

Transportation Resilience

Transportation resilience is an integral component of a reliable transportation system. Resilience refers to the system’s “ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from [natural-caused] disruptions”.¹ A resilient system, therefore, will continue to function safely and securely in the face of a changing climate with more frequent extreme weather events. (Human-caused disruptions are addressed in [Transportation Safety and Security](#).²)

This document identifies major hazards in the Treasure Valley—Ada and Canyon Counties—and their potential adverse impacts on transportation system functionality. Planning for such occurrences protects overall investments in the Treasure Valley’s transportation system and increases quality of life for all in the region. Special attention is paid during the planning process to potential impacts on vulnerable populations.

FEDERAL REQUIREMENTS

The 2015 Fixing America’s Surface Transportation Act ([FAST Act](#)) expanded the scope of the metropolitan transportation planning process to include actions that improve transportation system resilience and reliability and increase the security of all motorized and non-motorized users.³ The [2021 Infrastructure Investment and Jobs Act](#) defines resilience to include actions that ensure a transportation project can withstand or reduce the magnitude of, and adapt to and recover from, impacts from weather events and natural disasters.⁴

Additional guidance from federal agencies on how to build resilient transportation systems is ongoing. Notably, [Federal Highway Administration Order 5520](#) encourages proactive management by “developing engineering solutions, operations and maintenance strategies, asset management plans and transportation programs [to] address risk and promote resilience at both the project and systems level.”⁵ August 2021’s [Climate Action Plan: Revitalizing Efforts to Bolster Adaptation & Increase Resilience](#) by the US Department of Transportation provides additional guidance on policies and priorities.⁶

PLANNING FOR A RESILIENT TRANSPORTATION SYSTEM

Environmental changes and disasters can adversely affect transportation system functionality. In the Treasure Valley, hotter temperatures are a prime concern. The frequency of days over 91°F will “increase from a historical baseline of around 16 days per summer to 66 days per summer by the mid-21st century.”⁷ As a result, moderate drought conditions are expected to increase from once every four years to once every two years.⁸ In addition to secondary impacts of heat and drought (below), hot temperatures can directly damage transportation infrastructure (Figure 1).



Figure 1. Heat-related pavement buckle on Veterans Memorial Parkway in Boise. Photo: Ada County Highway District.

Hotter temperatures have also caused more wildfires across the Northwest. From 2015–2020, the US Bureau of Land Management recorded 152 fires that burned 15,415 total acres in Ada County and 22 fires that burned 1,263 acres in Canyon County (Figure 2).⁹ A climate mapper tool suggests that by the year 2100, the probability of very large fires (over 12,500 acres) in the Treasure Valley will increase by over 200%, based on changes in humidity, precipitation, and solar radiation.¹⁰



Figure 2. Foothills near the City of Eagle after the October 2021 Goose Fire. Photo: City of Eagle Trails and Pathways Department.

In the same time frame, the Treasure Valley is projected to double the number of heavy precipitation days (days where daily total precipitation exceeds 0.7") from 0.72 to 1.44 annually.¹¹ With temperatures rising, snowpack will melt earlier and cause higher seasonal stream flows on the Boise and Snake Rivers in the winter and spring, resulting in increased flooding of roadways and pathways (Figure 3).



Figure 3. Flooded pathway along the Boise Greenbelt.

According to the [2017 Ada County Multi-Hazard Mitigation Plan](#), “the potential impacts of climate change on the operations of Lucky Peak Dam are real. The Boise River could see increased flows in response to a changing hydrograph that dictates dam operations” (Figure 4).¹²

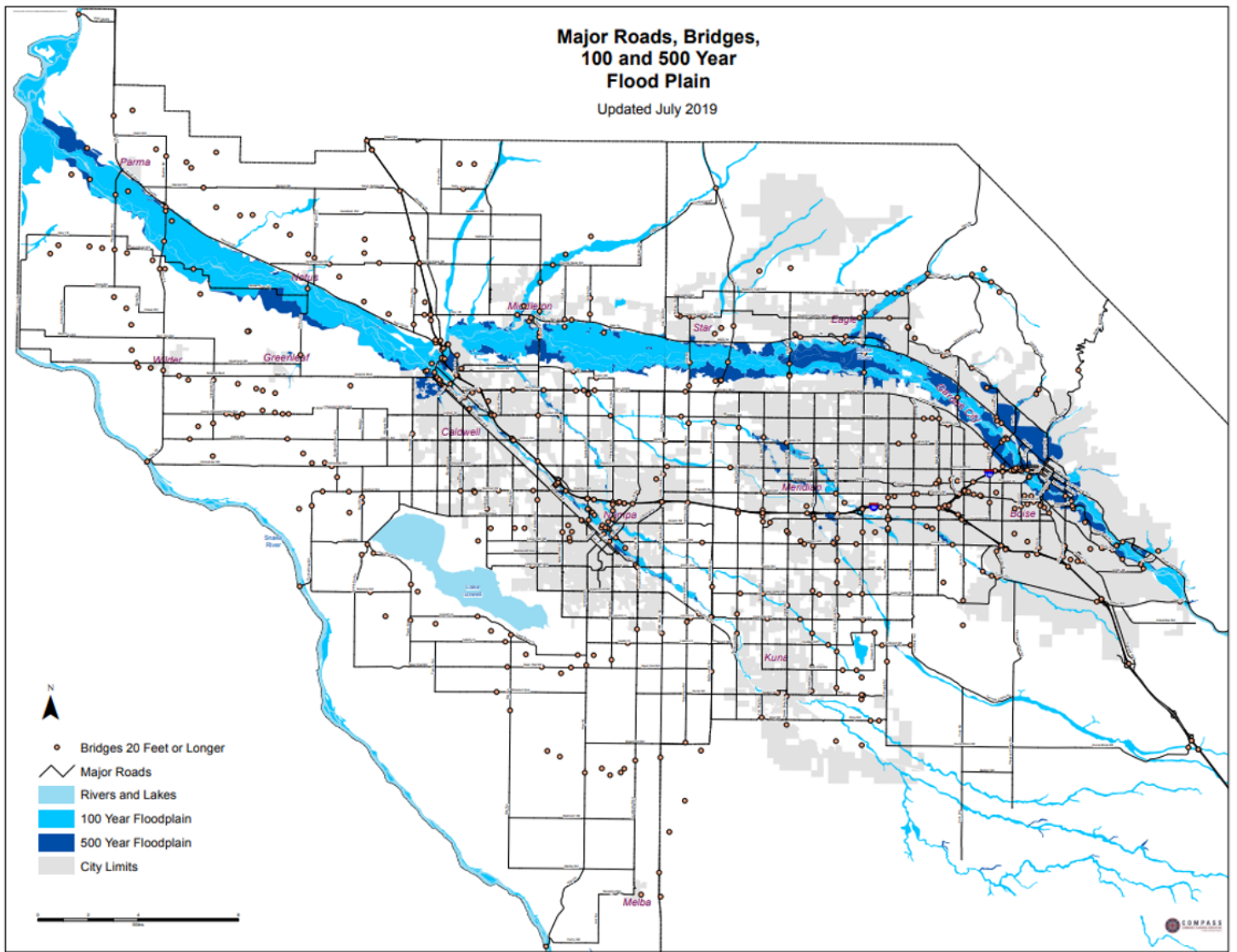


Figure 4. Major roads, bridges, and 100- and 500-year floodplains in Ada and Canyon Counties

The Treasure Valley experiences minor earthquakes frequently, but most are too small to cause damage or for people to even notice. While it is unlikely that Idaho will experience its own major earthquake, nearby regions have a potential for massive earthquakes. The Cascadia subduction zone, which runs along the Washington and Oregon coastline, has a 37% chance of experiencing a megathrust earthquake (7.1+ magnitude) in the next 50 years.¹³ In California, there is 48% probability that a magnitude 7.0 or greater earthquake will strike along the San Andreas Fault Line in the next 30 years.¹⁴ If such earthquakes were to occur, Idaho’s transportation infrastructure would be critical for transporting equipment and supplies to the affected areas while evacuees from those areas may head to Idaho.

Over time, any or all of these changing environmental conditions could cause critical components of the Treasure Valley’s transportation system to fail (Table 1).

Table 1: Environmental hazards in the Treasure Valley

Hazard	Infrastructure Damage	Description	Vulnerable Infrastructure
Warmer Temperatures	Pavement buckles	Pavement buckles present safety concerns to all who use sidewalks. This issue disproportionately affects older adults and people with disabilities who cannot easily navigate pavement buckles.	Older roadways and pathways
	Sinkholes	Sinkholes present safety concerns to all drivers and pedestrians.	Roadways with degraded foundations that asphalt can melt into
	Degradation of roadway materials	Roadway signage may degrade faster under warmer temperatures, potentially causing visibility issues for drivers. Roadway materials may degrade faster under warmer temperatures, causing safety issues such as potholes and pavement buckles.	Roadways and related infrastructure built with materials with a low heat index
Changing Precipitation Patterns	Minor and major flooding	Changing precipitation patterns may increase the frequency of minor and major flooding. Floods affect everyone in the inundation zone but may disproportionately impact those with fewer resources or less physical mobility, including older adults and people with disabilities, low incomes, and/or limited English proficiency.	Bridges Roadways and transportation infrastructure in the floodplain
	Potholes	Potholes present safety concerns to all drivers and pedestrians.	Roadways and pathways

Hazard	Infrastructure Damage	Description	Vulnerable Infrastructure
Wildfire	Landslides	Wildfires may trigger landslides in areas with steep slopes. Landslides affect everyone in the affected zone but may disproportionately impact those with fewer resources or less physical mobility, including older adults and people with disabilities, low incomes, and/or limited English proficiency.	Roadways and transportation infrastructure near steep slopes and steep cuts and fills.
	Degradation of roadway materials	Heavy fire trucks and emergency vehicles on roads can cause damage to roadways, especially if the pavement is softened due to high temperatures from the fire. Wildfires can also cause pavement to crack, develop potholes, or melt, and in very intense heat, burn.	Roadways, pathways, and transportation infrastructure
Regional Earthquake	Increased traffic due to assisting in emergency response	A large regional earthquake (e.g., near the Washington or Oregon coast) would not present immediate safety concerns to Idaho drivers or pedestrians, but Idaho's interstate highways will be critical in delivering emergency response to affected areas, which will affect daily travel for those in the Treasure Valley.	Increased traffic on main arterials into Idaho (I-84, US-95)

GROWING RISK

In the Treasure Valley, market pressures due to a growing population have increased development in high-risk areas such as floodplains and the wildland-urban interface. In 2020, 4.7% of all newly permitted housing developments occurred in the wildland-urban interface and 5.2% occurred in a floodplain. Building in these high-risk areas makes residents and infrastructure more vulnerable to disaster. For example, on October 7, 2021, a 441-acre grass fire that was started by fireworks in the Boise foothills threatened residents near a City of Eagle sports complex (Figure 5). Luckily, no homes were damaged and no residents were injured. To mitigate the risk, development in these areas requires multiple access routes to reduce bottlenecks or blockage in an emergency. Even with adequate emergency planning, older adults and people with disabilities, low incomes, and/or limited English proficiency remain vulnerable, as they are less likely to own a vehicle or be able to drive, impacting their ability to escape in a timely manner.



Figure 5. Big Springs Boulevard south of the Eagle Sports Complex during the Goose Fire in October 2021. Photo: City of Eagle Trails and Pathways Department.

Inadequate funding for maintenance of the existing transportation system can also exacerbate risks, as older roads may lack adequate emergency access or be especially susceptible to environmental hazards.

Ada County participates in the National Flood Insurance Program (NFIP), and the Ada County Cities of Eagle, Garden City, Boise, and Meridian participate in the Community Rating System (CRS)—a voluntary incentive program through the US Federal Emergency Management Agency that encourages management practices that exceed the minimum requirements of the NFIP.¹⁵ Canyon County and its cities do not participate in NFIP or CRS.

ADDRESSING DISRUPTIONS

COMPASS works with local agencies to plan for the transportation system to continue to operate throughout a disruptive event. The Idaho Transportation Department (ITD) addresses emergency and security issues statewide and deploys the 511 Travel Information Line and [website](#).¹⁶ The [2017 Ada County Multi-Hazard Mitigation Plan](#)¹⁷ and the [2021 Canyon County All-Hazard Mitigation Plan](#)¹⁸ identify each county's goals, objectives, and strategies to mitigate hazards.

Intelligent transportation system investments on roadways help inform travelers of crashes or other impediments via dynamic message boards. These investments also provide operators with data to reroute traffic and deal with disruptions more efficiently. The [2020 Treasure Valley Transportation System Management and Operations \(TSMO\) Plan](#) outlines strategies to maintain, manage, and even restore the performance of the Treasure Valley’s transportation system, including after a temporary outage.¹⁹ As investments in next-generation transportation technology increase, the region will continue to improve the resilience of the transportation system to nature-caused disruptions.

PLANNING FOR A RESILIENT SYSTEM

Communities in Motion 2050 includes performance measures and targets addressing resilience (Table 2).

Table 2. CIM 2050 performance measures and targets addressing resilience

Description	Baseline Condition	CIM 2050 Target
Percentage of newly permitted housing units located in the wildland-urban interface	4.7% (2020)	< 5% (2030)
Percentage of newly permitted housing units located in the floodplain	5.2% (2020)	< 5% (2030)
Percentage of bridges located in the floodplain considered to be in “poor” condition	0.3% (2019)	0% (2030)

These performance measures were used to help prioritize transportation projects for future funding. For example, projects in the floodplain or wildland-urban interface were specifically identified during initial project ranking, and that information helped inform [prioritization decisions](#).²⁰

Mitigation Strategies

Performance data were also used to develop mitigation strategies to improve future transportation resilience in the region. Table 3 offers strategies for near-term and long-term activities that agencies can implement (individually and through regional partnerships) to sustain the momentum of plan development and address identified hazards.

Table 3. Near- and long-term strategies for increased resilience

Strategies	Status	Responsible Agency
Near-Term Strategies		
Review local emergency management plans (hazards mitigation plans, local continuity of operations plans, stormwater management plans, etc.)* <ul style="list-style-type: none"> • Identify vulnerable critical roadway infrastructure • Determine capacity and availability of alternate routes 	Ongoing	Local agencies
Identify locations of vulnerable populations, first-responder facilities, and sheltering sites* <ul style="list-style-type: none"> • Nursing homes, retirement communities, medical facilities, schools, etc. 	Ongoing	COMPASS
Include stakeholders, including the public, when planning for regional transportation resilience	Ongoing	COMPASS
Collect data on weather-induced unplanned maintenance events	Pending	Local agencies
Integrate weather hazard scenarios into the <i>Treasure Valley Incident Management Operations Manual and Detour Route Plan</i> ²¹	Pending	Ada and Canyon Counties
Develop a resilience improvement plan, including an emergency evacuation route map for the region	Pending	COMPASS
Improve education on existing services that provide real-time data to residents on heavy traffic and weather-caused road closures in the Treasure Valley	Ongoing	Local agencies
Encourage higher regulatory standards in hazard-vulnerable zones through zoning overlays, subdivision and development reviews, conservation easements, ²² and/or a community rating system	Ongoing	Local agencies
Support research that investigates the link between harsh weather and transportation system impacts in the Treasure Valley through collaborations with local universities and other organizations	Ongoing	Local agencies

Strategies	Status	Responsible Agency
Long-Term Strategies		
Continue to collaborate with local agencies and organizations involved in resilience*	Ongoing	Local agencies
Promote open space in the wildland-urban interface and the floodplain by implementing planned-unit developments, easements, setbacks, and sensitive-area tracks	Pending	Local agencies
Integrate floodplain management policies into other planning mechanisms within the Treasure Valley	Ongoing	Local agencies
Engage in environmental remediation activities for transportation infrastructure	Ongoing	ITD/Local agencies
Locate or relocate critical facilities outside the wildland-urban interface and the floodplain*	Pending	Local agencies
Incorporate retrofitting or replacement of critical system elements in capital improvement plans*	Pending	ITD/Local agencies
Identify opportunities to increase system redundancy through alternate transit routes	Ongoing	Local agencies

*Strategy aligns with initiatives identified in the [2017 Ada County Multi-Hazard Mitigation Plan: Countywide Elements](#)²³ and/or the [2021 Canyon County All-Hazard Mitigation Plan: Countywide Initiatives](#).²⁴

CONCLUSION

As the region continues to grow, a strong proactive approach to identifying the vulnerabilities of the transportation system to environmental hazards will help maintain a resilient and functioning system for all. COMPASS will continue to work with its members and other stakeholders to develop solutions to address hazards, implement strategies, track performance measures, and consider emergency response in regional transportation planning and decision making. Proactive preparedness and hazard management protects the lives and livelihoods of current and future generations.

ENDNOTES

- 1 Presidential Policy Directive 21, Critical Infrastructure Security and Resilience, February 2013. obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil
- 2 Transportation Safety and Security, CIM 2050, <https://cim2050.compassidaho.org/SafetySecurity.pdf>
- 3 Fixing America's Surface Transportation Act (Fast Act), www.govinfo.gov/content/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf
- 4 Infrastructure Investment and Jobs Act, <https://www.fhwa.dot.gov/bipartisan-infrastructure-law/>
- 5 FHWA Order 5520, Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events, December 2014. www.fhwa.dot.gov/legsregs/directives/orders/5520.cfm
- 6 Climate Action Plan: Revitalizing Efforts to Bolster Adaptation & Increase Resilience, US Department of Transportation, www.sustainability.gov/pdfs/dot-2021-cap.pdf
- 7 Boise Climate Adaptive Assessment, prepared by Climate Impacts Research Consortium et al. for the City of Boise, pnwcirc.org/sites/pnwcirc.org/files/ho2_boise_climate_adaptive_assessment_2_pager.pdf
- 8 Ibid.
- 9 US Bureau of Land Management email to COMPASS, November 2021
- 10 Climate Mapper Tool, Climate Toolbox, <https://climatetoolbox.org/tool/Climate-Mapper>
- 11 See note 7.
- 12 2017 Ada County Multi-Hazard Mitigation Plan, Ada County Emergency Management & Community Resilience, adacounty.id.gov/emergencymanagement/mitigation
- 13 Cascadia Subduction Zone, Oregon Office of Emergency Management, www.oregon.gov/oem/hazardsprep/Pages/Cascadia-Subduction-Zone.aspx
- 14 Edward Field et al., A New Earthquake Forecast for California's Complex Fault System, United States Geological Survey, pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf
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- 17 See note 12.
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- 19 Treasure Valley Transportation Systems Management and Operations (TSMO) Strategic Plan 2020-2030 Update, COMPASS, compassidaho.org/documents/prodserv/tsmo/COMPASSTSMOPlan_FINAL.pdf
- 20 Prioritization, CIM 2050, <https://cim2050.compassidaho.org/Prioritization.pdf>
- 21 Treasure Valley Incident Management Operations Manual and Detour Route Plan (2017 Update), COMPASS, https://compassidaho.org/wp-content/uploads/TVIMReport_Final12-29-17.pdf
- 22 Idaho Uniform Conservation Easement Act, Idaho Code § 55-2101 (1988).
[https://legislature.idaho.gov/statutesrules/idstat/title55/t55ch21/sect55-2101/#:~:text=\(1\)%20%22Conservation%20easement%22,forest%2C%20recreational%2C%20or%20open%2D](https://legislature.idaho.gov/statutesrules/idstat/title55/t55ch21/sect55-2101/#:~:text=(1)%20%22Conservation%20easement%22,forest%2C%20recreational%2C%20or%20open%2D)
- 23 See note 12.
- 24 See note 18.