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