Calibration of the 2002 AASHTO Pavement Design Guide for Minnesota Portland Cement Concrete Pavements and Hot Mix Asphalt Pavements

TAP meeting

February 10, 2004

Project Objectives

- Calibrate the 2002 Design Guide for Mn conditions
- Develop default inputs and a catalog of trial designs
- Develop training materials
- Develop recommendations for future improvements

Improvement of the 2002 Guide is NOT an objective of this study

Project Tasks

- Task 1: Determine typical design features
- Task 2: Evaluate typical 2002 Design Guide Inputs
- Task 3: Conduct laboratory testing
- Task 4: Establish performance criteria
- Task 5: Perform sensitivity runs
- Task 6: Predict pavement performance

- Task 7: Recalibrate 2002 Design prediction models
- Task 8: Develop catalog for trail designs
- Task 9: Modify training manuals
- Task 10: Develop a report documenting the work and findings.

Task 1: Determine typical design features

- Design Features
  - pavement cross-section
  - presence of shoulder
  - lane width
  - presence of dowels, etc
- Data sources
  - MnRoad
  - PM database and other MnDOT data
  - LTPP
  - RIPPER
  - Sections surveyed in this study

Task 2: Evaluate typical 2002 Design Guide Inputs

- Traffic inputs
- Material properties of typical PCC mixes, asphalt mixes, and granular bases.
- Resilient properties of the subgrade
- Seasonal variation of subgrade properties
- Seasonal variation of depth to water table
- PCC pavements construction data

An attempt to assign inputs for the projects identified in task 1 will be made

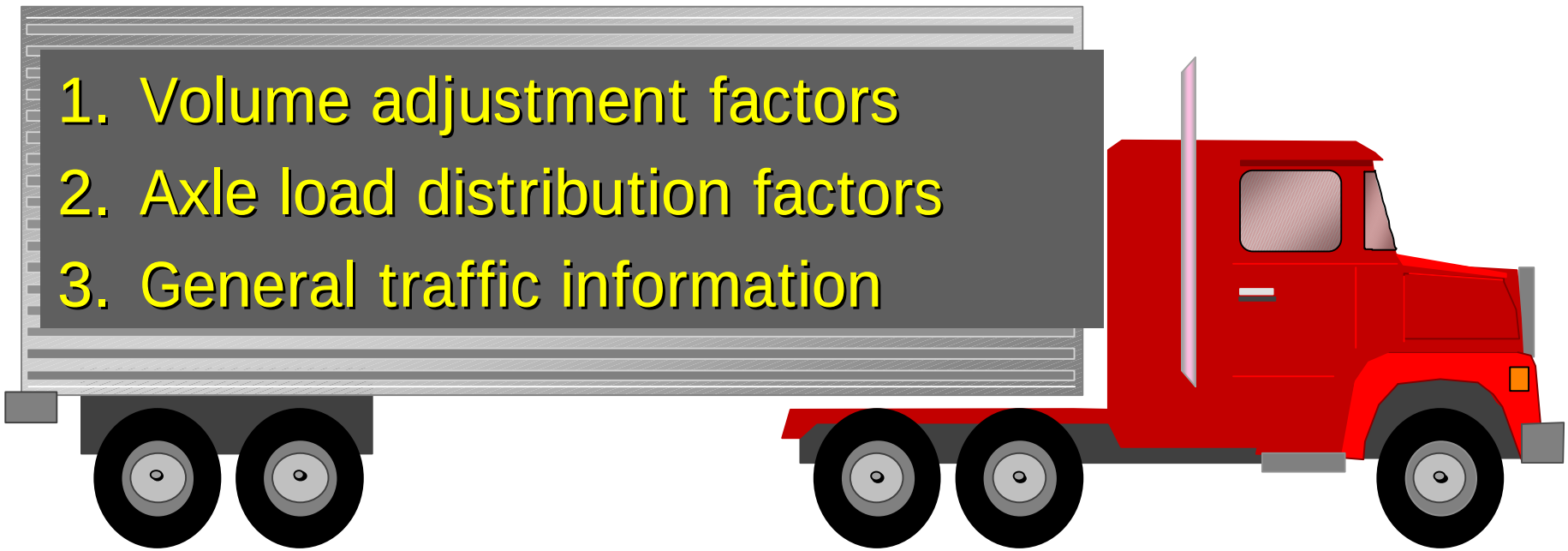
Task 2: Evaluate typical 2002 Design Guide Inputs – Traffic Inputs

- Current AASHTO – ESALs
- MnPave – ESALs or axle spectrum
- 2002 Guide – AADT and/or axle spectrum

2002 GuideTraffic Hierarchical Input Levels

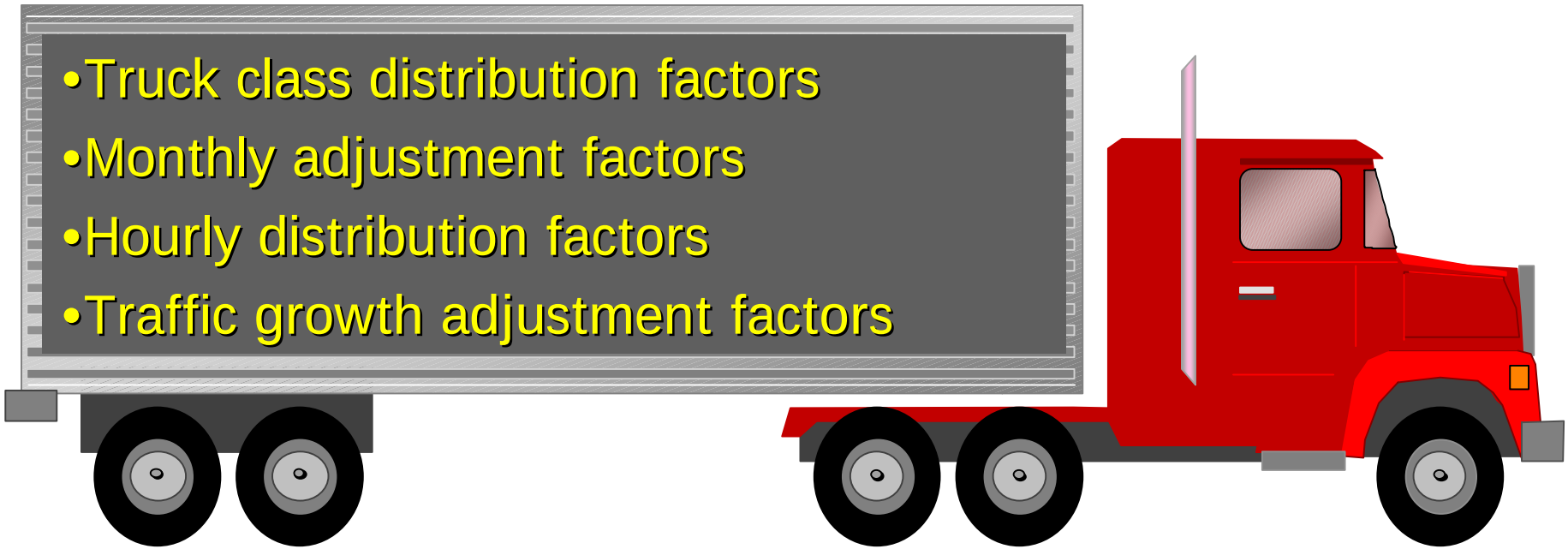
Input Level	Input Values	Knowledge of Parameters
1	Segment-Specific Data (AVC, WIM, vehicle counts)	Good
2	Regional/Statewide Data (AVC, WIM, vehicle counts)	Fair
3	National Data (AVC, WIM, vehicle counts) Educated Guess based on local experience	Poor

Traffic Module – Input Categories



Truck Traffic Volume Adjustment Factors

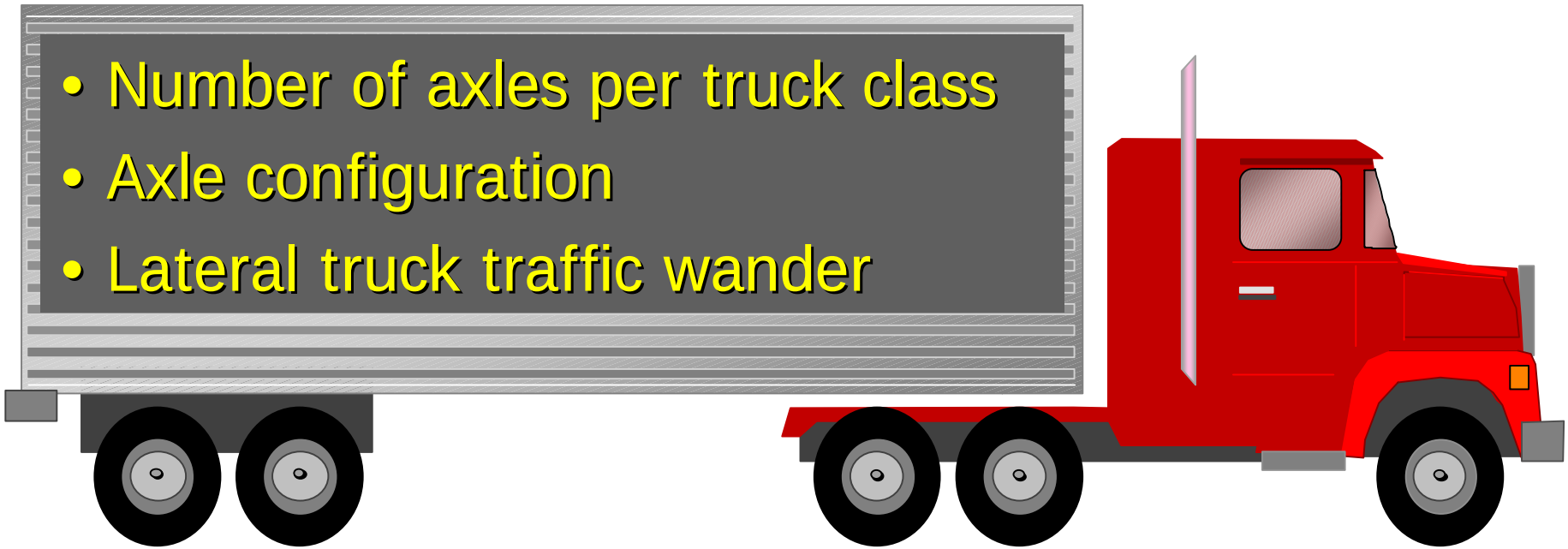
- Truck class distribution factors
- Monthly adjustment factors
- Hourly distribution factors
- Traffic growth adjustment factors



Axle Load Distribution Factors

General Truck Traffic Information

- Number of axles per truck class
- Axle configuration
- Lateral truck traffic wander



Task 2: Evaluate typical 2002 Design Guide Inputs – Climatic Data

- Location
  - Latitude
  - Longitude
  - Elevation
- Depth of water table (seasonal)

Task 2: Evaluate typical 2002 Design Guide Inputs – PCC properties

Input	Used to predict
General properties	•Mechanistic response
Thermal properties	•Slab deformations due to temperature changes •Temperature profile in slab
Mix properties	•Concrete set temperature •Strength gain over time
Strength properties	•Strength gain over time •Mechanistic response

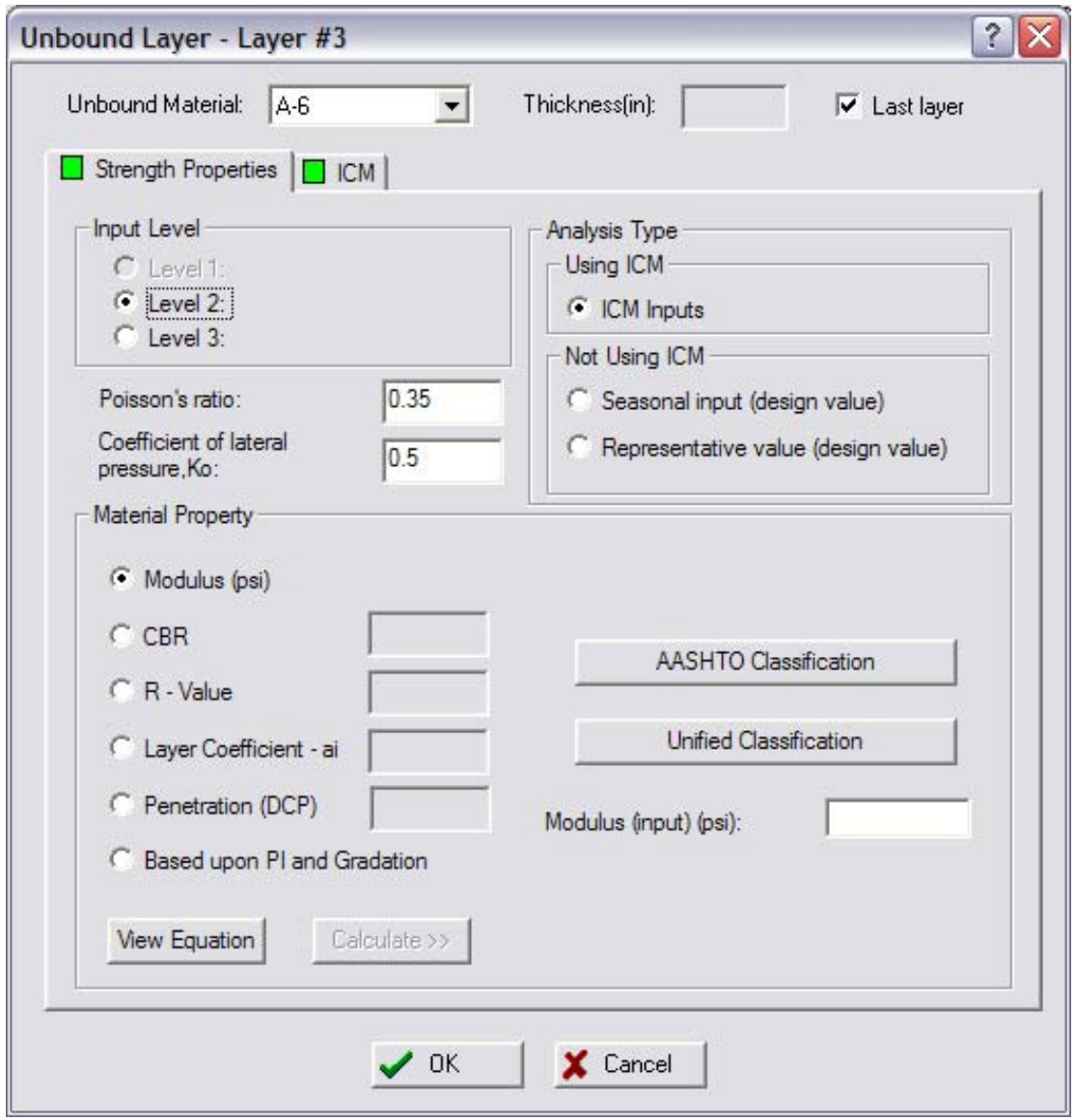
Task 2: Evaluate typical 2002 Design Guide Inputs – AC properties

- Asphalt mix properties
- Asphalt binders properties
- Asphalt general properties

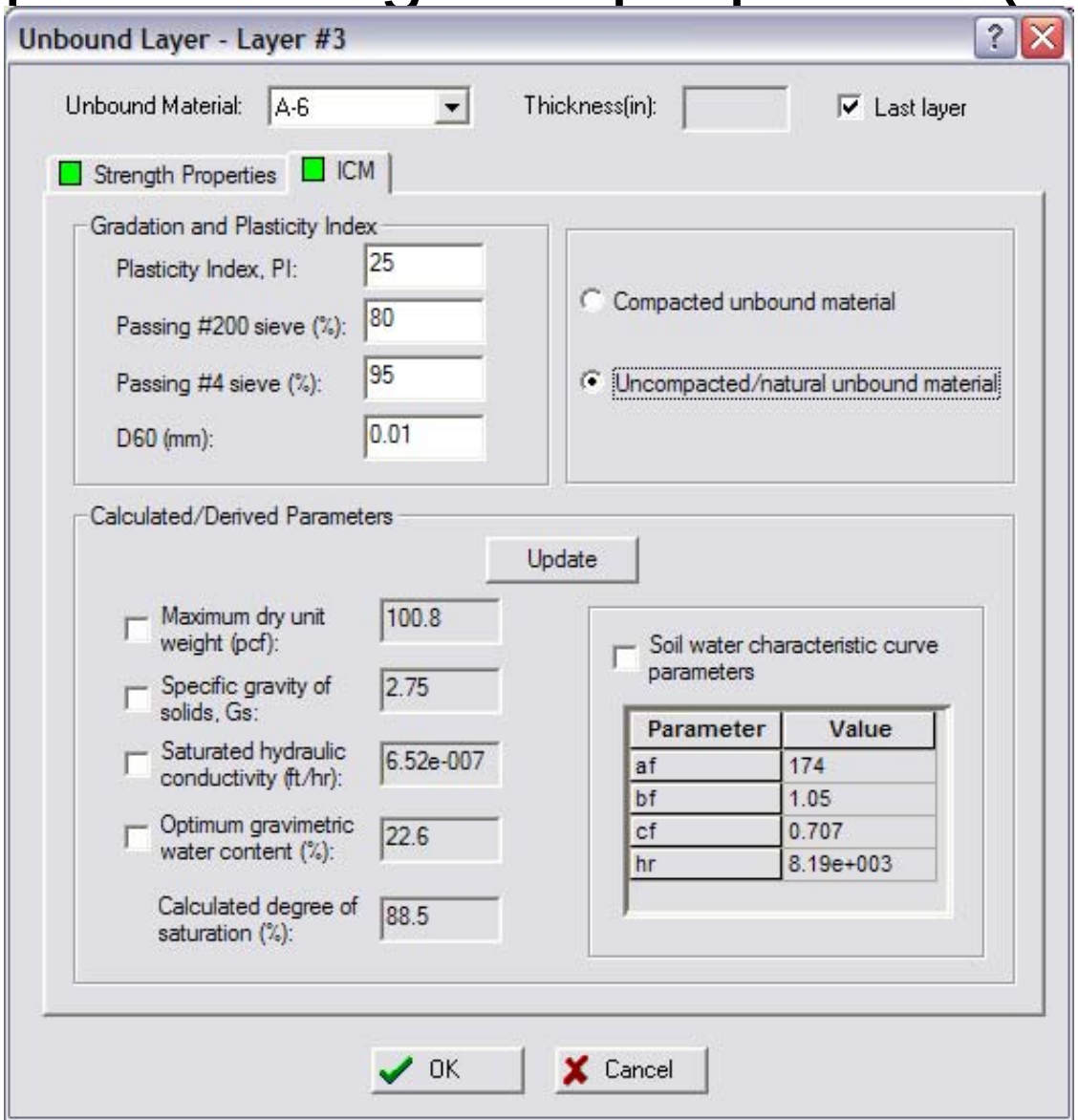
Asphalt General Properties

- Reference temperature (a temperature at which a master curve is constructed)
- Volumetric properties
  - Effective binder content (% by volume)
  - Air void
  - Total unit weight (pcf)
- Thermal properties
  - Thermal conductivity
  - Heat capacity
- Poisson’s ratio
  - Direct input
  - Equation

Task 2: Evaluate typical 2002 Design Guide Inputs – subgrade properties



Task 2: Evaluate typical 2002 Design Guide Inputs – subgrade properties (cont.)



Task 2: Evaluate typical 2002 Design Guide Inputs – PCC Construction Data

- Zero-stress temperature
- Zero-stress temperature gradient (built-in curling)

Task 3: Laboratory Testing

- Will be conducted jointly by MnDOT and UMn
- Detailed program will be determined later

Task 4: Establish performance criteria

- PCC
  - Cracking
  - Faulting
- AC
  - Cracking (top-down and alligator)
  - Rutting (total and AC only)
  - Thermal cracking
  - CTB fatigue
- PCC and AC

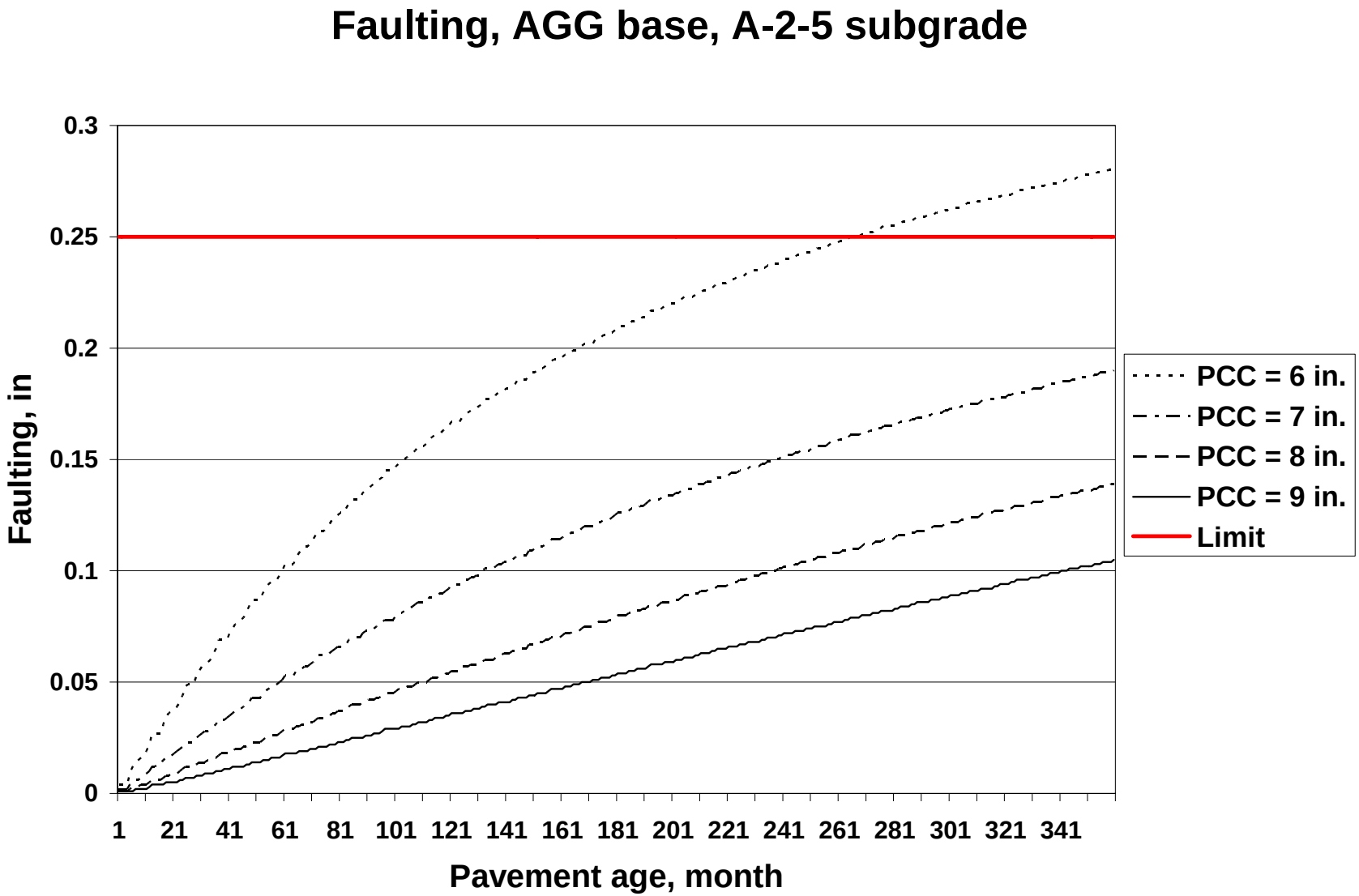
Task 4: Establish Performance Criteria (cont.)

- Obtain inputs from the industries
- Obtain inputs from MnDOT
- Organize consensus building meeting

Task 5: Perform Sensitivity Runs

- Various cross-sections
- Various design features
- Various locations

Task 5: Perform Sensitivity Runs - Example



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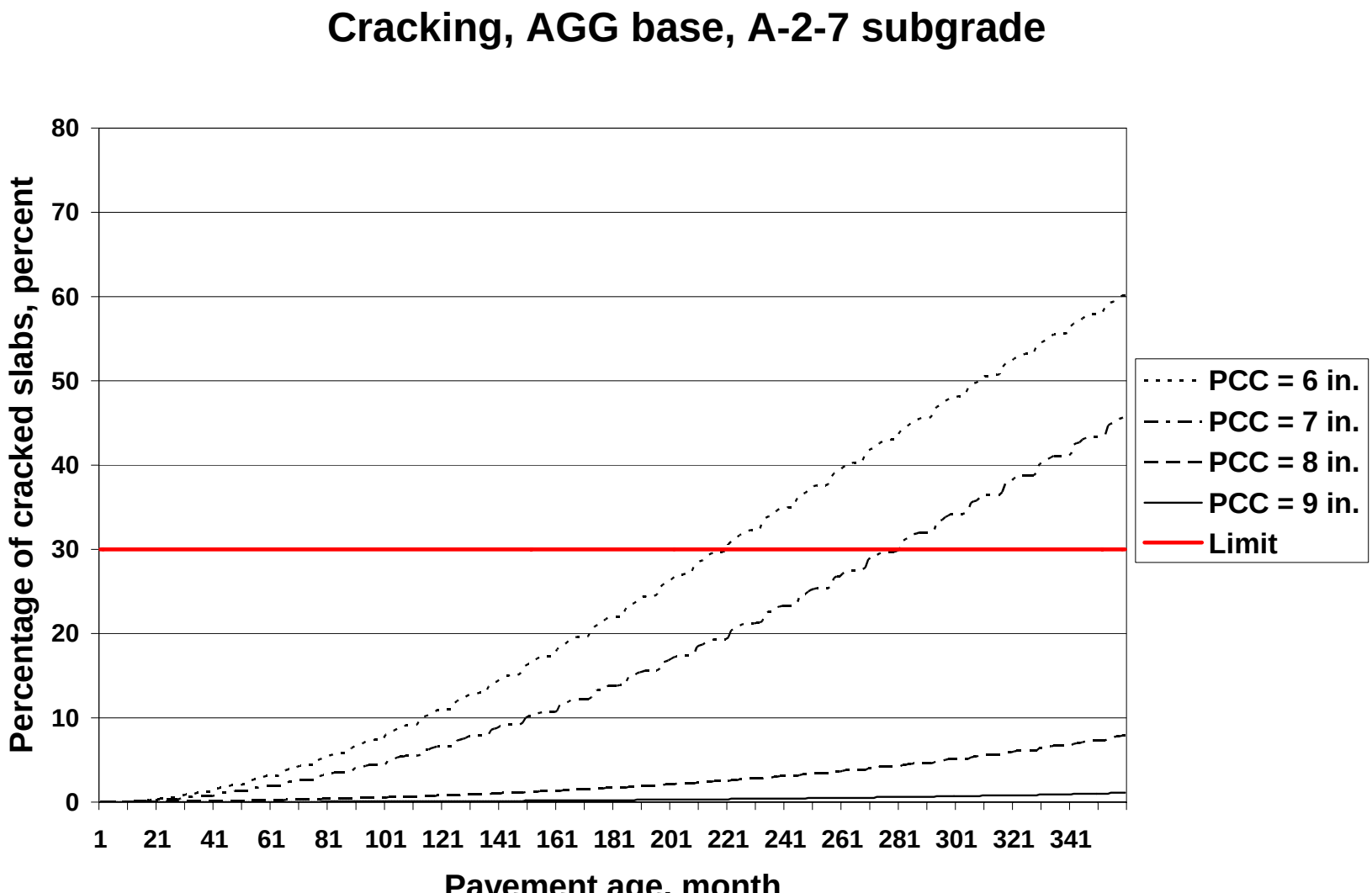

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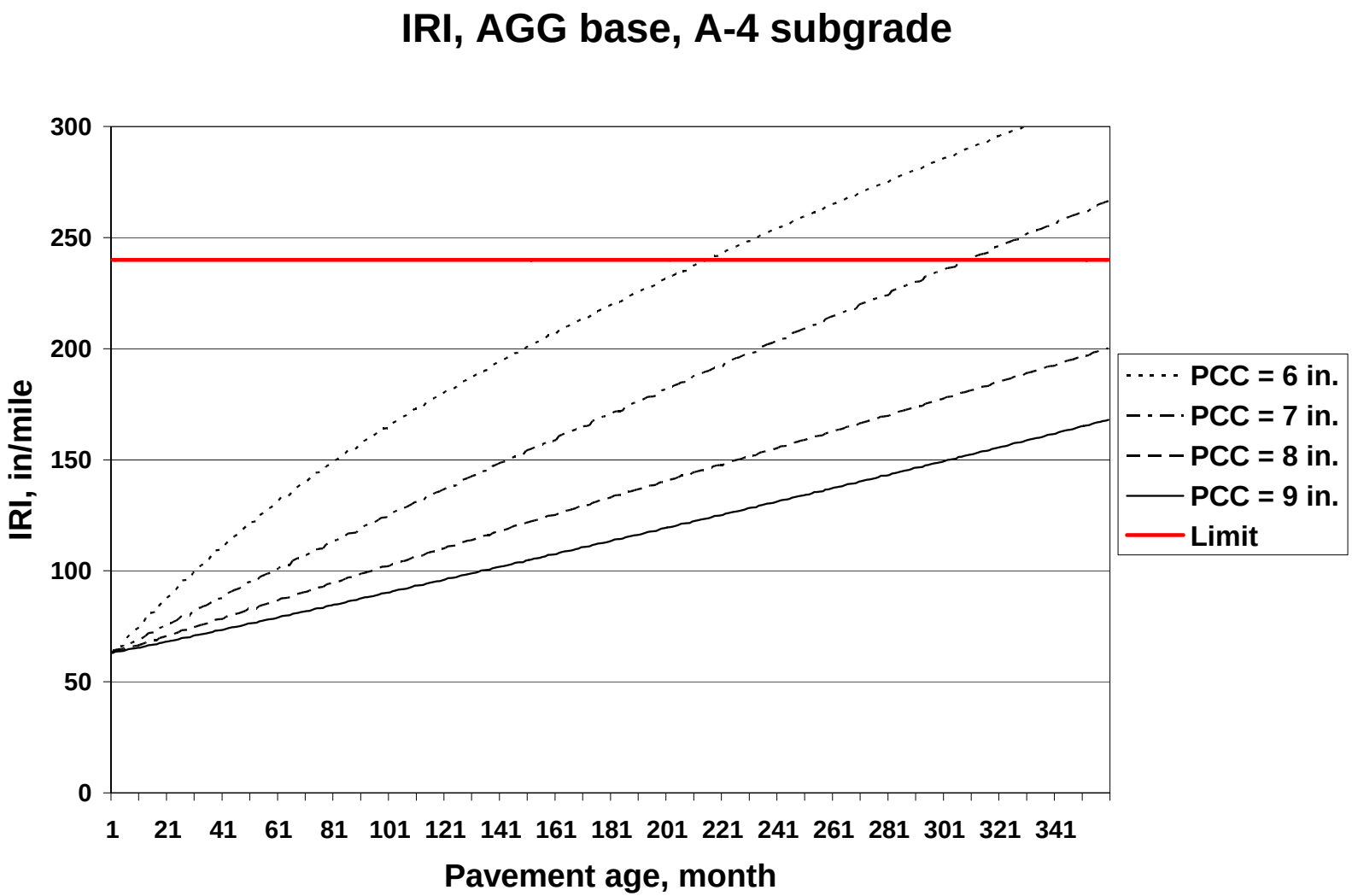

Task 3: Predict pavement performance

- Run 2002 Design Guide Software for the project identified in task 1 using:
  - Project-specific inputs
  - Level 3 inputs
- Compare predicted and measured performance
- Identify needs for re-calibration

Project Schedule