# IDOT HMA Update

59th Annual Bituminous Conference

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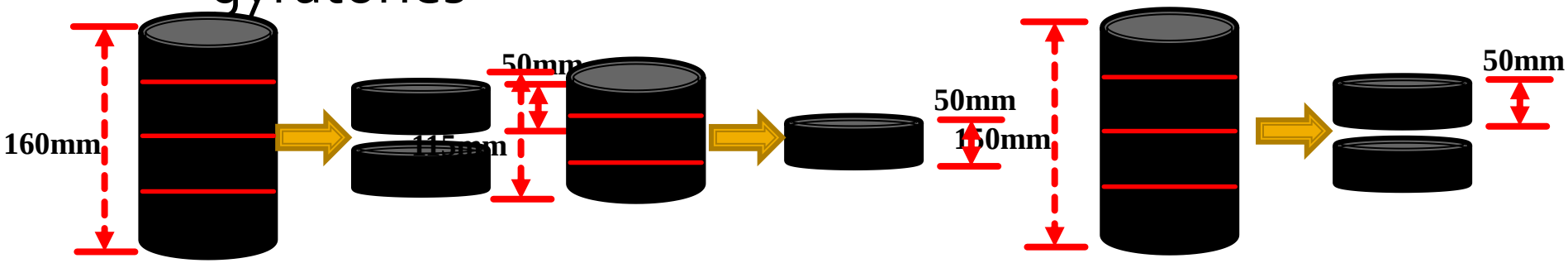
# Topics

- I-FIT
  - 2018 & 2019 Round Robins
  - Implementation Task Force
  - Implementation Plan
- Asphalt Binder Performance Test
- PG Binder Usage
- AASHTO Proficiency Sample Program (PSP)
- Tack Coat
- Intelligent Compaction (IC)

# 2018 I-FIT Round Robin Approach

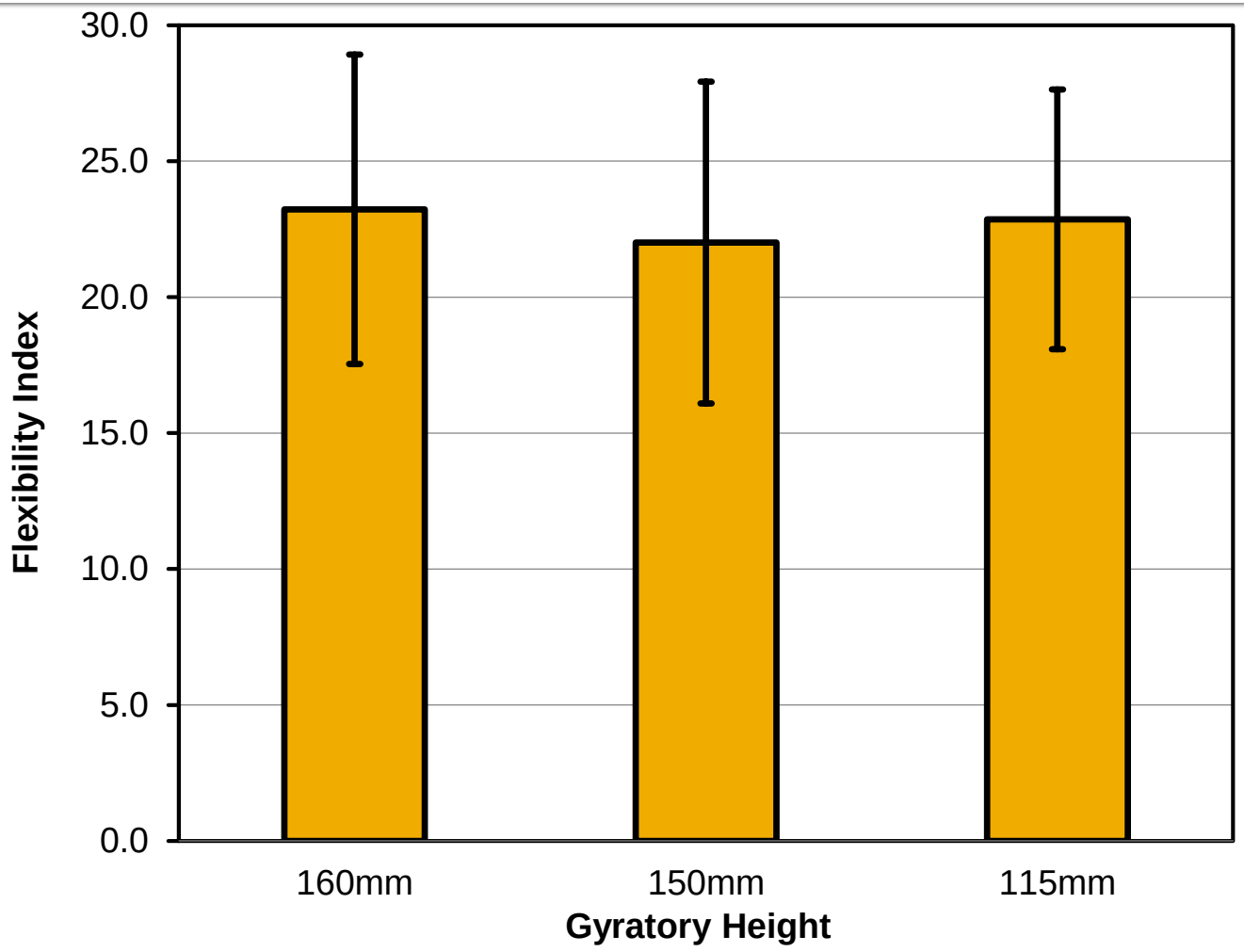
- **Set A – Testing**
  - Test I-FIT specimens cut from 160mm tall gyratory
- **Set B –Testing**
  - Test I-FIT specimens cut from 150mm tall gyratory
- **Set C – Testing**
  - Test I-FIT specimens cut from 115mm tall gyratories



# Round 1(A) Results

| I-FIT Round Robin - 160mm Gyratory Height | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Test Group | Number of Test Sets | Avg. $G_f$* ($J/m^2$) | Avg $G_f$ COV (%) | Avg. Slope (kN/mm) | Avg Slope COV (%) | Avg. FI | Individual Lab FI COV (%) | Population FI COV (%) |
| IDOT | 10 | 2522.1 | 8.1 | 1.0 | 17.8 | 25.3 | 15.7 | 19.9 |
| Private | 17 | 2422.3 | 9.4 | 1.2 | 15.4 | 21.5 | 18.1 | 26.3 |
| Other States and University | 7 | 2461.3 | 4.3 | 1.0 | 9.2 | 24.9 | 10.0 | 22.1 |
| Testquip Vertical | 26 | 2453.5 | 8.1 | 1.2 | 15.5 | 22.7 | 16.8 | 26.1 |
| Testquip Horizontal | 2 | 2483.2 | 7.6 | 1.0 | 11.8 | 25.7 | 12.4 | 13.3 |
| Instrotek | 3 | 2453.2 | 5.5 | 1.0 | 9.9 | 25.1 | 12.5 | 16.0 |
| IPC | 1 | 2319.1 | 9.9 | 1.3 | 16.0 | 18.4 | 19.3 | 19.3 |
| MTS | 1 | 2351.8 | 16.8 | 0.9 | 27.0 | 27.3 | 10.3 | 10.3 |
| Interlaken | 1 | 2811.7 | 3.3 | 1.0 | 10.8 | 29.9 | 5.5 | 5.5 |
| **All Machines** | **34** | **2459.7** | **8.0** | **1.1** | **14.8** | **23.3** | **15.7** | **24.5** |

# Effect of Gyratory Height



# 2018 I-FIT Round Robin Findings

- Results showed no consistent trends with gyratory height
- Testquip-Horizontal, MTS, & Interlaken produced consistently higher FI than Testquip-Vertical & Instrotek devices
- Individual lab COV's for FI were less than 16%

# 2019 I-FIT Round Robin

- Provide final data needed for AASHTO to develop Precision Statement for TP-124
  - Needed:
    - 3 mixes total
    - ≥ 30 labs ideal
    - A mix w/ 3 replicates per lab
    - Labs Compact, Cut & Test (115's for Troxlers - 160 all others)
    - By January 2019 for consideration at AASHTO Mid-Year Mtg
- 2019 I-FIT RR completed December 7th
- Volumetric & Hamburg currently being tested

# I-FIT Implementation Task Force Update

# Perpetual Mix Designs

- Current Requirements:
  - New design is good for 3 years before reverification
  - Uses same Agg Bulk Specific Gravities ($G_{sb}$) for 3 yrs

# Perpetual Mix Designs

- Perpetual Mix Designs
  - New design verified by District Lab
  - Mix Design updated annually w/ current $G_{sb}$'s
  - ≥ 0.020 change in combined $G_{sb}$ triggers new design
  - Change in ledge prior construction season requires 1 point design w/ Hamburg, IFIT & TSR
  - Change in ledge during construction:
    - Use plant produced mix for Hamburg, IFIT, TSR.
    - Contractor makes needed adjustment – new $G_{sb}$ used for volumetric calculation going forward.

# Perpetual Mix Designs

- Benefits:
  - Increase accuracy of calculated VMA ($G_{mb}$, AC, Combined $G_{sb}$)
  - Reduction in cost & time of doing mix designs & design verifications
  - Department focuses on as-produced (PFP, QCP, Hamburg, I-FIT)

# PG XX-28 for Overlays in D1 – D6

| Type of HMA Pavement | Layer | Illinois $N_{design}$ Number | Design ESALs[1] (million) | PG Binder Grade[2][3] Traffic Loading Rate | | |
|---|---|---|---|---|---|---|
| | | | | Standard[4] | Slow[5] or High ESALs[5] | Standing[7] |
| IL-4.75 | Surface[8] and Binder | 50 | ≤ 10 | SBS PG 70-22 | SBS PG 70-22 | SBS PG 70-22 |
| | | | > 10 | SBS PG 76-22 | SBS PG 76-22 | SBS PG 76-22 |
| SMA Overlay of PCC or Composite Pavement | Surface and Binder | 50 | ≤ 10 | SBS PG 76-22 | SBS PG 76-22 | SBS PG 76-22 |
| | | 80 | > 10 | SBS PG 76-22 | SBS PG 76-22 | SBS PG 76-22 |
| SMA for Full-Depth Pavement and Overlays of Full-Depth Pavement | Surface and Binder | 50 | ≤ 10 | SBS PG 76-28 | SBS PG 76-28 | SBS PG 76-28 |
| | | 80 | > 10 | SBS PG 76-28 | SBS PG 76-28 | SBS PG 76-28 |
| Overlay of PCC or Composite Pavement | Surface or Binder | 30 | ≤ 0.3 | PG 58-22 | PG 64-22 | PG 64-22 |
| | | 50 | > 0.3 to 3 | PG 64-22 | SBS PG 70-22 | SBS PG 76-22 |
| | | 70 | > 3 to 10 | PG 64-22 | SBS PG 70-22 | SBS PG 76-22 |
| | | 90 | > 10 | SBS PG 70-22 | SBS PG 70-22 | SBS PG 76-22 |
| ***Districts 1-6*** Full-Depth Pavement and Overlays of Full-Depth Pavement | Surface and Top Binder | All | All Levels | SBS PG 64-28[9] | SBS PG 70-28 | SBS PG 76-28 |
| | Lower Binder | All | All Levels | PG 64-22 | PG 64-22 | PG 64-22 |
| ***Districts 7-9*** Full-Depth Pavement and Overlays of Full-Depth Pavement | Surface and Top Binder | All | All Levels | PG 64-22[9] | SBS PG 70-22 | SBS PG 76-22 |
| | Lower Binder | All | All Levels | PG 64-22 | PG 64-22 | PG 64-22 |

# ABR Limits

**FRAP/RAS Maximum Asphalt Binder Replacement (ABR) Percentage**

| HMA Mixtures 1/, 2/ | FRAP/RAS Maximum ABR % | | | | | |
|---|---|---|---|---|---|---|
| Ndesign | Binder/Leveling Binder | | Surface | | Polymer Modified | |
| | w/o I-FIT | with I-FIT | w/o I-FIT | with I-FIT | w/o I-FIT | with I-FIT |
| 30 | 50 | 55 | 40 | 45 | 10 | 15 |
| 50 | 40 | 45 | 35 | 40 | 10 | 15 |
| 70 | 40 | 45 | 30 | 35 | 10 | 15 |
| 90 | 40 | 45 | 30 | 35 | 10 | 15 |
| SMA | - - | - - | - - | - - | 20 | 25 |
| IL-4.75 | - - | - - | - - | - - | 30 | 35 |

# Increase FI Thresholds for:

- SMA
- IL-4.75 for use as crack retarding binders

# Explore FI Moving Average Concept

- Add a Production Testing Frequency
- Moving Average ≥ 8.0
- Establish Control Limits for Individual
- Would prevent Shutdown on failing Individual
- Need to wait until 2021 to determine District Testing Capability

# I-FIT Implementation

- 2019: I-FIT on all Interstates
  - Additional projects as approved by Central Office
  - Spec include 5% higher ABR for I-FIT projects
- 2020: I-FIT on all HMA projects
  - LTA protocol on all surface mixes
  - Perpetual Mix Design & New FI Thresholds for SMA & Crack Retarding IL-4.75 binders
  - Begin allowing Modified Asphalt Binders

# Asphalt Binder Performance Test

# ICT R27-196HS

## Rheology/Chemical Based Procedure to Evaluate Additives/Modifiers used in Asphalt Binders for Performance Enhancements (Phase 2)

# Research Objective

Develop advanced screening protocol w/ long-term aging & rheological/chemical characterization methods for modified binders.

- Evaluate the effect of modifiers on binder chemistry & performance
- Develop an efficient long term aging procedure for modified binders
- Validate & fine-tune preliminary thresholds

# Identify and Collect Modifiers

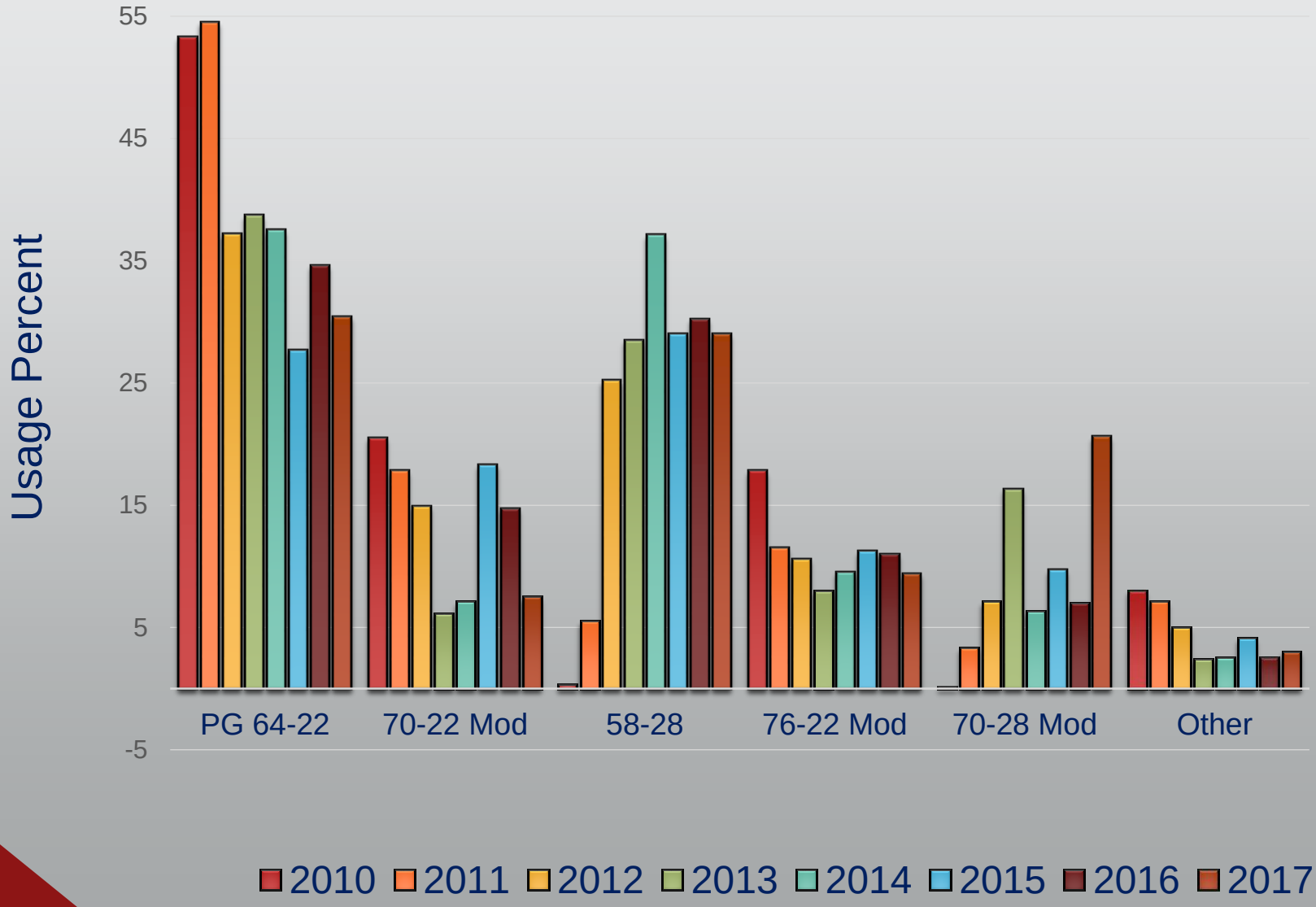
- Working w/ Industry to identify & collect Modifiers & Additives available in IL
  - Up to 10 Modifiers/Additives Considered
  - Samples of Modifiers & Additives will be Characterized
- Asphalt Binders to be Collected & Tested
  - 64-22’s (Base Binders), 58-28, 52-34, 46-34
- Formulas, Mix Ratios & Blending Requirements Provided by Suppliers

# Field Core Selection

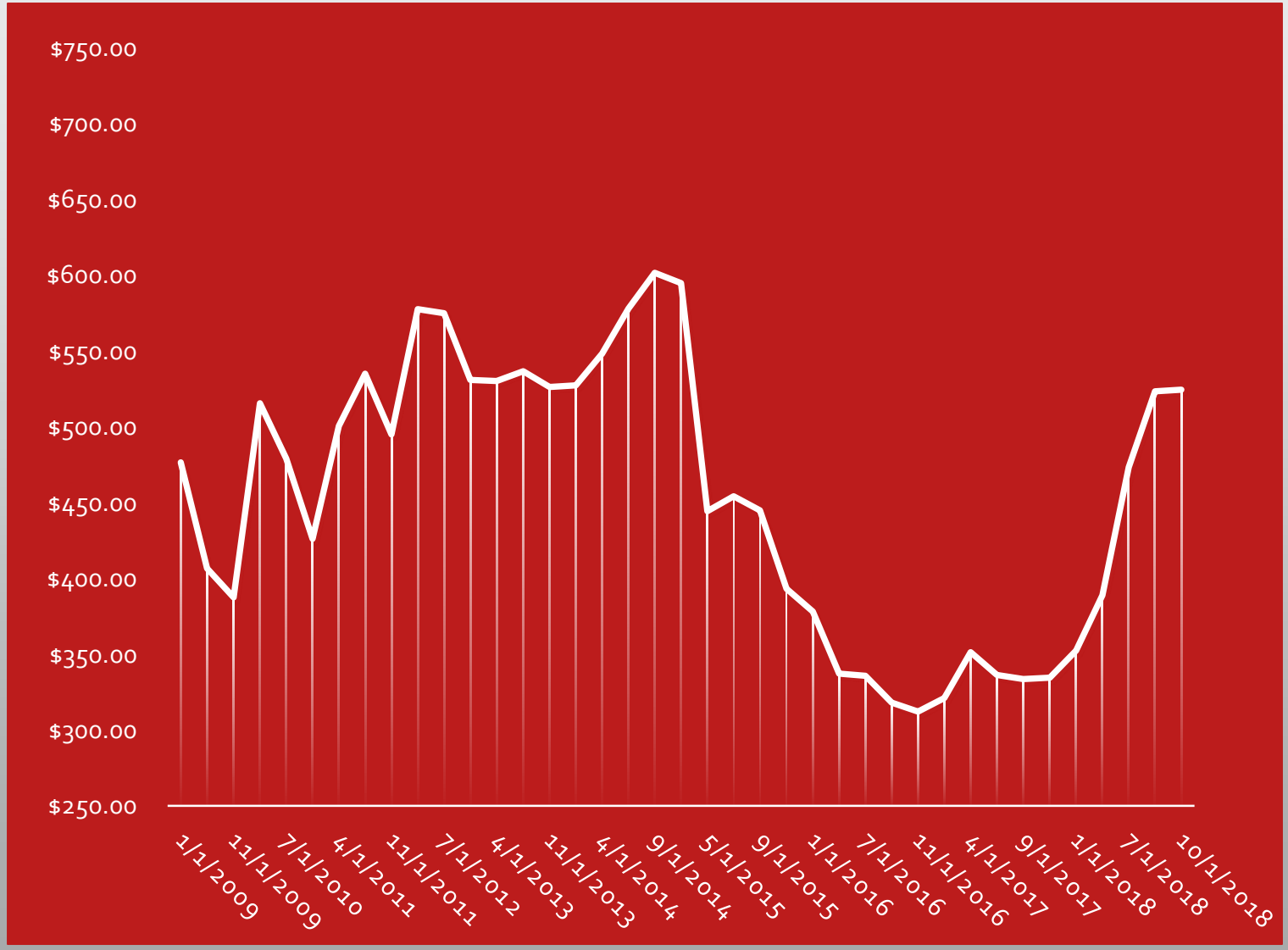
- Objective of collecting cores is to determine impact of long-term binder aging & set baseline for developing LTA protocol
- Cores should represent typical surface mixtures used in the region
  - Avoid mixtures with RAP > 20% & RAS
  - Avoid poor performers
- Working w/ Tollway & Districts to identify field core locations & send cores & construction history to ICT

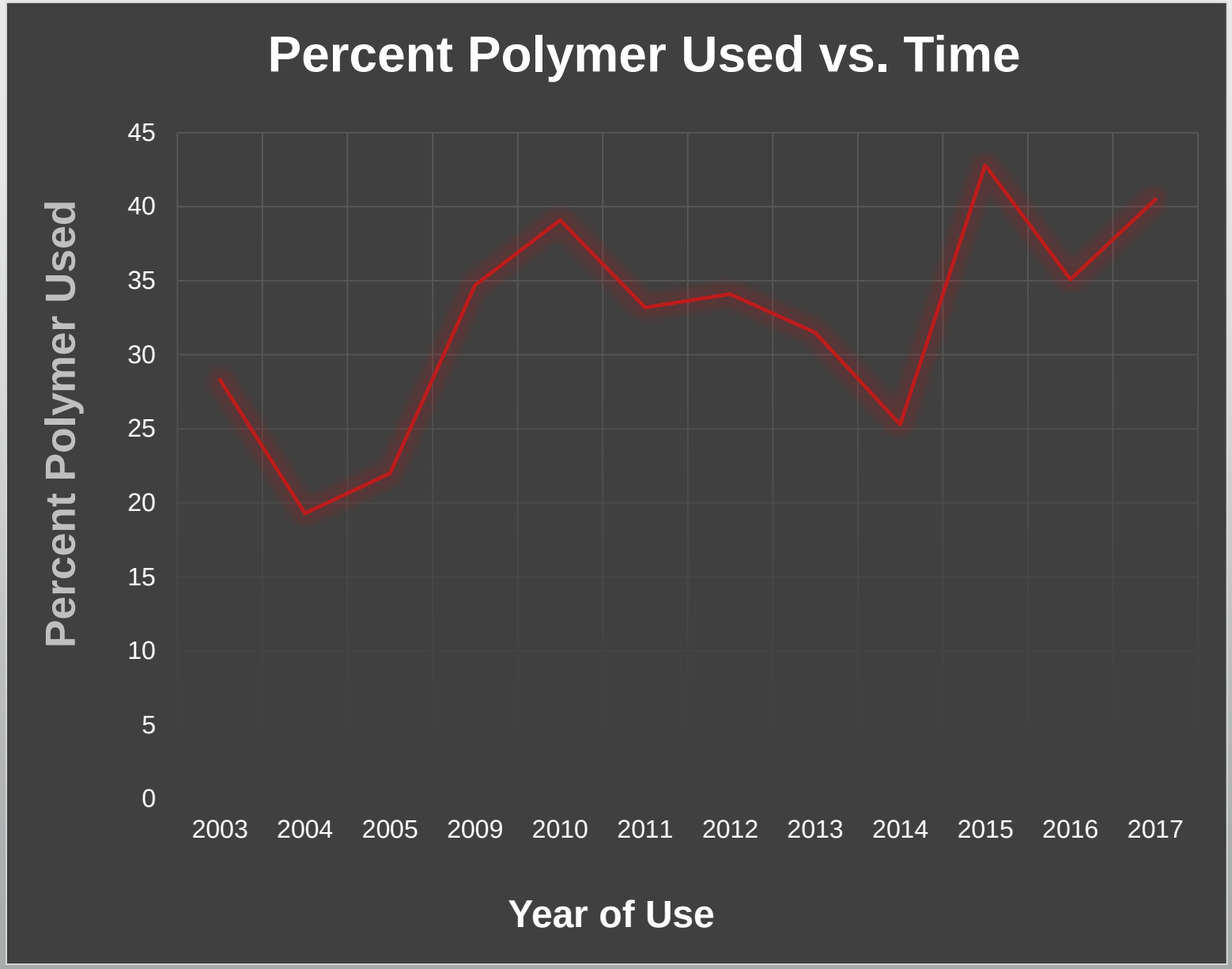
# PG Binder Usage

# 2010 to 2017 Grade Usage



# Bituminous Price Index




Percent Polymer Used vs. Time
Percent Polymer Used
45
40
35
30
25
20
15
10
5
0
2003
2004
2005
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year of Use

# AASHTO Proficiency Sample Program (PSP)

# Disputing Individual Test Results

- PFP Spec Rev. to allow Method 2 Dispute Resolution Provided:
  - Contractor Lab participates in AASHTO PSP & Scores Rating ≥ 3
  - Adjusted Split Sample exceed Precision Limits
- Requires all District QA Labs also participate in AASHTO PSP

# AASHTO re:source Proficiency Sample Program (PSP)

- Intent:
  - Allow Contractors to dispute individual parameters in PFP
  - Compare individual labs results with large pool of results
  - Verify testing apparatus and operator under actual testing conditions
  - Opportunity to identify and correct problems
  - Allow Illinois to align results w/ the rest of the Country
- AASHTO provides results rating sheet
  - Good Rating = 3, 4, or 5, Low Rating = 2 or less

# PSP Observations:

- All private & State labs received good scores on Gyratory Bulk Gravities ($G_{mb}$)
- Some labs on both sides had some issues w/ Max Gravities ($G_{mm}$) that warraned investigation, corrective action & retesting
- Illinois as a whole was light on the Gyratory Bulk Gravities ($G_{mb}$)

# Hot-Applied Tack Coats w/ Wax

# New Tack Coat Products

- 6 New Tack Product to Expedite Paving were evaluated through ICT Research
  - 4 Hot Applied Asphalt Binders w/ wax
  - 2 Quick Set Emulsions
- Evaluate Bond Strength of New Products
  - Bond Strength ≥ SS-1h
    - Lab Shear Test using ATREL Device Lab Specimens
- Products were found perform comparable to SS-1h

# Hot-Applied Asphalt Tack Coat w/ Wax

- Work with Industry to develop a material specification
- Chemical Test Unit will evaluate and characterize the materials
- Develop an Experimental Feature Workplan
- Solicit Districts for projects in 2019

# Intelligent Compaction

- Field Project
  - Veteran's Parkway in Bloomington, IL
- Lessons Learned
  - Need IC Temperature and Location Verification each day of paving
  - Need new Manual of Test Procedures IC Document
  - Need Equipment Accuracy Table in QCP Special Provision
  - Need to Update Minimum Untrimmed Percent Coverage

# Questions

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