Emergency Evacuation and ITS – weather and special events:

Plan, implement, post-event assessment

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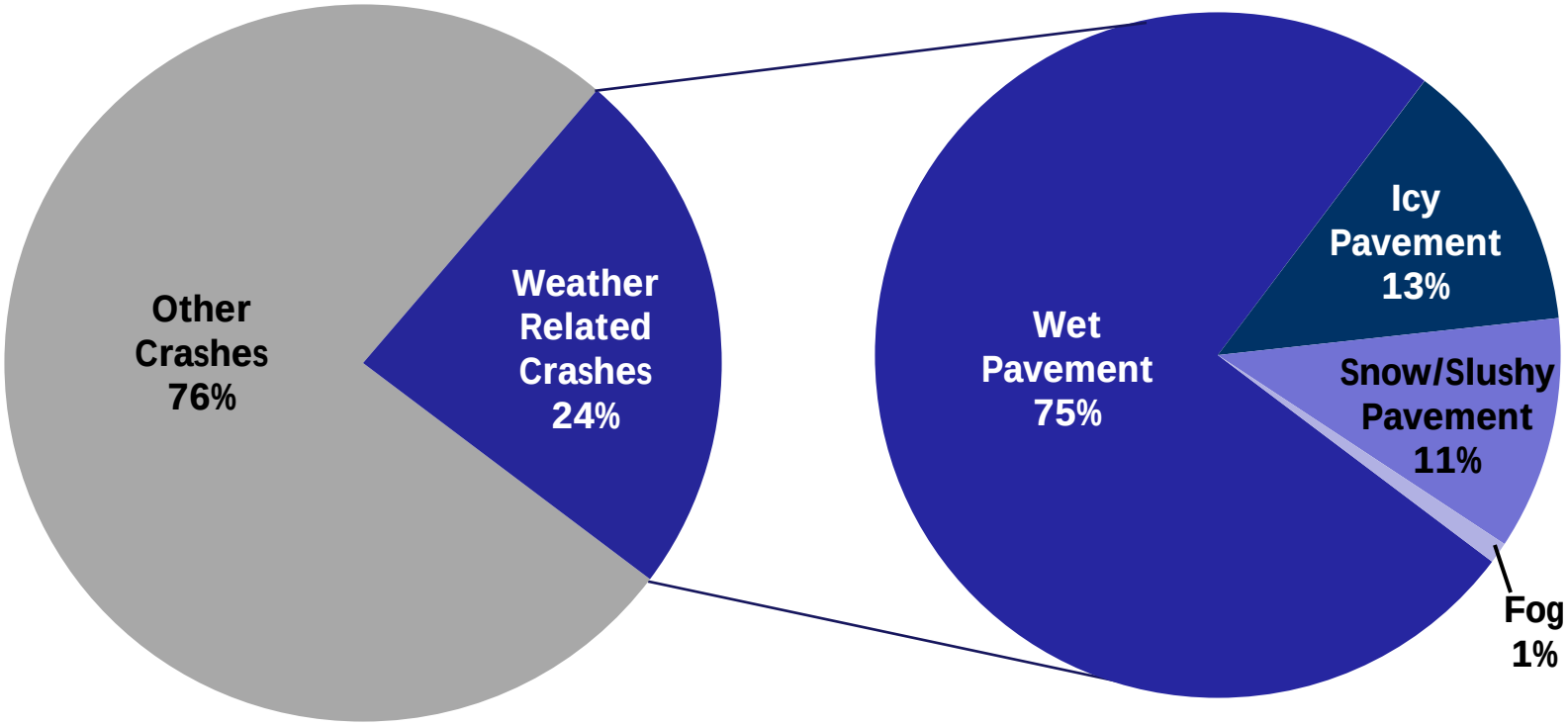
Overview of Presentation

- Explore the weather and climate challenge
- Describe how our current efforts provide a solid foundation for highway operations
  - Highlight the role of ITS
- Consider the emerging changes and how we could respond
- Define agency considerations and next steps

Crash History Under Adverse Weather

Total Annual Crashes
Average = 6,301,000

Weather Related Crashes
By Road Weather Condition*

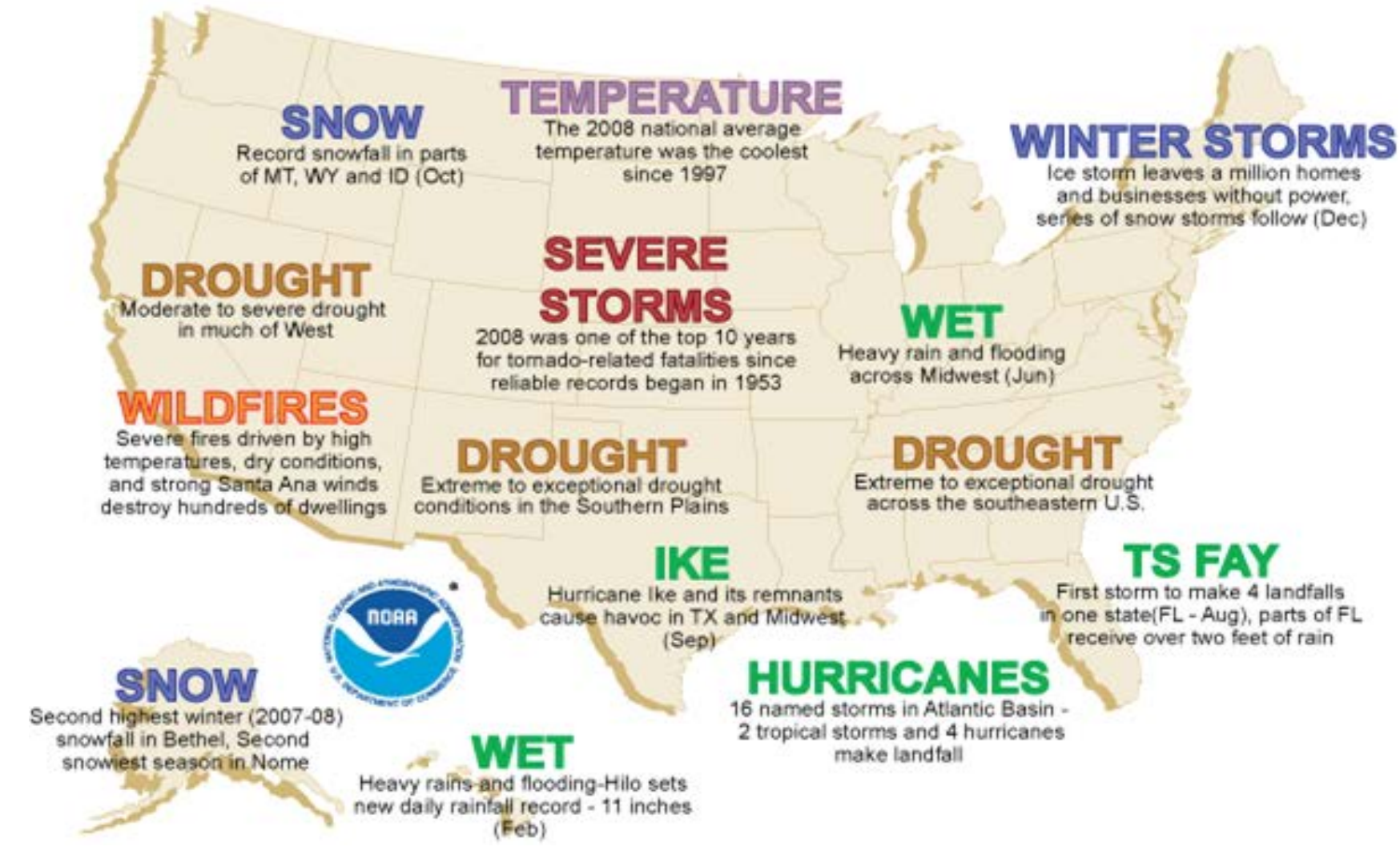


Source: *Road Weather Management Program, Table: Weather-Related Crash Statistics (Annual Averages), Available at: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm*

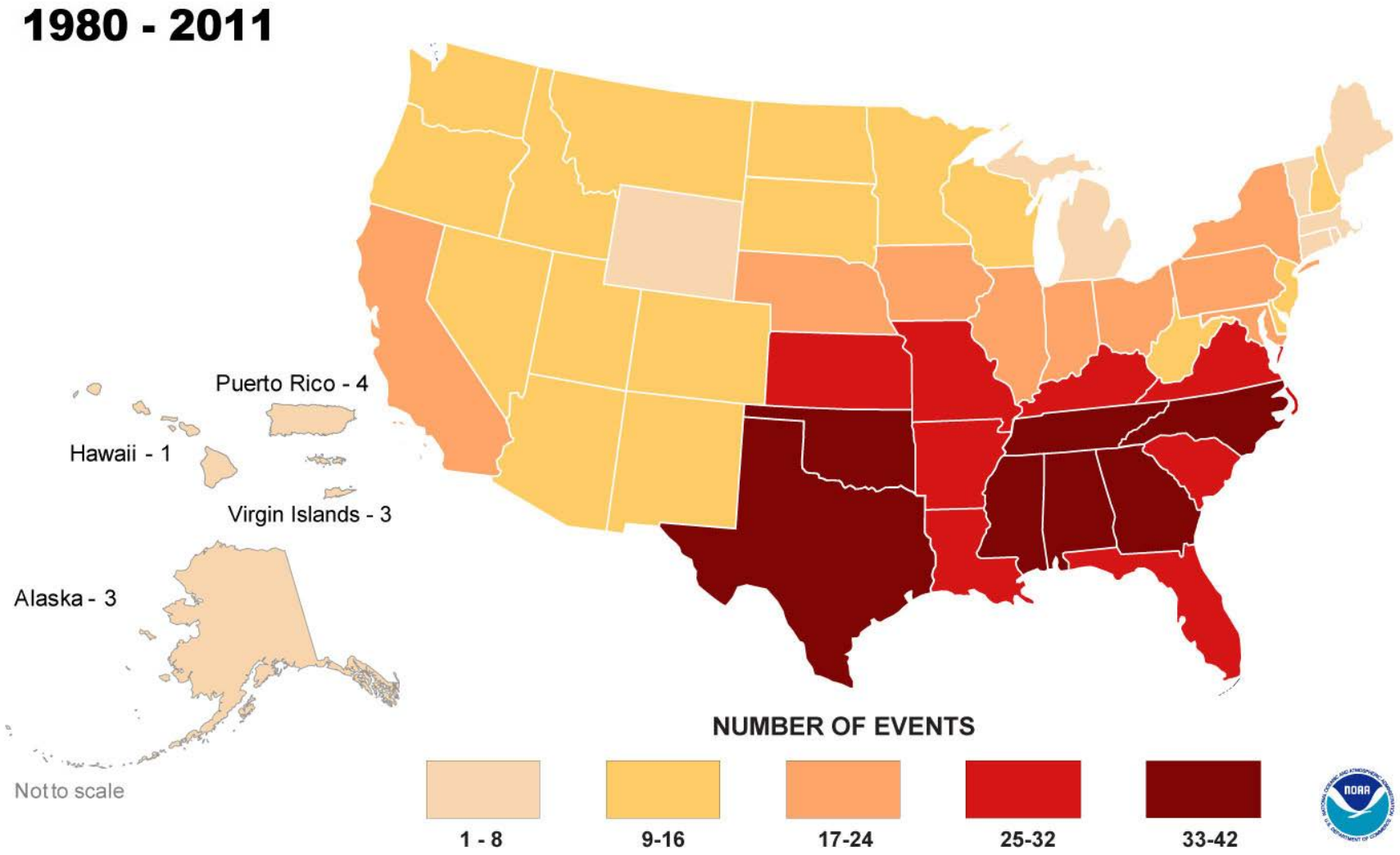
Weather-related Costs

- Direct costs to State DOTs are:
  - $2 billion/yr on snow and ice control
  - $5 billion/yr on snow & ice infrastructure repairs
- Indirect costs in terms of travel time delay for…
  - all travelers is $11.6 billion/yr from snow/ice/fog
  - the freight community is $8.7 billion/yr nationwide; $3.1 billion/yr in the 50 largest cities
- Considering lost wages, taxes and retail sales of a one-day shutdown, the costs are estimated to be $3.8 billion across 15 northern states

Significant Weather & Climate Events in 2008



Billion Dollar Weather Disasters



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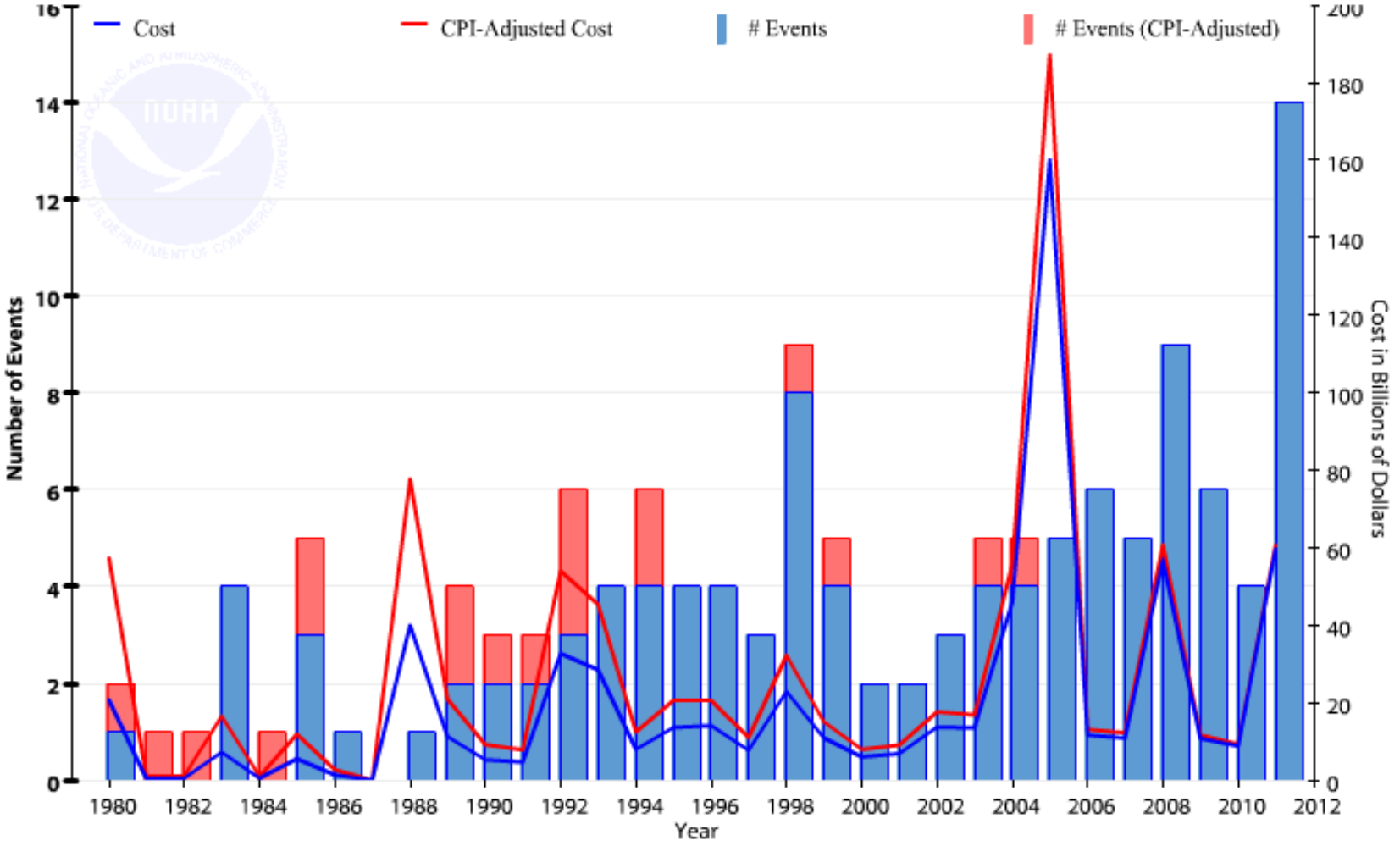


Impacts: Scale Versus Frequency

Impact

10 9 8 7		Complete Failure
6 5 4		Temporary Operational Failure
3 2 1		Reduced Capacity

Proactively Operating the Transportation System Requires:

- Real-time and forecasted information
- Measuring / monitoring performance
- Good analytical foundation / tools
- State of the art technologies and strategies
- Integration across system elements, jurisdictions, and modes
- An organization and workforce capable of managing all of the above

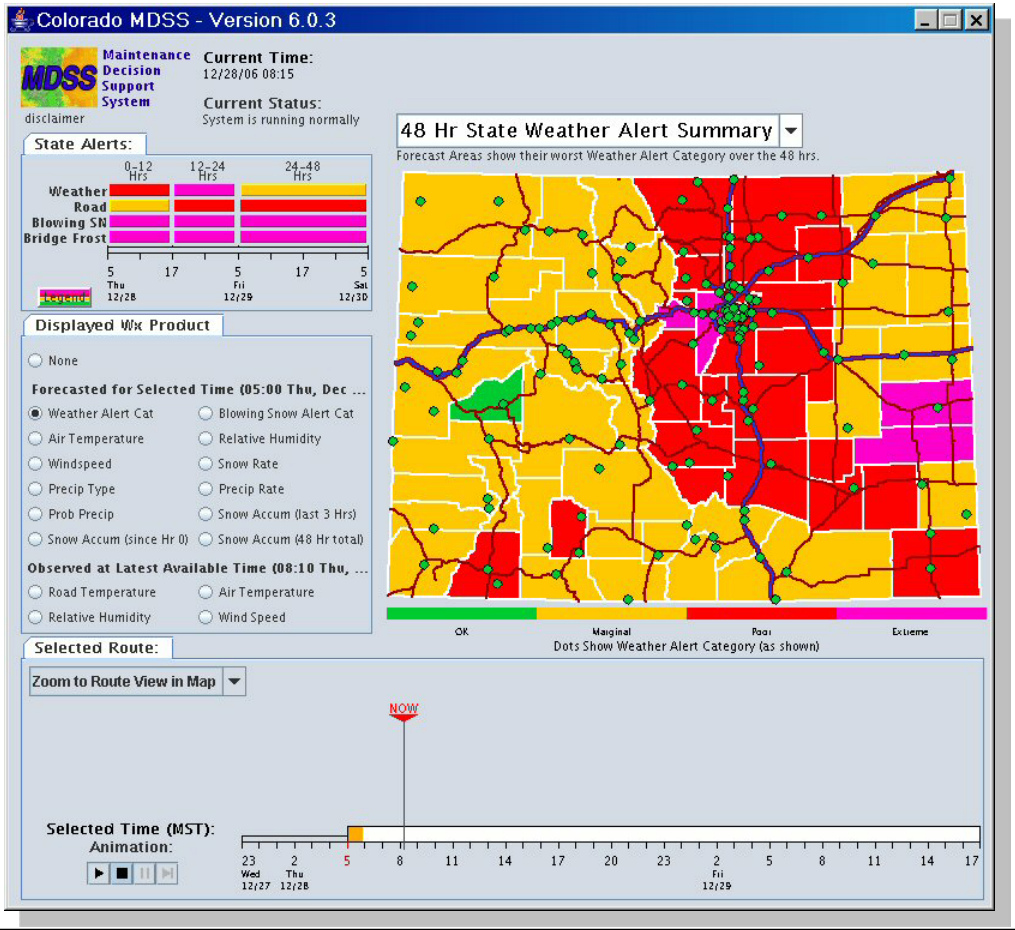
The Role of ITS

- ITS encompasses managing the transportation system for ever-changing conditions, including:
  - Incident and Emergency Management
  - Active Traffic and Demand Management
  - Integrated Corridor Management
  - Road Weather Management

  and all the supporting technologies and institutional relationships to make them work

Road Weather Management

Maintenance Decision Support System



Emerging Changes to the System

- Our work today is based on current conditions
- What happens when the climate changes?
  - What are the impacts to highway operations if there's an increase in coastal flooding?
  - What are the impacts to highway operations if we experience more icing events instead of snow events
  - Or what if we have more frequent and severe thunderstorms and flash floods?

Responding to the Changes

We are exploring the climate effects, the transportation impacts of these effects, and the potential responses for the following sectors:

- System Maintenance
- System Operations
- Travelers (including Traveler Behavior)
- Freight Transportation

Climate Change Effects and Potential Responses: System Maintenance

- Shifting rain/snow/ice line will mean…
  - Changes in resource needs (e.g., less snow fighting, more ice fighting, more flooding)
  - Altered construction and maintenance schedules
- Increased frequency, duration and intensity of droughts
  - Changes in vegetation management
- Increased coastal and inland flooding
  - Increased and more frequent use of resources (e.g., staff, evacuation materials)
- Increase in magnitude & duration of severe heat waves
  - Altered construction and maintenance schedules
  - Deploy “quick maintenance” patrols to address potholes and buckling issues

Climate Change Effects and Potential Responses: System Operations

- Increased coastal and inland flooding will mean…
  - Increased and more frequent use of resources (e.g., staff, evacuation materials)
- Increase in intensity of tropical cyclones, rising sea levels, increased occurrence of wildfires
  - Broader preparedness for potential evacuation
  - Increase TMC staff and ITS resources to provide traveler information during evacuations
  - More frequent disaster preparation, operations and recovery
- Increase in energy demand
  - Need for more resilient TMC communications and ITS hardware

Climate Change Effects and Potential Responses: Travelers & Traveler Behavior

- Increased exposure to hazardous driving conditions (e.g., flooding, road conditions, smoke from wildfires) and human health impacts
  - Increased need for timely, accurate and relevant traveler information from TMC's and private sector information service providers to support route & mode choice, departure times
  - Less consistent mode split impacting day-to-day congestion and safety issues
  - Potential mode shift to/from alternate modes, e.g., using transit, biking, or walking
  - Increased emphasis on carpooling and teleworking to reduce impacts to highways

Climate Change Effects and Potential Responses: Freight Transportation

- Increased frequency, duration and intensity of droughts; increased coastal and inland flooding
  - Restricted access to ports and shipping channels for inland waterways
  - Mode shift – e.g., from inland waterways to highways due to changes in reliability
- Increase in magnitude & duration of severe heat waves
  - Mandatory freight diversion to more robust alternate routes
  - Dynamic or seasonal restrictions for trucks or rail during times of high heat, reducing either acceptable speed or weight
  - Policy and regulation changes to restrict truck size and weights

Framing the Questions: Agency Considerations

- What can we do to improve our abilities to manage the system?
  - Build more robust, resilient and flexible Intelligent Transportation Systems
  - Integrate sophisticated weather & road condition information into transportation operations centers
  - Establish greater inter- and intra-agency cooperation, especially for resource/asset management and resource allocation
  - Examine Standard Operating Procedures for rapid mobilization and deployment
  - Cross-train staff, especially for unusual events

Our Next Steps

- Information sharing across agencies and countries
  - Work with the weather and climate communities to better understand the emerging changes
- Capture the state-of-the-practice
- Conduct gap analyses
  - Technical capabilities
  - Institutional capabilities
- Explore more formal ways to incorporate risk and uncertainty