NATIONAL CONFERENCE ON TRANSPORTATION ASSET MANAGEMENT

Minneapolis, MN July 9th-12th

Vulnerability and Risk Assessment

- Identify types of risk MDOT infrastructure
- Identify specific “at-risk” assets
- Identify method to incorporate risk into asset management systems and FHWA Framework
- Identify gaps in asset management inventories critical to a vulnerability assessment.

Climate Variables

Issue(s) of Concern	Climate Variable	Operationalized Climate Variables
Increased erosion from intense precipitation, decreased snow/increased rain bridge scour	Extreme precipitation	• Change in 24-hour rain event (30-year, 50-year, 100-year events) • Change in precipitation as snow versus rain
Freeze/thaw Great Lakes ice cover (and impact on lake effect snow)	Winter temperatures/ temperature variability	• Number of days below freezing (change from present for 2050, 2100) • Number of consecutive frost-free days (change from present for 2050, 2100)
Road buckling	Extreme summer temperatures	• Number of days over 95 degrees
Lake levels		• Qualitative analysis based on research
Wildfire		• Qualitative analysis based on research

Climate Analysis Findings – Temperature

- Annual average, minimum, and maximum temperatures will continue to increase under both emission scenarios
- Hot days (>95 °F) projected to increase across Michigan –greater increases further South
- By 2100, southern Michigan might see region could 60% fewer days below freezing
- Freeze-thaw patterns are expected to remain to 2050, then decline by half in the southern region by 2100

*maximum temperature > 32°F and the minimum < 32°F

Climate Analysis Findings - Precipitation

- Average annual precipitation
  - Increase by as much as 70% in some scenarios
- Seasonal precipitation
  - More certainty in winter precipitation increase
- Extreme precipitation (100-year, 24-hour event)
  - Greater increase in Southern Michigan
  - More variability in high emissions scenario than the medium emissions scenario

Approach – Statewide Risk Analysis

- Statewide analysis: Risk = criticality X vulnerability
  - Criticality – based on existing MDOT approach for bridges
  - Vulnerability – Intersection of Asset Data and Climate Analysis Results
- Vulnerability – Multiple scenarios to account for uncertainty
  - Medium and high emissions
  - Five climate models

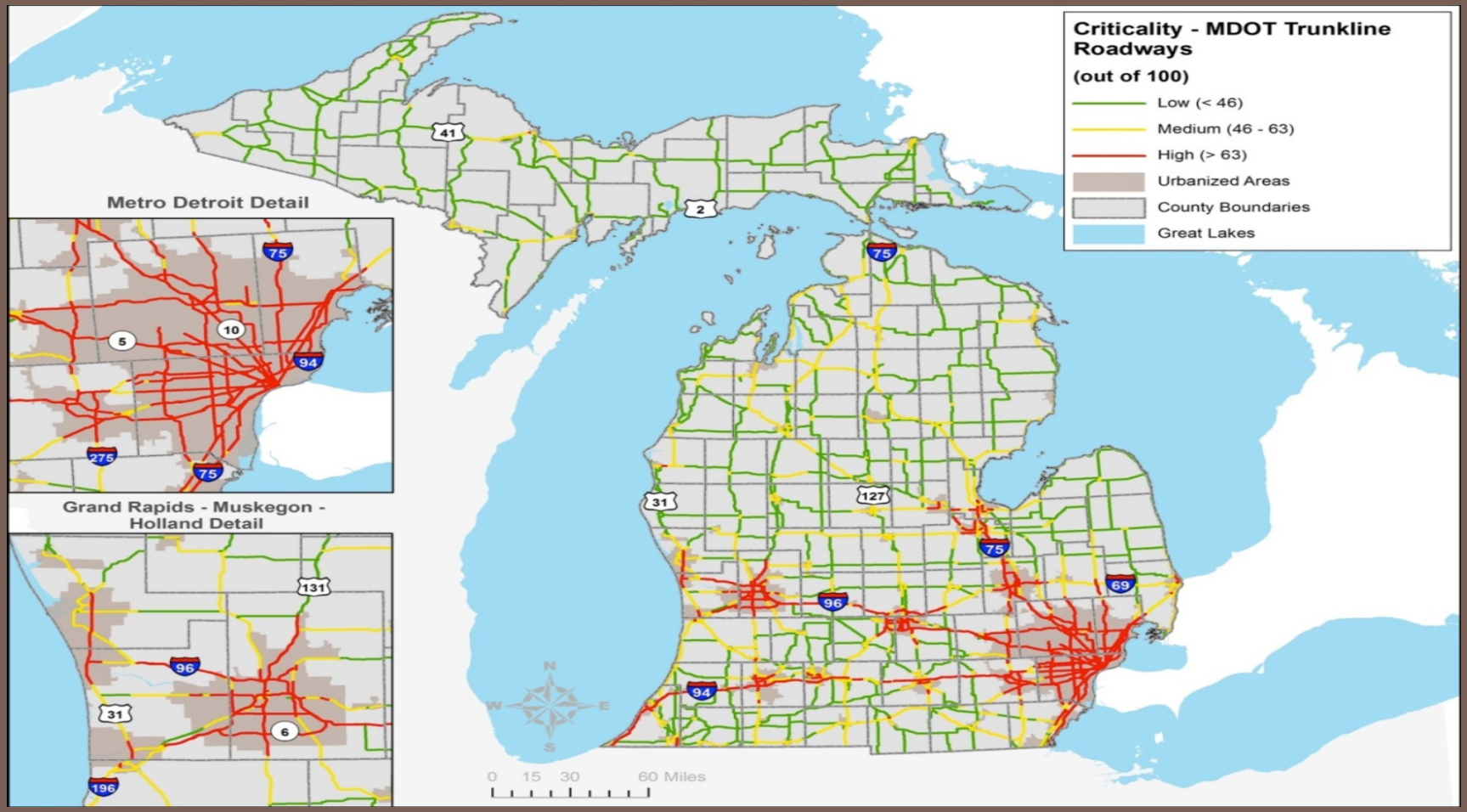
Criticality Approach - Bridges

- MDOT Bridge Scour spreadsheet includes a score for criticality based on:
  - Traffic volume (highest weight)
  - Functional classification
  - Detour length
  - Cost of replacement
  - Economic impact (truck volumes and presence of marine navigation)
- We used this as basis for our criticality analysis, and replicated it for all MDOT bridges using NBI data

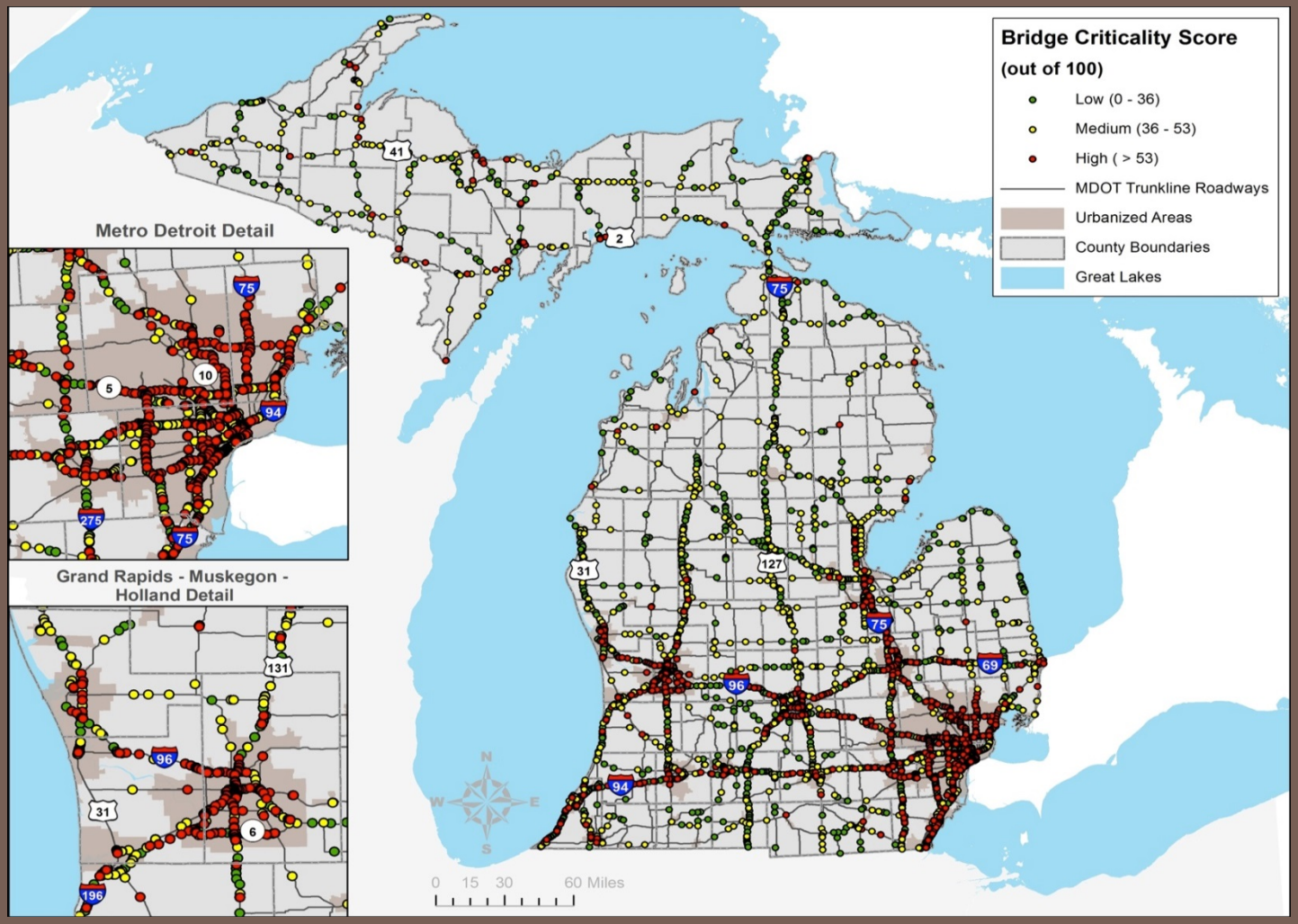
Criticality Approach - Roadways

- Like for bridges, roadway criticality scores based on:
  - Traffic volume (highest weight)
  - Functional classification
  - Cost of replacement
  - Economic impact (truck volumes)
- Final criticality scores are on a scale from 0-100
- Like original bridge scour spreadsheet, 1/3 of assets placed into each of three categories: low, medium, and high

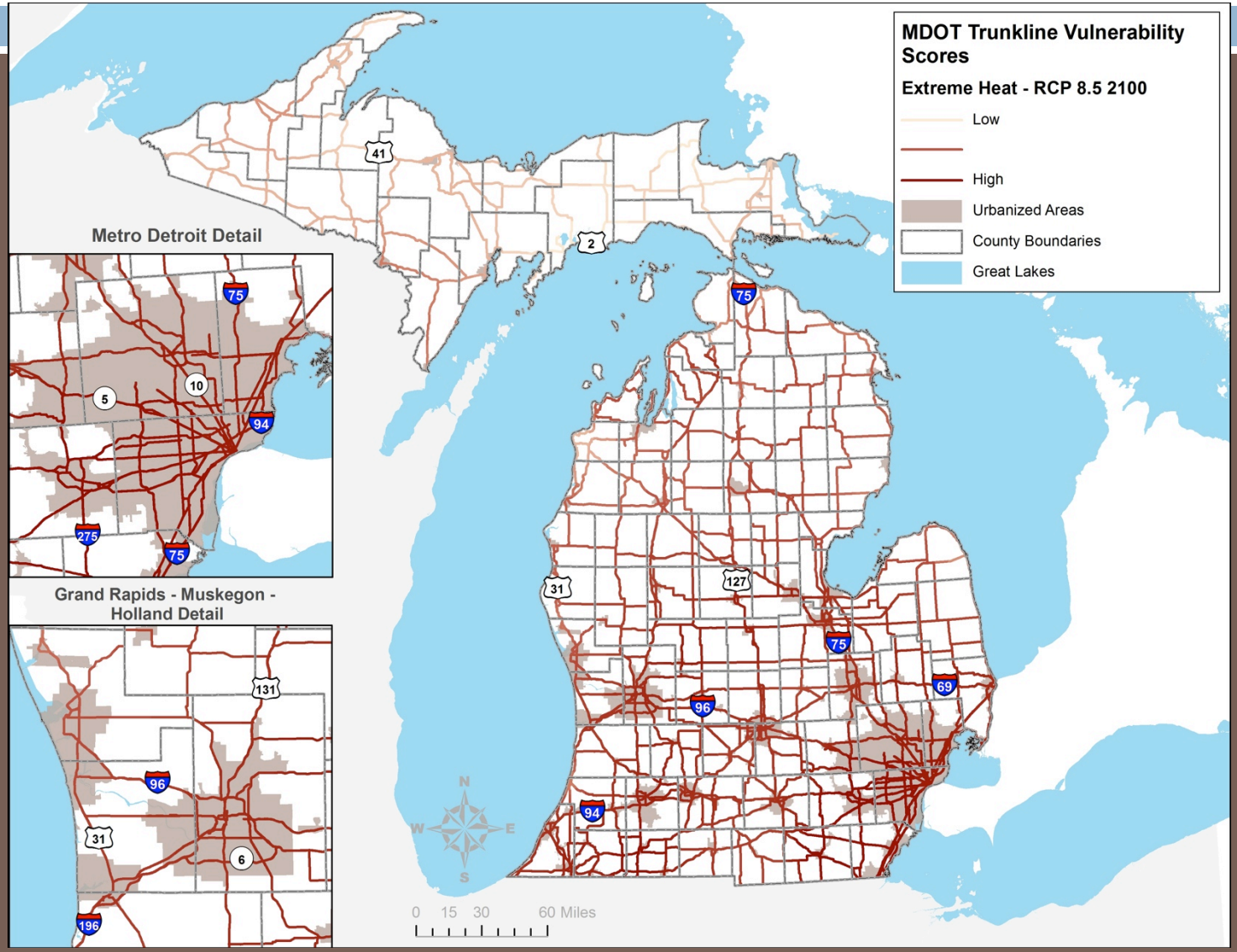
Trunkline Roadway Criticality Assessment Results



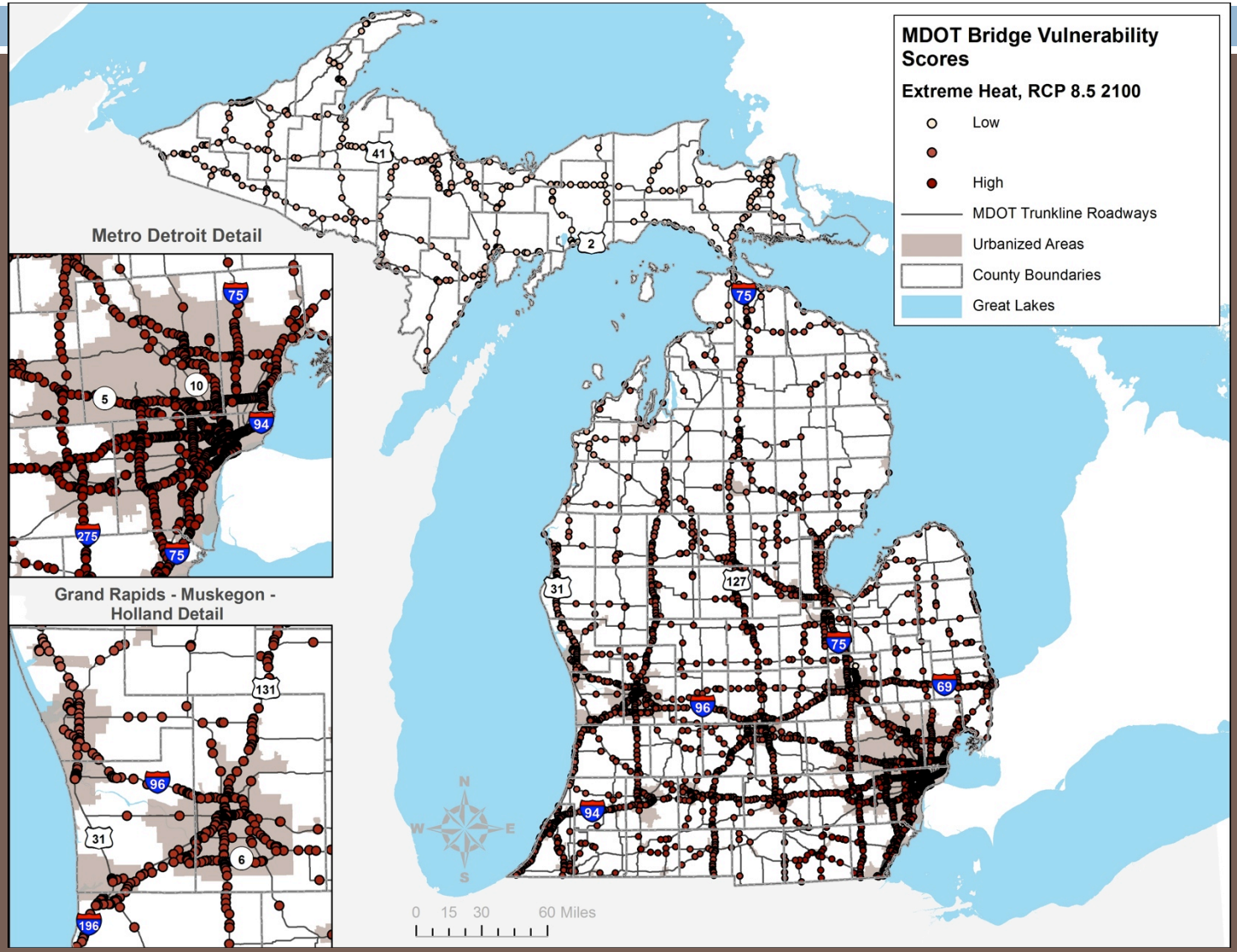
MDOT Bridge Criticality



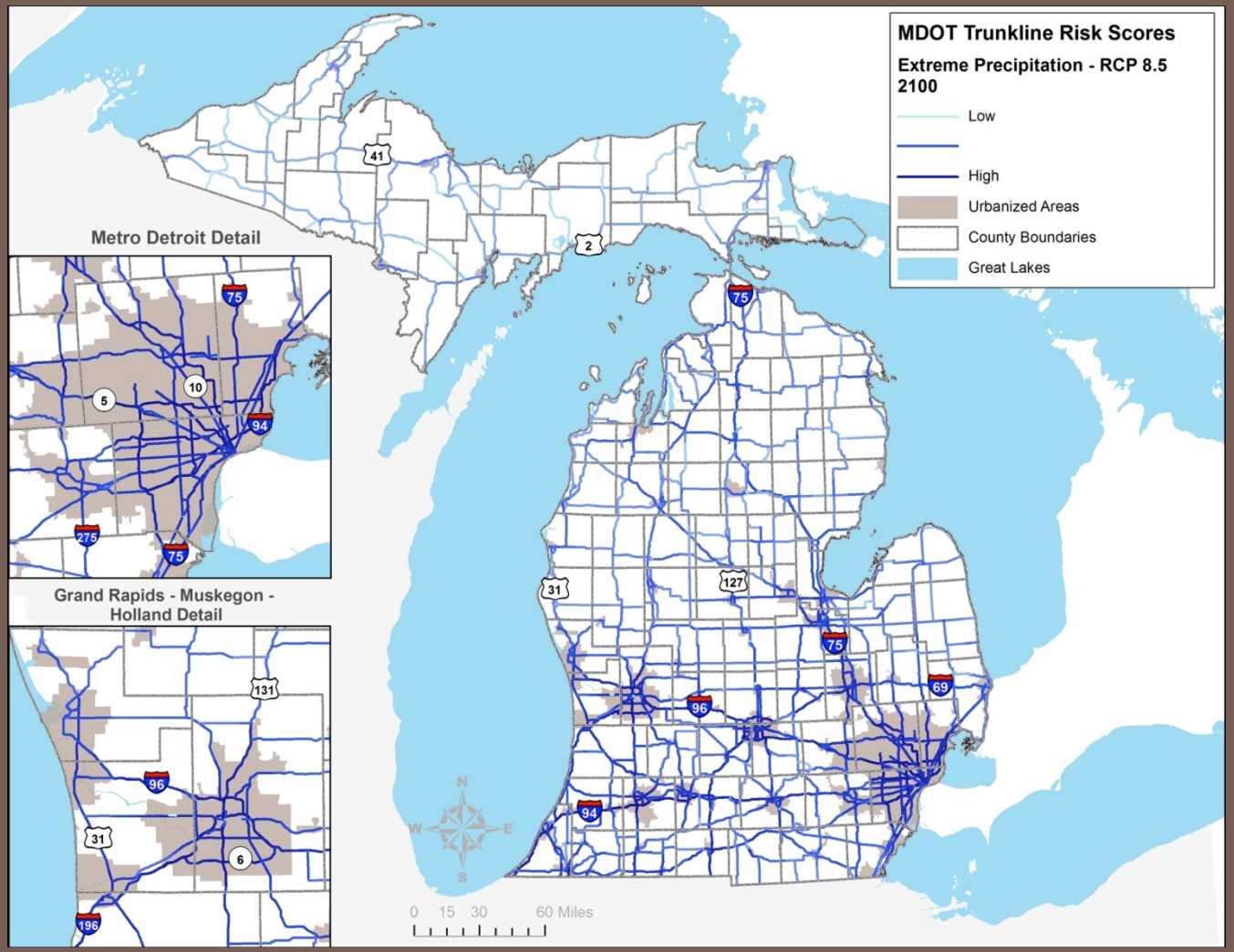
Trunkline Vulnerability to Extreme Heat: 2100 – High Scenario



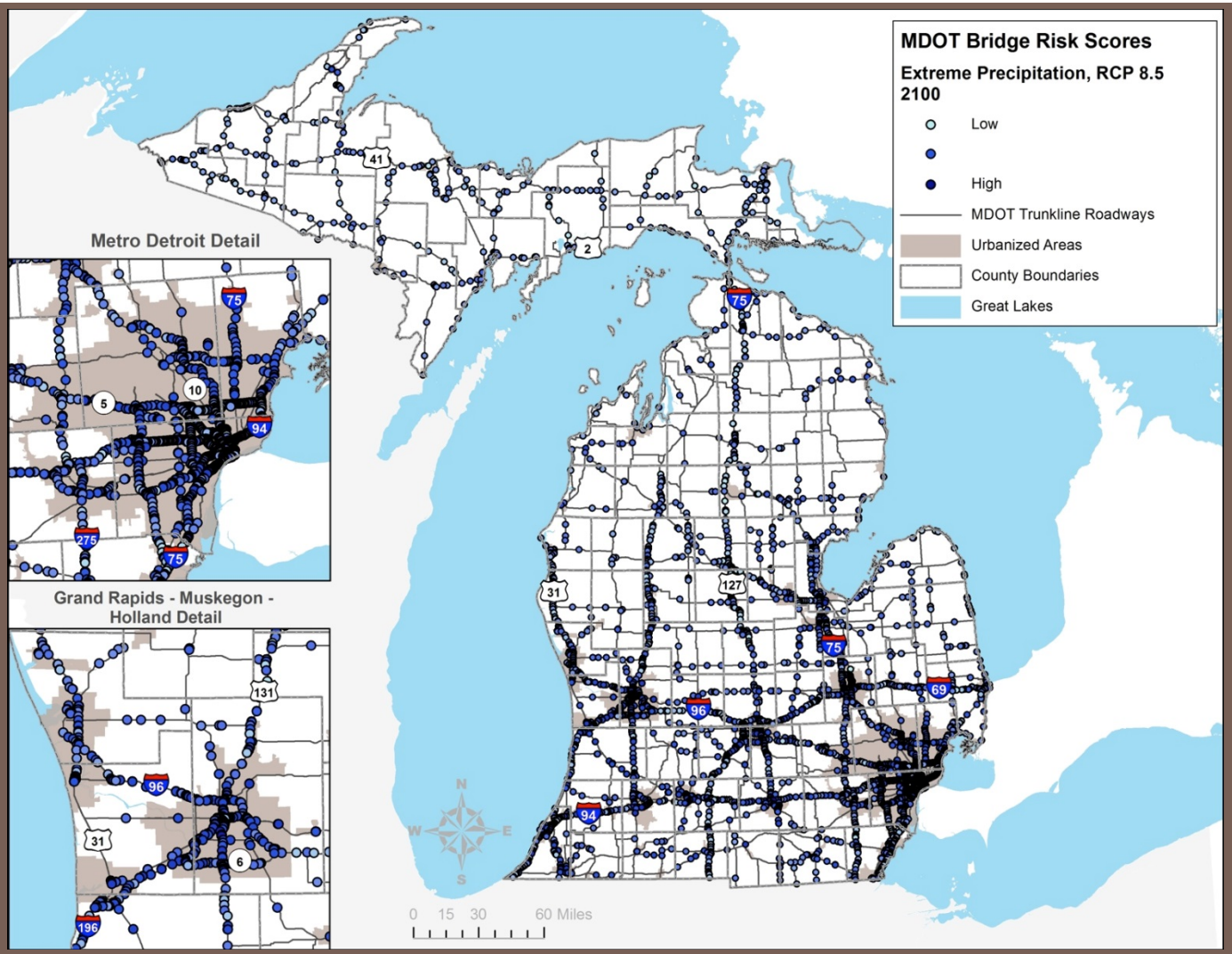
Bridge Vulnerability to Extreme Heat: 2100 – High Scenario



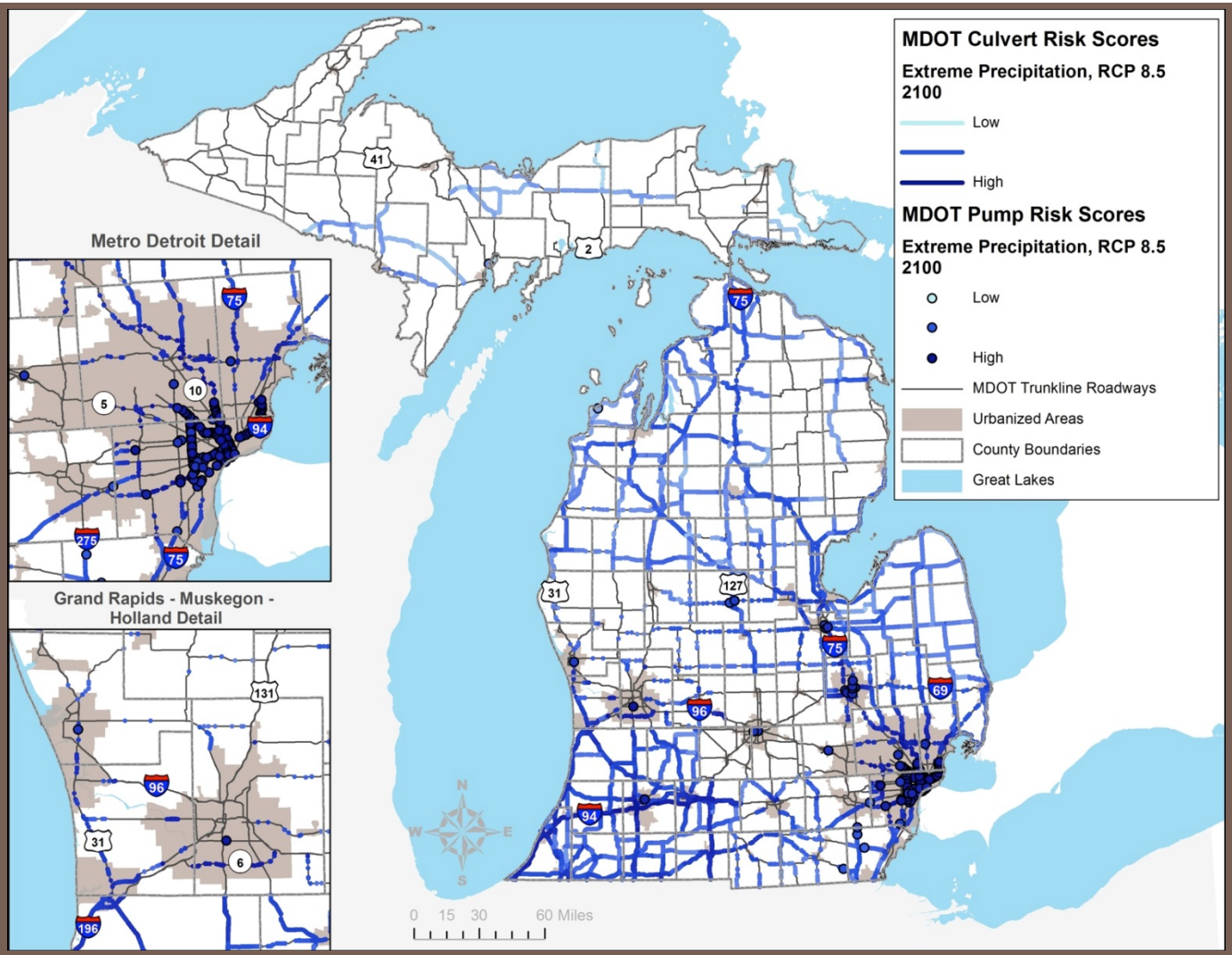
Trunkline Extreme Precipitation Risk: 2100 – High Scenario



Bridge Extreme Precipitation Risk: 2100 – High Scenario

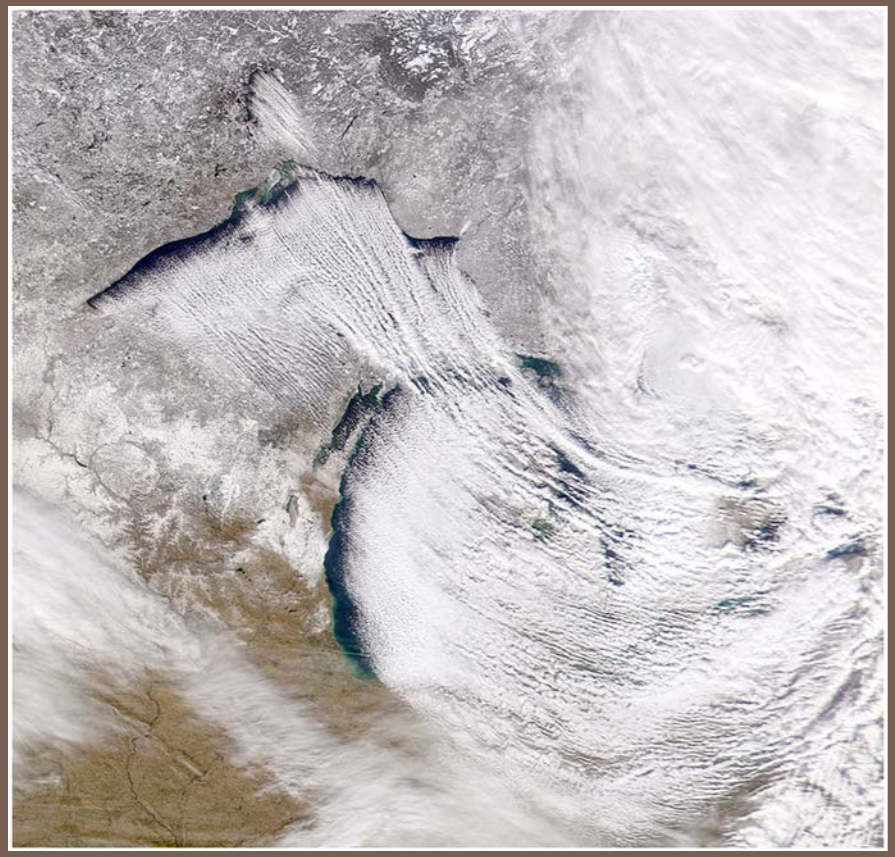


Pump and Culvert Extreme Precipitation Risk: 2100 – High Scenario



Implications for Operations and Maintenance

- Potential need for significant adjustments to operations, maintenance and, construction
- Possible to see longer construction seasons
- However, increased likelihood of extreme events could limit construction days



Operations and Maintenance

- Road closures due to flooding likely to increase
- Recent experience with flooding on below-grade freeways highlighted the need to work with municipal partners regarding pump station operability

Potential Action Items

- Track extreme weather-related disruptions to construction days and adjust guidelines if needed
- Continue to develop robust information regarding materials expenditures during extreme winter weather events
- Evaluate economic impacts of roadway closures and establish thresholds for acceptable closure levels for specific events
- Develop more detailed analysis in high-risk/high-value corridors

Questions?

- Thanks to MDOT's DII Division for developing the web-based tool