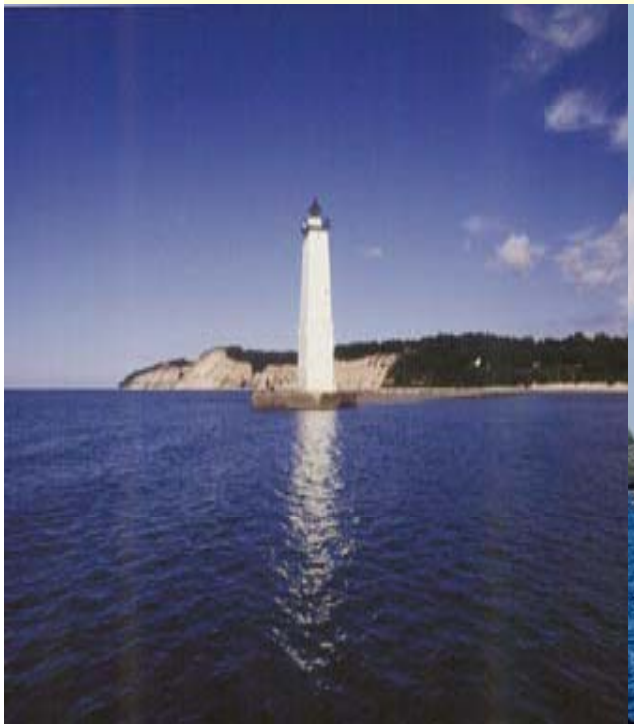
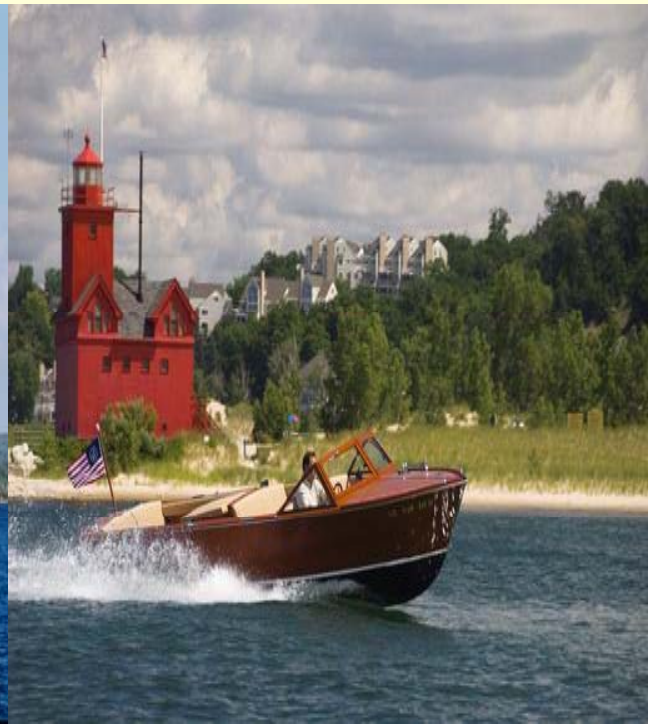
Climate Change Adaptation Issues in Highway Operations Michigan Department of Transportation

Michigan’s Climate

Michigan's Climate Risks

- Change level and temp of great lakes
  - Risk to shipping, fishing, tourism





Michigan's Climate Risks

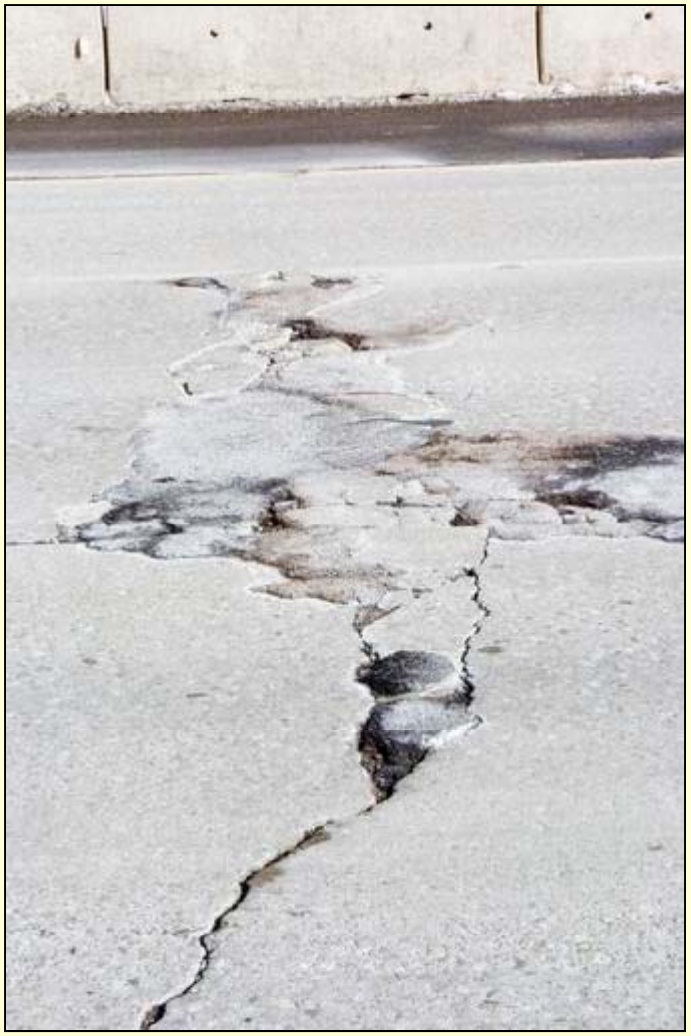
- Impacts local weather patterns
  - potential for more snow in lake effect
  - less ability to moderate weather

Michigan's Climate Risks

- More frequent and intense rain events
  - Wash out of transportation infrastructure
- Increased frequency of freeze thaw cycle

Michigan's Climate Risks

- Increased and prolonged summer temperatures extremes
  - Both will deteriorate roads more rapidly
- Changes to maintenance needs



Michigan’s Climate Risks

- Stress on indigenous vegetation and wildlife
- Invasive species more tolerant of a changed climate
- Higher incidence of wildfires

What to do

- Continue to develop Asset Management Databases
- Data will be used to identify potential risks
- Ideal situation would be to have a set of areas/infrastructure that is at greatest risk.
- Address these risks through regular transportation program process

What to do

- Research program in 2012 to assess available climate models, compare them to asset management data and prepare set of infrastructure at most risk for climate change
- Looking for research conducted on regional climate change impacts

What Do These things Mean for Highway Operations (Design, Construction, Systems Operations and Maintenance)

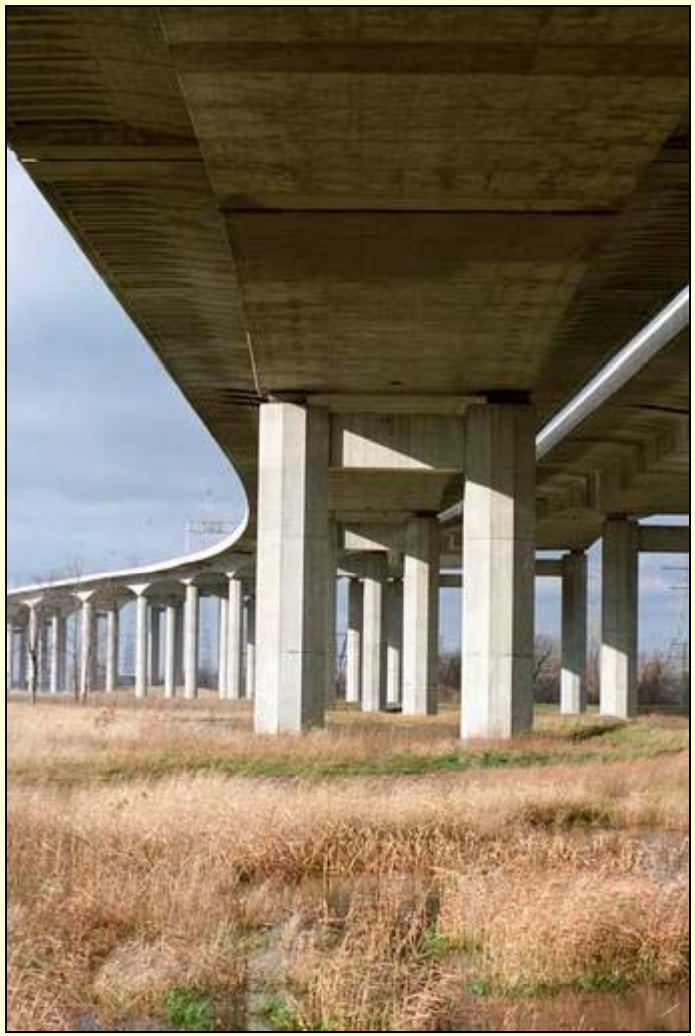
Climate Change Design Considerations

More Intense Storms – Strategy: Design assets that are less impacted by affects of Climate Change

- Larger hydraulic openings for bridges over waterways
- Heavier and lengthier armoring of river and stream banks and ditches to prevent erosion
- Investigate greater pavement crowns to move runoff off of pavement quicker

Design Considerations – Intense Storms Cont'd

- Design of additional in-system detention to meter runoff outflow
- Eliminate bridge design elements that could make a bridge scour critical
  - i.e. piers in the river, spread footings, use more sheet piling left in place
- Design terraced vegetated slopes using a variety of plant species



Design Considerations – Intense Storms Cont'd

- Design more robust pavement markings that can be seen during wet/night conditions
- Larger capacity pumps/pump stations for below grade freeways to prevent flooding

Design Considerations- Hotter Drier Summers

Strategy: Design tougher, more resilient, lower maintenance roadways, bridges, facilities and roadsides

- Design lower maintenance bridge expansion
- Design seed/vegetation mixtures that create a denser, deep-rooted vegetation mat that is more erosion resistant

Design Considerations- Hotter Drier Summers

- Eliminate monoculture roadside vegetation designs that may not survive extended drought periods or invasive species attack
- Ensure all roadside building designs are LEED certified or modified to be energy efficient

Climate Change Construction Considerations

More Intense Storms –
  Strategy: protect motorists, workers, and the environment from hazards created in work zone by strong weather events

- Stronger specifications for protection of work under construction

Climate Change Construction Considerations

- Stronger Specifications that require contractor response plans for work zone impacted by high intensity storms

Construction Considerations Hotter and Drier

Strategy: Protect work in progress from effects of higher temperatures for both short term and long term durability

- Encourage more night/cooler weather work to prevent damage such as slab curling, premature cracking, loss of air entrainment in concrete pavements, rutting and flushing in asphalt pavements

Construction Considerations Hotter and Drier

- More closely monitor moisture in aggregate piles
- Incorporate materials whose performance are less variable in weather extremes
- Modify vegetation planting periods to ensure optimal growth and survival

Construction Considerations – Hotter and Drier Cont'd

- Stronger specifications for Dust Control/Wind Erosion
- Worker Safety during extreme heat periods must be addressed

Climate Change – System Operations and Maintenance

More Intense Storms - Strategy: Use best practices to keep transportation infrastructure operating as safely and efficiently as possible during increased frequency and more intense winter storms

- Increased deployment and use of Roadway Weather Information Stations (RWIS) to effectively plan and respond to winter storms

More Intense Storms – System Operations

- Keep motorists informed of hazardous conditions/roadway closures using appropriate technology (changeable message boards, etc.)
- Develop stronger contingency response plans for extraordinary winter storms

System Operation and Maintenance Considerations – More Intense Storms Cont'd

- Monitor potential hazard of snow accumulation during a more frequent storm period along barriers and plan for routine removal
- Create an appropriate winter maintenance budget that reflects the cost of responding to numerous and intensive storms in a manner that meets public expectation

System Operation and Maintenance Considerations – More Intense Storms Cont'd

- Create a detailed economic model that speaks to the societal costs of delayed or inappropriate response to winter storms
- Routine maintenance items such as ditch cleanout, drainage structure cleanout must be emphasized to avoid failure during an intense rainfall event

System Operation and Maintenance Considerations – More Intense Storms Cont'd

- Monitor and clean, as needed, bike lanes, shoulders, and non motorized trails in vertical curve sag areas.
- Siltation, gravel, and other debris that present serious hazards to bicyclist may accumulate after winter plowing and heavy rainfall events

System Operation and Maintenance Considerations – Hotter and Drier

Strategy: Use best practices to keep roadways and roadsides in a safe and aesthetically acceptable condition during the heat of summer

- Make sure vegetation is managed appropriately during drought periods near roadsides that are susceptible to wildfires
- Monitor and be ready to respond quickly to pavement “tenting” due to excessive heat periods
- Monitor health of vegetation in right of way that may be stressed due to extreme weather or invasive/new northerly migrating insect species and remove and replace as necessary

Questions