Mechanistic-Empirical Pavement Design in Illinois

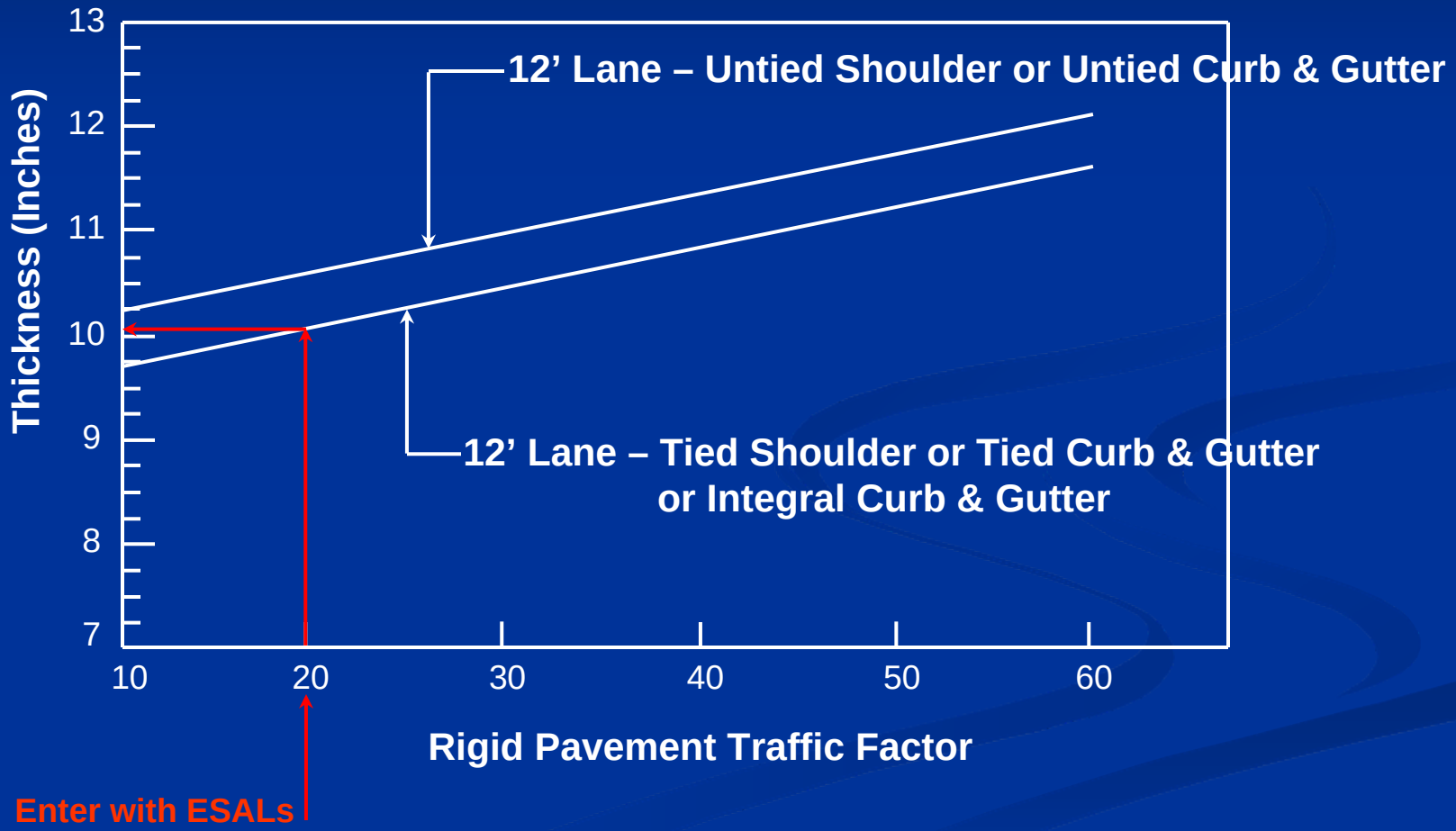
North Central MEPDG Users Group

February 19, 2008

Pavement Design in Illinois

- M-E pavement design adopted August 1989
  - Full-Depth HMA
  - Jointed PCC (15-foot doweled slabs)
  - Traffic and subgrade inputs common to both
- Modified AASHTO design for CRCP

Jointed PCC Thickness



CRCP Design

- IL-Modified AASHTO with CRCP = 0.8 JRCP
- CRCP used if design traffic ≥ 35 million ESALs
- Performance indicates design is conservative

PCC Proposed Changes

- IHR-57, "Evaluation And Implementation Of Improved CRCP And JPCP Design Methods For Illinois " – Jeff Roesler
- Update JPCP design
- Develop M-E CRCP design

ILLINOIS CENTER FOR TRANSPORTATION

JPCP Review/Proposed Changes

- ESALs vs. Load Spectra
  - Vehicle/axle type has minimal impact on T_{PCC}
- Effect of climate has minimal impact on T_{PCC}
- Revisit shoulder type, base type/effect of erosion, fatigue algorithm, reliability, definition of failure, cracking/damage calibration
- Consider endurance limit

ILLINOIS CENTER FOR TRANSPORTATION

CRCP Development

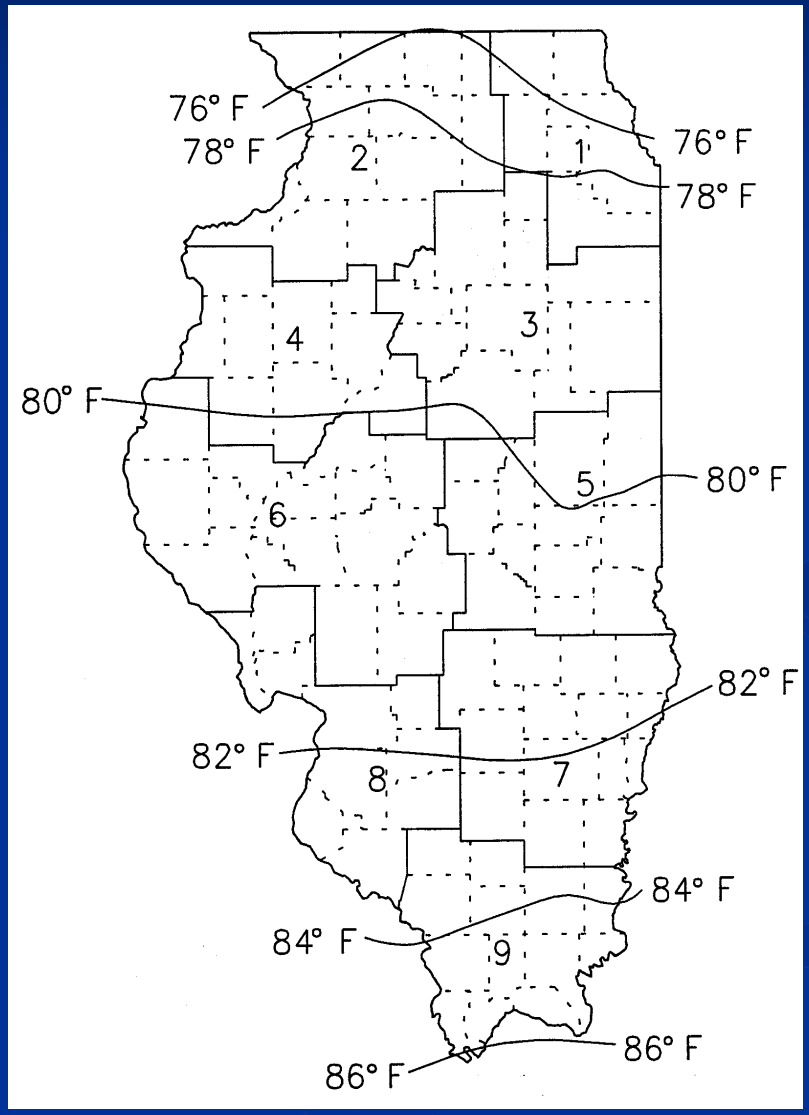
- MEPDG and Zollinger/TX spreadsheet
- Main inputs: T_{PCC}, design life, climate (seasonal basis), ESALs, shoulder type, base type, and construction season
- Failure mode = punchouts/mile
- Want to consider endurance limit concept
- Revisions underway to tailor to IL

ILLINOIS CENTER FOR TRANSPORTATION

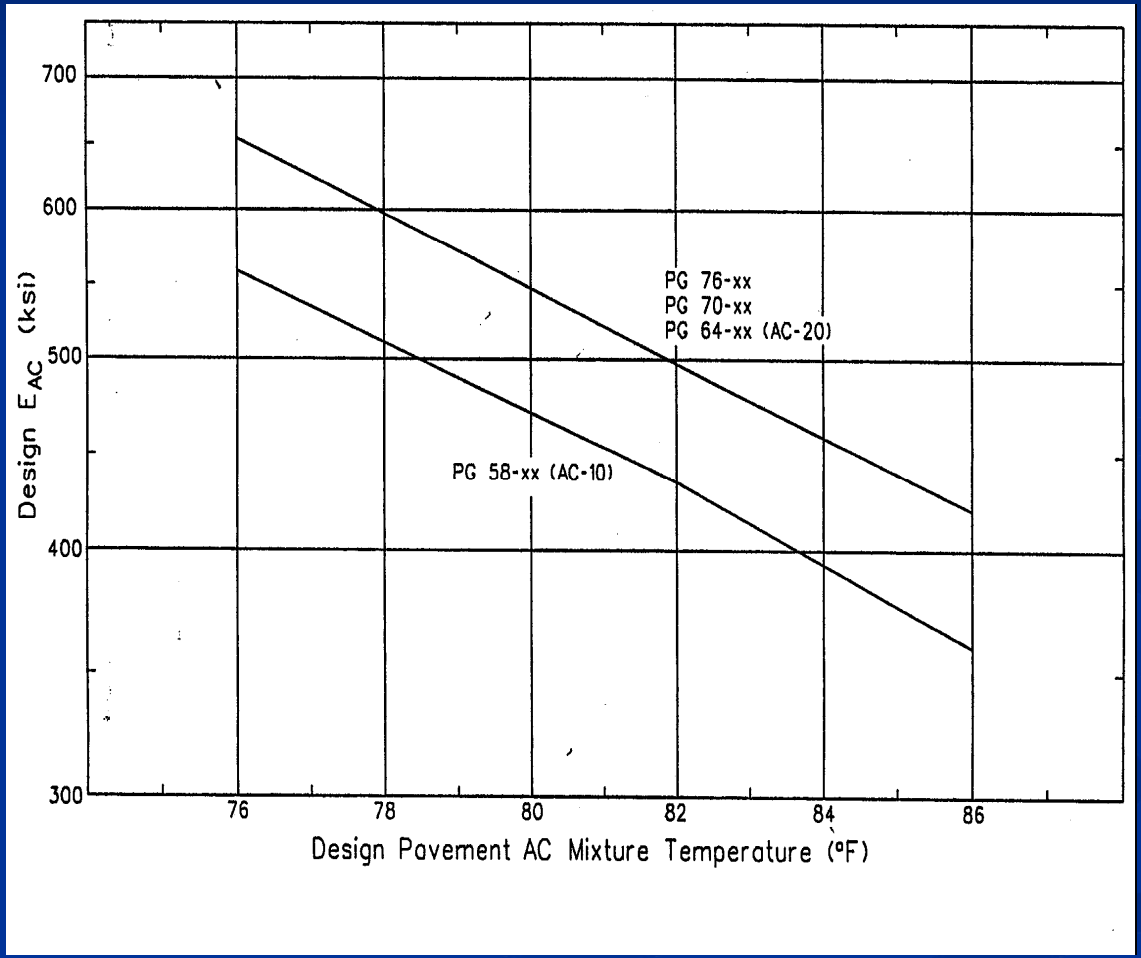
Full-Depth HMA Design

- Failure mode = fatigue cracking
- Traffic
- Subgrade Support Rating
- ….

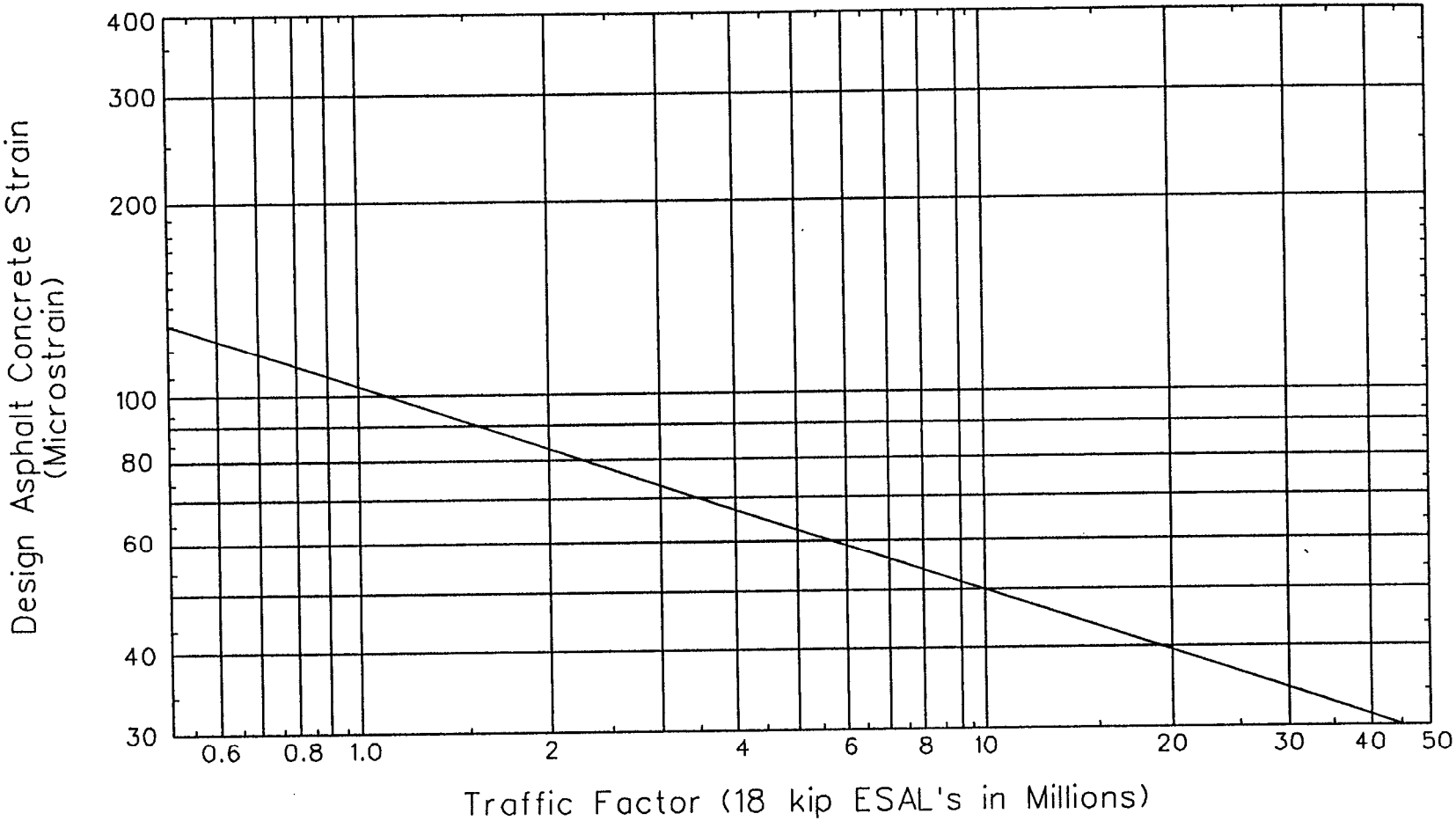
Design Time HMA Temperature



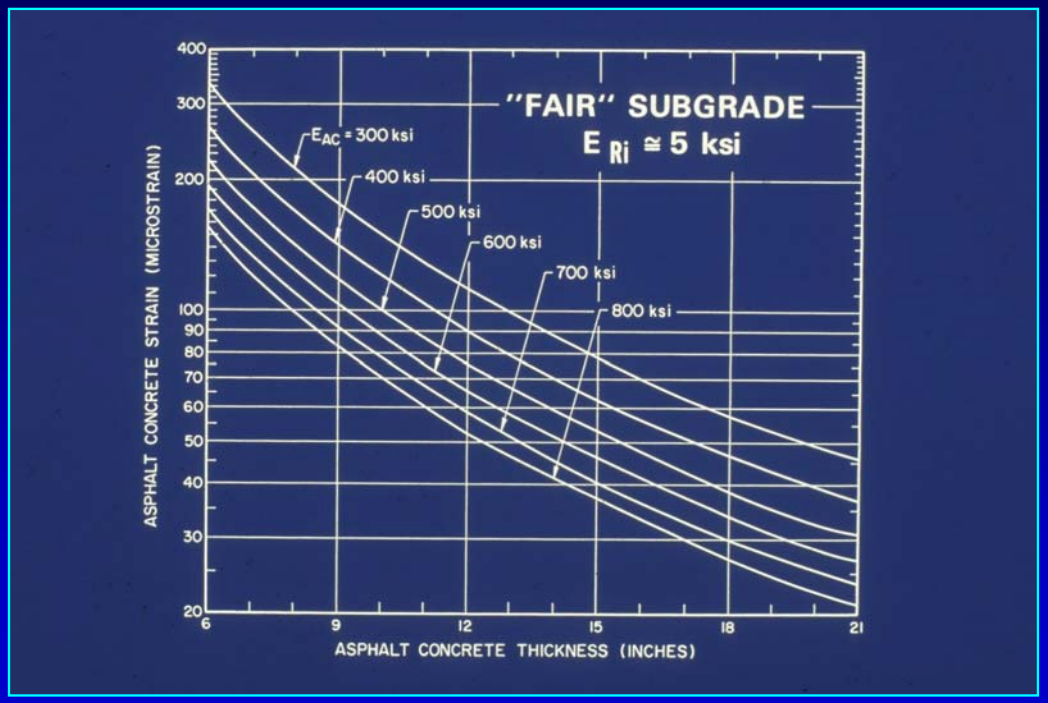
HMA Modulus


700
600
500
400
300
Design E_{AC} (ksi)
PG 76-xx
PG 70-xx
PG 64-xx (AC-20)
PG 58-xx (AC-10)
76
78
80
82
84
86
Design Pavement AC Mixture Temperature (°F)

Design Strain



HMA Thickness

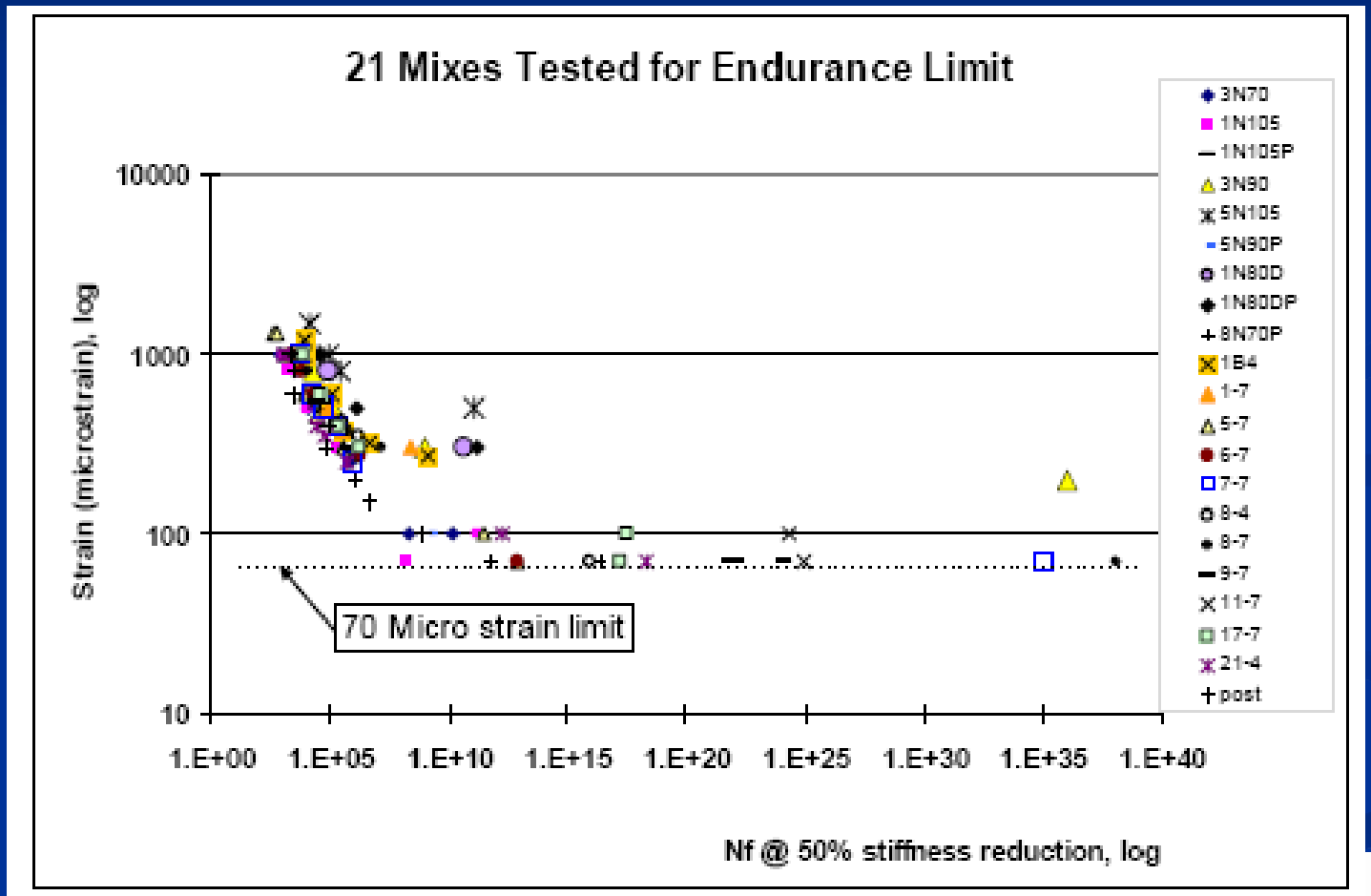


Full-Depth HMA Changes

- Dynamic Modulus Prediction Model Inputs
  - Mix temperature
  - Mix design parameters
  - Binder properties
- Fatigue Algorithm
  - Form: $N = K1 \times (1 / \text{HMA STRAIN})^{K2}$
  - Current: $N = 5 \times 10^{-6} (1 / \text{HMA STRAIN})^{3.0}$
  - Proposed: $N = 2.65 \times 10^{-9} (1 / \text{HMA STRAIN})^{4.0}$

ILLINOIS CENTER FOR TRANSPORTATION

Extended Life Design



ILLINOIS CENTER FOR TRANSPORTATION