Cost of Bad Roads in Oregon

Oregon's State Highway Fund is currently insufficient to sustain current conditions of Oregon's pavement and bridges. This is true for all roads in the state, regardless of ownership. As a result, conditions will deteriorate over time, bridges will not be able to carry heavy freight trucks or heavy emergency vehicles, and the number of road closures will increase. Transportation costs in Oregon will rise, increasing the cost to businesses, workers and consumers, negatively impacting safety, and reducing Oregon's economic competitiveness over time. Oregon will forfeit thousands of future jobs and lose out on billions of gross domestic products.

European Union countries are dealing with infrastructure older than Oregon and they have studied the effects of systemic backlogs in maintenance:

"… a backlog of outstanding maintenance has caused irreversible deterioration of the road network. If insufficient maintenance is carried out, roads can need replacing or major repairs after just a few years. That deterioration spread across a road system very quickly results in soaring costs and a major financial impact on the economy and citizens. … Although road traffic injuries occur for a multitude of reasons, the condition of the road surface is an important factor in preventing crashes."

Aging Infrastructure

Oregon depends on a safe and efficient transportation system to move people and goods and maintain our competitive position in a global market. Oregon is a trade-dependent state, relying heavily on exports from our farms, forests and factories to create jobs. The state's transportation system is vital to the economy; one in five jobs in Oregon is in transportation or trade-related industries.

Over half of Oregon's 2,773 bridges were built before 1970. Most of these bridges have reached or exceeded their 50-year design life and were not built to withstand a major seismic event. Many bridges will need to be replaced or undergo major repair in the foreseeable future. Nearly one third of state highway bridges are forecast to be in poor condition by 2036, with about 370 bridges projected to be weight restricted. Weight restricted bridges force heavy trucks to detour and impact emergency vehicle accessibility. Similarly, ODOT pavement funding is insufficient to preserve and maintain over 8,000 miles of state highways. Beyond 2030, ODOT can only afford to pave interstate. Without additional investment nearly half of state-owned highway pavement will be in poor condition by 2036. The 2024 County Road Needs Study forecasts a 59% funding shortfall over the next 5 years to meet needs like maintenance and safety.

Maintaining bridges and pavement is like maintaining a house. If the roof starts to leak, you repair it to make it last longer and delay the need to replace it in the future. In the later stages of a pavement's service life, deterioration occurs at an increasing rate, making it critically important not to defer preservation treatment much longer. If treatment is applied before a pavement reaches poor condition, the service life can be extended for a fraction of the cost of reconstruction. Deferring maintenance just a few years will cost much more in the long run. According to the American Association of State Highway and Transportation Officials, every dollar spent on road maintenance avoids $8 to $19 needed later to rebuild a road that has irreparably deteriorated.

Bridges last much longer than pavement, but regular maintenance is also required to keep them in good condition. For example, bridges depend on paint to protect them from corrosion and maintain structural integrity. They are inspected every 2 years and if painting is delayed when needed, additional costs arise quickly as repairs or replacement of corroded components become necessary. Extended delay of paint protection may result in weight restrictions due to a compromised structure. Preserving existing infrastructure is key to ODOT's good stewardship of the state transportation system and minimizing lifecycle costs of expensive assets.

The Cost of Doing Nothing

The traveling public and businesses have become accustomed to using the transportation system to benefit their lives and livelihoods. They expect these systems to continue to provide safe and reliable travel in the future. This is why maintaining existing transportation assets is a priority for ODOT, as stated in the long range 2023 Oregon Transportation Plan and the short term Strategic Action Plan of the Oregon Transportation Commission.

In early 2017, ODOT produced a study evaluating the potential economic impacts of deteriorating infrastructure due to insufficient investment to maintain and preserve the current transportation system: "Rough Roads Ahead 2: Economic Implication of Deteriorating Highway Conditions". *The results of the analysis prepared in Rough Roads Ahead 2 remain relevant today.* The study shared three key findings:

1. Oregon's economy depends on a good transportation system – businesses and households rely on a safe, well-functioning transportation system.
2. Road conditions will deteriorate – the 20-year forecast budget for the state highway system is insufficient to preserve and maintain current conditions of pavement and bridges going forward. As a result, highway conditions will deteriorate over time and user costs will rise and safety will be impacted.
3. Pay now or pay more later – weight restricted bridges increase the cost of shipping goods by truck because more time and distance is necessary to reach their destinations; rough pavement increases wear and tear on all vehicles, slows down traffic speeds, and create hazards impacting safety.

The study describes how an inadequately maintained transportation system is likely to result in future job losses, fewer businesses, and reduction in gross state product. More importantly, as stewards of a large valuable public asset, it is more affordable to keep up with infrastructure

maintenance than to let conditions deteriorate, requiring larger investment to get facilities back to acceptable condition. The study compared different scenarios to evaluate the trade-offs associated with different levels of funding and the associated levels of system deterioration.

The study cost estimates did not anticipate the high level of inflation experienced recently, meaning the economic impacts would be larger if the analysis were updated using actual cost data since 2016. Four exploratory funding scenarios were used to identify potential impacts to the state economy, illustrated in **Table 1.**

Table 1. Rough Roads Ahead 2: Deteriorating Highway Conditions Analysis Scenarios

Scenario 1: Current ODOT forecast budget for the state system (from 2016 ODOT revenue forecast).	**Scenario 3**: Hypothetical "What Would It Take" to preserve and repair the entire network of Fix-It priority routes.
Scenario 2: Limited expansion of current investment; adds the remainder of Interstate-5 and Interstate-84 to the limited network that can be addressed under the current budget.	**Scenario 4**: Hypothetical "What Would it Take" to maintain current bridge and pavement conditions for the entire state-owned and operated system, including seismic preparation.

Results from the 4 scenarios are presented in **Table 2**. The study quantified the economic benefits and costs associated with different funding levels. As the backlog of bridge and pavement maintenance and preservation is addressed, future negative impacts to the Oregon economy are reduced. However, funding only providing enough to address investment needs of the interstate system and several priority corridors on the state "Fix-It" routes fails to mitigate negative impacts to the rest of the state highway system. Negative impacts occur resulting in future lost jobs, reduced Gross Domestic Product (GDP) and over 300 bridge weight restrictions.

Table 2: Rough Roads Ahead 2: Scenario Analysis Summary of Results

	Scenario 1 Current Funding	Scenario 2 Limited Highway Corridors	Scenario 3 Preserve Priority Corridors	Scenario 4 Meet Needs
Economic Impacts				
Forfeit Jobs	75,000 - 120,000	70,000 - 90,000	50,000 - 60,000	0
Lost GDP, billions	$155 -$605	$144 - $355	$88 - $156	0
State Infrastructure Condition				
Bridges Repaired	130	355	482	1179
Bridges Weight Restricted	370	317	272	0
Pavement % Fair or Better	53%	68%	76%	90%
20 Year Budget,* billions	$8.7	$14.7	$17.7	$25.5
Bridge Backlog, billions (disinvestment)	$7.4	$5.7	$4.3	$0.0
Pavement Backlog, billions (disinvestment)	$4.6	$2.5	$1.7	$0.0
* See scenario descriptions for detailed list of assumptions. Increased budgets are for 20-year core highway budget categories only: Maintenance, Pavement, Bridge, Seismic, Enhance and Other, not entire ODOT budget; dollars are expressed as 2016 values.				

Climate Patterns are Stressing an Already Stressed System

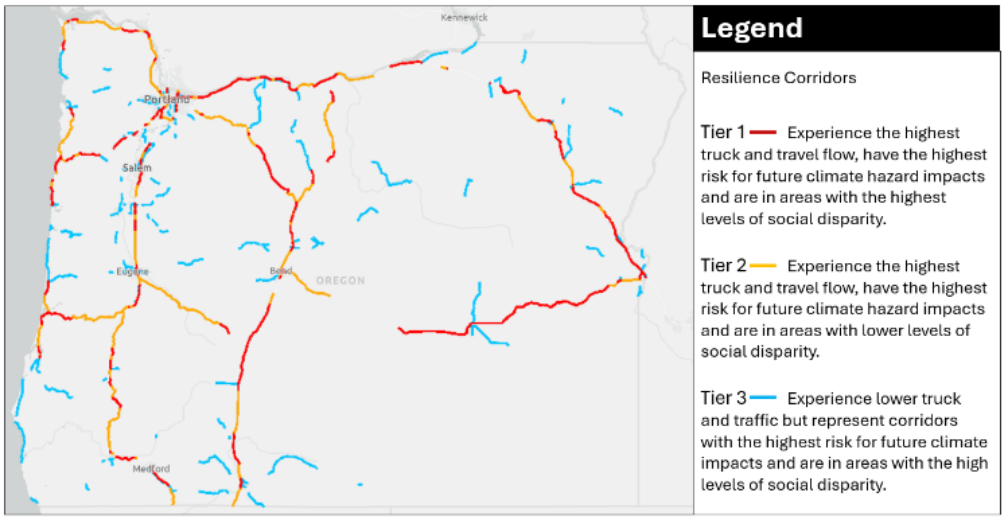
In addition to deterioration from aging pavement and bridges, the transportation system is being damaged by more frequent and severe weather and climate in Oregon. Federal Highway Administration estimates 24% of total damage to rigid pavement (cement) and 36% of damage to flexible pavement (asphalt) are caused by environmental factors. Such factors include hot and cold extremes and heavy rainfall, snowfall or ice. Infrastructure is designed based on typical historic climate conditions that reflect local temperature ranges and precipitation. However, in the last few decades weather patterns have been changing, more extreme events than usual have occurred in frequency and severity. These patterns are accelerating deterioration, causing maintenance needs to accelerate as well.

Maintenance identifies and mitigates small issues before they become big problems, saving money down the road and reducing overall risk, in addition to improving day-to-day safety for Oregonians. State highway maintenance is primarily performed by ODOT crews and includes a range of activity that is either proactive or reactive:

- Proactive maintenance: planned actions to keep the system in good condition, such as sealing pavement cracks, cleaning drainage systems, and maintaining roadside vegetation. These actions prevent deterioration of the highway system and reduce safety risks.
- Reactive maintenance: response to incidents or weather to correct an immediate problem, such as repairing damage from a crash, addressing wildfire damage, clearing and repairing landslides, repairing damage from flooding, plowing snow and sanding/deicing the roadway.

Changes in climate patterns are stressing the transportation system and maintenance budgets. ODOT prepared the Climate Adaptation and Resilience Roadmap carefully evaluating vulnerability across the state. This resulted in a tiered approach to prioritizing climate preparation and mitigation across the state highway system, summarized in **Figure 1**. Tiers 1 and 2 include ODOT priority corridors, which have higher truck and traffic flows and are given preference for maintenance and other investments. Tier 3 includes lower truck and traffic flow corridors that have historically not received preference for maintenance or other investments due to funding shortfalls.

Figure 1. ODOT Resilience Corridors



This study also reported real-world examples illustrating the range of climate hazards and the impacts to communities including:

- Inland Flooding: February 2020 rain and snow melt, driven by an atmospheric river, led to disaster-level flooding that caused evacuations, rescues and deaths near Pendleton, Oregon. I-84 was closed to at least one lane of traffic for six days. Four nearby state highways were also impacted by closures (Highways 204, 207, 237 and 245). Cost estimates for road and bridge damage, and debris removal are upwards of $12 million, with an additional $17 million requested from ODOT to FHWA for damages to major transportation networks.
- Extreme Heat: more than 100 people died across Oregon during a “heat dome” event in June 2021. Temperatures soared to over 110° and lingered for three consecutive days in Oregon’s most populous cities and surrounding areas. In the Portland area, power cables melted, which disabled transit systems and caused residential outages. Businesses and schools closed due to lack of air conditioning, and roads in Washington closed due to asphalt buckling.
- Wildfire: The cost of National Forest Service fighting Oregon wildfires during the 2024 fire season reached $250 million by September. More than 1.5 million acres burned statewide, which is more than double Oregon’s 10-year average. Years 2020 and 2021 exceeded $120 million in firefighting costs.

Maintenance Case Study: Pavement Striping

Real-world examples illustrate challenges faced by ODOT and local agencies working to preserve and maintain an aging system with insufficient funding. For example, one of the most important aspects of a safe and efficient roadway is maintaining uniform application of pavement marking to delineate the roadway path, traffic lanes and pedestrian crosswalks. They serve as visual guides for safe use of the roadway system for all users and represent foundational maintenance activity providing good returns on investment. There are 3 types of pavement paint: waterborne striping paint, spray-on thermoplastic paint, and surface applied extrusion thermoplastic. Each has advantages and disadvantages:

- *Waterborne Striping Paint*: less expensive up-front, short lifespan, must be reapplied each year, higher life cycle cost but lower up-front cost.
- *Thermoplastic "Paint"*: this "paint" is a liquid traffic marking paint that is durable and versatile, able to withstand severe weather conditions, high traffic volumes, heavy trucks, chains, studded tires, and snowplows. This paint is more expensive up-front, has a longer life span, requires less maintenance, and has lower life cycle costs.

Table 3 illustrates the cost of different paint applications. Thermoplastic paint generally costs less than waterborne paint and provides considerable reductions in costs associated with labor, worker travel, less exposure to damage claims by the public, less exposure of workers to traffic injuries, less delay imposed on traffic due to fast drying times. However, pavement quality effects the life cycle of this paint, enough to impact manufacturer warranty periods. This material also requires dry surfaces for application and temperatures greater than 40°F making the application season about 50 working days a year. Budget cycles often require agencies to choose options with higher life-cycle costs in the short term to ensure safe use of the system within the boundaries of available budget.

Table 3 presents costs for one continuous stripe for one mile but does not adequately relate the challenges faced by maintenance management crews. For example, ODOT Region 3 predominantly utilizes thermoplastic paint. The annual cost of the paint alone is about $1.15 million per year. Crews focus on striping activity during the summer, but also do other necessary maintenance work, including assessing existing pavement marking condition to plan future work, provide incidence response assistance, wildfire assistance, and other needed assistance on any given day. As ODOT employees, crew members can be utilized across disciplines as needed to ensure fast response times, safe conditions and avoid reduced level-of-service to roads.

Table 3. Cost of Different Paint Striping Material Used on Pavement

	Cost	Material for One Mile continuous line	Total Cost: One Mile Line	Expected Life (Warrantee Y/N)	Annual Cost
Waterborne Striping Paint	$48 per gal.	16.5 gal.	$ 792	1 year (N)	$ 792
Spray-on Thermoplastic "paint" (R1& R3)	$1.75 /lb	1,075 lbs	$ 1,881	3 years (Y)	$ 627
Surface Applied Extrusion Thermoplastic	$2.12 /lb	1,175 lbs	$ 2,491	3 years (Y)	$ 830
Surface Applied Extrusion Thermoplastic	$3.53 /lb	1,175 lbs	$ 4,148	3 years (Y)	$ 1,383
Surface Applied Extrusion Thermoplastic	$4.12 /lb	1,175 lbs	$ 4,841	3 years (Y)	$ 1,614

Past criticism of ODOT maintenance operations has suggested this work be shifted to private contractors, implying they would be more efficient and affordable. In practice the opposite is true, shifting pavement striping alone to a consulting firm would cost more. Where ODOT pays $1.15 million in paint, a private contractor would charge $3.6 million for the same material, which is 3 times the cost ODOT pays and does not include any of the extra services provided by ODOT crews, those additional services would cost extra.

Maintenance is a very important activity for the Oregon transportation system, a less visible service provided every day by ODOT, cities and counties, to ensure roads are open and safe in the most affordable and efficient manner within the constraints of shrinking budgets and rising needs.

Conclusion

Like most transportation agencies nationwide, ODOT's transportation assets are deteriorating. Funding for maintenance and repair has not kept up with needs. Deliberate strategies of public agencies help stretch available funding and slow system deterioration, but system aging and deterioration has reached a tipping point where continued deferred maintenance will result in deterioration rates rising faster and faster over time. Once this tipping point is passed, the cost to return assets into good condition will rise much more in the future.

The Rough Roads Ahead 2 analysis estimated deterioration of the state-owned transportation system will make Oregon less competitive, reducing up to 120,000 future jobs by 2036 and up to $600 billion in lost gross domestic product by 2036. System conditions are more severe on local infrastructure, which increases economic impacts even more, with potential to increase job losses as much as 50% and GDP losses quadruple estimated losses caused by the state system deterioration. Vehicle repair and operating costs to users will rise as pavement conditions deteriorate and heavy trucks and heavy emergency vehicles must detour around weight restricted bridges. By 2036, an estimated $5.25- $7.2 billion (adjusted for inflation to 2024 dollars) would be required to return degraded pavement to current conditions.