Overview – ODOT Asset Risk/Reliability

- Motivation and Goal of the Project
- Climate Forecasts for Ohio
- What This Means for Transportation
- The Risk Assessment Process
- Future Steps
Asset Reliability – Motivation and Goal

Final Rule for Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events (23 CFR Parts 515)

(c) State DOT shall establish a process for developing a risk management plan…with the following information:

» (6) A summary of the evaluations of facilities repeatedly damaged by emergency events relating to the State’s NHS pavements and bridges.

» Each State… shall conduct statewide evaluations to determine if there are reasonable alternatives to roads, highways, and bridges that have required repair and reconstruction activities on two or more occasions due to emergency events.
Asset Reliability – Motivation and Goal

To conduct systems-level risk assessment of ODOT’s infrastructure -- highways, bridges, culverts—

…that will likely be impacted by extreme weather.
Asset Reliability – Goals of the Project

- Prioritize Highways, Bridges and Culverts According:
  - Risk of Flooding
  - Exposure to Extreme Weather
- Engage ODOT District Staff in Model Validation
- Develop a Workplan for Monitoring Asset Reliability
Climate Forecasts for Ohio – Three Sources

- National Climate Assessment (NCA 4)
- Ohio River Basin Climate Change (USACE/NOAA)
- Bureau of Reclamation’s Downscaled CMIP5 Climate and Hydrology Projections (DCHP)
Climate Forecasts for Ohio

(a) A1

(b) A2

(c) B1

(d) B2

Global carbon dioxide emissions (GtC/yr)

Year (1990-2090)
OHIO RIVER BASIN—
Formulating Climate Change Mitigation/Adaptation Strategies through Regional Collaboration with the ORB Alliance

U.S. Army Corps of Engineers and Ohio River Basin Alliance
Institute for Water Resources, Responses to Climate Change Program

Climate Forecasts for Ohio – Areas for Climate Downscaling (ORBCC)
Projected Climate Effect – Increasing Variability of Precipitation & Stream Flows
Climate Forecasts for Ohio – ICF

Annual Number of Baseline Very Heavy Precipitation Events


Map created by ICF

Number of Baseline Very Heavy Precipitation Events

10 11 12 13 14
Climate Forecasts for Ohio – Areas for Climate Downscaling (ORBCC)

Annual Days with Freeze Thaw Cycle

- Observed (1952-2001)
- Mid-century (2041-2070)
- End-of-century (2071-2099)

Map created by ICF
Climate Forecasts for Ohio – Key Messages

Unprecedented warming is projected by the end of 21st century; of particular concern in Ohio’s urban areas for health impacts of prolonged heat.

Severe drought is a risk to agriculture. Future temperature increases may increase the intensity of naturally-occurring droughts.

Ohio has experienced a significant increase in heavy rain events. Increases in winter and spring precipitation are projected and will raise the risk of springtime flooding.
## What this Means for Transportation

<table>
<thead>
<tr>
<th>Magnitude of Consequences</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Virtually Certain</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Subway and tunnel flooding</td>
<td>Increased widespread flooding of transportation facilities</td>
<td>Major localized flooding disrupts transportation systems</td>
<td>Inundation of coastal assets due to storm surge</td>
</tr>
<tr>
<td>Medium</td>
<td>Increased rock/mud slides blocking road and rail facilities</td>
<td>Train derailment due to rail buckling</td>
<td>Increased disruption of barge traffic due to flooding</td>
<td>Short-term road flooding and blocked culverts due to extreme events</td>
</tr>
<tr>
<td>Low</td>
<td>Lower visibility from wildfires due to drought conditions</td>
<td>Northward shift of agricultural production places more demand and stress on roads and systems not prepared for higher volumes</td>
<td>Pavement heaving and reduced pavement life due to high temperatures</td>
<td>Inundation of local roads due to sea level rise</td>
</tr>
<tr>
<td>Positive (beneficial)</td>
<td>Reduced flight cancellations due to fewer blizzards</td>
<td>Reduced maintenance costs for highways and airports due to warmer winters</td>
<td>Reduced Great Lakes freezing, leading to longer shipping season</td>
<td>Longer seasonal opening of Northwest Passage</td>
</tr>
</tbody>
</table>
FHWA Vulnerability Assessment Scoring Tool - VAST

- Change in Precipitation to 2099
- % Forest
- % Urban
- % Wetlands & Lakes

- Scour Rating
- Waterway Adequacy Rating
- Channel Condition Rating
- Substructure Condition Rating

- Future AADT
- Truck AADT
- Detour Length
- Strategic Transportation System
- Distance to Critical Facilities

Normalize and Weight

Exposure Score

Sensitivity Score

Weight

Vulnerability Score
Illustrative VAST Model Output

Most Vulnerable Assets

number of assets: 5608
with valid scores: 5444
shown here: top 10
The Risk Assessment Process

- Update Climate Projections
- Review/Confirm Data Sources for the VAST Model
- Fine Tune VAST Model Weights
- Review/Confirm Results with ODOT District
- Develop Workplan for Vulnerability Monitoring and Programming