Performance-Related Specifications for Highway Pavements: Current Status and Future Directions

Michael E. Ayers, Ph.D.
Director of Technical Services

American Concrete Pavement Association

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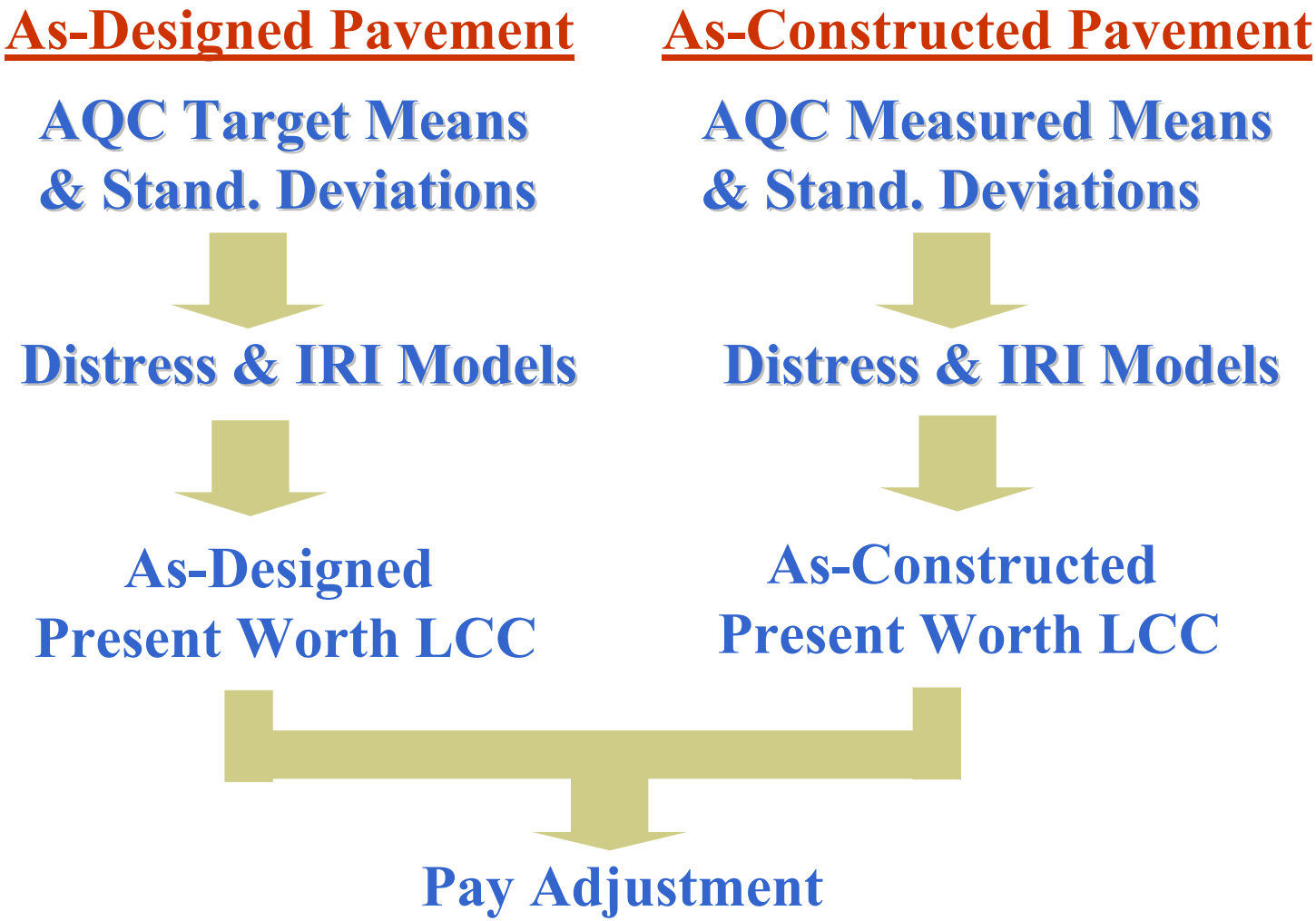
PRS Definitions

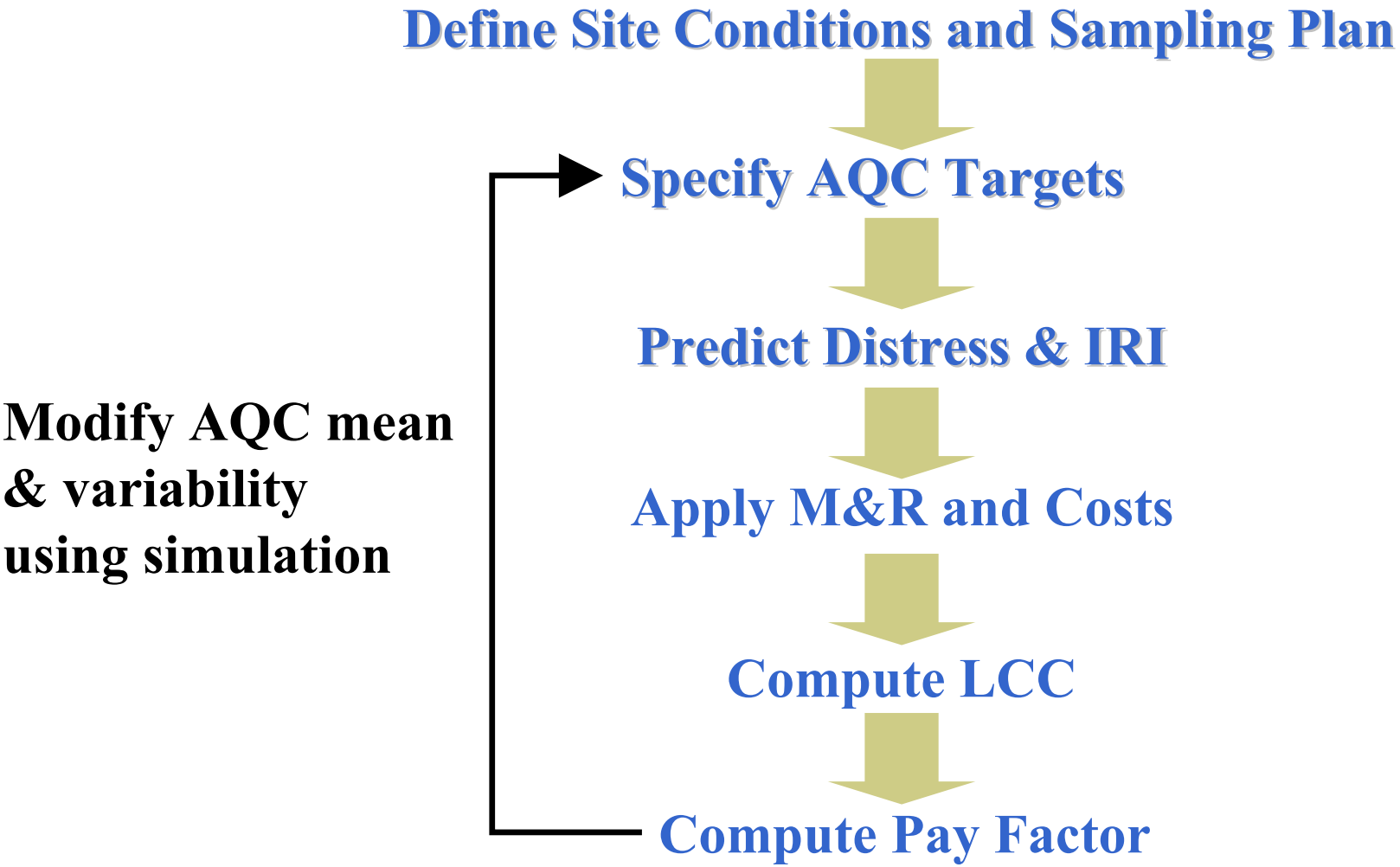
- Technical Definition: Specifications that use quantified acceptance quality characteristics (AQC's) and life cycle cost (LCC) relationships that are correlated to product performance

- Management Definition: A bridge between construction quality and long-term product performance

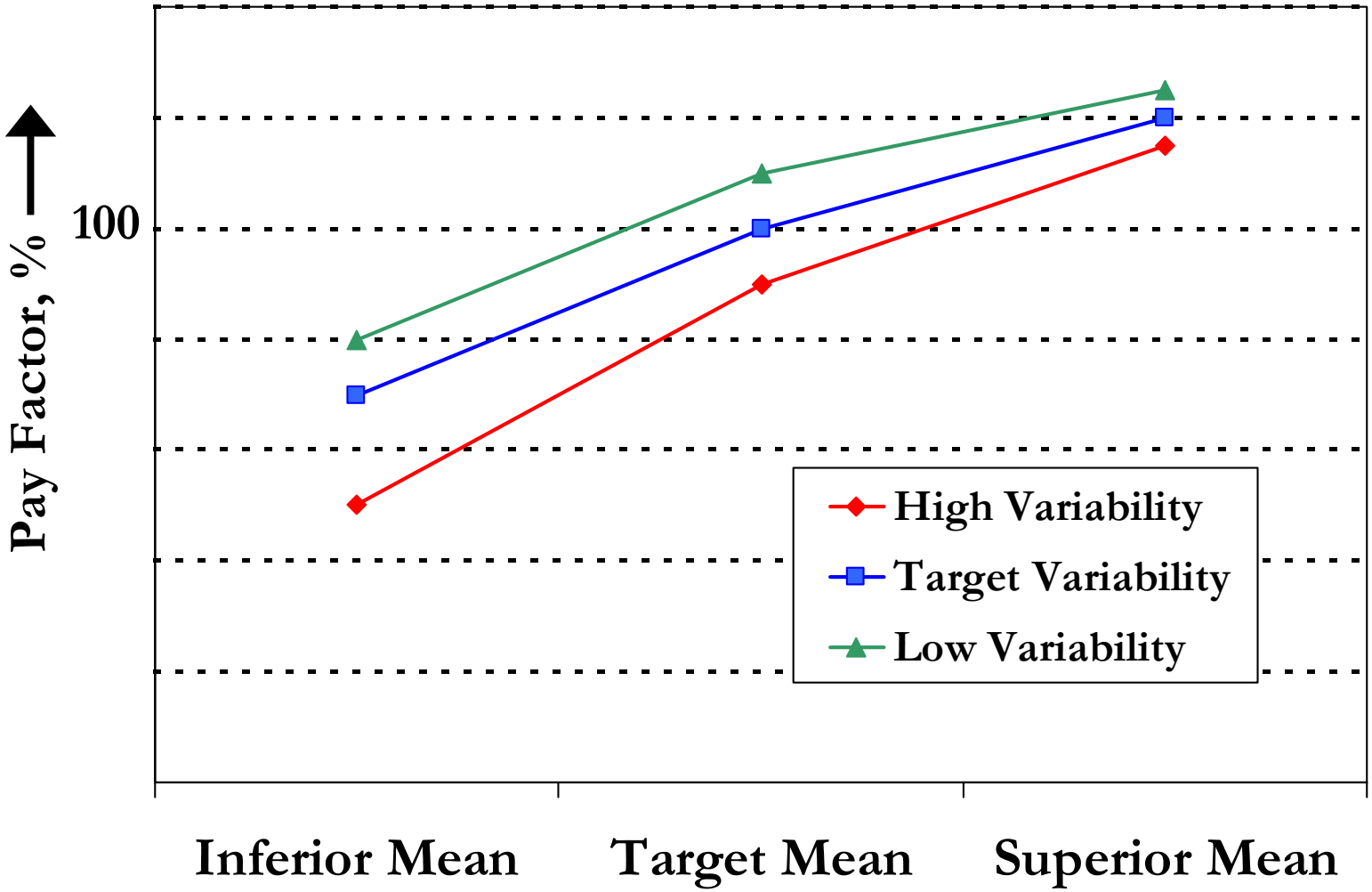
PRS Concept


As-Designed Pavement
AQC Target Means & Stand. Deviations
Distress & IRI Models
As-Designed Present Worth LCC
As-Constructed Pavement
AQC Measured Means & Stand. Deviations
Distress & IRI Models
As-Constructed Present Worth LCC
Pay Adjustment

PRS Methodology (PaveSpec)



Example PF Curves



Why PRS?

- Higher quality pavements (through pay adjustment)
- Focus on product long-term performance
- Scientific, yet simple
- Allow contractors to be innovative
- Low “fear factor” for contractors, compared to warranties

Acceptance Quality Characteristics

PRS require specifying the target mean and variability levels of AQC's that:

- Are measurable
- Have been found to correlate with performance
- Are under the contractor's control

Rigid Pavement AQC's

- Initial smoothness (IRI or Profile Index)
- Concrete strength (compressive or flexural)
- Slab thickness
- Air content
- Consolidation around dowel bars

Rigid Pavement Performance Measures

- IRI (LTPP-based models)
- Transverse cracking (LTPP-based models)
- Joint faulting (LTPP-based models)
- Joint spalling (LTPP-based models)

PRS Development and Implementation Steps

- Step 1: Select AQC's and performance measures
- Step 2: Collect design data and historical testing results for the selected AQC's
- Step 3: Establish targets for the AQC's based on design, historical data, and agency policy
- Step 4: Establish a maintenance and rehabilitation plan and costs

PRS Development and Implementation Steps (cont.)

- Step 5: Establish a statistical sampling and testing plan
- Step 6: Run PRS software to generate the PF curves (PaveSpec)
- Step 7: Develop operating characteristic (OC) curves to test the sampling plan
- Step 8: Training and field implementation

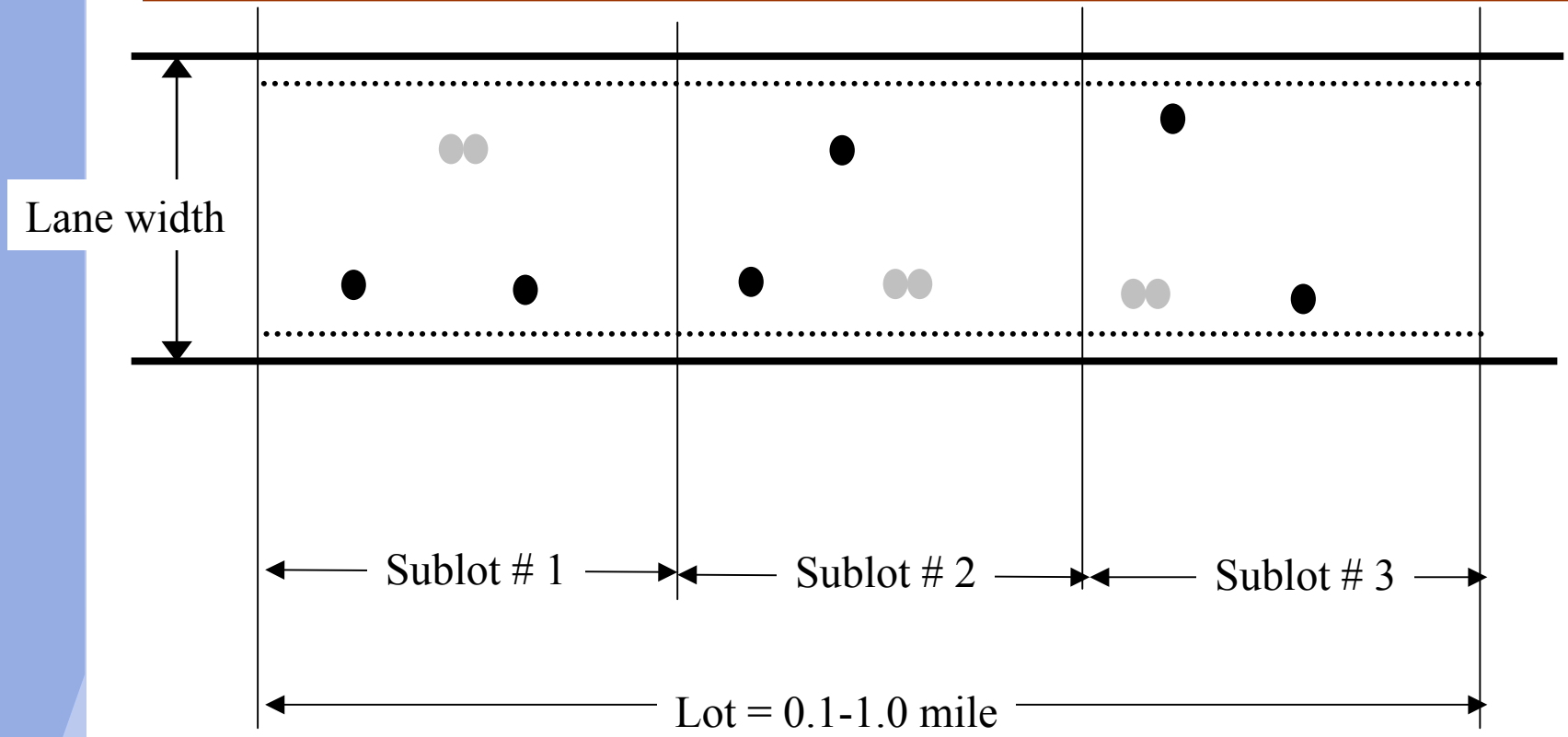
Statistical Sampling and Testing

- Step 1: Divide the project into lots and sublots
- Step 2: Determine the sampling frequencies
- Step 3: Test the adequacy of the sampling plan using OC curves

Statistical Sampling and Testing - General Issues

- Lot is a homogeneous area or quantity of pavement
- Pay adjustment is made on a lot-by-lot basis; thus, the mean and standard deviation must be computed for each AQC within the lot
- Sublots are used for sampling and testing purposes (not pay adjustment)
- Non-PRS AQC's should be sampled and tested according to the agency's existing specifications

Example Sampling Plan: Rigid Pavement in Florida

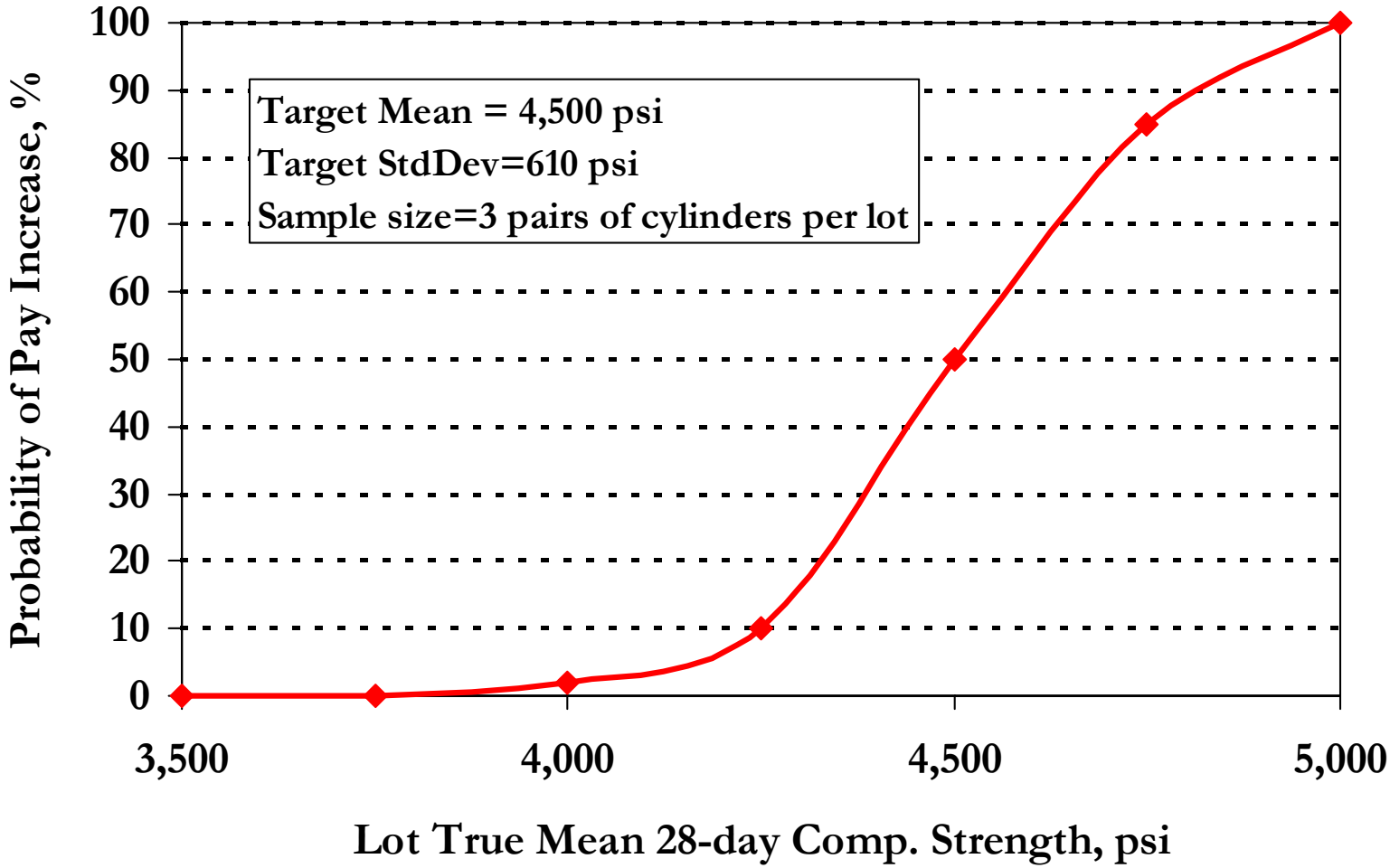


Strength cylinders

Thickness core

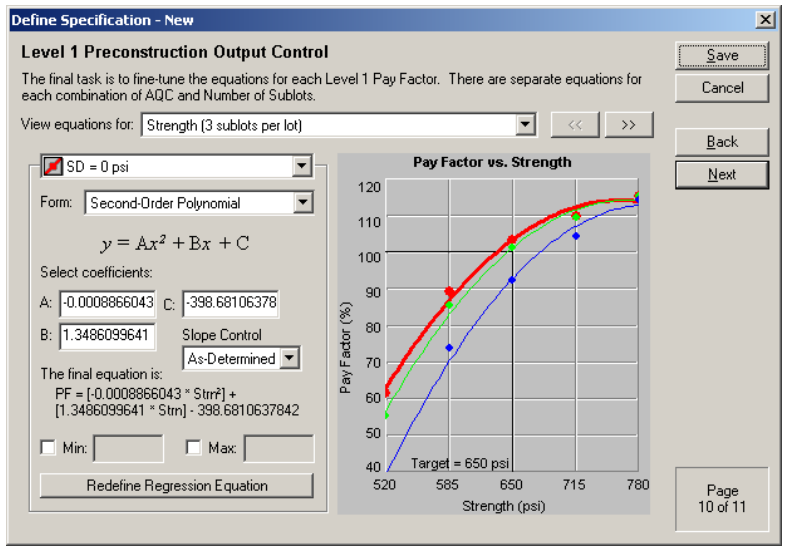
..... Profile trace in the wheel path

Example OC Curve: Rigid Pavement in Florida



PaveSpec – PRS Software for Rigid Pavements

- Developed by ERES and sponsored by the FHWA
- Version 3.0



PRS Implementation in the U.S. – Rigid Pavements

- Indiana: Full implementation in 2000 and 2002
- Florida: Full implementation in 2001
- Tennessee: Full implementation in 2001
- California: Full implementation in 2002
- New Mexico: Shadow specs in 1997
- Missouri: Shadow specs in 1997
- Nebraska: Shadow specs in 1997

Future Directions

- Training for the highway agencies and contractors (FHWA lead)
- Incorporate the 2002 mechanistic-empirical models (FHWA and NCHRP lead)

Future Directions (cont.)

- Incorporate more AQC's, such as depth of saw-cut for concrete pavements
- PRS for airport pavements
- Additional field implementation

Summary

- PRS is a bridge between construction quality and long-term product performance
- PRS use:
  - AQC's that are found to affect performance
  - Statistical sampling
  - Performance prediction models
  - Life cycle cost analysis
  - Monte Carlo simulation

Summary (cont.)

- PaveSpec has produced reasonable results in the U.S.
- Future efforts:
  - Training
  - More field implementation
  - Improved performance prediction models (2002 models)
  - More AQC's
  - Airport pavements

Contact Information

Michael E. Ayers, Ph.D.

American Concrete Pavement Association

Tel. 217-621-3438, mayers@pavement.com

Nasir Gharaibeh, Ph.D.

ERES Consultants, a Division or ARA

Tel. 217-356-4500, ngharaibeh@ara.com