The National Cooperative Highway Research Program

NCHRP Research Update for STEICS

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
4 PROJECTS OF BROAD INTEREST TO STEICS

- NCHRP Project 20-83(5): Climate Change and the Highway System: Impacts and Adaptation Approaches;
- NCHRP Synthesis 20-05/Topic 44-08: Response to Extreme Weather Impacts on Transportation Systems;
- NCHRP 08-36/Task 107: Synthesis of State DOT and MPO Planning and Analysis Strategies to Reduce Greenhouse Gas Emissions; and
- NCHRP 25-25/Task 76: Synthesis of Climate Change and Transportation Research Efforts at State DOTs, State Universities, and Federal Level;
Synthesize the current state of knowledge on the range of impacts of climate change on the highway system by region of the United States for the period 2030-2050.

Recommend institutional arrangements, tools, approaches and strategies that state DOTs can use during the different stages of planning and project development and system management to adapt both infrastructure and operations to these impacts.

Prepare guidance for dealing with impacts.

Identify future research and activities needed to improve our understanding.
Prepare guidance, materials and methods for dealing with these impacts:

1. How might climate change affect xxxxx?
2. What is the adaptive transportation system management approach to considering climate change?
3. What are the elements of an adaptive xxxxx program?
4. What strategies can be considered as part of the adaptive xxxxx program?
5. What is the process for considering the analysis of such strategies as part of decision making?
6. What are the risk assessment and cost effectiveness tools that can be used to analyze possible strategies?
7. How is a adaptive xxxxx program established?
LONG-TERM ENVIRONMENTAL CHANGES
Adaptation = Actions taken to reduce the vulnerability of natural and human systems and/or increase system resiliency in light of expected climate change.
Climate Adaptation Planning Framework and Guidebook Organization

Chapter 4
- Identify key goals and performance measures
- Define policies on assets, asset types or locations that will receive adaptation consideration

Chapter 3
- Identify predominant climate change trends and their likelihoods for region
- Identify likely changes on local environmental conditions
- Identify other agency plans, strategies and actions relating to climate change

Chapter 5
- Identify adaptation options for high-risk assets and assess feasibility, cost effectiveness and defensibility of options

Chapter 6
- Conduct site analysis (see Chpt. 6) or programmatically change design standards, change operating strategies, change maintenance practices, change construction practices, etc.

Chapter 7
- Identify agency and public risk tolerance and set trigger thresholds that will initiate implementation of adaptation options (optional)
- Coordinate agency functions for adaptation program implementation

Is action necessary, e.g., are current or future (expected) thresholds reached?
- YES
- NO
  - Monitor climate conditions/asset performance
  - Planning
  - Design
  - Operations
  - Maintenance
  - Construction
  - Other Functions
<table>
<thead>
<tr>
<th>Climatic/Weather Change</th>
<th>Impact to Infrastructure</th>
<th>Impact to Operations/ Maintenance</th>
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</table>
| Increased intense precipitation, other change in storm intensity (except hurricanes) | • Heavy winter rain with accompanying mudslides can damage roads (washouts and undercutting), which could lead to permanent road closures;  
• Heavy precipitation and increased runoff are likely to cause significant flood damage to tunnels, culverts, roads in or near flood zones, and coastal highways;  
• Bridges are more prone to extreme wind events and scouring from higher stream runoff;  
• Bridges, signs, overhead cables, tall structures at risk from increased wind speeds. | • Number of road closures due to flooding and washouts will rise;  
• Severe erosion at road construction project sites as heavy rain events take place more frequently;  
• Road construction activities will be disrupted;  
• Increase in weather-related highway accidents, delays, and traffic disruptions;  
• Increase in landslides, closures or major disruptions of roads, emergency evacuations and travel delays;  
• Increased wind speeds could result in loss of visibility from drifting snow, loss of vehicle stability/maneuverability, lane obstruction (debris), and treatment chemical dispersion;  
• Lightning/electrical disturbance could disrupt transportation electronic infrastructure and signaling, pose risk to personnel, and delay maintenance activity. |
Practitioners’ Web-based Tool to Suggest What Adaptive Actions Should be Considered, If Any

<table>
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<tr>
<th>First-Order Climate Variable (Columns B and C)</th>
<th>Second-Order Climate Variable (If Applicable) (Column D)</th>
<th>Method for Estimating the Second-Order Climate Variable (If Applicable) (Column E)</th>
<th>Affected Design Input (Column F)</th>
<th>Typical Source(s) of Referenced Design Input (Column G)</th>
<th>What Future Value to Use for the Affected Design Input? (Column H)</th>
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| Precipitation                                 | More extreme rainfall events (2 - 100 year recurrence intervals) | Theoretical models (TR-20, TR-55, HEC-HMS, rational method)                     | 24-Hour precipitation for given recurrence interval | NOAA Atlas 14 or TP-40                                 | Preferred: Utilize downscaled projected climate change precipitation values  
Alternative: Use relative increases in precipitation amounts following the Clasius-Clapeyron relationship |
|                                               |                                                          |                                                                                 | IDF Curves                      | NOAA Atlas 14, TP-40, or state specific sources     | Preferred: Utilize projected IDF curves reflecting projected climate change if available  
Alternative: Use relative increases in precipitation totals following the Clasius-Clapeyron relationship |
|                                               |                                                          |                                                                                 | Precipitation distribution     | NRCS type curves or state specific curves           | Preferred: Utilize projected precipitation distribution type curves from climate models  
Alternative: Assume no changes and utilize existing curves |
FOR EXAMPLE, PROACTIVE STRATEGIES TO FLOOD RISK

- Preventing flooding by improving the rainfall capture and storage capacity of a catchment (e.g. by enhancing or mimicking the water storage capacity of the soil);
- Increasing conveyance capacity to disperse floodwaters;
- Creating policies to maintain existing levels of service which incorporate climate change factors at the time or upgrades;

Scope: Using a case example approach, this project will document information on extreme events on the transportation system, including riverine flooding; high intensity rain events; hurricanes; wildfires; drought; tornadoes; prolonged heat events; and snow storms.

Consultant is on-board.

Final Report expected in September 2013.
NCHRP 25-25 AND 08-36 EFFORTS

- NCHRP 08-36/Task 107 Synthesis of State DOT and MPO Planning and Analysis Strategies to Reduce Greenhouse Gas Emissions
  - Identify agencies that have conducted thorough analysis to reduce GHG emissions and if they have incorporated those plans into the planning process.
  - Final Report due in November 2012

- NCHRP 25-25/Task 76: Synthesis of Climate Change and Transportation Research Efforts at State DOTs, State Universities, and Federal Level
  - Synthesis of existing literature on climate change and transportation being conducted at the state, university, and federal-levels.
  - Final report available on the NCHRP website
ADDITIONAL ONGOING SYNTHESIS PROJECTS

- 44-01 FEMA and FHWA Emergency Relief Funds Reimbursements to DOTs.
- 44-12 Interactive Training for All-Hazards Emergency Planning, Preparation, and Response for Maintenance and Operations Personnel