Potential Impacts of Climate Change on U.S. Transportation

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Transportation Research Board
Division on Earth and Life Studies
National Research Council

STUDY FOCUS

Potential consequences of climate change on transportation and adaptation strategies

--Why adaptation?

--Which transportation systems?

STUDY SPONSORS

- Transportation Research Board
- National Cooperative Highway Research Program
- U.S. Department of Transportation
- Transit Cooperative Research Program
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers

Committee on Climate Change and U.S. Transportation

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Christopher R. Zeppie, The Port Authority of New York and New Jersey, New York City

NRC STUDY COMMITTEE PROCESS

- Formation of committee
- Committee deliberation
- Preparation of draft report
- Independent review of report
- Report publication and dissemination

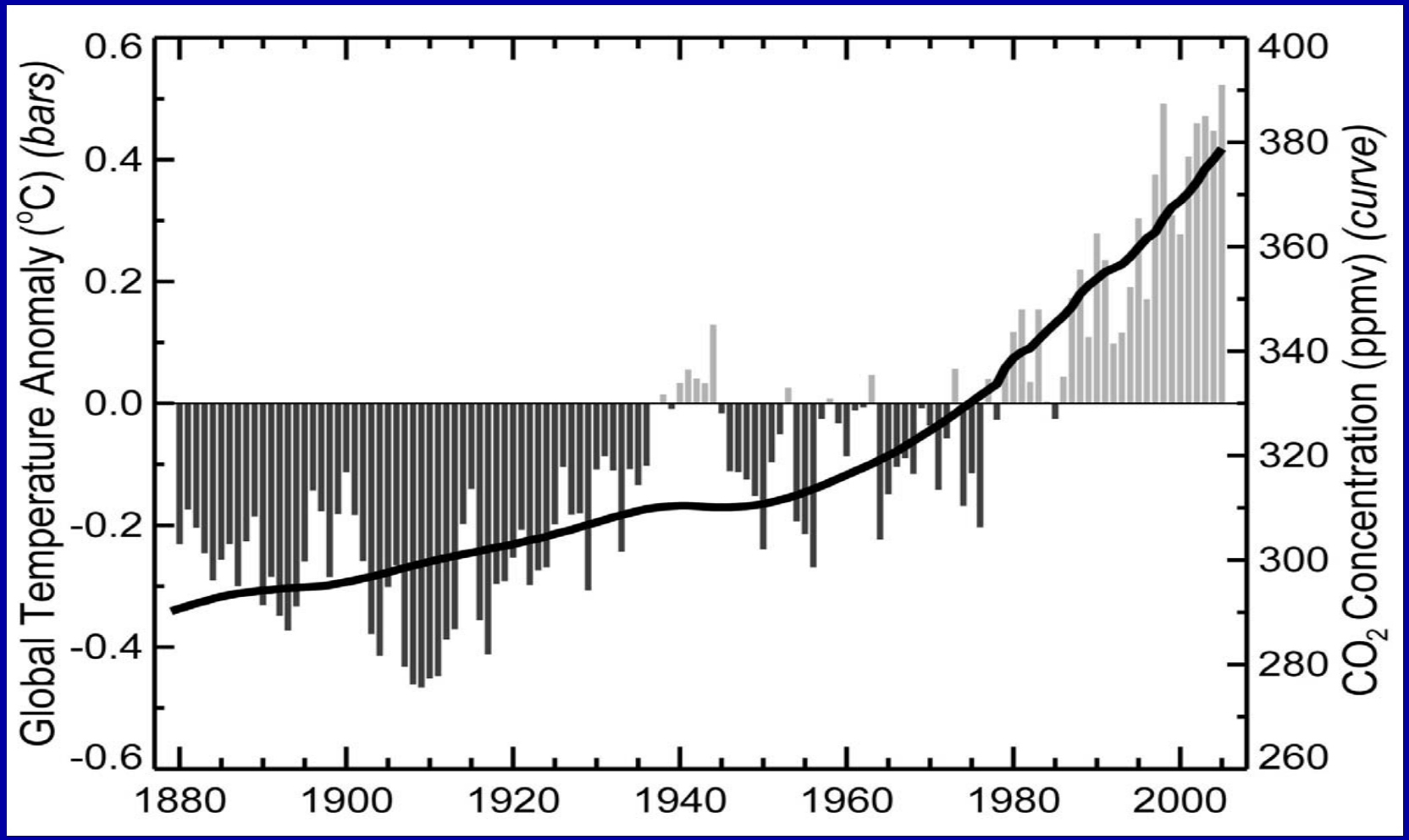
STUDY CHARGE

- Provide overview of scientific consensus regarding climate change
- Identify potential impacts on U.S. transportation and adaptation options
- Summarize previous work on mitigation strategies
- Provide recommendations on necessary research and policies

MAIN FINDINGS

- Global warming is occurring, and future climate changes are unlikely to unfold gradually (i.e., weather extremes and surprises).
- Historical climate patterns may no longer be a reliable planning guide.
- Impacts will affect all U.S. regions and all transportation modes – flooding of coastal infrastructure potentially the greatest impact
- Climate changes will require significant changes in how transportation professionals plan, design, operate, and maintain the infrastructure
- Today's investment decisions will affect how well the infrastructure adapts to climate change far into the future

Globally averaged surface air temperature and CO2 concentrations since 1880



THE SCIENCE: CLIMATE CHANGES OCCURRING OVER THE NEXT 50-100 YEARS OF RELEVANCE FOR TRANSPORTATION

- Rising sea levels (virtually certain)
- Increases in very hot days and heat waves (very likely)
- Increases in Arctic temperatures (virtually certain)
- Increases in intense precipitation events (very likely)
- Increases in hurricane intensity (likely)

IMPACTS ON TRANSPORTATION

- **Rising sea levels added to storm surge**
  - More frequent flooding of tunnels, unprotected marine terminals and warehouse entrances, and other low lying infrastructure
  - Inadequate clearance of dock cranes and other structures
  - Inundation of roads, rail lines, and runways in coastal areas
  - Closure or restrictions for several top 50 airports in coastal zones
- **Increase in very hot days / heat waves**
  - Thermal expansion – bridges and pavements
  - Rail track deformations
  - Lift-off limits at hot weather airports
  - Limitations on hours of construction

IMPACTS ON TRANSPORTATION

- **Increase in Arctic temperatures**
  - More ice-free northwest passage and longer ocean transport season
  - Thawing of permafrost – subsidence of highways, rail beds, pipelines, and runways
  - Shorter season for ice roads
- **Increase in intense precipitation events**
  - Traffic disruptions
  - Flooding of roadways, rail lines, runways
  - Scouring of pipeline supports and bridge foundations

IMPACTS ON TRANSPORTATION

- **More frequent strong hurricanes**
  - More frequent and costly evacuations
  - Greater probability of infrastructure failures - failure of bridge decks
  - Damage to ports and harbors

RECOMMENDATIONS
Decision Framework and Data

- Inventory critical infrastructure, particularly in vulnerable locations
- Incorporate climate change in investment plans and decisions
- Adopt strategic, risk-based approaches to decision making
- Improve communication and establish information clearinghouse (NOAA, USDOT, USGS)
- Address needs of transportation decision makers in climate science research

RECOMMENDATIONS (cont'd)
Adaptation Strategies

- Operations: integrate emergency response into transportation operations (and vice versa) to handle weather and climate extremes
- Design:
  - Reevaluate design standards – develop a research plan and cost proposal for Congressional action
  - Rebuild infrastructure in vulnerable locations to higher standards
- Monitoring: Develop new technologies to track conditions and warn of pending failure

RECOMMENDATIONS (cont'd)
Adaptation Strategies

- Technology transfer: Develop a mechanism for sharing best practices (AASHTO, FHWA, other professional organizations)
- Transportation and land use planning: incorporate climate change in investment and development decisions
- Flood insurance: reevaluate National Flood Insurance Program and update flood zone maps to account for sea level rise
- New organizational arrangements: develop regional and multistate structures to address climate change impacts and create a federal interagency working group on adaptation

WHERE TO BEGIN?

- Which climate changes most relevant for a region?
- How are climate changes likely to be manifest?
- What transportation assets will be affected?
- What performance levels are required?
- What level of investment is needed?
- What are the risks if no action is taken?
- Who will make these judgments and decisions?
- How will investment priorities be determined?
- How will they be funded?

HOW TO ACCESS THE REPORT

Report is available

at

http://trb.org/news/blurb_detail.asp?id=8794

QUESTIONS?