

# Workability of Pavement Concrete for Successful Construction

Monday, March 28, 2022



## *Field Evaluation of the Tarantula Curve and the Box Test*

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# Disclaimers



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- **FHWA is the source of all images in this presentation unless otherwise noted.**

# FHWA Mobile Concrete Technology Center (MCTC)

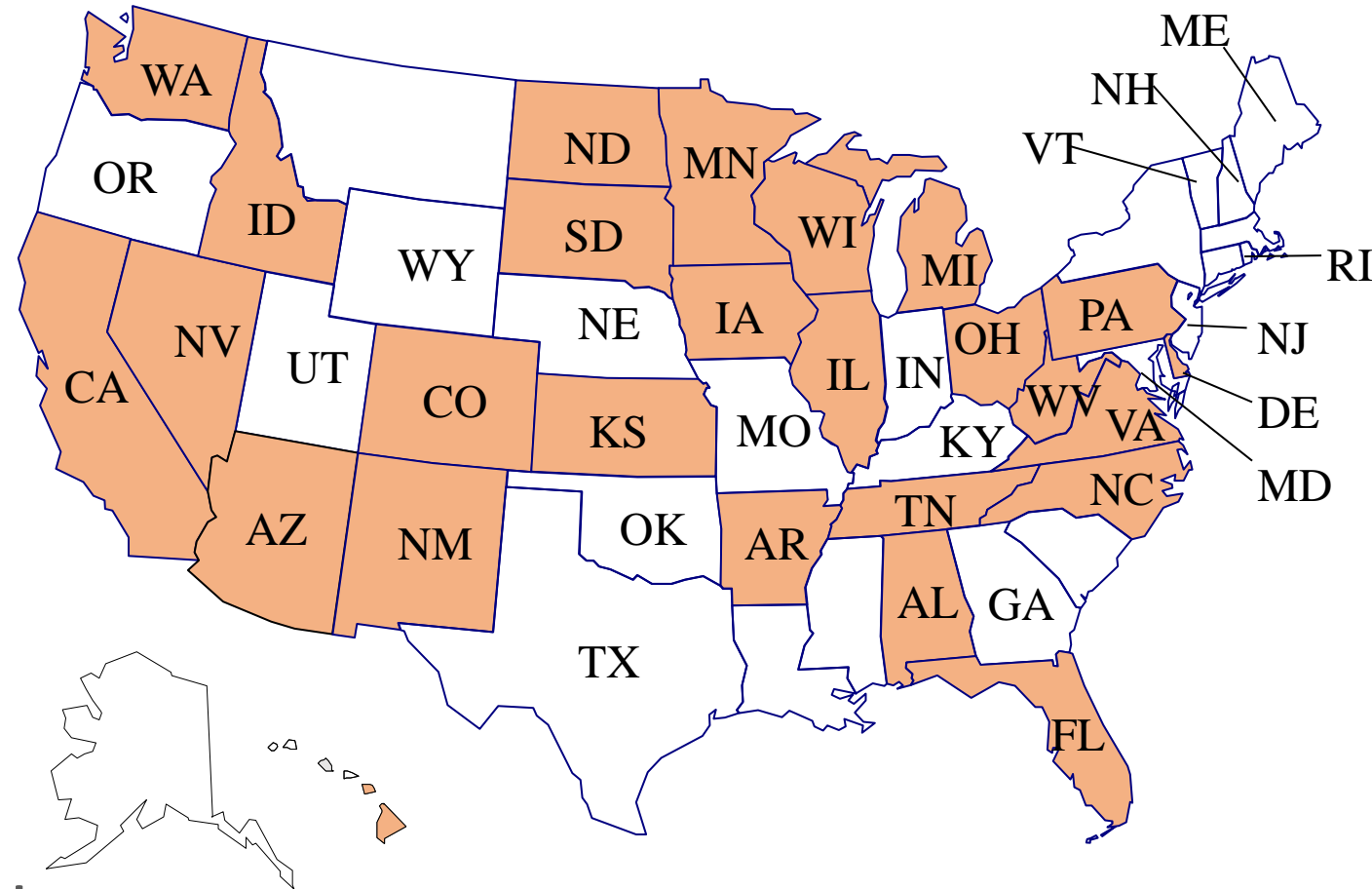
## ➤ Technology Transfer to SHA's

- Field demos on active projects
- Equipment loan
- Training of staff
- Conferences and workshops
- Specification review and technical assistance



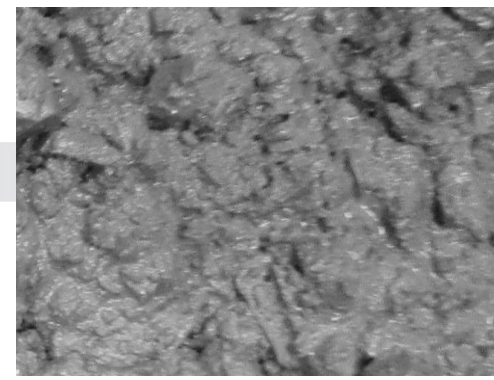
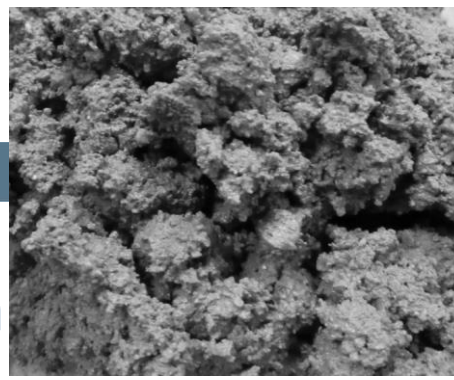
# FHWA Data Collection Efforts

- Data from 2011-2019
- 24 States (30 project mixes)
- Only Mainline Paving projects
- Workability Analysis
  - Combined Aggregate Gradation
    - Tarantula Curve – 2011
    - Box Test – 2015-2019
    - Finish in the Field – 2015 - 2019
- Objectives
  - Where do current gradations fall?
  - Is there a correlation between Tarantula, Box Test and field observations?



# Tarantula Curve

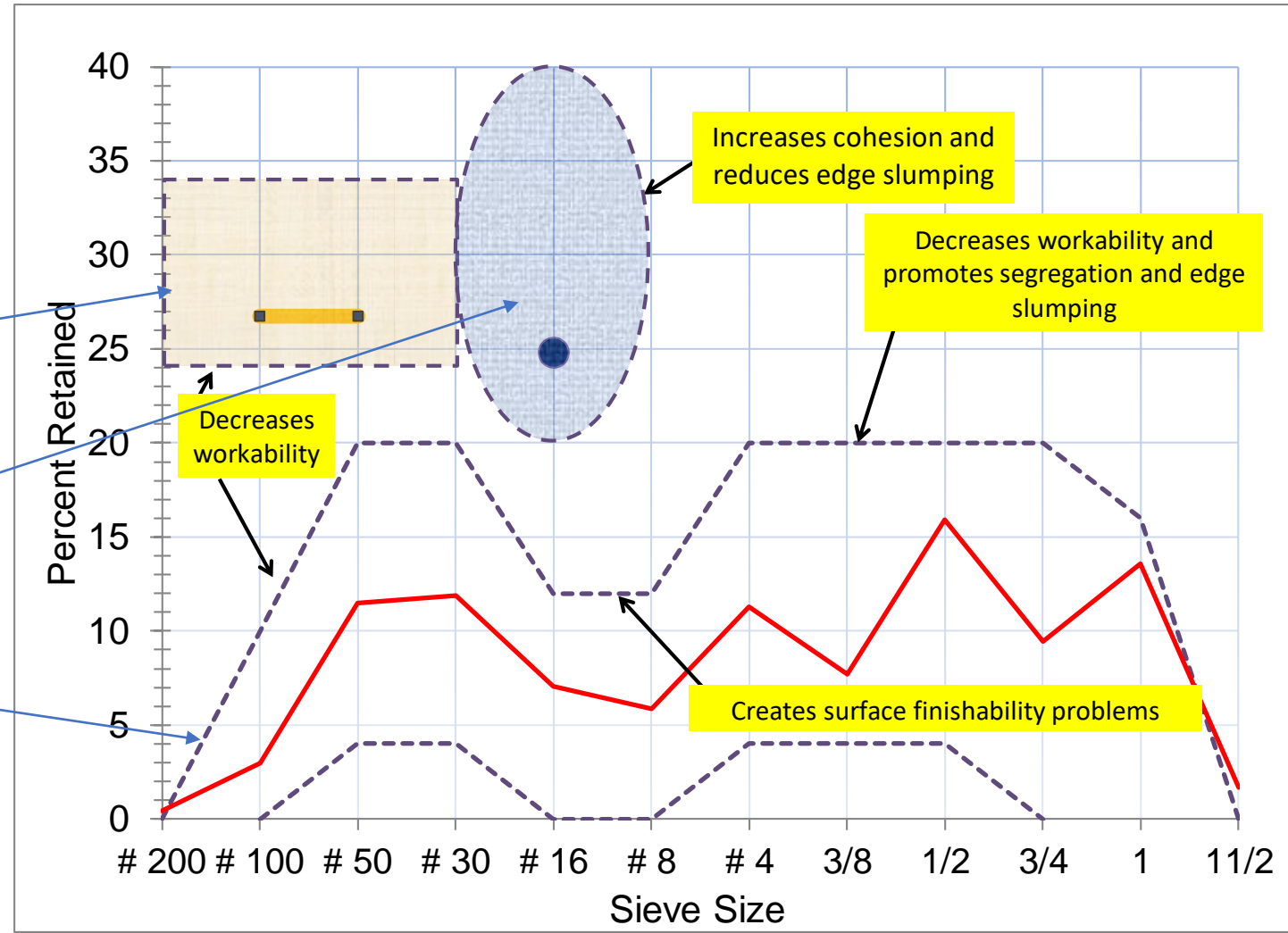
## ➤ Combined Aggregate Gradation



**Criterion 3**

**Criterion 2**

**Criterion 1**

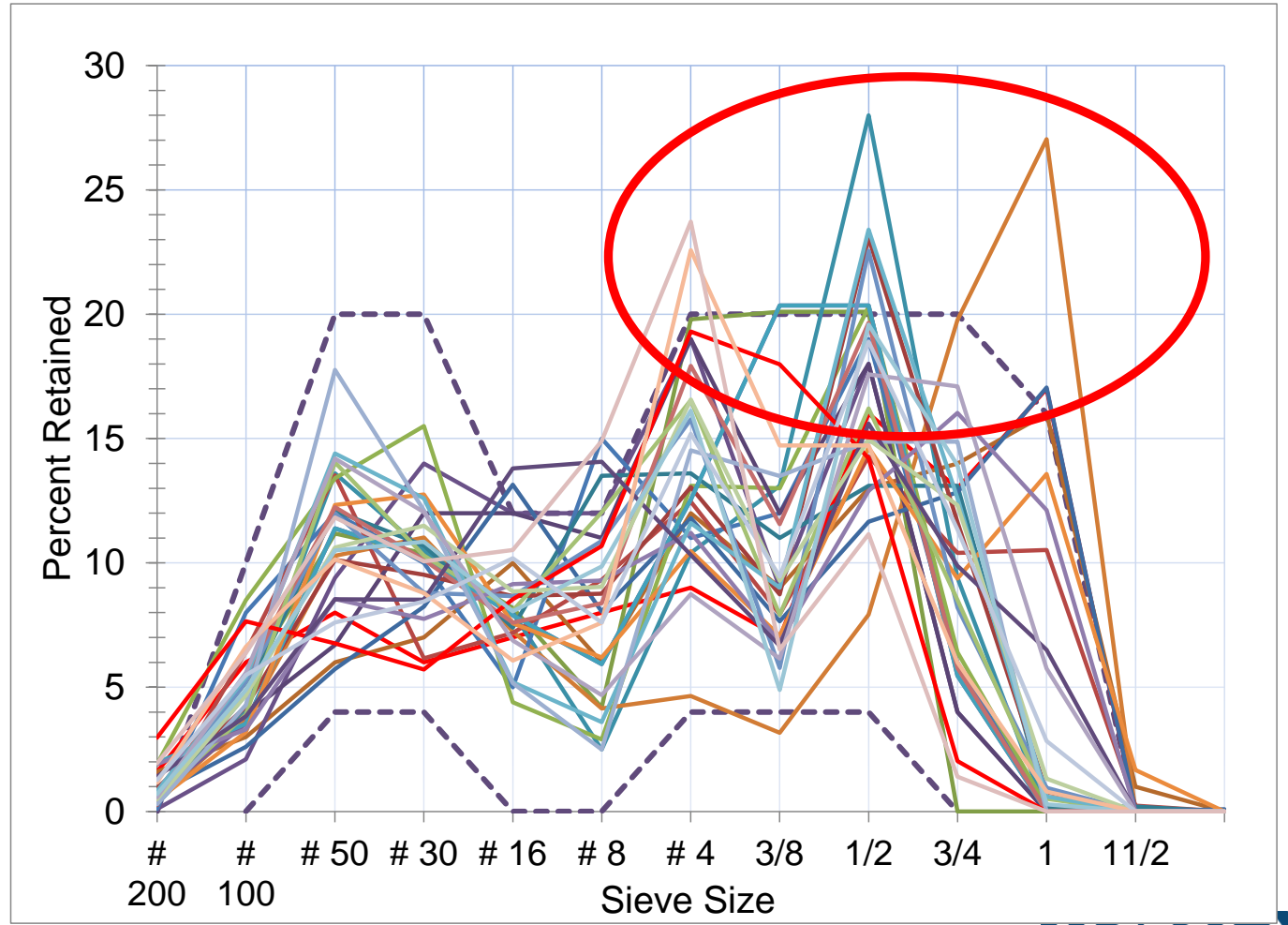


# Tarantula Curve

## ➤ 30 Mixtures

### Tarantula Curve: Criterion 1

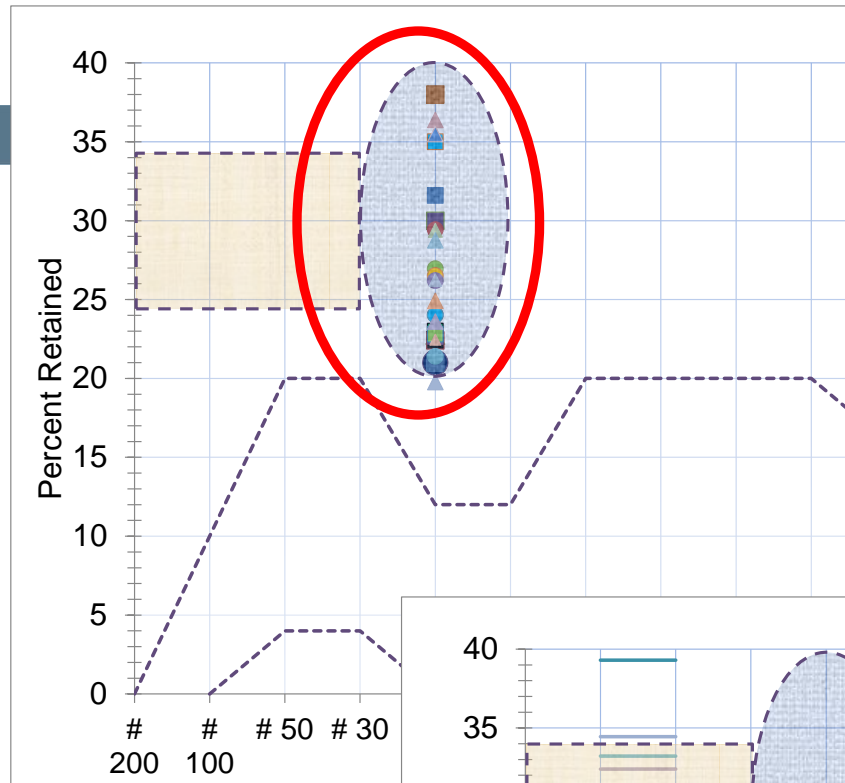
Tarantula Curve	Met	Did not Meet
Criterion 1	21	9



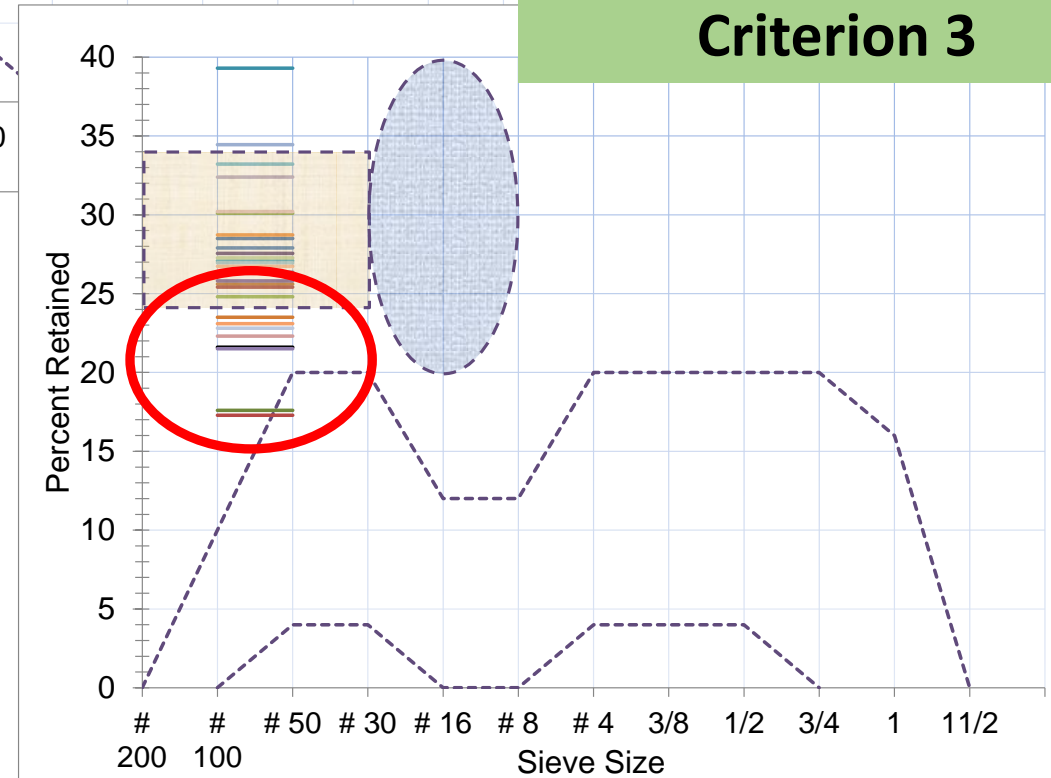
# Tarantula Curve

➤ 30 Mixtures

**Tarantula Curve:  
Criterion 2**



**Tarantula Curve:  
Criterion 3**

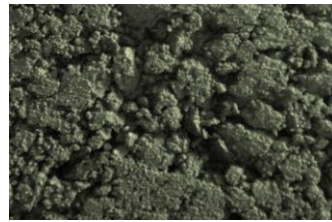


Tarantula Curve	Met	Did not Meet
Criterion 2	29	1
Criterion 3	20	10

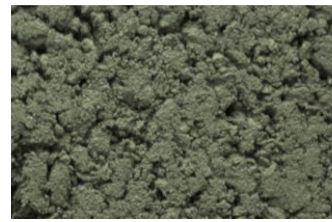
# Box Test

## ➤ Indicators

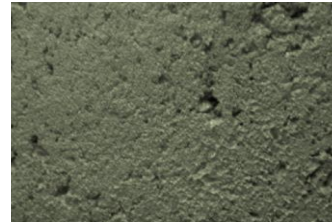
- Consolidation Ranking
- Edge Slump Potential



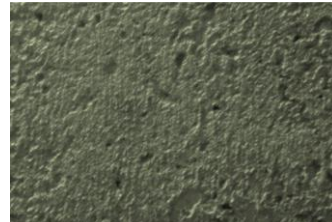
4



3



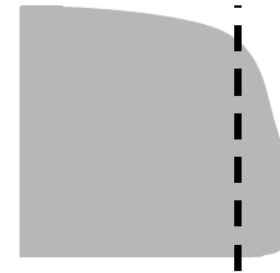
2



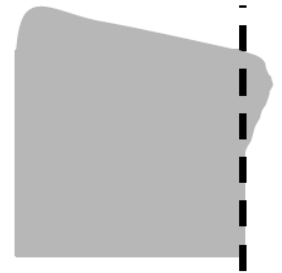
1

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Consolidation Issues



Bottom Edge  
Slumping



Top Edge  
Slumping

If deflection is more than 1/4" then it fails

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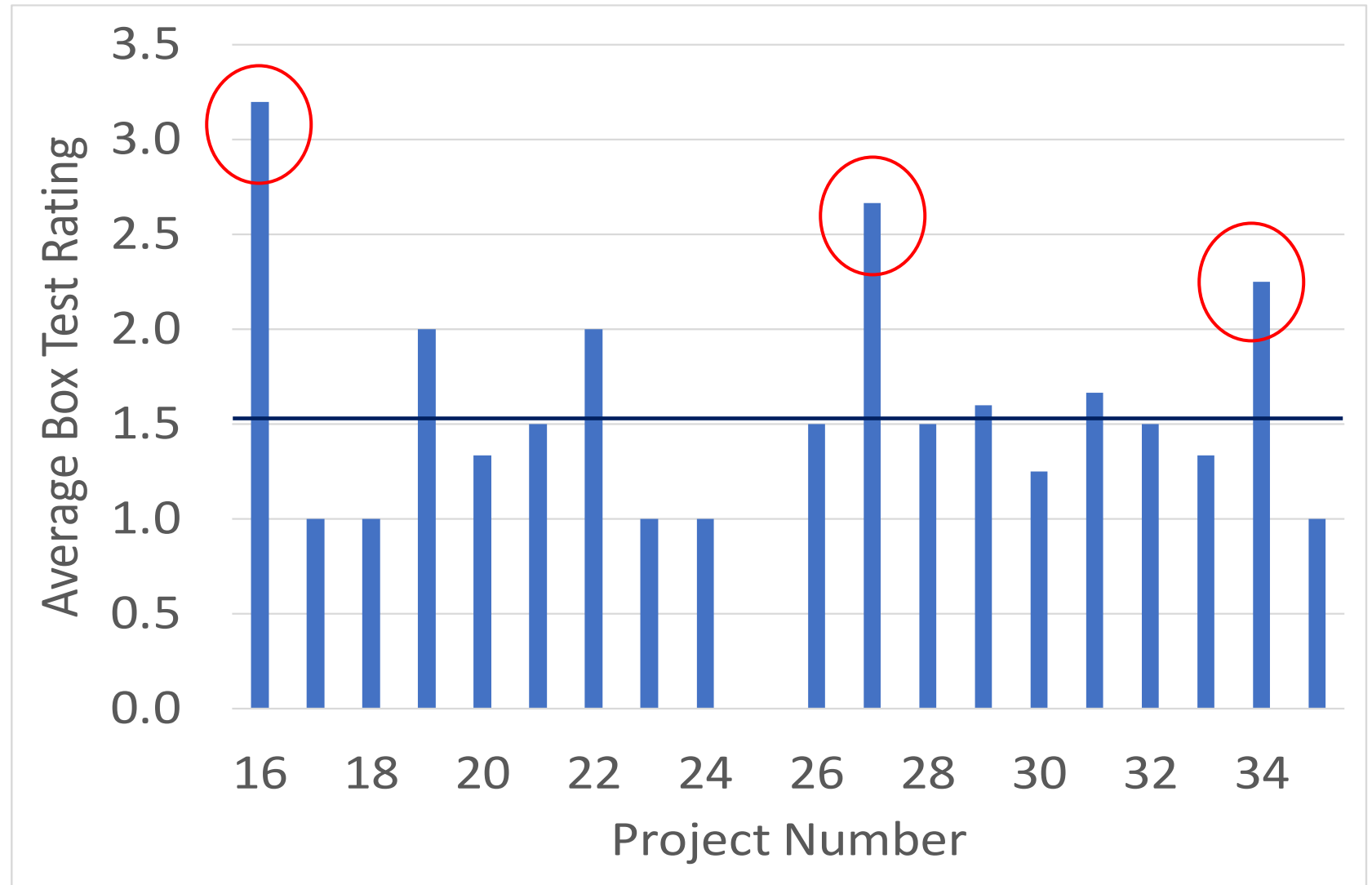
Edge Slump Issues



# Box Test Results

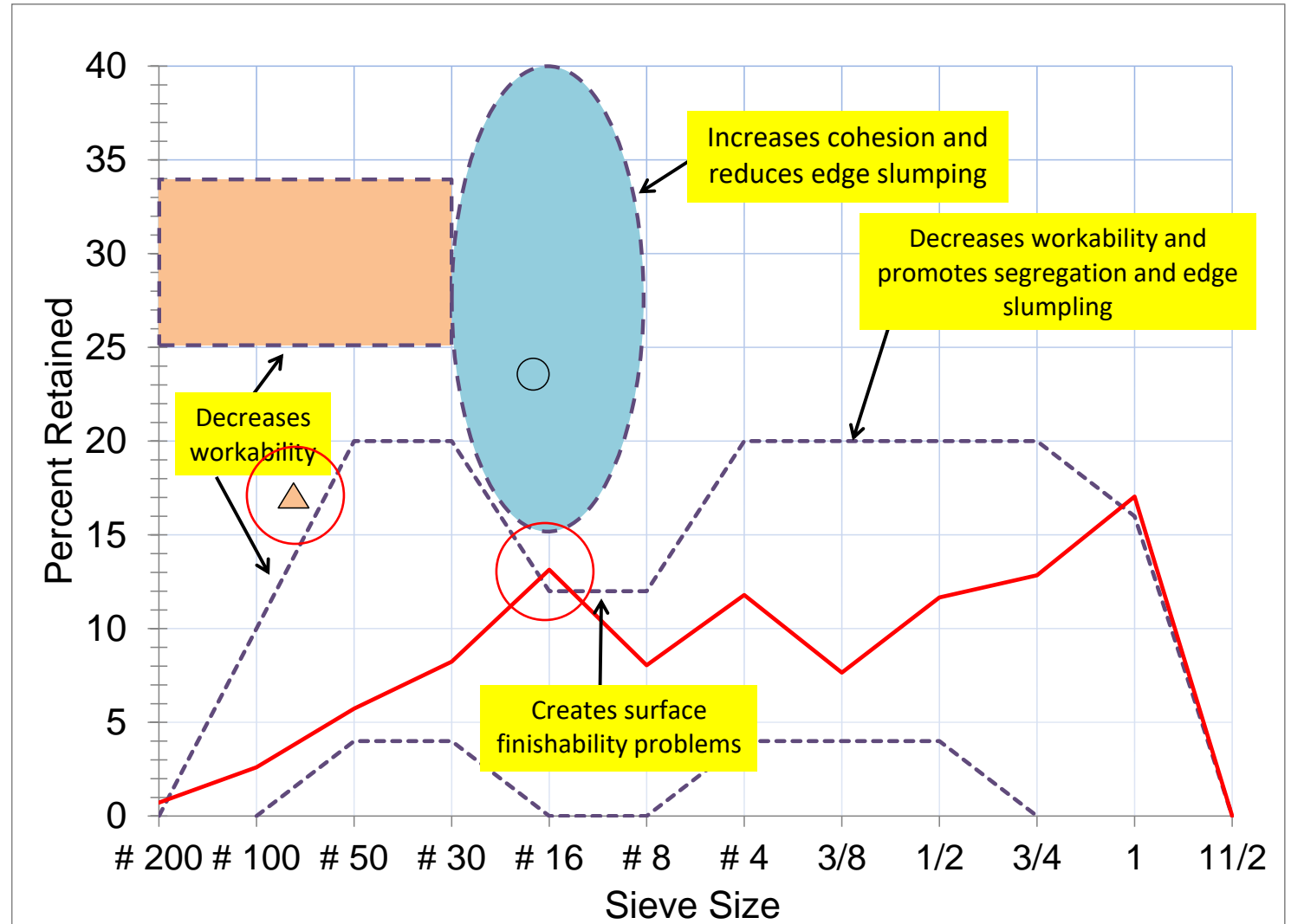
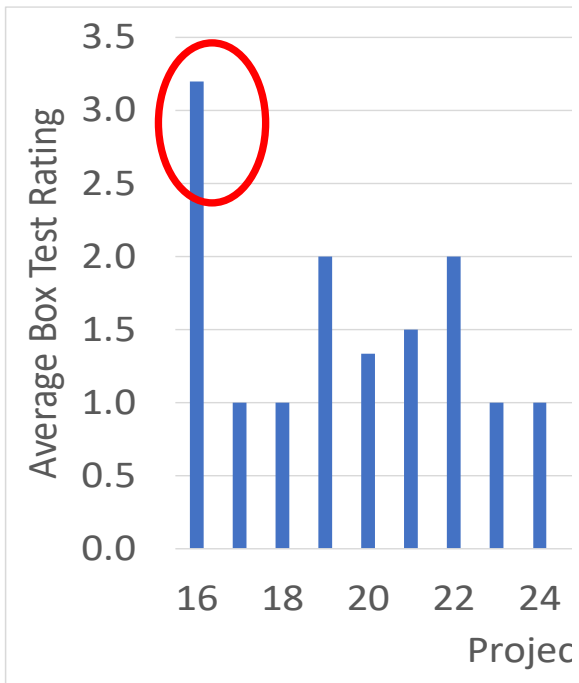
- Consolidation Ranking from Box Test
- Box Test Ranking from 19 Projects

Box Test Ranking Over 1.5	7 out of 19 projects
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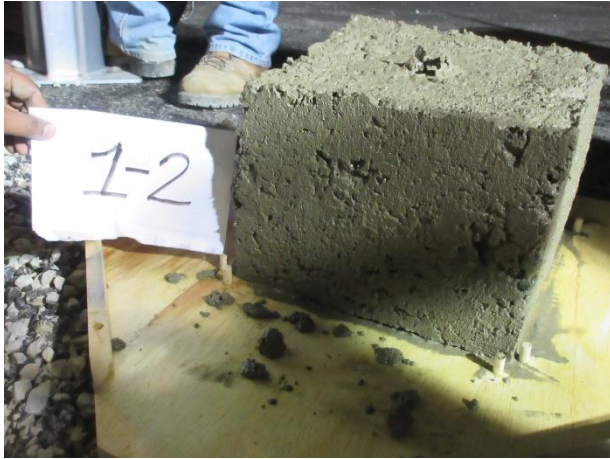
# Tarantula Curve

## Project 16



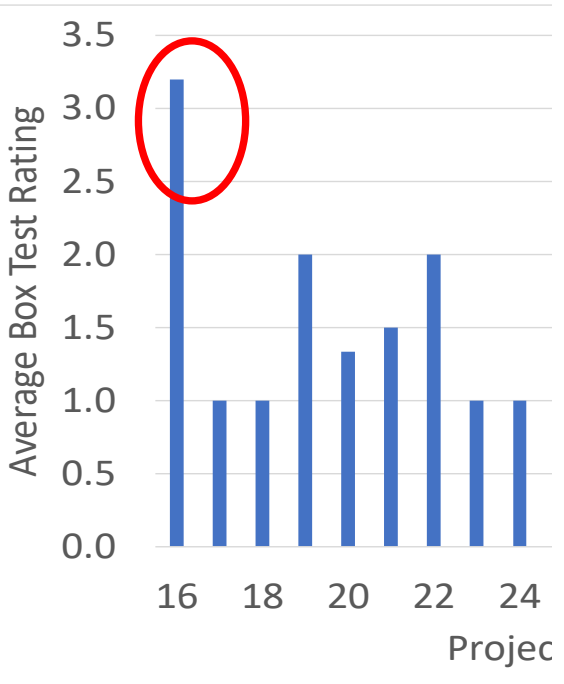
# Box Test Results

## ➤ Project 16



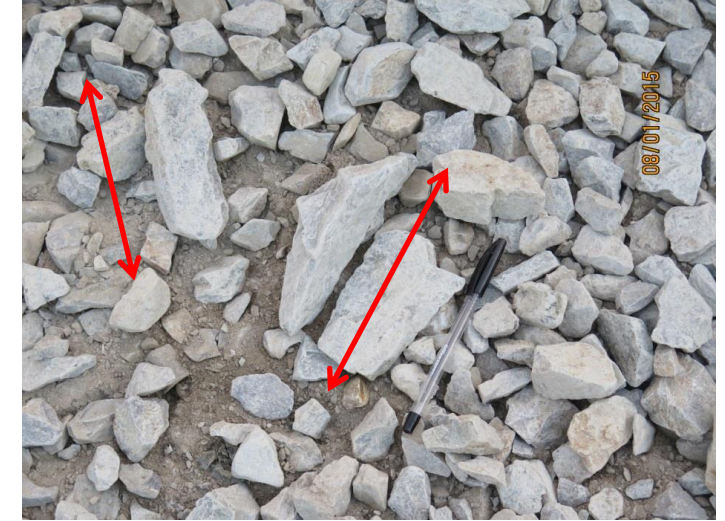
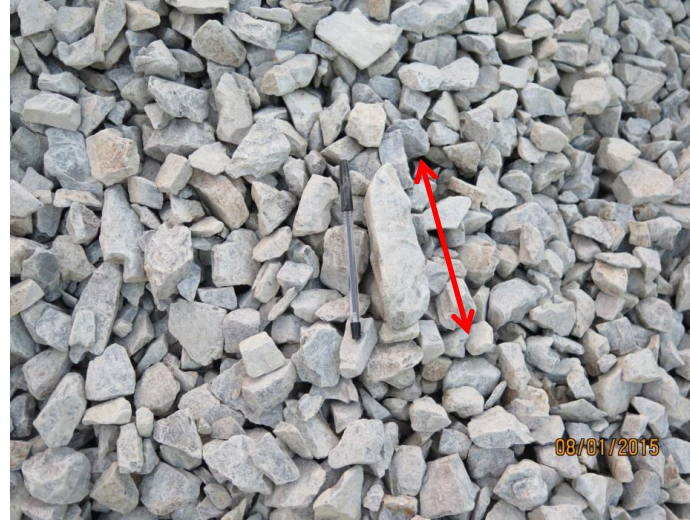
# Field Performance

## ➤ Project 16



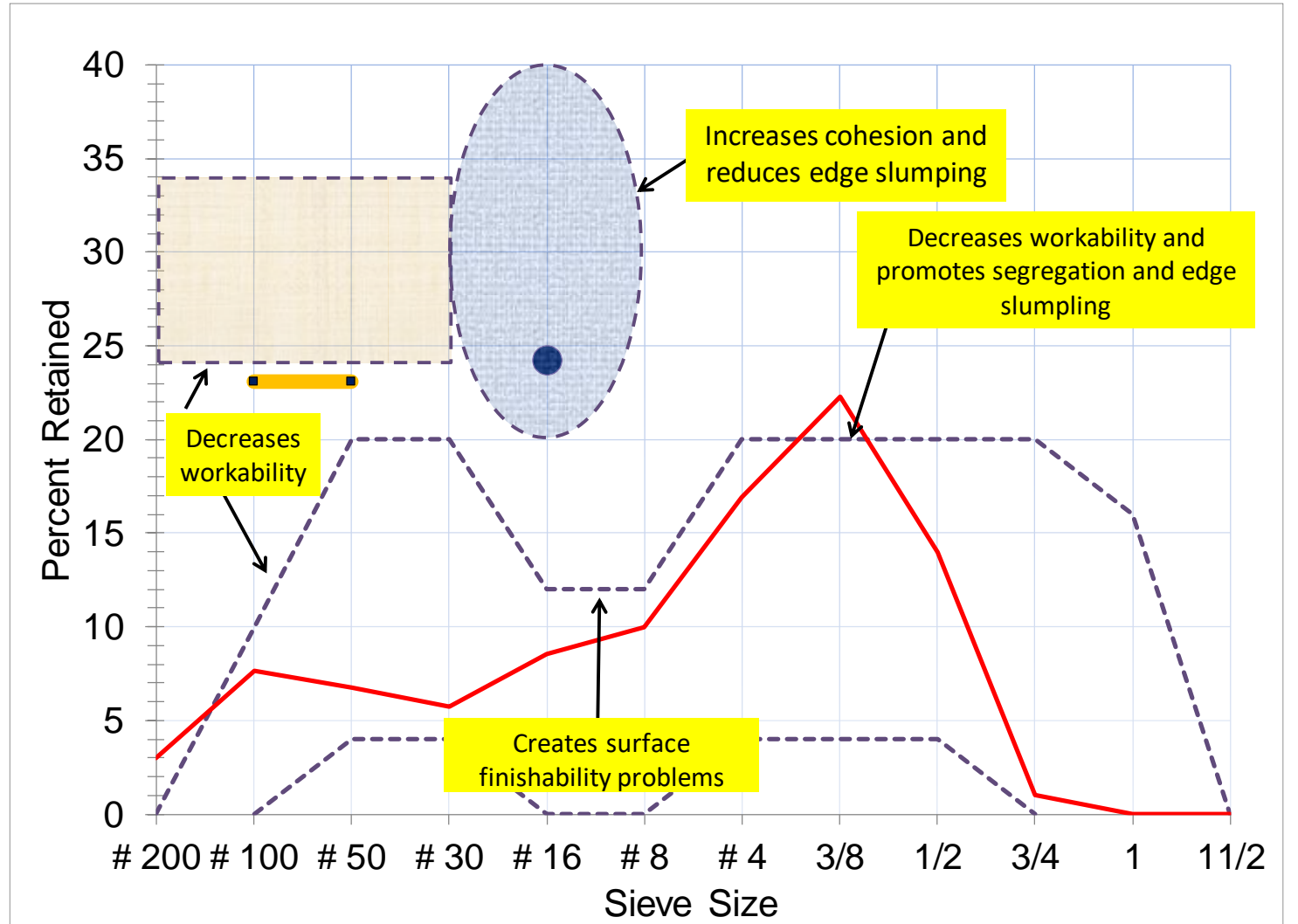
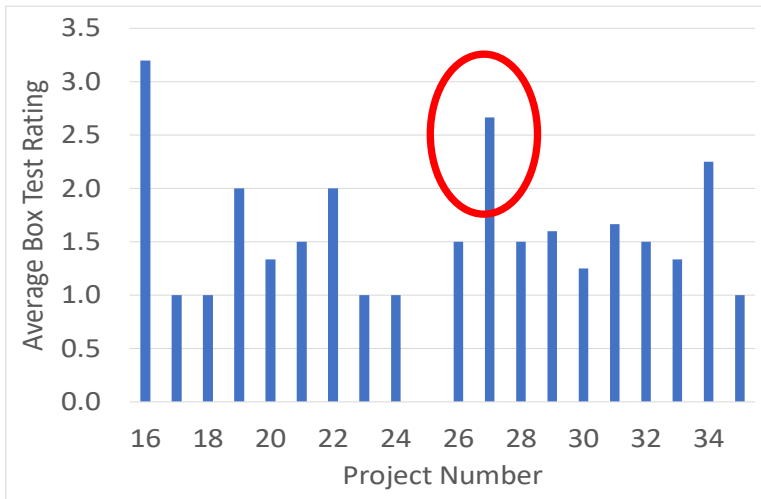
# Project 16

- **Two Coarse and two fine aggregates**
  - Flat and Elongated (Coarse)
  - Coarse Fine Aggregates



# Tarantula Curve

## Project 27



# Box Test Results

## ➤ Project 27



# Field Performance

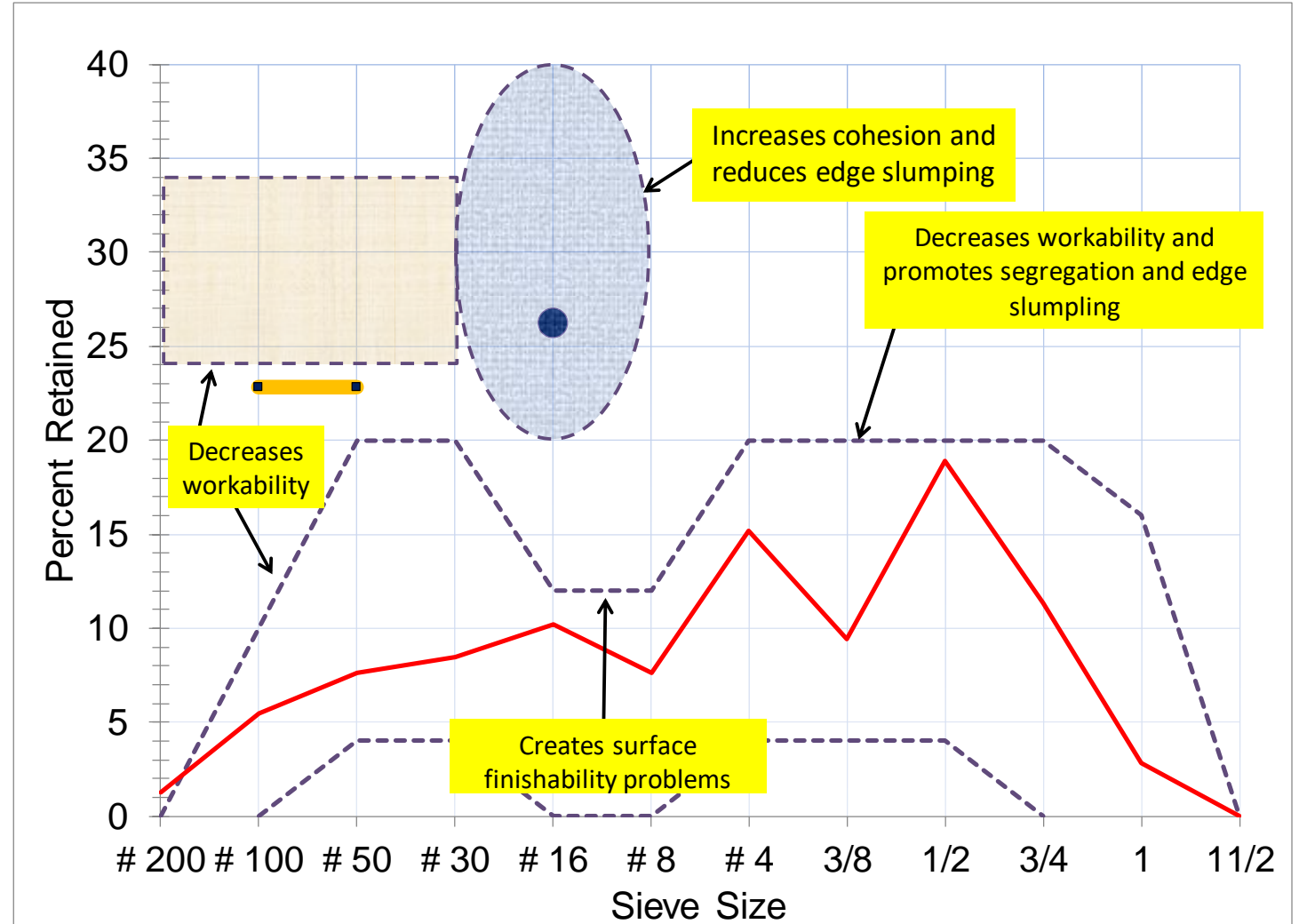
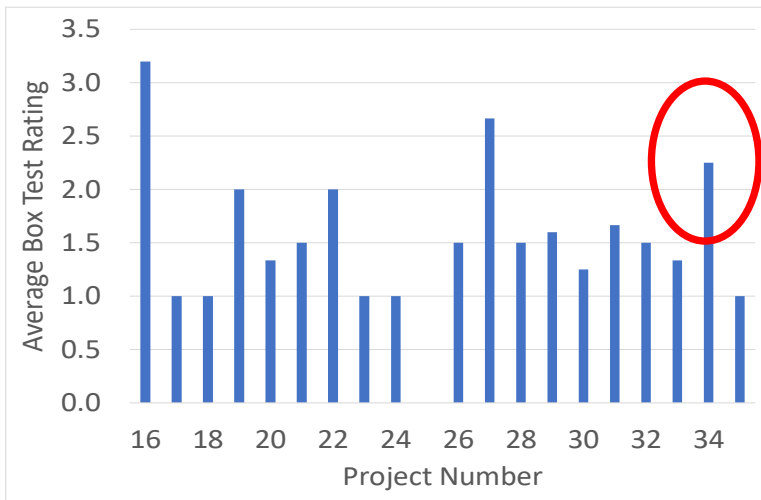
## ➤ Project 27





# Tarantula Curve

## Project 34



# Box Test and Field Performance

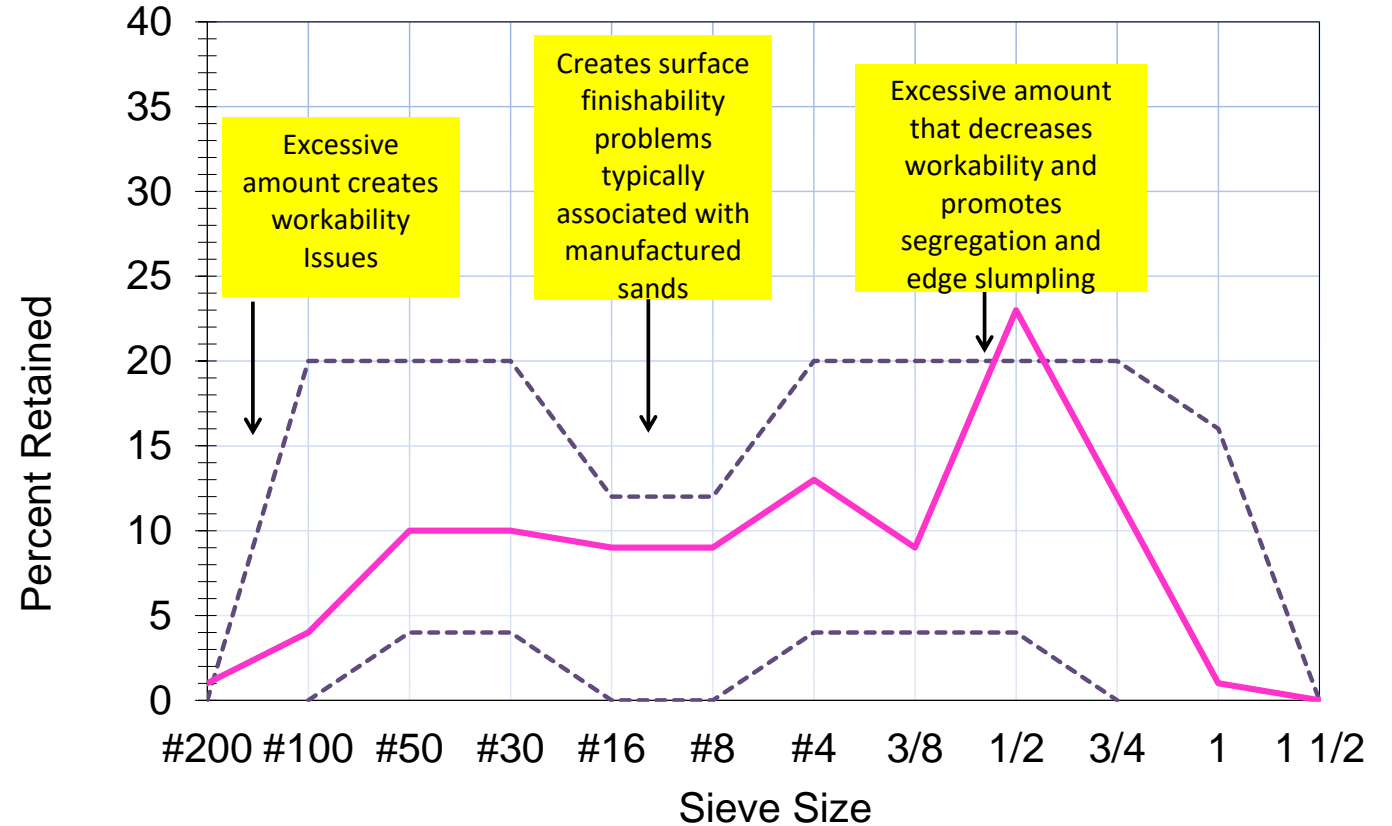
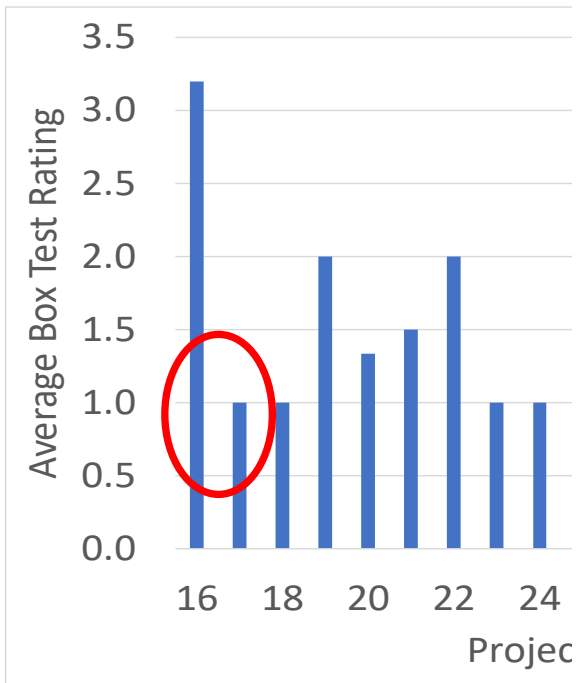
## ➤ Project 34



# Tarantula Curve

## ➤ Project 17

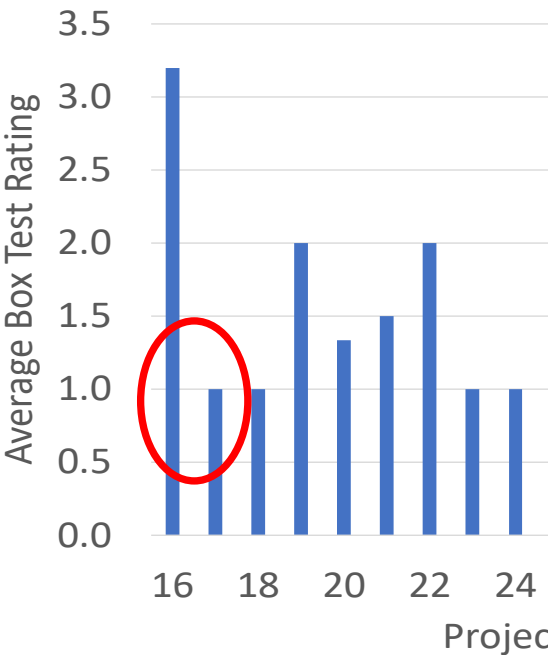
## ➤ Edge Slump Issue



# Box Test Results and Field Performance

## ➤ Project 17

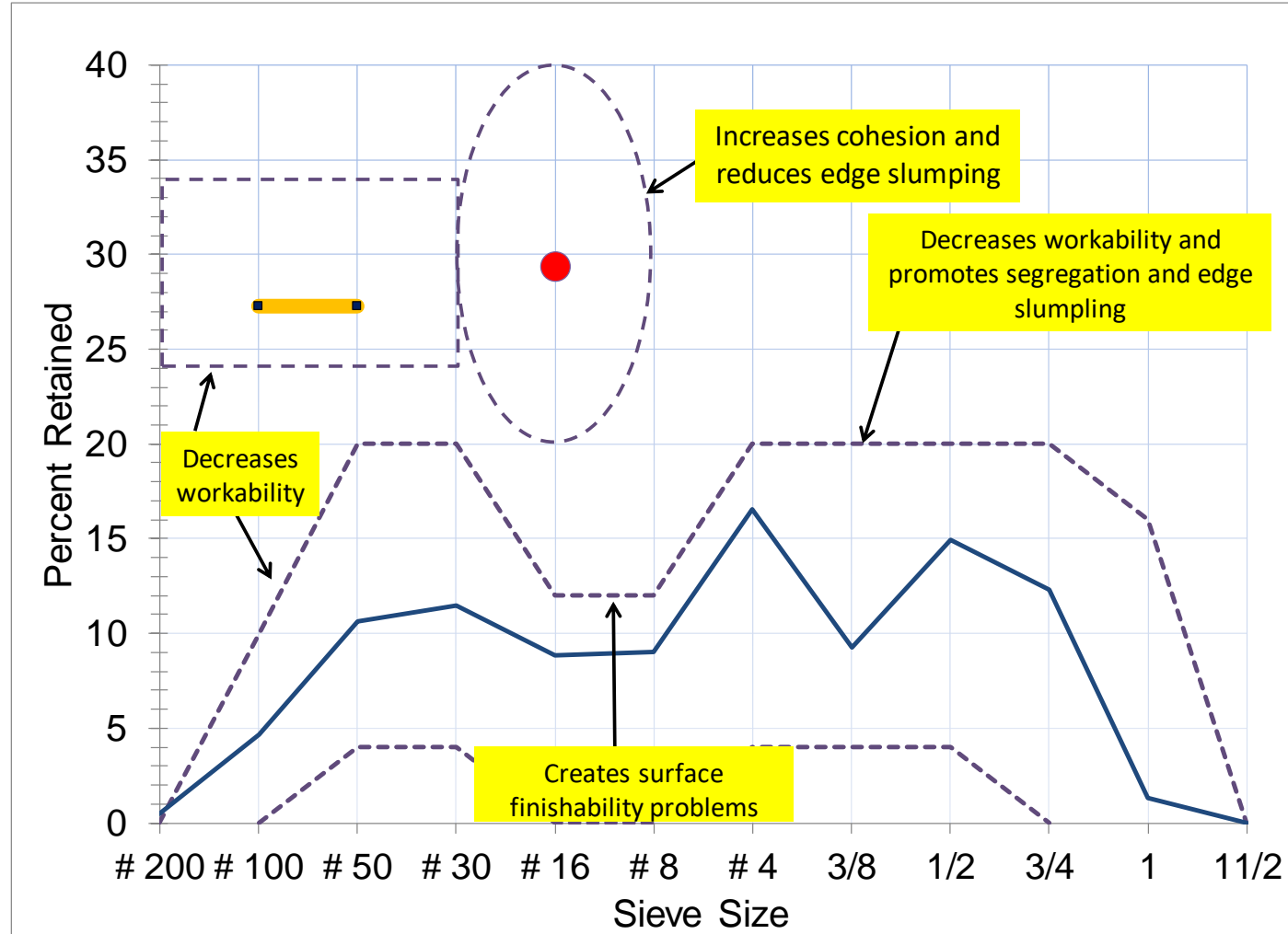
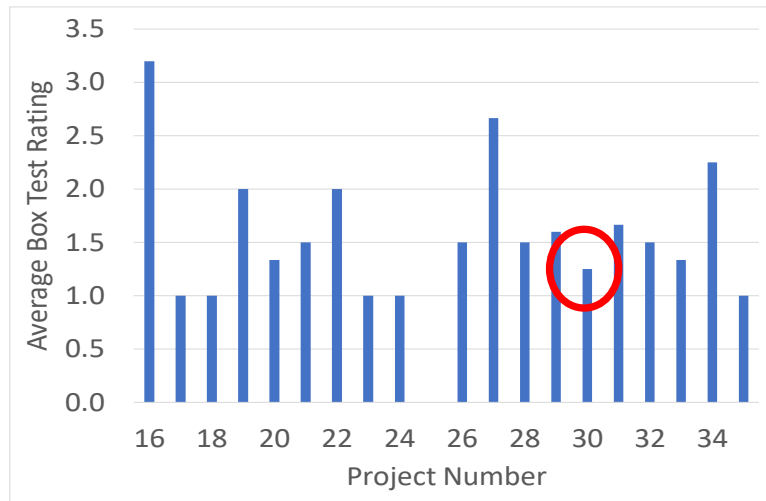
## ➤ Edge Slump



# Tarantula Curve

➤ Project 30

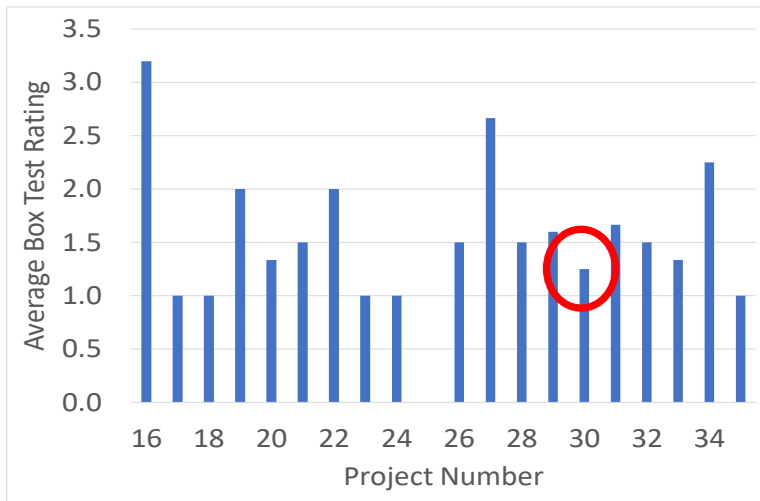
➤ Iowa



# Box Test Results

➤ Project 30

➤ Iowa



# Field Performance

➤ Project 30

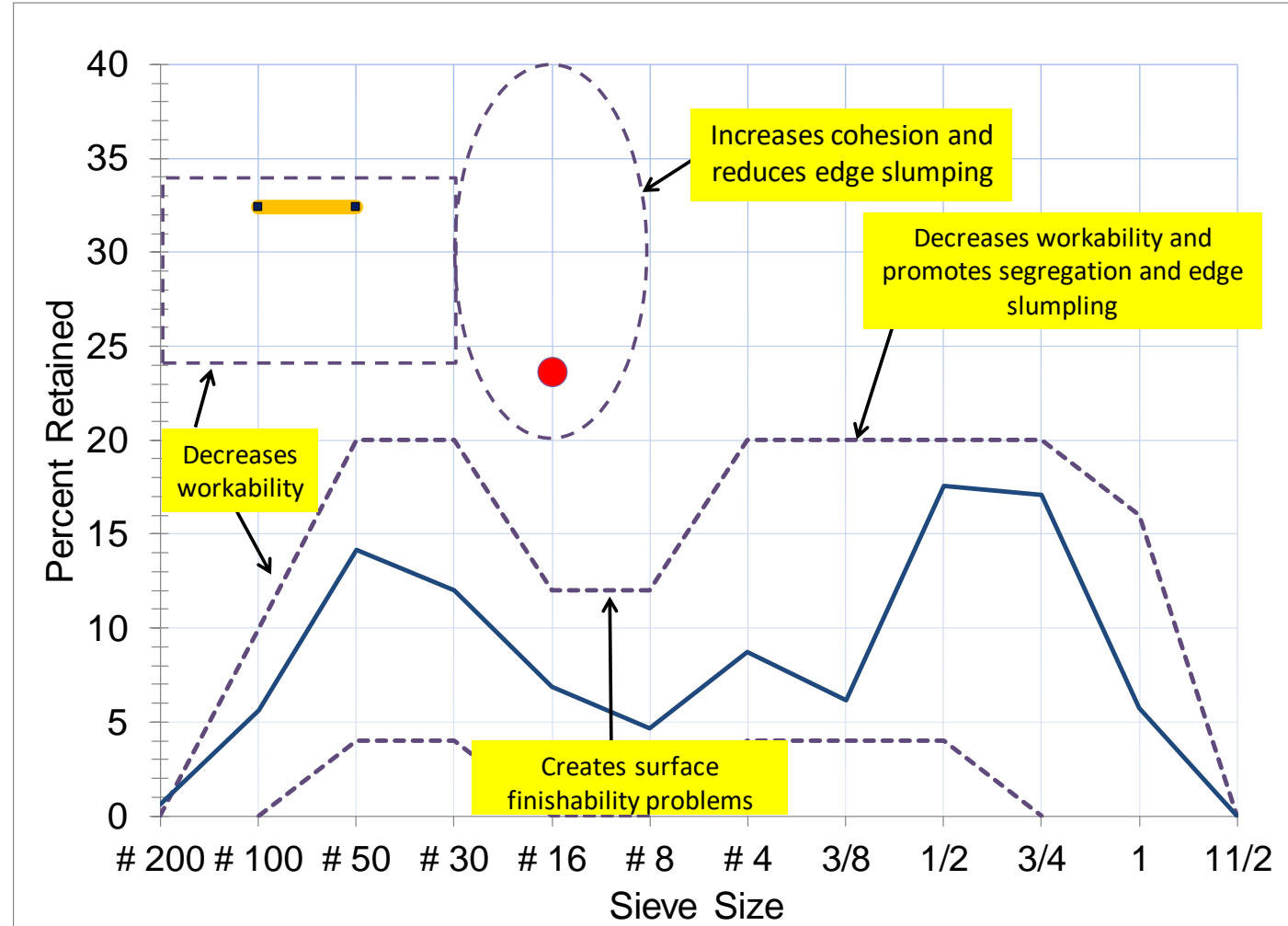
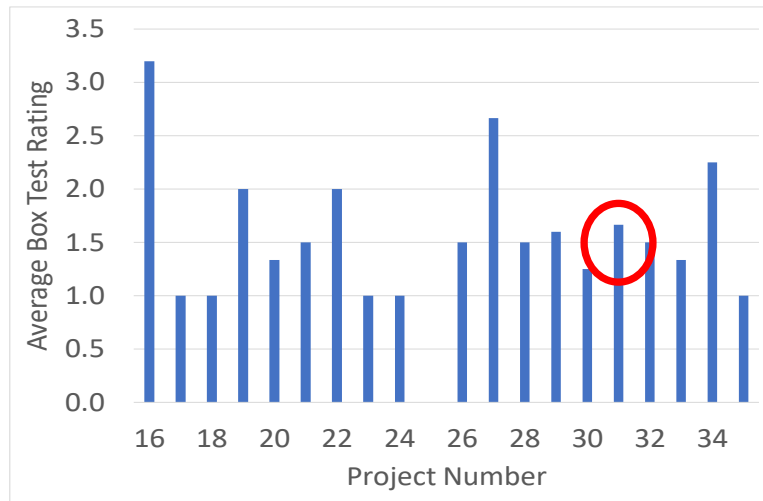
➤ Iowa



# Tarantula Curve

➤ Project 31

➤ Minnesota

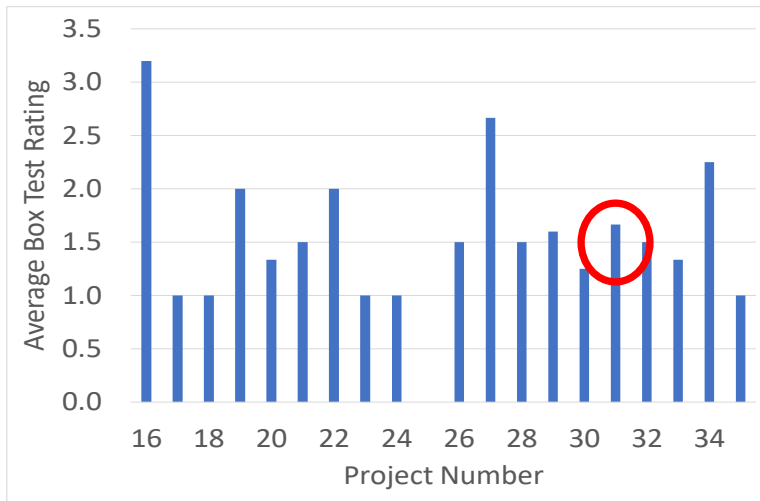




# Box Test Results

➤ Project 31

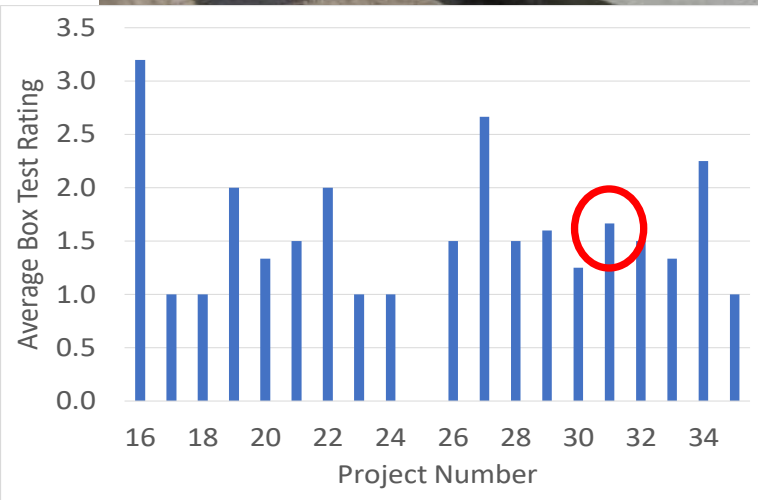
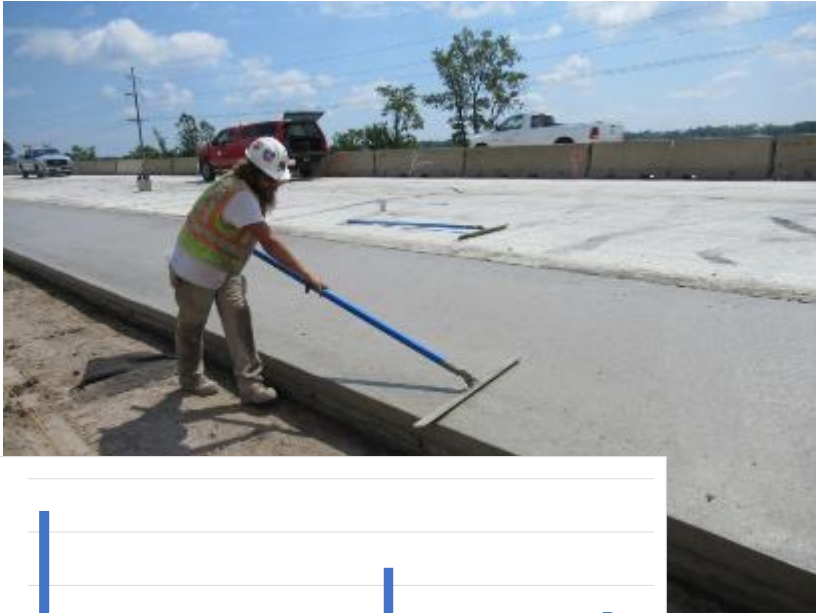
➤ Minnesota



# Field Performance

## ➤ Project 31

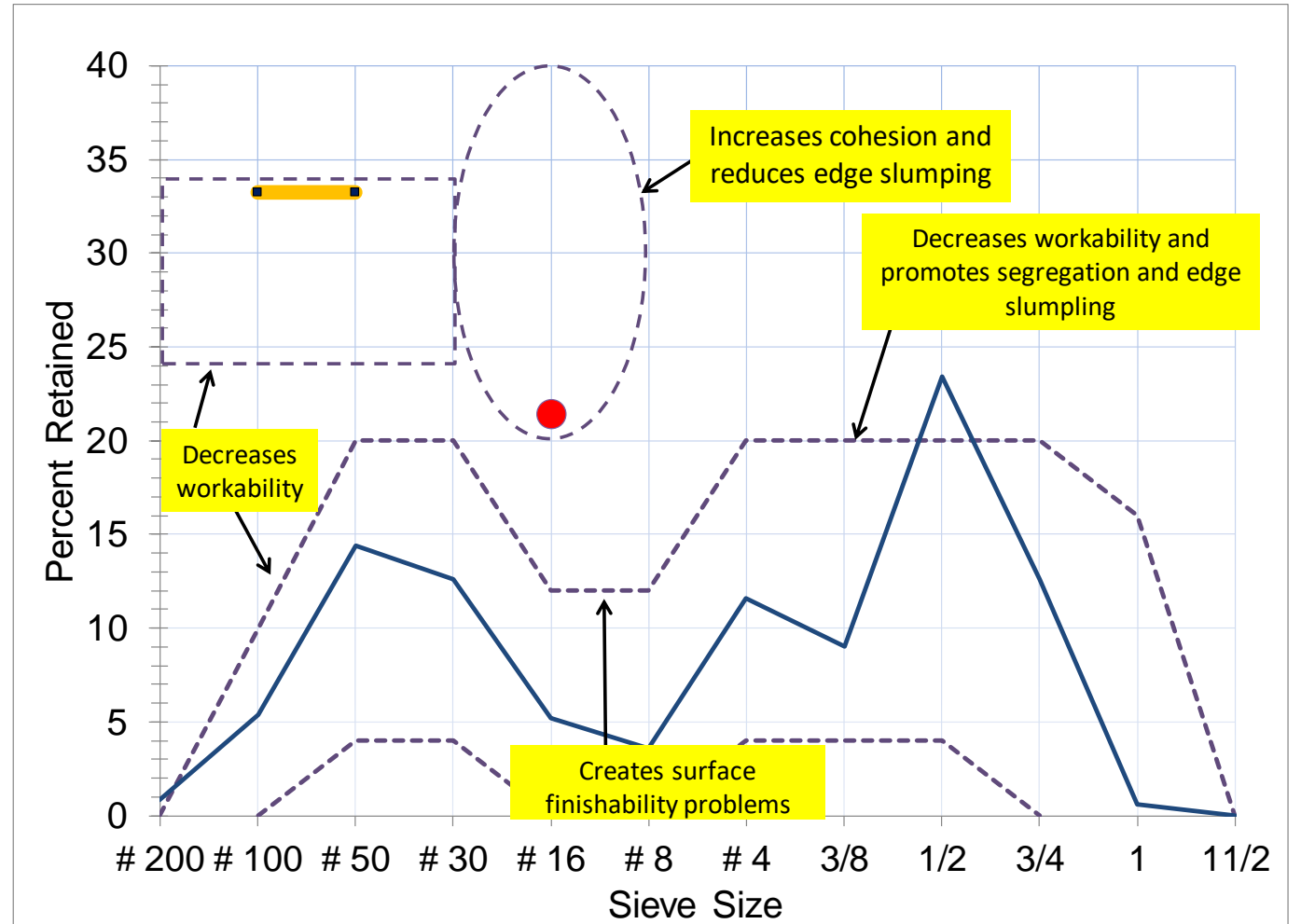
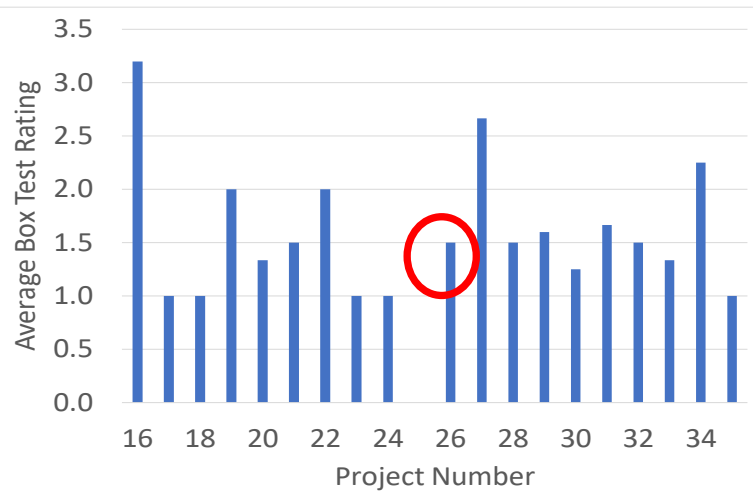
## ➤ Minnesota



# Tarantula Curve

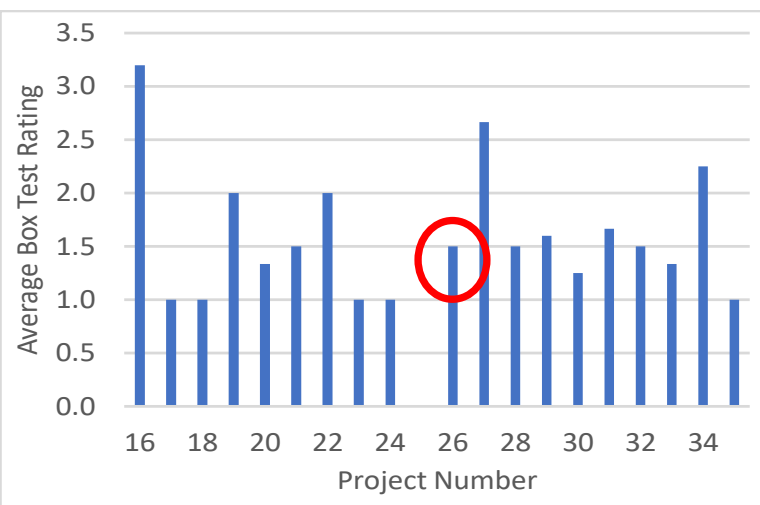
➤ Project 26

➤ Arkansas



# Field Performance

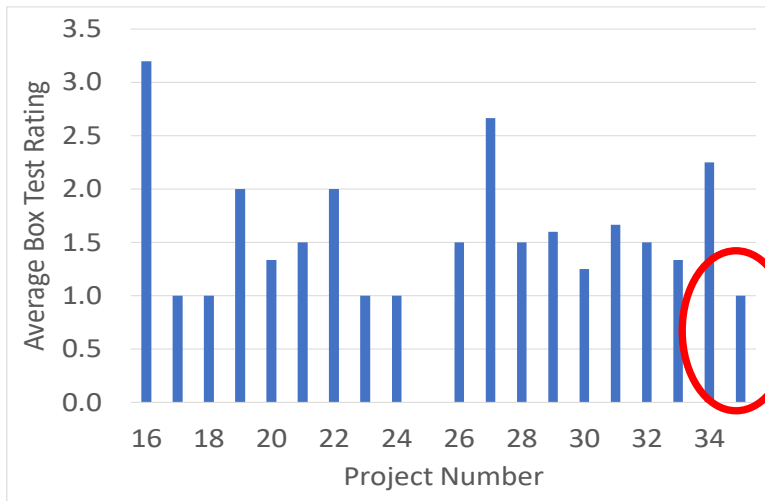
- Project 26
- Arkansas



# Box Test Results

➤ Project 35

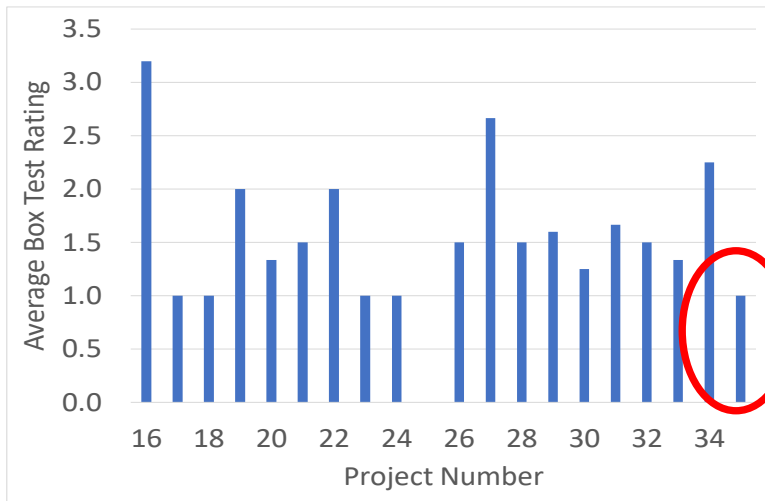
➤ Kansas



# Field Performance

➤ Project 35

➤ Kansas



# Change in Workability with Time

## Kansas



0min



15 min



30 min



45 min

## North Carolina



0 min



20 min



40 min



60 min



75 min



90 min

# Observations



## ➤ Tarantula Curve

### ➤ Criterion 1 (individual sizes)

- Met most of the time
- One size aggregate is often off

### ➤ Criterion 2 (Coarse part of the fine aggregate)

- Almost always passes

### ➤ Criterion 3 (Fine part of the fine aggregate)

- Impacts consolidation and finishability
- Criterion is not met all the time



# Observations

A decorative horizontal bar at the top of the slide, consisting of a series of overlapping arrows pointing to the right. The arrows are in shades of blue and grey, with the rightmost arrow being a solid dark blue.

- **The Tarantula Curve, Box Test, and Field Observations Correlate in almost all cases**
- **The Box Test surface finish has excellent correlation to field finish**
- **Asses change in workability over time by running the Box Test at different intervals of time**



# THANK YOU!



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<https://www.fhwa.dot.gov/mctc>



# Data Collection Efforts

## ➤ Two Weeks

- Fresh Concrete
- Hardened Concrete

## ➤ Later Age Testing

- 28 Day
- 56 Day

## ➤ Wide Variety of Data

- 30+ parameters

