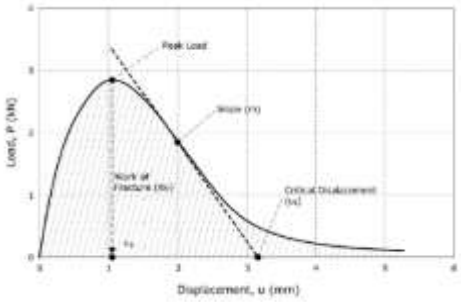
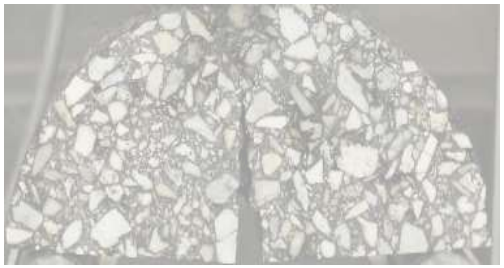
I-FIT Implementation

–

Lessons Learned





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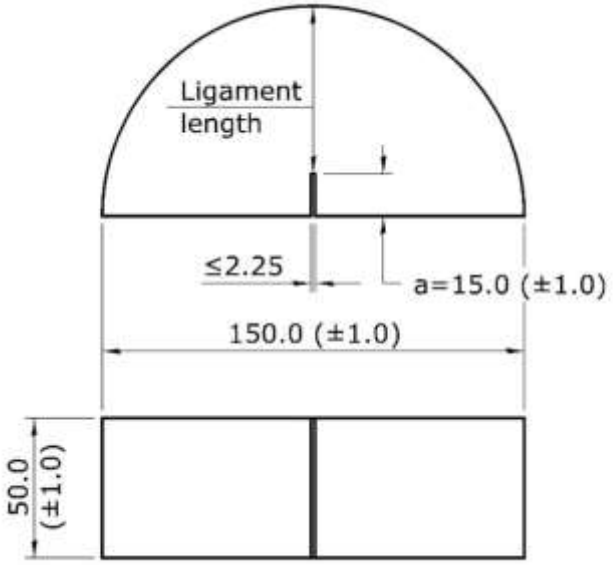
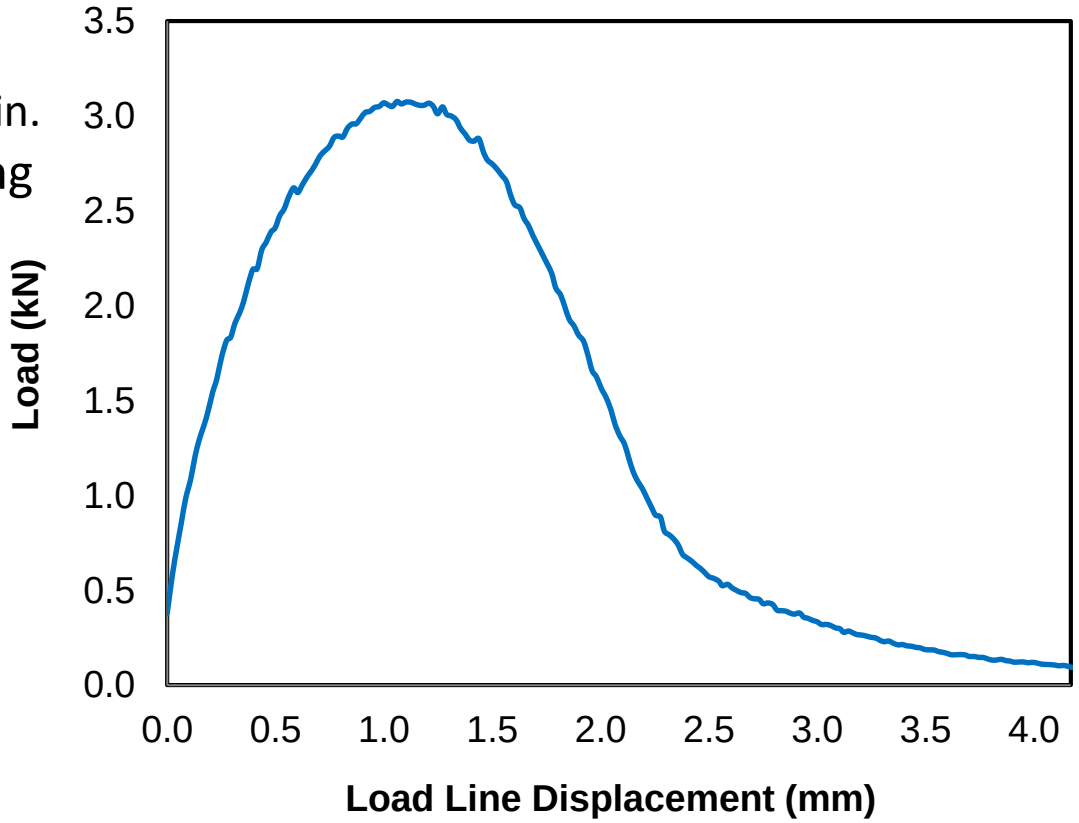
Illinois Flexibility Index Test

- IL Modified AASHTO TP124
- Conditioning
  - 25°C ± 0.5°C for 2.0hrs ± 10min.
- Load Line Displacement Loading Rate
  - 50mm/min





Units in mm

Illinois Flexibility Index Test

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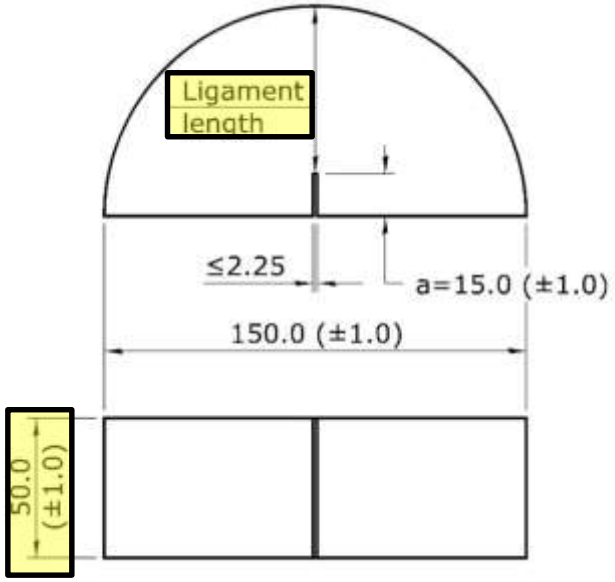
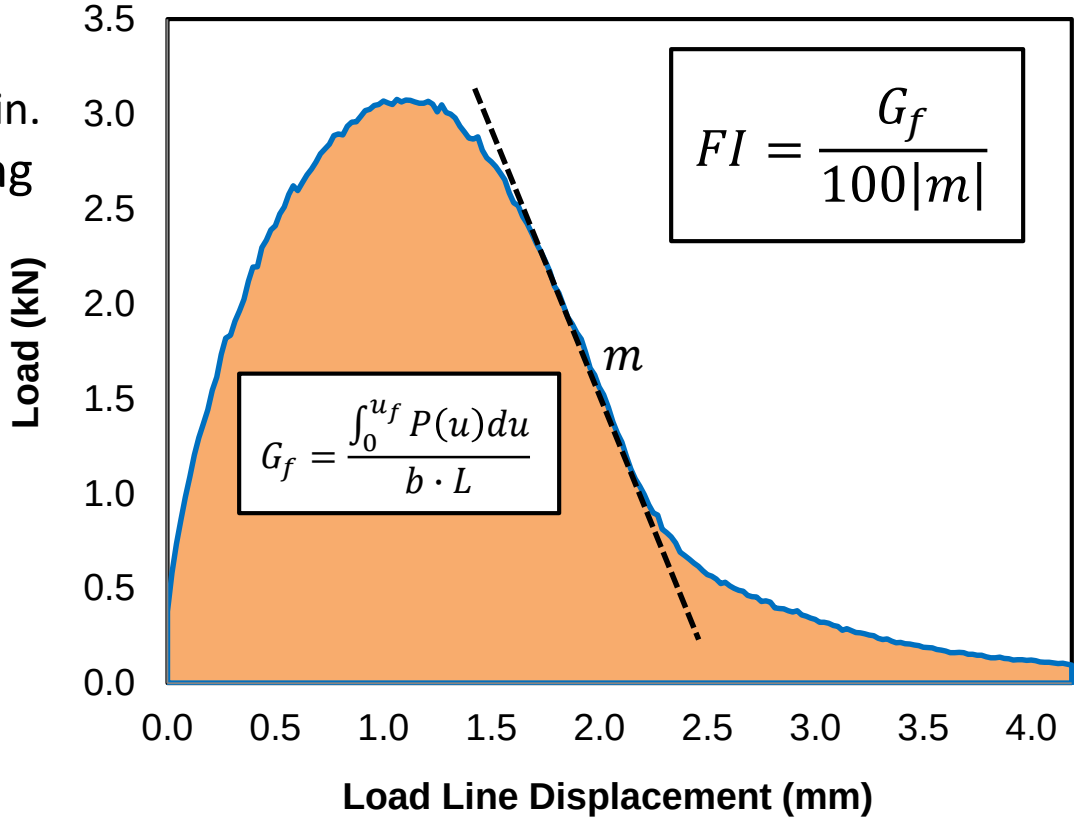
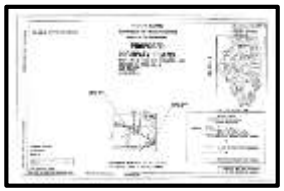


Units in mm



IDOT I-FIT Implementation Timeline



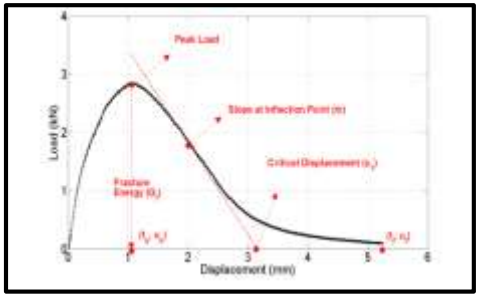
2012 2013 2014 2015 2016 2017 2018 2019

2013 UIUC I-FIT Research Study #1 Began

2014 UIUC HMA Field Research Study Began

2015 IDOT CBM Began Testing Mixtures Using I-FIT Procedure

2016 UIUC I-FIT Research Study #1 Completed



2016 IDOT I-FIT Pilot Projects

2017 IDOT I-FIT Uniformity Studies Began

2017 All IDOT District I-FIT Machines Online

2018 UIUC I-FIT Research Study #2 Began

2018 UIUC HMA Field Research Study Completed

2019 UIUC I-FIT Research Study #2 Will Be Completed

2019 I-FIT on all Interstates

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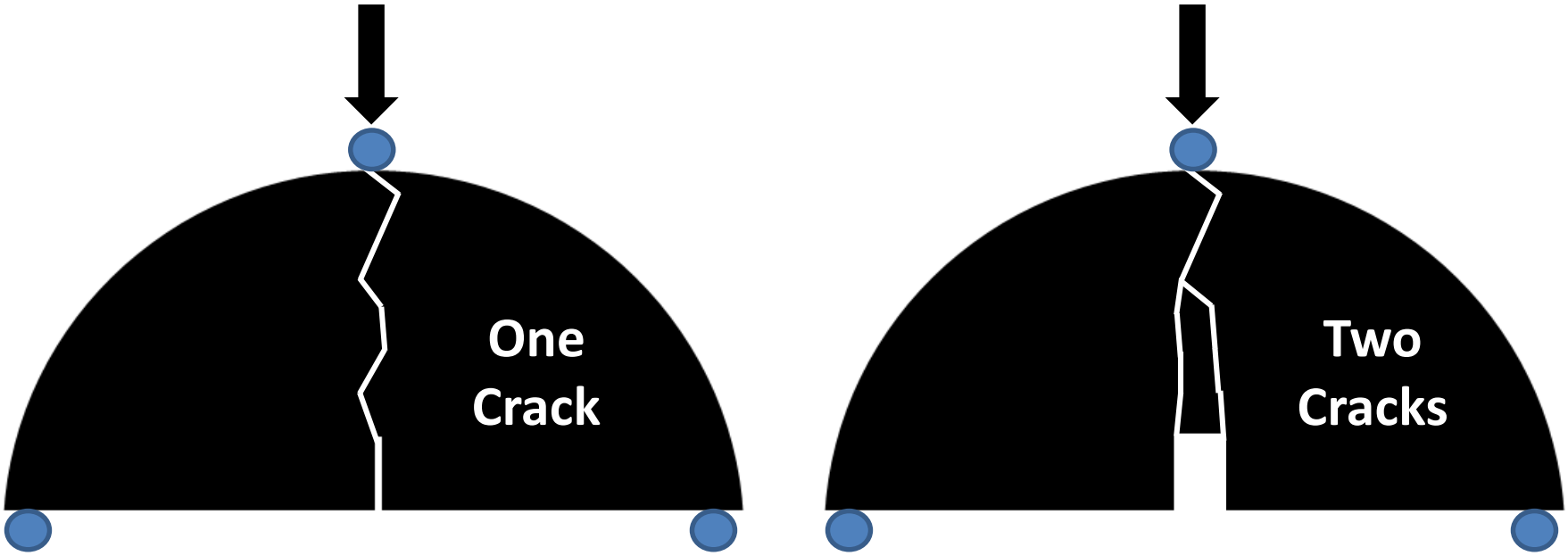
Lesson 1 – Geometry

Notch

- Goals of Notch
  - Thin, Straight, Appropriate Length
  - Produces singular crack

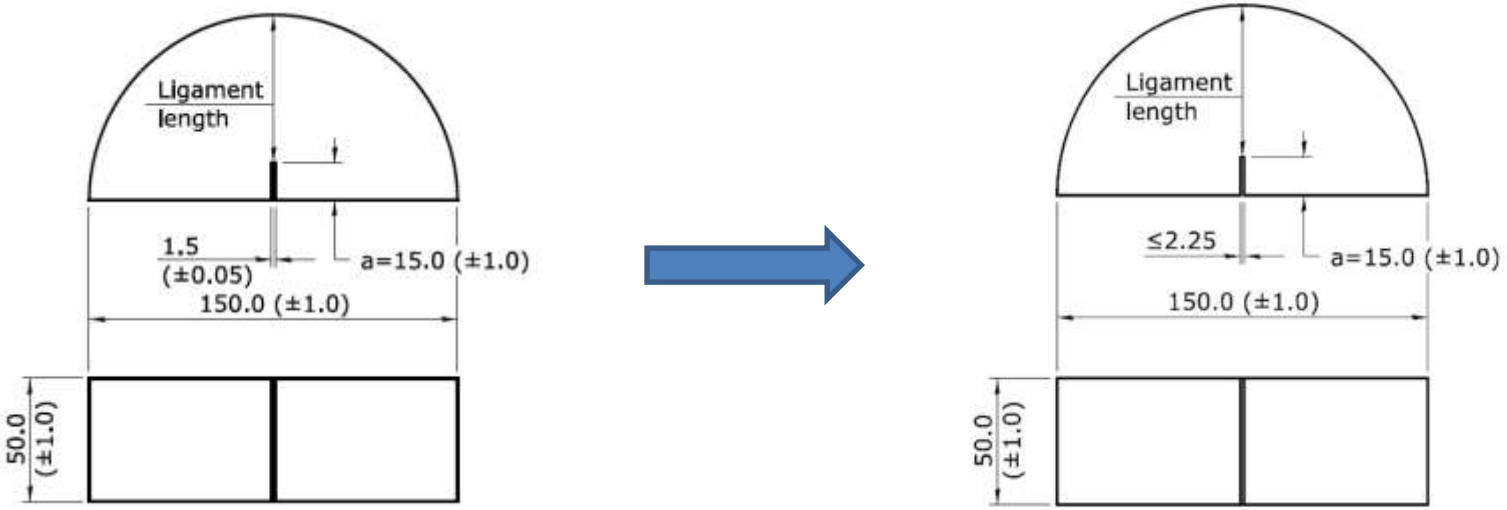


Notch

- Goals of Notch
  - Thin, Straight, Appropriate Length
  - Produces singular crack
- Notch/"Starter Notch" in Metal Fracture Testing (ASTM E399)
  - Used to create stress amplification for fatigue pre-cracking
  - Not easily re-created in HMA

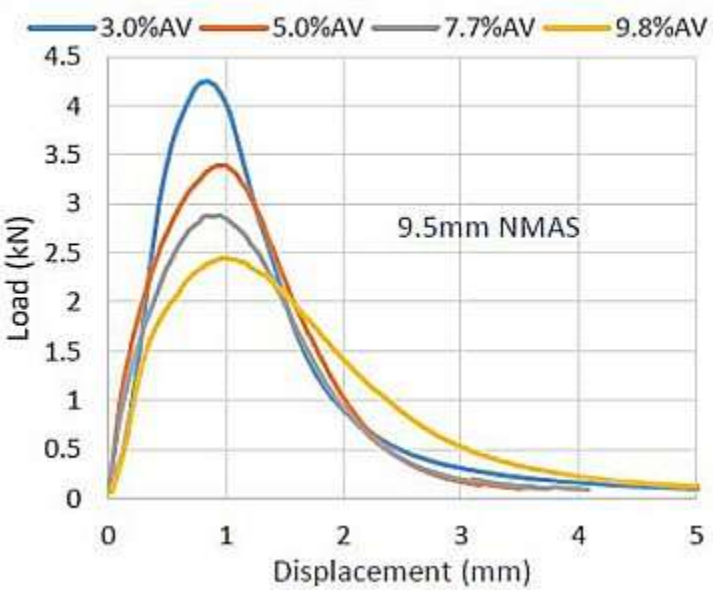
Notch Thickness Criteria

- Notch Width Initial Criteria
  - 1.50mm ± 0.05mm
- Notch Width Current Criteria
  - ≤ 2.25mm



Limiting Air Void Range

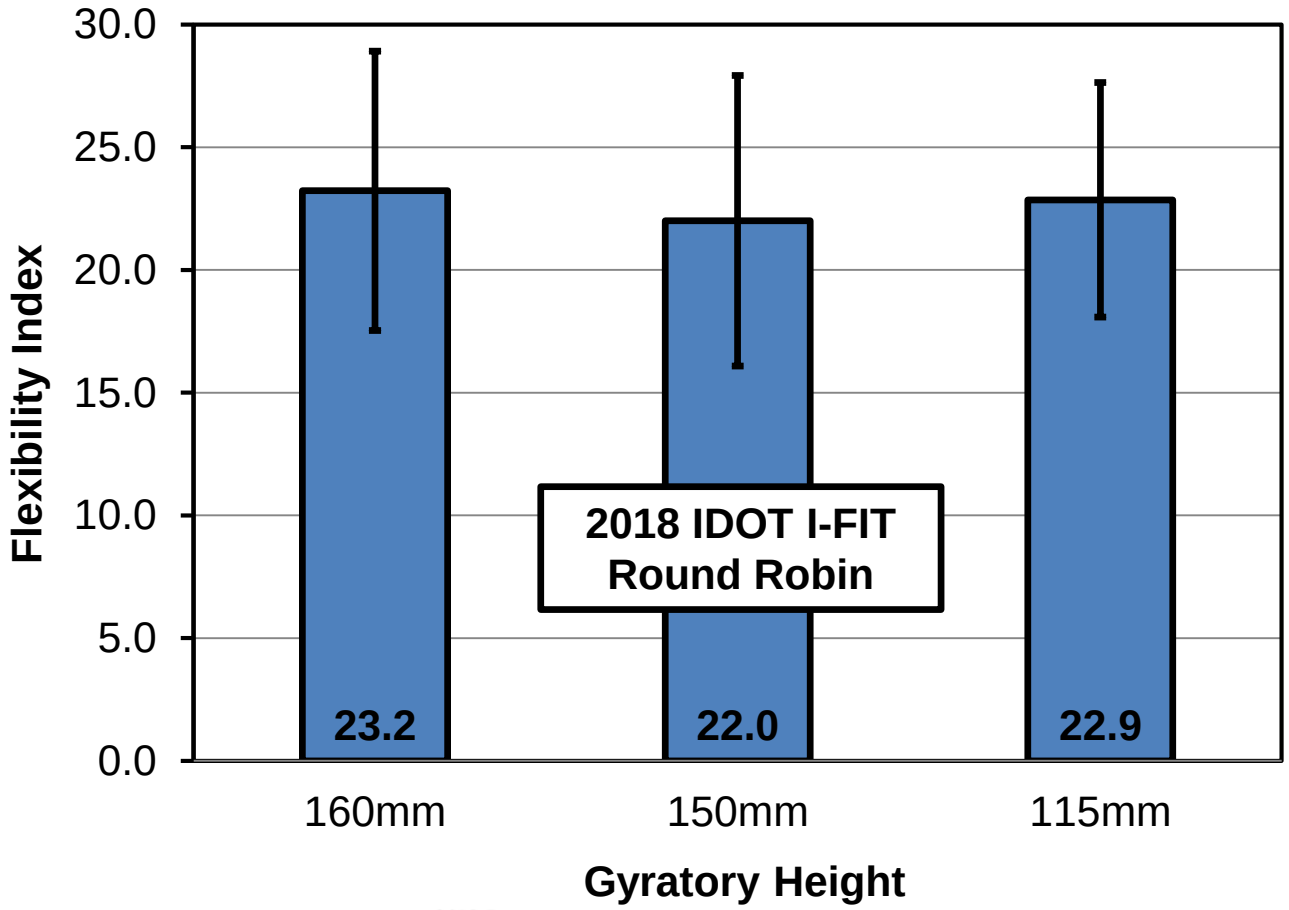
- Wide ranges (3 to 10%) in air voids affect HMA fracture response
- Air Voids Initial Criteria
  - 7.0% ± 0.5%
- Air Voids Current Criteria
  - 7.0% ± 1.0%
    - **Matches Hamburg Wheel Criteria**



Barry, M.K. (2016) *An Analysis of Impact Factors on the Illinois Flexibility Index Test*. Master's Thesis. University of Illinois at Urbana-Champaign.

Gyratory Height

- AASHTO TP124 allows both 160 and 115mm tall gyratories



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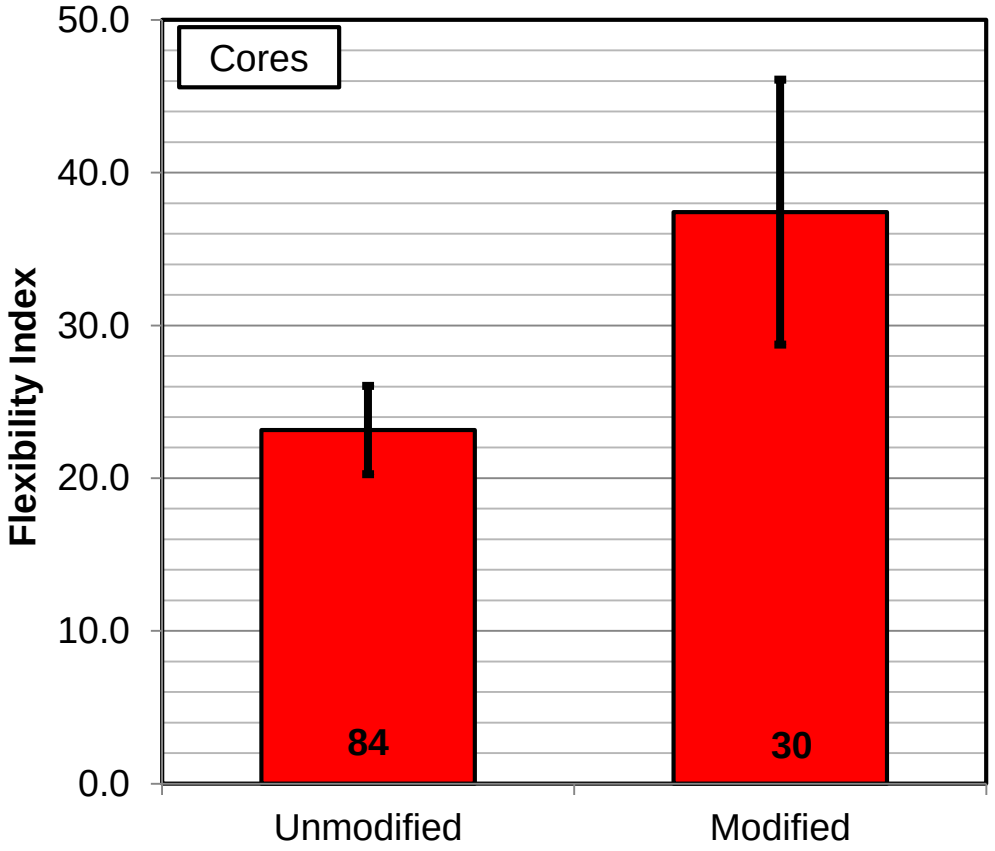
Lesson 2 – Mixture Design Variables

IDOT I-FIT Database

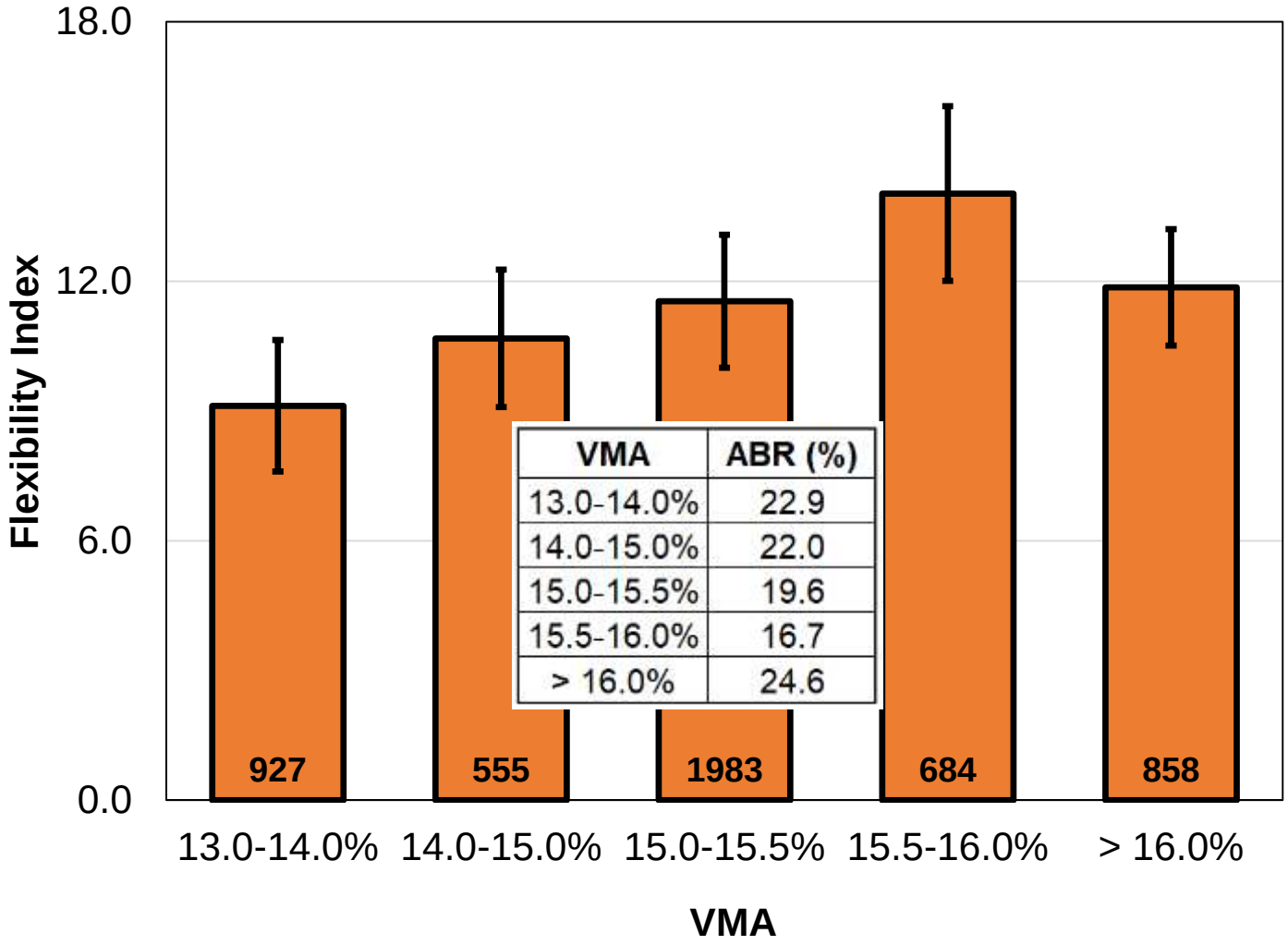
- Database Contents
  - Approximately 1900 test sets evaluated
    - Typically, 4 specimens tested per mixture
    - Average of the closest 3 specimens used in analysis (IL Mod. AASHTO TP124)
    - Includes CBM and District Test Results
  - Analysis Breakouts
    - **Total AC Content**
    - **Virgin AC Content**
    - **Design VMA**
    - **ABR**
    - Test Specimen Air Void Content
    - Specimen Type (Lab/Plant/Cores)
    - Polymer Modification
    - Virgin Asphalt Binder Low Temperature Grade
    - Test Specimen VMA
    - NMAS
    - Volume of Effective Binder (VBE)

Plotting Methodology

- FI vs. Variable (Ex. Cores with/without SBS polymer modifiers)
- Bar values represent Average FI (Trimmed Mean ($\overline{FI}$))
- Error bars represent one average standard deviation (σ) on either side of the trimmed mean
  - $COV(\%) = 100(\frac{\sigma}{\overline{FI}})$
- Values at the bottom of each bar represent the number of test specimens represented in the trimmed mean

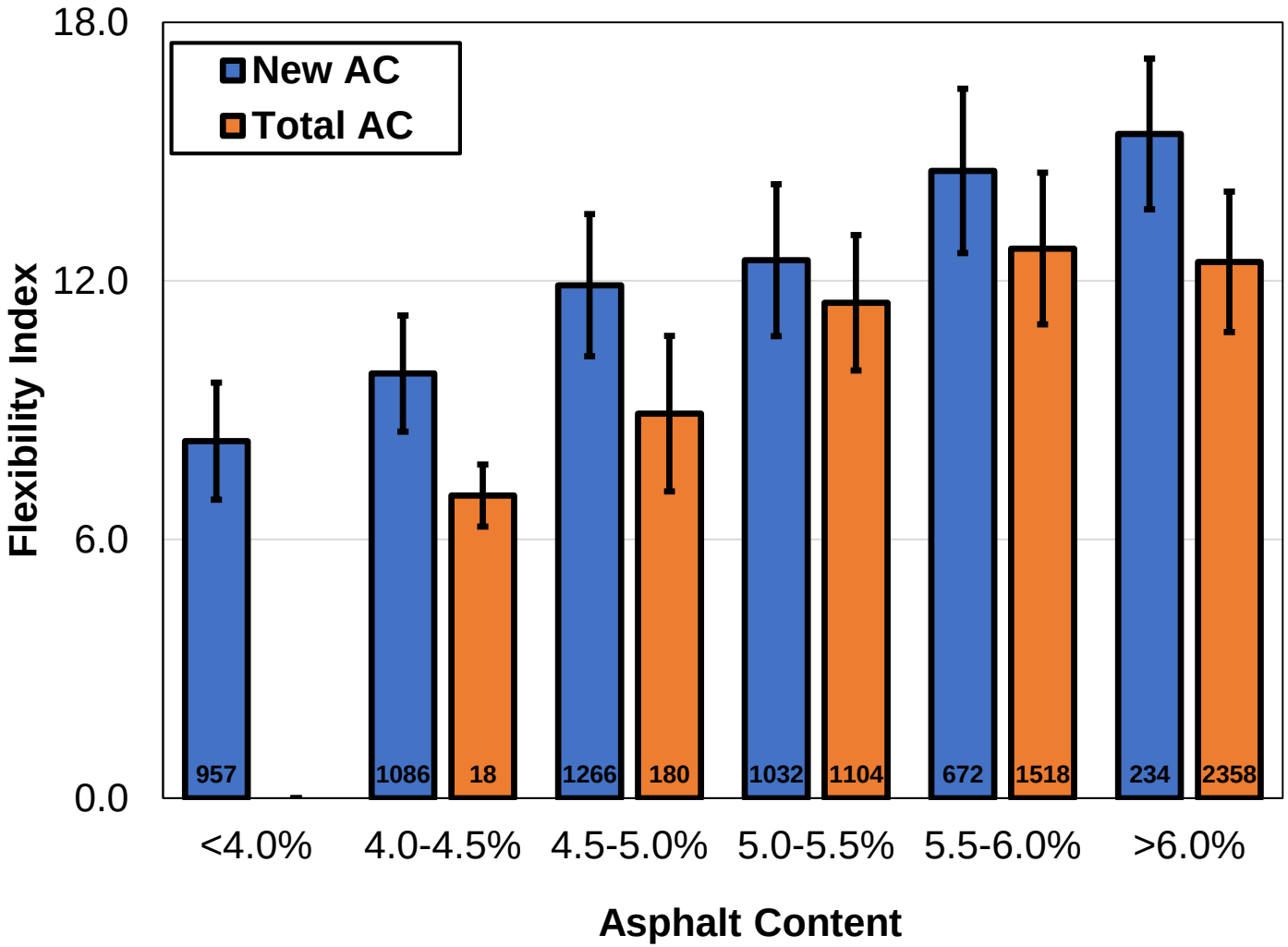


VMA



VMA	ABR (%)
13.0-14.0%	22.9
14.0-15.0%	22.0
15.0-15.5%	19.6
15.5-16.0%	16.7
> 16.0%	24.6

Asphalt Content



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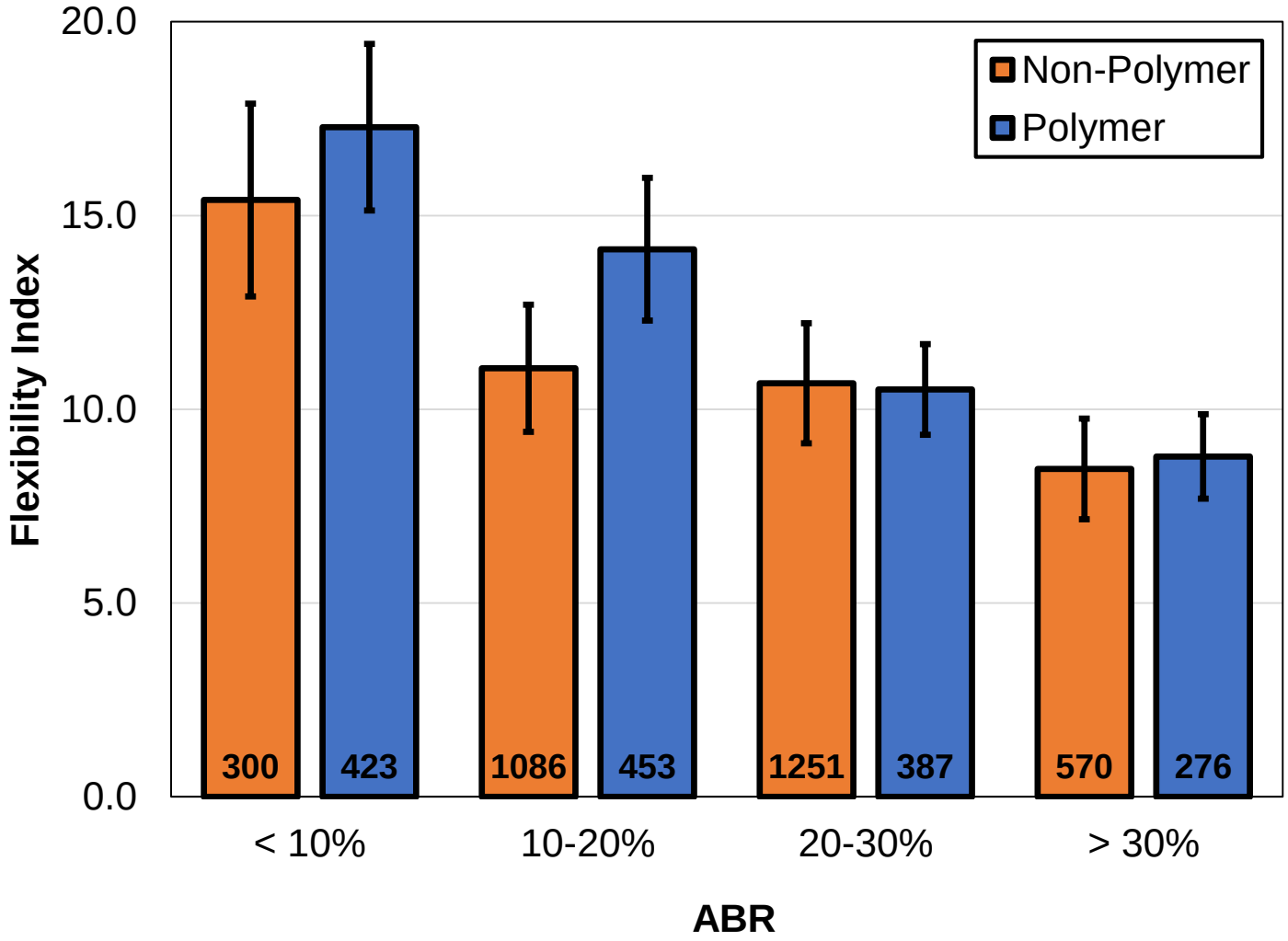
ABR



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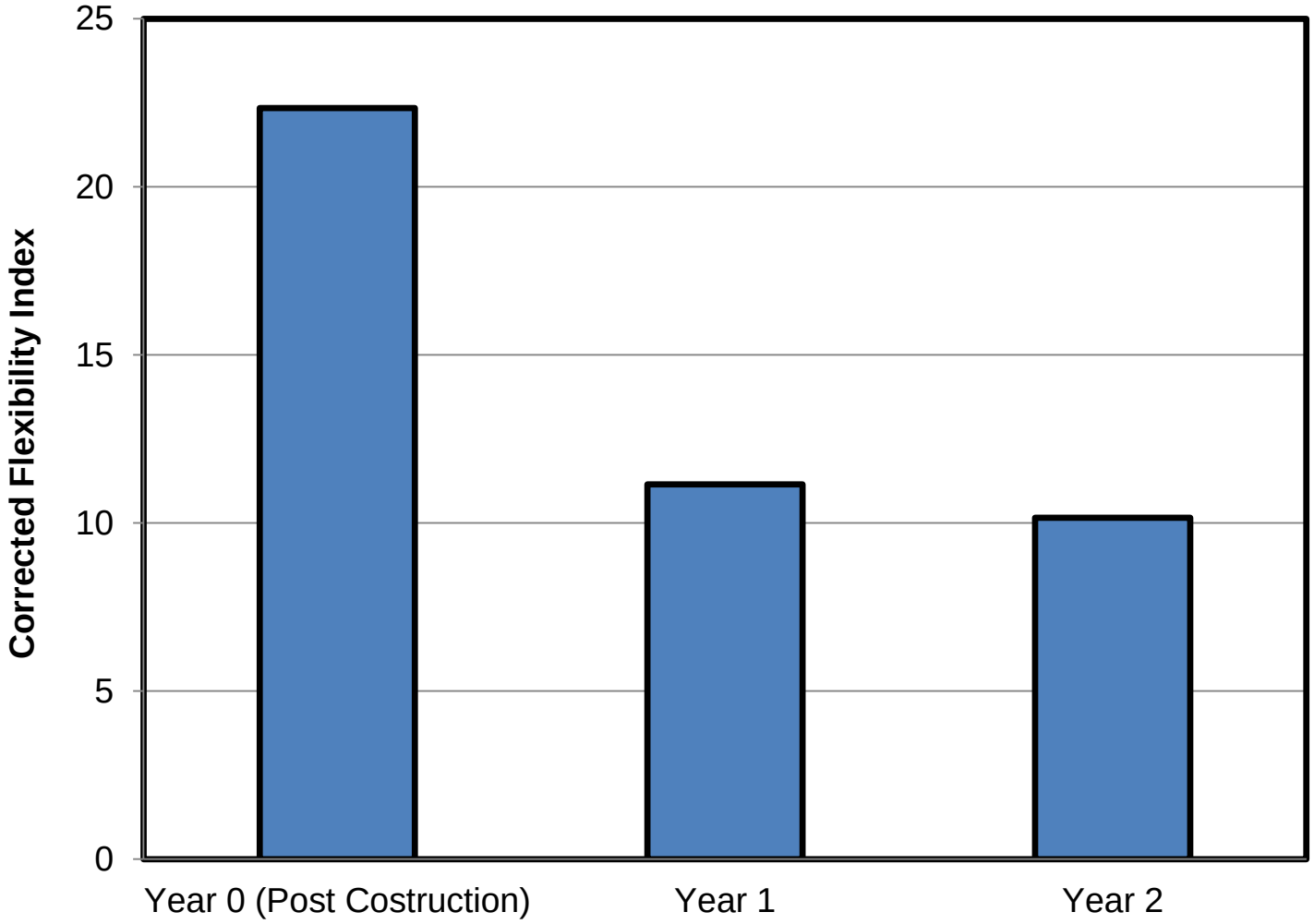
Lesson 3 – Field Projects

2016 IDOT I-FIT Pilot Projects

- 11 Projects Across All 9 Districts
- Mix Design and Production Testing, HWTT & I-FIT
- Pre-construction Distress Surveys Conducted
- Planned Annual Coring for I-FIT and Distress Surveys

2016 I-FIT Pilot Project Core Results



Lesson 4 – Recurrent Analyses

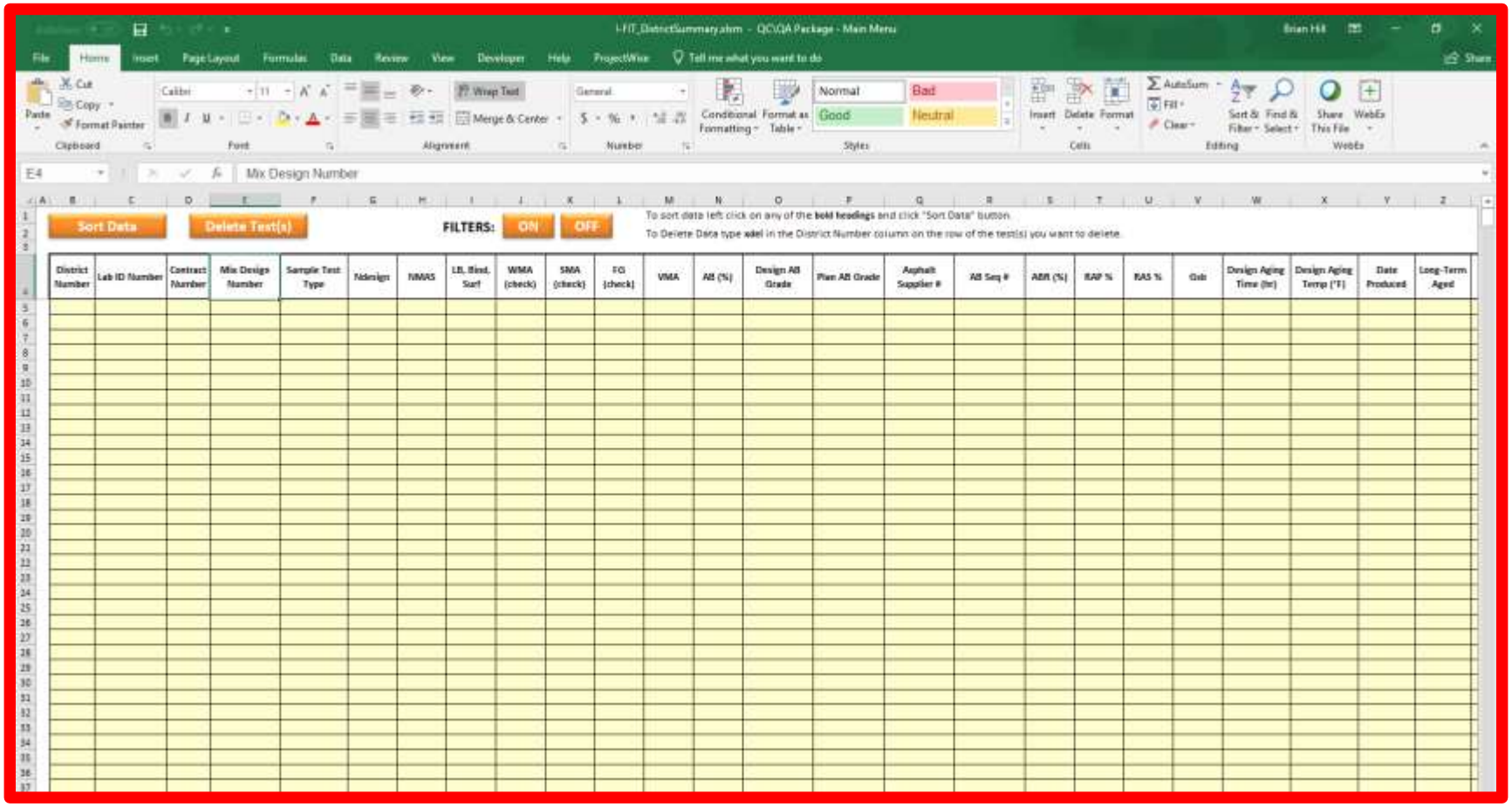
IDOT I-FIT Round Robins

- **2017 – 30 Machines**: IDOT (10), WISDOT, INDOT, Private Labs (15), and ICT (3)
- **2018 – 34 Machines**: Added MODOT, NCAT, and two IL labs
- **2019 – 35 Machines**: Added Ohio and Oklahoma DOT's
- Approx. 12 Test Specimens/Round Robin/Machine
- Samples provided by IDOT CBM

I-FIT Databases

- Applicable at the State/District/Contractor Levels
- Partial List of Variables to Consider
  - Mix Design vs. Plant Production
    - VMA (Design/Production)
    - Binder Content (Design/Production)
  - Daily Production Variation
  - Long-Term Aging (Lab Oven Conditioning)
  - Binder Suppliers

I-FIT Database in QC/QA Package



Thank You for Your Attention!