Evaluation of Laboratory Performance in MSCR Testing (T350/D7405) Using AASHTO re:source PSP Data

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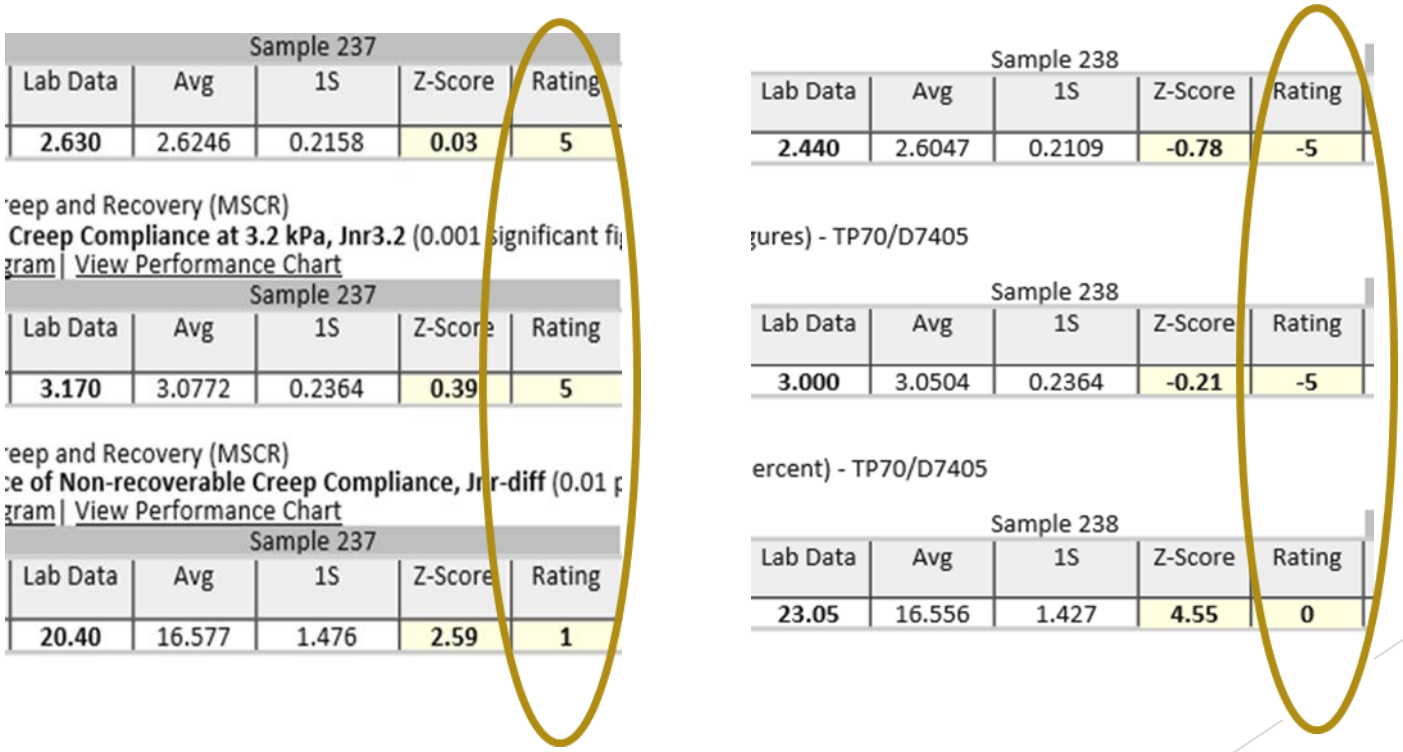
AASHTO re:source Proficiency Sample Program

Initial Concerns:

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



Sample 237

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

eep and Recovery (MSCR)
Creep Compliance at 3.2 kPa, Jnr3.2 (0.001 significant fi
gram | View Performance Chart

Sample 237

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

eep and Recovery (MSCR)
e of Non-recoverable Creep Compliance, Jnr-diff (0.01 p
gram | 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

gures) - TP70/D7405

Sample 238

Lab Data	Avg	1S	Z-Score	Rating
3.000	3.0504	0.2364	-0.21	-5

ercent) - TP70/D7405

Sample 238

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

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”.
- 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.

$$J_{nrdiff} = \frac{\left[J_{nr3.2} - J_{nr0.1}\right] \times 100}{J_{nr0.1}}$$

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

Statistically Significant Data
PGB Rounds 241/242 (64-28p)

- 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)

Outcome:

- 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 proposed 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).

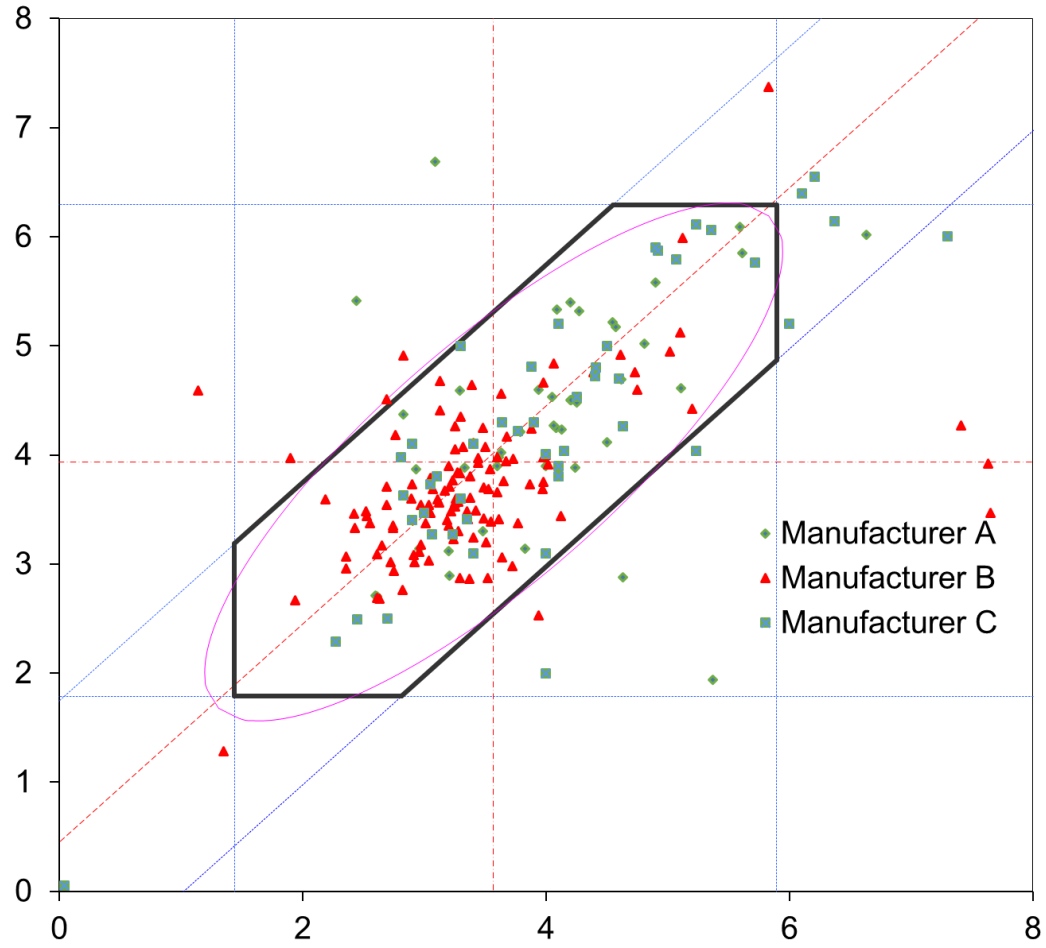
Results from PGB 243/244

(PG 64-22)
(evaluation using Welch-t)

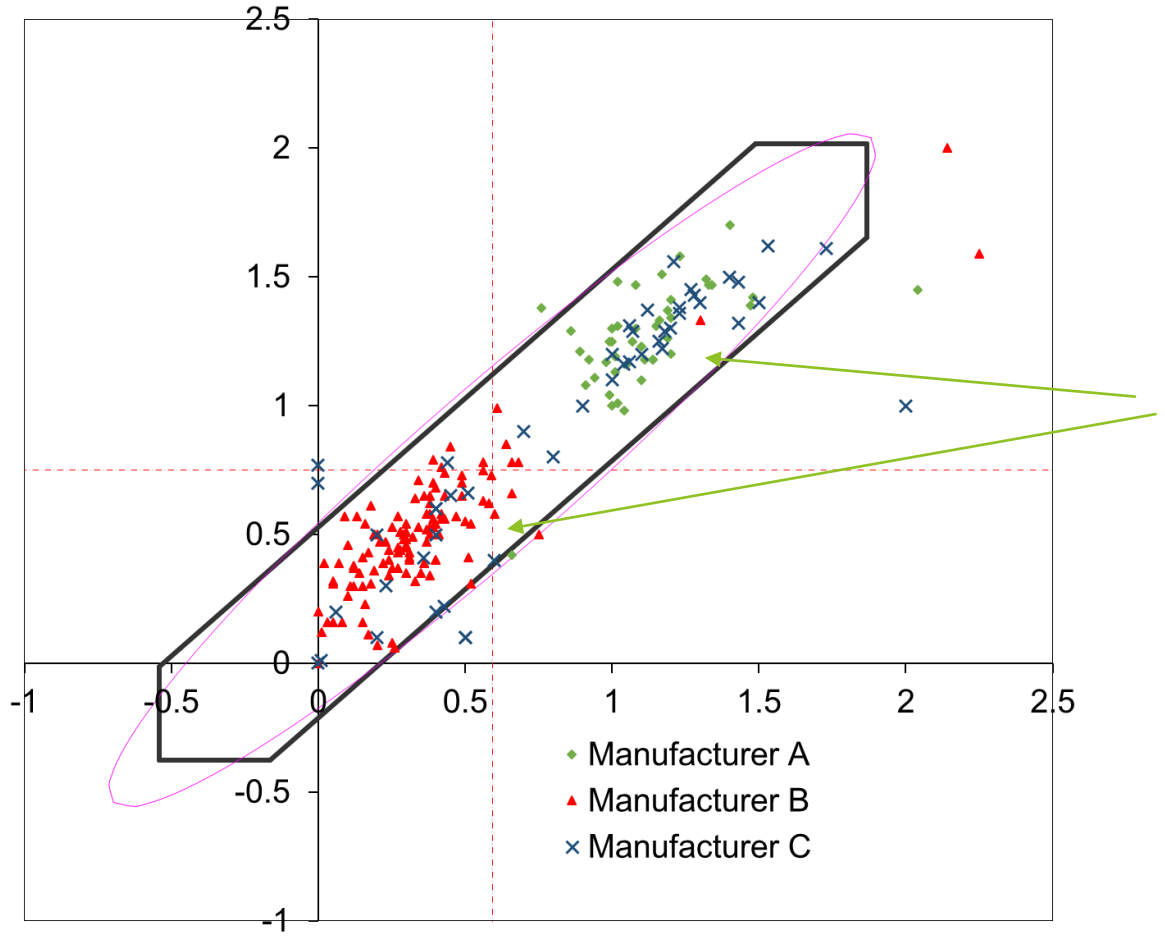
- Statistical significance exists between manufacturers for the following parameters:
  - % recovery at 0.1 kPa (all manufacturers)
  - % recovery at 3.2 kPa (all manufacturers)
  - % difference in recovery (all manufacturers)
  - % difference in jnr (all manufacturers)

Scatter Plots

(Percent Recovery at 0.1 kPa)



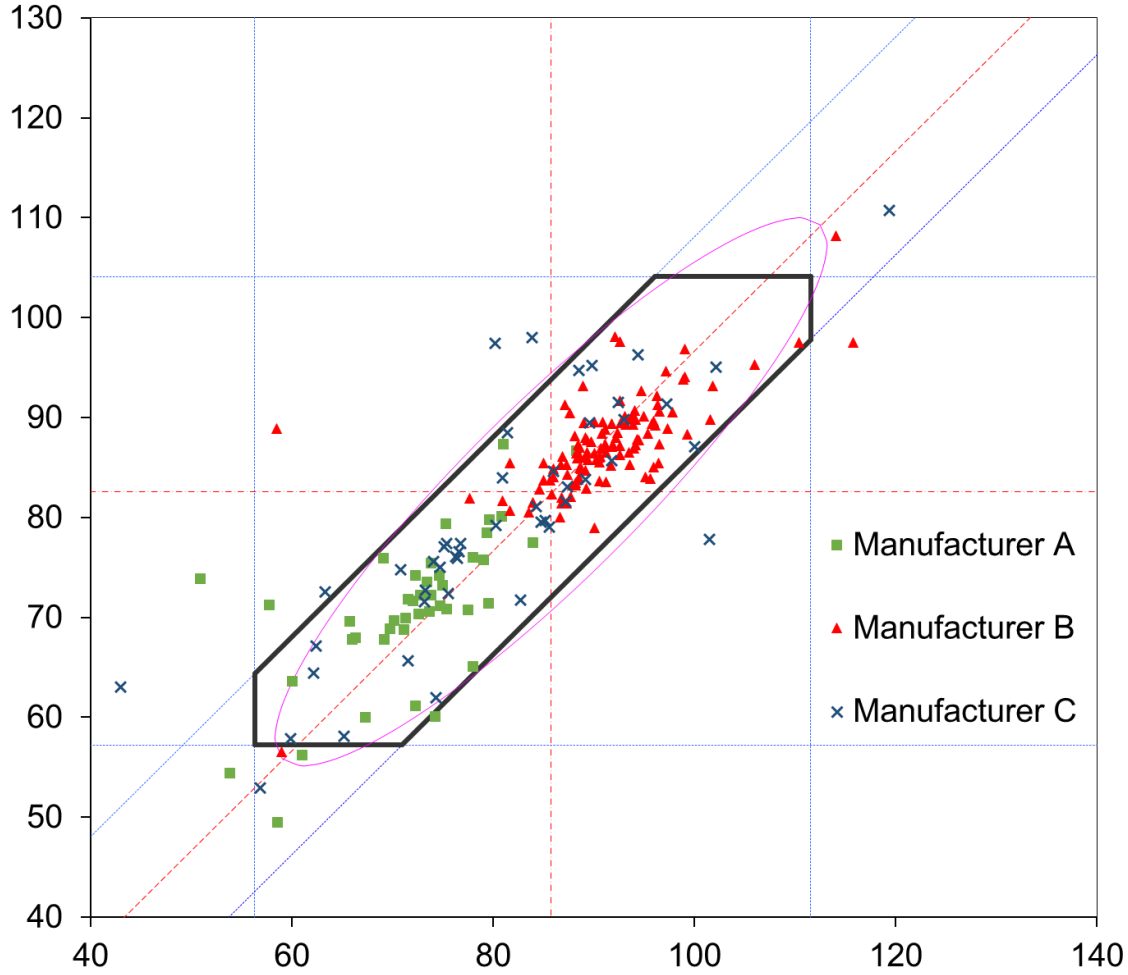
Percent Recovery at 3.2kPa



Bi-modal distribution

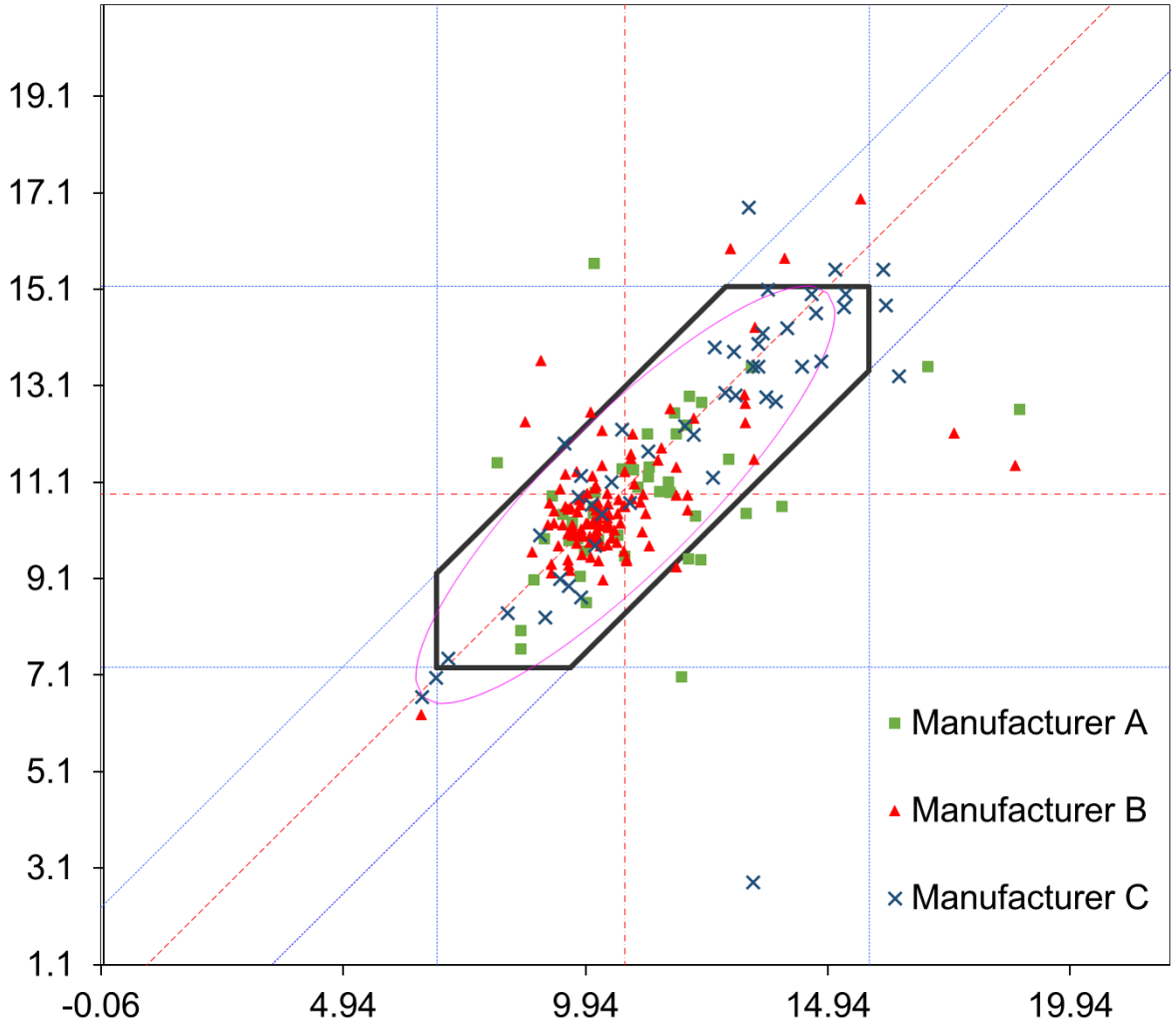
Ratings were suppressed

Percent Difference in Recovery



Bi-modal distribution
Ratings suppressed

Percent Difference in jnr



Discussion:

- Contacted DSR Manufacturers to cross reference the reported versions.
  - Communication indicates that laboratories are not certain on what type of software they have.
  - DSR manufacturers are reaching out to customers to ensure that software is being updated to the most current versions.
- AASHTO re:source Assessments:
  - Identifying devices w/o most current software.
  - Assessors are looking for the data to determine if conditioning cycles are being used.
  - Implemented in 2014 – tour cycle is close to 30 months (6 month lag)

Options

- Collect data based off of the correct software versions.
  - Be more clear in specialized sample round instructions.
- New RTFO sample vs. tested RTFO DSR sample with “rest” period (AASHTO and ASTM allow both)
- Revise the standards to require most current version of software from the manufacturer
- Any suggestions?

Developing Precision Estimates

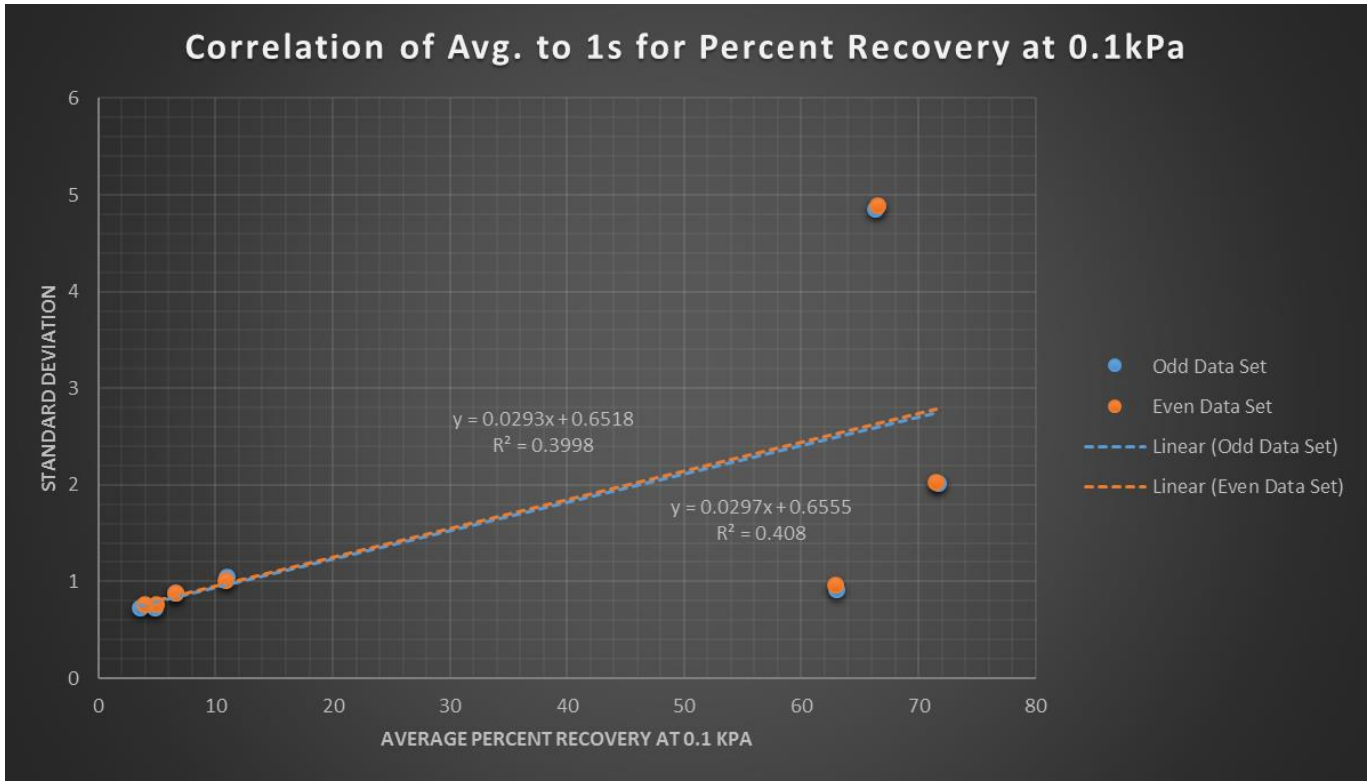
- Manner of expression of estimates (AASHTO and ASTM):
  - Standard deviation with 95% confidence interval
  - Coefficient of Variation expressed as a percentage
- Regression analysis:
  - Plot sample averages vs. the standard deviation and analyze with regression
    - Evaluate the points
    - Evaluate the r^2 value
- Determine the manner of expression
  - High r^2 = use % CV, low r^2 = use 1s

Binder Rounds and Type

Sample ID	No. of Participants	PG Grade	MSCR Grade
229 & 230	150	70-28 (p)	70-28(H)
233 & 234	163	82-22 (p)	FAILED*
235 & 236	181	58-28	58-28(S)
237 & 238	181	70-22	70-22(S)
239 & 240	196	64-22	64-22(H)
241 & 242	207	58-28 (p)	58-28(H)
243 & 244	209	64-22	64-22(S)
* % Diff in Jnr was >75%			

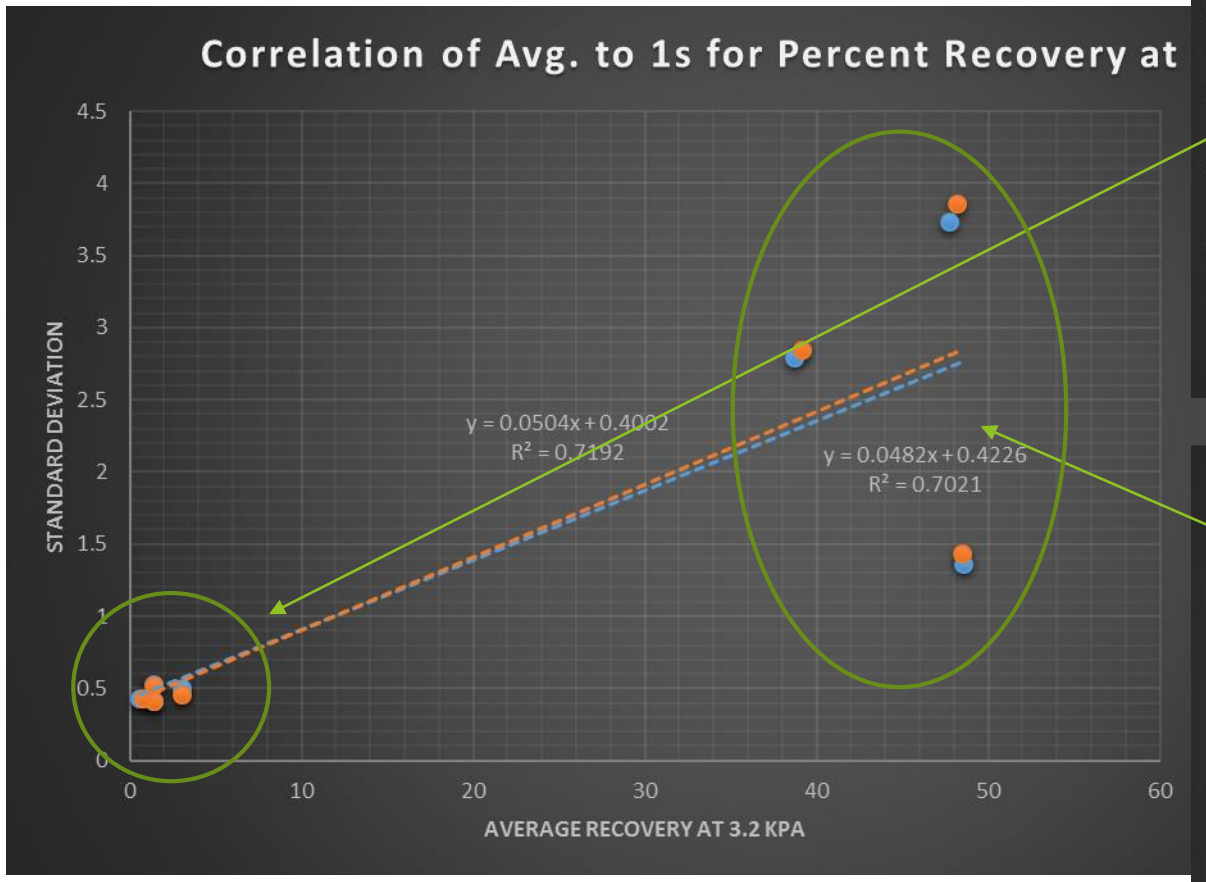
Estimates From MSCR Test Parameters

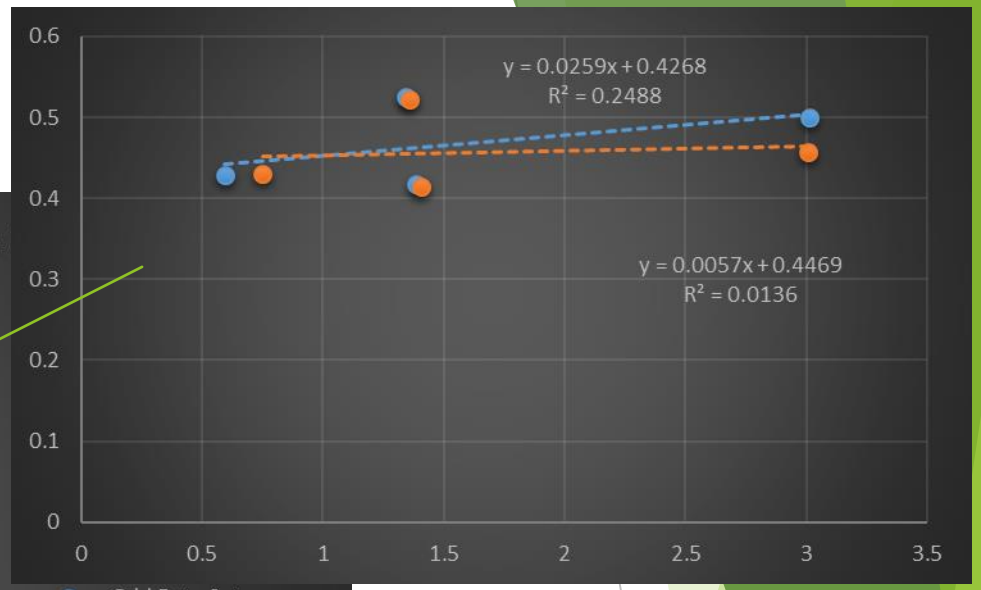
- Percent Recovery at 0.1 kPa

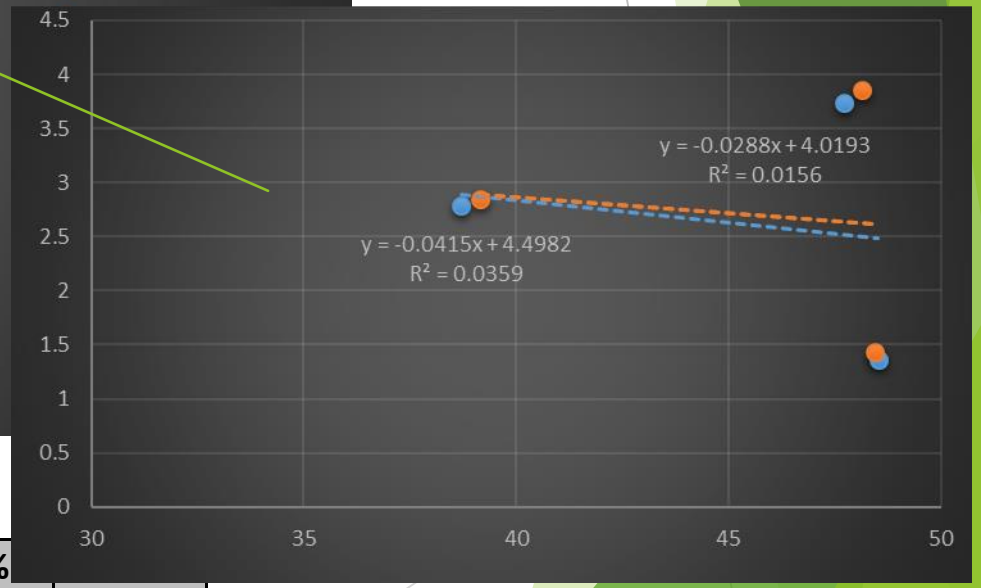


	1s	d2s
Single Operator	0.72	2.0
Inter-laboratory	3.14	8.8

- Percent Recovery at 3.2 kPa



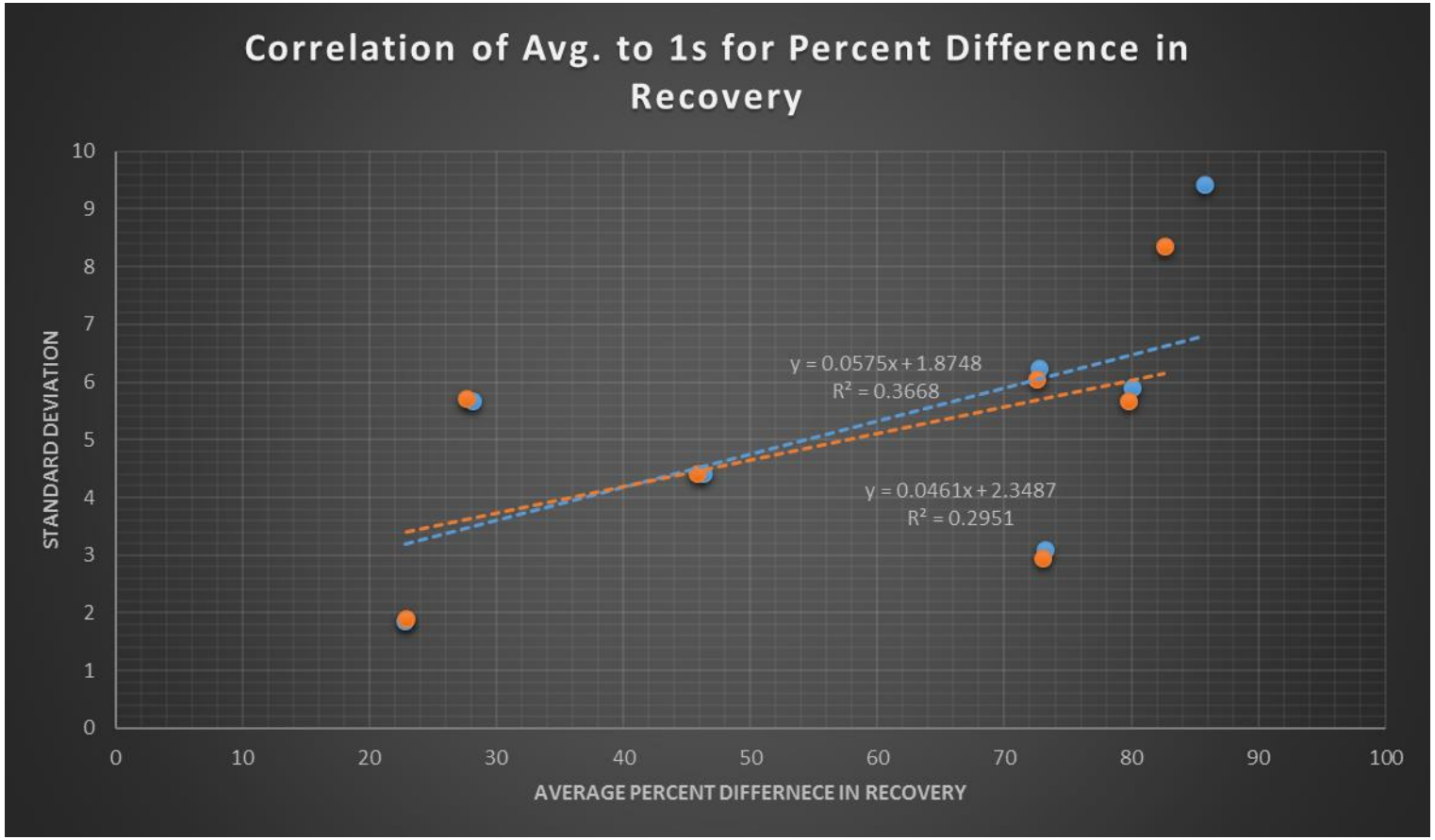




	1s	d2s
Single Operator	0.85	2.4
Inter-laboratory	2.68	7.5

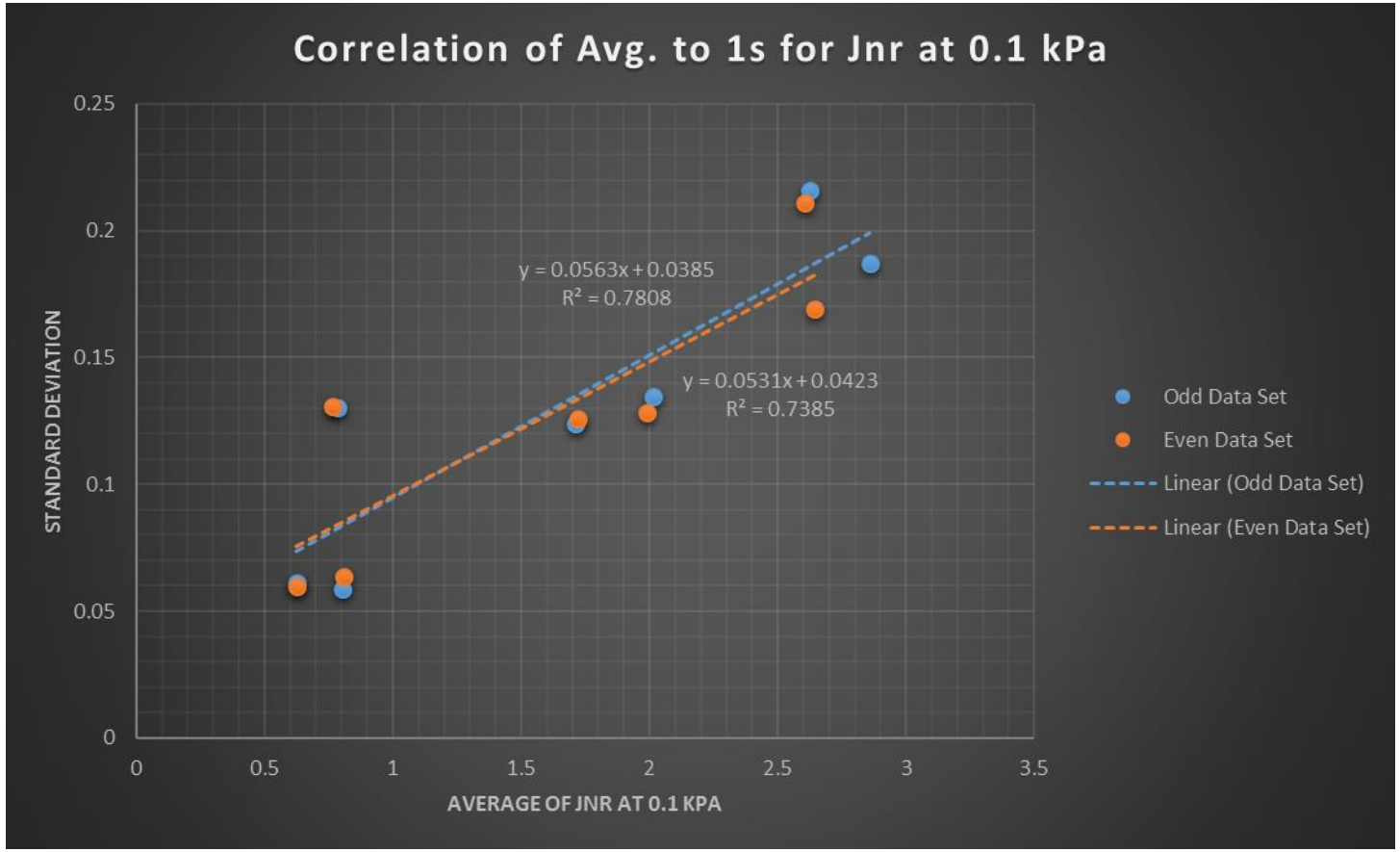
	1s%	
Single Operator	5.99	16.8
Inter-laboratory	23.90	66.9

- Percent Difference in Recovery



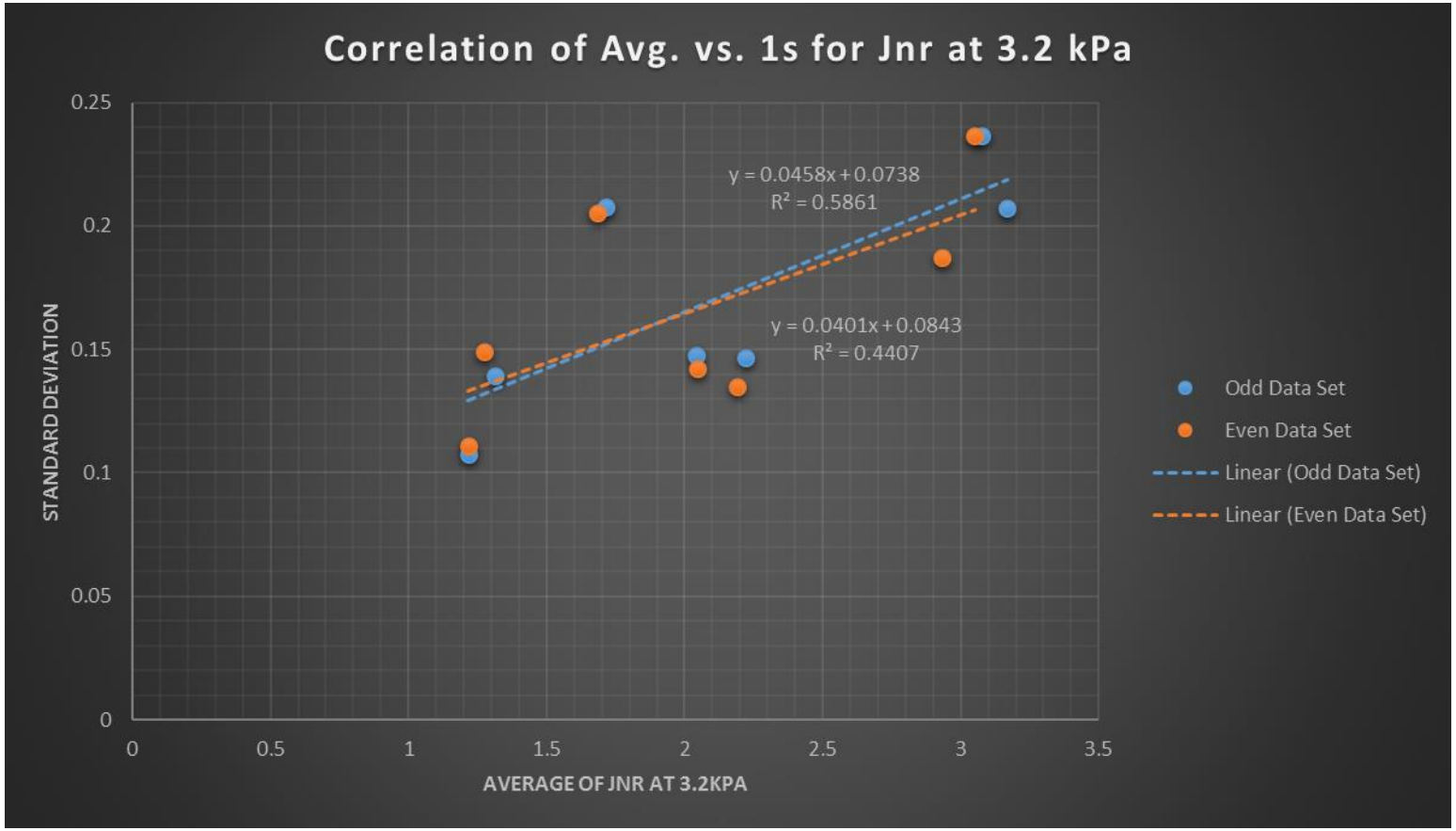
	1s	d2s
Single Operator	1.86	5.2
Inter-laboratory	7.90	22.1

- Jnr at 0.1 kPa



	1s%	d2s%
Single Operator	3.61	10.1
Inter-laboratory	8.99	25.2

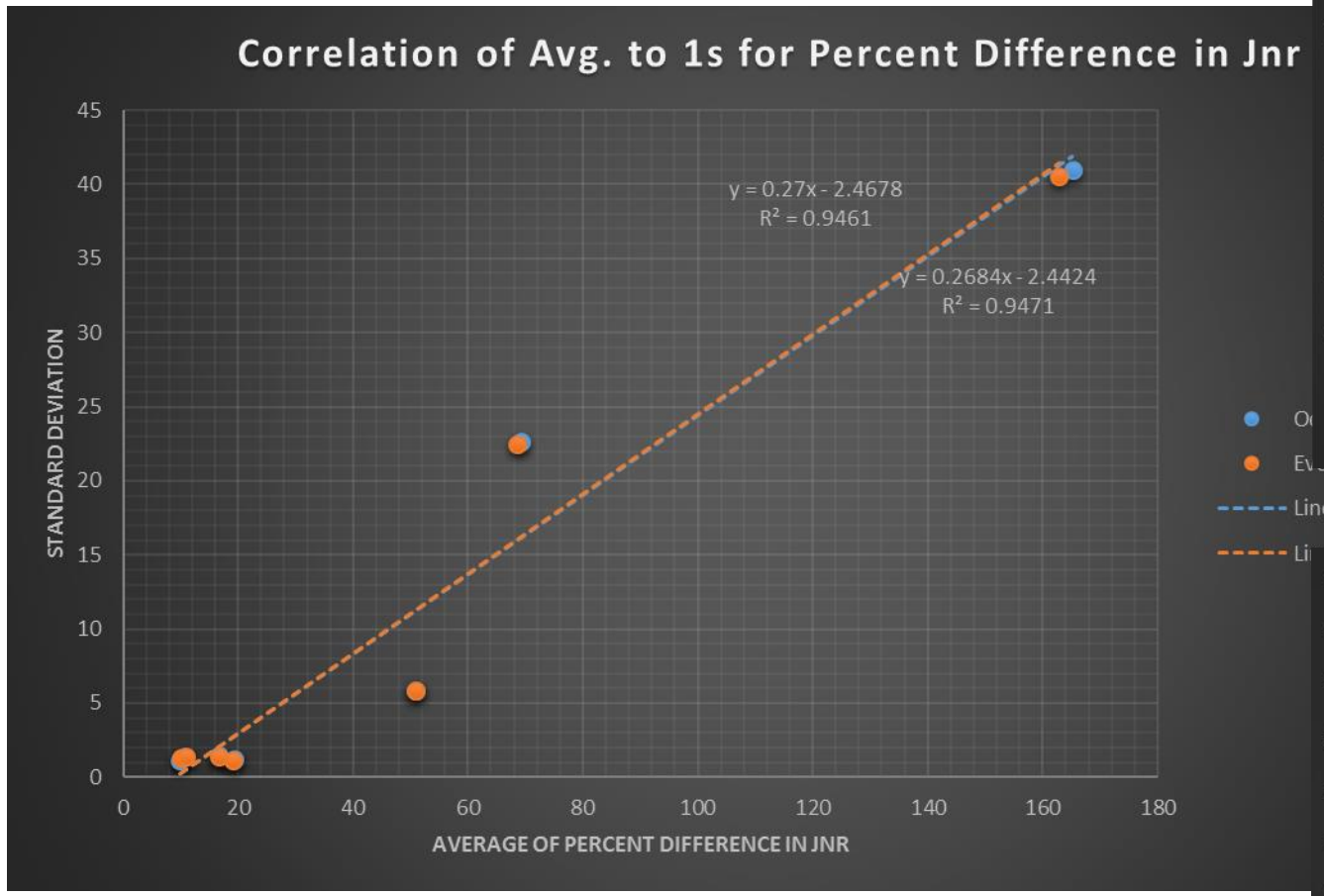
- Jnr at 3.2 kPa

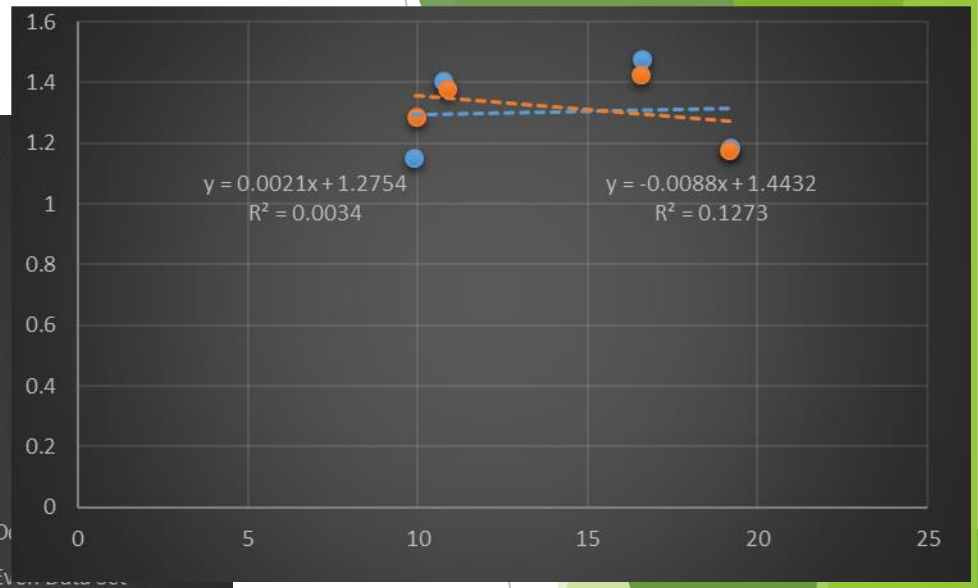


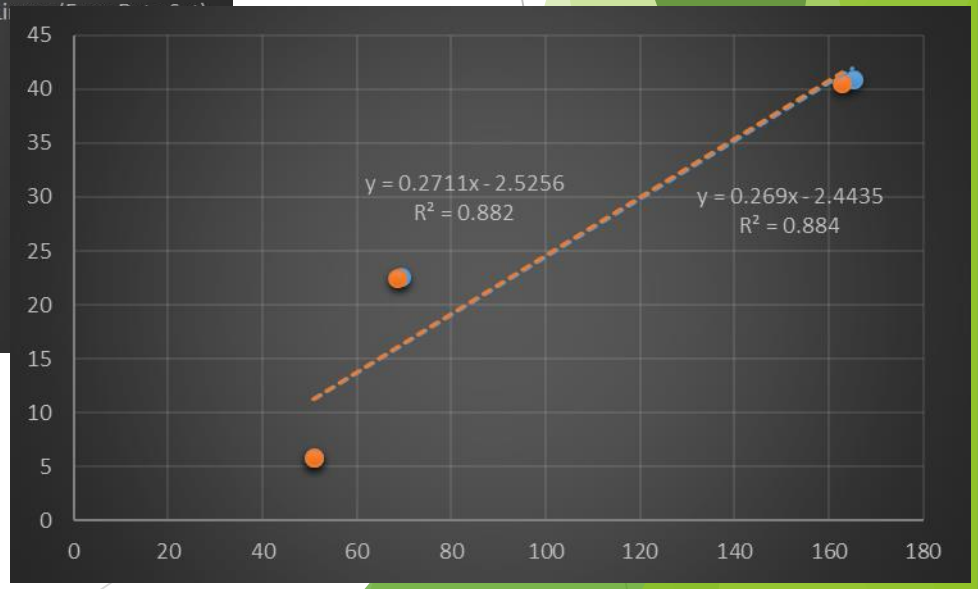
	1s	d2s
Single Operator	0.08	0.2
Inter-laboratory	0.23	0.6

	1s%	d2s%
Single Operator	3.69	10.3
Inter-laboratory	8.56	24.0

- Percent Difference in Jnr







	1s%	d2s%
Single Operator	4.6	12.9
Inter-laboratory	15.6	43.7

	1s	d2s
Single Operator	3.36	9.4
Inter-laboratory	24.67	69.1

Results and Conclusion

- Evaluation of data sets is not clear:
  - Use 1s or %CV appears to be dependent on test parameter and on the material (modified vs. unmodified)
- Combination of 1s or %CV may be needed for different materials

Thank You!

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