I-FIT Implementation

Lessons Learned
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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\[
F_I = \frac{G_f}{100|m|}
\]

\[
G_f = \frac{\int_0^{u_f} P(u)du}{b \cdot L}
\]

*Units in mm*
IDOT I-FIT Implementation Timeline

2012
UIUC I-FIT Research Study #1 Began

2013
UIUC HMA Field Research Study Began

2014
IDOT CBM Began Testing Mixtures Using I-FIT Procedure

2015
IDOT I-FIT Pilot Projects

2016
IDOT I-FIT Uniformity Studies Began

2017
All IDOT District I-FIT Machines Online

2018
UIUC I-FIT Research Study #2 Began

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

I-FIT on all Interstates
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

Gyratory Height

- AASHTO TP124 allows both 160 and 115mm tall gyratories
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 ($\sigma$) on either side of the trimmed mean
  - $COV(\%) = 100\left(\frac{\sigma}{\overline{FI}}\right)$
- Values at the bottom of each bar represent the number of test specimens represented in the trimmed mean
### VMA

![Bar chart showing flexibility index for different VMA ranges.](image)

<table>
<thead>
<tr>
<th>VMA</th>
<th>ABR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.0-14.0%</td>
<td>22.9</td>
</tr>
<tr>
<td>14.0-15.0%</td>
<td>22.0</td>
</tr>
<tr>
<td>15.0-15.5%</td>
<td>19.6</td>
</tr>
<tr>
<td>15.5-16.0%</td>
<td>16.7</td>
</tr>
<tr>
<td>&gt; 16.0%</td>
<td>24.6</td>
</tr>
</tbody>
</table>
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

Corrected Flexibility Index

Year 0 (Post Construction) | Year 1 | Year 2
--- | --- | ---
23 | 12 | 10
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!