

## State DOT Seismic Resiliency Assessment Process and Mitigation Program

Most state DOT's that are located in high seismic regions have found a need to assess the vulnerability of bridges and consider implementing a mitigation program to increase transportation system resilience. This paper presents a framework or steps that have been shown to be effective in providing needed data and presenting it to the public and transportation funding authorities to help implement a seismic retrofits program. The following steps are part of a comprehensive assessment process:

1. Assess Vulnerability of Assets (bridges and landslides)
2. Identify bridge damage states and landslides/rockfall dynamic stability
3. Validate Design Criteria consistency with risk
4. Estimate cost of mitigation (retrofit or replace)
5. Identify Lifeline Routes and Establish priority for rescue, recovery
6. Estimate impact to rescue efforts and economy
7. Prioritize plan for mitigation, considering condition of assets
8. Establish Resiliency Investment options
9. Develop triage approach for reduced level of mobility
10. Coordinate investment plan statewide with other modes/sectors through DHS/TSA Regional Resiliency Assessment Program. (RRAP)

Scientists have documented a long history of earthquakes and tsunamis on the CSZ. Since damage is expected to be so widespread throughout western Oregon and the Cascade Mountain range, in 2004 ODOT developed and adopted a "Performance Level" criteria for highway structures. ODOT's seismic design criterion requires bridges in western Oregon to remain serviceable after a CSZ earthquake and sustain only minor damage. Although the construction cost for bridges meeting our seismic criteria are a bit higher (compared to the typical bridge construction cost,) the long term benefits are considered to be justified. This investment will facilitate rescue and economic recovery after a major event.

ODOT defined highway segments that are considered lifeline routes using three evaluation factors:

1. Support survivability immediately following the event (short term).

2. Provide transportation facilities critical to life support for an interim period following the event (mid-term).
3. Support statewide economic recovery (long-term).

The bridges and landslides on the selected routes are priority candidates for seismic investments. ODOT has conducted more detailed vulnerability assessment of bridges and unstable slopes to improve the estimated program cost several times based on the most current data and level of risk based on seismic design criteria updates. The evaluation criteria for bridges developed for this study considered other existing structural deficiencies and the age of structures. The cost for replacing nearly 140 bridges, retrofitting 580 others, and mitigating nearly 1,200 unstable slopes along our lifeline corridors was estimated to be \$5 billion.

Once it became clear that the State could not support a level of investment to achieve the needed level of resilience, ODOT began a series of new studies using a “triage” approach that uses regional and local agency routes to achieve minimal levels of mobility for rescue and economic recovery.

The extended abstract and presentation will provide details about the Oregon vulnerability studies and resilience planning.

The prioritized mitigation program is based on a combination of:

1. identification of the most critical route segments and
2. those segments that could most cost effectively be made resilient.

The plan assigned US97 as the first highway segment to be retrofitted. OR58 from US97 to the Interstate 5 was identified as the next critical facility to be retrofitted. These two segments will provide a continuous north-south corridor from California to Washington and one route east-west from US97 into the Willamette Valley and I-5.

Although we are confident with our selected path toward resiliency, we do realize that this is a long-term process and it will take several years to complete.

We understand the magnitude of the difference between responding to an isolated event versus responding to a statewide event that occurs every 300-350 years.

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