

Survey of State PMS Practices for Concrete Pavements

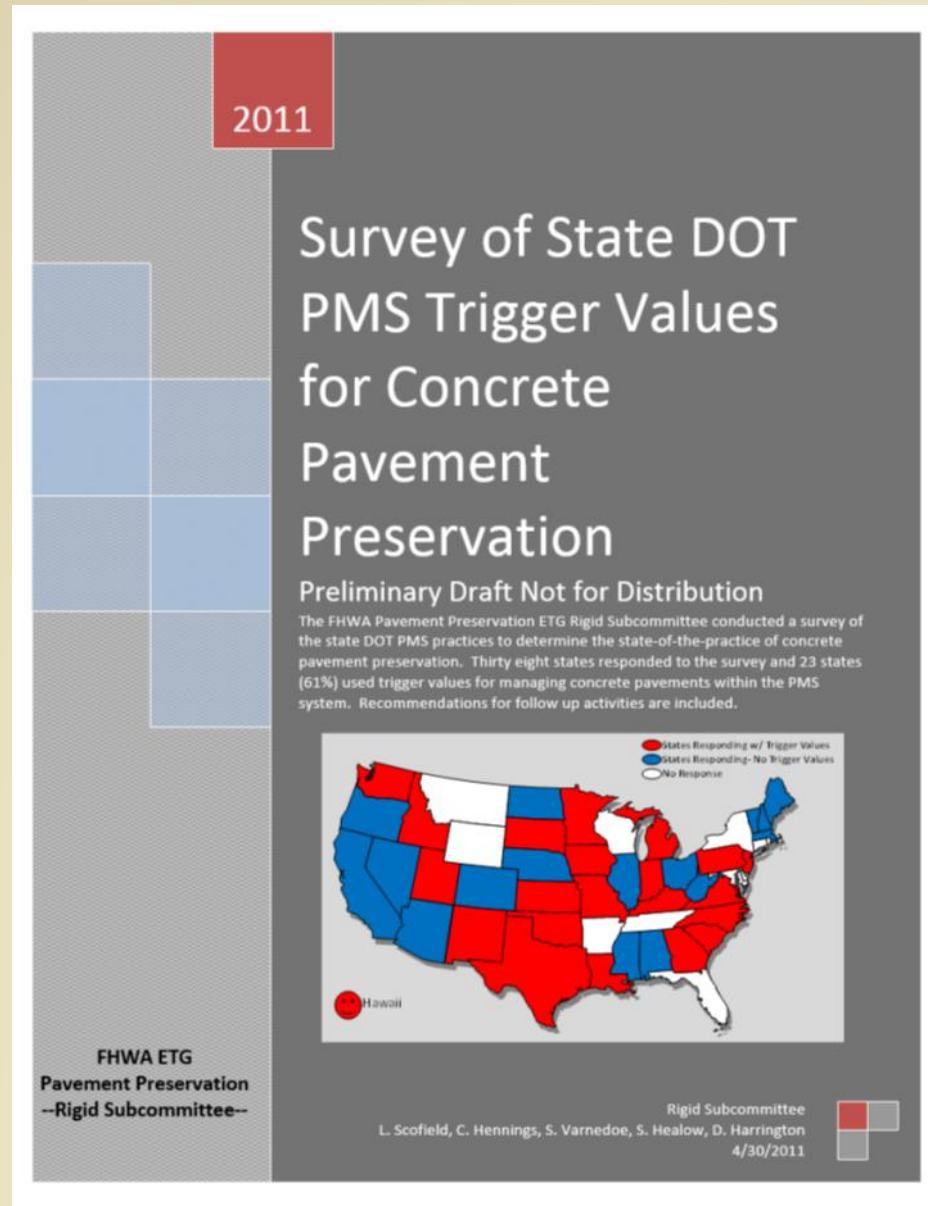
2016 National Pavement
Preservation Conference

Larry Scofield, P.E.

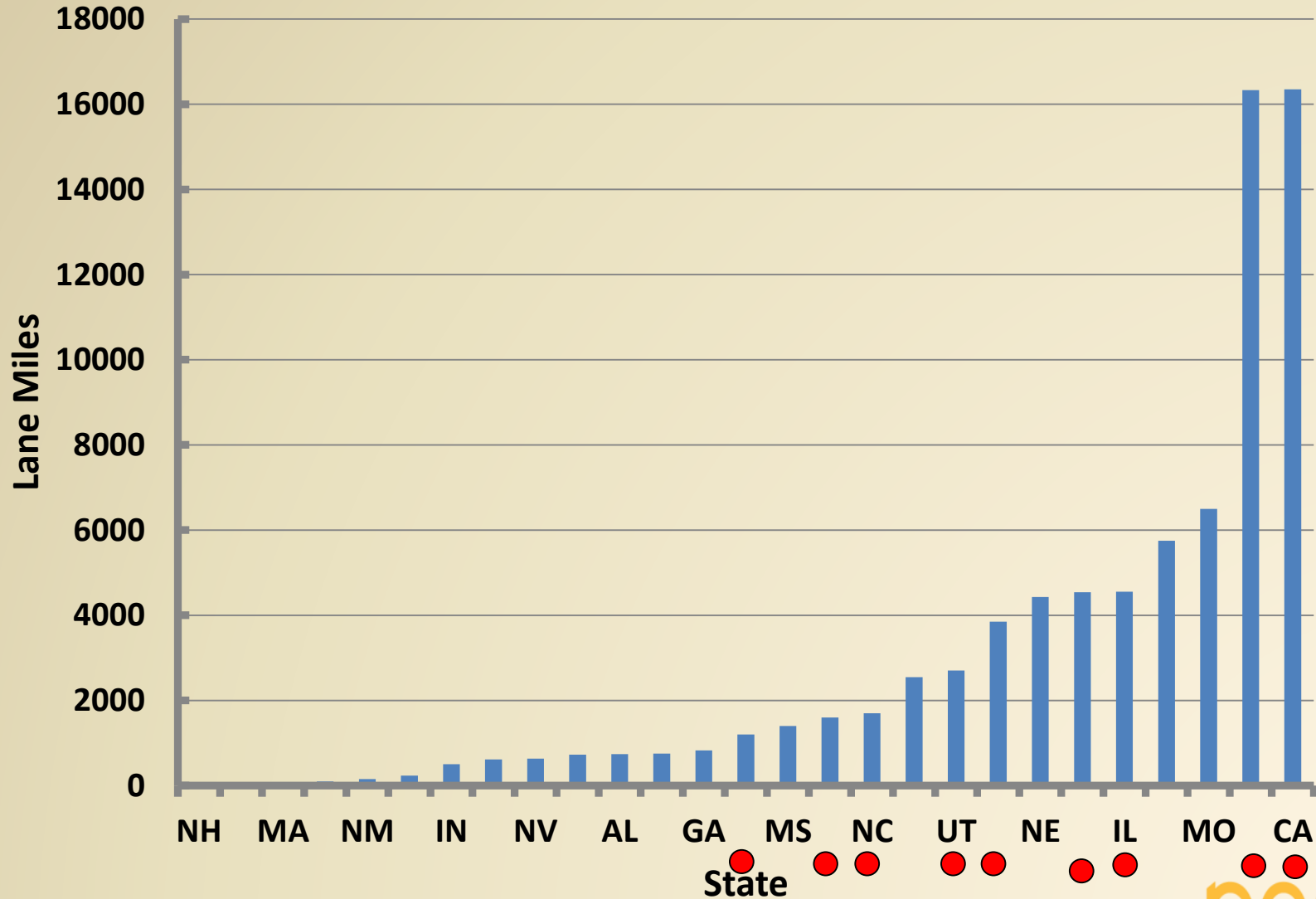
IGGA



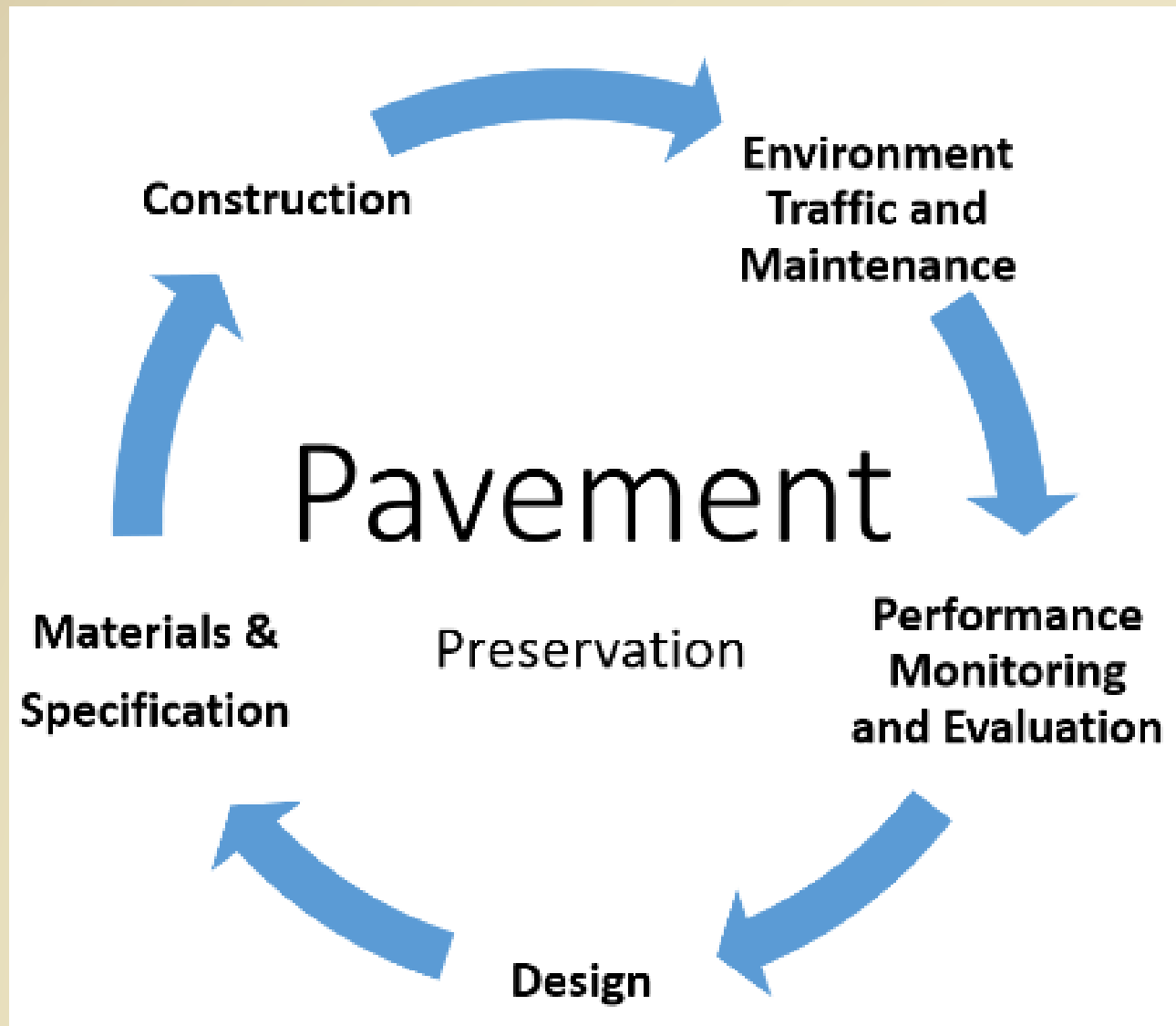
2009/2010 PMS Survey



Lanes Miles of Concrete on State Systems 2009 - 2010

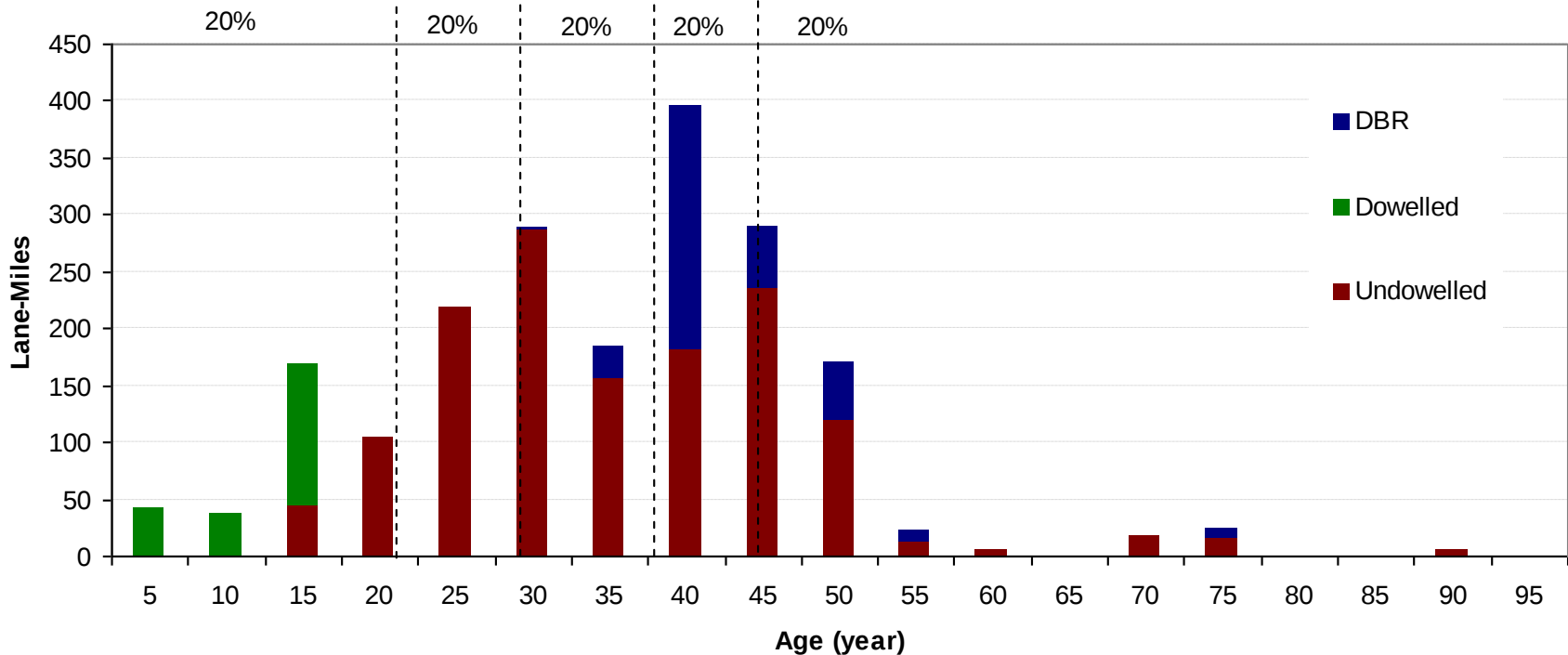


Circle of Life – PMS Style



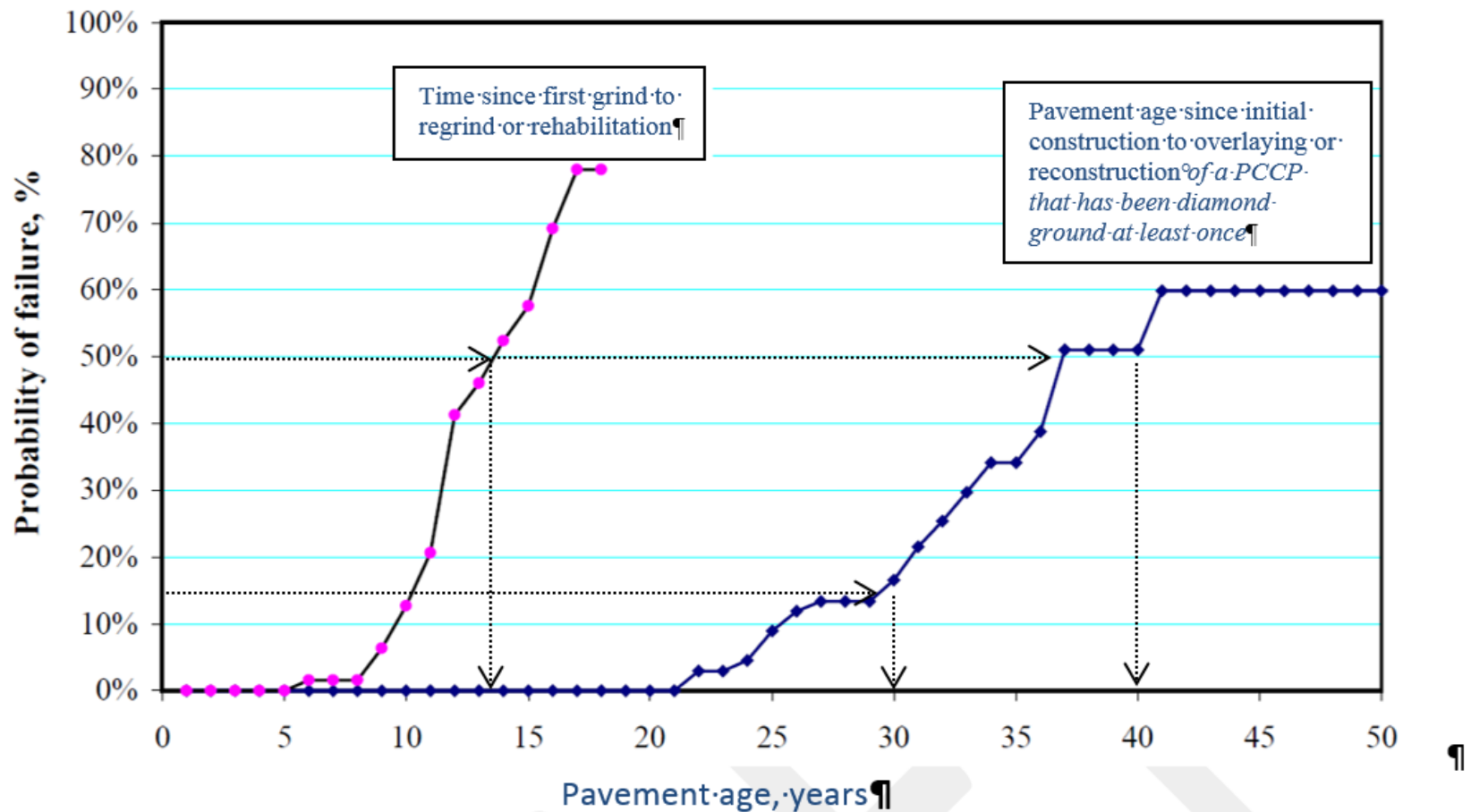
WSDOT Concrete Pavement

Concrete Pavement Age

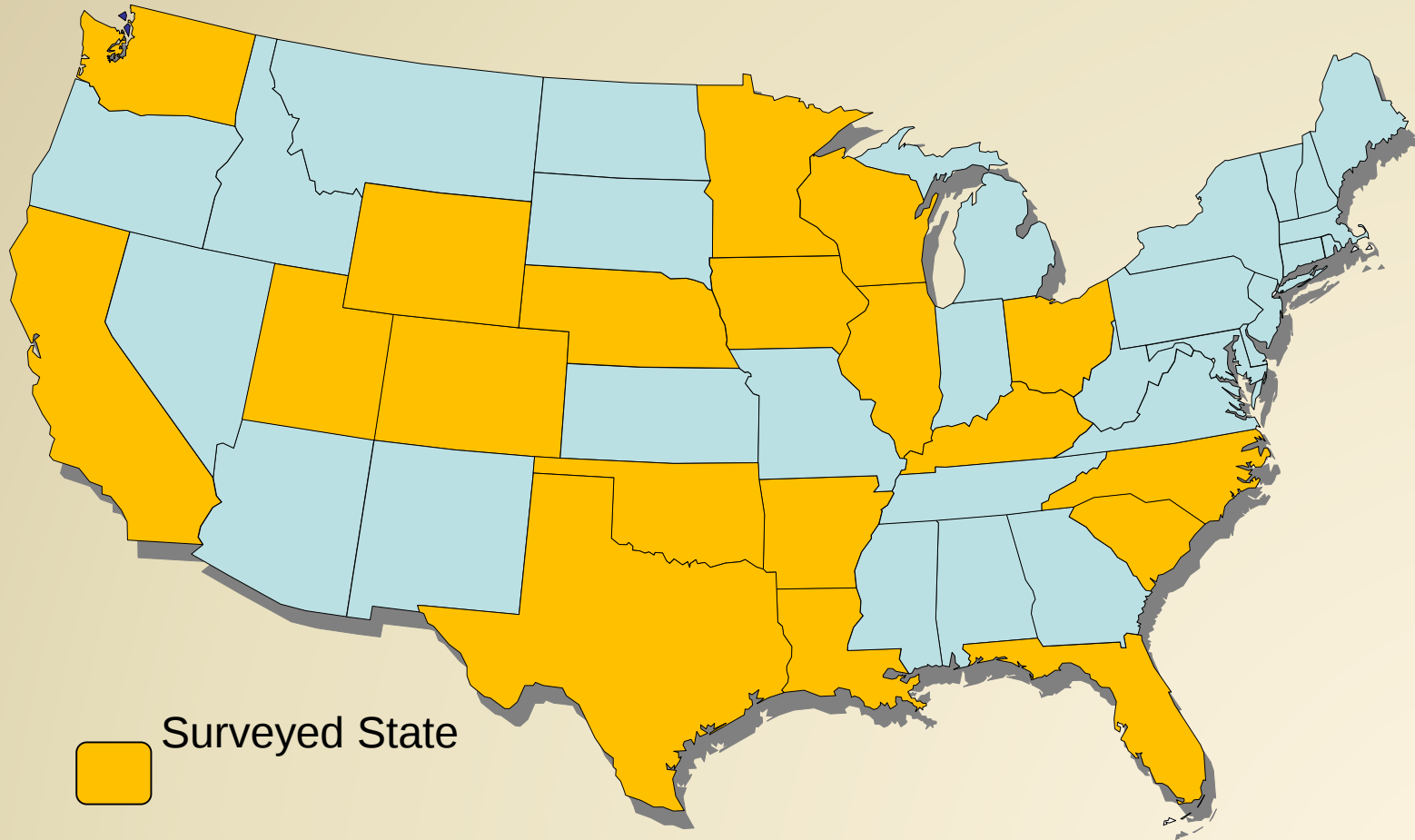


Slide Courtesy of David Luhr

Survival Curves for Diamond Ground Pavements



Surveyed States 2016



PMS Survey Questionnaire

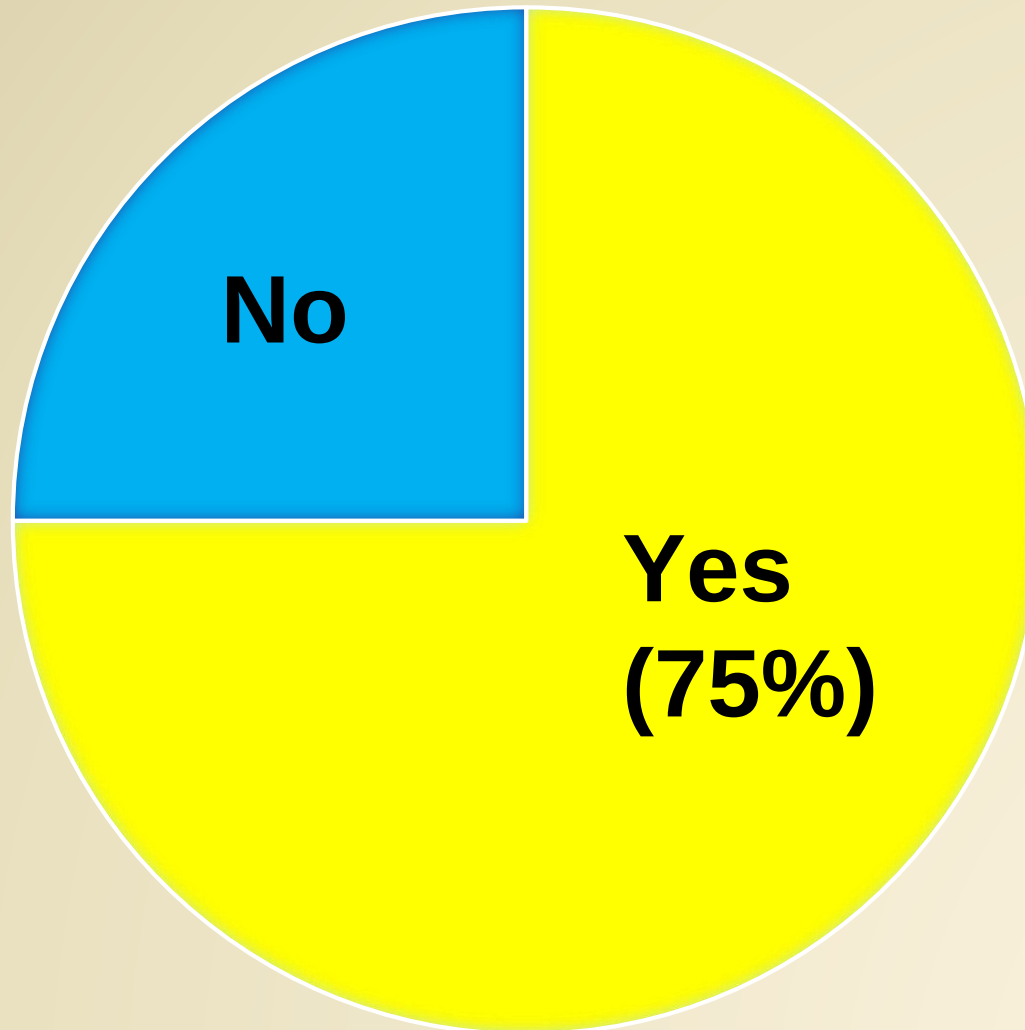
- **Organizational Setting of PMS Unit**
- **Pavement Funding Sources Used to Fund PMS Designated Projects**
- **PMS Distress Data Collection**
- **PMS Operation**
- **Miscellaneous**

Organizational Setting

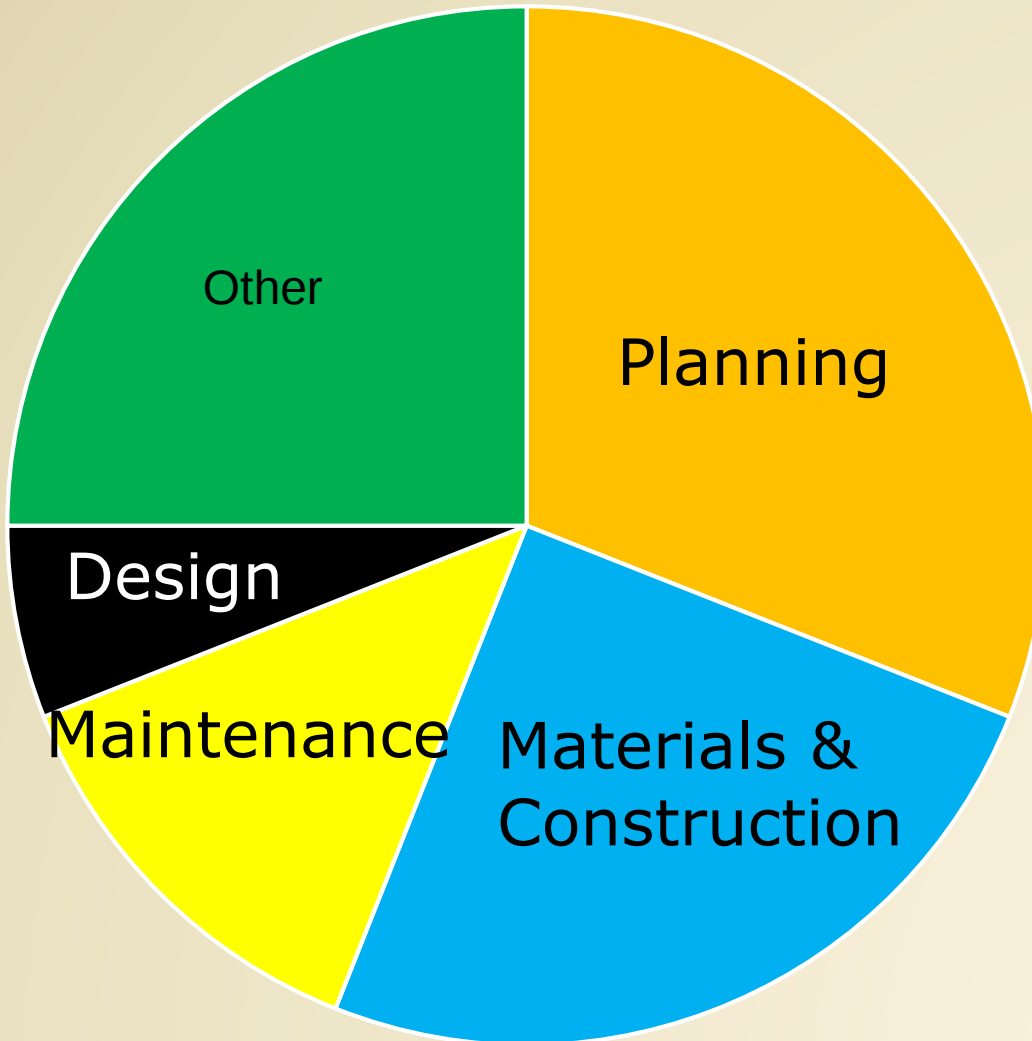


Do You Know
the Name of
Thomas
Edison's
Brother?

Asset Management Group



Location of PMS Unit



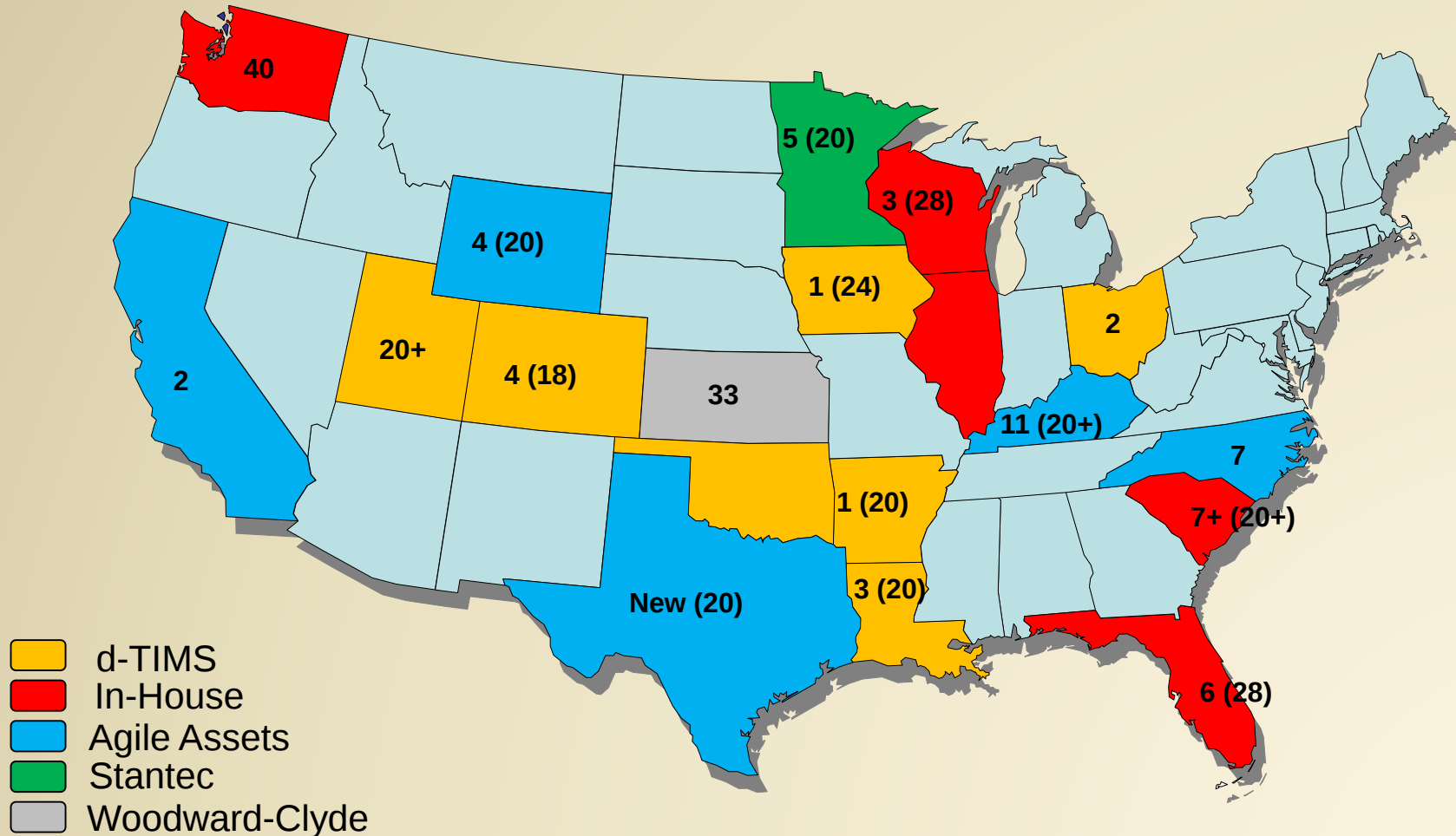
PMS Operation



Questions on PMS Operations

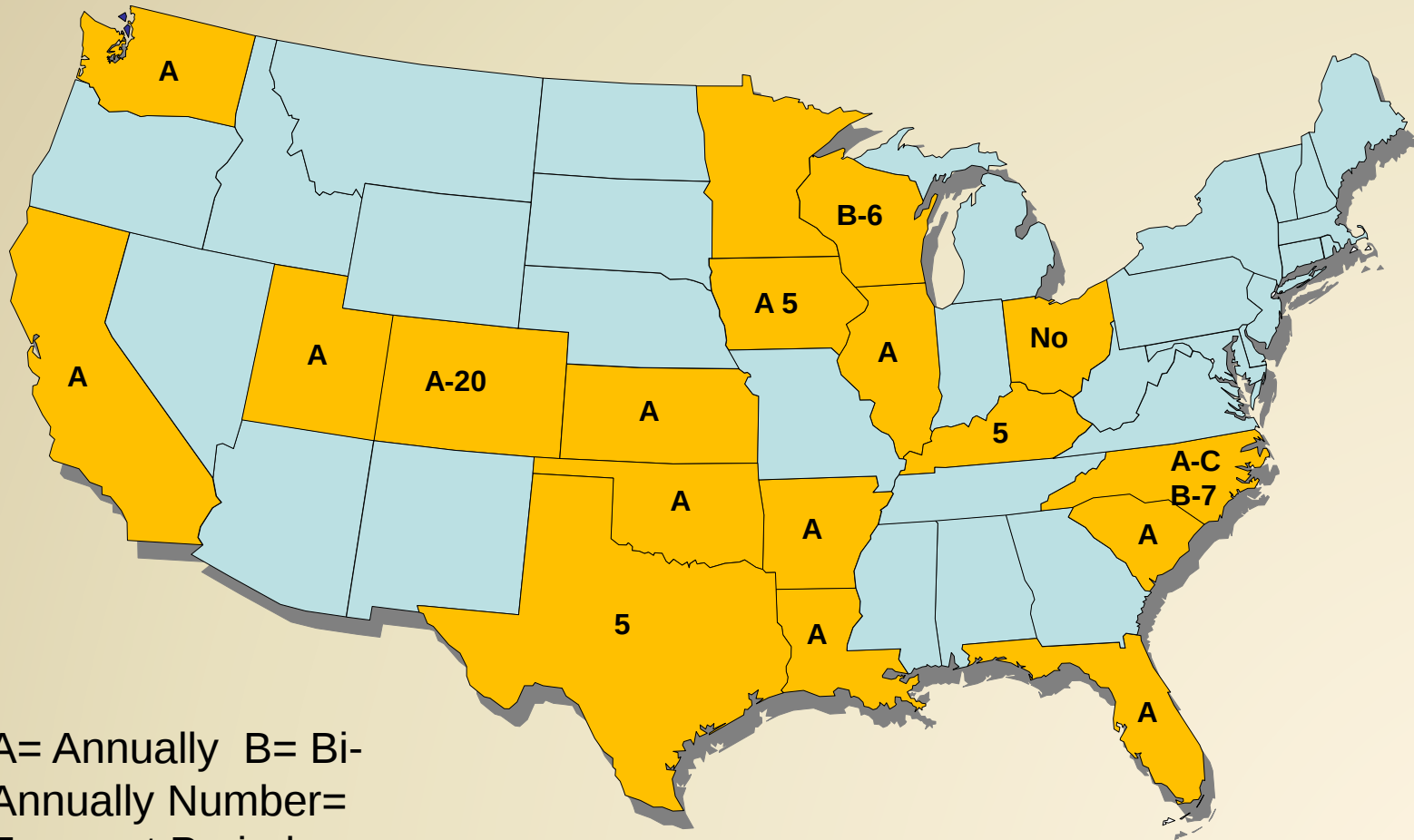
- What PMS Software does your agency use?
- Is an annual report prepared and if so, what period of time is covered (i.e. 3 yrs, 5 yrs)
- What models are used to predict the concrete pavement performance and associated trigger values for intervention for the various strategies.
- Is there a different model for each strategy type (i.e. overlay, diamond grinding, etc.)
- How often are the models re-evaluated to verify adequate prediction capability?
- What are the approximate percentages of pavement interventions triggered by each of the different models (i.e. for example 25% of the projects for faulting, 15% due to cracking, etc.)
- How is the service life defined?
 - Remaining Service Life
 - Present Condition Index
 - Remaining Service Interval
 - Time Based
 - Other?
- Are maintenance costs tracked and included in the PMS decision process
- How does the PMS system develop the prioritized listing of projects and funding levels for the annual program?
- How does the PMS system account for the projects that were not executed as planned?
- Are there any planned near-term changes to the PMS operation planned?
- How long has the state been operating a PMS system and how long has the current process been in use.

Software Use and Maturity 2016



State	Performance Models
Iowa	Each strategy modeled for each distress
Illinois	Single Model Defined by Condition Ride Score?
Florida	Piece wise linear regression for all strategies
South Carolina	Single Sigmoidal Model
Ohio	Model for each strategy & distress
Kentucky	None
Utah	Four models
Minnesota	Decision Trees
North Carolina	Single Sigmoidal Model for all
Oklahoma	PQI based on deduct values and condition index
Colorado	Three models
Texas	Decision Tree & Composite Scores
Wisconsin	Different models for each strategy
Kansas	Markov Optimization
California	3 rd Stage Crck, Faulting, IRI, Decision tree used to associate condition& Treatment

Reporting Frequency and Forecasts Period



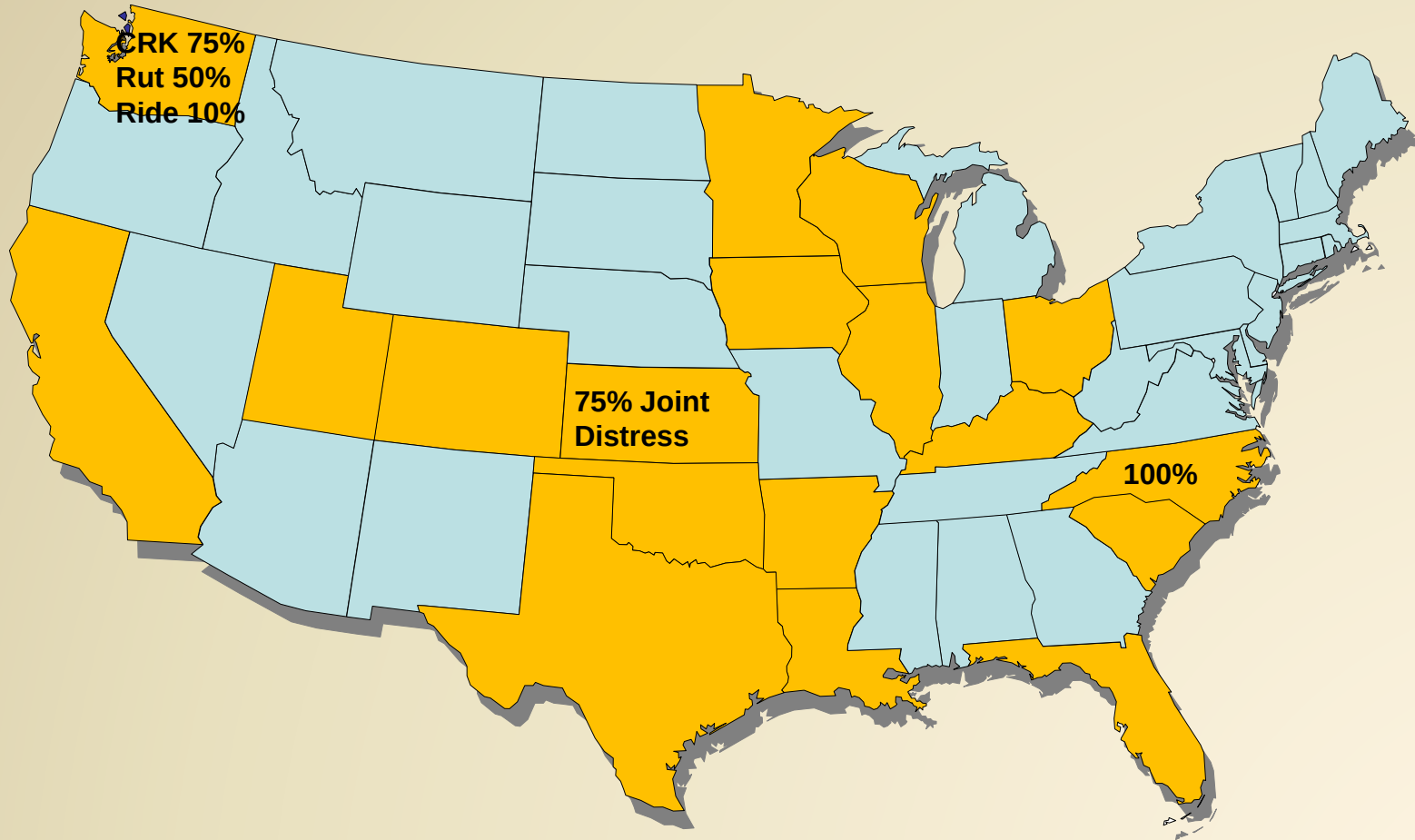
A= Annually B= Bi-
Annually Number=
Forecast Period

Performance Model Update Periods

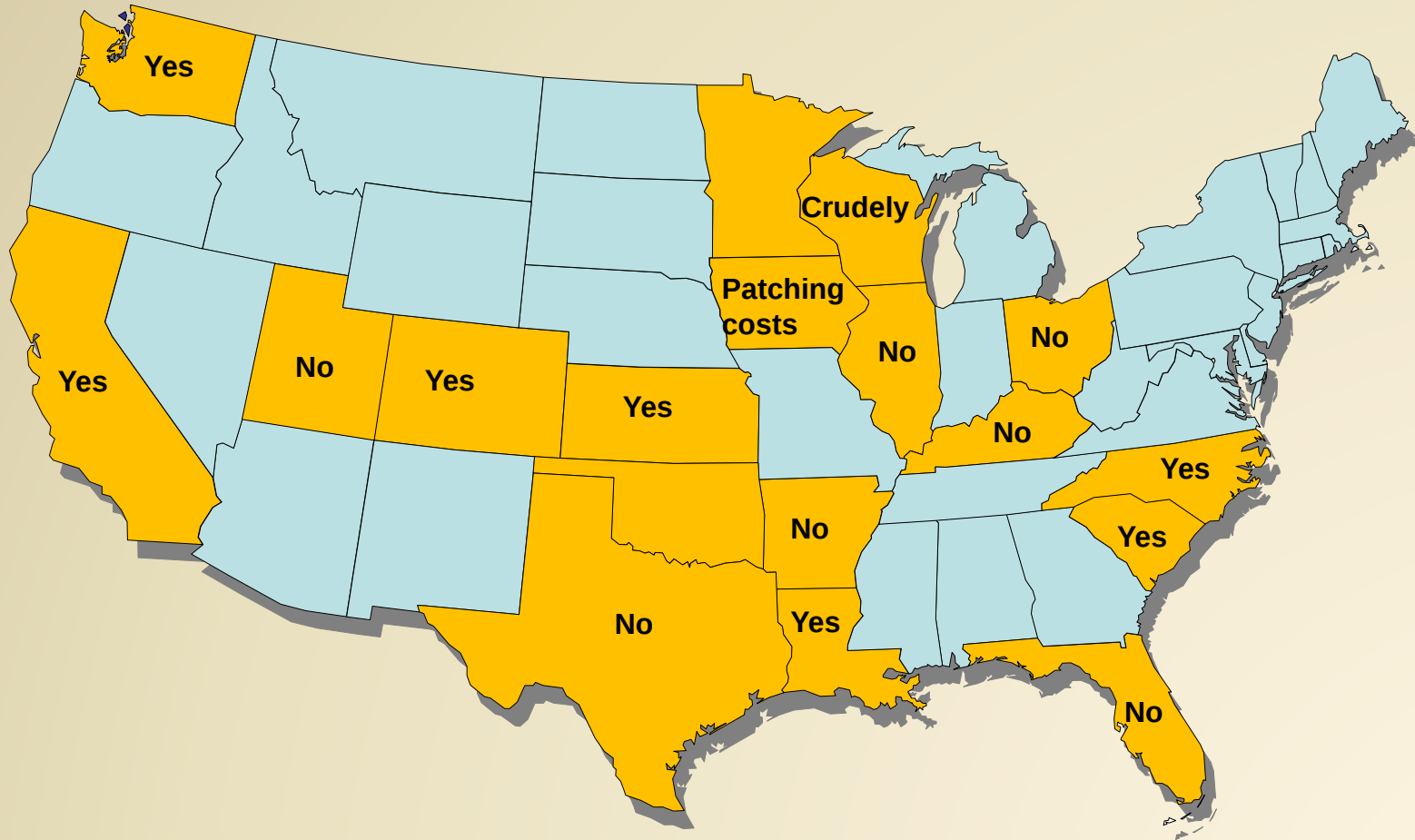


Note: Cost Models Oftentimes
Updated Annually

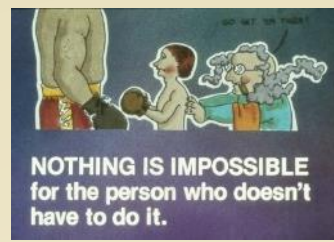
Approximate % of Interventions Triggered by Each Model



Maintenance Costs Tracked and Included in PMS



Implementation of PMS Program

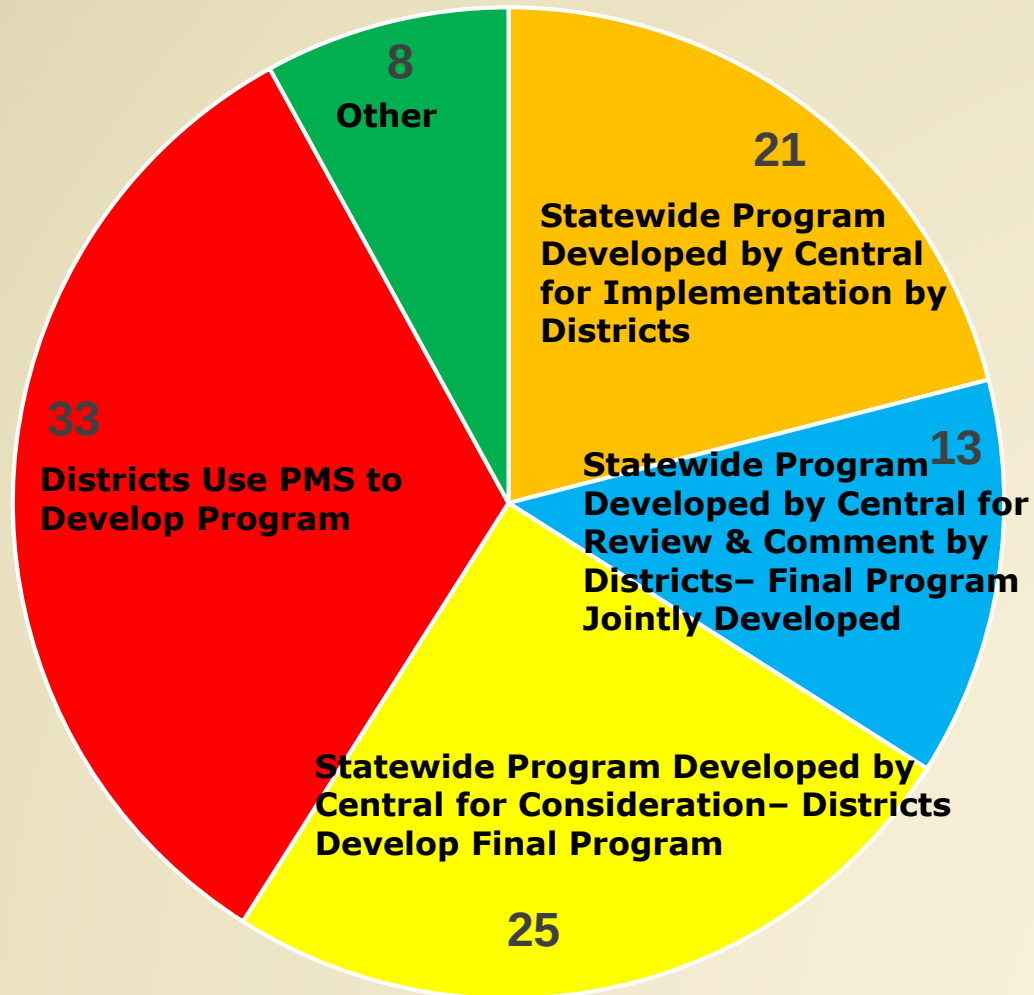


Program Implementation

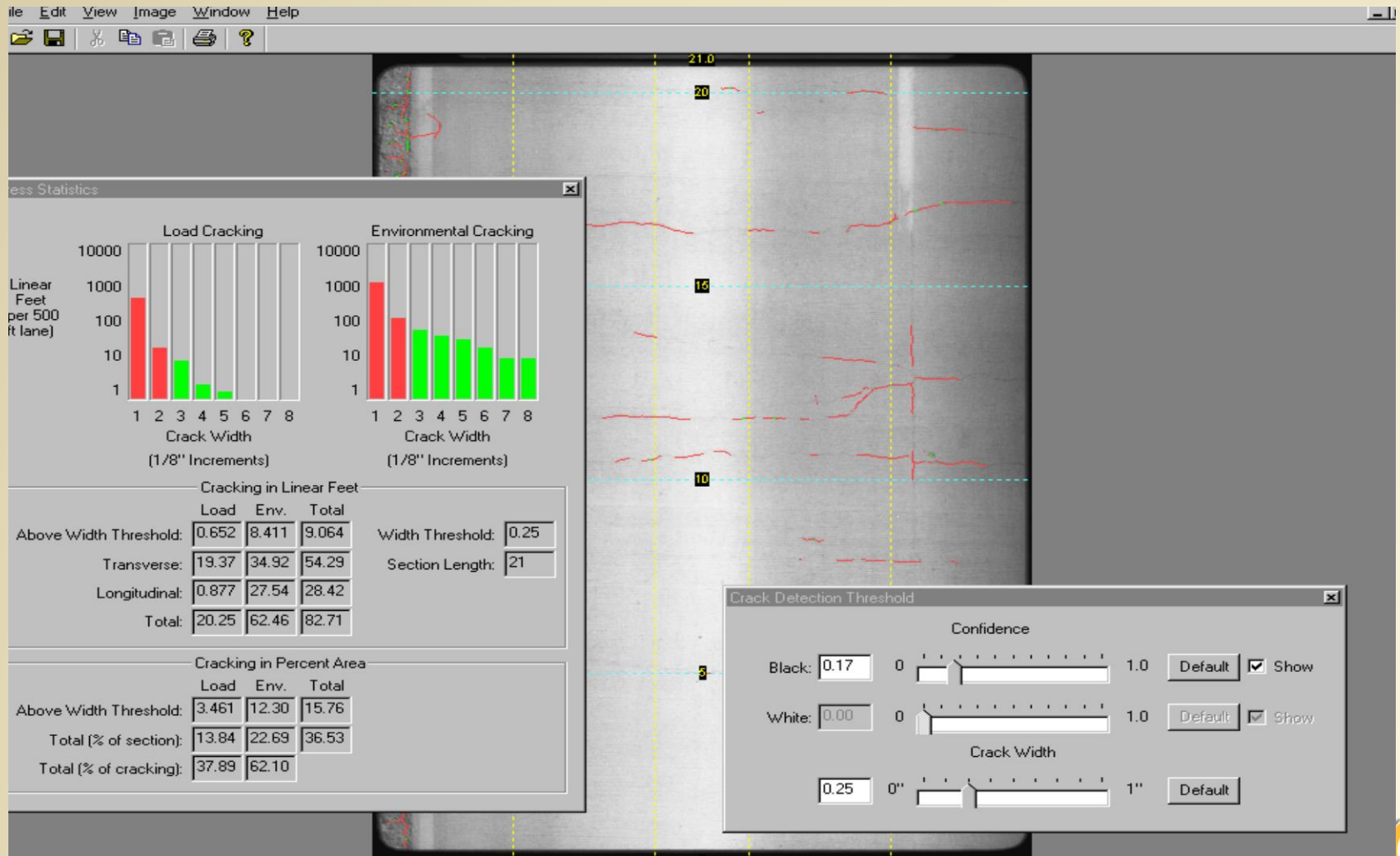
Which of the following scenarios best describes the implementation of the actual PMS program?

- Annual program is developed by central office for statewide application and is sent to Districts for implementation. Districts must implement the plan unless exception reports are made justifying other actions or strategies.
- Annual program is developed by central office for statewide application and is sent to Districts for review and comment. Final prioritized list of projects and strategies is jointly developed by PMS Unit and District offices.
- Annual program is developed by central office for statewide application and is sent to Districts for consideration. Districts develop final prioritized list of projects and strategies.
- Each District uses the PMS system to prepare their own list of prioritized projects and strategies for their District.
- Other Please Explain.

Implementation of PMS Program



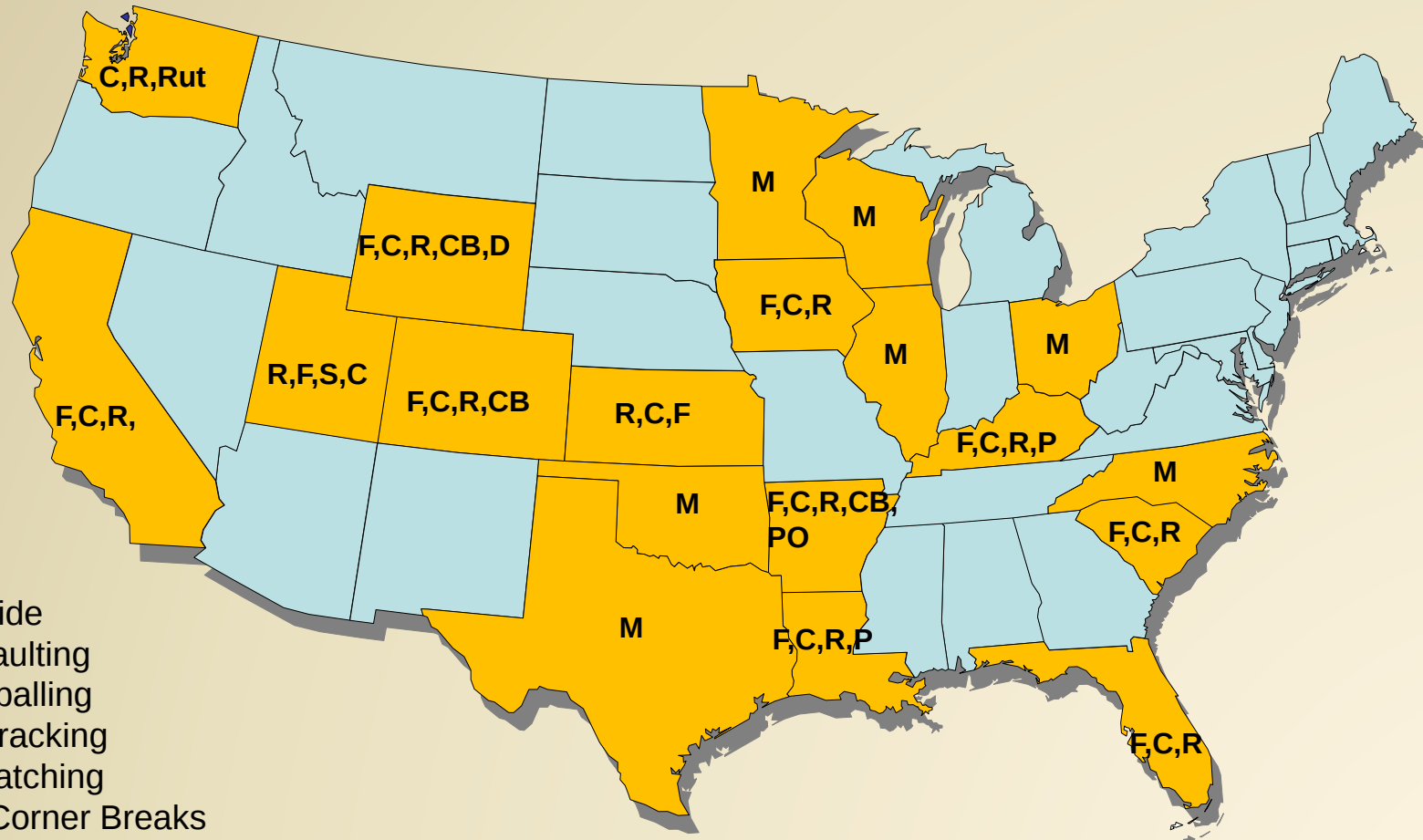
PMS Distresses



PMS Distress Data Collection

- What Distresses/Attributes are monitored for the PMS and which ones apply to concrete (i.e. faulting, longitudinal cracking, roughness, transverse cracking, friction, etc.)
- What frequency is each distress/attribute monitored (i.e. annually, bi-annually, etc.)
- Is deflection testing conducted as part of the PMS or is it only conducted for project design
- How is your PMS data collected, by contract, in-house, combination of both?

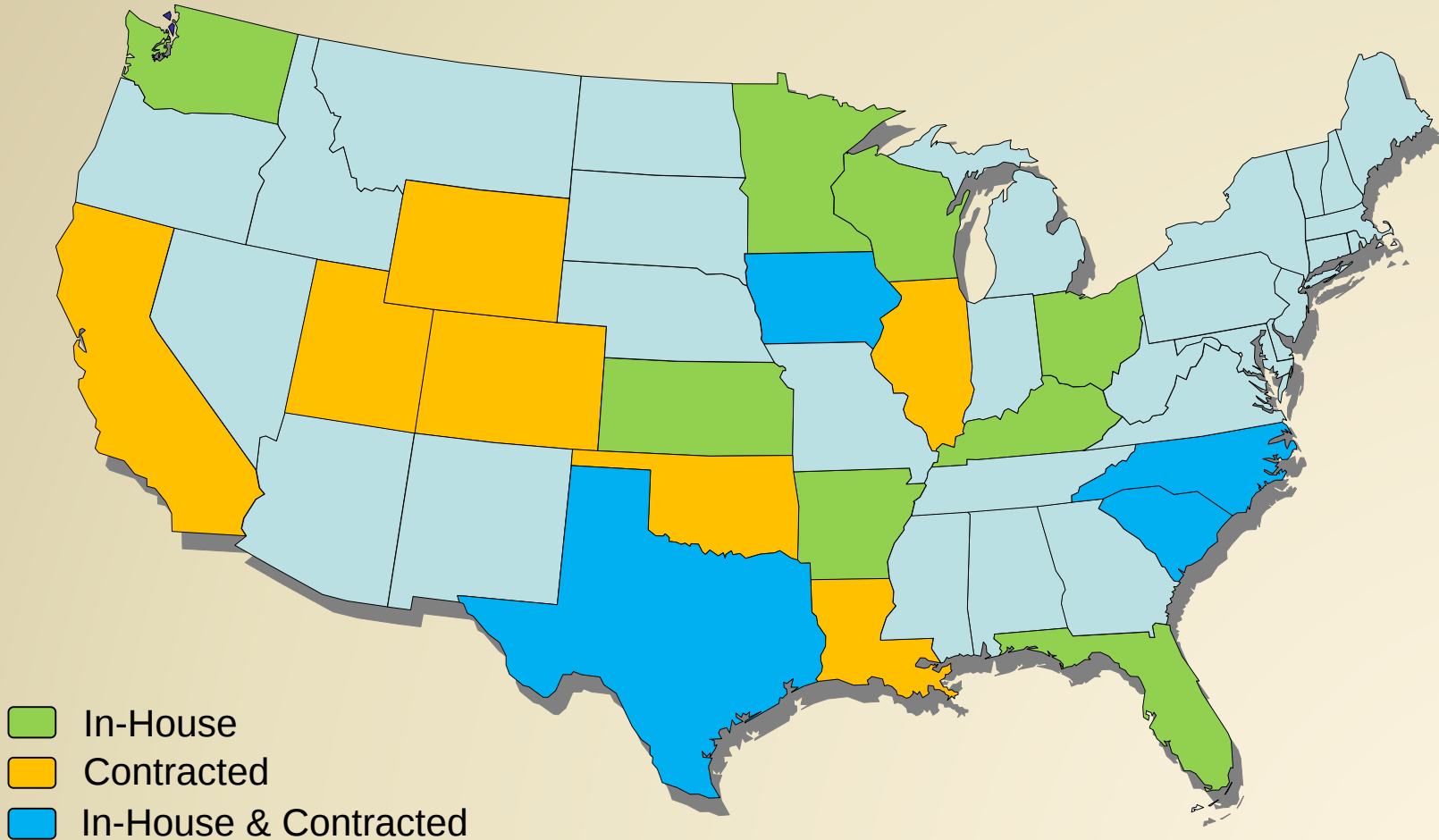
Measured Distresses



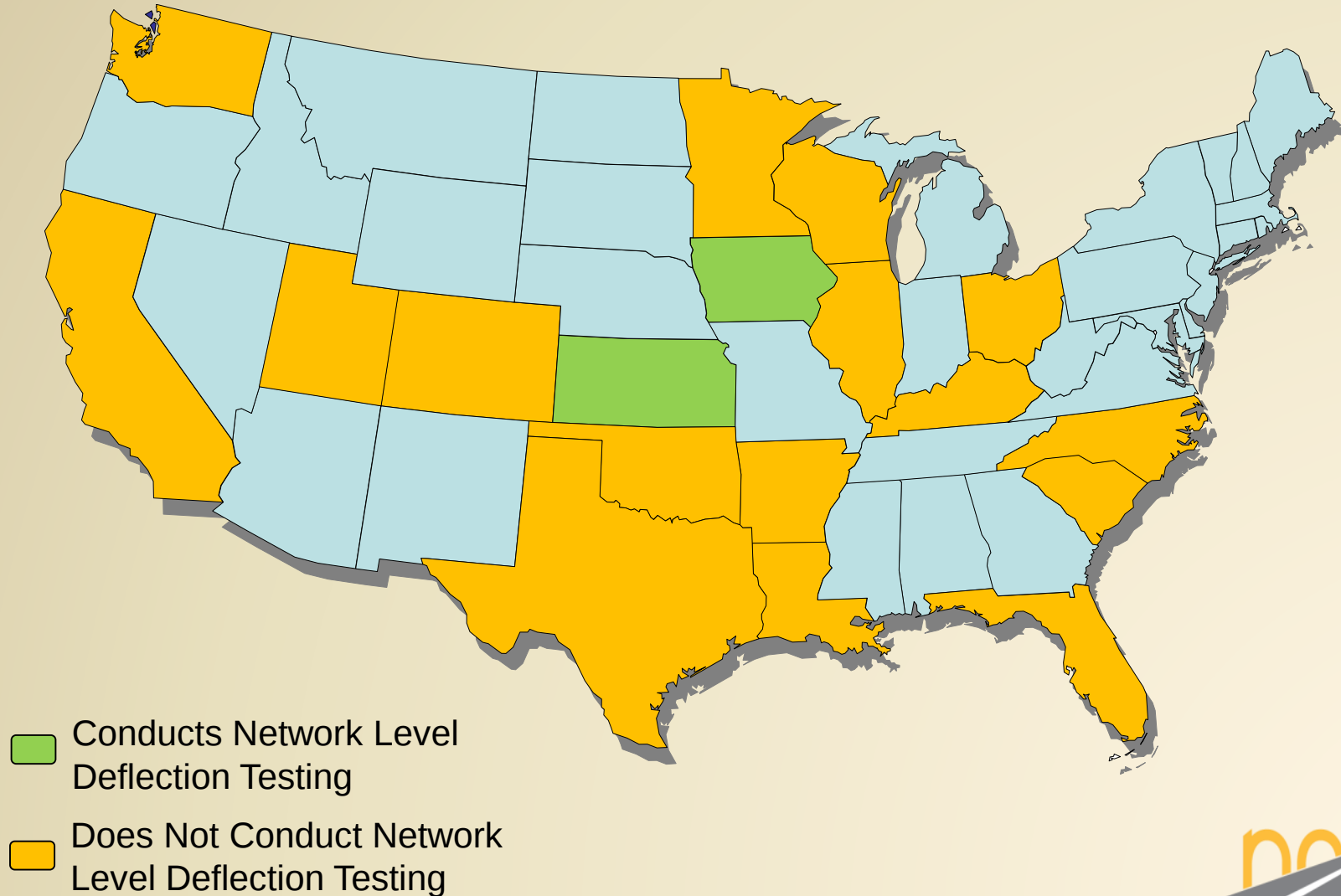
R= Ride
F= Faulting
S= Spalling
C= Cracking
P= Patching
CB=Corner Breaks
M= Many
PO=Punch Out
D=D-Cracking

Pavement ME Distresses for Design: F,R,C

How States Conduct Network Level Testing



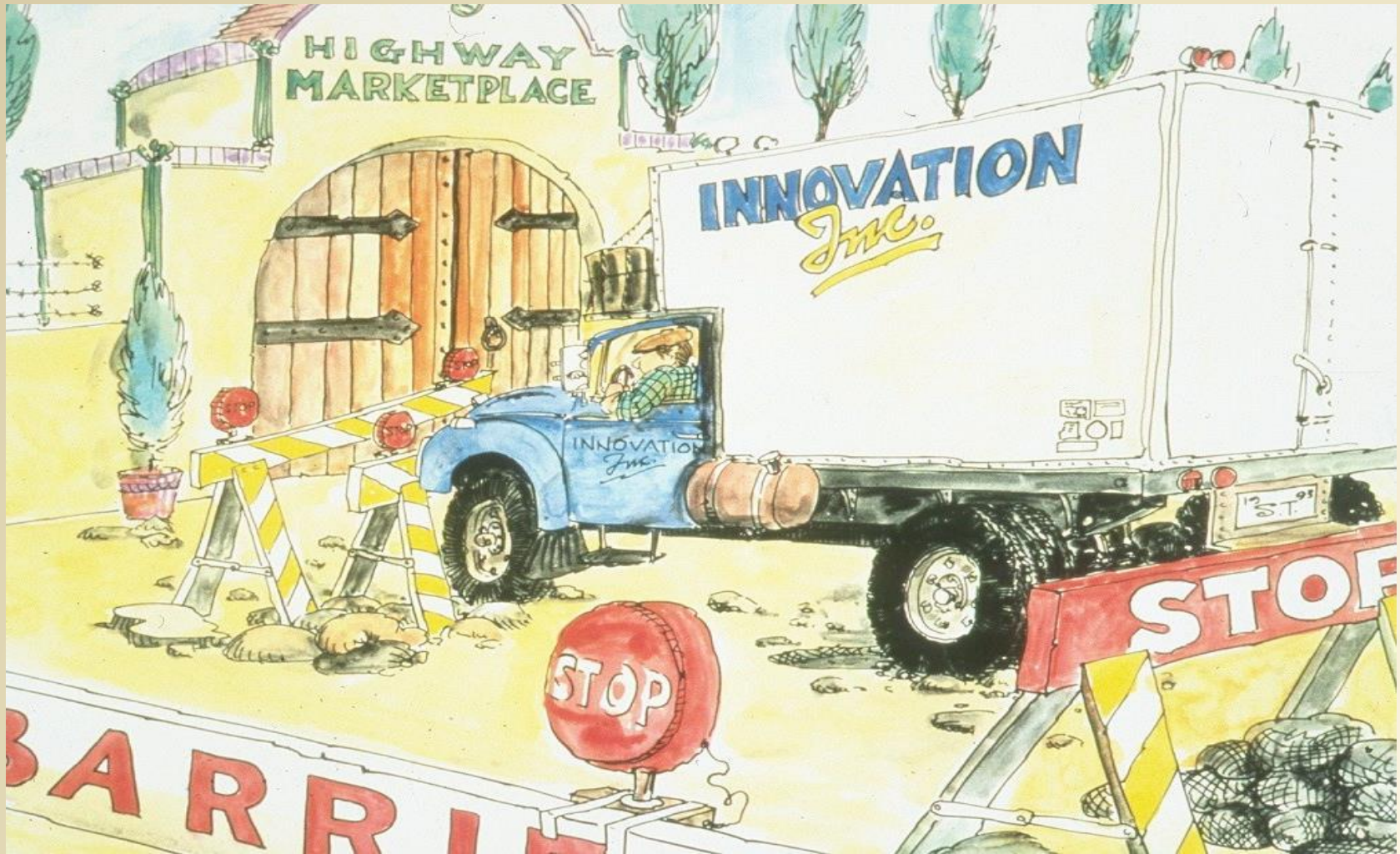
Deflection Testing as Part of Network Level PMS Surveys



Miscellaneous

- **What are the perceived risks of using concrete based pavement strategies such as new construction, preservation?**
- **Did you or will you use your PMS data to conduct local calibration of Pavement ME?**

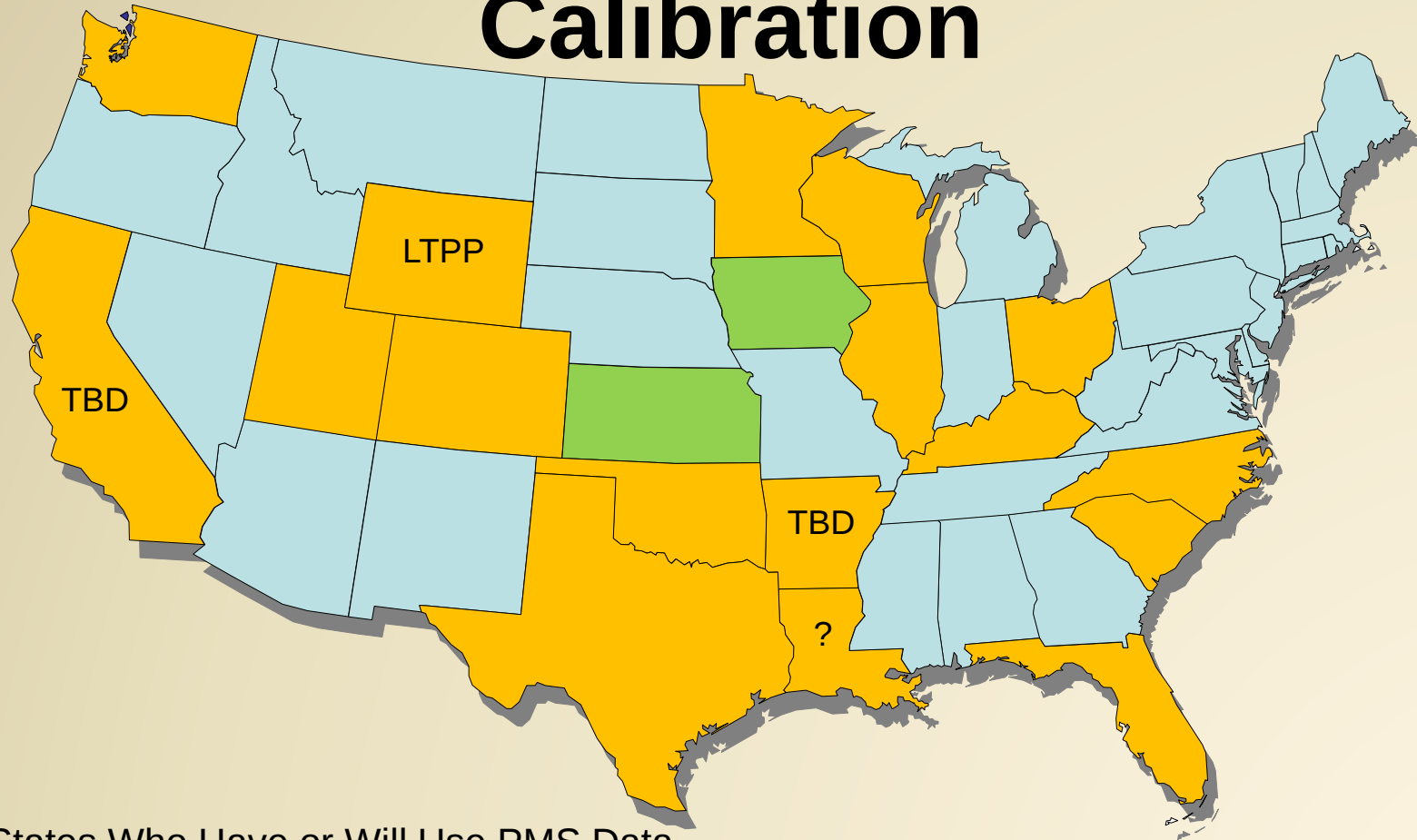
Barriers to Using Concrete



Barriers to Using Concrete

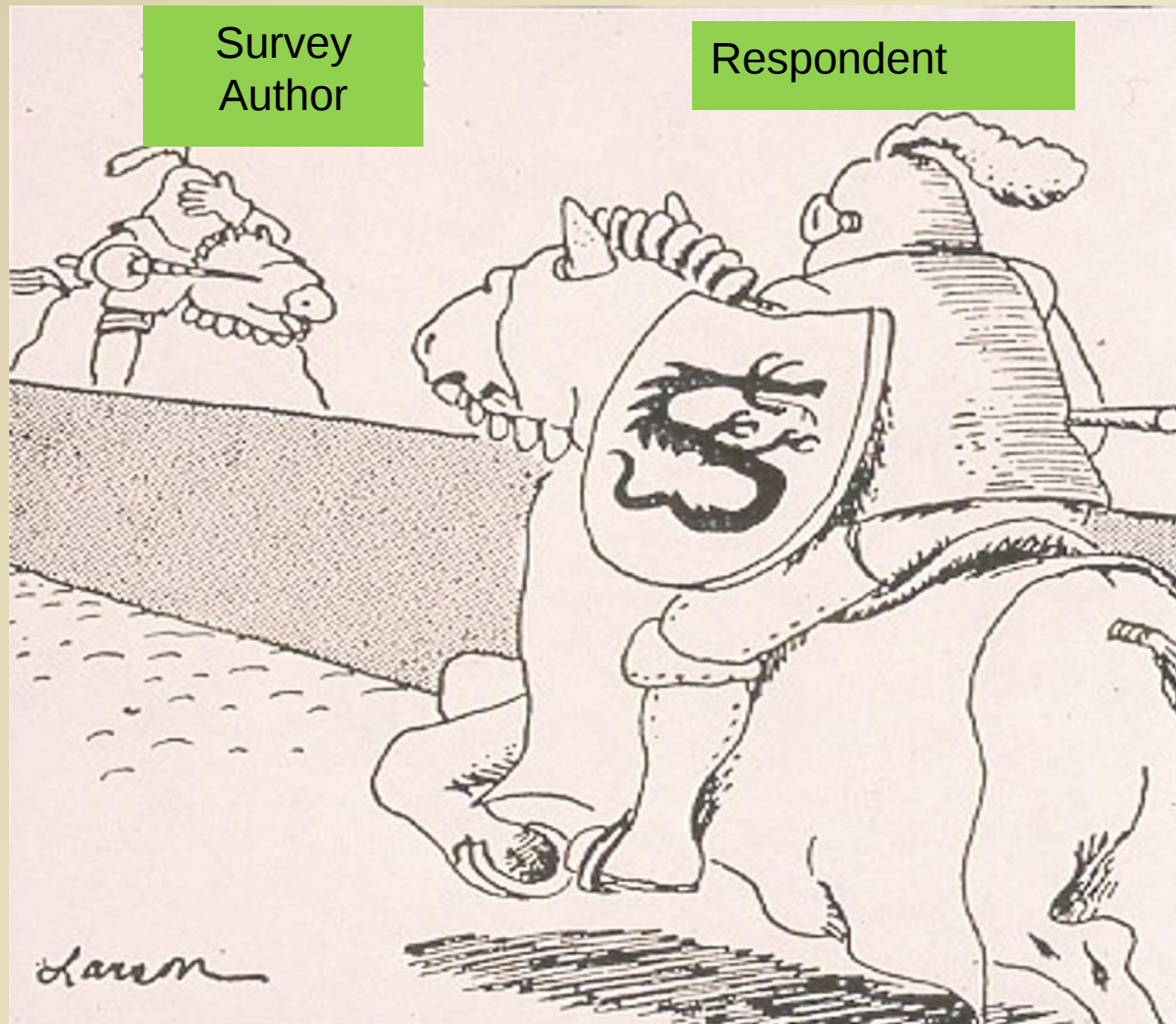
- Failures are Very Expensive
- D-Cracking, ASR, and Air Voids Issues
- In-experienced personnel for new construction
- Districts that Lack Concrete Experience
- Will it Last as Long as We Think
- Knowing when preservation is not an option
- High Cost of Maintenance and Construction Issues Like Phasing

States Who Have or Will Use PMS Data for Pavement ME Local Calibration



- States Who Have or Will Use PMS Data for Pavement ME Calibration
- States Who Have Not Used PMS Data for Pavement ME Calibration

What We Didn't Ask



What We Didn't Ask

- Visualization Capability versus Data Only Approach
- 2D versus 3D Data Collection
- Perhaps Mulligans on:
 - Performance thresholds (what's triggering projects)
 - Reporting periods for distress versus funding
- Analysis Segment Lengths Or Dynamic Segmentation Capability
- What is the Time (lag) Between PMS Identified Need and Project Completion

Opportunities



What We Don't Know About Our Product

- We Need to Better Understand How Each of the Concrete Strategies is Modeled and How Each Strategy, New and Preservation, Performs
- We Need to Know What Distresses Are Triggering the Intervention Cycles to Better Improve Our Product
- How to Create Performance Curves for Strategies which may currently not be used by a given state
- Better Understanding of the Value of Probabilistic and Deterministic Approaches—Difficult to grasp the impact of data variability on long term prediction
- What is the Best Time frame to forecast Out-- That is the longer the forecast period used the more the results mimic the model and perhaps not real data
- We don't know typical maintenance costs for each of the concrete strategies
- Deflection is typically not collected for PMS. Should highway speed deflection data collection be promoted from a structural capacity and fuel efficiency consideration—Consider development of a State-of-the-practice report on highway speed deflection data collection
- We should promote common terminology on strategies to assist comparisons of data
- What are the Important Distresses for Strategy Performance

On Going Research to Consider (Controlled Data Sources)

- SPS-2 Pooled Fund
- NRRRA Pooled Fund
- LTPP SPS-12
- LTPP InfoPAV

Quote of the Day

“...and the inference may be drawn that the question of expense of construction and repairs is not the only important economical question involved.”

Harper's Weekly September 18, 1869

Questions?

