Addressing Climate Change Adaptation
California Department of Transportation

Richard Land
California Department of Transportation
Chief Deputy Director (Acting)
Presentation Overview

- Adaptation at the Policy and Planning Level
  - Statewide Policies
  - Risks
  - Interagency Coordination

- Adaptation at the Project Level
  - Drivers for Policy
  - Policy Development
  - Next Steps
California’s Diverse Landscape

- North to South, California extends nearly 800 miles
- Local climates are very diverse, from temperate rainforests in the North to arid deserts in the South
- Within 80 miles of one another lie the highest and lowest points in the lower 48 states – Mount Whitney at 14,495 ft. and Death Valley at 282 ft. below sea level
California Transportation Statistics

- 15,192 centerline miles*
- 265 state highways*
- 177.0 billion annual vehicle miles traveled (AVMT)*
- 12,995 Caltrans owned buildings and structures
- 34,229,631 registered vehicles in the state (Jan 2010)

* 2009 data for the state highway system
Assembly Bill 32 (AB32) – The Global Warming Solutions Act of 2006
  - Requires reductions of GHG emissions to 1990 levels by 2020

Senate Bill 375 (SB375)
  - Enhances California’s ability to reach our AB 32 goals by promoting good land use and transportation planning with the goal of more sustainable communities
Executive Order S-13-08 (EO S-13-08) Identify and prepare for expected sea level rise impacts

- Effect on environmental documents:
  - all state agencies ...shall, for the purposes of planning, consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise

- Requires a sea level rise assessment be prepared by the National Academies of Sciences
Sea Level Rise (SLR)

California has coastal routes along the entire coast of the state.

San Francisco Airport 1 meter SLR

California state route 1 beach buildup
Changing Precipitation Patterns – Potentially More Flooding

Interstate 505 flood

State Route 162

Flood, mudslide on Interstate 80
Changing Precipitation Patterns – Landslides

State Route 1

40-foot section of Highway 1 collapses

Detour recommended by Caltrans
Alternate detour

Source: Caltrans

State Route 1

MERCURY NEWS
Projected Temperature Increases

Figure 1. California Historical & Projected July Temperature Increase 1961-2099

Source: Dan Cayan et al. 2009.
Climate Change Coordination Activities

- National Academies of Sciences Study
  - Estimated completion mid 2012

- California Climate Action Team
  - Coastal-Ocean Climate Action Team

- Washington, Oregon, California DOT coordination
The Project Level View

- The Drivers
  - Comments during environmental process
    - California Coastal Commission
    - Public
The Project Level View

The Drivers (cont.)

- Litigation
  - Sea level rise is a cause of action for a highway project near the Port of Los Angeles
    - National Resources Defense Council
The Drivers (cont.)

- Executive Order and action by the Coastal-Ocean Climate Action Team
- Most importantly, we are charged with protecting public safety and the public’s investment in the state highway system
Initial Challenges

The “reality” of climate change and risk

What do we design to?

- How much sea level rise?
- How much surge?
- How much will temperature rise?
- What is the increase in storm frequency and intensity?
Initial Challenges

- What is the best use of taxpayer dollars?
  - Worst-case?

- At the time we started the policy discussion—Should Caltrans be setting policy? Isn’t this a statewide issue?
Guidance on Incorporating Sea Level Rise

- Decisions made
  - Focus guidance on the project initiation phase
    - Adapting projects will likely require more capital investment
      - Starting the incorporation at the initiation phase allows programming of those capital dollars
  - Projects already in the delivery pipeline may use the guidance at the discretion of the project team
Guidance on Incorporating Sea Level Rise

- Decisions made
  - Planning scenarios for sea level rise
    - Use Coastal-Ocean Climate Action Team sea level rise scenarios
## Sea Level Rise Scenarios

<table>
<thead>
<tr>
<th>Year</th>
<th>Average of Models</th>
<th>Range of Models</th>
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<tbody>
<tr>
<td>2030</td>
<td>7 in (18 cm)</td>
<td>5-8 in (9-17 cm)</td>
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<td>2050</td>
<td>14 in (36 cm)</td>
<td>10-17 in (26-43 cm)</td>
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<tr>
<td>2070</td>
<td>Low: 23 in (59 cm)</td>
<td>17-27 in (43-70 cm)</td>
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<tr>
<td>2100</td>
<td>Low: 40 in (97 cm)</td>
<td>31-50 in (78-128 cm)</td>
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**SOURCE:** STATE OF CALIFORNIA Ocean Protection Council Sea Level Rise Resolution (March 2011)
Guidance on Incorporating Sea Level Rise

- **Decisions made**
  - Guidance is based on level of risk and consequences
  - Has two screening mechanisms
    1. Should project include a “hard look” at sea level rise?
    2. Should project include adaptation measures in its design?
“Hard Look” Screening

1. Is project located in the coastal zone or an area known to be subject to coastal inundation?
2. Would project be potentially impacted by an increase in sea level rise?

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</tr>
<tr>
<td>Medium</td>
<td>24 in (62 cm)</td>
<td>18-29 in (46-74 cm)</td>
</tr>
<tr>
<td>High</td>
<td>27 in (69 cm)</td>
<td>20-32 in (51-81 cm)</td>
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<tr>
<td>Low</td>
<td>40 in (97 cm)</td>
<td>31-50 in (78-128 cm)</td>
</tr>
<tr>
<td>Medium</td>
<td>47 in (121 cm)</td>
<td>37-60 in (95-152 cm)</td>
</tr>
<tr>
<td>High</td>
<td>55. in (140 cm)</td>
<td>43-69 in (110-176 cm)</td>
</tr>
</tbody>
</table>
3. What is the design life of the proposed project—is it greater than year 2030?
“Hard Look” Screening

- If the answer to all three questions is “yes”, then project goes on to the next screening.
Should project incorporate adaptation measures?
- Based on a qualitative balancing of risk and consequences
## The Balancing

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<tr>
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<th>Towards incorporating SLR into project design</th>
<th>Towards not incorporating SLR into project design</th>
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<tbody>
<tr>
<td>1</td>
<td>Project design life</td>
<td>Long (20+ years)</td>
</tr>
<tr>
<td>2</td>
<td>Redundancy/alternative route(s)</td>
<td>No redundant / alternative route</td>
</tr>
<tr>
<td>3</td>
<td>Anticipated travel delays</td>
<td>Substantial delays</td>
</tr>
<tr>
<td>4</td>
<td>Goods movement / interstate commerce</td>
<td>Critical route for commercial goods movement</td>
</tr>
<tr>
<td>5</td>
<td>Evacuations / emergencies</td>
<td>Vital for emergency evacuations; loss of route would result in major increases to emergency response time</td>
</tr>
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</table>
## Towards incorporating SLR into project design

<table>
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<tr>
<th>6</th>
<th>Traveler safety (delaying the project to incorporate SLR would lead to on-going or new safety concerns)</th>
<th>Safety project but little or no delay would result; non safety project</th>
<th>Safety project and delay would be substantial</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Expenditure of public funds</td>
<td>Large investment</td>
<td>Small investment</td>
</tr>
<tr>
<td>8</td>
<td>Scope of project – “point” vs. “linear”</td>
<td>Project scope is a “point” – e.g. culvert replacement</td>
<td>Project scope is substantial – e.g. new section of roadway</td>
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<td>9</td>
<td>Effect of incorporating SLR on non-state highway (interconnectivity issues with local streets and roads)</td>
<td>Minor or no effect – adjacent local street and roads would not have to be modified</td>
</tr>
<tr>
<td>10</td>
<td>Environmental constraints</td>
<td>Minor or no increase in project footprint in ESAs</td>
</tr>
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</table>
Range of Adaptation Responses

- Maintain and manage
  - Absorb increased maintenance / repair costs
  - Improve real-time response to severe events

- Strengthen structures / protect facilities
  - Design changes when rebuilding / new investment
  - Promote buffers

Slide by: Joanne Potter, Cambridge Systematics
Range of Adaptation Responses

- Enhance redundancy
  - Identify system alternatives

- Relocate / avoid
  - Move or abandon existing facilities (seasonal?)
  - Site new facilities in less vulnerable locations

Slide by: Joanne Potter, Cambridge Systematics
Future Direction on Climate Change Issues

- New Caltrans policy on climate change
- Caltrans climate change workgroup

Upcoming climate change efforts

- Inventorying current and planned mitigation projects throughout Caltrans
- Development of a guidance for regional planning agencies to incorporate adaptation into their long range transportation plans
- Developing a map to identify infrastructure vulnerable to sea level rise
- Our Division of Research and Innovation is continuously seeking new climate change research opportunities
- Continue investigations and discussions on design aspects of adaptation—what should the design standards be?
- Support research and develop policies for other adaptation issues such as temperature increases and increasing storm intensity
Strategic Implementation Issues

- Internal Organizational Structure – Dedicate Resources?
- Internal/External Communication Plan
- Local Agency Coordination – Route/Mode Compatibility
- State/Federal Collaboration – Pool effort and share information
- Shift focus from projects to route/corridor planning
- Monitoring component – Establish mechanism to track climate change impacts to drive future needs
- System Vulnerability Assessment
Policy Implementation Issues

- Funding – Research, Pre-project, Project
- Resource Distribution – More allocated to Planning and Project Initiation phases
- Development of revised Manuals, Guidance, Standards and Directives
- Staff Expertise vs. External Assistance
- Periodic Review and Revision of Criteria
Technical Implementation Issues

- Timing corrosion effects from salt water intrusion or inundation
- Estimating stream scour/aggradations due to changing stream tailwater and morphology
- Geotechnical studies to predict future subsidence and uplift
- Verification of survey data vs. sea level elevations
- SLR impacts to Laws/Regulations—FEMA, Fish Passage, etc.
- Use of operational measures in lieu of structural measures
- Collaboration/coordination on research with others
Advice for other state DOT’s

- Communicate internally on climate change issues
- Think cross-functionally and across agencies
- Partner with other states that have similar climates and projected climate change impacts
- Include stakeholders in climate change decision making
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