

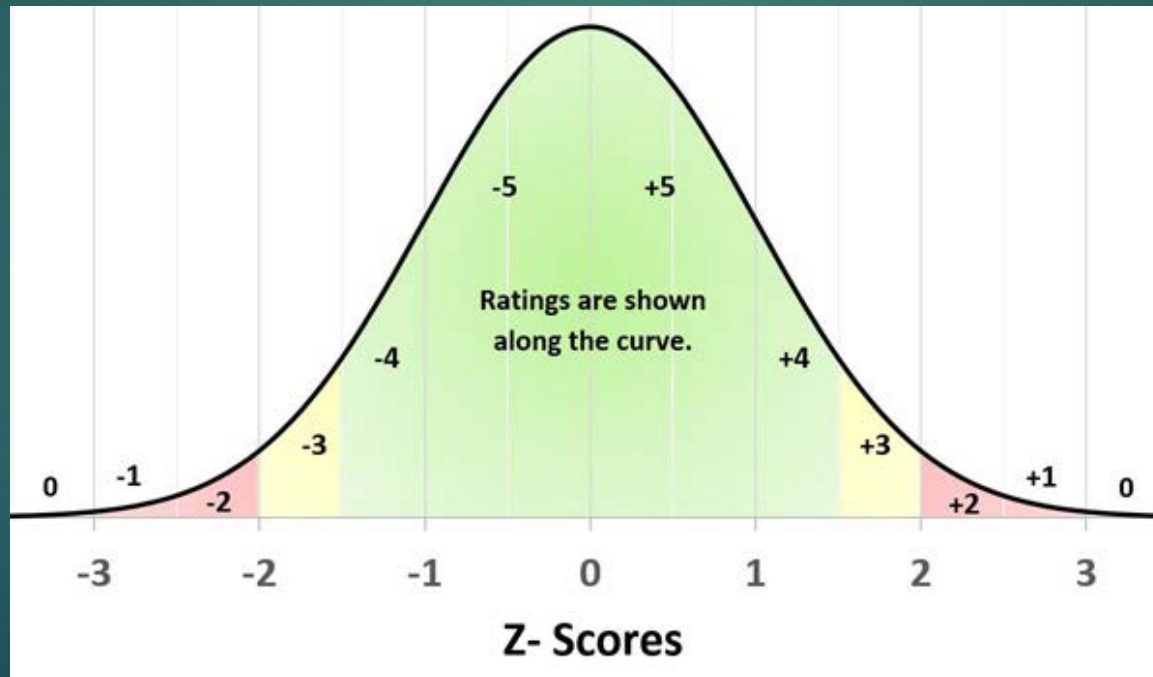


Evaluation of Laboratory Performance in MSCR Testing (T350/D7405) Using AMRL PSP Data

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AMRL PROFICIENCY SAMPLE PROGRAM

The Issue:

- ▶ Laboratories are receiving satisfactory ratings (± 3 , ± 4 , ± 5 s) on percent recovery and J_{nr} values at 0.1 and 3.2 kPa, but receiving low ratings (0, ± 1 s, ± 2 s) on the percent differences (recovery and J_{nr}).



Concerns:

- ▶ From a DSR manufacturer (urged from users)
- ▶ State DoTs (New England) and Universities (AMRL Feedback and SOM Meeting)
- ▶ Private testing laboratories (AMRL Feedback and ASTM Meetings)

AMRL's Evaluation of the Issue:

- ▶ From the initial feedback and comments we determined that this was an isolated event happening in one PSP round. Caused by the difference in values between the "+5s and the -5s".
- ▶ Not the case:

| Sample 237 | | | | |
|------------|--------|--------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 2.630 | 2.6246 | 0.2158 | 0.03 | 5 |

Creep and Recovery (MSCR)
Creep Compliance at 3.2 kPa, Jnr3.2 (0.001 significant figures) - TP70/D7405
View Performance Chart

| Sample 237 | | | | |
|------------|--------|--------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 3.170 | 3.0772 | 0.2364 | 0.39 | 5 |

Creep and Recovery (MSCR)
Creep Compliance at 3.2 kPa, Jnr3.2 (0.001 significant figures) - TP70/D7405
View Performance Chart

| Sample 237 | | | | |
|------------|--------|-------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 20.40 | 16.577 | 1.476 | 2.59 | 1 |

| Sample 238 | | | | |
|------------|--------|--------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 2.440 | 2.6047 | 0.2109 | -0.78 | -5 |

Creep and Recovery (MSCR)
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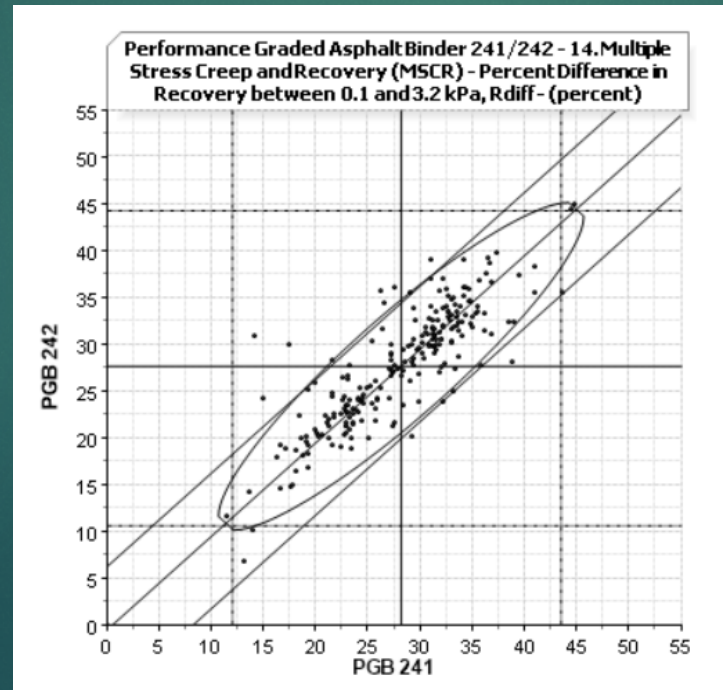
| Sample 238 | | | | |
|------------|--------|--------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 3.000 | 3.0504 | 0.2364 | -0.21 | -5 |

Creep and Recovery (MSCR)
Creep Compliance at 3.2 kPa, Jnr3.2 (0.001 significant figures) - TP70/D7405
View Performance Chart

| Sample 238 | | | | |
|------------|--------|-------|---------|--------|
| Lab Data | Avg | 1S | Z-Score | Rating |
| 23.05 | 16.556 | 1.427 | 4.55 | 0 |

Evaluation Continued:

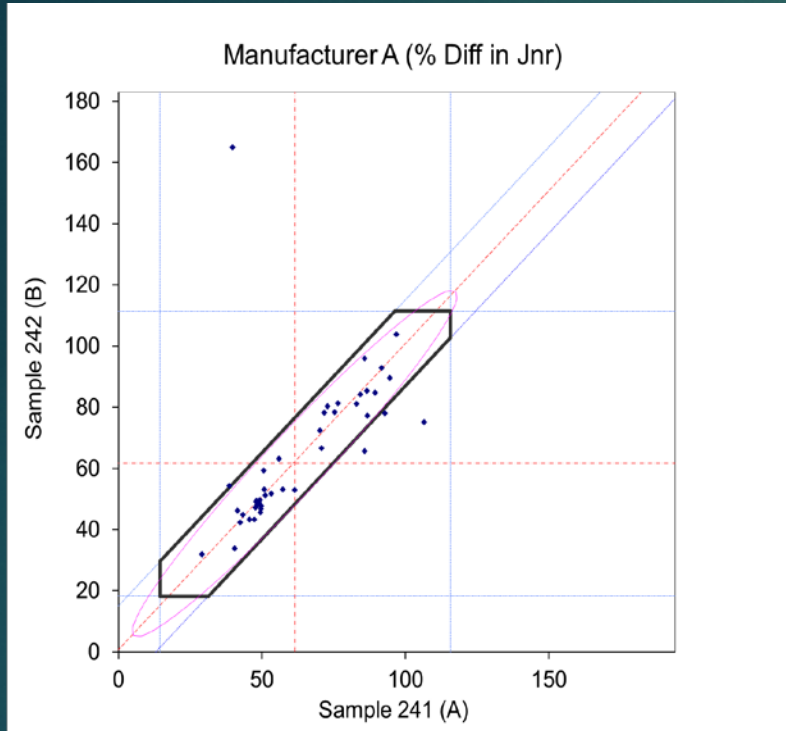
- ▶ Updated PSP Data sheet for PGB rounds to provide DSR Manufacturer and Software information.
 - ▶ Discussed at SOM in Pittsburgh.
- ▶ One round of PGB 241/242 (Fall 2015) data has been collected and the data has been analyzed.



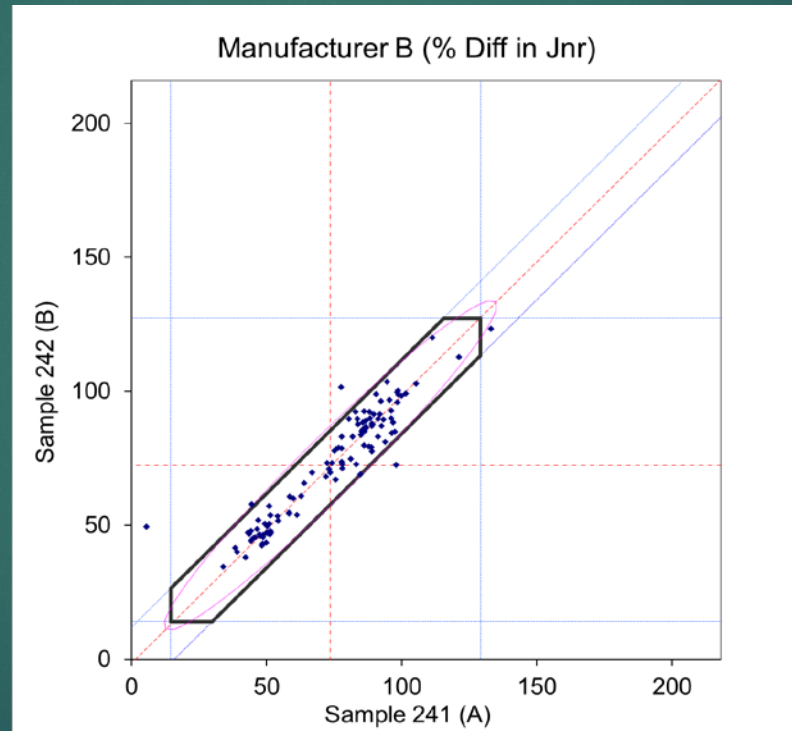
Looking for Bias or Something:

- ▶ Regardless of the manufacturer, all data appears to be normally distributed.
 - ▶ Individually or grouped together
 - ▶ Evaluation of normal probability show r^2 values > 0.9 .
 - ▶ Indication that manufacturer bias is not present (no skewness)
- ▶ “Welch’s t” test was conducted to check for statistical significance (difference) between manufacturers (“Big Three”).
 - ▶ Statistics indicate there is a difference between some of the manufacturers for some of the test parameters.

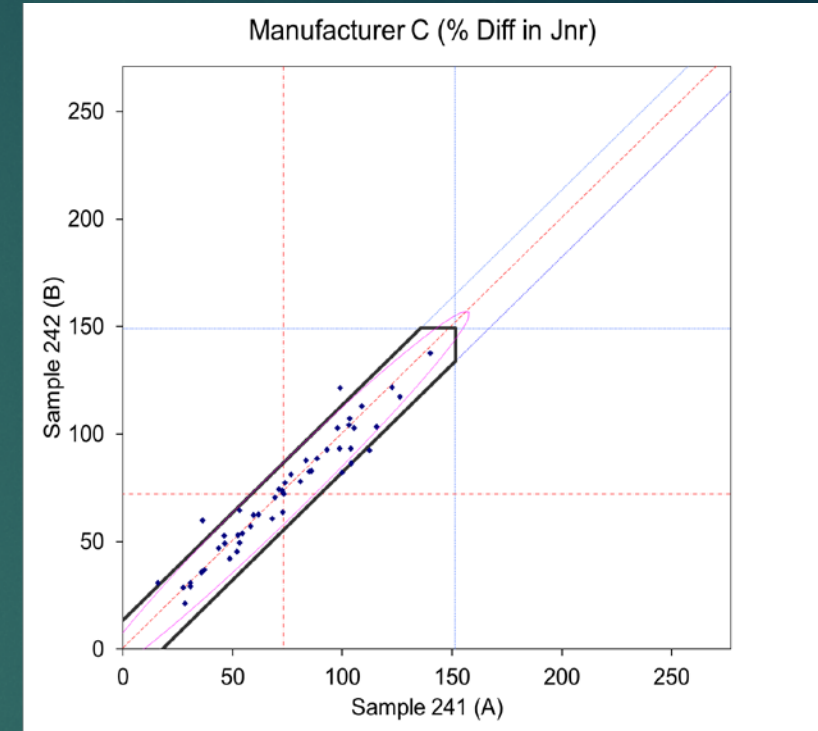
Statistical Significance:



| Average Results | |
|-----------------|-------|
| Odd | Even |
| 61.41 | 61.62 |



| Average Results | |
|-----------------|-------|
| Odd | Even |
| 73.6 | 72.41 |



| Average Results | |
|-----------------|-------|
| Odd | Even |
| 72.99 | 72.31 |

Statistically Significant Differences:

- ▶ Out of the six reporting parameters in T350/D7405, statistical differences existed between manufacturers (A, B, & C) for these four test parameters:
 - ▶ % Recovery at 0.1 kPa (A – B)
 - ▶ % Difference in Recovery (A – B)
 - ▶ J_{nr} at 0.1 kPa (A – B)
 - ▶ % Difference in J_{nr} (A – B – C)

A Second Look:

- ▶ Looking back on our first thought - “difference between a +5 and a -5”.
- ▶ It doesn't matter where the data falls when calculating a % difference.

$$J_{avg} = \frac{[J_{3.2} - J_{0.1}] \times 100}{J_{0.1}}$$

AVG = 50
1s = 10

| Lab 1 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 40 | 60 | 50 |

-5 +5 +5

| Lab 2 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 30 | 45 | 50 |

-4 -5 +5

| Lab 3 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 10 | 15 | 50 |

-2 -2 +5

| Lab 4 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 60 | 90 | 50 |

+5 +2 +5

The % Difference Parameters:

- ▶ % Difference recovery and in J_{nr} may not be a good way to evaluate laboratory performance for accreditation purposes.
- ▶ Percent difference values are determined using intermediate test data.
 - ▶ Intermediate data can be from anywhere about the distribution regardless of the proximity from the “true value”.
- ▶ Satisfactory ratings will be received as long as the ratio between the difference value and 0.1 kPa value is within two standard deviations.

| Lab 3 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 10 | 15 | 50 |
| -2 | -2 | +5 |

| Lab 4 | | |
|---------|---------|--------|
| 0.1 kPa | 3.2 kPa | % Diff |
| 60 | 90 | 50 |
| +5 | +2 | +5 |

The AMRL PSP Analysis:

- ▶ The method analyzes the data it is given.
- ▶ The analysis process is robust enough to cover any form of bias between manufacturers due to the methodology and includes all random and systematic error associated with the test.
- ▶ A recommendation was given that the AMRL PSP analysis should be performed in accordance with ASTM D4460 (Standard Practice for Calculating Precision Limits Where Values are Calculated from Other Test Methods)
 - ▶ Only covers precision limits (development of a precision statement) - PSP is measuring accuracy of participants.
 - ▶ Used when a new standard in question is using test values from other test standards with established precision estimates. MSCR was not developed from other standards.

Looking Ahead:

- ▶ We will continue to solicit for test data for all reporting parameters in the MSCR (T350/D7405).
- ▶ Administrative Task Group has been informed of the situation.
 - ▶ AAP's proposal to the ATG is to not evaluate % difference in recovery and % difference in J_{nr} for accreditation purposes.
 - ▶ Still evaluate data for % recovery and J_{nr} values at 0.1 and 3.2 kPa, respectively.
- ▶ Continue to evaluate the data after each PSP round and look for issues (check model and software version).
- ▶ Feedback from you?
 - ▶ John Malusky (jmalusky@amrl.net)

Questions?

