Washington State DOT’s Vulnerability Assessment: Asking the “Climate Question”

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Infrastructure Adaptation Workshop  
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Traverse City, MI
Washington Climate Change impacts assessment

• Funded by the Washington State Legislature

• Published in 2009

• Comprehensive report on climate change impacts in Washington

• Downscaled from global climate models

• Detailed data and technical support available
Goal: Preserve assets in a changing environment

• **Apply an asset management approach**
  – Be ready for severe weather events *and* long-term changes in site conditions
  – Inform long-term decisions
  – Build resilience where possible

• **Conduct a statewide vulnerability assessment**
  – Test-drive the FHWA model
  – Understand and communicate current science
  – Scope: Consider impacts on our all WSDOT assets
    Highways, Ferries, State-owned Rail and Airports
Our approach used internal experts

- Local maintenance, bridge preservation, hydraulics, geotechnical, materials, project development, planners, environmental staff
- Workshop format (similar to cost/risk assessments)
- Share climate change information and why this was important – stressed what is happening now (observed)
- Questions:
  - “What keeps you up at night?”
  - “What if it gets worse (given the scenario)?”
  - “How resilient is our existing system?”
Step 1 – How critical is the asset?

**WSDOT Methodology**

<table>
<thead>
<tr>
<th>Very low to low</th>
<th>Moderate</th>
<th>Critical to Very Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>9</td>
</tr>
<tr>
<td>10</td>
<td></td>
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</tbody>
</table>

**Criticality of asset**

Notice that along with the qualitative terms there is an associated scale of 1 to 10, this is to serve as a facilitation tool for some people who may find it useful to think in terms of a numerical scale - although the scoring by each individual is of course subjective. The scale is a generic scale of criticality where “1” is very low (least critical) and “10” is very critical.

Typically involves:
- non-NHS
- low AADT
- alternate routes available

Typically involves:
- some-NHS
- non-NHS
- low to medium AADT
- serves as an alternative for other state routes

Typically involves:
- Interstate
- Lifeline
- some NHS
- sole access
- no alternate routes
Step 2: How might climate impact that asset?

<table>
<thead>
<tr>
<th>Primary climate drivers</th>
<th>Can lead to impacts on...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Expansion joints, pavement, rail tracks, construction periods, habitat projects, electrical equipment</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Flooding of surface roads &amp; tunnels, road washout, pump capacity, drainage</td>
</tr>
<tr>
<td>Hydrologic shifts</td>
<td>Soil instability, water supply, bridge and road support structures</td>
</tr>
<tr>
<td>Sea level rise, storm surge</td>
<td>Coastal erosion, coastal and upriver flooding, bridge footings, drainage, roadside stability, salt / corrosion</td>
</tr>
</tbody>
</table>
We used our experience to gauge future impacts

Scour and damage to structures - Just off US 12 Davis Creek
Oct. 4, 2009: Dust storm closes I-90 between Moses Lake and Ritzville
Complete catastrophic failure

Results in total loss or ruin of asset. Asset *may* be available for *limited* use after at least 60 days and would require major repair or rebuild over extended period of time. “Complete and/or catastrophic failure” typically involves:

- Immediate road closure;
- Disruptions to travel;
- Vehicles forced to re-route to other roads;
- Reduced commerce in affected areas;
- Reduces or eliminates access to some destinations;
- May sever some utilities located within right-of-way;
- May damage drainage conveyance or storage systems.

Temporary operational failure

Results in minor damage and/or disruption to asset. Asset would be available with either full or limited use within 60 days and may have immediate limited use still available.

“Temporary Operational Failure” typically involves:

- Temporary road closure, hours to weeks;
- Reduced access to destinations served by the asset;
- Stranded vehicles;
- Possible temporary utility failures.

Reduced capacity

Results in little or negligible impact to asset. Asset would be available with full use within 10 days and has immediate limited use still available. “Reduced capacity” typically involves:

- Less convenient travel;
- Occasional/brief lane closures, but roads remain open;
- A few vehicles may move to alternate routes;

*Figure 2.1 Photo depictions of qualitatively assessed climate change consequences*
FOR PLANNING ONLY
Not suitable for site specific use
What did we find?

- Intensifies known threats
- Reinforces value of our current maintenance and retrofit programs
- Some surprises
- Unique way to capture knowledge of field staff
WSDOT’s study of climate impacts vulnerability

- Workshops across the state to evaluate all WSDOT Assets
- Map and communicate results
- Develop strategies
- Integrate into asset management paths

2011
- Oct.
- Jan.
- June

2012
- Nov.
- Jan.
- May
- Sept.

2013
- Jan.
- June
Adapting to a changing climate

Statewide study of climate-related infrastructure risks

Our climate is changing. Demand for transportation resources continues to grow. Keeping state-owned and managed infrastructure safe and operational is key to a growing economy and building a more resilient and sustainable transportation system.

Protecting infrastructure, freight routes and keeping drivers safe for the long-haul

Our economy and quality of life can take serious hits when extreme weather events, floods, hurricanes, and blizzards strike. The past has shown how storms can wreak havoc on our daily lives and prevent goods and services getting to customers.

WSDOT’s job is to keep the state’s transportation system safe and operational. This means planning and preparing to protect and manage our vital roads, bridges, ferry terminals and other facilities that could be vulnerable to severe weather. We must be resilient and adapt to future environmental conditions. Thanks to a $10,500 Federal Highway Administration (FHWA) national pilot project grant, WSDOT was able to complete the groundwork on assessing how our state-owned and operated transportation assets may fare under extreme weather changes.

WSDOT pilots infrastructure vulnerability assessment

We conducted workshops with our field staff from across the state to assess the vulnerability of our highways, ferry terminals and other infrastructure to changes in our climate and weather extremes. We presented the participants with climate scenarios such as extreme temperatures and sea-level rise, asking, “What would be the likely impact on our facilities?” The results from each workshop were used to create a series of planning-level maps.

USDOT Climate Change Policy

In addition to the federal dollars from the H-WA pilot project, United States Department of Transportation (USDOT) policy supports climate adaptation efforts. In a June 2011 policy statement, U.S. Transportation Secretary Ray LaHood directed USDOT agencies (such as the Federal Highway and Transit Administrations) to consider climate change impacts on current systems and future investments.

The USDOT climate change policy statement further states that “planning for climate adaptation assists State and local transportation agencies, and USDOT, to identify how climate change is likely to impact their ability to achieve their mission, continue operations, and to meet policy and program objectives.”

http://www.wsdot.wa.gov/SustainableTransportation/adapting.htm