MCTC

Enhanced Construction Productivity Through Workability

Wednesday, November 6, 2024

Field Evaluation of the Tarantula Curve and the Box Test to Assess/Predict the Workability of Concrete Paving Mixtures

Jagan M Gudimettla, P.E.

FHWA / Brick & Byte, Inc

U.S. Department of Transportation
Federal Highway Administration

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

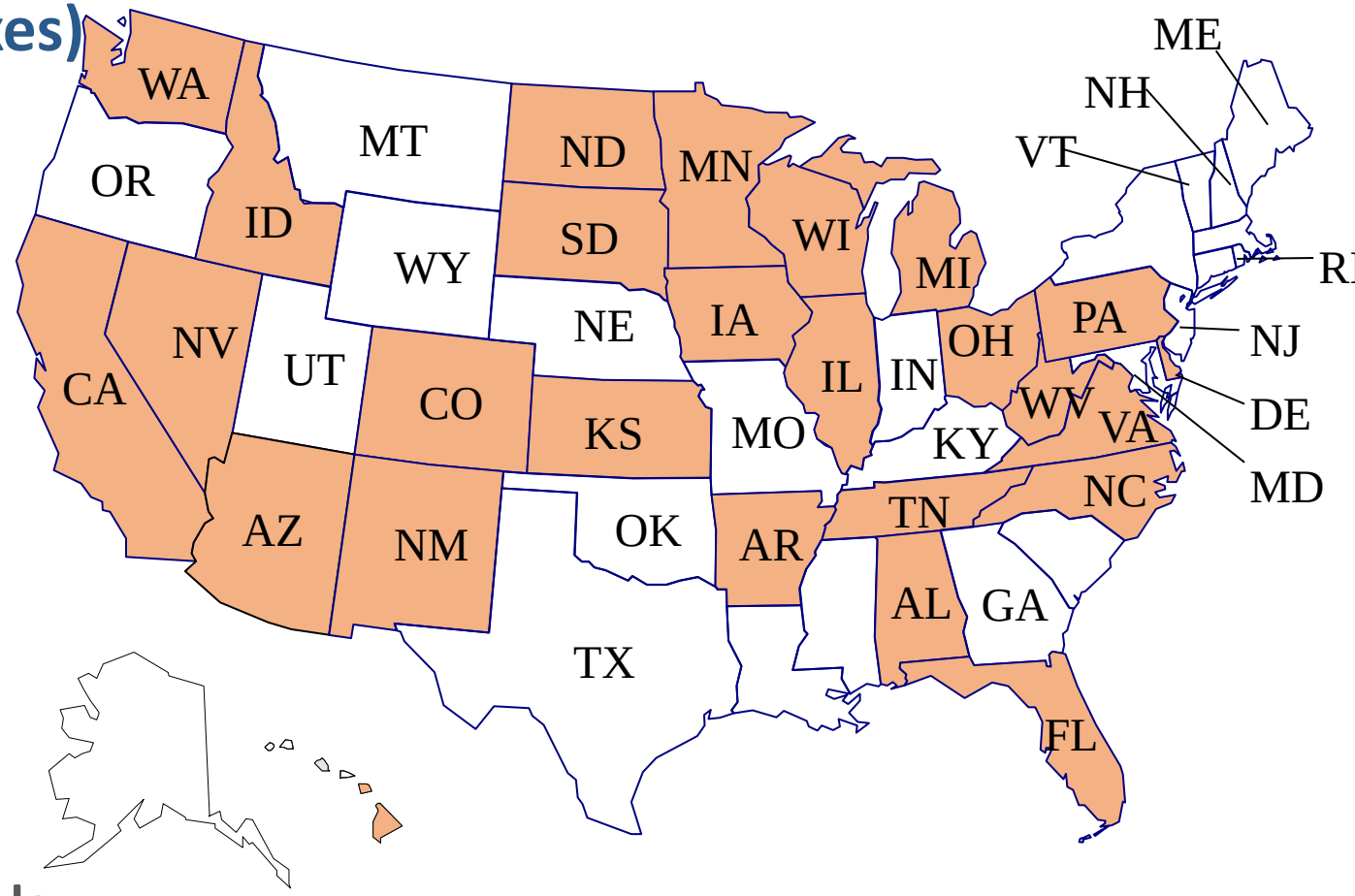
FHWA Mobile Concrete Technology Center (MCTC)

Technology Transfer to SHA's

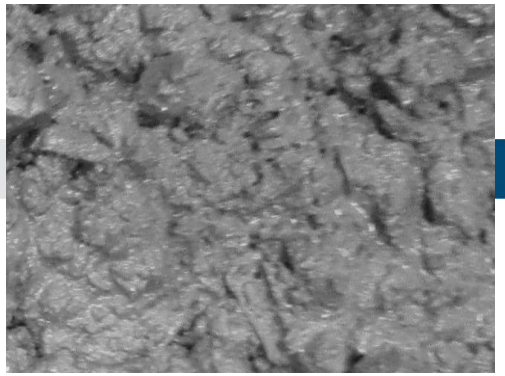
- Field demos on active projects
- Equipment loan
- Training of staff
- Conferences and workshops
- Specification review and technical assistance

FHWA Data Collection Efforts

- Data from 24 States (30 project mixes)
- 2011-2019
- 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?



The Tarantula Curve

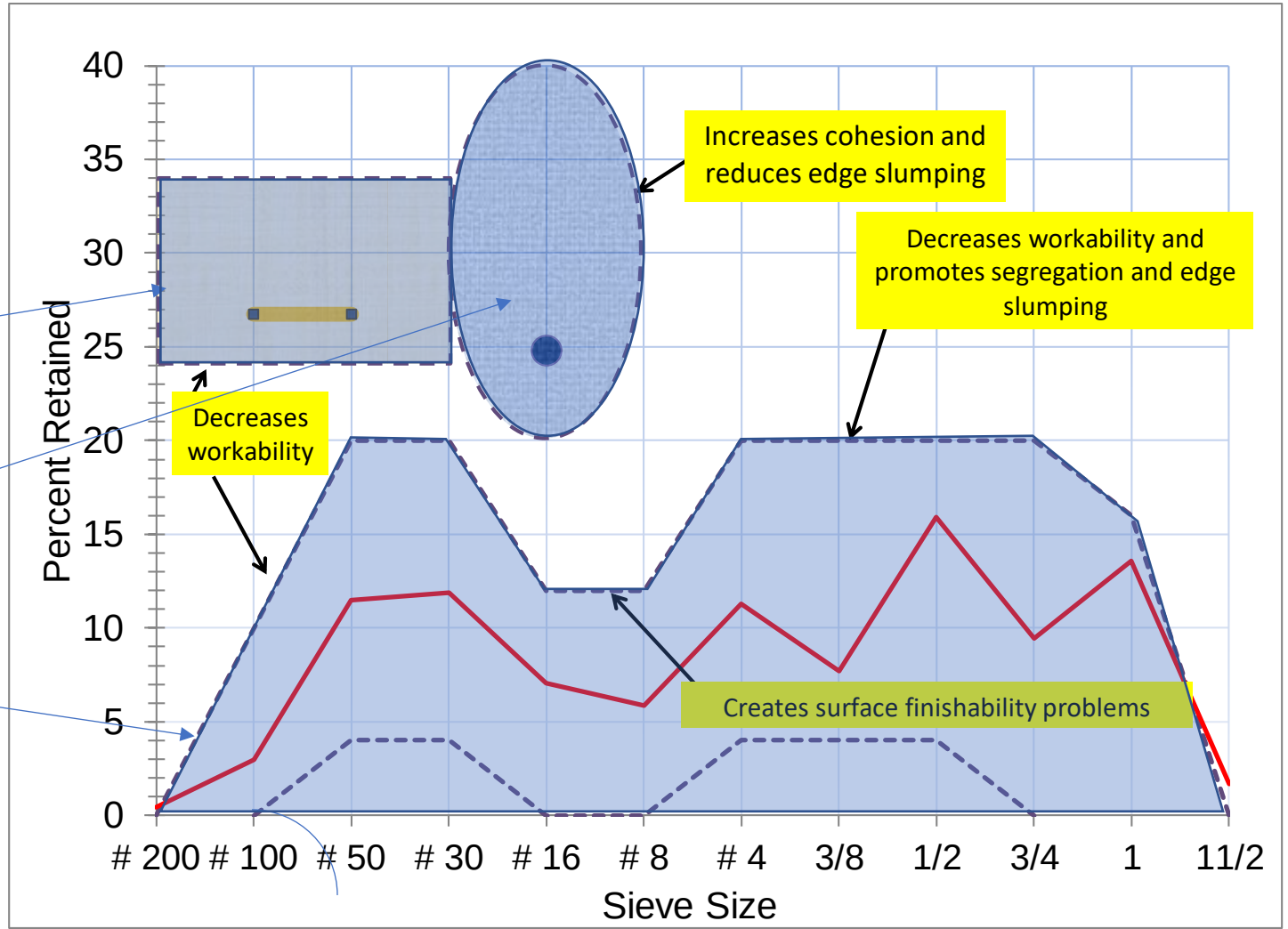




- **Combined Aggregate Gradation**

Criterion 3

Criterion 2

Criterion 1



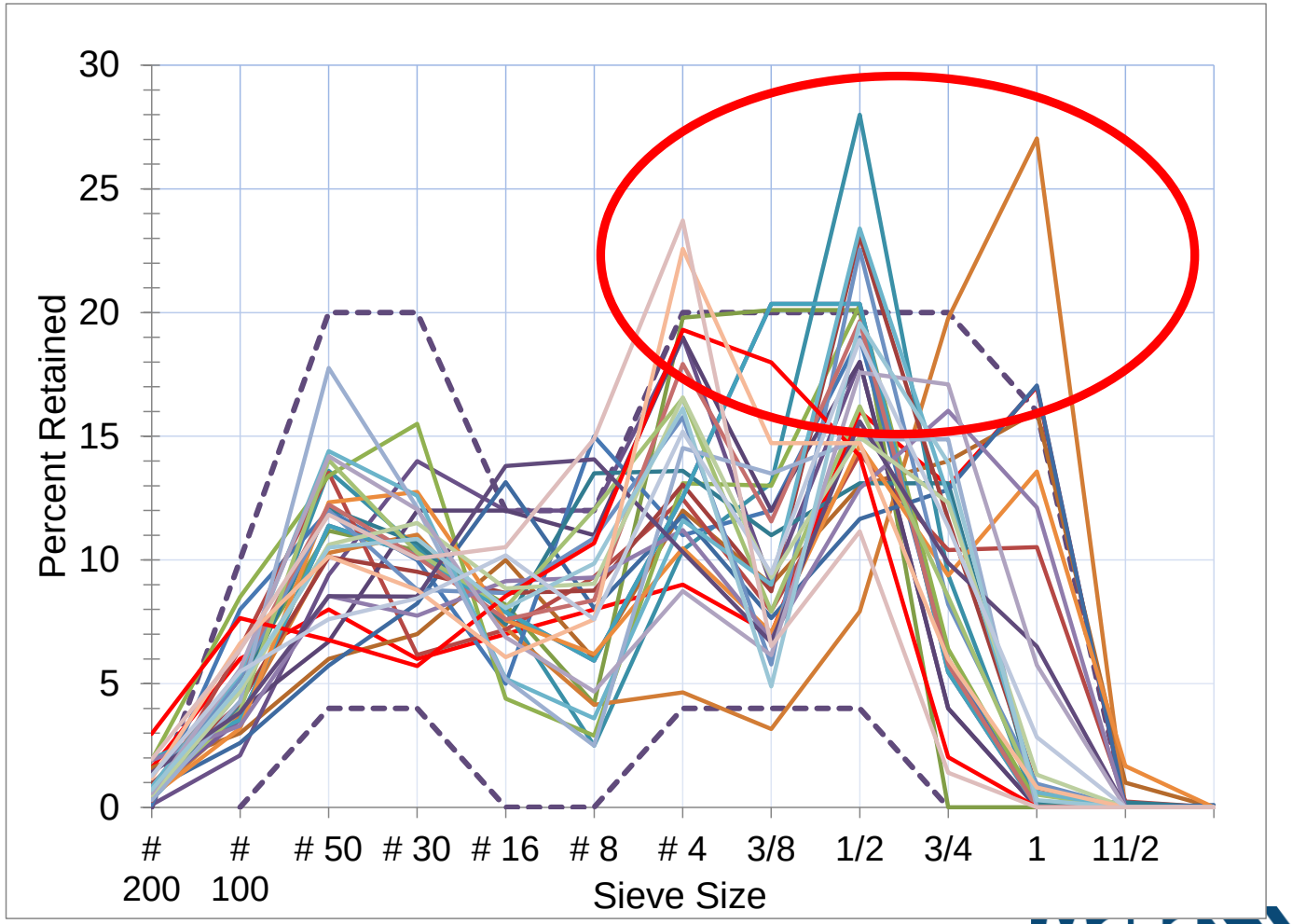
Photos Courtesy: Dr. Tyler Ley, Oklahoma State University

Tarantula Curve

- 30 Mixtures

Tarantula Curve	Met	Did not Meet
Criterion 1	21	9

Tarantula Curve: Criterion 1



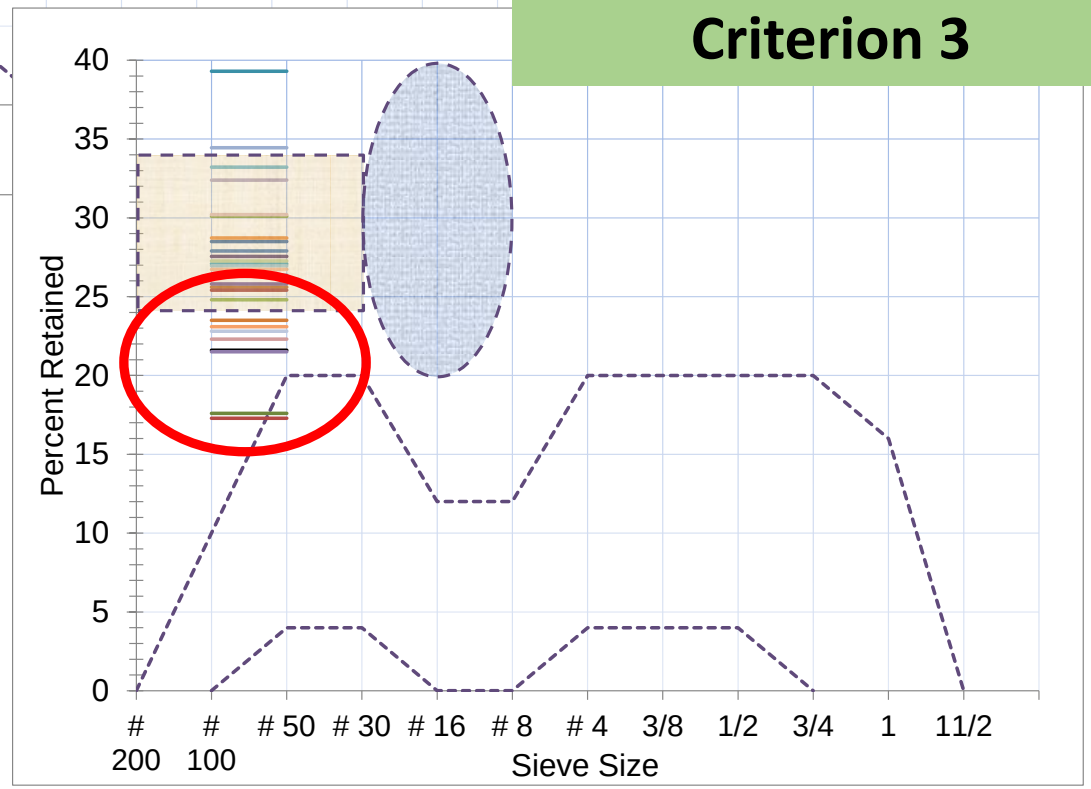
Tarantula Curve

- 30 Mixtures

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

Tarantula Curve: Criterion 2

Tarantula Curve: Criterion 3



The Box Test

- A workability test
- Simple
- Best use is for mixture design
- Will it go through the paver?

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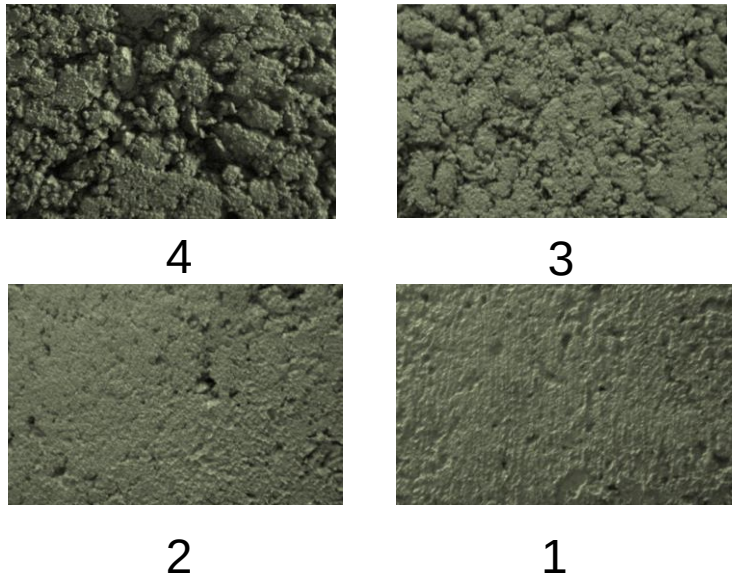
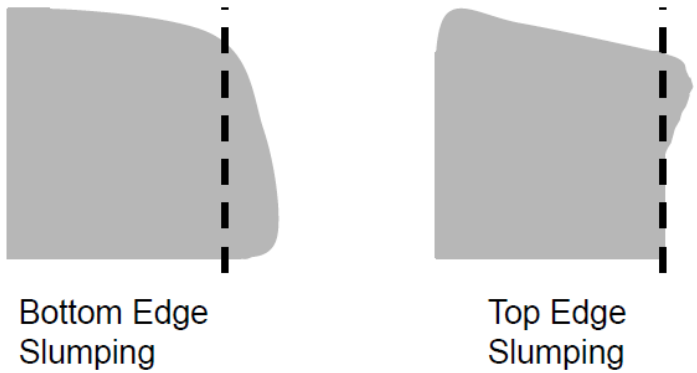
Box Test

- **Indicators**
  - **Consolidation Ranking**
  - **Edge Slump Potential**



Consolidation Issues

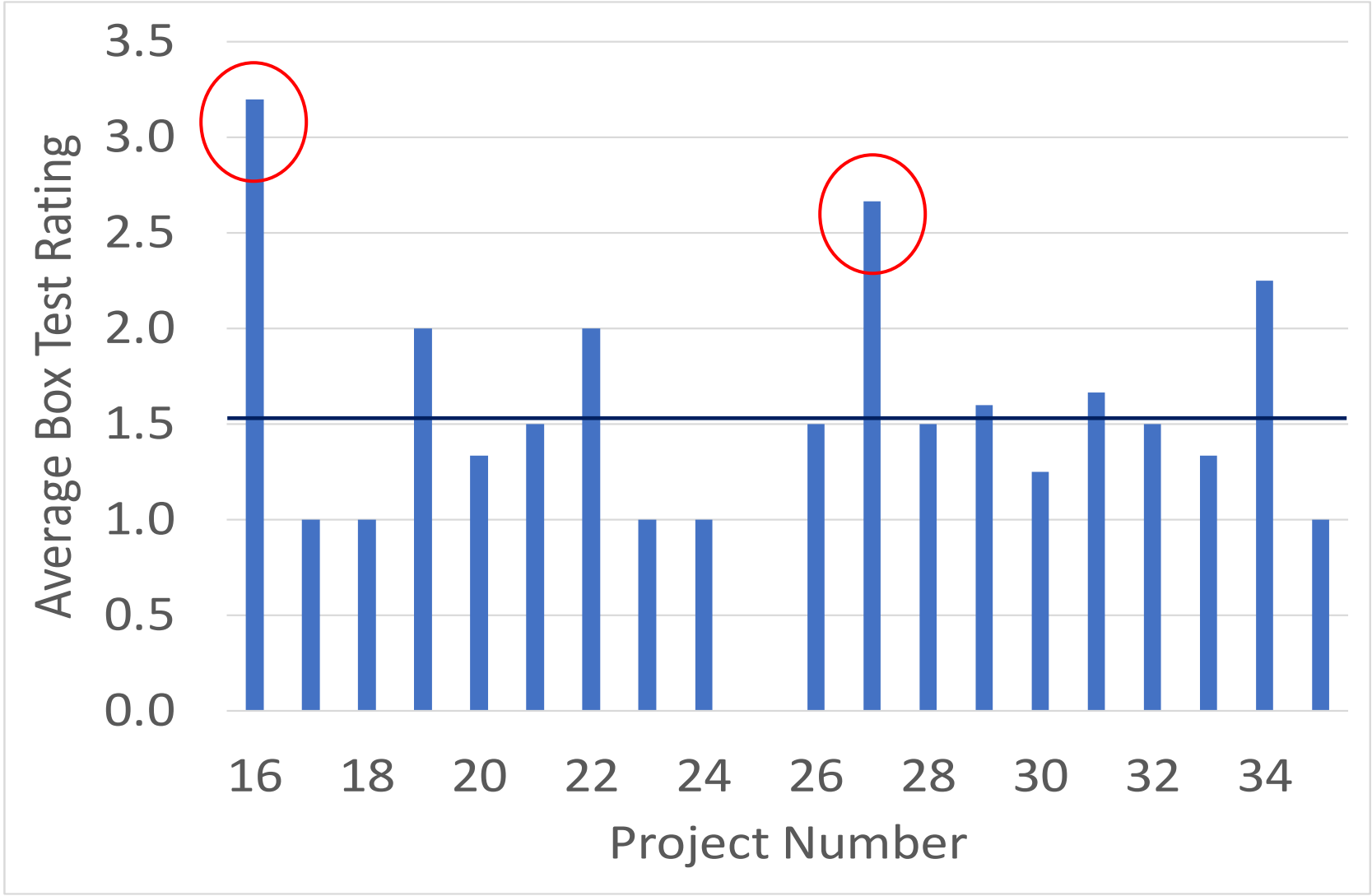


Edge Slump Issues

Box Test Results

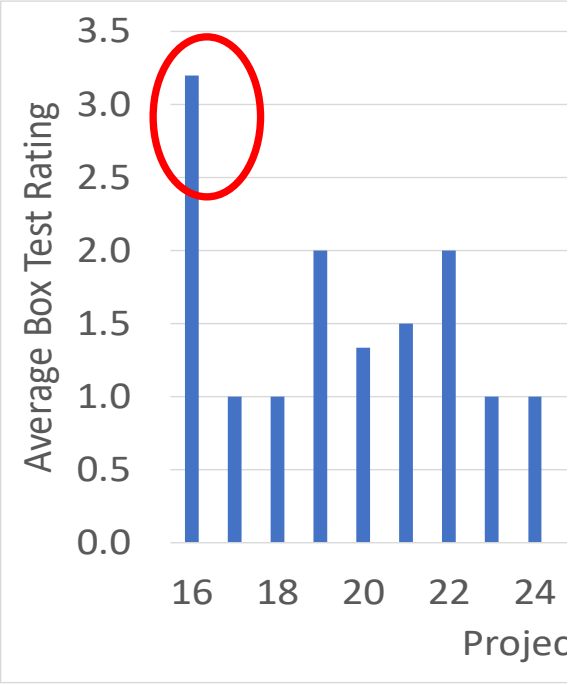
- Consolidation Ranking from Box Test
- Box Test Ranking from 19 Projects

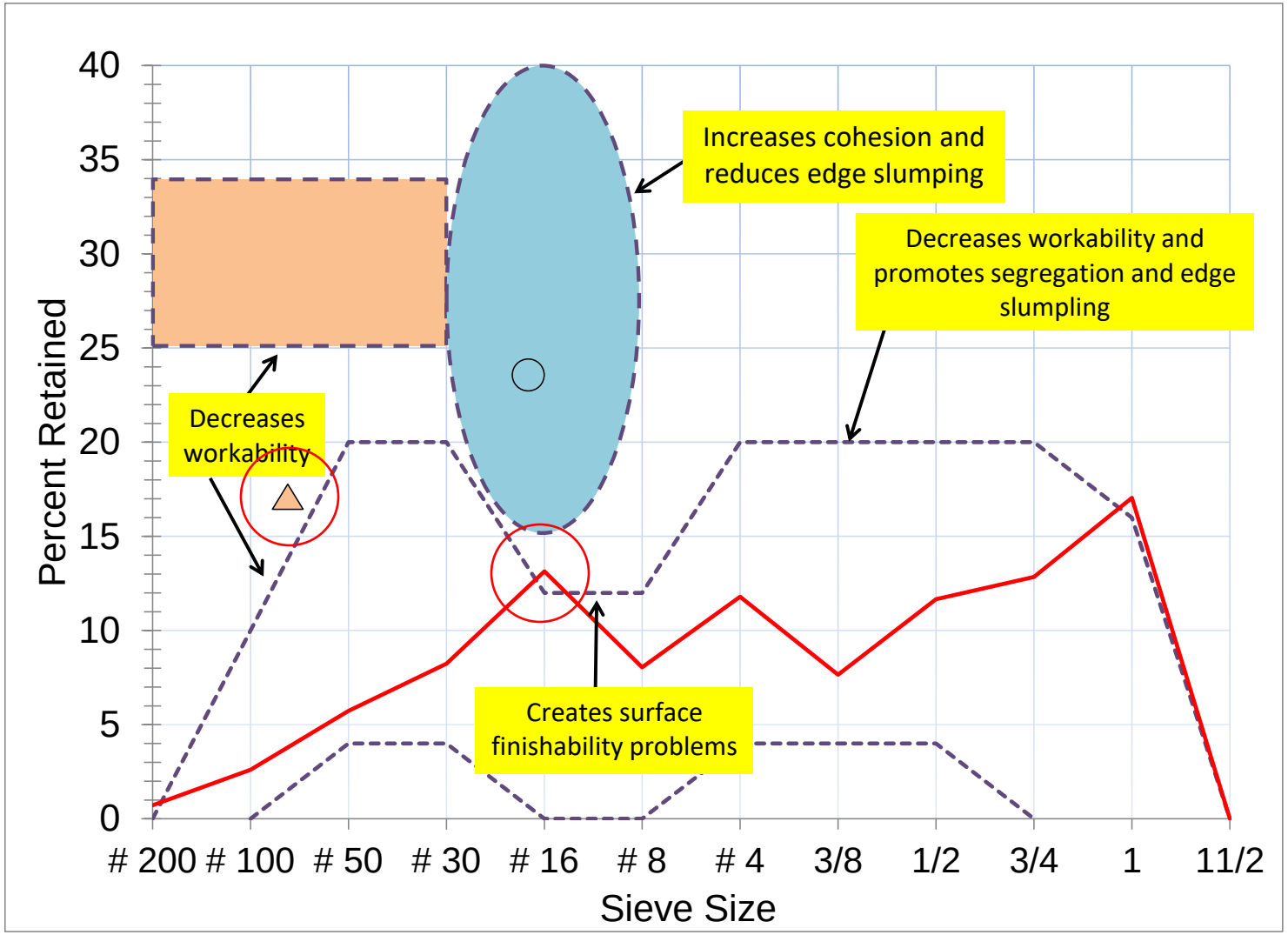
Box Test Ranking Over 1.5	7 out of 19 projects



Tarantula Curve

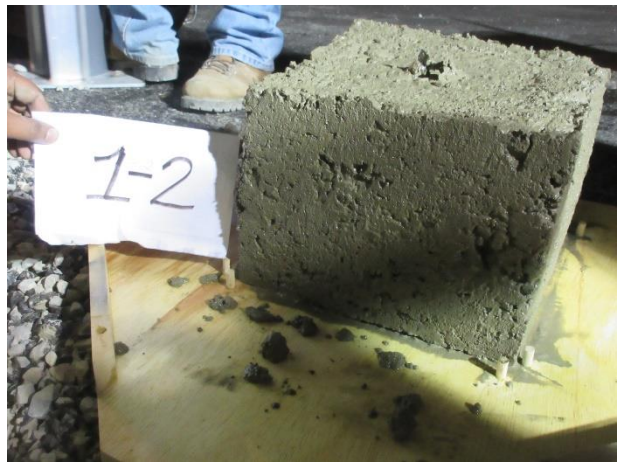
➢Project 16





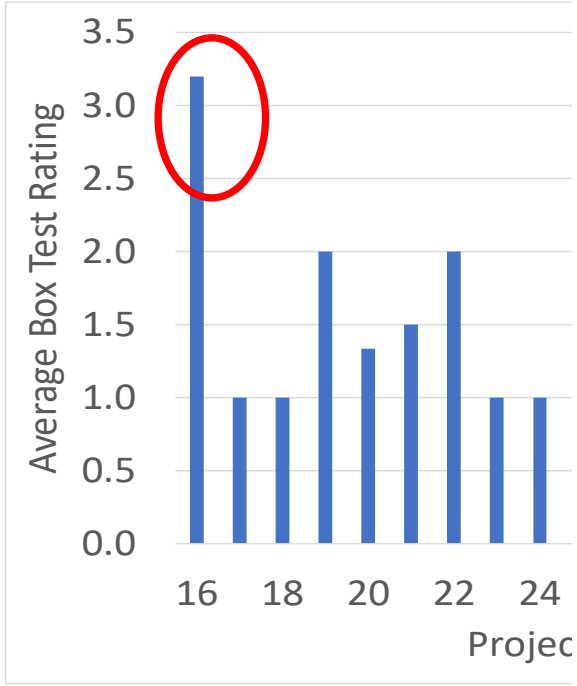
Box Test Results

- Project 16



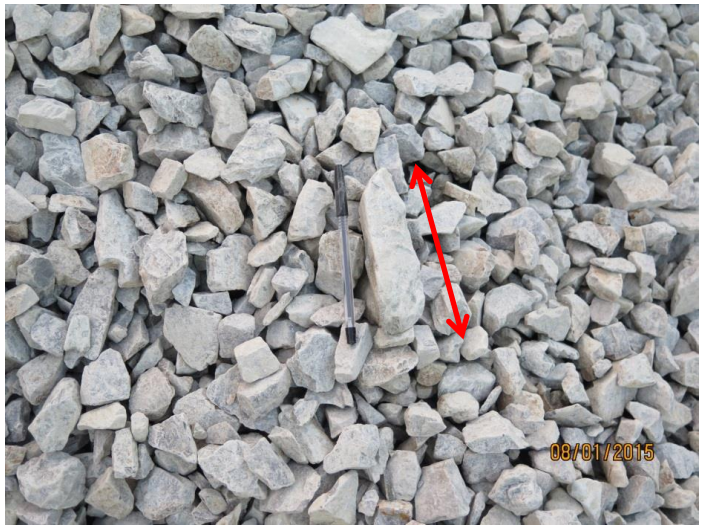
Field Performance

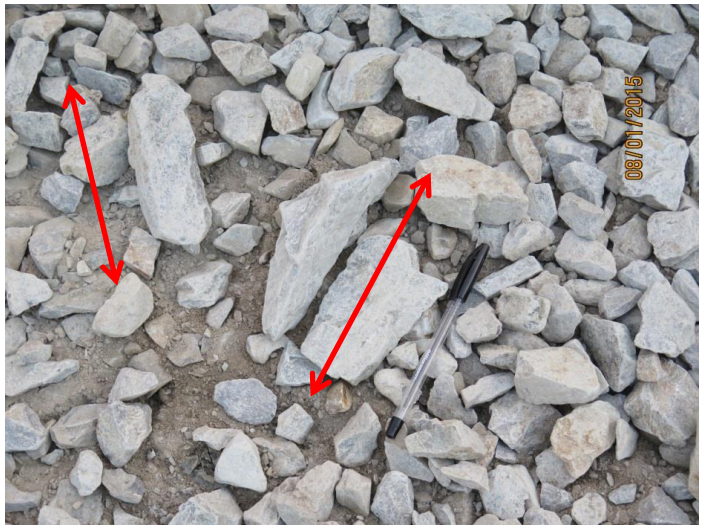
➢Project 16



Project 16

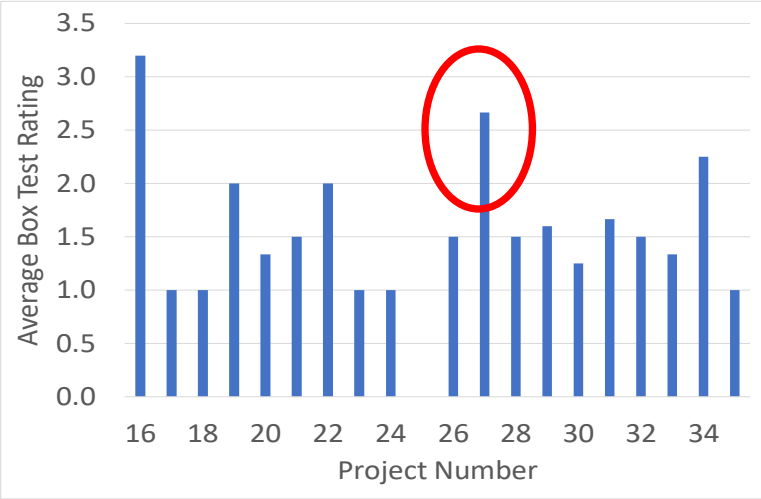
- Two Coarse and two fine aggregates
  - Flat and Elongated (Coarse)
  - Coarse Fine Aggregates

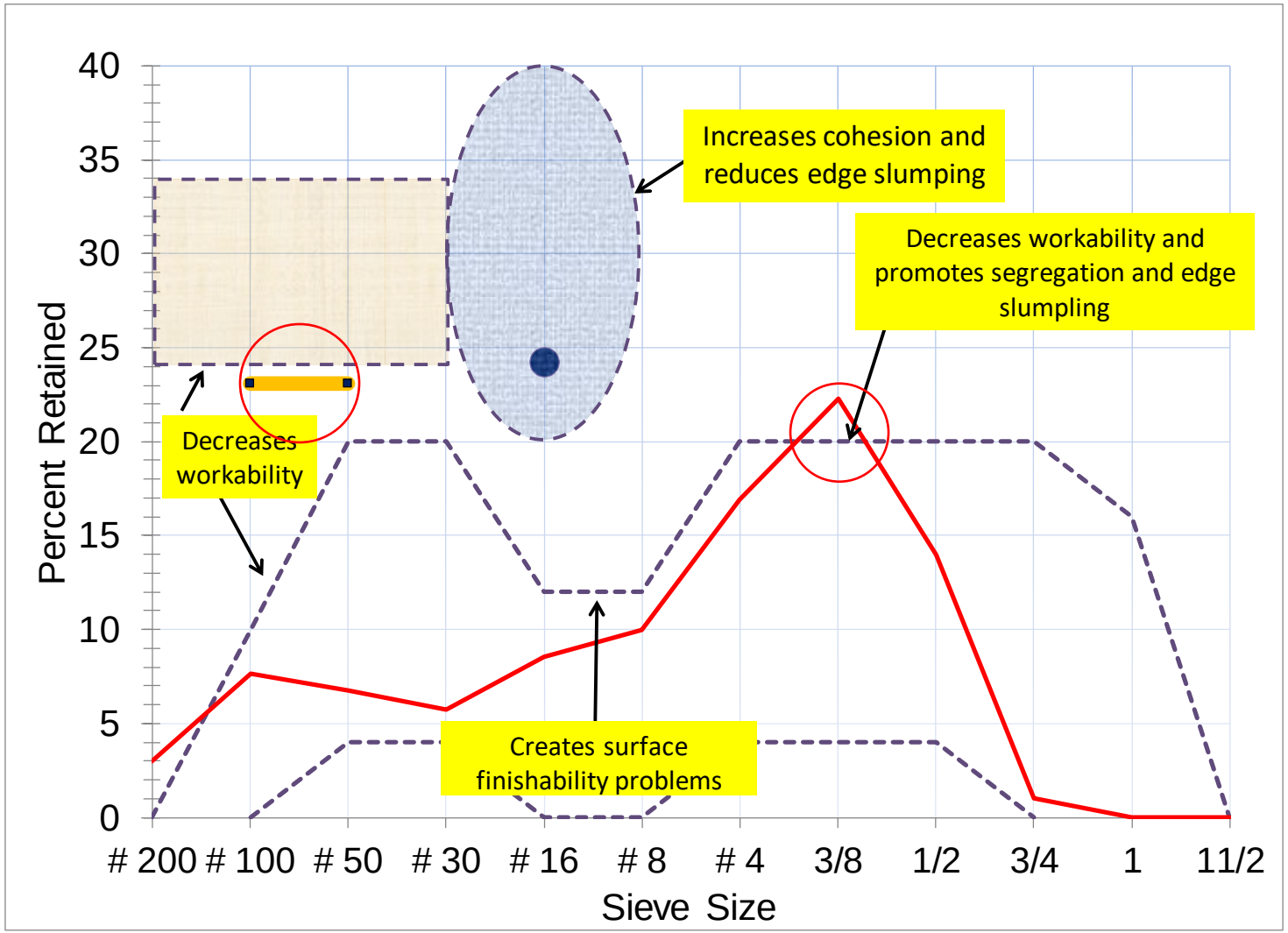




Tarantula Curve

➢Project 27





Box Test Results

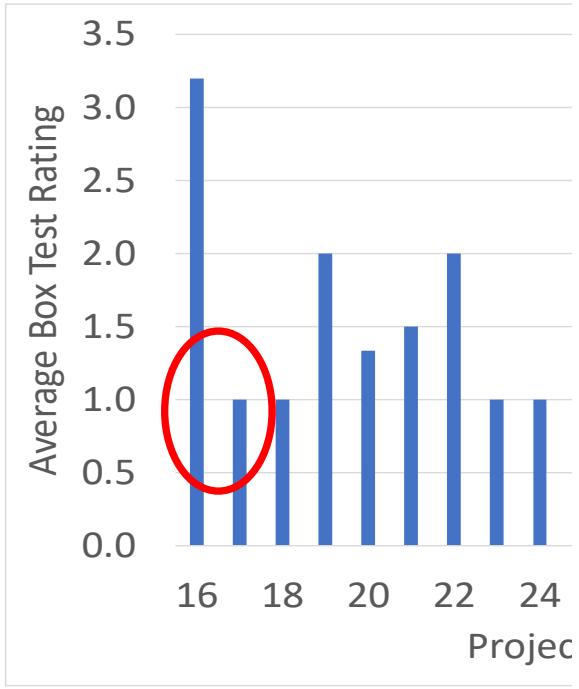
- Project 27

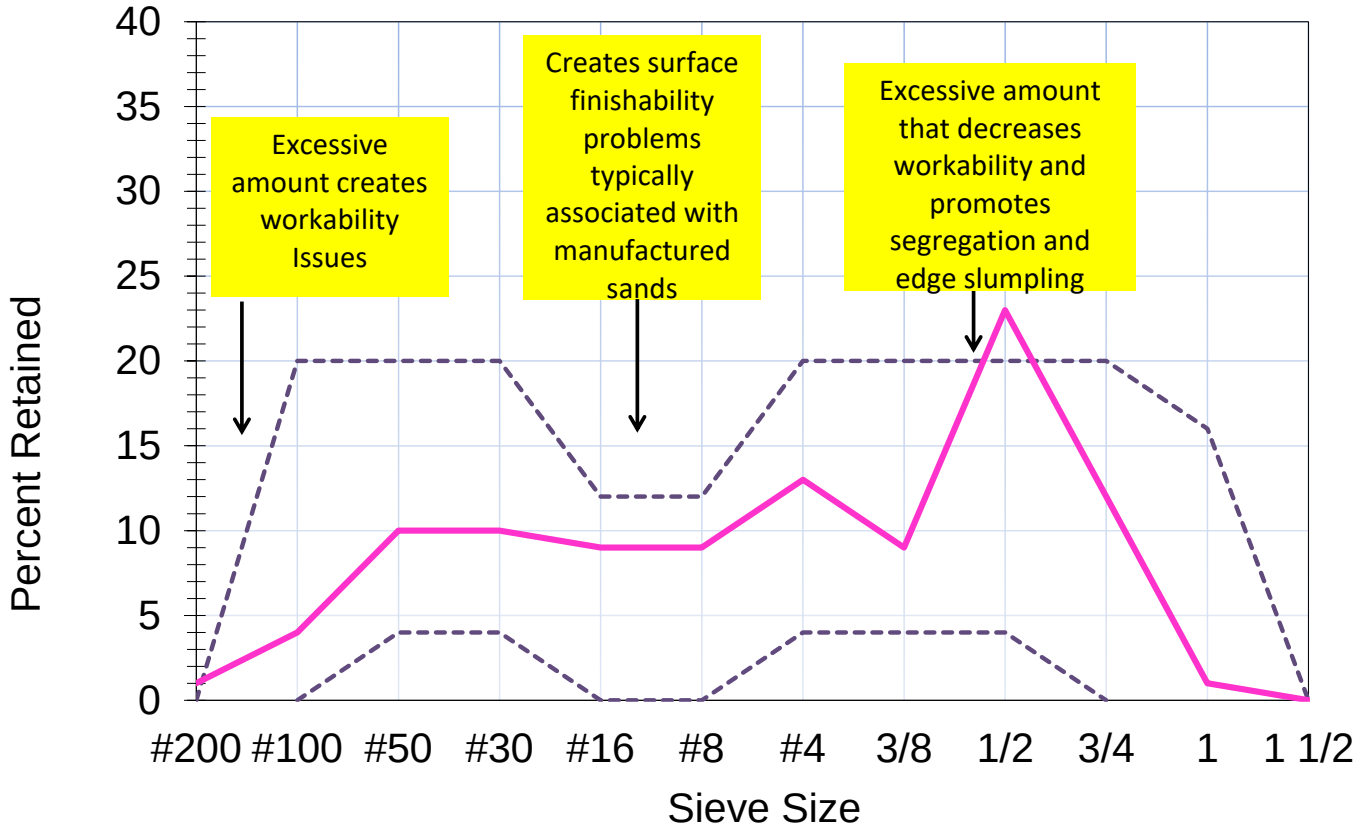
Field Performance

➢Project 27

Tarantula Curve

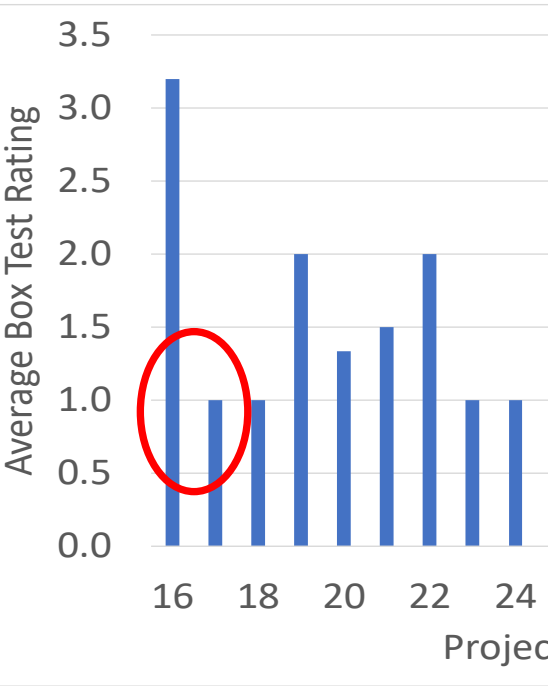
- Project 17
- Edge Slump Issue





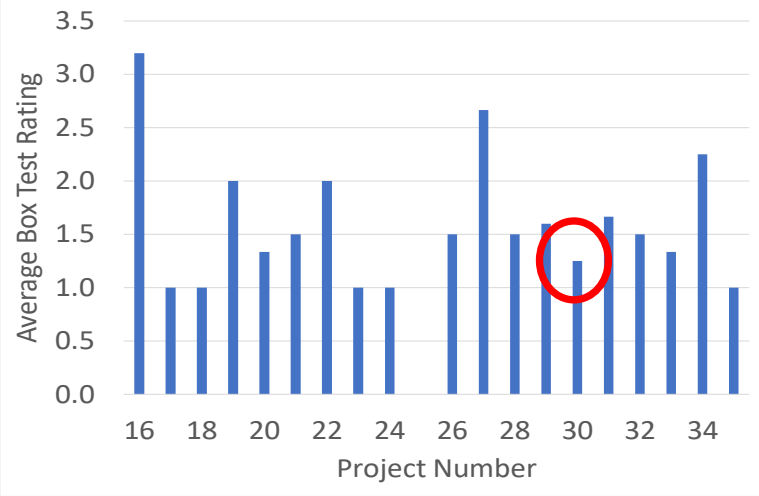
Box Test Results and Field Performance

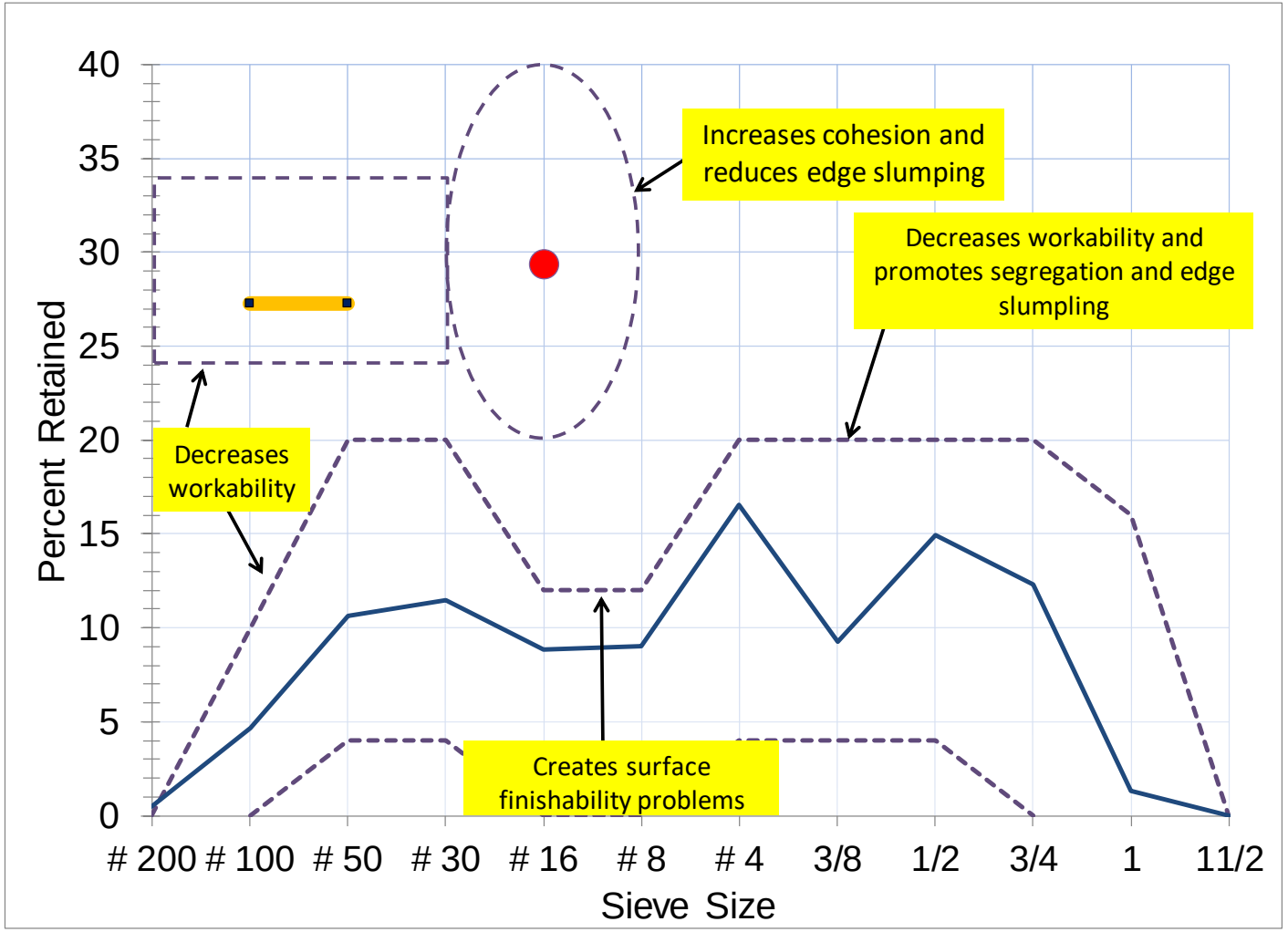
- Project 17
- Edge Slump



Tarantula Curve

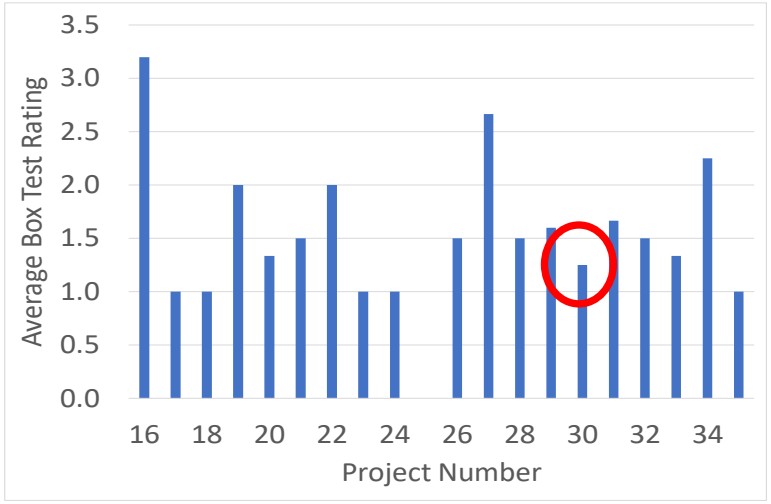
- Project 30
- Iowa





Box Test Results

- Project 30
- Iowa

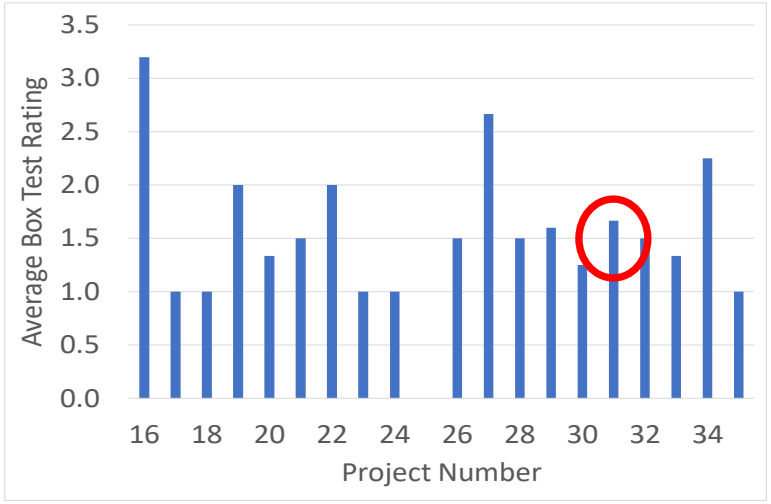


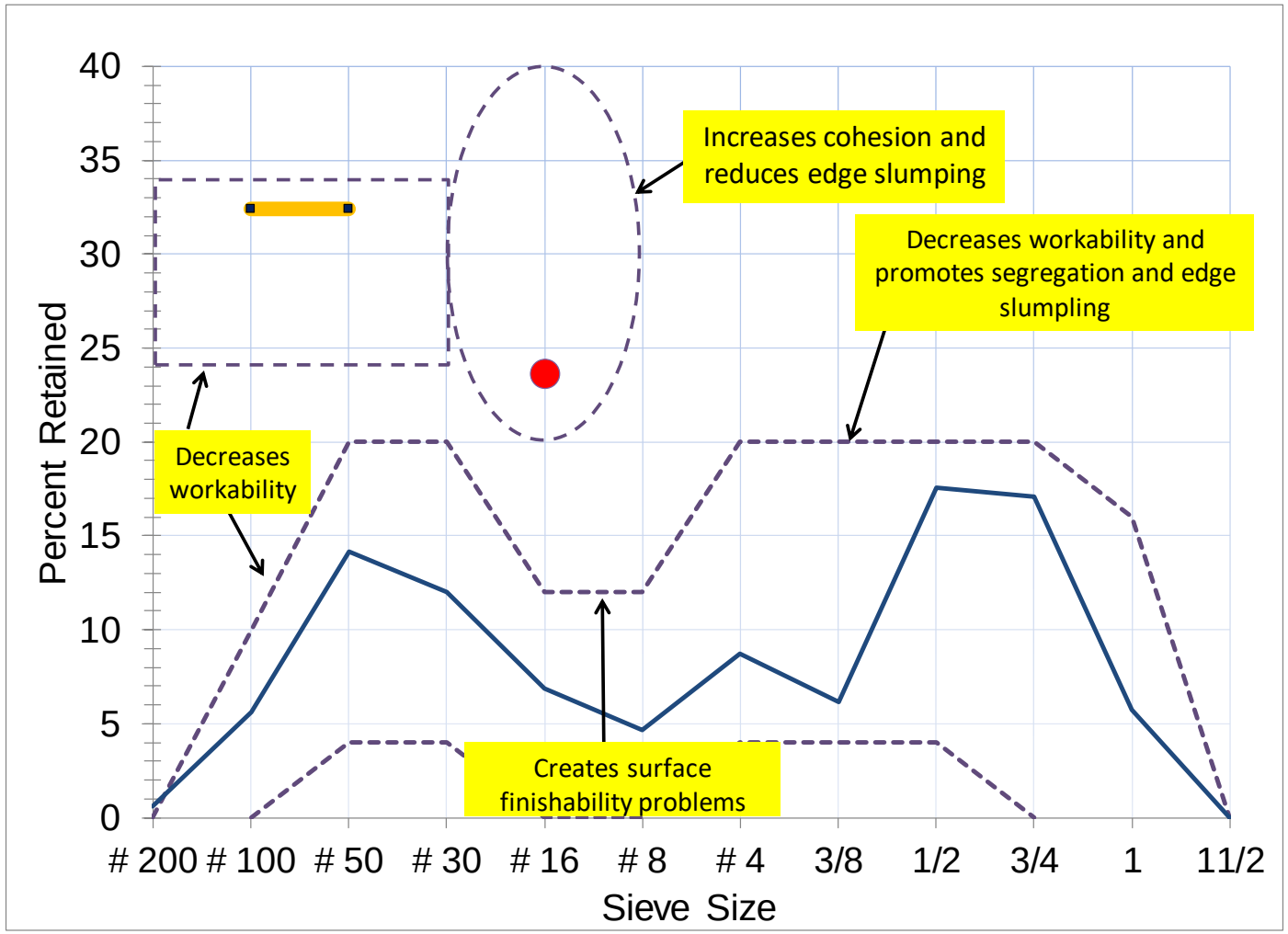
Field Performance

- Project 30
- Iowa

Tarantula Curve

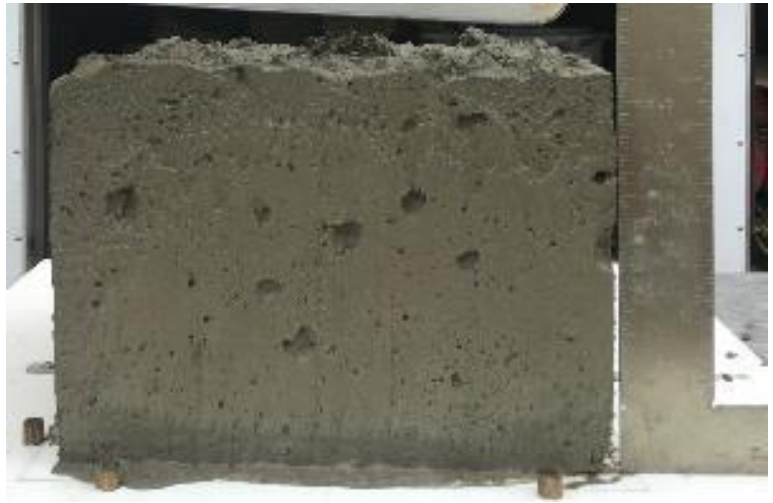
- Project 31
- Minnesota

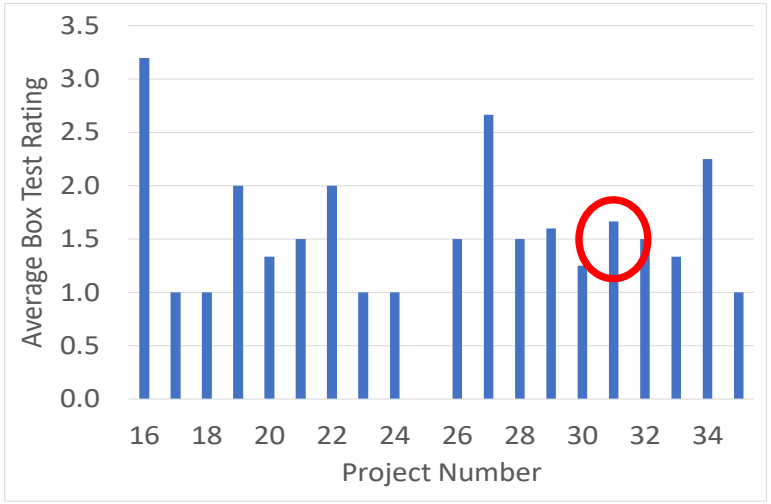




Box Test Results

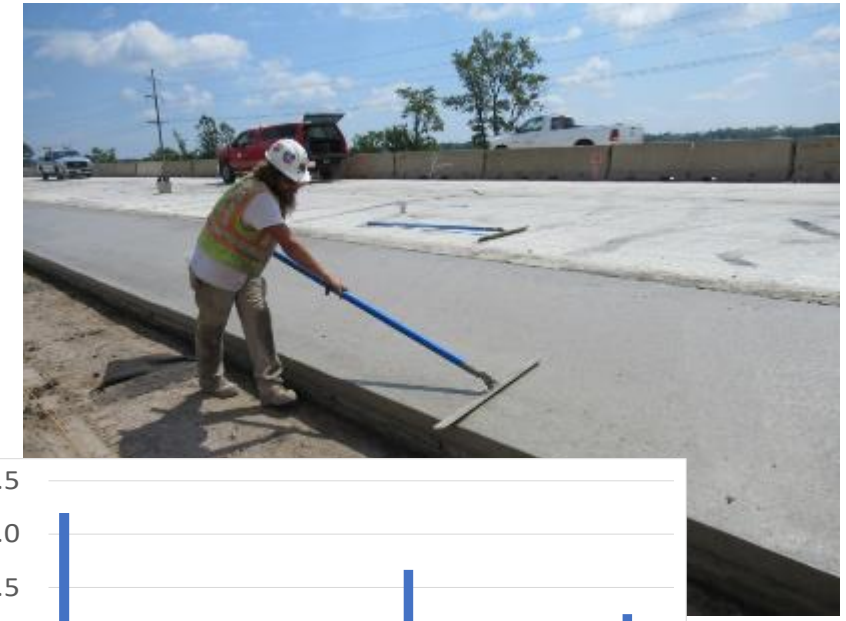
- Project 31
- Minnesota

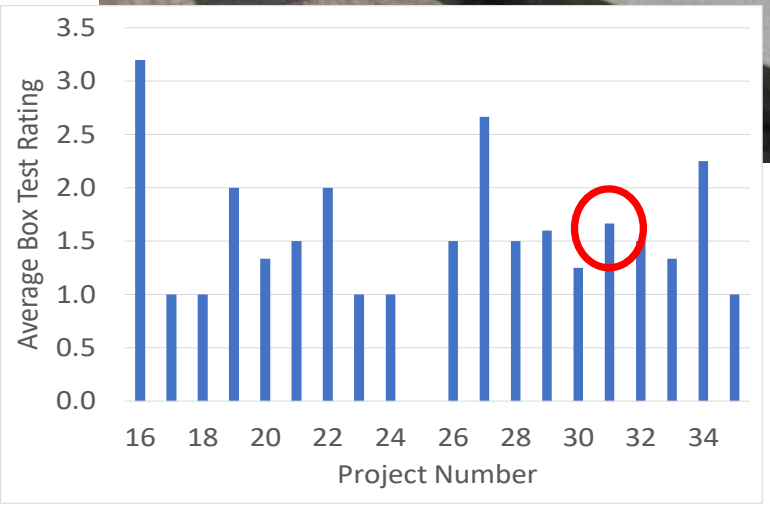




Field Performance

- Project 31
- Minnesota





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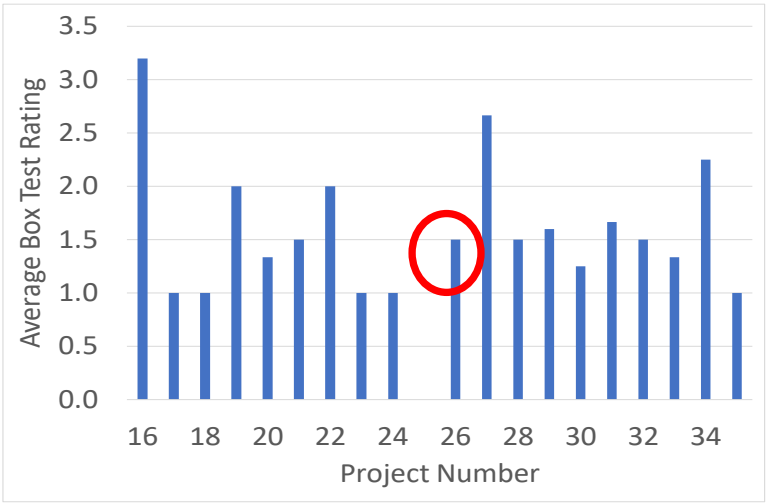
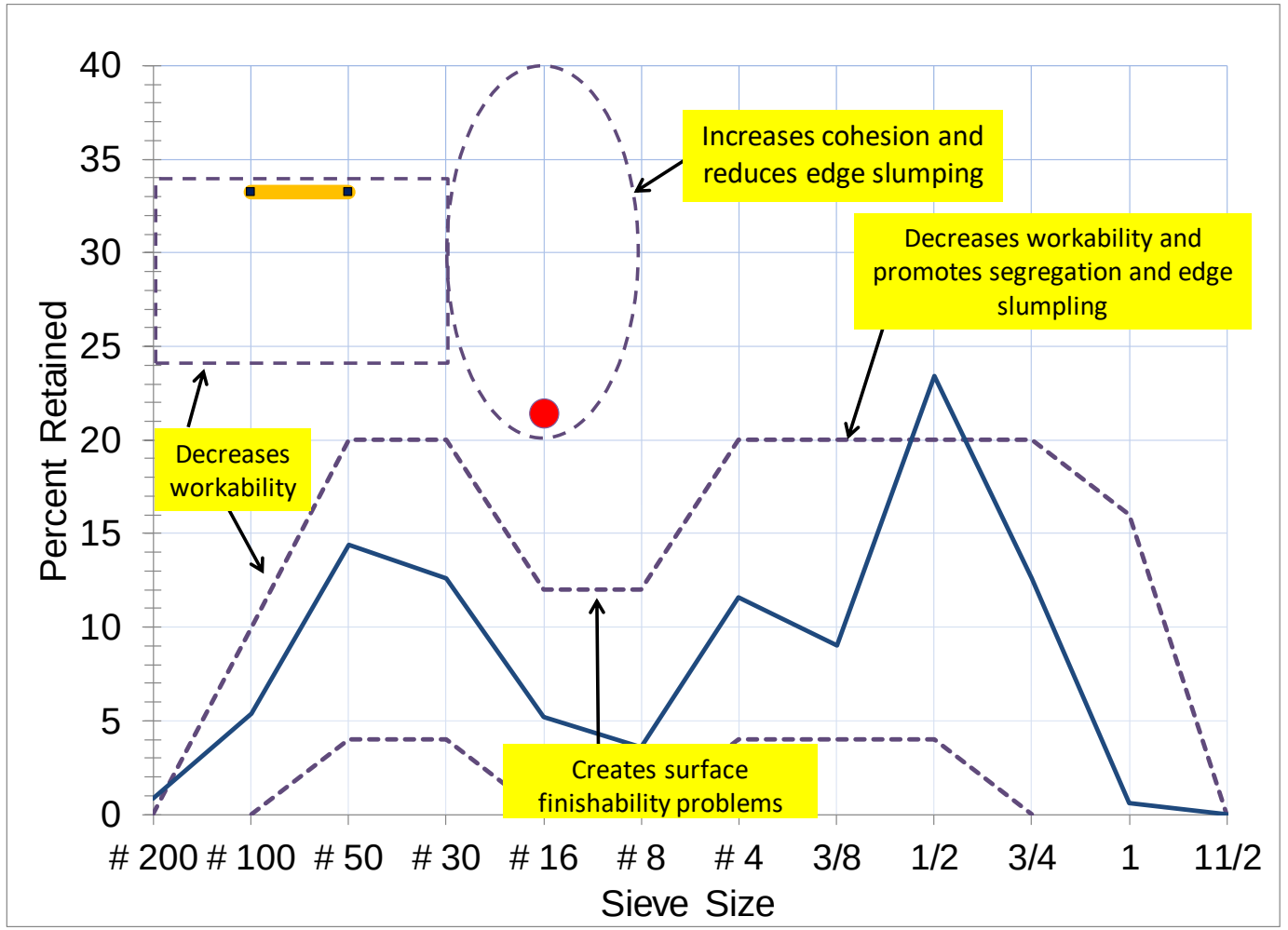
Tarantula Curve

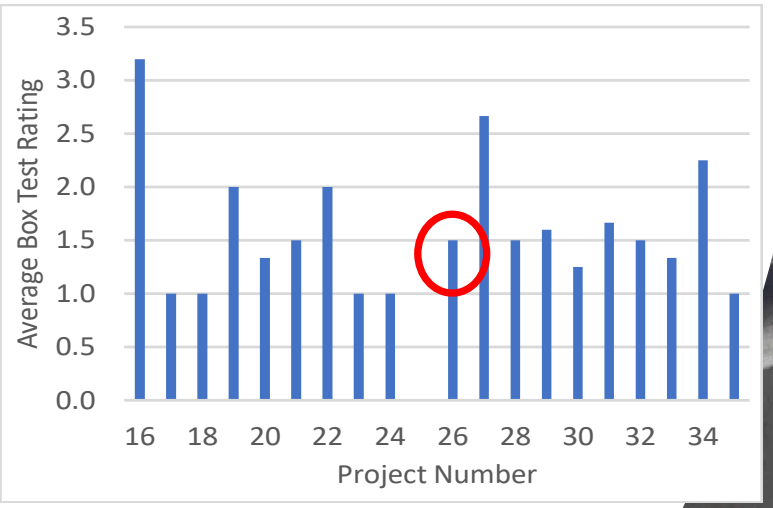
- Project 26
- Arkansas





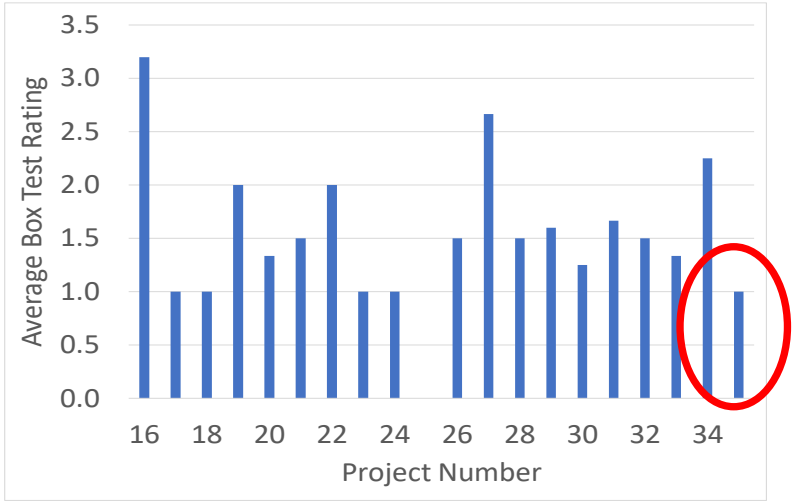
Field Performance

- Project 26
- Arkansas



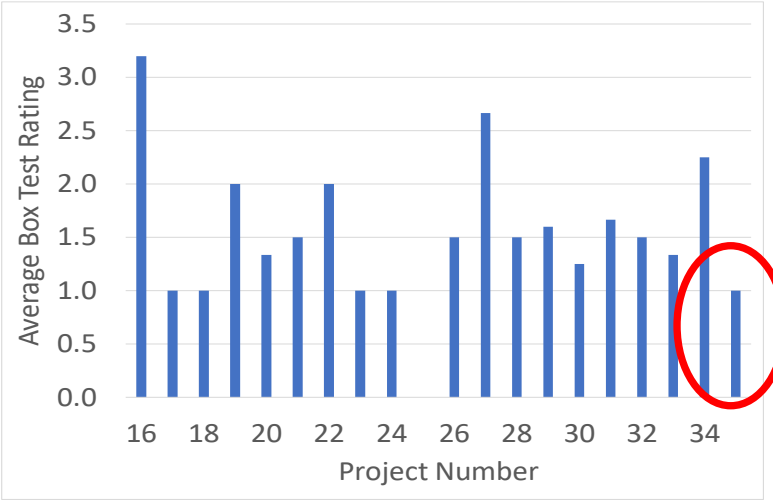
Box Test Results

- Project 35
- Kansas



Field Performance

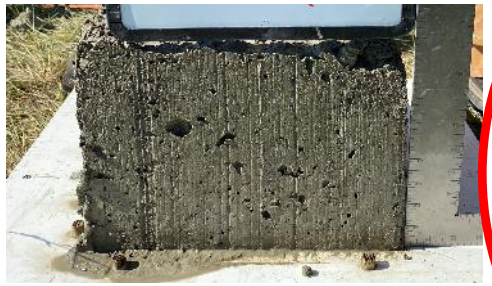
- Project 35
- Kansas



Assessing Change in Workability with Time

Project A

0 min



15 min

30 min

45 min

60 min

Project B

0 min

15 min

30 min

45 min

60 min

Field Observations

Project A

Project B

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

- 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

The Box Test is a great tool to use during the Mixture Design Process

THANK YOU!

Jagan Gudimettla
Jagan.gudimettla.ctr@dot.gov

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