

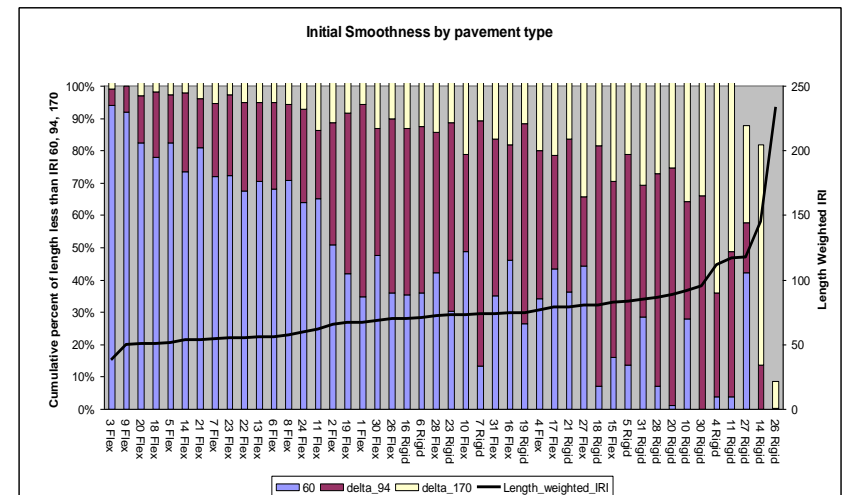
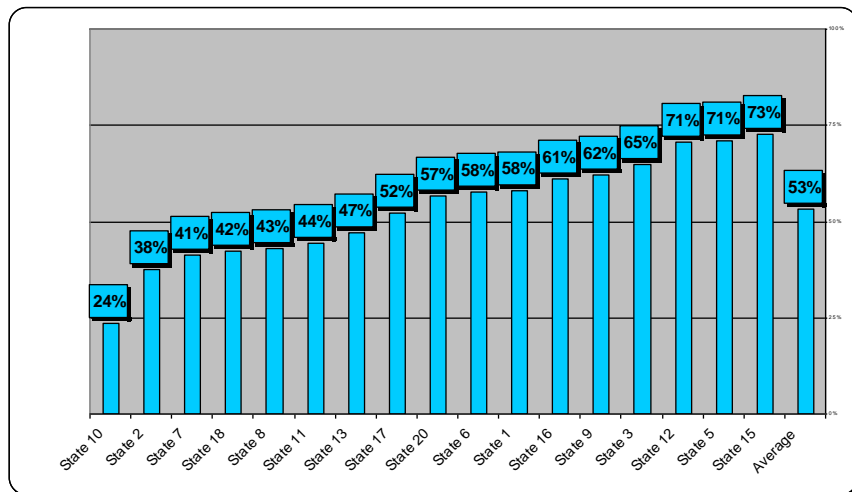
NCHRP 20-24(37B) – Comparative Performance Measurement

Smooth Pavements: International Roughness Index

October, 2008

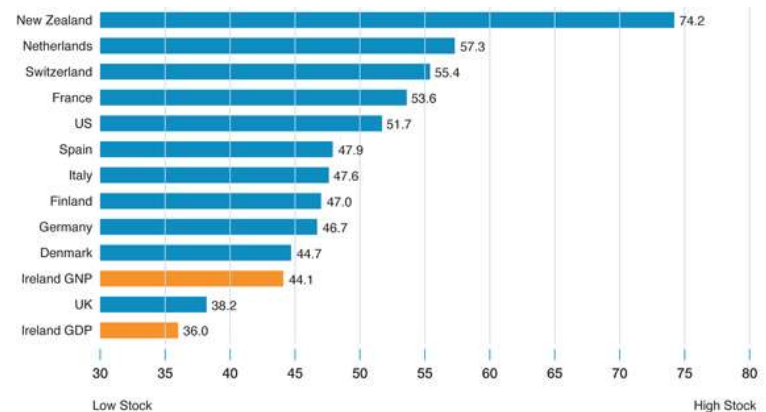
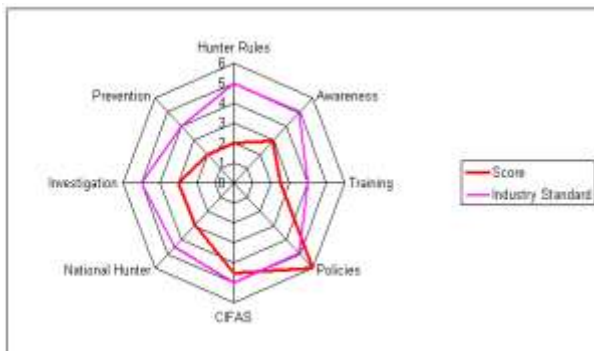
Agenda

- Project Context
- Project Objectives and Scope
- Project Participants
- DATA COMPARISON ISSUES
- Project Findings



Project Context - Why Comparative Performance Measurement?

- State DOTs share similar strategic goals
- Best practices can be shared – learn more from each other
- DOTs’ senior executive staff seek means for understanding & learning from differences
- Counter outside efforts to measure DOTs (e.g. TTI, Hartgen, Governing Magazine)
- New tool for implementing continuous improvement philosophy
- Provide “one-stop shop” for priority and emerging business areas (e.g. safety)

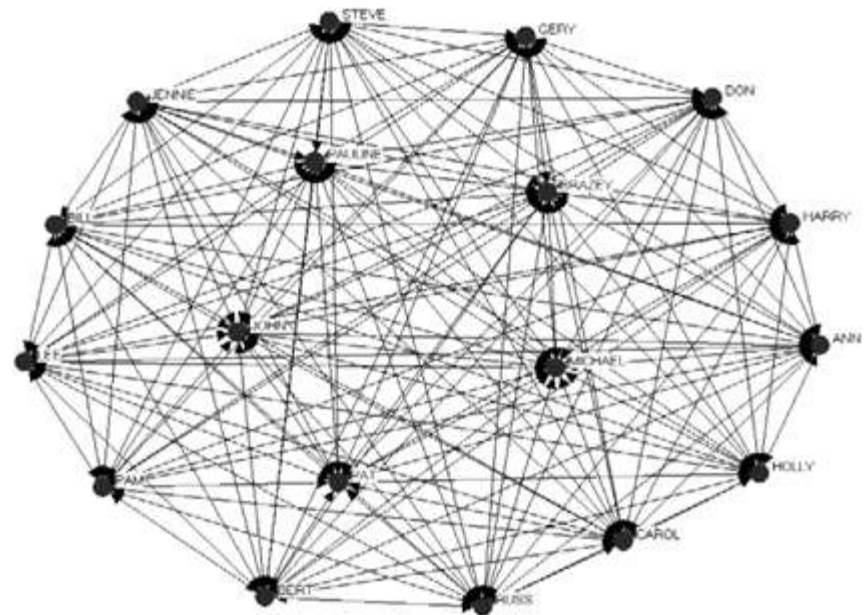


Project Context - History

- Comparative performance measurement effort initiated in 2004
- Initial set of activities involved workshops and conversations with executives to identify candidate areas of interest
- Project delivery chosen as pilot focus area. Seven states sign on for pilot - Delaware, Florida, Missouri, New Mexico, Ohio, Virginia, and Washington State
 - Developed prototype approach for comparative performance measurement
- Pilot project transitioned to first comparative performance measurement study – on-time and on-budget construction
 - Study conducted in 2006, report completed in March 2007
- **Current project for smooth pavement – IRI started in September 2007 and is completed**
 - **Final report issued**
- Funding for next project secured, likely to start fall 2008

Project Context – Basic Principles

- Make participation voluntary
- Focus on knowledge sharing
- Comparisons between peers
- Rigorous measurement methodologies
- Build on DOTs efforts
- Minimize added burden on data collection
- Protect DOTs from unfair scrutiny
- Start small

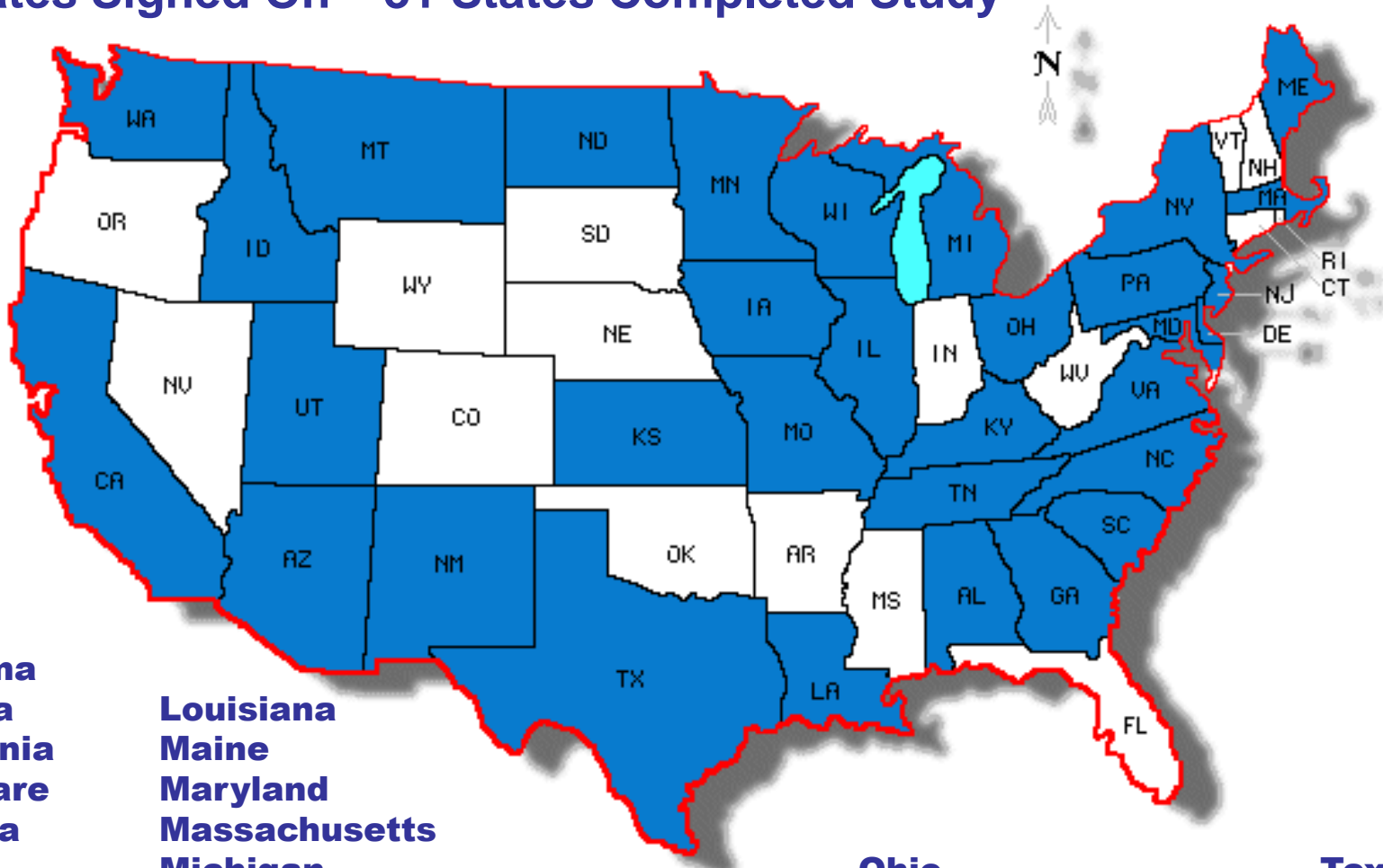


Smooth Pavements – International Roughness Index

- Use comparative performance measures as a means to improved practice (NOT as a report card.)
- Obtain *interstate* IRI data from multiple state DOT's.
- Obtain metadata about IRI measurement and reporting methods.
- Identify the top five performers with respect to selected measures derived from the IRI data.
- Obtain information on pavement construction and maintenance practices for the top five performers, and document conclusions that can be drawn about best practice for achieving smooth pavements.

Participation

32 States Signed On – 31 States Completed Study



Alabama
Arizona
California
Delaware
Georgia
Idaho
Illinois
Iowa
Kansas
Kentucky

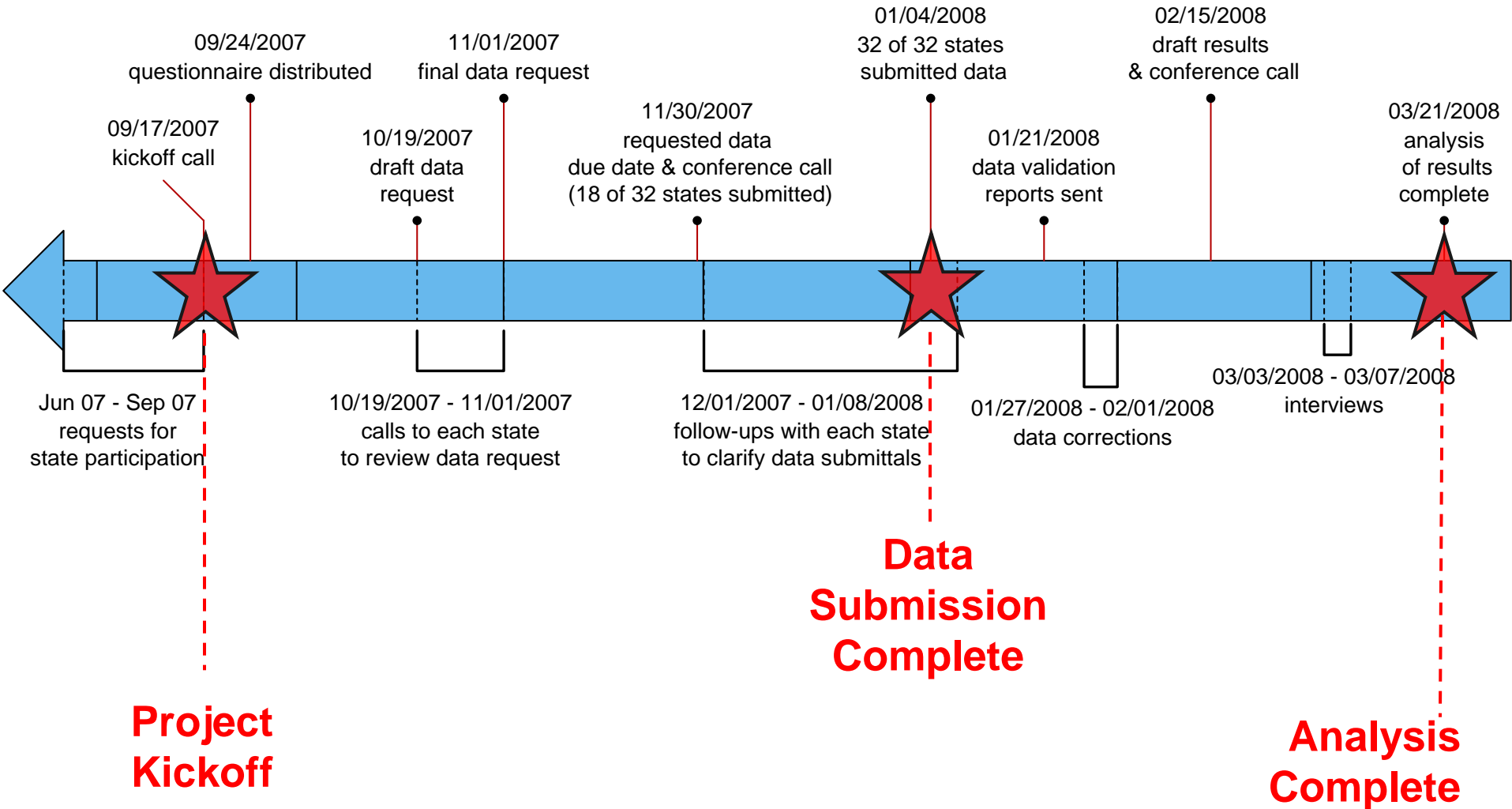
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Missouri
Montana
New Jersey

New Mexico
New York
North Carolina
North Dakota

Ohio
Pennsylvania
South Carolina
South Dakota
Tennessee

Texas
Utah
Virginia
Washington
Wisconsin

Project Timeline



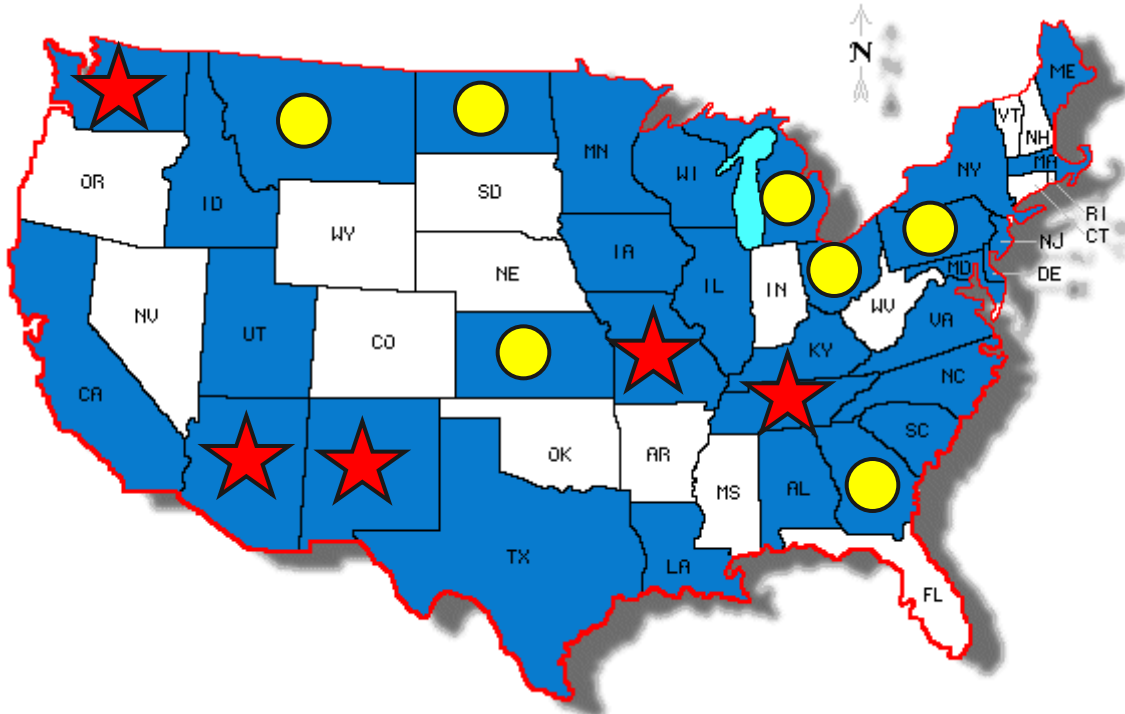
Selected States

★ Top Five States - Interviewed

- Arizona DOT
- Missouri DOT
- New Mexico DOT
- Tennessee DOT
- Washington State DOT

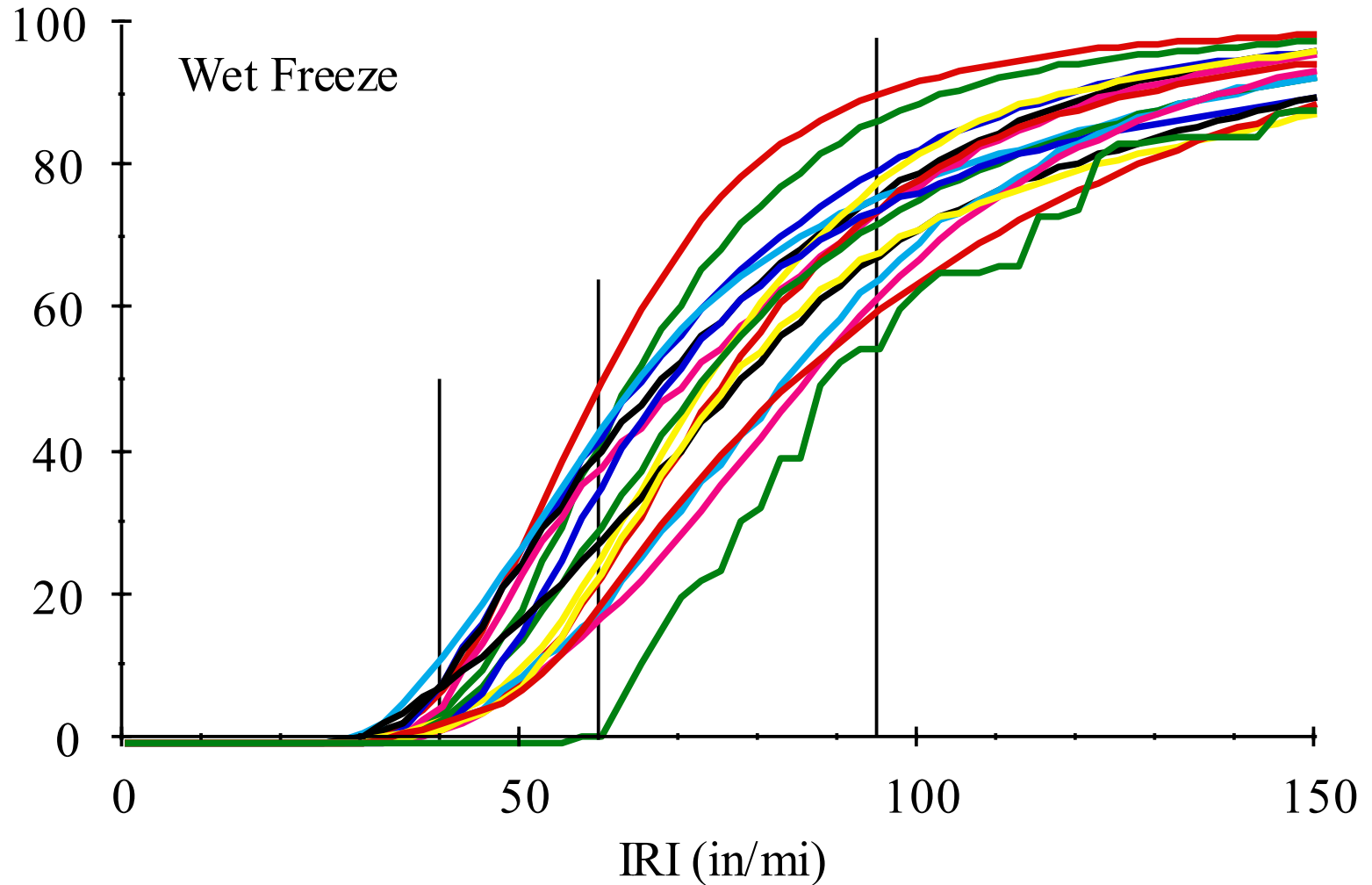
● Additional States – Sent Questionnaire

- Georgia DOT
- Kansas DOT
- Michigan DOT
- Montana DOT
- North Dakota DOT
- Ohio DOT
- Pennsylvania DOT



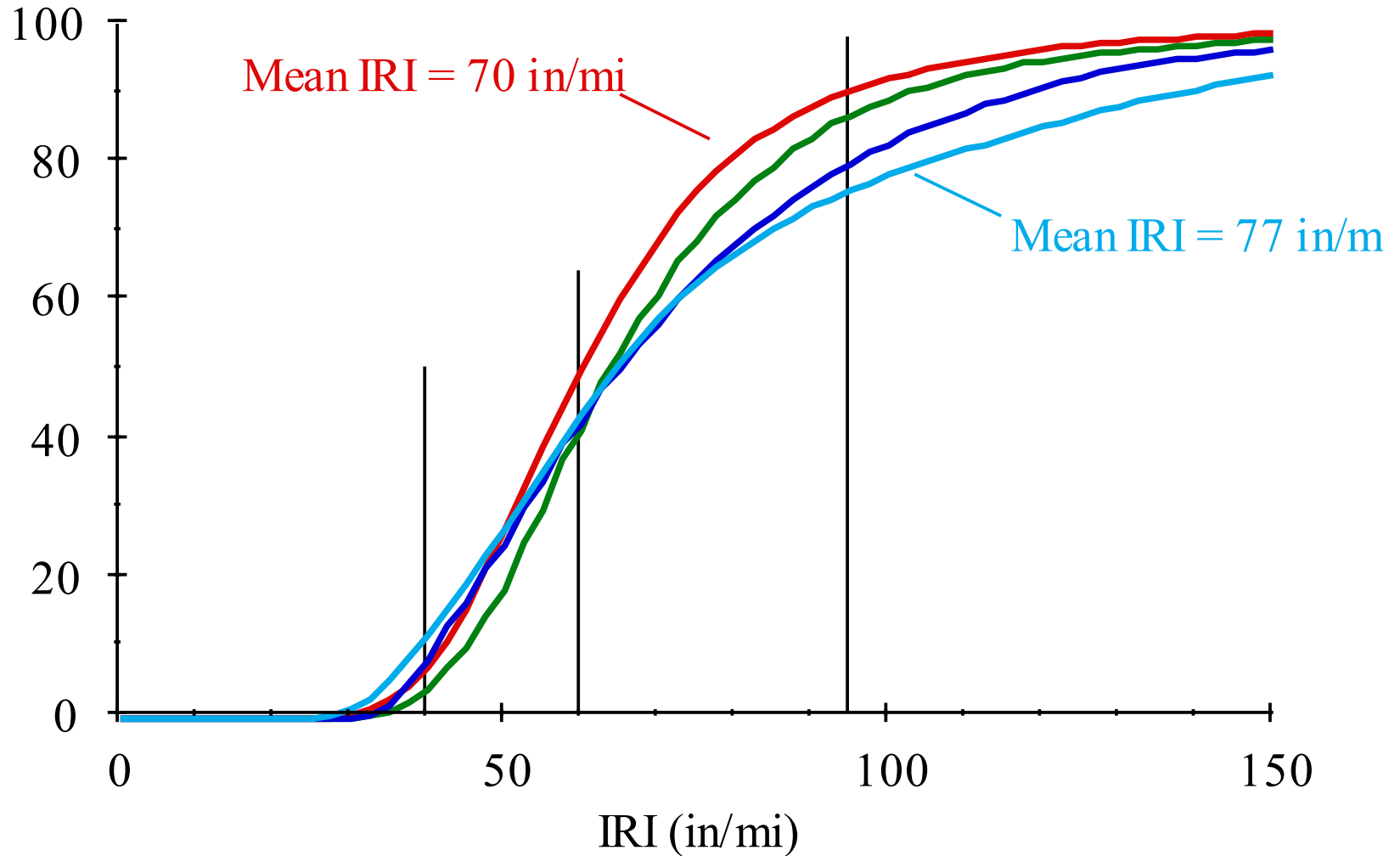
Region-wide Comparison, Bridges and Tolls out

Percentile (Length Weighted)

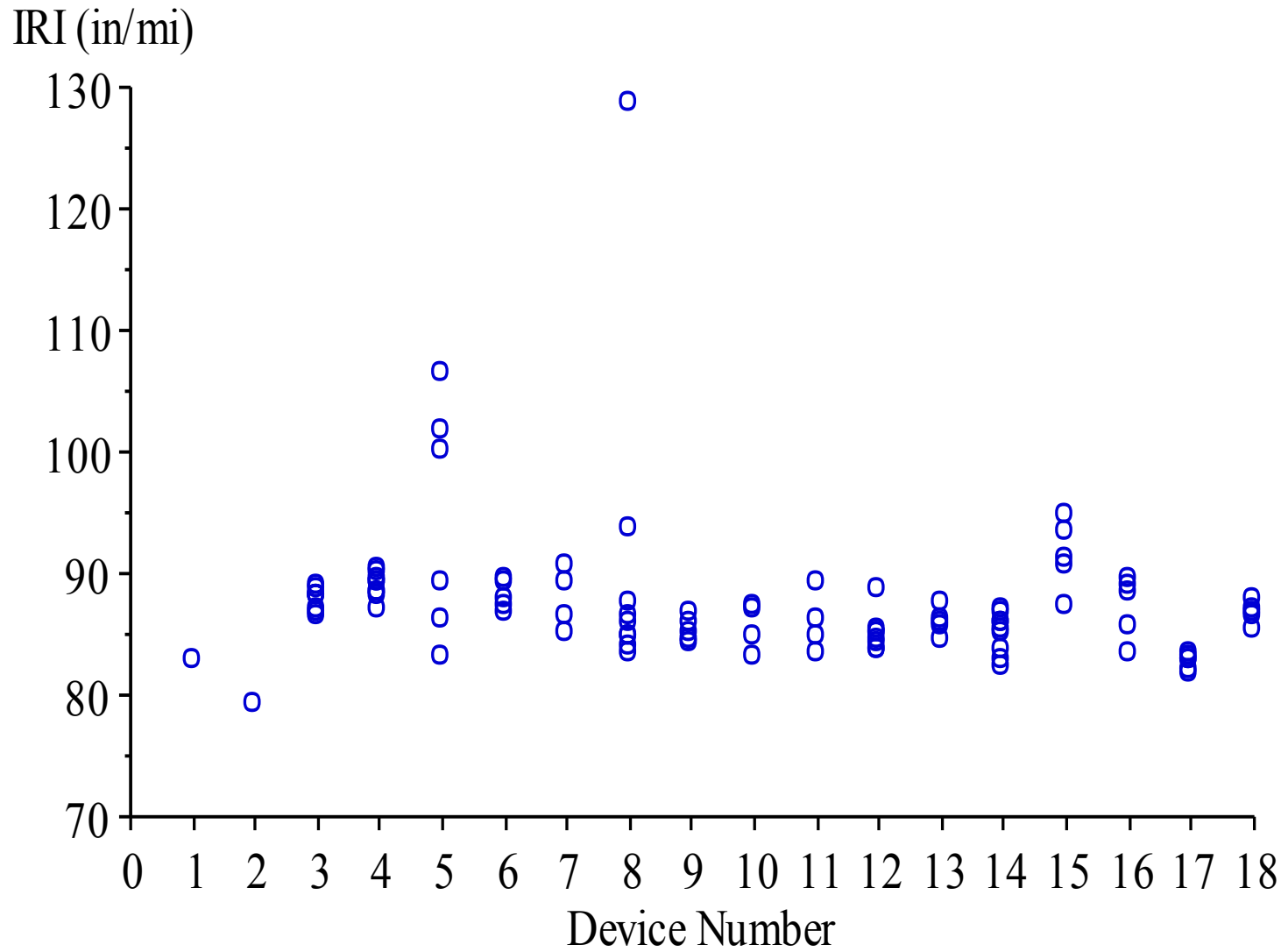


Front-runners

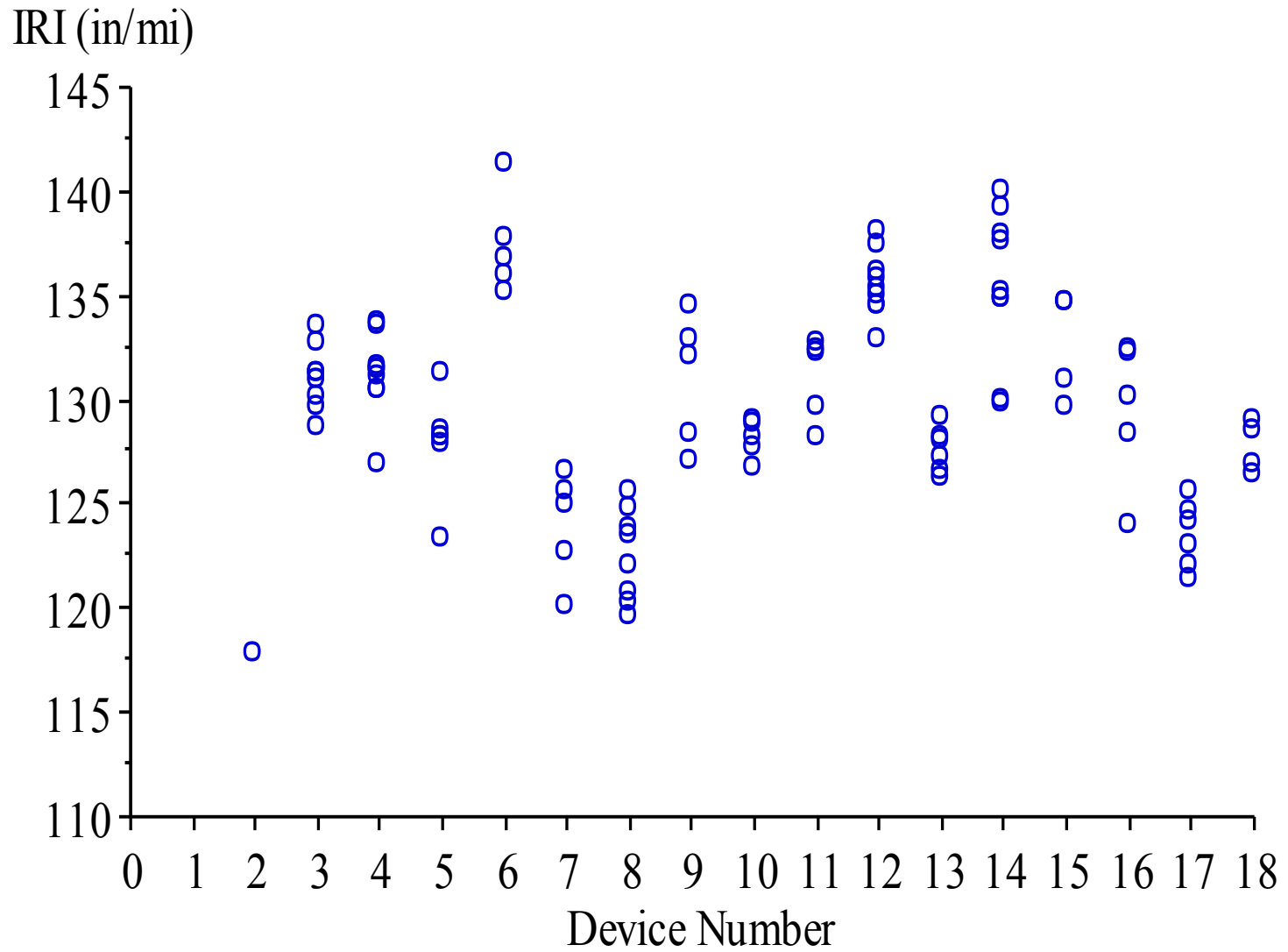
Percentile (Length Weighted)



IRI Agreement, 9.5mm SMA



IRI Agreement, OGFC



Profiler Attributes

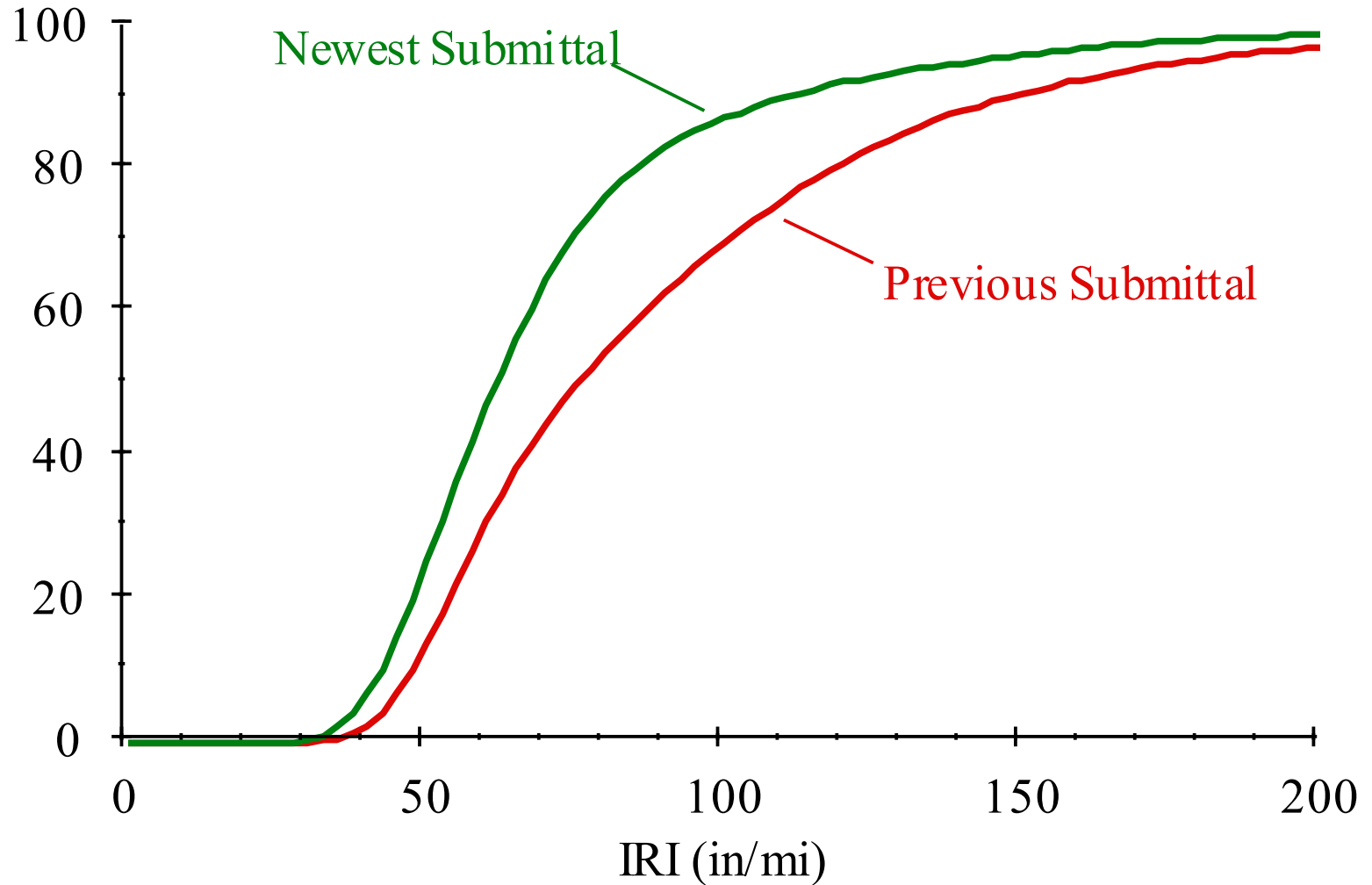
Surveyed:

- Profiler make, model
- Index type, lane, wheelpath
- Filtering and sampling practices
- Height sensor footprint
- Profiler verification procedures

Asked for 1 mile of profile.

Change with Time, One State

Percentile (Length Weighted)



IRI Calculation, One State

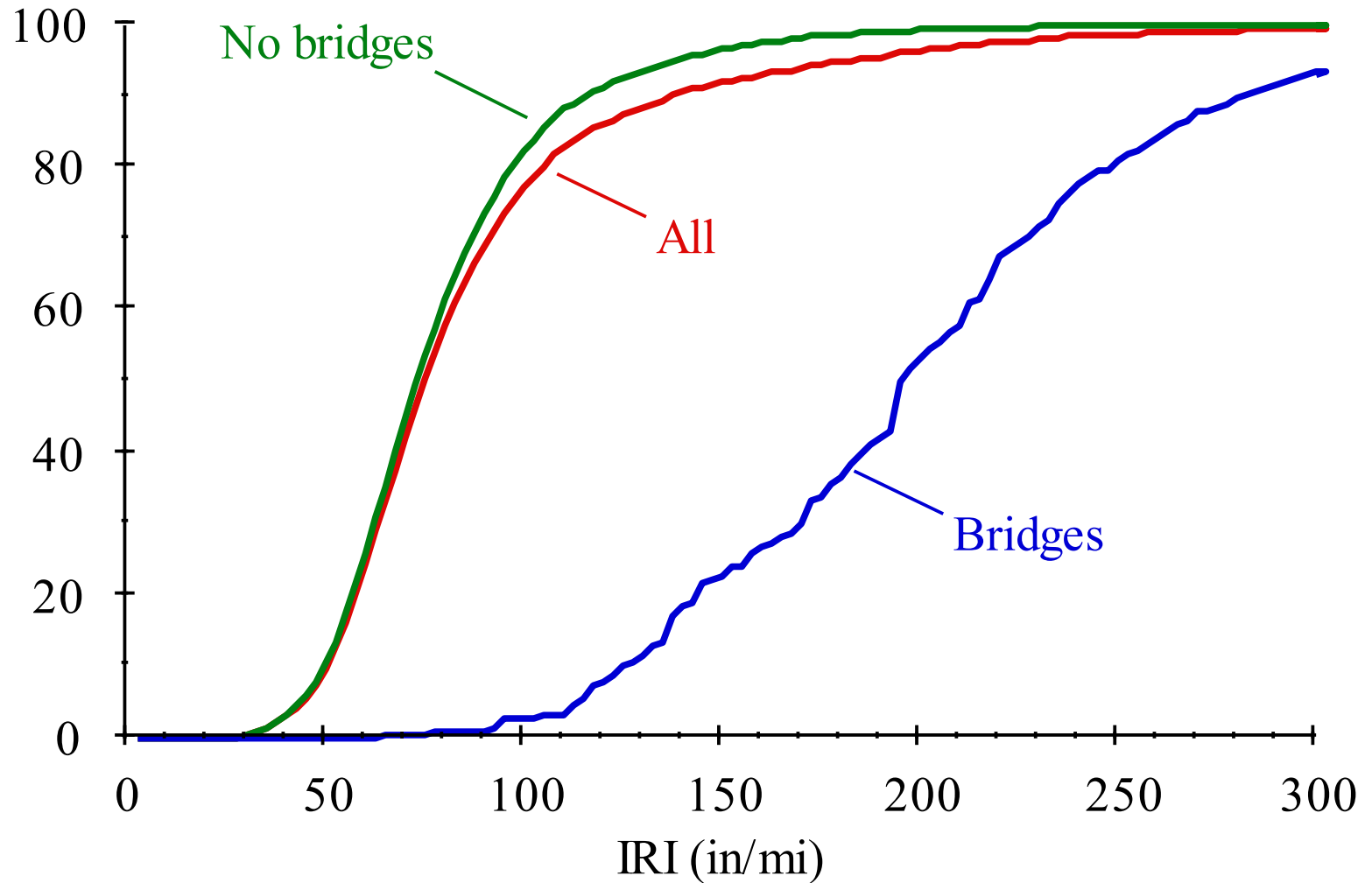
5.8-mile section:

- Vendor IRI: 78.8 in/mi
- Value from exported profile: 78.4 in/mi

0.1-mile segments: -1.7 to 1.1 in/mi difference

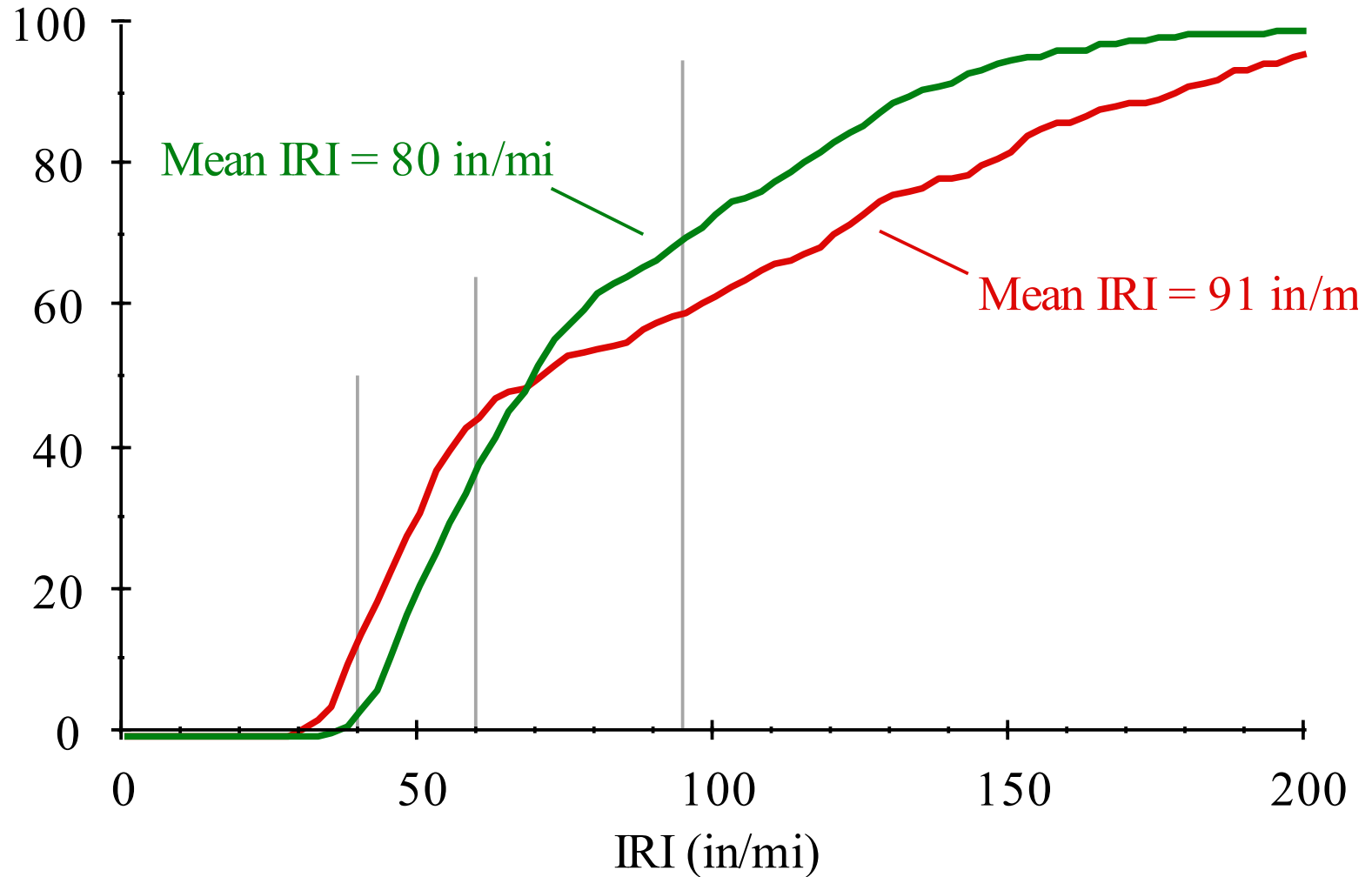
Effect of Bridges

Percentile (Length Weighted)



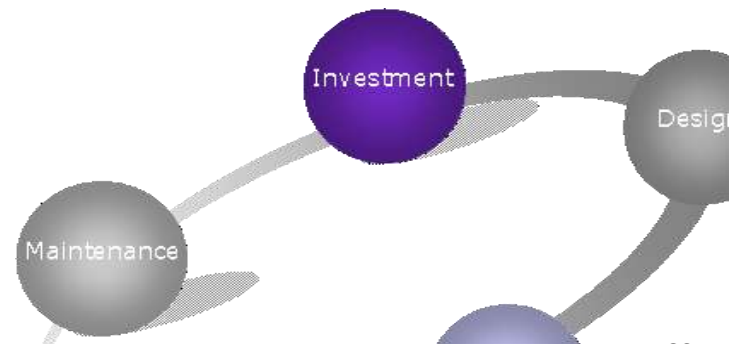
PCC Only

Percentile (Length Weighted)



Summary Findings

- Practices used by top performing states require a clear focus by the agency, and policies and programs that support that focus.
- Highlights identified include (1) use of end result ride specifications with financial incentives for good performance and (2) establishment of close working relationships with the contractor community.
- Five agency practices and four contractor practices were identified as valuable for achievement of smooth pavements.
- Recommendations for improving future comparative performance measurement using IRI developed



Agency Practice # 1: Use End Result Pavement Construction Specifications with Incentive Bonuses

- Use end-result ride specifications that put responsibility on the contractor to achieve target performance and provide them with the flexibility to decide how to meet them.
- Provide incentive bonuses to contractors for exceeding smoothness targets.
- Involve industry representatives on task forces to establish target values.
- Periodically tighten performance specifications as practice improves.
- Establish specifications with targets that can be achieved through good construction practices – without extensive grinding.
- Move towards use of the IRI for acceptance testing; if a profilograph is used, compute the Profile Index (PI) with a zero blanking band.

Agency Practice #2: Build Close Working Relationships with Paving Contractors

- Establish close partnerships with industry, moving away from an “us vs. them” mindset towards a cooperative working relationship to achieve a common purpose.
- Periodically involve contractors in joint meetings to address pavement quality issues.
- Hold pre-construction kickoff meetings with contractors to provide “just-in-time” training and jointly identify opportunities to enhance smoothness.
- Conduct education and outreach programs on quality pavement construction attended by construction supervisors, crew members and agency inspectors.
- Establish recognition programs, with annual smooth pavement awards for the contracting community.

Agency Practice #3: Align Pavement Const. and Maint. Programs with Network Performance Targets for Pavement Smoothness

- Establish network performance targets to provide a focus for improvement efforts and a basis for funding requests.
- Track progress and publish information on actual performance against targets.
- Align pavement construction and management practices to achieve targets.

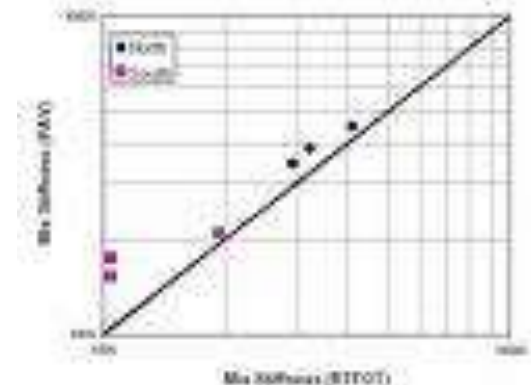
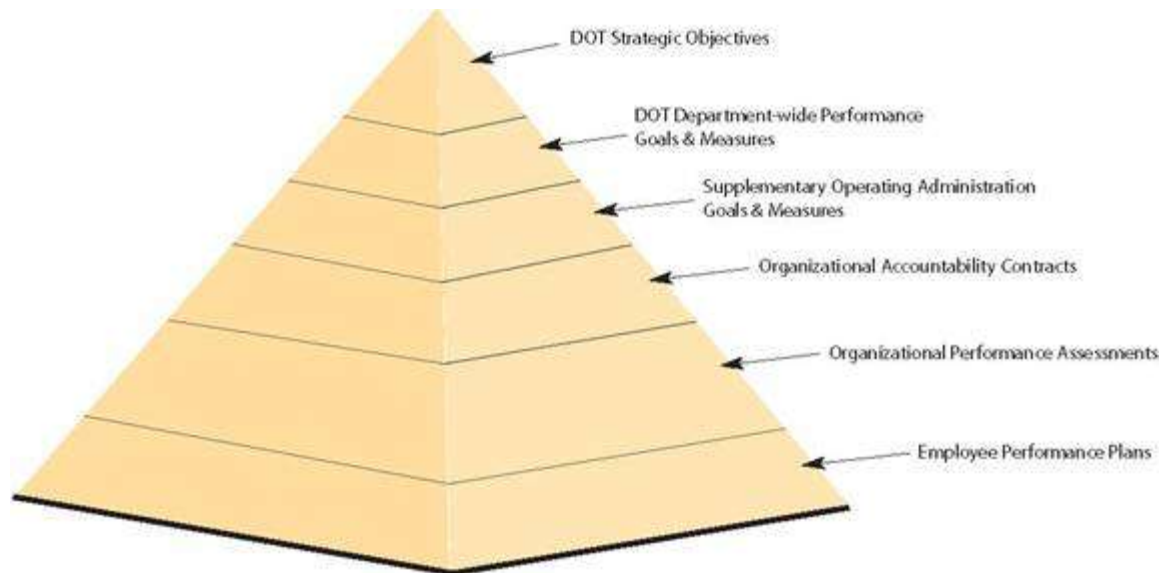
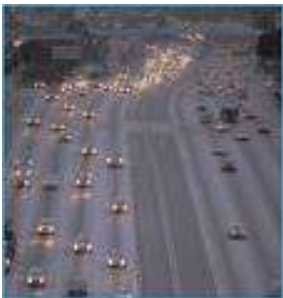


Figure 8. 2016 Performance (PAX) from BTEOT and PAX Data

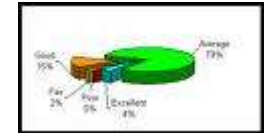
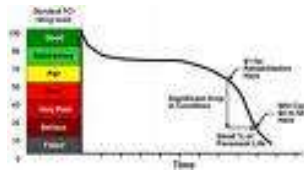
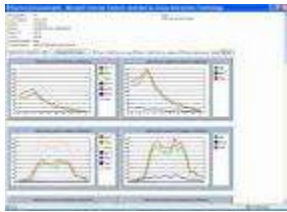
Agency Practice # 4: Integrate Customer Input

- Involve the public to gauge acceptable levels of pavement roughness and use these as input for establishment of rehabilitation triggers and performance targets.

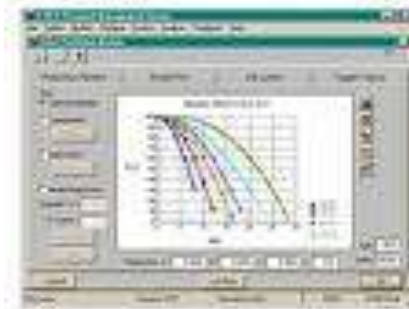
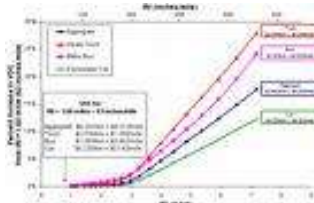
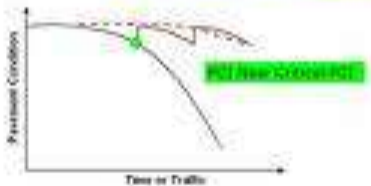


Agency Practice #5: Pavement Management

- Invest in strong bases and preventive maintenance to maximize pavement life at lowest life cycle cost, and rehabilitate pavements well before they become noticeably rough.
- Use pavement smoothness as one criterion for rehabilitation triggers and prioritization.



Preventive Maintenance Maintenance is performed to Increase PCI and Slow Rate of Deterioration



Contractor Practices

Category #1: Materials, Placement and Finishing Techniques

Category #2: Equipment Deployment

Category #3: Daily Testing and Adjustment

- Use of profilers to provide daily testing that can identify the need for immediate adjustments to improve smoothness

Category #4: Cultivating a "Quality Mindset"

Improving Future Comparative Performance Measurement Using IRI

- Addressing Data Gaps that Limit Comparative Performance Analyses
 - Maintain historical IRI data for .1 mile sections
 - Maintain information about pavement types with accurate spatial referencing
 - Maintain accurate pavement treatment history records
 - Maintain accurate information on bridge locations
 - Provide data integration capabilities that are accessible to end users

Improving Future Comparative Performance Measurement Using IRI

- Improving IRI Measurement Accuracy and Consistency
 - Encourage adherence to AASHTO standards
 - Encourage rigorous application of regular calibration procedures and system checks
 - Further develop AASHTO standards for network view
 - Spot check profile data on control sections to ensure that profilers are functioning properly
 - Verify IRI calculation software
 - Require profiler accuracy and repeatability testing as a condition of procurement contracts

Recommended Next Steps

- **Outreach** – communication of the findings of this project to state DOTs, their construction contractors, and IRI equipment vendors.
- **Continuation** – a second round of data collection should be considered in the 2009 time frame.
- **Additional Analysis** – The database assembled as part of this project contains a wealth of information that could be further mined to gain an understanding of factors influencing pavement smoothness.
- **Pavement Standards Initiative** – lack of standardized methods for classifying pavement types and treatments proved to be a barrier to assembling comparable information across states.