Daimler Surveillance Panel Meeting Minutes

August 9, 2022
10:00 AM – 11:00 AM CST

Call Participants:
Lubrizol - Andrew Stevens (Chairman), Patrick Joyce, John Loop, Robert Slocum
Southwest Research Institute – Jose Starling (Secretary), Travis Kostan, Robert Warden
Intertek – Josh Ward, Joe Franklin
Daimler - Suzanne Neal
Afton –Cory Koglin, Joseph Hoehn, Bob Campbell
Infineum - David Brass, Elisa Santos
TEI – Derek Grosch
Chevron Oronite – David Lee, Josephine Martinez, Shawn Whitacre
TMC – **Sean Moyer**
Haltermann Solutions – Prasad Tumati
ExxonMobil – Paul Rubas

Agenda Items

Andrew Stevens made the motion to approve the meeting minutes from the June 2, 2021 meeting. Jose Starling seconded the motion. No comments on the motion. The motion carried.

Update to DD13 SP Chair: Andrew Stevens from Lubrizol will be stepping down as SP Chair and Robert Slocum who will be the DD13 Test Engineer at Lubrizol will be the new SP Chair in place of Andrew. This will be the last meeting attended by Andrew for the DD13 SP.

DD13 PC-12 Discussion – Surveillance Panel

DD13 Statistician Support - DD13 is under consideration for the PC-12 category through NCDT and there are several statistical questions and requests that need to be completed for this process. Suzanne asked if there were any statisticians that would be willing to volunteer to help with the necessary analysis moving forward. Elisa Santos, Travis Kostan and Jo Martinez all volunteered to help in any way they could.

NCDT Questions and Test Development Review: It was asked by NCDT if the SP at the time of the precision matrix was looked at and if they were looked at why was no transformation implemented.

A presentation from 2016 by Kevin O'Malley who is no longer at Lubrizol was shown at the meeting (see attached) and presented by Patrick Joyce. The slides in this presentation outline the data from the three active labs at that point who participated in the precision matrix for the test. Patrick described the various forms of analysis and transformations that Kevin likely considered during review of the data, none of which ended up being applied due to the limited data set at the time.

David Brass stated that trying to explain the various transformation in the group will likely add to the confusion. It's likely best to simply state that transformations were considered but none implemented.

The API group has some questions on how the precision matrix was completed and just wanted to make sure that the precision matrix was completed to the same level of effort as other tests.

Travis mentioned that it would likely be helpful to re-asses the reference test data to see if any updates need to be made to the precision statements. Elisa Santos volunteered to go back and take another look at all the data and present a summary of any findings to the group and also to help aid in discussion at the next NCDT meeting to be held August 23rd, 2022.

It was asked why two very similar oils (Oil X and Oil C) were utilized for the precision matrix. It was reminded that Oil X was supposed to perform differently than Oil C, however other than a few fliers it ended up performing similar to Oil C. Oil D which consistently ran out to 200 hours was not selected as a precision matrix oil due to the thought that it would misrepresent the test and its precision would be an issue.

Jo asked why there was an outlier (121 hour data point) in the precision matrix and why it was kept. It was stated that a very complete review of that test and comparison with other tests showed nothing out of the ordinary and test run to procedure.

It was also mentioned that it would be helpful to review the design of the precision matrix and be able to discuss why the matrix was designed that way (12 total tests, 3 labs, 2 oils and 2 engines). Travis stated it would be helpful to re-asses the data including results after the precision matrix to insure no changes or updates are necessary.

Walk-in Topics: None

Meeting was adjourned at 10:49 AM CST.

Next Meeting: Potentially to be scheduled for Next week, but a meeting invitation will be sent out.

DAIMLER TRUCK

Daimler Surveillance Panel – DD13 Scuffing Test

August 9th, 2022 11:00 AM to 12:00 PM EST (Virtual)

Agenda

1. Approval of 6/2/21 Minutes
2. Roll Call
   - SP Membership changes and additions
3. DD13 PC-12 Discussion
   - DD13 SP Statistician(s) Support
   - NCDT Question Review
   - Test Development Review
4. Next Steps

Update: DD13 SP Chair

Daimler Surveillance Panel Key Contacts	
Activity	SP is Active (Initiated June 2016)
SP Chair *(Update as of August 2022)*	Previous: Andrew Stevens – Lubrizol Corporation New: Robert Slocum – Lubrizol Corporation
SP Secretary	Jose Starling – Southwest Research Institute
SP OEM Representative	Suzanne Neal – Daimler Truck
SP TMC Representative	Sean Moyer
SP TEI Representative	Derek Grosch
SP Liaison	Patrick Joyce – Lubrizol Corporation

DD13 PC-12 Discussion

- PC-12:
  - DD13 is under consideration for PC-12 category through NCDT.
- DD13 SP Statistician(s) Support:
  - Previously Kevin O'Malley, Jim Rutherford, Elisa Santos
  - Current = Elisa Santos, Travis Kostan, Jo Martinez
- NCDT Questions/Requests:
  - Precision Matrix:
    - Explanation of DD13 Scuffing Test Precision Matrix and Statistical Analysis
  - Test Development Review
    - Explanation of the organizational/decision making process for precision matrix
      - i.e. DD13 ASTM Taskforce, 3 Test Labs Participated, TMC/TEI involvement and other industry representation, etc.

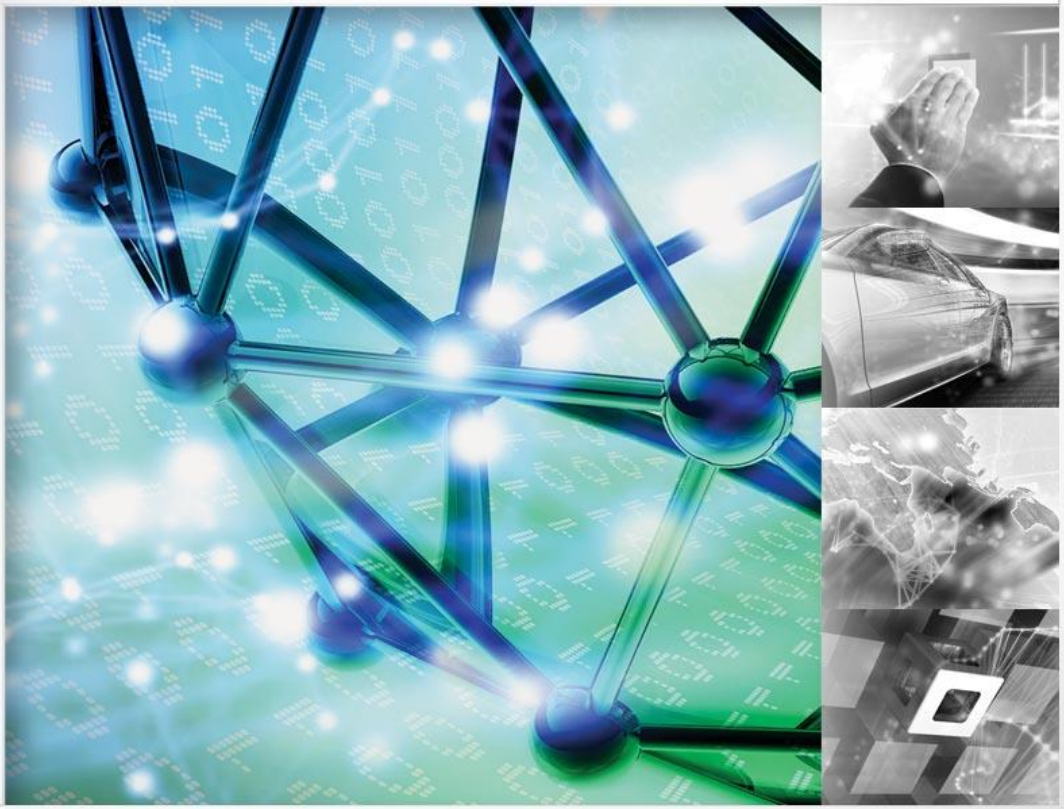
Next Steps

Next SP Meeting:

- Tuesday August 16th, 2022

NCDT Presentation:

- Tuesday August 23rd, 2022



DD13 Scuffing Test Precision Matrix Analysis

Kevin O'Malley
The Lubrizol Corporation
April 28, 2016

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DD13 Scuffing Test Precision Matrix

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12 tests:

- 3 labs
- 2 oils
- 2 engines

LZ	SwRI	IAR
Oil X Engine 1	Oil C Engine 1	Oil X Engine 1
Oil C Engine 2	Oil X Engine 2	Oil C Engine 2
Oil X Engine 2	Oil C Engine 2	Oil C Engine 1
Oil C Engine 1	Oil X Engine 1	Oil X Engine 2

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DD13 Scuffing Test Precision Matrix Results

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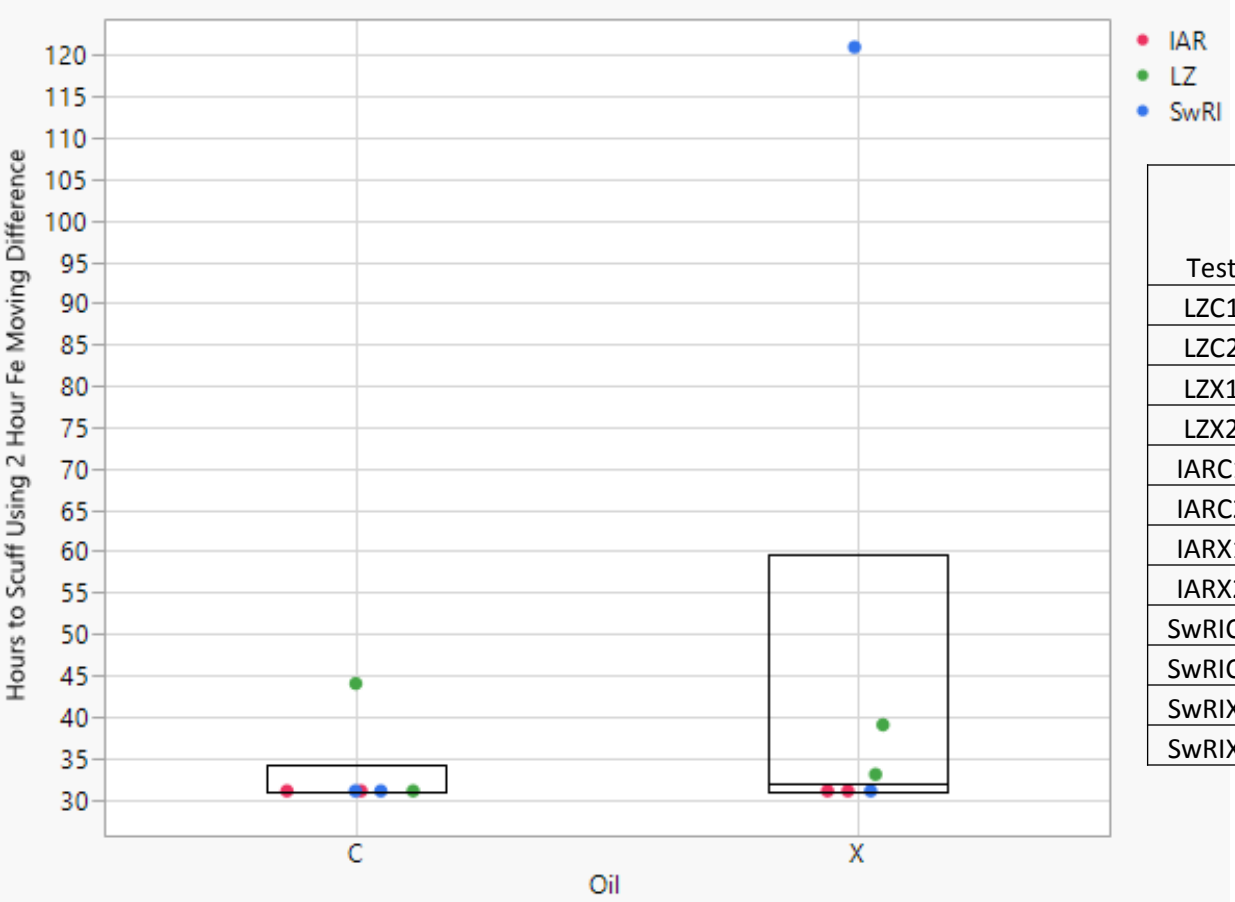

Test	Oil	LAB	Engine	Hours to Scuff Using 2 Hour Moving Difference
LZC1	C	LZ	2	31
LZC2	C	LZ	1	44
LZX1	X	LZ	1	33
LZX2	X	LZ	2	39
IARC1	C	IAR	2	31
IARC2	C	IAR	1	31
IARX1	X	IAR	1	31
IARX2	X	IAR	2	31
SwRIC1	C	SwRI	1	31
SwRIC2	C	SwRI	2	31
SwRIX2	X	SwRI	2	31
SwRIX3	X	SwRI	1	121

Oil X appears to have higher variability which is heavily influenced by the result of SwRIX3

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DD13 Scuffing Test
Precision Matrix Results

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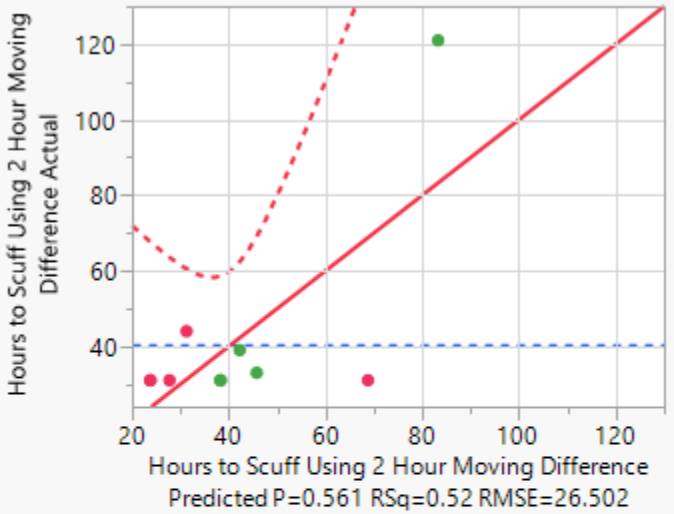
Actual by Predicted Plot



Summary of Fit

RSquare	0.517147
RSquare Adj	-0.06228
Root Mean Square Error	26.50189
Mean of Response	40.41667
Observations (or Sum Wgts)	12

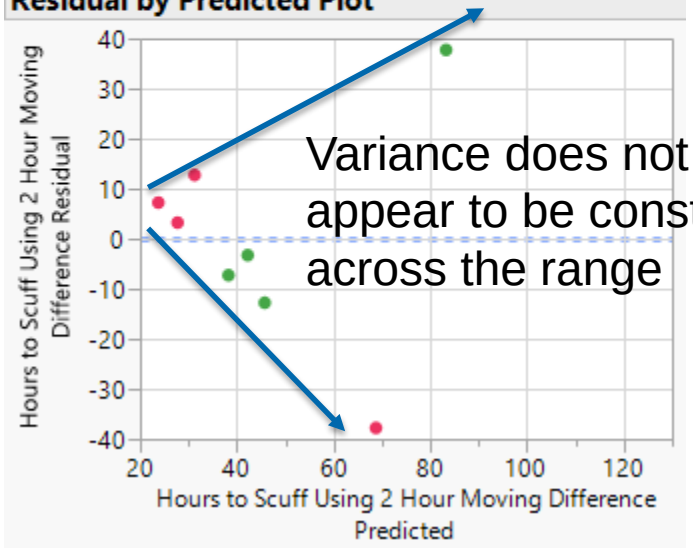
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	6	3761.1667	626.861	0.8925
Error	5	3511.7500	702.350	Prob > F
C. Total	11	7272.9167		0.5610

Effect Tests

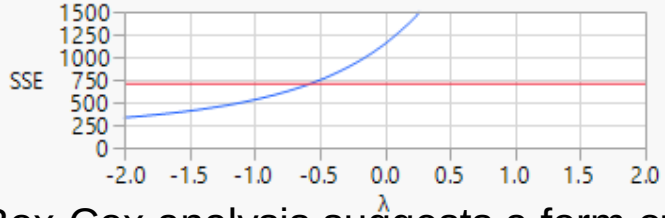
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Oil	1	1	630.7500	0.8981	0.3868
LAB	2	2	1093.1667	0.7782	0.5079
Engine[LAB]	3	3	2037.2500	0.9669	0.4770

Residual by Predicted Plot



Variance does not appear to be constant across the range

Box-Cox Transformations



Box-Cox analysis suggests a form of $\frac{1}{Y^2}$ as the best transformation based on these data

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DD13 Scuffing Test Transformation Selection

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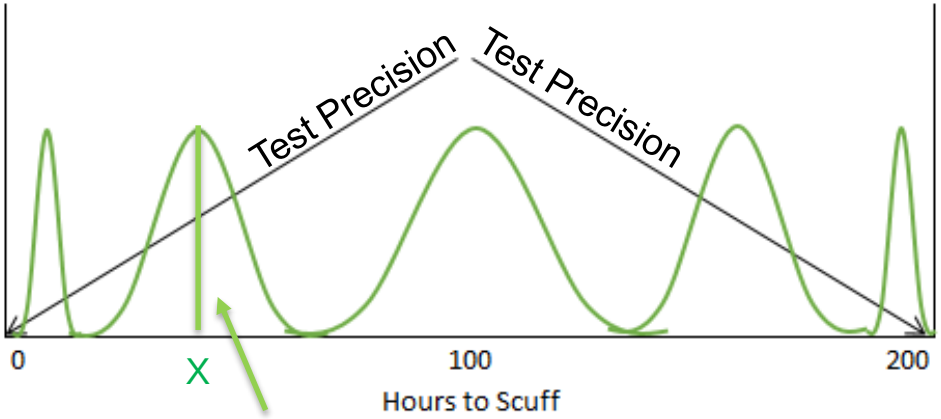
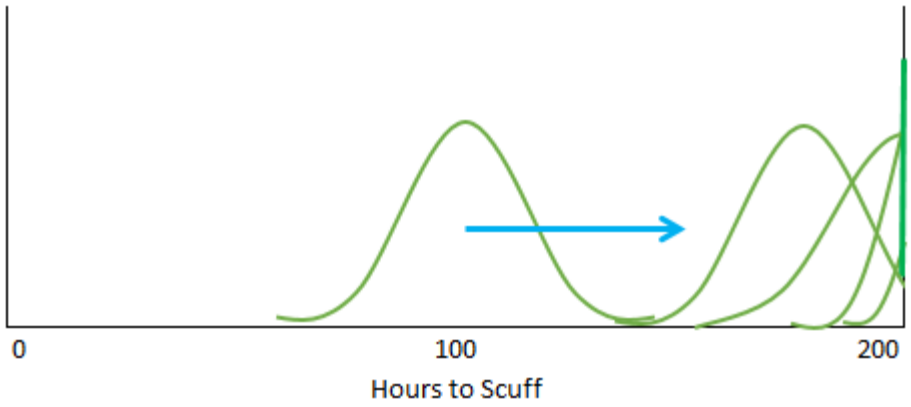
Test precision highest in the middle; lower at extremes



Distribution of test results from oil whose true mean is X

This approach makes sense because the range is bounded?



Consider what happens to the distribution of test results as an oil's mean approaches 200.
The observed variance in the reported results decreases.

A similar point can be made as an oil's mean approaches 0.

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DD13 Scuffing Test Transformation Selection

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Some Transformations:

Transformation	$\text{Arcsine}\left(\sqrt{\frac{Y}{200}}\right)$	$\ln\left(\frac{Y}{(201-Y)}\right)$
Oil C Standard Deviation	0.0341	0.1754
Oil X Standard Deviation	0.1943	0.8418
% Difference in Std Dev	469.6	379.8
Standard Deviation	0.1391	0.6063
Back transformation	200*Sine(x)^2	$\frac{201e^x}{(1+e^x)}$

Other transformations were considered, but they induce additional complexities if implemented

Y=Hours to Scuff; X = Transformed Hours to Scuff

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DD13 Scuffing Test Transformation Selection

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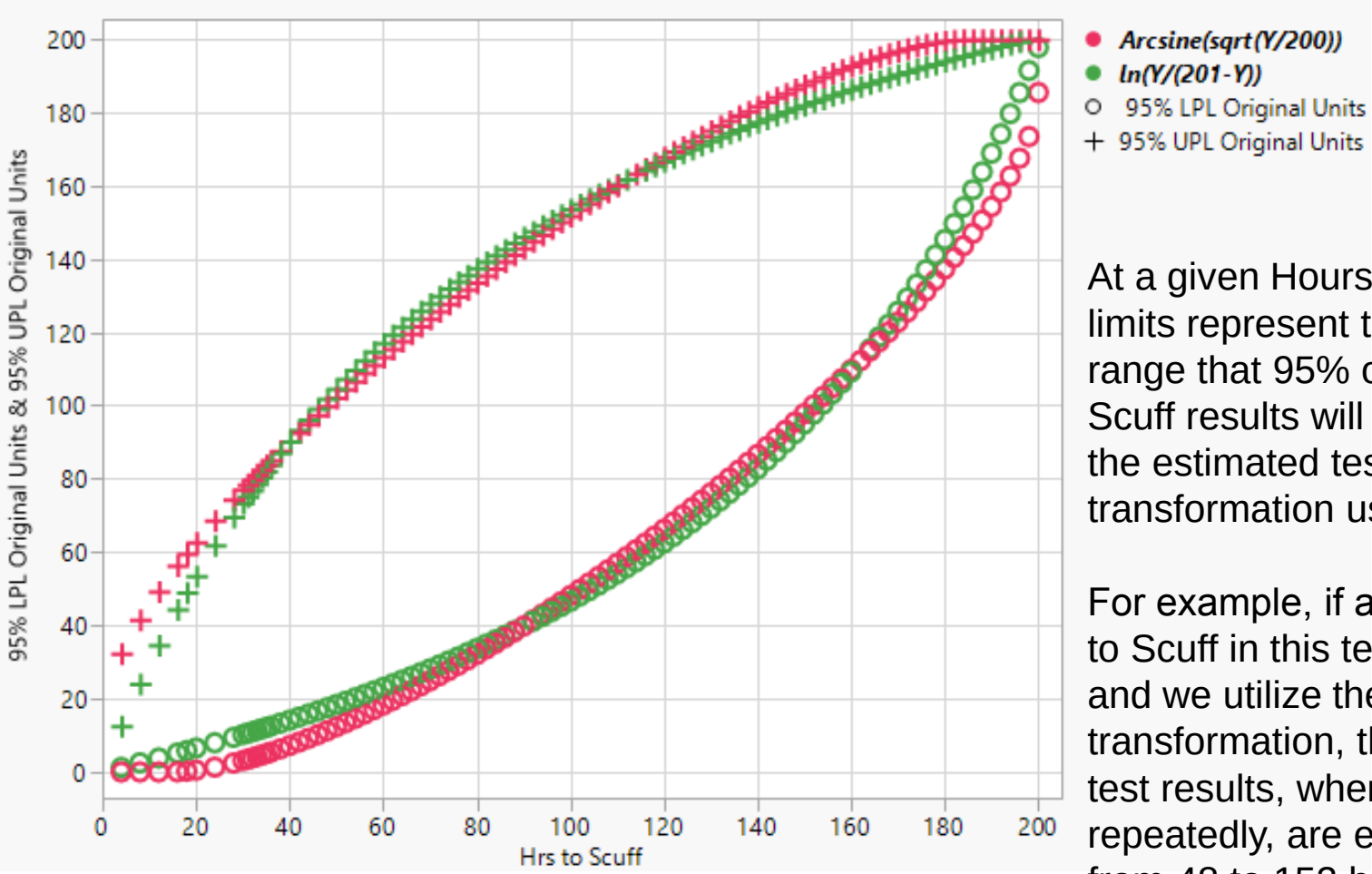

At a given Hours to Scuff, the 95% limits represent the expected range that 95% of the Hours to Scuff results will fall in based on the estimated test precision and transformation used.

For example, if an oil's true Hours to Scuff in this test is 100 hours and we utilize the arcsine transformation, then 95% of the test results, when this oil is tested repeatedly, are estimated to span from 48 to 152 hours.

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DD13 Scuffing Test Transformation Selection

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Application of ASTM defined precision:

Transformation	$s_{i.p.}$ in transformed units	Intermediate Precision Limit (i.p.) in transformed units	First Set of Test Results		Second Set of Test Results		Third Set of Test Results		Fourth Set of Test Results	
			Test Result 1	Test Result 2	Test Result 1	Test Result 2	Test Result 1	Test Result 2	Test Result 1	Test Result 2
$\text{Arcsine}(\sqrt{\frac{Y}{200}})$	0.1391	0.3856	4	51	200	172	100	30	100	170
ln(Y/(201-Y))	0.6063	1.6806	4	20	200	196	100	31	100	169

Intermediate Precision Conditions – Conditions where test results are obtained at the same laboratory with the same test method using the same oil, with changing conditions such as operators, measuring equipment, and time.

Intermediate Precision Limit (i.p.) – The difference between two transformed results obtained under intermediate precision conditions that would, in the long run, in the normal and correct conduct of the test method, exceed the value only in one case in twenty.

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DD13 Scuffing Test
Matrix Analysis at Apr 4th-5th Face-to-Face

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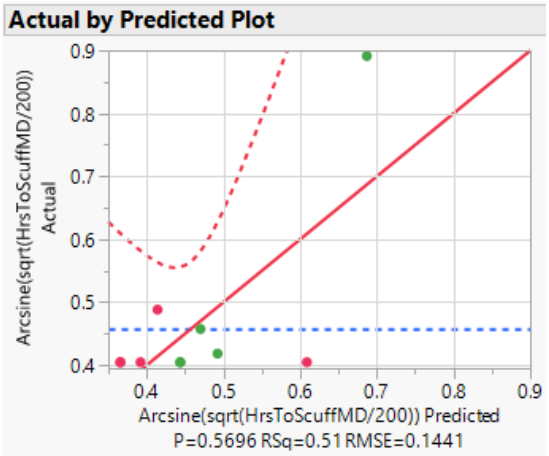

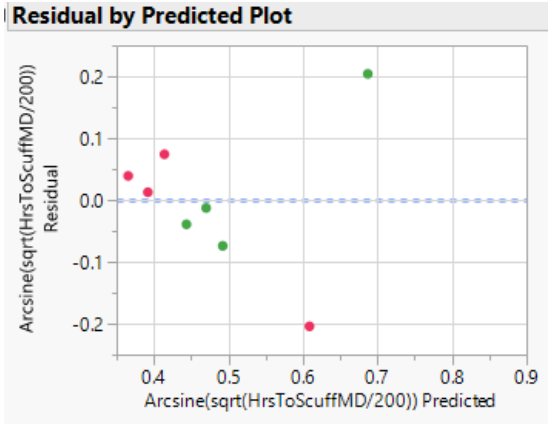

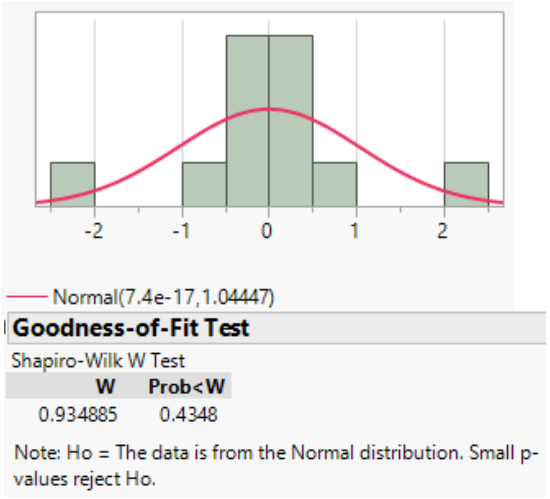

Summary of Fit

RSquare	0.5123
RSquare Adj	-0.07294
Root Mean Square Error	0.144107
Mean of Response	0.45769
Observations (or Sum Wgts)	12

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Oil	1	1	0.01835626	0.8839	0.3903
LAB	2	2	0.03104186	0.7474	0.5200
Engine[LAB]	3	3	0.05967291	0.9578	0.4804

Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
C	0.41857891	0.05883130	0.418579
X	0.49680137	0.05883130	0.496801

Least squares means used as oil targets; estimates are consistent with model only containing oil effect as well as mean of raw transformed data

No significant effect of oil, lab or engine
(this is consistent across the various transformations)

Since oil, lab, and engine were not found to significantly affect hours to scuff, the standard deviation of the transformed results was used for oil targets and test precision (0.1391)

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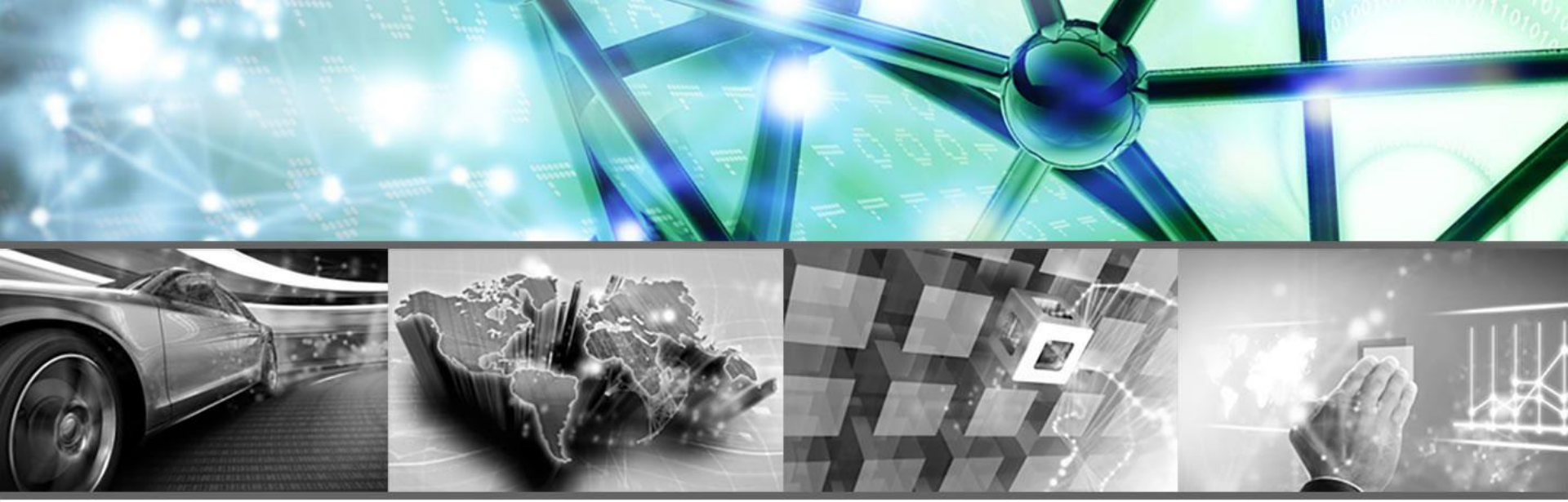

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When your company and ours combine energies, great things can happen. You bring ideas, challenges and opportunities. We'll bring powerful additive and market expertise, unmatched testing capabilities, integrated global supply and an independent approach to help you differentiate and succeed.

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