

MSCR Demistified & re:Source (AMRL) Concerns Revisited

Prepared for the PCCAS

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Excerpts from ETG 2017 Meeting; Salt Lake City

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

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Excerpts from ETG 2017 Meeting; Salt Lake City

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)

Excerpts from ETG 2017 Meeting; Salt Lake City

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)
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
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

Excerpts from ETG 2017 Meeting; Salt Lake City

Looking for Bias or Something: (Posed by DSR Manufacturer)

- ▶ 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.

Excerpts from ETG 2017 Meeting; Salt Lake City

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 is to the ATG is to **not** evaluate % difference in recovery and % difference in J_{nr} for accreditation purposes.
 - ▶ Still look at % 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)

Excerpts from AMAP 2017 Meeting

Multi-Stress Creep and Recovery Test Method New Specification

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Excerpts from AMAP 2017 Meeting

Issues with Adoption of the MSCR

- Many highway agencies are adopting the MSCR specification over the past year.
- In general, this has been a smooth transition. However, in a few locations, issues have arisen leading to a rocky transition.
- One of the major issues involves the criteria for Jnr diff.
- Several new concepts are being explored to better evaluate the potential for stress sensitivity and how to apply it in the specification.

Excerpts from AMAP 2017 Meeting

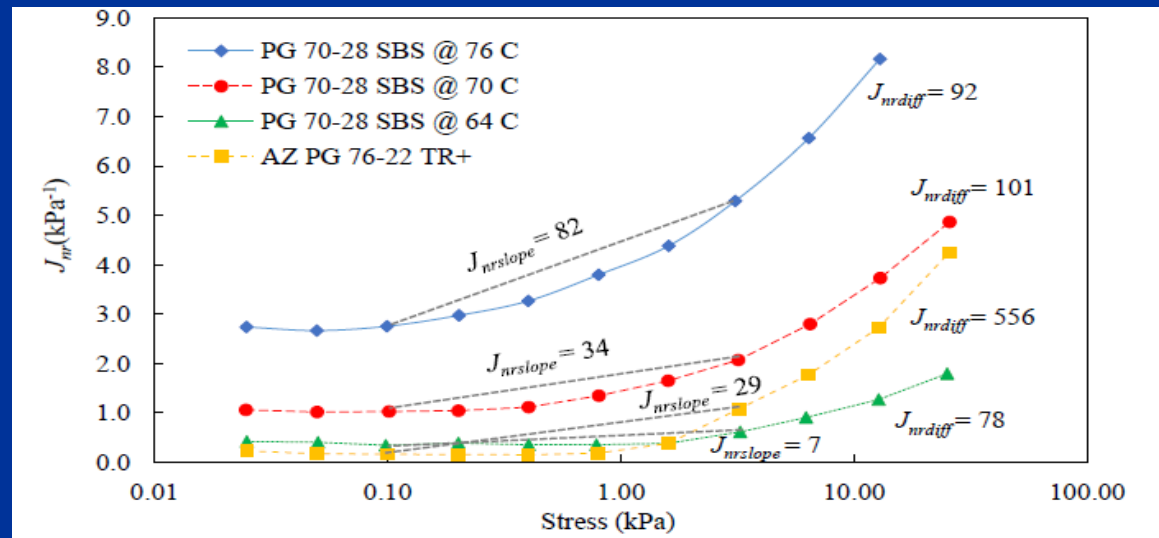
Issues with Jnr diff

- Issue one
 - Labs which have 4's or 5's on Jnr values have 1's on Jnr diff.
 - AASHTO issue they used the wrong analysis.
- Issue two
 - Highly modified binders with large recoveries.

Excerpts from AMAP 2017 Meeting

New Arizona State Procedure

- Slope is less affected by small number.
- $(J_{nr \text{ high}} - J_{nr \text{ low}}) / (\text{stress high} - \text{stress low})$



Excerpts from AMAP 2017 Meeting

Correction of Jnr Diff

- Increase the low stress from .1 to .8 kPa still in the linear range for most AC's
- Consider going to Jnr slope Arizona procedure.

What's All This Mean?

- › These concerns with **%diff recovery** and **%diff Jnr** have been raised to the Binder ETG
- › A task group is working with AMRL to make some language changes in T350 to provide a formal solution
- › FHWA is working with the Asphalt Institute, as well
- › **AMRL accreditation will not be in jeopardy based on these results**
- › Overall goal is to get M332 implemented across all regions
 - *“Just because the cup’s chipped doesn’t mean we can’t drink from it”* Matt Corrigan

The PCCAS Regional Survey

- › **DSR Software; AASHTO tests to T315, TP70 & T350**
 - Kinexus rSpace version 1.7X (1.70 & 1.72) are current and acceptable data collection and analysis for reporting
 - Bohlin 6.5X (6.50 & 6.51) are current and acceptable data collection
 - **For MSCR Analysis & Reporting use rSpace v1.7X**
- › **Data for all raw & processed results are easily accessible**
 - Review in subsequent slides
- › **Access for user edits or modifications is available**
- › **Malvern reviews & revises its AASHTO sequences yearly**
- › **Software updates are free for the life of the instrument**
- › **Service updates software at yearly calibration visits**

Multiple Stress Creep Recovery (MSCR)

AASHTO
T350-14-UL

Please follow
the
instructions
on the
screen.

You will have
the option to
report the Jnr
Grade or the
Percent
Recovery
Analysis as a
Test Result.

kinexus

More rheology less effort

Next



Malvern MSCR Sequence; Inside the Sequence

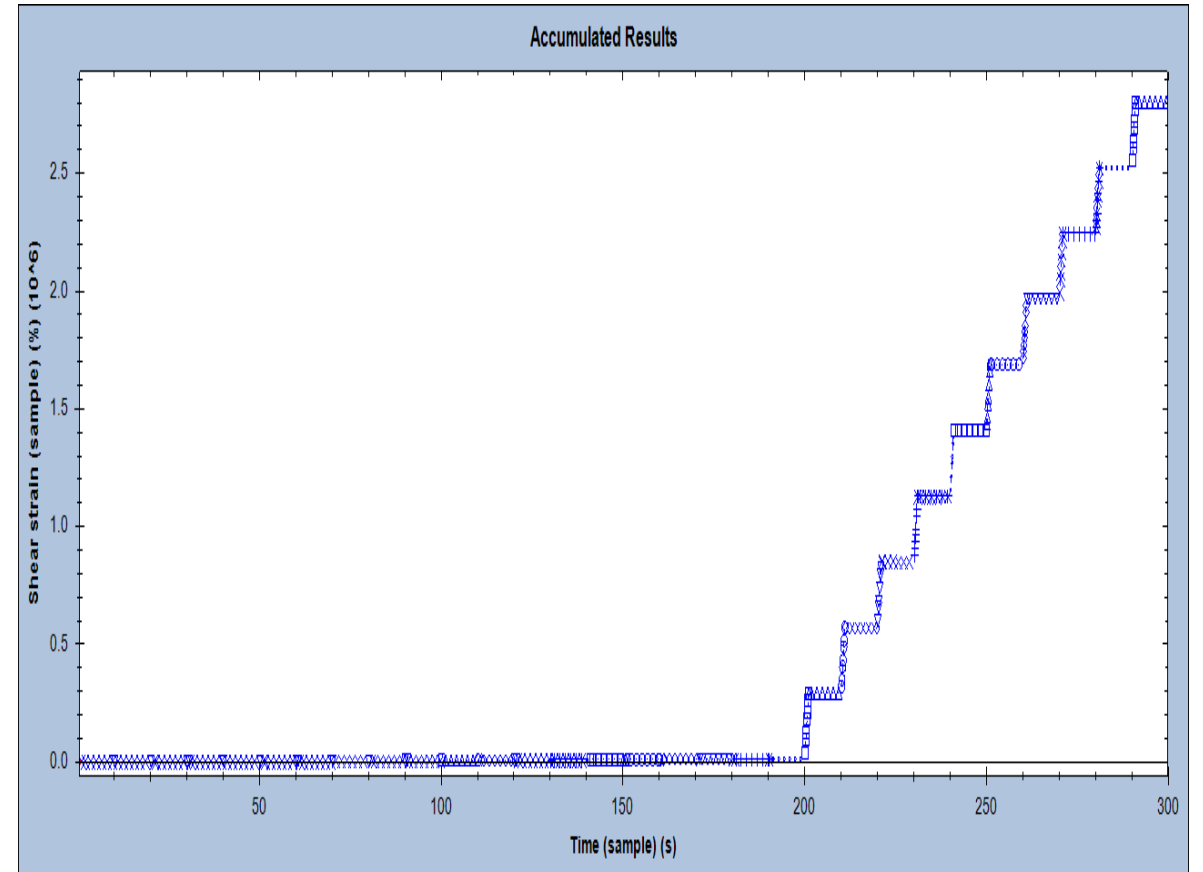
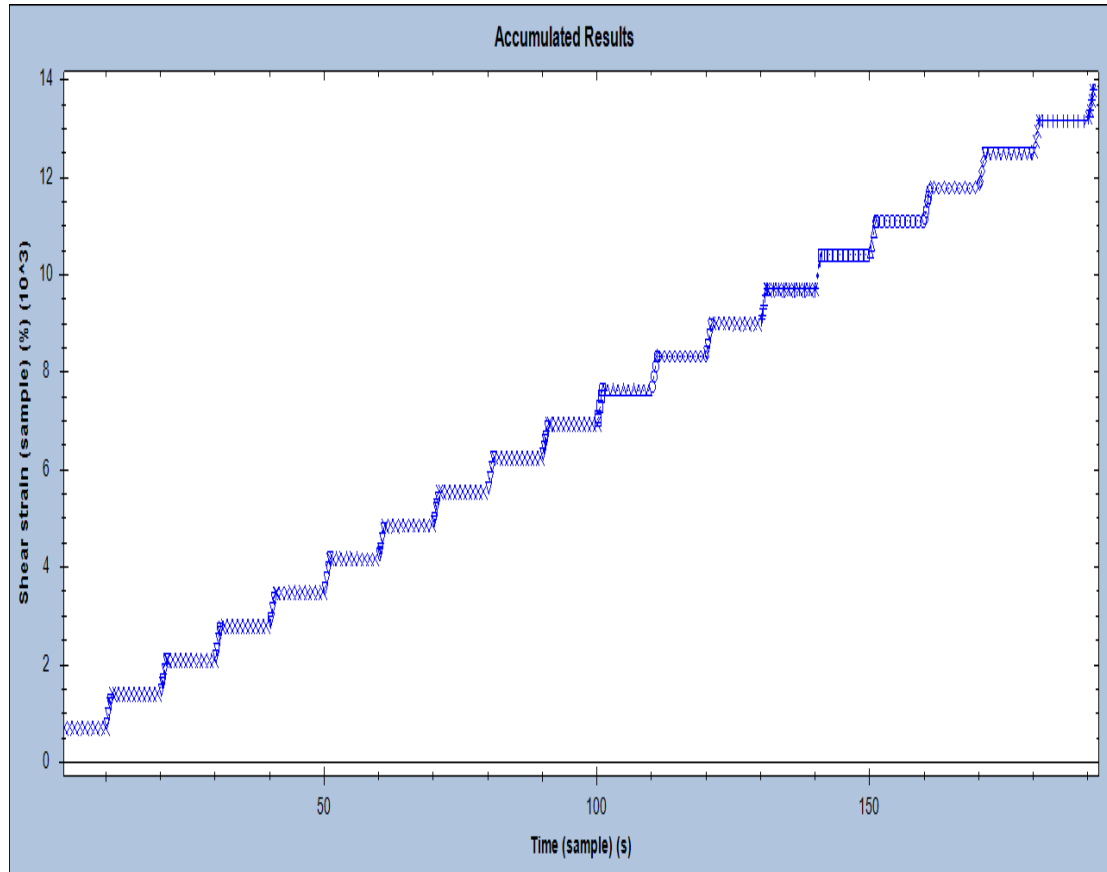
Properties	Live Display	Start Sequence	Save options	Results	Perform MCSR Data Collection	Find Points for Analysis	Perform Analysis AASHTO TP-70	MSCR elastic response and grade	Sample loading	change temperature	unload sample	Determine Jnr Grade	Full Report	Brief Report
Drag an action from the Palette list on the left to its appropriate position below. Then modify its Properties , if needed.														
Action	Enabled	Type	Comment											
Start of sequence prompt	<input checked="" type="checkbox"/>	Prompt	Sequence prompt											
Clear Test Result	<input checked="" type="checkbox"/>	Modify Value	Set Test Result to Not Tested											
Clear Test Result in Notes	<input checked="" type="checkbox"/>	Modify Value	Set Test Result to Not Tested											
Clear Passing Point	<input checked="" type="checkbox"/>	Modify Value	Set Test Result to Not Tested											
Log Plate Diameter	<input checked="" type="checkbox"/>	Modify Value	Plate diameter											
Reset test counter	<input checked="" type="checkbox"/>	Modify Value	User 18 - to monitor number of retesting											
Enter Sample Details	<input checked="" type="checkbox"/>	Enter Sample Details												
Check if Sample Loaded	<input checked="" type="checkbox"/>	Test True/ False												
False	<input checked="" type="checkbox"/>	Test True/ False												
Is Hood Open	<input checked="" type="checkbox"/>	Test True/ False	Check to see if oven open											
Run Sample Loading	<input checked="" type="checkbox"/>	Run Subsequence												
Run test	<input checked="" type="checkbox"/>	Run Subsequence												
True	<input checked="" type="checkbox"/>	Test True/ False												
Run again choice	<input checked="" type="checkbox"/>	Choose Question												
Run test (at current temperature with no time for thermal equilibrium)	<input checked="" type="checkbox"/>	Choose Question												
Run test (change temperature parameters)	<input checked="" type="checkbox"/>	Choose Question												
Clean up and Exit	<input checked="" type="checkbox"/>	Choose Question												
Prompt clean up and data deletion	<input checked="" type="checkbox"/>	Prompt												
Run Clean Up	<input checked="" type="checkbox"/>	Run Subsequence												
Sequence completed	<input checked="" type="checkbox"/>	Prompt	Informs the user that the sequence has finished...											

Perform the Data Collection

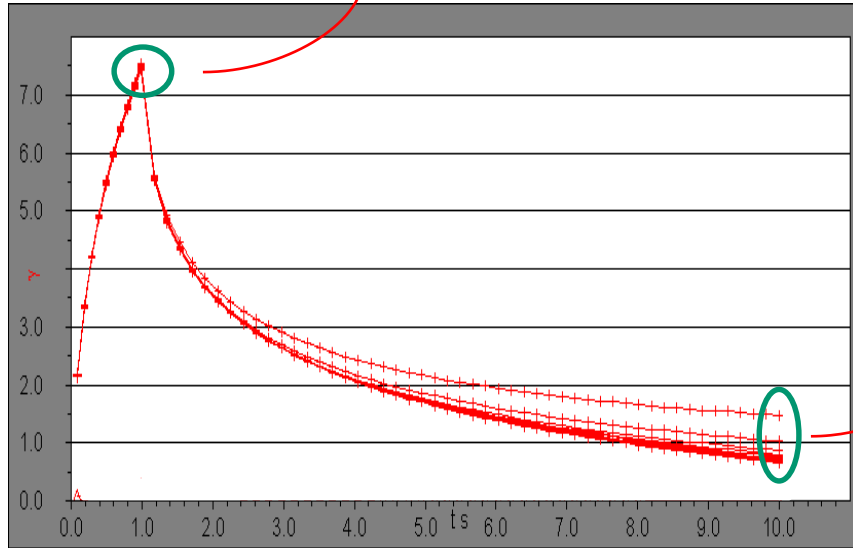
Applied Values		
Use engineering units	No	
Target shear stress	100.0	Pa
Perform recovery	Yes	
Sampling		
Linear Sampling	Yes	
Maximum sampling interval	0.00:00:00.100	
Raw data		
Raw data rate	50	
Integration time	0.00:00:00.500	
Use minimum displacement	No	
Store raw data?	Yes	
Store live data?	Yes	
Creep equilibrium settings		
Use creep equilibrium	No	
Creep end conditions		
Use maximum creep time	Yes	
Maximum creep time	0.00:00:01	
Recovery end conditions		
Use maximum recovery time	Yes	
Maximum recovery time	0.00:00:09	
Use creep dependant end time	No	

Action	Enabled	Type	Comment
Reset sample time	<input checked="" type="checkbox"/>	Reset sample time	
Loop preconditioning 10 cycles	<input checked="" type="checkbox"/>	Loop	Disable to perform AASHTO TP-70
0.1kPa precondition cycle	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (1)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (2)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (3)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (4)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (5)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (6)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (7)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (8)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (9)	<input checked="" type="checkbox"/>	Creep and Recovery	
0.1kPa creep (10)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (1)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (2)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (3)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (4)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (5)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (6)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (7)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (8)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (9)	<input checked="" type="checkbox"/>	Creep and Recovery	
3.2kPa creep (10)	<input checked="" type="checkbox"/>	Creep and Recovery	
Run Find points for analysis	<input checked="" type="checkbox"/>	Run Subsequence	

Live Feedback Display of the Results



Find Points for Analysis



Action	Enabled	Type	Comment
End creep strain 0.1kPa (1)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (2)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (3)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (4)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (5)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (6)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (7)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (8)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (9)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 0.1kPa (10)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (1)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (2)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (3)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (4)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (5)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (6)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (7)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (8)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (9)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End recovery strain 0.1kPa (10)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 3.2kPa (11)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 3.2kPa (12)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 3.2kPa (13)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	
End creep strain 3.2kPa (14)	<input checked="" type="checkbox"/>	Peak and Valley Analysis	

Perform the Analysis

Input Data | Output Parameters

Data Source
 Data Source: Active selection Sequence results

Variables
 X-variable: Time (action)
 X-variable units: s
 Y-variable: Shear strain
 Y-variable units: Strain

Filters
 X filter: No filter
 Y filter: No filter

Data selection
 Selected data

- Find Points for Analysis
 - End creep strain 0.1kPa (1)
 - Result data
 - Original data
 - End creep strain 0.1kPa (2)
 - End creep strain 0.1kPa (3)
 - End creep strain 0.1kPa (4)
 - End creep strain 0.1kPa (5)
 - End creep strain 0.1kPa (6)
 - End creep strain 0.1kPa (7)
 - End creep strain 0.1kPa (8)
 - End creep strain 0.1kPa (9)
 - End creep strain 0.1kPa (10)
 - End recovery strain 0.1kPa (1)
 - End recovery strain 0.1kPa (2)
 - End recovery strain 0.1kPa (3)

Action	Enabled	Type	Comment
Average creep strain at 0.1kPa in strain	<input checked="" type="checkbox"/>	Point Statistics	Stats for User 1
Average end strain at 0.1kPa in strain	<input checked="" type="checkbox"/>	Point Statistics	Stats for User 2
Average creep compliance at 0.1kPa in Pa-1	<input checked="" type="checkbox"/>	Point Statistics	Jc
Average end compliance at 0.1kPa in Pa-1	<input checked="" type="checkbox"/>	Point Statistics	Jr
Average Jnr	<input checked="" type="checkbox"/>	Calculate Value	User 4 Jnr
Average creep strain at 0.1kPa output	<input checked="" type="checkbox"/>	Calculate Value	User 1 E1 From point stats
Average end strain at 0.1kPa output	<input checked="" type="checkbox"/>	Calculate Value	User 2 E10 From point stats
Average recoverable strain 0.1kPa R0.1	<input checked="" type="checkbox"/>	Calculate Value	User 3 (E1 - E10) R0.1 or [user1-user2]
% recoverable strain	<input checked="" type="checkbox"/>	Calculate Value	User 5 ((E1 - E10) / E1) *100
% non recoverable strain	<input checked="" type="checkbox"/>	Calculate Value	User 6 (E10 / E1) *100
Equation	<input checked="" type="checkbox"/>	CS	Stats for User 7
Equation	<input checked="" type="checkbox"/>	CS	Stats for User 8
Equation	<input checked="" type="checkbox"/>	CS	Jc
Equation	<input checked="" type="checkbox"/>	CS	Jr
Average creep strain at 3.2kPa output	<input checked="" type="checkbox"/>	Calculate Value	User 7 E1 From point stats
Average end strain at 3.2kPa output	<input checked="" type="checkbox"/>	Calculate Value	User 8 E10 From point stats
Average recoverable strain 3.2kPa (1) R3.2	<input checked="" type="checkbox"/>	Calculate Value	User 9 (E1 - E10) R3.2 or [user7-user8]
Average Jnr 3.2k (1)	<input checked="" type="checkbox"/>	Calculate Value	User 10 Jnr
% recoverable strain 3.2k (1)	<input checked="" type="checkbox"/>	Calculate Value	User 11 ((E1 - E10) / E1) / *100
% non recoverable strain 3.2k (1)	<input checked="" type="checkbox"/>	Calculate Value	User 12 (E10 / E1) *100
% Difference in recovery	<input checked="" type="checkbox"/>	Calculate Value	User 13 ((%R0.1 - %R3.2) / %R0.1) *100 or [((user5-user11)/user5)*100]
% Difference of Jnr	<input checked="" type="checkbox"/>	Calculate Value	User 14 ((Jnr3.2 - Jnr0.1) / Jnr0.1) *100 or [((user10-user4)/user4)*100]

Equation

$$\frac{([Instrument]. [Sample]. [User Numeric 5]) - [Instrument]. [Sample]. [User Numeric 11]}{([Instrument]. [Sample]. [User Numeric 5])} * 100$$

Equation

$$\frac{([Instrument]. [Sample]. [User Numeric 10]) - [Instrument]. [Sample]. [User Numeric 4]}{([Instrument]. [Sample]. [User Numeric 4])} * 100$$

Comprehensive Reporting (*easily changed*)

Company name
Experiment Name
Material name
Sample Description
Sample ID
Batch number
Operator name
Plate diameter
Temperature control method
Temperature(°C)
Non-recoverable creep compliance at 0.1kPa (kPa-1)
Non-recoverable creep compliance at 3.2kPa (kPa-1)
Percent difference between non-recoverable creep compliance (%)
Percent recoverable strain at 0.1kPa (%)
Percent recoverable strain at 3.2kPa (%)
Percent difference between average percent recovery (%)
Average creep strain at 0.1kPa (Strain)
Average creep strain at 3.2kPa (Strain)
Average end strain at 0.1kPa (Strain)
Average end strain at 3.2kPa (Strain)
Average recoverable strain at 0.1kPa (Strain)
Average recoverable strain at 3.2kPa (Strain)
Percent non-recoverable strain at 0.1kPa (% Strain)
Percent non-recoverable strain at 3.2kPa (% Strain)
Test result
% Recoverable Strain 3.2kPa Passing Point
Notes

Co.	Malvern Instruments Ltd
Exp.	AASHTO_0007 TP-70 Multiple Stress Creep Recovery
Material	RTFO
Samp.	MSCR test with pdms
Sample id	
Batch No.	
Op.	
Dplate	25.00
Tcontroller	Peltier Dry Chamber
T(°C)	25.00
Jnr (0.1)	0.02676
Jnr (3.2)	0.04052
% Jnr diff	51.4
% R (0.1)	41.3
% R (3.2)	17.4
% Rdiff	57.8
Av E1 (0.1)	4.557E-003
Av E1 (3.2)	0.1570
Av E10 (0.1)	2.676E-003
Av E10 (3.2)	0.1297
(E1 - E10) 0.1kPa	1.881E-003
(E1 - E10) 3.2kPa	0.02736
% Enr (0.1)	58.7
% Enr (3.2)	82.6
Result	FAIL - The result fell below the comparison line at 25.0°C
PassPoint	68.9
Notes	

Co.	Malvern Instruments Ltd
Exp.	AASHTO_0007 TP-70 Multiple Stress Creep Recovery
Material	RTFO
Samp.	MSCR test with pdms
Dplate	25.00
Tcontroller	Peltier Dry Chamber
T(°C)	25.00
Jnr (3.2)	0.04052
% R (3.2)	17.4
% Jnr diff	51.4
Result	FAIL - The result fell below the comparison line at 25.0°C


Automated Analysis


Do you want to also perform the % Recovery Analysis?

Press YES to add the Analysis for % Recovery or NO to just report the Jnr Grade result.

NO = Standard reporting for Jnr (S) (H) (V) or (E) grade.

YES = % Recovery vs. Jnr to identify if the data is above the curve and report the PASS Grade. Data below the curve is reported as a FAIL.

Yes: Run %Recovery Analysis 

No: Run Jnr Grade Analysis 

Logical Sieve to Determine Jnr Grade

Target Property

- Instrument
- Sequence
 - Start Sequence
 - Results
 - Perform MCSR Data Collection
 - Find Points for Analysis
 - Perform Analysis AASHTO TP-70
 - MCSR elastic response and grade
 - Sample loading
 - change temperature
 - unload sample
 - Determine Jnr Grade
 - Look up Jnr at 3200Pa
 - Calculated value
 - Test Jnr=0 Invalid data
 - Test Jnr<4.5
 - Test Jnr>0.5
 - Test Jnr>1
 - Test Jnr>2
 - Test Jnr>4
 - Test True/ False Pass Jnr% Difference

Action	Enabled	Type	Comment
Look up Jnr at 3200Pa	<input checked="" type="checkbox"/>	Calculate V...	retrieves the Jnr from the sample properties [User 10]
Test Jnr=0 Invalid data	<input checked="" type="checkbox"/>	Test True/ ...	
False 1 Run Analysis	<input checked="" type="checkbox"/>	Test True/ ...	
Test Jnr <4.5	<input checked="" type="checkbox"/>	Test True/ ...	This set of actions test for grade compliance.
False 2 Data outside range	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result FAIL	<input checked="" type="checkbox"/>	Calculate V...	
Fail Jnr values outside the acceptable range of 4.5	<input checked="" type="checkbox"/>	Prompt	
True 2 Data in range	<input checked="" type="checkbox"/>	Test True/ ...	
Test Jnr >0.5	<input checked="" type="checkbox"/>	Test True/ ...	
False 3	<input checked="" type="checkbox"/>	Test True/ ...	
Test Jnr >1	<input checked="" type="checkbox"/>	Test True/ ...	
False 4	<input checked="" type="checkbox"/>	Test True/ ...	
Test Jnr >2	<input checked="" type="checkbox"/>	Test True/ ...	
False 5	<input checked="" type="checkbox"/>	Test True/ ...	
Test Jnr >4	<input checked="" type="checkbox"/>	Test True/ ...	
False 6	<input checked="" type="checkbox"/>	Test True/ ...	
True 6	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result Standard Grade	<input checked="" type="checkbox"/>	Calculate V...	
Pass Standard Grade	<input checked="" type="checkbox"/>	Prompt	
True 5	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result Heavy Grade	<input checked="" type="checkbox"/>	Calculate V...	
Pass Heavy Grade	<input checked="" type="checkbox"/>	Prompt	
True 4	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result Pass V	<input checked="" type="checkbox"/>	Calculate V...	
Pass Very Heavy Grade	<input checked="" type="checkbox"/>	Prompt	
True 3	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result Pass E	<input checked="" type="checkbox"/>	Calculate V...	
Pass Extremely Heavy Grade	<input checked="" type="checkbox"/>	Prompt	
True 1	<input checked="" type="checkbox"/>	Test True/ ...	
Log Test Result Fail No Grade zero results	<input checked="" type="checkbox"/>	Calculate V...	
Fail No Grade Determined results were zero	<input checked="" type="checkbox"/>	Prompt	
Test True/ False Pass Jnr% Difference	<input checked="" type="checkbox"/>	Test True/ ...	
True	<input checked="" type="checkbox"/>	Test True/ ...	
False	<input checked="" type="checkbox"/>	Test True/ ...	
Fail: % Recovery Difference is Greater than 75%	<input checked="" type="checkbox"/>	Prompt	Passing is 75% or less.
Fail for Jnr %Diff being over 75%	<input checked="" type="checkbox"/>	Modify Value	

Logical Sieve to Determine both Grade & Elastic Response


- Average creep strain at 0.1kPa output
- Average end strain at 0.1kPa output
- Average recoverable strain 0.1kPa R0.1
- % recoverable strain
- % non recoverable strain
- Average creep strain at 3.2kPa in strain (1)
- Average end strain at 3.2kPa in strain (1)
- Average creep compliance at 3.2kPa in Pa-1 (1)
- Average end compliance at 3.2kPa in Pa-1 (1)
- Average creep strain at 3.2kPa output
- Average end strain at 3.2kPa output
- Average recoverable strain 3.2kPa (1) R3.2
- Average Jnr 3.2k (1)
- % recoverable strain 3.2k (1)
- % non recoverable strain 3.2k (1)
- % Difference in recovery
- % Difference of Jnr
- MSCR elastic response and grade
 - Look up Jnr at 3200Pa
 - Calculated value
 - Look up % recovery at 3200Pa
 - Find value for Comparison
 - Value for Comparison Passing
 - Calculate Value for Comparison
 - Test Jnr < 4.5
 - Test for elastic response
 - test binder grade S
 - Test binder grade H

Action	Enabled	Type	Comment
Look up Jnr at 3200Pa	<input checked="" type="checkbox"/>	Calculate Value	retrieves the Jnr from the sample properties [user 10]
Look up % recovery at 3200Pa	<input checked="" type="checkbox"/>	Calculate Value	retrieves the % recovery from the sample properties [user 11]
Import Jnr to %Recovery limit	<input checked="" type="checkbox"/>	Import data	imports the comparison curve from User Results\ySure\MSCR data table.txt
Find value for Comparison	<input checked="" type="checkbox"/>	Find value	finds the result point on the comparison curve
Value for Comparison Passing	<input checked="" type="checkbox"/>	Calculate Value	
Calculate Value for Comparison	<input checked="" type="checkbox"/>	Calculate Value	calculates if the result is above or below the comparison line (actual value - reference value)
Test Jnr < 4.5	<input checked="" type="checkbox"/>	Test True/False	This set of actions test for grade compliance.
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> Test for elastic response	<input checked="" type="checkbox"/>	Test True/False	Identify Elastic Response and ensure it is within acceptable limits
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Fail and %Recovery (1)	<input checked="" type="checkbox"/>	Calculate Value	
Fail: Jnr to %Recovery Analysis	<input checked="" type="checkbox"/>	Prompt	Fail
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
Pass: Jnr to %Recovery Analysis	<input checked="" type="checkbox"/>	Prompt	Pass Jnr to % Recovery
<input checked="" type="checkbox"/> test binder grade S	<input checked="" type="checkbox"/>	Test True/False	Pass S Grade
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Fail and %Recovery	<input checked="" type="checkbox"/>	Calculate Value	Fail S Grade to % Recovery
Fail Grade	<input checked="" type="checkbox"/>	Prompt	
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> Test binder grade H	<input checked="" type="checkbox"/>	Test True/False	Test if H Grade
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Pass S and %Recovery	<input checked="" type="checkbox"/>	Calculate Value	Pass S Grade to Recovery
S standard grade	<input checked="" type="checkbox"/>	Prompt	Pass S Grade
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> Test binder grade V	<input checked="" type="checkbox"/>	Test True/False	Test if V Grade
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Pass H and %Recovery	<input checked="" type="checkbox"/>	Calculate Value	Pass H Grade to % Recovery
H Heavy grade	<input checked="" type="checkbox"/>	Prompt	Pass H Grade
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> Test binder grade E	<input checked="" type="checkbox"/>	Test True/False	Test if E Grade
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Pass V and %Rec...	<input checked="" type="checkbox"/>	Calculate Value	Pass V Grade to % Recovery
V Very heavy grade	<input checked="" type="checkbox"/>	Prompt	Pass V Grade
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
Log Test Result: Pass E and %Rec...	<input checked="" type="checkbox"/>	Calculate Value	Pass E Grade to % Recovery
E Extremely heavy grade	<input checked="" type="checkbox"/>	Prompt	Pass E Grade
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Fail Jnr was greater than 4.5	<input checked="" type="checkbox"/>	Prompt	
Log Test Result: Fail Jnr greater than 4.5	<input checked="" type="checkbox"/>	Calculate Value	Fail Jnr greater than 4.5
<input checked="" type="checkbox"/> Test True/False Pass % Difference	<input type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> Test True/False Pass Jnr % Difference	<input checked="" type="checkbox"/>	Test True/False	Pass Jnr % Diff
<input checked="" type="checkbox"/> True	<input checked="" type="checkbox"/>	Test True/False	
<input checked="" type="checkbox"/> False	<input checked="" type="checkbox"/>	Test True/False	
Fail: % Recovery Difference is Greater than 75% (1)	<input checked="" type="checkbox"/>	Prompt	% Recovery is 75% or more
Fail for Jnr %Diff being over 75%	<input checked="" type="checkbox"/>	Modify Value	

Feedback of Test Results

PASS Jnr Heavy Grade (H grade)

The result of Jnr fell within AASHTO MP-19 grading range for a Jnr Passing Heavy Grade (H grade)

Next 

Percent non-recoverable strain at 3.2kPa (% strain)

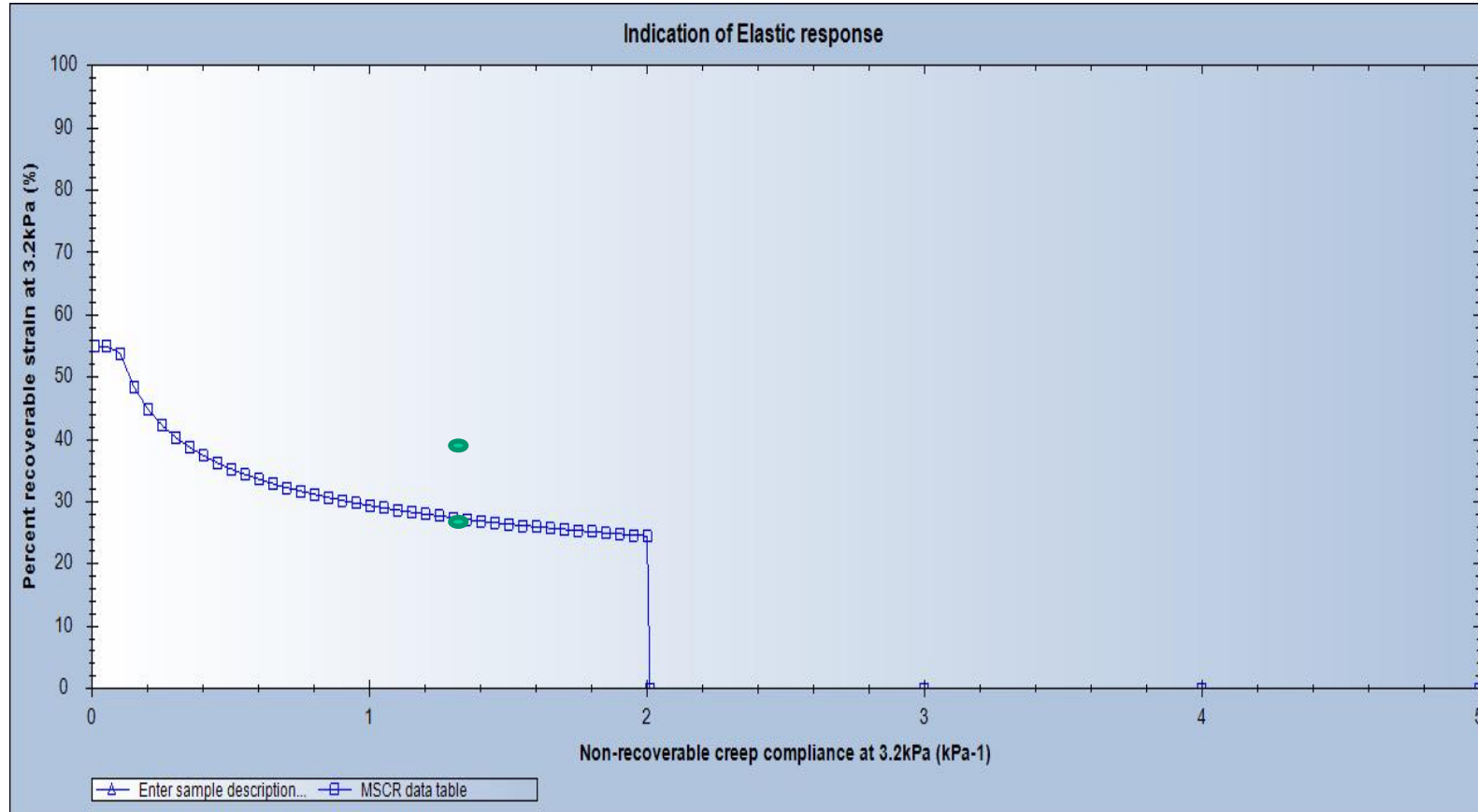
Test result

Fail - Jnr % Diff is over 75%

Fail - Jnr is greater than 4.5 at 64.0C


Pass - VH Grade at 64.0C

Pass - VH Grade and %Recovery at 64.0C




FAIL

Jnr was greater than 4.5

Next 


FAIL

The result fell below the comparison line
The indication is that the asphalt binder is not adequately modified

Next 

FAIL

The result indicates the Jnr % Difference is over 75%
The indication is that the asphalt binder is not adequately modified.

Next 

Access to all raw and processed results

RAW Data

Results | Palette | Properties

- 0.1kPa precondition cycle:Creep phase (10)
- 0.1kPa precondition cycle:Recovery Phase (10)
- 0.1kPa creep (1):Creep phase
 - Final results**
- 0.1kPa creep (1):Recovery Phase
- 0.1kPa creep (2):Creep phase
- 0.1kPa creep (2):Recovery Phase
- 0.1kPa creep (3):Creep phase
- 0.1kPa creep (3):Recovery Phase
- 0.1kPa creep (4):Creep phase
- 0.1kPa creep (4):Recovery Phase
- 0.1kPa creep (5):Creep phase
- 0.1kPa creep (5):Recovery Phase
- 0.1kPa creep (6):Creep phase
- 0.1kPa creep (6):Recovery Phase
- 0.1kPa creep (7):Creep phase
- 0.1kPa creep (7):Recovery Phase
- 0.1kPa creep (8):Creep phase
- 0.1kPa creep (8):Recovery Phase
- 0.1kPa creep (9):Creep phase
- 0.1kPa creep (9):Recovery Phase
- 0.1kPa creep (10):Creep phase
- 0.1kPa creep (10):Recovery Phase
- 3.2kPa creep (1):Creep phase
- 3.2kPa creep (1):Recovery Phase
- 3.2kPa creep (2):Creep phase
- 3.2kPa creep (2):Recovery Phase
- 3.2kPa creep (3):Creep phase
- 3.2kPa creep (3):Recovery Phase
- 3.2kPa creep (4):Creep phase
- 3.2kPa creep (4):Recovery Phase
- 3.2kPa creep (5):Creep phase
- 3.2kPa creep (5):Recovery Phase
- 3.2kPa creep (6):Creep phase

- 3.2kPa creep (6):Creep phase
- 3.2kPa creep (6):Recovery Phase
- 3.2kPa creep (7):Creep phase
- 3.2kPa creep (7):Recovery Phase
- 3.2kPa creep (8):Creep phase
- 3.2kPa creep (8):Recovery Phase
- 3.2kPa creep (9):Creep phase
- 3.2kPa creep (9):Recovery Phase
- 3.2kPa creep (10):Creep phase
- 3.2kPa creep (10):Recovery Phase
- End creep strain 0.1kPa (1)
- End creep strain 0.1kPa (2)
- End creep strain 0.1kPa (3)
- End creep strain 0.1kPa (4)
- End creep strain 0.1kPa (5)
- End creep strain 0.1kPa (6)
- End creep strain 0.1kPa (7)
- End creep strain 0.1kPa (8)
- End creep strain 0.1kPa (9)
- End creep strain 0.1kPa (10)
- End recovery strain 0.1kPa (1)
- End recovery strain 0.1kPa (2)
- End recovery strain 0.1kPa (3)
- End recovery strain 0.1kPa (4)
- End recovery strain 0.1kPa (5)
- End recovery strain 0.1kPa (6)
- End recovery strain 0.1kPa (7)
- End recovery strain 0.1kPa (8)
- End recovery strain 0.1kPa (9)
- End recovery strain 0.1kPa (10)
- End creep strain 3.2kPa (11)
- End creep strain 3.2kPa (12)
- End creep strain 3.2kPa (13)

Analysis & Results

- End recovery strain 3.2kPa (14)
- End recovery strain 3.2kPa (15)
- End recovery strain 3.2kPa (16)
- End recovery strain 3.2kPa (17)
- End recovery strain 3.2kPa (18)
- End recovery strain 3.2kPa (19)
- End recovery strain 3.2kPa (20)
- Average creep strain at 0.1kPa in strain
 - Statistics (y(%) vs t(s))
 - Error bar data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
 - Original data (y(%) vs t(s))
- Average end strain at 0.1kPa in strain
- Average creep compliance at 0.1kPa in Pa-1
- Average end compliance at 0.1kPa in Pa-1
- Average creep strain at 3.2kPa in strain (1)
- Average end strain at 3.2kPa in strain (1)
- Average creep compliance at 3.2kPa in Pa-1 (1)
- Average end compliance at 3.2kPa in Pa-1 (1)
- Results
 - Final results

Questions?

Sequence completed



Next

