

# California DOT (Caltrans)

**Mike Johnson**



# Extreme Weather Risks in Transportation Asset Management

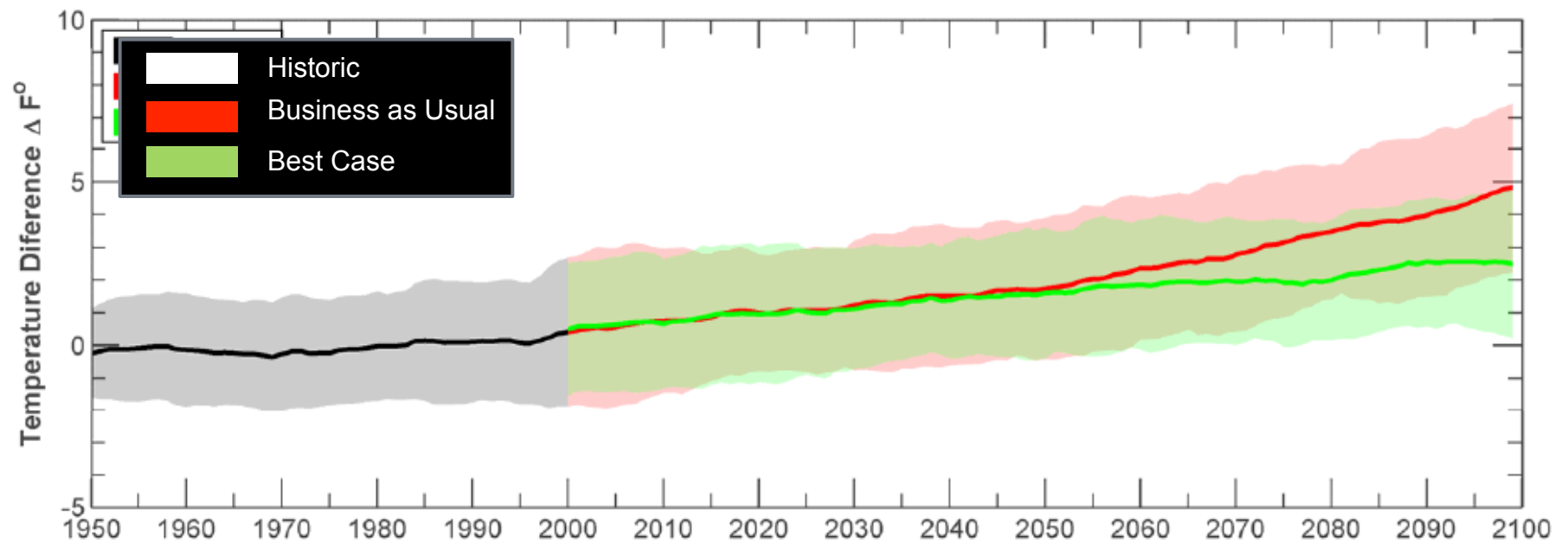
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Risk Management Peer Exchange – Minneapolis Minn.

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# Climate Change Effects





# Risk Minimization.....

## Its Not Too late

- AB 32 – Reduce GHG emissions to 1990 levels by 2020
- Executive Order (4/2015) – Reduce GHG to 40% below 1990 levels by 2030

# Vulnerability Assessment



- Draw from Seismic Vulnerability Assessment Experience
- Three Dimensional Assessment
  - Hazard/Risk – What is the risk and how likely is it to occur?
  - Consequence – What will happen to the infrastructure if the hazard/risk is realized
  - Impact on System – What impact to the transportation system will the vulnerability cause
- An Absurd Example



# Extreme Weather Vulnerabilities

- Excessive Precipitation
- Prolonged Drought
- Sea Level Rise / Wave Erosion

# Excessive Precipitation



# Excessive Precipitation



- Design Standards
  - Bridge Scour – 100 Year Flood - design flow (1% AEP)
  - Drainage structures – 50 Year Flood - Design (2% AEP)
  - Are our hydraulic models valid for extreme events?
- Acceptable Risk
  - Risk can be minimized but not eliminated
  - Must develop criteria for acceptable risk
- Cost Benefit Evaluation
  - Monetization of consequences relative to cost to mitigate



Sea Level Rise

Decreased Rainfall

Increased Rain Intensity

Wave attack  
Runoff  
Erosion on  
Landslide

Adaptation approaches



Bridge over  
Tunnel under



Photos: California Coastal Records Project

# Prolonged Drought



- Increased Fire Risk
  - Fires can damage infrastructure ... Material selection
  - Impact land use
- Subsidence
  - Excessive ground water extraction
- Changing Land Use
  - Will origins and destinations or industry change?
- Water Conservation
  - Tailoring transportation to be drought tolerant

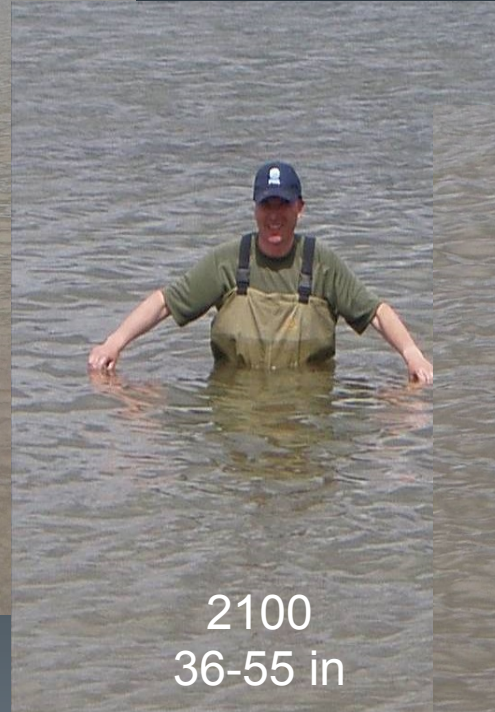
# Sea Level Rise



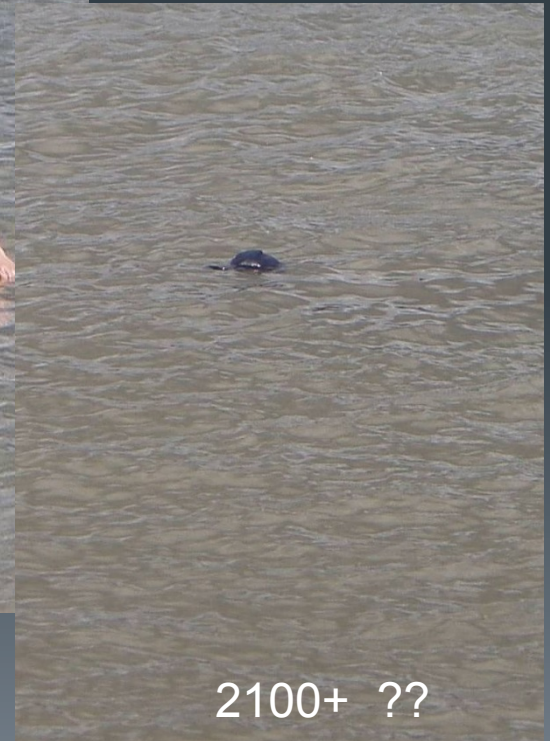
2000



2050  
12-14 in



2100  
36-55 in



2100+ ??

# Del Norte County



Last Chance Grade

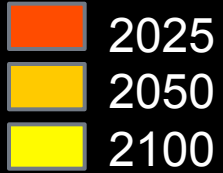
# Del Norte County



# Coastal Vulnerabilities

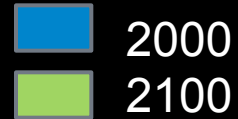
## Erosion Hazard Zones

Data: PWA 2008



## 100-yr Coastal Flood Zone

Data: Humboldt Bay SLR  
Adaptation Planning/NHE



# Inundation Questions



- Timing
  - Sea Level rise occurs very slowly... when to take action?
- Determine Important Routes
  - Evacuation
  - Emergency services routes
  - Redundancy
- Coastal Erosion
- How will the land use change?
  - Will the population migrate from current locations?

# Summary



- Avoid / Minimize risk through proactive action
- Reevaluate design standards
- Consider land use - Bigger than just transportation
- Assess Vulnerabilities / Mitigate high priorities
- Monetize impacts of vulnerabilities relative to cost for prioritization