

2017 PMA Mini Round Robin

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2017 Test Data from four (4) DOTs
on (4) four PG 76-22 binders
provided by (4) different Suppliers,
in order to compare the testing
accuracy.

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Purpose:

- To determine the accuracy of Laboratory testing by four DOT Labs (Repeatability).
- To compare how the four PG 76-22 test out and are graded in the M320 vs. M332 specifications [comparing for PG 76- and PG 64X-].

Arrangements:

- Four PG 76-22 Binders from four different Suppliers.
- Four DOT Labs doing each a full set of Tests in Duplicate.
- All using the same Data Sheet.

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Observations:

Grading in M320 and M332:

- All 4 Labs test all 4 binders as meeting the M320 spec for PG 76-22.
- If the % Jnr Diff. requirement is waived, then all 4 binders meet PG 64E-22.
- In addition 2 of the 4 Labs qualify binder D as PG 64E-22 meeting all of M332.
- Grading the 4 binders with the M332 spec for PG76X-22 (excluding % Jnr Diff);
 - a) Binder A would be a PG 76E-22.
 - b) Binder B would be a PG 76S-22.
 - c) Binder C; 3 Labs test it as PG 76E-22, and one Lab as a PG 76V-22.
 - d) Binder D would be a PG 76V-22.

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Repeatability:

- Lab #1 is “OUT”; 1x ER and 5X DSR.
- Lab #3 is “OUT”; 2x for DSR Tests.
- Lab #4 is “OUT”; 1x for ER.

Reproduceability:

- The “Reproducibility” is presented based on the MAX and MIN values of:
 - 1) all 8 test results (chance of 1 in 32).
 - 2) the 4 averages (chance of 1 in 16).
- Both represent the worst case !

Repeatability

Summary for Labs OUT of the Repeatability Range.

All four PG 76-22 binders tested in-spec.

Important here is the repeatability of; Elastic Recovery and the various DSR tests.

BINDER	Test	AASHTO	Binder Condition Temp		Lab #1	Lab #2	Lab #3	Lab #4
Can A	Rotational							
	Visc	T 316	Original	230 °C				OUT
	Mass Change	T240	RTFO					OUT
	PAV DSR							
	G* Sinδ	T315	PAV (100)	25 °C	OUT			

Can B	Flash Point	T48	Original	Variable	OUT			
	Elastic Rec.	T301	RTFO	25 °C				OUT

Can C	Mass Change	T240	RTFO			OUT	OUT	OUT
	Elastic Rec.	T301	RTFO	25 °C	OUT			
	PAV DSR							
	G* Sinδ	T315	RTFO	64 °C	OUT			
	PAV DSR							
	G* Sinδ	T315	PAV (100)	31 °C				OUT
	PAV DSR							
	G* Sinδ	T315	PAV (100)	25 °C				OUT

Can D	Mass Change	T240	RTFO		OUT	OUT		OUT
	PAV DSR							
	G* Sinδ	T315	Original	76 °C	OUT			
	PAV DSR							
	G* Sinδ	T315	RTFO	76 °C	OUT			
	PAV DSR							
	G* Sinδ	T315	RTFO	64 °C	OUT			
	PAV DSR							
	G* Sinδ	T315	PAV (100)	31 °C	OUT			

9 x OUT 2 x OUT 3 x OUT 5 x OUT

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Elastic Indicators: Delta, Ductility, % ER, % Rec, % Jnr, % Jnr Diff, and Jnr-line ???

Elastic indicators

Based on the averages of four pairs of two tests.

	Original	Original	Original	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	RTFO	PAV	PAV	
									Jnr					Jnr			
	δ	δ	Ductility	δ	Duct	ER	% Rec	% Jnr	% Jnr Diff	Conclusion	δ	% Rec	% Jnr	% Jnr Diff	Conclusion	δ	δ
	76 °C	64 °C	25 °C	76 °C	25 °C	25 °C	76 °C	76 °C	76 °C	76 °C	64 °C	64 °C	64 °C	64 °C	64 °C	31 °C	25 °C
Binder A	49.1	55.7	38.6	54.6	31	82.5	91.76	0.068	697.3	Elastic	58.8	92.94	0.026	683.9	25% Non-E	62.7	56.6
Binder B	72.7	66.4	109.4	65.7	77	88.8	12.03	2.532	81.5	100% Non-E	60.4	40.09	0.348	36.1	25% Non-E	46.8	43
Binder C	60	58.7	104.8	53.7	80	91.3	63.17	0.467	109.1	Elastic	53.7	78.21	0.091	65.2	Elastic	51.4	49
Binder D	64.6	63.7	93.1	58.9	60	85.6	59.53	0.560	68.3	Elastic	58.4	71.63	0.135	48.7	Elastic	51.3	47.7

- Delta is the ratio between Visc. and Elastic of binder behavior.
- Ductility is reduced by ageing, and differs from % Rec, % Jnr, and Jnr-line trend.
- % ER does not discriminate between these 4 binders.
- % Rec, % Jnr, and the Jnr-line do compare well, they are affected by temp change.
- % Rec and Jnr-line identify binder B as Non-Elastic, % ER determines it as Modified.
- **Question:** Which parameter(s) to believe as an indicator of Elastic behavior ???

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Overview of % Jnr Diff variability:

Variability of % Jnr Difference																
Jnr diff <75 %	A		A		B		B		C		C		D		D	
Binder	76 °C		64 °C		76 °C		64 °C		76 °C		64 °C		76 °C		64 °C	
Temp	76 °C		64 °C		76 °C		64 °C		76 °C		64 °C		76 °C		64 °C	
Lab #1	69	Elas	2	Elas	60	Non-E	16	Non-E	39	Elas	6	Elas	20	Elas	5	Elas
	50	Elas	1	Elas	60	Non-E	18	Non-E	28	Elas	3	Elas	25	Elas	6	Elas
Lab #2	456	Elas	594	Non-E	105	Non-E	57	Elas	196	Elas	119	Elas	121	Elas	89	Elas
	680	Elas	2139	Elas	100	Non-E	54	Elas	173	Elas	125	Elas	106	Elas	89	Elas
Lab #3	715	Elas	453	Elas	87	Non-E	46	Elas	174	Elas	87	Elas	101	Elas	61	Elas
	643	Elas	387	Elas	91	Non-E	46	Elas	178	Elas	120	Elas	85	Elas	74	Elas
Lab #4	1875	Elas	1678	Non-E	74	Non-E	45	Elas	189	Elas	119	Elas	82	Elas	92	Elas
	795	Elas	160	Elas	63	Non-E	48	Elas	159	Elas	134	Elas	112	Elas	92	Elas

- Only Lab #1 shows % Jnr Diff results lower than 75%.
- All 3 other Labs have wildly varying % Jnr Diff results ranging from 45% to 2,139%.
- **Conclusion:** % Jnr Diff seems not to be a useful specification requirement !!!

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**Thanks goes to the four Labs which volunteered
to perform all the testing !!!**

Questions?

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