each zone.

Zone crews provide services to maintain and preserve Lane County's roads and bridges. Services also include grading gravel roads, vegetation management, ditch and drainage maintenance, culvert maintenance, storm response, winter sanding and snow plowing, leaf pickup, event permits, and signs and striping.

Road and Bridge Maintenance Services
Bridge Inspections and Maintenance
Culvert Inspection and Maintenance
Driveway Permits
Pavement Management: Chip Seal, Crack Seal, Paving, Striping
Roadway Signage
Roadside Ditch and Drainage Maintenance
Roadside Vegetation Management
Storm Response
Winter Sanding and Snow Plowing
Leaf Pickup on Streets With Curbs
Roadway Event Permits

Pavement Management and Preventive Maintenance

Most roads are made up of a base structure and hard pavement cap, usually either asphalt or cement. Most of Lane County's roads are capped with Asphalt Concrete Pavement (ACP). One of the purposes of the pavement cap is to protect the base structure by preventing the intrusion of water into the base materials.

The American Association of State Highway and Transportation Officials (AASHTO) defines pavement management as the effective and efficient implementation of activities to sustain pavement in a condition acceptable to the traveling public at the least life cycle cost.

Pavements do not last forever. However, pavement maintenance and preservation activities can reduce the rate of deterioration resulting in cost-savings over the life of a road.

Pavements can deteriorate over time and fail, and once a pavement fails, the road structure will fail. Environmental forces and load-related forces cause asphalt pavement deterioration. Environmental forces include the effects of temperature, moisture, freeze/thaw cycles, oxidation, and exposure to sunlight. These environmental effects can result in distresses such as thermal cracking and block cracking.

Load-related forces include trucks hauling loads that are heavier than a road's load carrying capacity, and can result in fatigue cracking and rutting. According to an American Association of State Highway and Transportation Officials report, the road damage caused by a fully loaded 5-axle tractor trailer is equal to 9600 cars.

Pavement preservation includes all of the activities taken to maintain serviceable roadways and to preserve the investment in the county road system. Pavement preservation includes preventive maintenance and corrective maintenance, as well as minor rehabilitation projects. Pavement preservation also includes new or reconstructed pavements and major rehabilitation projects.

BACKGROUND

Different types of pavement preservation activities are defined as follows:

Routine Maintenance – Daily activities that are routine and preserve the condition of the roadway or respond to specific conditions or events; For example, street sweeping, tree removal, and vegetation management

Preventive Maintenance – A planned strategy and application of a series of low-cost or cost-effective treatments before defects in the pavement occur to preserve the roadway system, prevent deterioration, and extend pavement life; For example, crack sealing, chip sealing, and slurry sealing

Corrective Maintenance – Activities that correct deficiencies in the pavement; For example, repairing potholes and extensive cracking

Rehabilitation – Once structural damage has occurred, and repair costs to the pavement exceed the benefits from preventive maintenance and corrective treatments, rehabilitation can restore the pavement; For example, milling the pavement and placing an asphalt overlay

Reconstruction – The replacement of the entire existing pavement structure by the placement of an equivalent or increased structure

Lane County uses the following preventive maintenance treatments:

Crack Seal – A crack seal involves filling a crack in the pavement surface with an adhesive sealant, usually an asphalt binder or emulsion of asphalt. Prompt treatment can prevent pavement deterioration. Sealing a crack will keep water and dirt or debris from getting under the pavement.

Slurry Seal – A slurry seal is a mixture of asphalt and fine aggregate. Slurry seals work best with pavements that are in good condition but are showing signs of aging. Slurry seals seal the pavement surface to fill cracks and prevent moisture from getting into the pavement.

Chip Seal – A chip seal, also called oil mat, is when the asphalt is sprayed with a layer of asphalt emulsion and then immediately covered in a layer of aggregate rock and rolled.

Fog Seal – A fog seal is a light asphalt emulsion diluted with water applied to the pavement surface. Fog seals are also used on newly applied chip seals.

Thin Asphalt Overlay – A thin asphalt overlay is a hot mix asphalt applied to the pavement surface at a thickness of 1.5 to 2 inches. A thin asphalt overlay can be used as a preventive maintenance treatment for roads with high traffic volume and load weights or as a rehabilitation treatment for distressed roads.

Pavement Condition Index is One Tool for Rating Pavement Condition

Lane County assesses its pavement condition using a Pavement Condition Index (PCI) rating score. This score is based on inspection rating procedures as defined by American Society for Testing and Materials (ASTM) Standards. The PCI scores are on a 0 to 100 scale.

Condition assessments, like the Pavement Condition Index, can help road departments establish and link maintenance priorities to organizational performance targets. Pavement Condition Index scores can also be used to help determine the pavement treatments that are most cost-effective.

BACKGROUND

Pavement Condition Index Ratings

Pavement Condition Index (PCI)	Description
Very Good PCI 80 to 100	Newly constructed or resurfaced pavement with few signs of distress
Good PCI 70 to 79	Pavement requiring mostly preventive maintenance and showing only low levels of distress
Fair PCI 60 to 69	Pavement at the low end of this range is significantly distressed and may require a combination of rehabilitation and preventive maintenance
At Risk PCI 50-59	Deteriorated pavement requiring immediate attention including rehabilitation
Poor PCI 25 to 49	Pavement showing extensive distress and requiring major rehabilitation or reconstruction
Failed PCI 0 to 24	Extremely rough pavement that needs complete reconstruction

The Pavement Condition Index has limitations, however, and should be used in combination with other road information, including traffic, climate, and truck load weights. The Pavement Condition Index only rates the pavement condition, not the condition of the underlying road structure. It is possible a road surface may be in good condition and show a high Pavement Condition Index rating, but the underlying structure could still be failing.

Pavement Management Systems can Help Plan and Budget for Pavement Preservation

Industry best practices recommend using a pavement management system to plan and budget for cost-effective activities that extend and maximize the life of pavements. A pavement management system can analyze pavement life cycles and help to identify the right type of treatment at the right time.

Components of a pavement management system include conducting regular pavement condition assessments, maintaining a database with all pavement information, analysis and forecasting tools, decision criteria, and implementation procedures.

Pavement information collected and maintained in a pavement management system include:

- Road type and surface type
- Condition assessment data
- Average daily trip (ADT) data, including vehicle and truck class
- Maintenance treatments

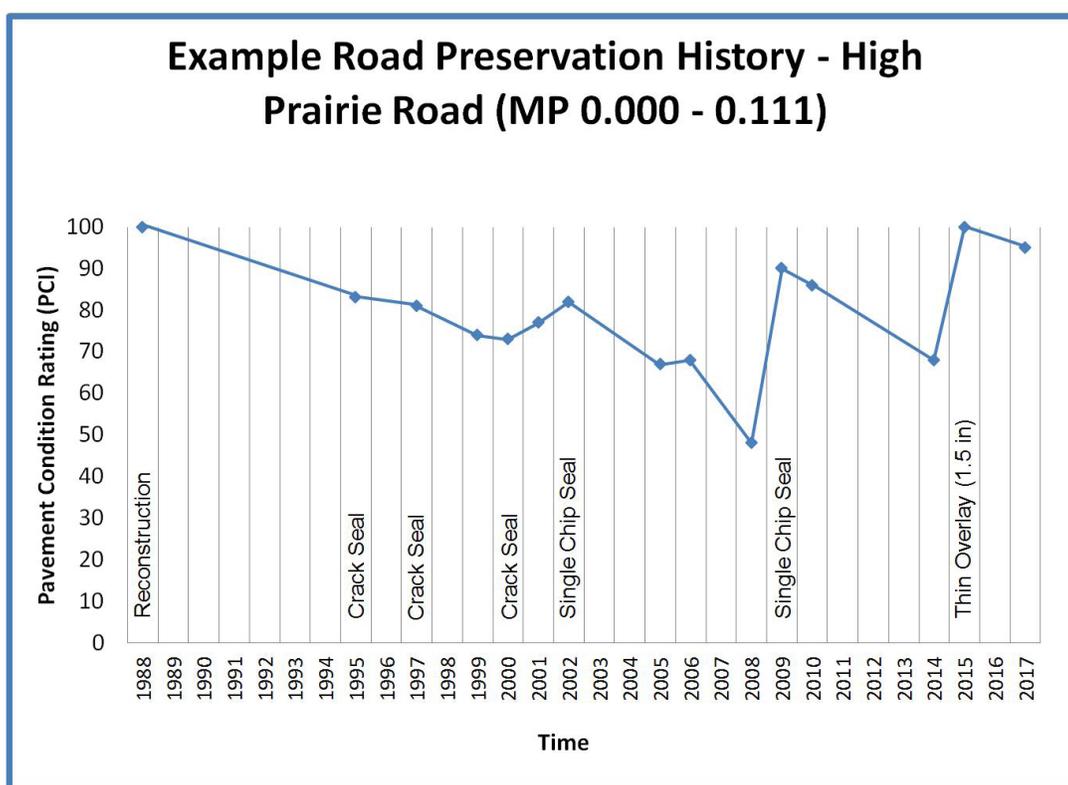
BACKGROUND

The analysis component of a pavement management system includes:

- Measuring the health of the road network and the change in the network over time
- Determining the annual estimated budget needed to maintain and preserve road assets at the chosen condition goal
- Prioritizing projects needing maintenance and rehabilitation
- Determining the impact of funding decisions on pavement condition

Lane County uses a pavement management system call StreetSaver, a system developed by the Metropolitan Transportation Commission.

The chart below shows the Pavement Condition Index rating trend for an example road, and how the rating improves with different treatments. The example road used is a section of High Prairie Road (mile post 0.000 – 0.111) maintained by Lane County. High Prairie Road is an urban collector road originally constructed in 1971.



Bridge Management and Preventive Maintenance

Most of Lane County's 415 bridges are concrete structures, 4 are steel structures, and 14 are covered bridges still open to vehicle traffic.

Similar to pavement preservation, industry best practices recommend a bridge management program include a systematic process for bridge preservation. Bridge preservation includes applying cost-effective bridge treatments at the right time to prevent or delay deterioration of bridges, keep bridges in good condition, and extend their life.

Bridge preservation encompasses preventive maintenance and rehabilitation activities. Some bridge preventive maintenance activities are cyclical, meaning they commonly occur on a regular interval (e.g every 10 years).

BACKGROUND

Examples of bridge preventive maintenance may include:

- Washing or cleaning bridge elements
- Sealing deck joints
- Applying deck overlays
- Facilitating drainage
- Sealing concrete
- Painting or coating steel elements
- Installing and monitoring of steel cathodic protection and prevention systems
- Removing channel debris
- Protecting against scour
- Lubricating bearings

Bridge Inspection Program and Bridge Condition Ratings

The Oregon Department of Transportation's Bridge Inspection Program inspects each of Lane County's bridges every two years. The inspectors assess specific bridge elements and assign condition ratings to each element. Included in the inspections are condition ratings for the National Bridge Index (NBI) components: Deck, Superstructure, Substructure, and Channel. Bridge condition ratings are on a 0 to 9 scale.

An overall bridge condition rating can be determined using the lowest National Bridge Index component rating for Deck, Superstructure, and Substructure. Also, bridges are considered Structurally Deficient if they have a National Bridge Index component rating of 4 or less for either deck, superstructure, or substructure. Structurally Deficient means a bridge's significant load carrying elements are found to be in poor condition due to deterioration and/or damage.



*Mosby Creek Covered Bridge
by Gary Halvorson, Oregon State Archives*

BACKGROUND

National Bridge Index General Condition Ratings

Code	Description	Actions
9	Excellent Condition	Preventive Maintenance
8	Very Good Condition – No problems noted	
7	Good Condition – Some minor problems	
6	Satisfactory Condition – Structural elements show some minor deterioration	Preventive Maintenance; and/or Repairs
5	Fair Condition – All primary structural elements are sound but may have some minor section loss, cracking, spalling, or scour	
4	Poor Condition – Advanced section loss, deterioration, spalling, or scour	Rehabilitation or Replacement
3	Serious Condition – Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.	
2	Critical Condition – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored the bridge may have to be closed until corrective action is taken.	
1	Imminent Failure Condition – Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put it back in light service.	
0	Failed Condition – Out of service; beyond corrective action	

In addition to bridge condition ratings, inspectors provide maintenance recommendations and assign a priority level to those recommendations. Oregon’s Bridge Inspection Program expects the county to address each Urgent and Critical recommendation as soon as possible. The county should also review and use Routine maintenance recommendations to plan its bridge maintenance work.

AUDIT RESULTS

Pavement Preservation Programs Extend the Life of Roads and Cost Less

There are two different strategies for pavement management: pavement preservation and rehabilitation only.

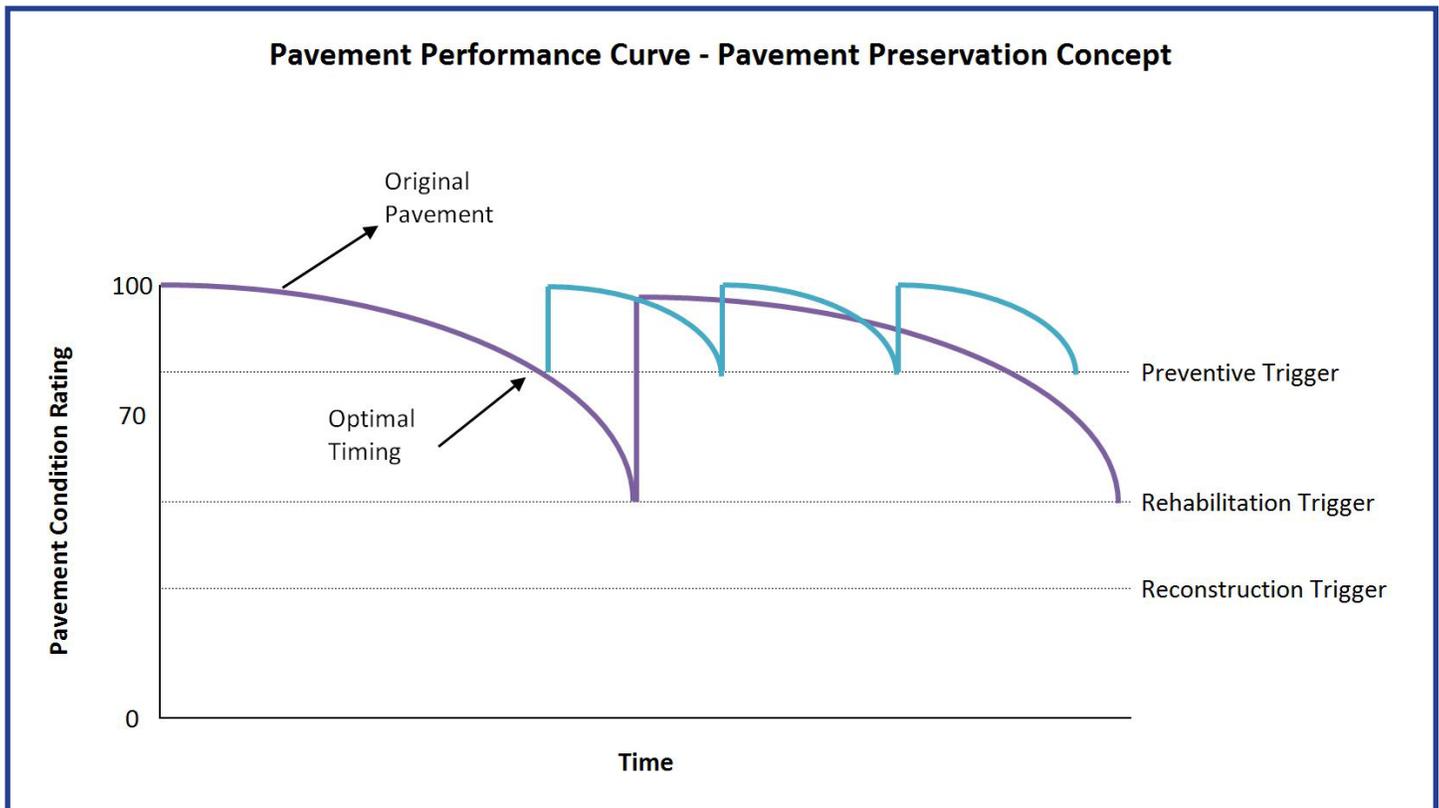
The rehabilitation only strategy is often referred to as “worst first,” which means addressing only those roads in need of rehabilitation and reconstruction. This is the most expensive way to manage a road system and rarely does sufficient funding exist to sustain this strategy. Spending \$1 on pavement preservation delays spending \$10 or more on future rehabilitation or reconstruction.

Pavement preservation has emerged as the industry best practice, and is a proactive and cost-effective strategy designed to keep good roads good. Preservation is also an investment and insurance against costly repairs.

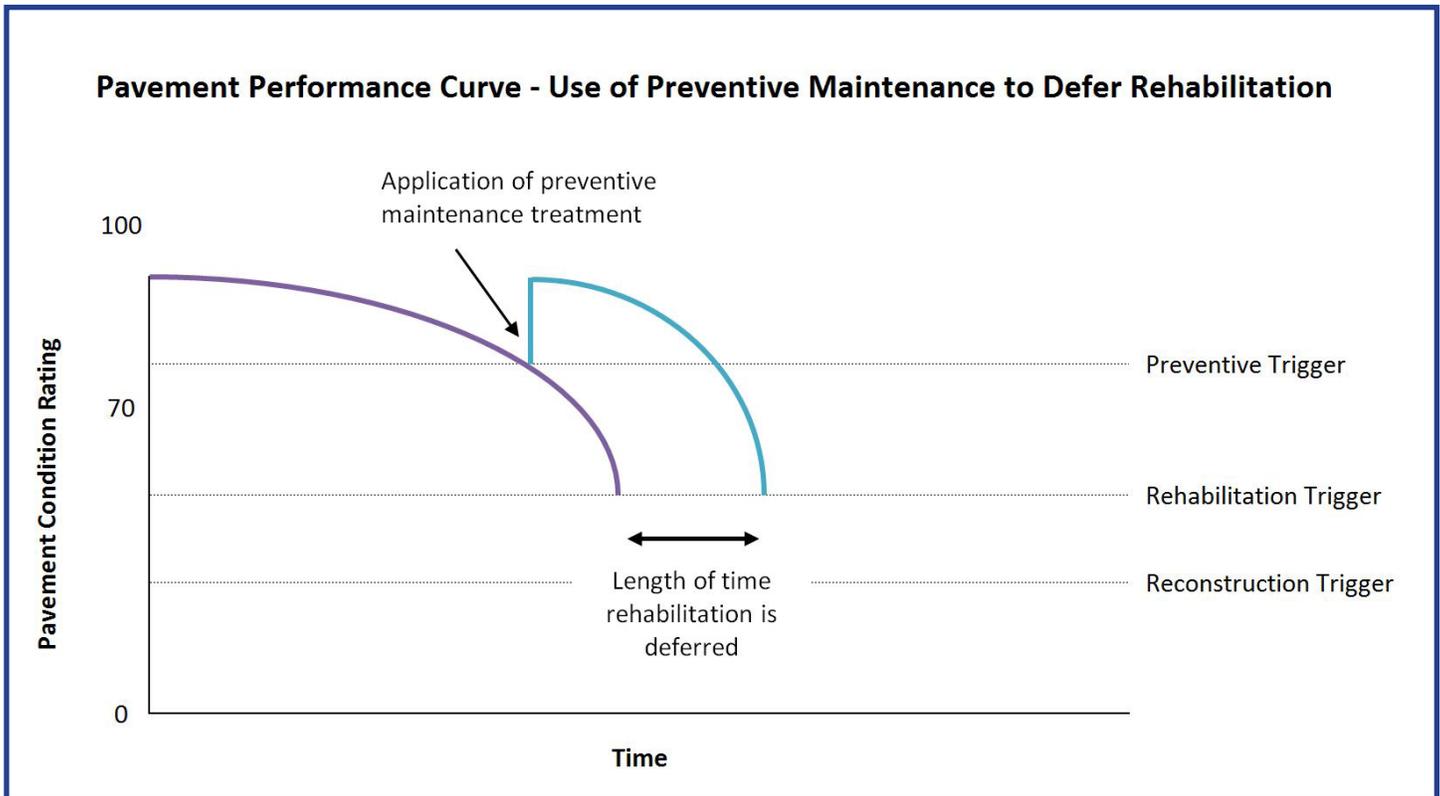
Pavement preservation means treating pavement even when the surface appears to be in good shape. Pavement preservation is about sealing out water and preventing cracks and potholes, which decreases the rate of deterioration. However, waiting until a problem develops, such as cracking, is too late. There is an optimal window of time for preventive treatment, beyond which it is too late and will require more expensive correction or rehabilitation.

Road departments have found that preventive maintenance can preserve more road miles and add more service life at less cost per mile than a rehabilitation-only program. This is because extending the life of a road will delay the rehabilitation or reconstruction of a road.

The two charts below demonstrate the pavement preservation concept.



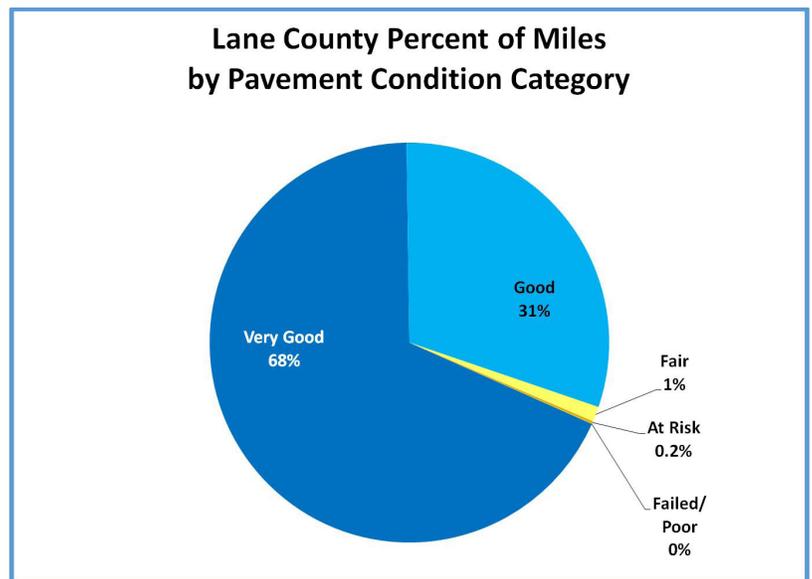
PAVEMENT CONDITION



It is also important to note, a pavement preservation strategy will still include rehabilitation and reconstruction projects. Even with preventive maintenance to extend the life of roads, roads only last so long. Getting the right proportion of preservation, rehabilitation, and reconstruction projects will improve road condition while safeguarding the road assets. Preventive maintenance activities should be done until repair costs exceed the benefits or until the pavement structure needs to be rehabilitated or reconstructed.

Currently the Pavement Condition Index Ratings are Good or Very Good for 99% of Lane County's Road Miles

Lane County's current Pavement Condition Index (PCI) ratings show 99% of the county's 1277 miles of paved road are in good or very good condition. A Pavement Condition Index of 70 to 79 is considered good and 80-100 is considered very good. The network average PCI rating is 81. This high number of good or very good roads reflects the county's history of pavement preservation activities.

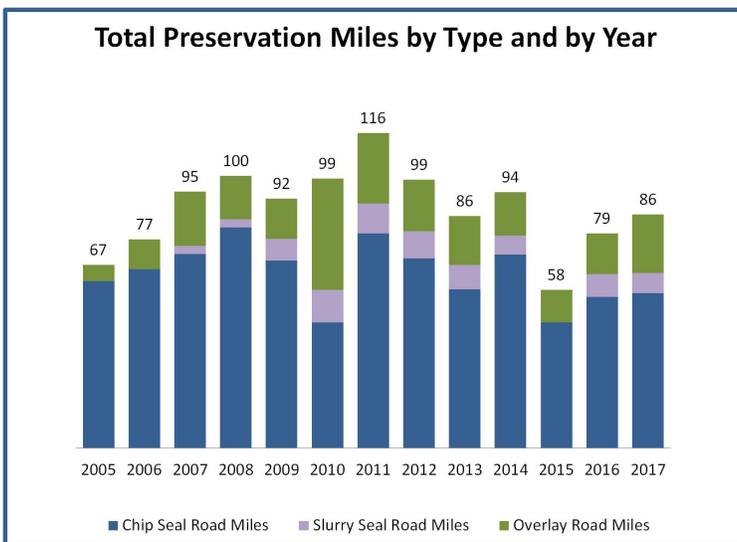
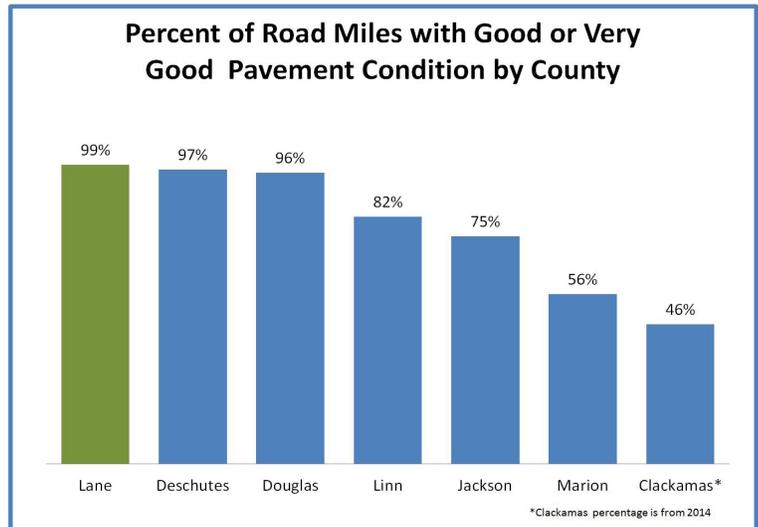


PAVEMENT CONDITION

Lane County has the highest percentage of road miles with a Pavement Condition Index rating of good or very good when compared to six other counties. We chose these six counties to compare to Lane County based on their similar geographic and population sizes.

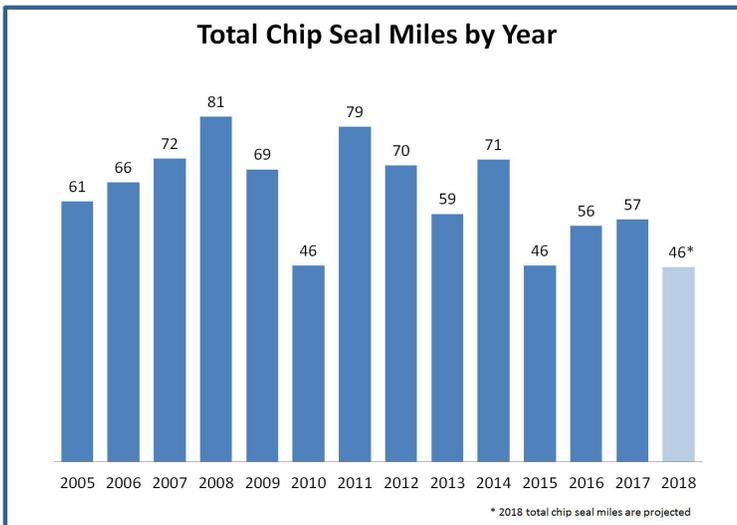
Pavement Preservation Activities Have Declined in Recent Years

Due to revenue reductions, the Road and Bridge Maintenance Division has performed less miles of pavement preservation treatments in recent years. Since 2005, the total number of miles with preservation treatment (chip seal, slurry seal, and thin asphalt overlay) peaked in 2012. Since 2012, there has been an overall downward trend with the lowest number of miles occurring in 2015.



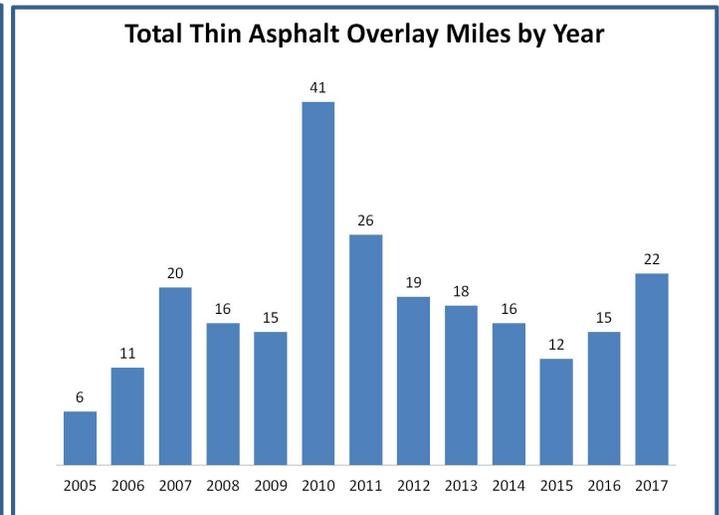
Since 2005, the number of miles with chip seal treatment was the highest in 2008 with an overall downward trend since then. The Division expects the total number of miles treated with chip seal in 2018 will match the number of miles treated in 2015. Without additional funding, future years will also have a similar number of miles treated with chip seal.

The total number of miles treated with slurry seal peaked in 2010 and has trended downward since then. There were no roads treated with slurry seal in the years 2005, 2006, or 2015.



The total number of miles treated with thin asphalt overlay also peaked in 2010. Since 2010, the number of thin asphalt overlay treated miles has trended downward with the exception of years 2016 and 2017, which saw a slight upward trend.

PAVEMENT CONDITION



Current Preventive Maintenance Efforts Fall Short of That Needed to Maintain Good Pavement Condition

Lane County plans to perform preventive maintenance treatment on 86 miles of road during the summer of 2017. This represents about 7 percent of Lane County’s 1277 miles of paved roads. Based on this plan, the county will fall short of needed treatment miles and funding to keep up with preventive maintenance on its paved road network and maintain good pavement condition.

There is a pavement management concept called remaining service life that can be used to forecast future maintenance needs. The basic concept is that the measurable loss of pavement life can be thought of as the network’s total miles multiplied by 1 year. For Lane County, if its road network ages 1 year, then the network ages 1277 miles per year. To offset this loss of pavement life to the road network, the county would annually need to perform a quantity of work to extend road life equal to the mile years lost. For Lane County, 1277 mile years would need to be added each year through preventive maintenance efforts. Performing a quantity of work that results in fewer mile years added to the road network will fall short of maintaining roads to the current condition. Thus, over time, the condition of the network will decline.

Each pavement treatment type has an assumed average service life extension in number of years. Industry research studies and other road agency experiences have identified consistent average life extensions for slurry seal, chip seal, and thin asphalt overlay. In addition to industry research findings, we used Lane County’s experience to come up with the average service life extension used in this audit.

Treatment Type	Average Service Life Extension (Years)
Slurry seal	7
Chip seal	10
Thin asphalt overlay	12

PAVEMENT CONDITION

Example: Lane County plans to treat 7.3 miles of local urban roads with slurry seal during the summer of 2017. To calculate the total mile years added to Lane County's road network, multiply 7.3 miles by the 7 year service life extension from the table above.

$$7.3 \text{ Miles} \times 7 \text{ Years} = 51 \text{ Mile Years}$$

For all planned 2017 preventive treatment projects, we found the county will add 884 mile years to its road network. However, the county will be short by 393 mile years to maintain the current condition.

Summer 2017 Preventive Maintenance Projects and Expected Road Service Life Gained

Treatment Type	Road Miles Treated	Service Life Extension (Years)	Expected Lane Mile Years Added to Network (Mile Years)	Estimated Total Cost
Slurry seal	7.3	7	51	\$184,712
Chip seal*	57.2	10	572	\$2,393,837
Thin asphalt overlay	21.8	12	261	\$3,873,568
Totals	86.2		884	\$6,452,117

*Chip seal includes crack sealing the year prior

We demonstrated one possible scenario for the ideal annual number of miles treated by treatment type. This plan would meet the need of adding 1277 mile years each year to the road network. The cost of this plan would be a little over \$1 million more compared to the county's summer 2017 plan.

To create this scenario, we reviewed the county's road inventory and the best treatment types for different classes of roads. Most local urban roads are treated with slurry seal, for example. Also, roads with a high volume of traffic or heavy traffic loads, are best treated with thin asphalt overlay.

This is an example scenario, and we would expect Division staff to develop their own ideal plan based on their knowledge of the road network and specific needs.

Ideal Annual Preventive Maintenance Projects and Funding Need

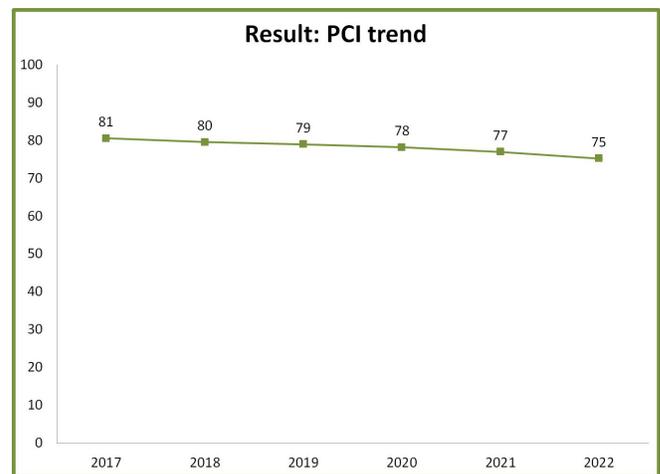
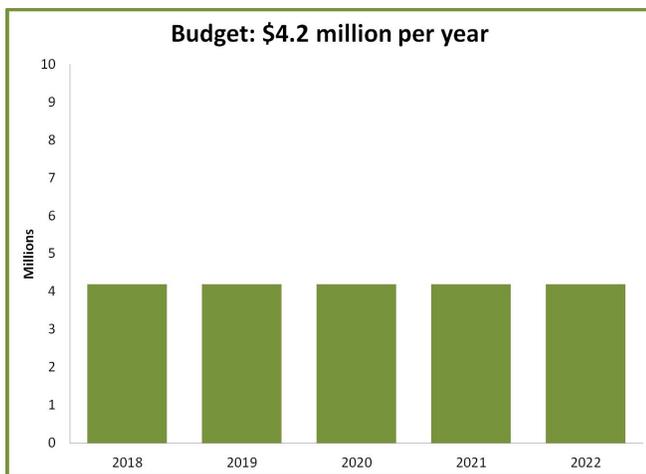
Treatment Type	Annual Need (Road Miles)	Service Life Extension (Years)	Expected Lane Mile Years Added to Network (Mile Years)	Estimated Annual Need
Slurry seal	14.0	7	98	\$355,119
Chip seal	97.0	10	970	\$4,060,614
Thin asphalt overlay	17.4	12	209	\$3,097,430
Totals	128.4		1277	\$7,513,163

PAVEMENT CONDITION

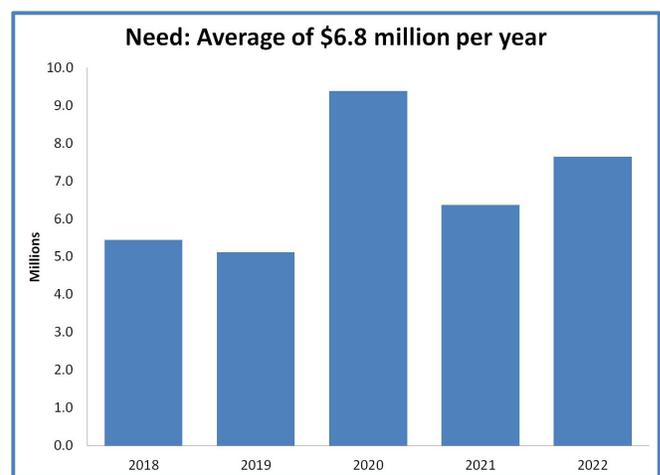
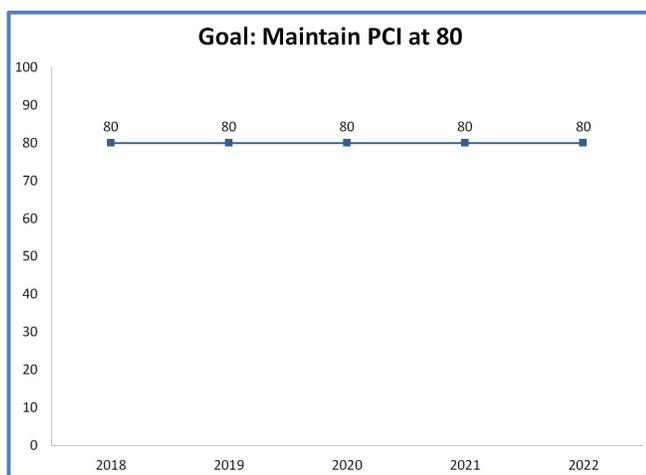
Another method for determining projected preventive maintenance treatment needs and funding needs is by using pavement management system tools. For example, Lane County's pavement management system, StreetSaver, has built in scenario tools.

Division staff used StreetSaver and county road condition and maintenance data to create an example budget driven scenario and an example target driven scenario. The following charts show the results of the two scenarios. The first pair of charts show projected deterioration of Pavement Condition Index (PCI) ratings if an annual \$4.2 million pavement preservation project budget was maintained over the next 5 years. The second pair of charts show the estimated funding need to maintain an overall network PCI rating of 80. As of 2017, the network average PCI rating was 81.

Projection: Continue the Current Budget



Projection: Funding Need to Maintain Current Pavement Condition Index Rating



PAVEMENT CONDITION

Higher Rehabilitation and Reconstruction Costs Will Cost Taxpayers More in the Long-term if Pavement Condition Declines Due to Inadequate Preventive Maintenance

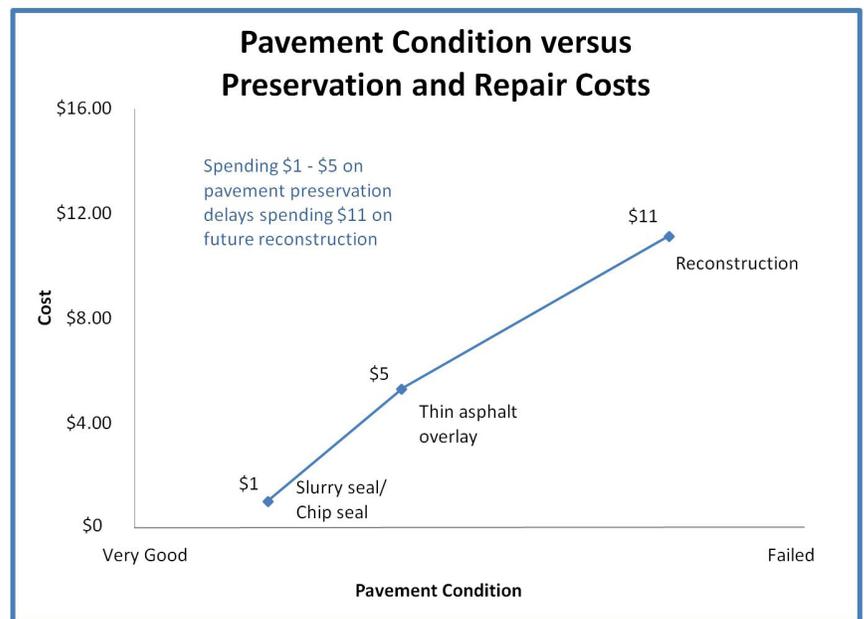
With less revenue and less road miles treated with preventive maintenance each year, the county will start to miss the window on preservation and pavement condition will decline. This will cost taxpayers more in the long-term due to the higher costs of repair, rehabilitation, and reconstruction.

Some of Lane County's roads are already beginning to show signs of deterioration, such as alligator cracking and potholes. Once the county misses the window on preservation treatment, the base structure of a road can fail. If the base structure fails, preventive maintenance will no longer protect the road and the road's expected life will shorten exponentially. Then the county can patch sections of the road to provide some life extension, but eventually the road will require reconstruction.

As the chart below shows, the county can spend \$1 to \$5 on timely preservation treatment or \$11 on future reconstruction.

Decreased Customer Satisfaction and Higher Vehicle Operating Costs May Result if Pavement Condition Declines

Lane County Residents have come to expect good quality pavement. This is due to historic timber funding levels and a long-term pavement preservation program, which have resulted in historically good pavement condition. Residents will become less satisfied, if Lane County's roads begin to deteriorate due to less preventive maintenance efforts.



If roads begin to deteriorate, causing potholes or uneven surfaces, Lane County residents may also be impacted by higher vehicle operating costs. TRIP, a nonprofit national transportation research group, reports it costs car owners an average of about \$500 annually in added vehicle operating costs due to driving on distressed roads. The added vehicle operating costs are due to increased vehicle deterioration and depreciation, thus the need for more frequent vehicle maintenance.

There are some road safety concerns due to poor road condition. According to crash data compiled by the National Highway Traffic Safety Administration, road condition can be a factor in vehicle crashes. However, the Administration reports only a very small percentage of vehicle crashes were due to roadway conditions.

In addition, if roads begin to deteriorate, Lane County risks higher liability claim costs. Liability claims can result if a vehicle is damaged by a pothole or other road defect.

BRIDGE CONDITION

Bridge Preservation Programs Extend the Life of Bridges and Cost Less

Bridge preservation and maintenance activities are cost effective ways of maintaining bridges. Bridge preservation includes actions that prevent or delay the deterioration of bridges, keep bridges in good condition, and extend their life.

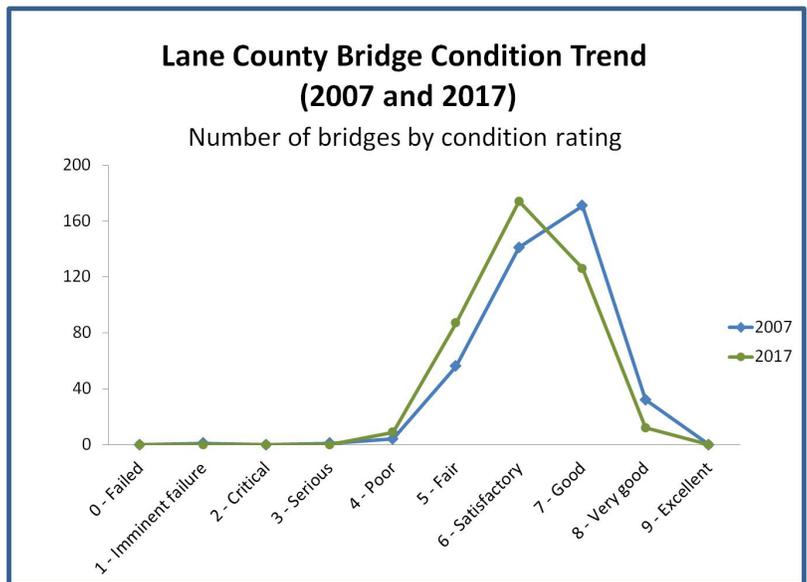
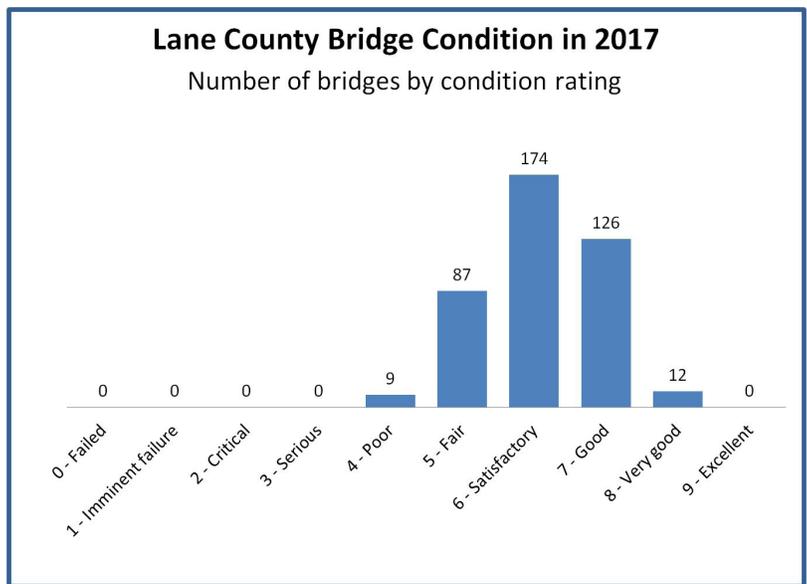
Effective and timely bridge preservation actions can delay the need for costly repair or reconstruction. This includes applying preservation strategies and actions on bridges while they are still in good or fair condition.

A preservation program requires sustained and adequate funding sources and adequate processes to ensure the appropriate treatments are applied at the appropriate time. Bridge preservation also includes regular needs assessments to identify, prioritize, and estimate the cost of planned work.

Currently 98% of Lane County's Bridges are Rated in Fair or Better Condition, but Condition has Declined in the Past 10 Years

Of Lane County's 408 bridges on the National Bridge Inventory, 98% are currently rated in fair or better condition. This high percentage reflects that Lane County has historically had a bridge preservation program vs. a replacement program. It also reflects the fact that most of Lane County's bridges were re-built in the 1970's and 1980's when federal timber funding was plentiful.

Although most of Lane County's bridges are rated as fair or better, there are now more bridges rated as fair than 10 years ago. Currently, 21% of bridges are rated in fair condition, up from 14% in 2007. Also, there are now less bridges rated as good and very good than in 2007.

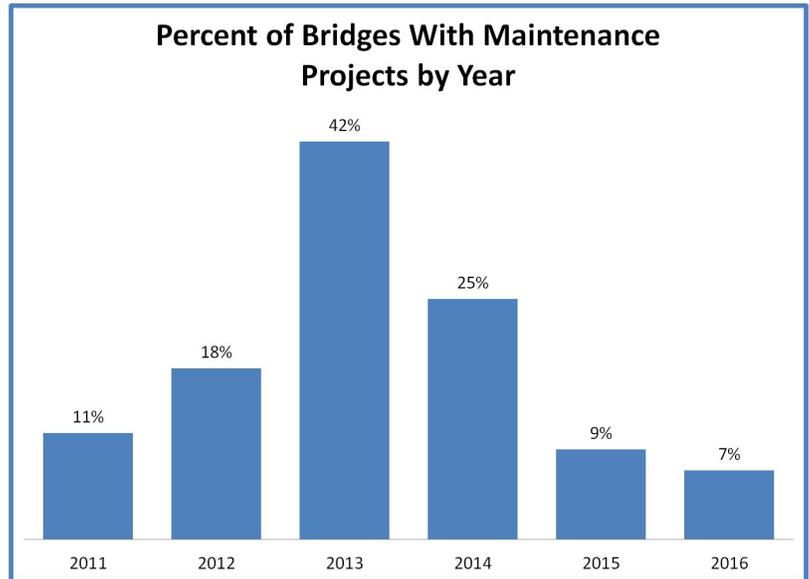


BRIDGE CONDITION

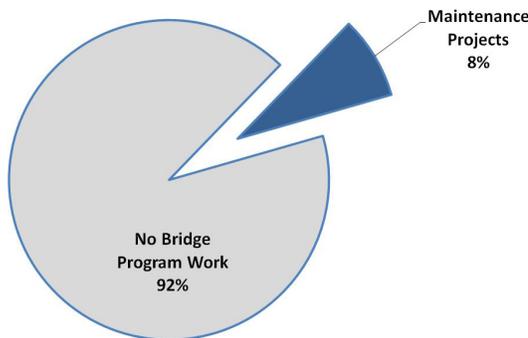
Routine and Preventive Bridge Maintenance Activities Have Declined in Recent Years

Due to budget reductions for maintenance supplies and staffing reductions, the number of bridges with routine and preventive maintenance activities has declined.

In the past 2 years, the Bridge Program completed maintenance projects for an average of 8 percent of bridges, leaving 92 percent of bridges with no maintenance work.



Average Annual Percent of Bridges with Maintenance Projects in Past Two Years



Current Preventive Maintenance Efforts Fall Short of That Needed to Maintain Good Bridge Condition

Due to budget and staffing cuts, the Bridge Program has not been able to keep up on needed bridge maintenance work to keep bridges in fair or good condition.

Industry experts recommend routine preventive maintenance work should be done on each bridge at least once every 3 to 10 years to maintain good condition. In recent years, Lane County's bridge maintenance work has become more reactive than routine or

preventive. The Bridge Program is currently not able to keep up with the list of maintenance projects that need to be done.

If basic preventive maintenance work is not kept up with, there is a risk bridges in fair condition will slip into poor condition. Of Lane County's 87 bridges rated in fair condition, 26 (30%) had no maintenance activity in the past six years.

It is the Bridge Program's responsibility to address all critical and urgent inspection recommendations, and to prioritize routine maintenance recommendations.

Based on the most recent bridge inspections, there were 378 bridges with routine maintenance recommendations. For 157 (42%) of those bridges, we found no documented bridge maintenance activity in the past five years. Oregon Department of Transportation bridge inspectors estimate this backlog of routine maintenance will cost Lane County just under \$1 million.

BRIDGE CONDITION

At the time of this review, Lane County had 11 bridges with outstanding urgent maintenance recommendations and no outstanding critical recommendations. Maintenance work is planned during the summer of 2017 to address the urgent recommendations for 9 of the 11 bridges. Two bridges have urgent recommendations that require design work, and this design work is currently underway.

Bridge Replacement is More Costly than Preventive Maintenance

If current maintenance efforts continue, Lane County's bridges are at risk for deterioration, higher repair costs, and costly bridge replacement.

For example, Lane County's Bridge Program failed in recent years to monitor the steel cathodic protection and prevention systems on its bridges. This lapse in monitoring caused steel piling section loss to occur on 13 bridges, which will require costly repairs.

The cost of restoring a structure to satisfactory or good condition is significantly greater than regularly maintaining the structure in good condition. Preventive maintenance is intended to delay the need for costly bridge replacement.

Bridge replacement can cost millions. For example, Lane County recently contracted out for the reconstruction of Cash Creek Bridge in Marcola at a total cost of \$1.6 million. If Lane County's bridges continue to deteriorate due to lack of preventive maintenance, the cost to the county for replacing these bridges will be significant.

Another impact of lack of preventive maintenance is a bridge may need to have load restrictions if the condition of the bridge deteriorates. Having load restrictions can affect the movement of commercial goods across those bridges, impacting the local economy.



Office Covered Bridge

CONCLUSION

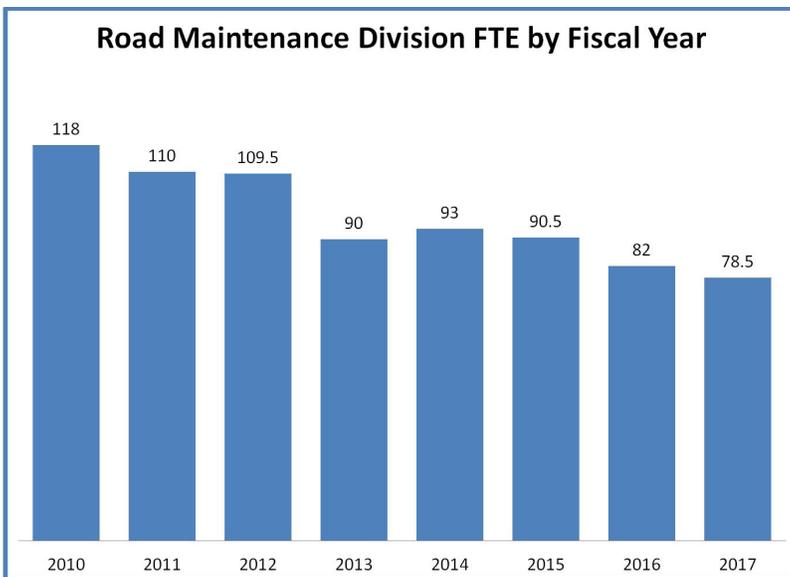
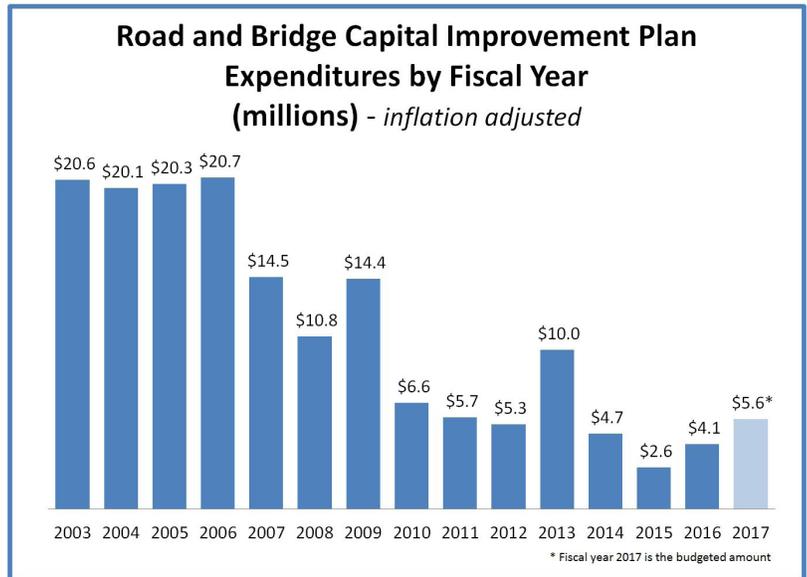
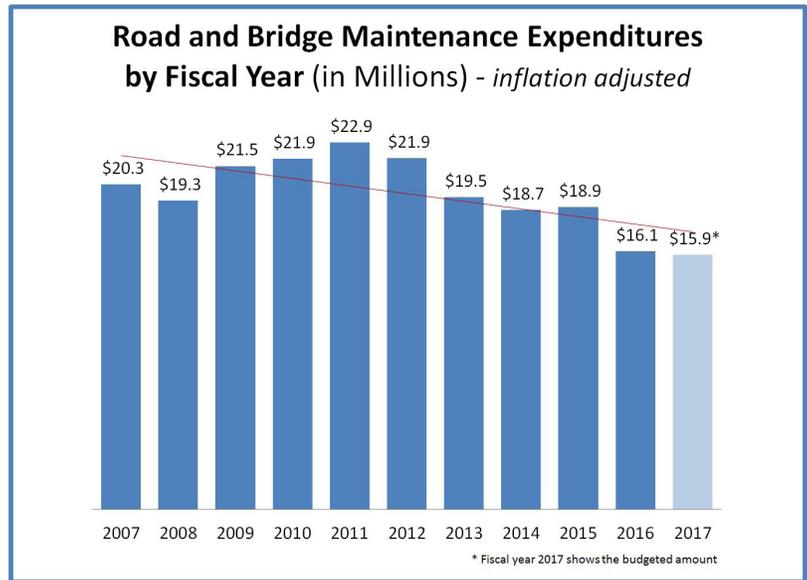
Current Funding Falls Short of What is Needed to Maintain Effective Pavement and Bridge Preservation Programs

Current Road and Bridge Maintenance Division funding is inadequate for keeping up with preventive maintenance projects and supporting effective pavement and bridge preservation programs. Due to the decline and end of federal Secure Rural School funding, total Division expenditures and staffing levels have gone down. Capital Improvement Plan expenditures have also gone down. These reductions have impacted the Division's ability to keep up with needed preventive maintenance activities for both roads and bridges.

The Division's expenditures are down 7 million since Fiscal Year 2011 when adjusting for inflation.

Adjusted for inflation, Road and Bridge Capital Improvement Plan Project expenditures are down significantly since fiscal year 2006.

Road and Bridge Maintenance Division positions, represented in full-time equivalent (FTE) employees, are down 39.5 FTE between Fiscal Year 2010 and 2017.



Toward the end of this audit, the Oregon Legislature was reviewing a proposed state transportation funding package worth \$8 billion over 10 years. The funding would come from a higher gas tax, higher vehicle registration fees, new taxes on cars and bicycles, and a statewide payroll tax. If the Oregon Legislature passes a transportation funding bill, Lane County will likely see increased revenues to help fund its road and bridge preservation activities.

CONCLUSION

Lane County Lacks Formal Preservation Management Strategies and Lacks a Long-term Asset Management Plan for Roads and Bridges

Lane County lacks formal preservation management strategies and lacks a long-term asset management plan for roads and bridges. Transportation agencies world-wide have found that cost-effectively keeping assets in good condition requires long-term asset management strategies linked with long-term financial plans.

A Long-term asset management plan is a decision-making tool. Industry best practices recommend developing long-term asset management plans for assets with long useful lives, such as roads and bridges. Best practice asset management plans include a stated preservation strategy, performance targets, maintenance plans, and a financial plan. The asset management planning process can also engage stakeholders and incorporate performance monitoring. The core elements of asset management planning include:

Strategies and Goals – Alignment with preservation strategies, which requires an organization to have a clear set of strategic goals

Performance Targets – Defined performance measures and targets that support the goals and strategies, and expected and desired asset performance and condition into the future

Maintenance Plans – Preservation and maintenance activities for each type of asset, and the amount of effort required each year for the preservation, maintenance and rehabilitation of assets during their useful life

Financial Plan – Identified funding needs and any gaps in funding for cost-effective planned maintenance activities, and establishment of how the agency will address the resources needed to achieve and sustain the long-term asset management strategies and goals

Engaging Stakeholders – Engagement with stakeholders in the decision-making process, and providing stakeholders with the information needed to support decisions, such as results of analyses and the implications of different investment decisions on asset performance

Performance Monitoring – Determine the results of plan decisions through annual monitoring and reporting of progress toward goals, performance targets, and implementation of planned activities

We found Lane County lacks a formal preservation management strategy for both roads and bridges. We found the Road and Bridge Maintenance Division currently identifies, prioritizes, and selects pavement and bridge preservation and rehabilitation projects based on an annual planning cycle. The Division also lacks a planner who could assist the Division in long-term asset management planning efforts.

CONCLUSION

Lane County Lacks an Effective Bridge Management System

Lane County's bridge management system is outdated and lacks best practice features, such as tools for planning, prioritizing, and budgeting bridge maintenance and preservation projects. The Bridge Program uses components of Lane County's Road Maintenance Information System (RMIS). RMIS is a business application system developed by Lane County's Technology Services Department, and upgraded almost 10 years ago.

The Federal Highway Administration recommends using an effective bridge management system to help facilitate a bridge preservation program and plan activities to extend the life and function of bridges. An effective bridge management system should include the ability to:

- Collect, process, and update bridge inventory and inspection data
- Track bridge condition ratings
- Define goals and objectives and monitor progress toward goals
- Identify and prioritize preventive maintenance needs
- Evaluate and report on the planned and accomplished preventive maintenance work
- Run mathematical models to predict deterioration, predict costs, forecast budget needs, and select recommended maintenance projects and schedules



Deerhorn Road
by Gary Halvorson, Oregon State Archives

RECOMMENDATIONS

To perform adequate preventive maintenance to protect Lane County's road and bridge assets and save taxpayer money over the life of these assets, we recommend Lane County:

- Adopt formal road and bridge preservation management strategies with condition and performance targets
- Develop a formal multi-year asset management plan, which is in addition to or incorporates the Capital Improvement Plan, and that includes:
 - Stated road and bridge preservation management strategies and performance targets
 - Road, bridge, and storm sewer system infrastructure maintenance plans, including planned pavement treatment miles per year and planned bridge maintenance projects
 - Identified annual funding needs and budget allocations
 - Current road and bridge condition ratings, and the number of bridges with weight or other functional limitations
- Identify alternative revenue solutions and seek tax payer support if gaps in funding are found during the multi-year asset management planning process
- Report annually on progress toward implementation of the multi-year asset management plan, including on progress toward planned activities, goals, and performance targets
- Consider adding back a planner position in the Road & Bridge Maintenance Division to assist with asset management planning efforts
- Work with the Technology Services Department to plan for and implement a new bridge management system that follows current industry best practices



Waldo Lake Road
by Gary Halvorson, Oregon State Archives

SCOPE AND METHODOLOGY

Our audit objective was to assess the current condition of Lane County's road pavement and bridges, and evaluate management strategies and funding needs for protecting the county's road and bridge capital assets. Our audit scope included the Road and Bridge Maintenance Division's pavement maintenance and bridge maintenance programs, but excluded culvert and storm sewer system maintenance.

We applied different audit methodologies to obtain and analyze information related to the audit scope and to support developing and testing the audit objective. The methodologies included the following:

- Researching criteria and best practices, including industry publications, for pavement preventive maintenance programs, evaluating remaining service life, and planning preventive treatments that have the greatest impact on network condition
- Researching criteria and best practices for bridge preventive maintenance programs
- Reviewing documentation to understand the Division's goals and activities related to pavement and bridge maintenance
- Collecting and analyzing data to determine the current Pavement Condition Index ratings of Lane County's roads, and comparing Lane County against similar counties
 - As part of analyzing the Pavement Condition Index ratings, we gained an understanding of pavement condition index scores and rating categories, pavement inspector data collection methods, and the pavement management system, StreetSaver
 - We assessed the reliability of pavement condition index data and determined that the data were sufficiently reliable for the purposes of this audit
 - We relied on the data provided by other county road agencies and did not independently assess the reliability of this data
- Collecting and analyzing data to determine the current condition ratings of Lane County's bridges
 - As part of analyzing the bridge condition ratings, we gained an understanding of bridge inspection scores and rating categories, Oregon Department of Transportation (ODOT) bridge inspector data collection methods, and ODOT's bridge inspection information system
 - We assessed the reliability of bridge condition inspection data and determined that the data were sufficiently reliable for the purposes of this audit
- Conducting field observations for a select number of roads
- Interviewing Division personnel and reviewing documentation on road and bridge maintenance activities currently being provided, the capacity for those activities, and any gaps in needed maintenance activities
- Analyzing projected funding needs to maintain Lane County roads in good condition
- Reviewing the StreetSaver generated scenarios performed by Division staff
- Reviewing documentation on historic service level trends, staffing trends, and expenditure trends
 - To account for inflation, we expressed expenditure trend data in constant dollars by adjusting dollar amounts for each prior year to equal the purchasing power of money in 2016; using the Consumer Price Index – All Urban Consumers U.S. City Average, as reported by the Bureau of Labor Statistics, U.S. Department of Labor
- Interviewing Division personnel and reviewing documentation to understand current maintenance management strategies, maintenance information systems, and maintenance planning and prioritization methods

SCOPE AND METHODOLOGY

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

DEPARTMENT RESPONSE



Lane County Public Works Department

June 6, 2017

Shanda Miller
Lane County Performance Auditor
125 East 8th Avenue
Eugene, OR 97401

Dear Shanda,

The Public Works Department would like to thank you and Shanna Bressie for your time and effort in performing this Audit. Your work has augmented some information we have previously known but has also provided us with new insights and perspectives. The Auditing Team worked closely with Road and Bridge Maintenance Staff, and in general the Public Works Department agrees with the methods of assessments of our operations, and with the conclusions reached. The concept of Expected Road Service Life Gained per year as compared to Road Miles Maintained is new to this Department and is a metric we will use in determining the adequacy of our maintenance and preservation efforts, not only in roadways but in other areas of maintenance as well.

Specifically, Public Works agrees that the following system or process improvements are needed in order to adequately maintain the County's road and bridge assets:

- Develop and adopt formal road and bridge preservation management strategies with condition and performance targets – Target Date – June 2019 – may be dependent on funding of a new Planner Position
- Incorporate Expected Road Service Life Gained per year versus Road Miles Maintained into our yearly review of Road and Bridge Maintenance and Preservation activities – Target Date - Immediate
- Develop a formal multi-year asset management plan, which incorporates the Capital Improvement Plan. This plan will include:
 - The adopted road and bridge preservation management strategies and performance targets identified above – Target Date: June 2019
 - Road, bridge, and storm sewer system infrastructure maintenance plans, including planned pavement treatment miles per year and planned bridge maintenance projects – Target Date: Annually

DEPARTMENT RESPONSE

- Identified annual funding needs and budget allocations – Target Date: – January 2018 for the Project phase/January 2019 for the implementation phase of the plan - then Annually
- Current road and bridge condition ratings, and the number of bridges with weight or other functional limitations – Target Date - Annually
- Work with Technology Services to Identify the most cost effective solution for implementing Road and Bridge asset management software – Target Date – Begin immediately with implementation target date July 2019
- Determine the current workload and expertise of existing staff and determine whether asset maintenance planning can be accomplished with current staff or if a planner will be needed – Target Date – September 2017
- Report annually on progress toward implementation of the multi-year asset management plan, including progress toward planned activities, goals, performance targets, identified funding shortfalls. Asset management plan will include projects and priorities for the items in this report and for items not included in the scope of this report, three of which are identified below. – Target Date – April 2018 – Annually thereafter

Limitations of the Performance Audit

There are areas we have identified that were not included in the Audit that will affect the prioritization of Road and Bridge maintenance funding including: seismic vulnerability of bridges, maintenance of the MS-4 system and upcoming changes to NPDES permitting requirements, and safety issues affecting Lane County roads.

The Oregon Department of Transportation is determining critical routes that will be necessary in the event of a catastrophic earthquake associated with the Cascadia Subduction Zone. This analysis will also include the bridges that will be seismically vulnerable along the critical routes. A high level cost analysis will be accomplished as a part of that study, and it will be necessary for the county to include that information when prioritizing future funding needs.

The audit also did not include the Municipal Separated Storm Sewer System (MS-4) in the urban areas of the county. The infrastructure of the MS-4 is aging and neither the maintenance nor reconstruction/rehabilitation of the system was within the scope of this audit. In addition, this storm sewer system is governed by a National Pollutant Discharge Elimination System (NPDES) permit which is regulated by the Oregon Department of Environmental Quality. Lane County is currently operating our MS-4 under an existing NPDES permit. However, in 2015, the Oregon DEQ hired a consultant to evaluate the NPDES permitting program and the recommendations from the consultant will result in upcoming changes in the permit requirements to ensure DEQ is regulating discharges so Oregon's waters meet state water quality standards. It will be necessary for the county to include

DEPARTMENT RESPONSE

maintenance of the system and the upcoming changes in the storm water permitting regulations when prioritizing future funding needs.

Finally, the audit did not include the need for safety improvements on the county road network. The county is in the process of developing a Transportation Safety Action Plan (TSAP) which will identify engineering, maintenance, education and enforcement actions that can be implemented to improve the safety of the traveling public. It will be necessary for the county to include this information when prioritizing future funding needs as well.

There will certainly be additional items identified in the future that will have to be taken into account when prioritizing the future maintenance needs of the road and bridge network including unexpected failures of segments of the road network due to weather or other events, permitting requirements that can and will affect the cost of roadway maintenance activities, weather events that require greater than anticipated county resources, among others.

Thank you again, for such a thorough analysis of the Road and Bridge Maintenance Division.

Sincerely,



Tim Elsea
Public Works Director