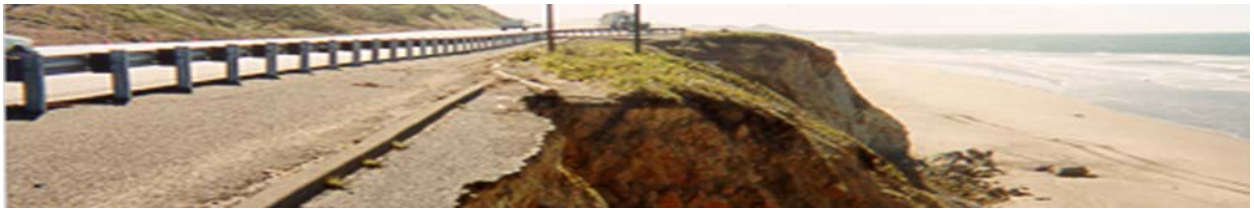
An Adaptation Menu of Investment Options

Potential Transportation Investments to Adapt to Climate Change Impacts



This document focuses on adaptation, while the companion piece – *Carbon Reduction Menu of Investment Options* – focuses on mitigation. A comprehensive approach for addressing climate change includes both *mitigation* and *adaptation* strategies.

Overview

Extreme weather and climate change pose a serious and increasing risk to transportation systems. Oregon is facing many of these threats now and they are projected to get worse in the coming decades. According to the Oregon Climate Assessment Report (OCAR),[1] the state will continue to experience climate variability and extremes in the form of increasing annual air temperatures, wildfires, and changing precipitation patterns. The coast is projected to experience the effects of rising sea levels and higher storm surge in the coming decades.

Adaptation consists of actions to reduce the vulnerability of natural and human systems or to increase system resiliency in light of expected climate change or extreme weather events. Adapting how transportation systems are planned, designed, operated and maintained can help to reduce travel delays and disruptions for all travelers, and lower transportation costs from repairs and reconstruction.

In Oregon, primary climate stressors impacting transportation include:

- Extreme Precipitation
  - Damages roads and can result in closures due to concentrated runoff and scour, flooding, landslides and rock-fall.
- Sea Level Rise
  - Damages roads and can result in closures from increased wave heights, flooding, storm surge, and coastal erosion.
- Extreme Temperatures and Wildfires
  - Damages roads and can result in closures due to extreme heat and wildfires.

The 2010 *Oregon Climate Change Adaptation Framework* looked at these and other risks, and high-level adaptation needs and activities were identified for transportation and other sectors. A few years later (2012) the Oregon Department of Transportation (ODOT) developed *ODOT's Climate Change Adaptation Strategy Report*. Both documents identify the need to better understand transportation infrastructure risks to stressors such as sea level rise through monitoring systems, and to conduct pilot projects to plan

[1] Produced biennially by the Oregon Climate Change Research Institute (OCCRI) at Oregon State University- http://www.occri.net/media/1055/ocar3_final_all_01-30-2017_compressed.pdf

and determine needed courses of action. Based on work since that time, more is understood about climate change stressors to the transportation system and probable infrastructure needs.

Overall, some of the more vulnerable parts of the state include the Oregon Coast. The coast is susceptible to extreme precipitation and sea level rise. Many other areas of the state also experience periods of intense rainfall. Such stressors require the need to address roadway drainages (e.g. culverts), armor bridges from undercutting of streams and the impacts of scour, mitigate and address landslides and rock falls, increase maintenance activities, and make other resilience improvements.

In central and eastern parts of the state, different stressors are present, such as extreme heat and wildfires. Extreme heat can cause pavements to fail faster than normal and accelerate the need to repave more frequently and address cracks and spalling. Wildfires can cause trees to fall on roadways, and slopes to become destabilized; requiring enhanced maintenance activities following a burn.

Climate Adaptation Investment Options

If transportation revenues increase within the State Highway Fund, many infrastructure investments can be made across the state to adapt to climate change stressors and make the transportation system more resilient. Funding can be focused and prioritized in locations where assets are most vulnerable and at-risk regardless of whether investments are on the state or local transportation system. Highway Trust Fund eligible investments for climate change adaptation have been organized into three primary categories: maintenance and operations, asset focus, and priority corridors. Each category is described in greater detail below and Appendix A includes more in-depth discussion of potential individual investments within each category.

Maintenance and Operations

Climate stressors will necessitate increased routine and responsive transportation maintenance activities. Examples of routine (proactive) maintenance include cleaning out of culverts and drainages, and hazard tree removal. Examples of responsive (reactive) maintenance include landslide and rock-fall removal, clearing burned and fallen trees, and serving as a “first responders” in major events such as in snowstorms, wildfires and floods. Increased investments in maintenance and operations will help keep more roads open and functional, and the traveling public safe.

Asset Focus

Assets like culverts, bridges, and pavements face unique vulnerabilities to climate change stressors, as do slopes along roadways. Many transportation funding programs are structured around specific assets like bridge and pavement, and management systems are used to make investments in the highest need locations. Asset condition information could be combined with vulnerability information to determine investments needed to address climate change adaptation needs.

Priority Corridors

Some of the more vulnerable areas of the state include roadways over mountains or along steep gradients, adjacent to rivers and low-lying areas subject to flooding, and in coastal areas subject to flooding, erosion, and storm surge. Investments could be made in vulnerable assets and in maintenance and operations within specific roadway corridors.

Potential Adaptation Investment Strategies

Additional funding is needed to support the transportation system in adapting to the impacts of climate change. More funding for maintenance and operations will help to proactively clear blockages in drainages, reshape slopes, and manage vegetation. Such funding is also essential in order to react to floods, landslides, wildfires or other disasters to not only clear roadways but to be first-responders and keep the traveling public safe. In addition to enhanced maintenance and operations, more funding will be needed for transportation infrastructure. Assets like bridges and culverts will need to be armored or upgraded in order to withstand Oregon's changing climate.

At the state level, ODOT invests in adaptation through budget categories (e.g. maintenance, and culverts) and the Statewide Transportation Improvement Program (STIP) Fix-It funding program, which includes the categories of bridge, pavement, and operations (e.g. landslides/rock-fall, intelligent transportation systems, and signs and signals). On the local system, some federal funding goes to support a local bridge program and counties and cities pay for their maintenance, operations, and assets out of their overall transportation budget. Current state and local resources, however, fall short of being able to respond to climate change impacts and the ability to make the transportation system more resilient.

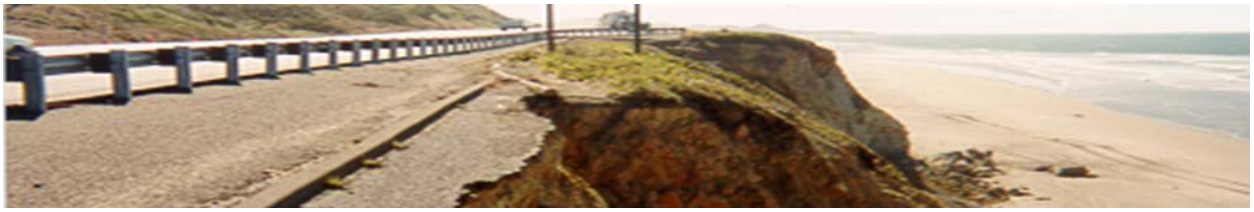
Additional State Highway Funds could be directed into existing funding programs, with a specific focus on adaptation and other important outcomes. Sub-categories of the existing programs could be created to assure that additional State Highway Funds be directed solely for adaptation or other purposes determined by policy makers.

More information on the funding programs mentioned and potential investment levels can be found in Appendix B.




An Adaptation Menu of Investment Options

Potential Transportation Investments to Adapt to Climate Change Impacts



APPENDIX A

Potential Asset Focus, Maintenance and Operations, and Priority Corridors Investments

The purpose of this appendix is to provide some specific examples of investments that could be made to support greenhouse gas emission reduction within each category. This is not an exhaustive list of potential investments, only a sampling.

Contents:

Maintenance & Operations

Overview

Road maintenance is the upkeep of the roadway system to extend the service life of roads and protect travelers from crashes and natural hazards. Maintenance includes pavement repair, striping, storm response, snow plowing and roadside vegetation management. As roadway conditions degrade they become increasingly vulnerable to impacts from extreme weather and climate change, such as scour, landslides, and washouts. In this way maintenance activities become even more important to protect against failing infrastructure and to keep roadways open and safe for travelers.

State Highway funds can be used for road improvements and maintenance operations activities.

Adaptation Menu

- Priority Corridors
- Asset Focus
- Maintenance & Operations

More frequent and severe climate impacts are increasing maintenance costs and the need to adapt maintenance practices. Maintenance crews are often the "first responders" responsible for clearing landslides, removing ice and snow, dealing with flood and fire, and responding to crashes to keep traffic moving. These types of strategies are reactive and necessary once impacts occur. Some more proactive approaches can also be taken, like cleaning culverts (drainage systems) so they don't overflow in the event of a large rainstorm, or removing hazardous trees that may fall on the road. More information on reactive and proactive approaches is described below:

- *Reactive* *"fix it if it breaks"* activities include responding to weather-related events to clear roads, responding to crashes, clearing ditches, and repairing guardrails, potholes or signals.
- *Proactive* *"spend now to save later"* activities include inspection and upkeep of bridges, culverts and pavement surfaces, and maintaining vegetation to ensure proper drainage and safety for motorists. Another strategy is clearing hazard trees from along roadways that could pose a danger during storm events.

Maintenance investments have a low-cost and a high return. Examples of maintenance activities with significant return on investment include:

- Adding winter maintenance staff, materials and equipment
- Implementing Intelligent Transportation System (ITS) to keep the system operational during extreme weather events and wildfires
- Increasing overall maintenance activities due to declining conditions of some assets, such as culverts

Across Oregon, there are more than 8,000 miles of state-managed highways and over 44,000 miles of local roads that require maintenance. An overall increase in maintenance funding is needed to deal with impacts of a changing climate. An additional $25 million per year could be used on roadways to help prepare for storms, floods, landslides, and other weather related hazards.

Example Additional Investments:

$25M per year for enhanced maintenance activities statewide.

Maintenance Strategies
Five general maintenance categories contribute to building a resilient system:

- Drainage, Slope Stability and Erosion Control
  Cleaning, repairing and reshaping of ditches, culverts, and stream channels; debris removal; erosion control; reshaping slopes and reinforcing slope stability.

- Vegetation Management
  Roadside mowing, brush removal and tree management; hazard tree removal; removing fire-impacted trees; reducing snowdrift accumulation and keeping roadways clear.

- Surface and Shoulder Maintenance
  Road repairs such as filling potholes to preserve pavement surfaces and make driving conditions safer; addressing issues with the road base and shoulder irregularities.

- Structures and Scour Protection
  Removing debris around bridges and bridge maintenance activities; replacing and enhancing structural drainage features; and placement of rock or other scour protection.

- Snow and Ice Removal Activities
  Removal of snow, ice, and slush from roadways, ramps, interchanges, and shoulders; application of approved deicer products for use in winter storms.

Example Additional Investments:

$10M per year for enhanced roadway drainage

$5M per year to improve slope stability

Sources:
Maintenance and Operations Branch data. Oregon Department of Transportation. 2016-2018.
Climate Change, Extreme Weather Events and the Highway System, Report 750, Volume 2. National Cooperative Highway Research Program (NCHRP). 2014.
Oregon Climate Assessment Report. Oregon Climate Change Research Institute. 2017.

Asset Focus
Culverts

Overview

Culverts convey water across a roadway; they prevent roadways from flooding, allow streams to flow naturally, and facilitate fish passage. During heavy rainfalls, culverts can overflow or fail causing flooding or pavement collapse. This damage can make roads impassable for days, weeks, or months, impacting statewide commerce and local economies. As heavy rainfall events become more frequent, newer or larger culverts are needed on many state highways and local roads to withstand these storms.

State Highway funds can be used to replace culverts to help highways and local roadways remain functional.

Adaptation Menu

- Priority Corridors
- Asset Focus
- Maintenance & Operations

Culverts are not typically visible to drivers, but provide critical drainage under Oregon's roadways. Many of today's culverts were installed when roads were originally built and several date back to the early 1900s. While many have outlasted their 40-50 year design life, they are all the more susceptible to the impacts of storms and extreme rainfalls that are projected to occur more frequently due to climate change. Even culverts in good condition, may be too small to handle heavy precipitation events. Overall, extreme weather and a changing climate - including more frequent and higher intensity storms - are projected to make these assets increasingly vulnerable to undercutting, degradation, and failure in rural and urban areas across the state.

Replacing Old Culverts

Culverts that outlast their design life are on borrowed time. For example, of ODOTs approximately 38,000 culverts, 30 percent are in poor or critical condition. These are extremely susceptible to damage or failure from storm surges or downpours. Failures may result in the form of sinkholes, slides, washouts, or flooding of roadways.

The cost of a proactive culvert replacement typically averages $125,000 to $150,000. It can cost upwards of $1,000,000 to replace a culvert once it fails due to road damage, closures, and reconstruction costs. Failure can also significantly impact local communities, such as the isolation and economic impacts that befell the community of Oceanside when a culvert collapsed a few years ago, or across Tillamook County when dozens of culverts failed in 2015, closing many roads in the area.

A proactive approach to culvert replacement is needed, especially in areas vulnerable to storms. Current investment levels are insufficient to bring culverts up to good condition on state and local roadways. However, focused investments can improve the worst culverts in the most vulnerable areas. For example, an additional investment of $20 million per year would allow culverts to be replaced along the Oregon coast, greatly improving resilience to storms, improving fish passage and native habitat, and addressing deteriorating conditions.

Culvert failure on U.S. 101 along the south coast (Dec 2014).

Example Additional Investments:

$20 million per year for culvert replacement along the coast

$20 million per year for culvert replacement statewide

Example Additional Investments:

$5 million per year for 10 years to upsize small culverts

Upsizing Small Culverts

For culverts that are in good condition and not slotted for replacement, there may still be a need to replace them because they are too small. Some culverts may need to be upsized (made larger) to accommodate higher flows and be better protected to handle washouts or undercutting. Larger culverts can have added co-benefits to the environment, such as supporting fish passage.

The size of the culvert needed is determined by forecasted storm runoff. The data for runoff is much better now than 50-70 years ago when many of the culverts were placed.

Investments should be focused on locations with heavy recurring rain storms and water flows, where the drainages are too small. Focus should be placed on addressing those culverts in good condition that are undersized, whereas other culverts should be addressed through culvert replacements due to condition.

In winter 2015 a series of major storms hit northwest Oregon and brought record-breaking rainfall, high winds, and high tides. Tillamook was one of the counties that experienced a state of emergency. Communities were isolated since state highways and local roads were closed due to flooding, failed culverts, landslides, and sinkholes. Inadequate culverts were identified as the main reason most roads didn't withstand the storms, resulting in nearly $20 million in damages.

Sources:

Oregon Climate Assessment Report. Oregon Climate Change Research Institute. 2017.

Culvert program data. Oregon Department of Transportation. 2016-2018.

Climate Change: Extreme Weather Events and the Highway System, Report 750, Volume 2. National Cooperative Highway Research Program (NCHRP). 2014.

ASSET FOCUS
Wildlife Crossings

Overview

Wildlife crossings are used to allow wildlife to move safely from one side of the road to the other and keep motorists safe from potential collisions. As Oregon's climate changes, so do the migration patterns of wildlife. Animals rely on habitat connectivity for access to food, to reproduce, to migrate, and for species to survive. Roads can form significant barriers to wildlife corridors and migration routes. Migration routes crossing roadways in turn pose threats to human safety and wildlife populations through vehicle-wildlife collisions.

State Highway Funds can be used for wildlife crossings to assure safe roadway operations

Adaptation Menu

- Priority Corridors
- **Asset Focus**
- Maintenance & Operations

Wildlife-vehicle collisions present substantial safety hazards to our traveling public, resulting in costly vehicle damage, human injuries, and deaths. In Oregon, at least two fatalities per year are a direct result of a wildlife collision. In 2017, the state had over 7,000 wildlife-involved traffic collisions. Research has shown that crossing structures present an opportunity to reduce wildlife-vehicle collisions by 85 percent.

Climate change is expected to have increasing impacts on wildlife habitat. Changes in wildlife movement have already been observed with increasing temperatures. The distributions of many terrestrial species is currently shifting in response to a changing climate, and more animals are expected to be on the move. These changing patterns in wildlife movement pose new safety challenges along roadways. There is also no dedicated transportation funding for wildlife crossing structures.

Wildlife crossings are needed on both state and local roadways, especially in eastern Oregon. Some of the highest density of wildlife-vehicle collisions on state roadways occur on US 97 in Central Oregon, US 395 near John Day, US 20 west of Ontario, I-5 in Southwest Oregon, and OR 11 south of Pendleton.

To address these and other problem areas across the state, investments can be made in animal detection systems, wildlife under-crossings, or wildlife over-crossings. Larger under-or over-crossing improvements typically cost a few million dollars, and some of the smaller under-crossing improvements like culverts can cost a few hundred thousand per location. Accompanying fencing and access points may increase overall costs per location. An investment of $5 million per year on the state and local system could help to address a wildlife crossing location each year.

Example Investments:

$5M per year for wildlife crossings in Central and Eastern Oregon

Sources

Wildlife Crossing Program, Oregon Department of Transportation, Geo-Environmental Section, 2018.

Oregon Climate Assessment Report, Oregon Climate Change Research Institute, 2017.

Bonnot, T. W., Thompson, F. R., & Millspaugh, J. J. (2017). Dynamic-landscape metapopulation models predict complex response of wildlife populations to climate and landscape change. Ecosphere, 8(7). doi:10.1002/ecs2.1890

Buttrick, S., Popper, K., McRae, B., Unnasch, B., Schindel, M., Jones, A., & Platt, J. (2016). Conserving Nature's Stage: Identifying Resilient Terrestrial Landscapes in the Pacific Northwest. Retrieved from Portland, Oregon: http://nature.ly/resilienceNW

Asset Focus
Fix-It Strategies

Overview

Fix-It Strategies support roadway improvements for assets including bridges and pavements, and for roadway operations like addressing landslides and rock-falls, placing signs, and using Intelligent Transportation Systems. Investments in these activities support a state of good repair for the transportation system to help keep roadways open and safe. Each of the main climate change stressors such as extreme precipitation, sea-level rise, and extreme temperatures and wildfires have adverse impacts on bridges and pavements, and will increase the need for enhanced operational activities.

State Highway funds are routinely used to deliver these core services which help highways and local roadways remain functional.

Adaptation Menu

- Priority Corridors
- Asset Focus
- Maintenance & Operations

The Fix-It Strategies encapsulate investments in bridges, pavements, and operations. Fix-It is a general funding category identified in the Statewide Transportation Improvement Program (STIP) used to improve system operations and roadway pavements, and repair and replace bridges.

Fix-It funds for operations are used to improve the safety and efficiency of the transportation system by addressing functional areas such as signs, rock fall and landslide mitigation, as well as Intelligent Transportation Systems (ITS) to alert drivers of road hazards or safety issues. The current condition of the system is in decline and HB 2017 only addressed half the funding needed to maintain a current system. Operational costs are likely to rise. For example, Oregon is already experiencing periods of extreme precipitation which is projected to continue and worsen, leading to destabilized slopes and the need increase spending to mitigate landslides and rock-falls. Proactive mitigation is likely to be expensive but help avoid the safety risks and economic impacts likely if roadways become blocked. An investment of $25 million per year could help to address high-risk slopes from landslides and rock-falls, as well as other operational enhancements.

For bridges, needs are likely to increase given sea-level rise and periods of intense precipitation. In coastal areas, for example, improvements will be needed to protect bridges against wave scour, flood inundation, and rising sea levels. Older bridges or those in the path of higher velocity stream flows will be at increased risk. An additional investment of $25 million per year for bridges could help prepare coastal infrastructure for climate impacts today and projected into the future.

For pavements, climate change impacts are likely to include increased rutting and cracking from weather extremes, such as more rainfall and extreme heat conditions. Increased pavement dollars can go to pavement preservation, rehabilitation or reconstruction in areas experiencing those extremes. An additional $25 million per year could be targeted in parts of central and eastern Oregon.

These new funds would targeted as describe, but will also help the growing backlog of deferred maintenance. Asset information on bridges and pavements can help to prioritize investments in climate-vulnerable areas across the state.

Example Additional Investments:

$25 million per year to address operational deficiencies

$25 million per year to address bridges along the coast

$25 million per year for pavement preservation

Sources:
Oregon Climate Assessment Report. Oregon Climate Change Research Institute. 2017
Statewide Transportation Improvement Program. Oregon Department of Transportation.

Priority Corridors
Oregon Coast

Overview

US 101 is a Lifeline Route along the Oregon Coast, providing access to communities, services, and recreation. Yet, US 101 and connecting roadways along the Oregon Coast are especially vulnerable to threats of climate change, including more frequent and intense rain events and sea level rise. Investments are needed to make sure US 101 remains functional in the face of these threats, as well as leverage transportation investments that enhance economic activity, seismic resilience and emergency response.

State Highway fund investments can be used for on-road improvements and some operational enhancements along the Oregon Coast.

Adaptation Menu

- Priority Corridors
- Asset Focus
- Maintenance & Operations

Oregon's highways are exposed to a range of weather and climate extremes, such as winter storms, extreme rainfall, and storm surge. Storms can damage and close roadways due to flooding from rivers and streams. By mid-century, sea level rise is also projected to impact highways along the coast.

Along the Oregon coast, the most vulnerable areas are roadways in the mountains along steep gradients and in areas adjacent to rivers and estuaries prone to flooding. Roads along the open coast can be subjected to bluff erosion, scour and storm surge. Corridor resilience investments could include: replacing bridges, culverts, and pavements, and mitigating landslides and rock falls that are high risk.

Resilience on the Oregon Coast

The Oregon Coast Highway (US 101), stretching 363 miles from California to Washington, is a priority corridor. Built in the 1920's and 1930's, US 101 is invaluable to national, state, and regional interests with its many scenic, economic, emergency access, and national defense attributes. Several east-west connector routes are also of critical importance and provide coastal communities with access to the inland valleys, (such as US 30, US 20, OR 38, and OR 18).

The age and coastal location of these routes are factors that add to the "wear and tear" of the roadway and increases their vulnerability to weather extremes. US 101 is one of the earliest to be built in Oregon and suffers from outdated construction standards. The coastal geology is unforgiving as land uplift, slides and fill settlements over the last century have caused culvert constrictions and separations. Surface failures are common since unstable fill materials were often used in early highway construction.

Major construction operations cause costly disruptions due to detours. In Lincoln County alone, an estimated $200,000 a year is spent maintaining US 101; however, when an emergency washout or landslide occurs, this cost can escalate into the millions. Emergency repairs can have significant impacts on the economy, environment and local communities, delaying travel for emergency services, tourists, and local residents. An estimated $50 million per year in additional funds is needed for resilience improvements on US 101 and connecting highway routes.

Coastal highways are subjected to storms coming off the Pacific and regularly face the impacts of high winds, waves and storm surge during winter months. These storms increase the severity and rate of coastal erosion adjacent to highways. Over two dozen highway locations have been identified as vulnerable to the threat bluff erosion and scour.

Sea level rise is projected to worsen, impacting low-lying roadways, mainly within coastal estuaries. A recent Sea Level Rise Exposure Inventory found that over 46 miles of coastal highways are likely to be inundated by the year 2050 during a 100-year storm event. Many coastal locations are already experiencing chronic flooding during high tides and large rainfall events in these same areas.

Potential investments to address coastal hazards brought by increasing climate extremes:

- Elevate roadways to reduce flood risk
- Upgrade culverts, enhance maintenance, and mitigate landslides to help keep roads open and safe, and save resources over the long-run
- Replace aging or undersized culverts
- Increase maintenance activities that clear debris and hazard trees prior to larger storms that inflict the most damage
- Mitigate higher risk landslides, rockfalls and scour
- Protect critical bridges from extreme events
- Increase exterior bridge treatments that protect structures from salt and corrosion to ward against material failure and extend their service life

Example Additional Investments:

$50M per year for resilience improvements on US 101 and connector routes.

$20M per year to mitigate landslides and rockfalls along US 101 and connector routes.

$10M per year to upsize small culverts along coastal highways and connectors.

Sources:
Rough Roads Ahead 2. Oregon Department of Transportation*. 2017.*
Highway 101 Slide Repair. Oregon Department of Transportation*. 2016.*
Sea Level Rise Exposure Inventory for State Highways. Department of Land Conservation and Development*. 2017.*
Oregon Climate Change Assessment Report. Oregon Climate Change Research Institute. 2017.

Potential Additional Investments for Climate Change Adaptation

(Shown relative to existing funding programs)

This document provides information on existing investment programs and potential programs that could support Climate Change Adaptation investments. This information is illustrative and does not supersede legislative or other conversation - it is purely informational

Adaptation (State)	ODOT STIP Fix-It Program			Maintenance	Culverts and Fish Passage	Wildlife Crossings
	Operations	Pavement Preservation	ODOT Bridge Program			
Description	Fix-It Operations funds are used to improve the safety and efficiency of the state's transportation system by addressing functional areas such as signs, rock fall and landslide mitigation, and other system operational deficiencies. Some of the project types below are data-driven, while others are based on state and federal regulations and regional priorities.	Fix-It Pavement Preservation funds are used for pavement preservation, rehabilitation or reconstruction. Relies on a systematic and data-driven approach to managing short and long-term pavement treatments to have the highest long-term pavement conditions.	Fix-It Bridge Program funds are used for basic bridge rehabilitation projects, replacement of high-risk bridges, or and to increase resilience of lifeline routes in priority order. Fix-It projects are selected using data and management systems to determine where conditions warrant priority investment.	Maintenance is a separate category than "Fix-It". The program focuses on daily activities of maintaining and repairing existing highways to keep them safe and usable for travelers.	Culvert funds focus on culvert rehabilitation of the culvert structure and culvert replacement projects. Fish Passage funds focus on bridge or culvert replacements, or on repairs that address existing barriers to fish passage. Both investments use a systematic and data-driven approach to determine investment priorities.	Not currently a stand-alone program. Sometimes Wildlife Crossing Projects are funded out of Operations or Safety funding. Investments are focused on crossings for areas where wildlife poses a safety risk to drivers.
Funding Type	Federal and State	Federal and State	Federal and State	Federal and State	Federal and State	Federal
Status	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	New - this program is not in existence today
Integrating funds for GHG reduction	Funding could be focused to areas vulnerable to sea-level rise, flooding, storms and wildfires	Funding could be focused to areas most susceptible to extreme temperature shifts (extreme heat or cold) like in ODOT Region 4 and ODOT Region 5	Funding could be focused to areas vulnerable to sea-level rise, flooding, and storms. Particular attention could be given to the Oregon Coast	Funding could be focused to areas vulnerable to sea-level rise, flooding, storms and wildfires. Particular attention could be given to the Oregon Coast		Support wildlife movement and migration pattern changes due to climate change and make roadways safer for the traveling public
Adaptation project types (State Highway Funds)	Landslides / Rock-fall Intelligent Transportation Systems (ITS)* Traffic Signs and Signals*	Pavement Preservation	Bridges	Drainage, Stability & Erosion Control Vegetation Management Surface & Shoulder Maintenance Structures & Scour Protection Snow & Ice Removal	Culverts and Fish Passage	Wildlife Crossings
Potential minimum investment amounts (per year)	$20 million +	$20 million +	$20 million +	$25 million +	$40 million +	$5 million +
Potential proportion allocations (per year)**	15%	5%	20%	15%	40%	5%

* Can be both an adaptation and mitigation project type

**State "Potential proportion allocations" are meant to be within whatever state allocation policy makers decide

If there is a Straight Allocation to Locals		If Local Funds Pass Through ODOT			
Adaptation (Local)**	E.g. 50/30/20 Split	Local STIP Fix-It Program (Enhance Process)	OR	Local Bridge Program	Local Pavement Program...
Description	Traditional funding split of State Highway Funds after off-the-top allocations	New program would need to be formed but could mimic the STIP Enhance process and projects could be solicited and awarded with STIP Enhance. Unlike STIP Enhance, this STIP Fix-It program would just be for locals, not ODOT		The Local Fix-It Bridge Program funds are used similarly to the state program and rely on a data-driven prioritization process.	The Local Fix-It Bridge Program could potentially be replicated for other assets like pavement, culverts, etc..
Funding Type	State	State		Federal + local match	State
Status	Ongoing	New - this program is not in existence today		Ongoing	New - this program is not in existence today
Integrating funds for GHG reduction	The Legislature could direct the use of the funding for certain activities that align with climate change adaptation	Funding could be focused to areas vulnerable to sea-level rise, flooding, storms and wildfires		Funding could be focused to areas vulnerable to sea-level rise, flooding, storms and wildfires	Funding could be focused to areas vulnerable to sea-level rise, flooding, storms and wildfires
Adaptation project types (State Highway Funds)	Operations (landslides, ITS, signs & signals) Pavement Preservation Maintenance Culverts / Fish Passage Wildlife Crossings	Operations Pavement Preservation Maintenance Culverts / Fish Passage Wildlife Crossings ADA		Bridges	E.g. Pavement
Potential minimum investment amounts (per year)	$130 million +	$130 million +		$20 million +	$20 million +
Potential proportion allocations (per year)***	100%	100%		20%	5%

**Potential Local Adaptation investment options. Local jurisdictions would know best what would work for them and it is up to Legislative direction. This table is illustrative and meant to inform conversations.

***Local "Potential proportion allocations" are meant to be within whatever state allocation policy makers decide