NEAUPG Binder Committee Activities

NEAUPG Annual Conference

Atlantic City, NJ

October 17, 2018

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Binder Committee Activities

- Delta Tc / Extended Aging ILS (Phase 2)
- Jnr difference
- Not my father's PG 76???
- QSM vs. Annual QC Plans

Delta Tc / Extended Aging ILS

- What is Delta Tc (ΔT_c)?
  - A new binder parameter used to measure the age related cracking potential of asphalt binders
  - It uses lab testing equipment currently being used in binder specifications

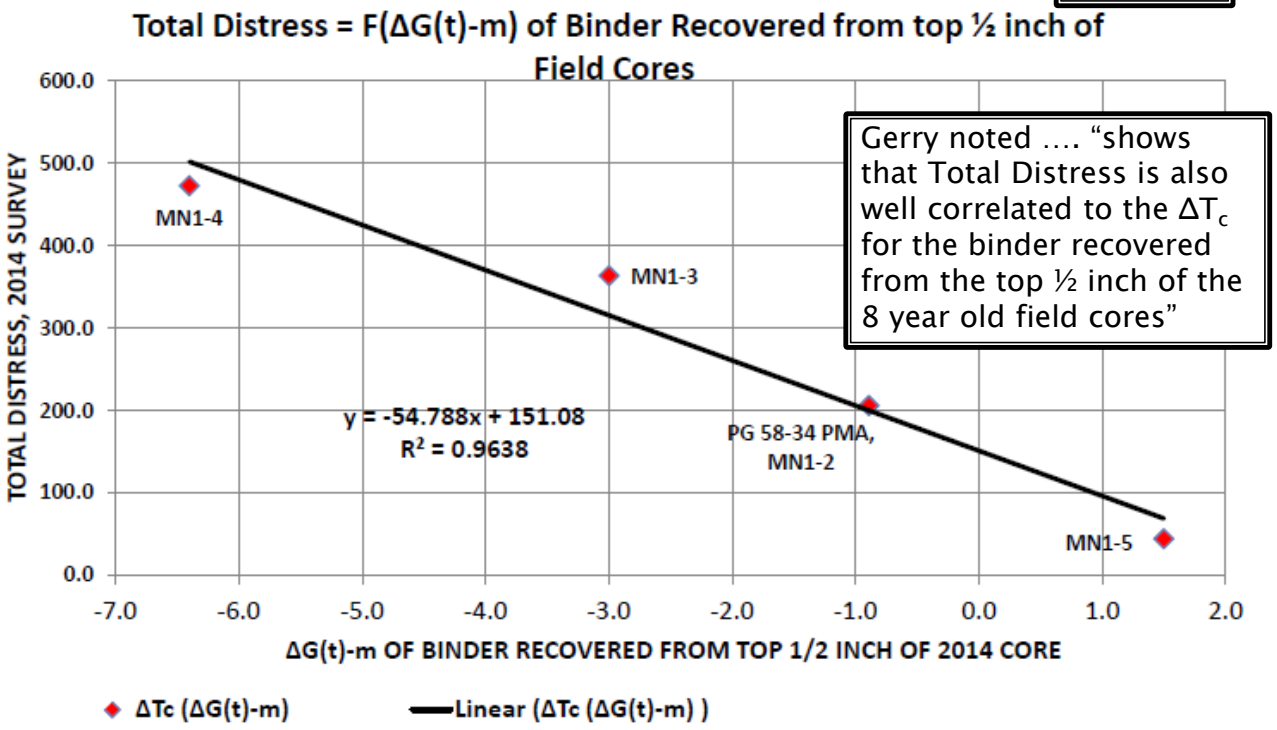
- What is extended aging?
  - Additional laboratory binder aging above and beyond what is required by the current specs
  - When used in conjunction with ΔT_c can identify binders with increased aging and cracking potential

What is ΔTc ?

- Defined as the difference between S and m criteria with the BBR
- $\Delta T_c = T_{cs(300\ Mpa)} - T_{cm(0.300)}$
- T is the grade temperature for either S or m
- ΔT_c = -3.0°C - Cracking Warning
- ΔT_c = -5.0°C - Cracking Limit

ΔT_c vs Distress

Reinke



Gerry noted …. "shows that Total Distress is also well correlated to the ΔT_c for the binder recovered from the top ½ inch of the 8 year old field cores"

Phase 1 - Delta Tc / Extended Aging ILS

- 23 labs (10 suppliers, 9 DOT's, FHWA, 3 Universities)
- Two binders
  - Binder A – PG 58S-28
  - Binder B – PG 64E-22
- Four Aging Conditions:
  - Method A – Standard 20-hour PAV
  - Method B – 20+20-hour PAV
  - Method C – 20+4+20-hour PAV
  - Method D – 40-hour PAV

Participating Labs (not in order)

- **Suit-Kote**
- **Axeon**
- **Marathon**
- **Midland**
- **Peckham**
- **Gorman**
- **Canadian Asphalt**
- **McAsphalt**
- **ASMG**
- **Pike**
- **NJDOT**
- **NYSDOT**
- **NHDOT**
- **VTAOT**
- **DelDOT**
- **MDSHA**
- **CTDOT**
- **PennDOT**
- **RIDOT**
- **FHWA**
- **Rutgers**
- **UCONN**
- **Rowan**

Phase 2 - Delta Tc / Extended Aging ILS

- 23 labs (11 suppliers, 9 DOT's, FHWA, 2 Universities)
- One engineered binder
  - Binder A – PG 58S-22
- Four Aging Conditions:
  - Method A – Standard 20-hour PAV
  - Method B – 20+20-hour PAV
  - Method C – 20+4+20-hour PAV
  - Method D – 40-hour PAV
  - ***Method E – Standard 20-hour PAV w/12.5 grams per pan***

Participating Labs (not in order)

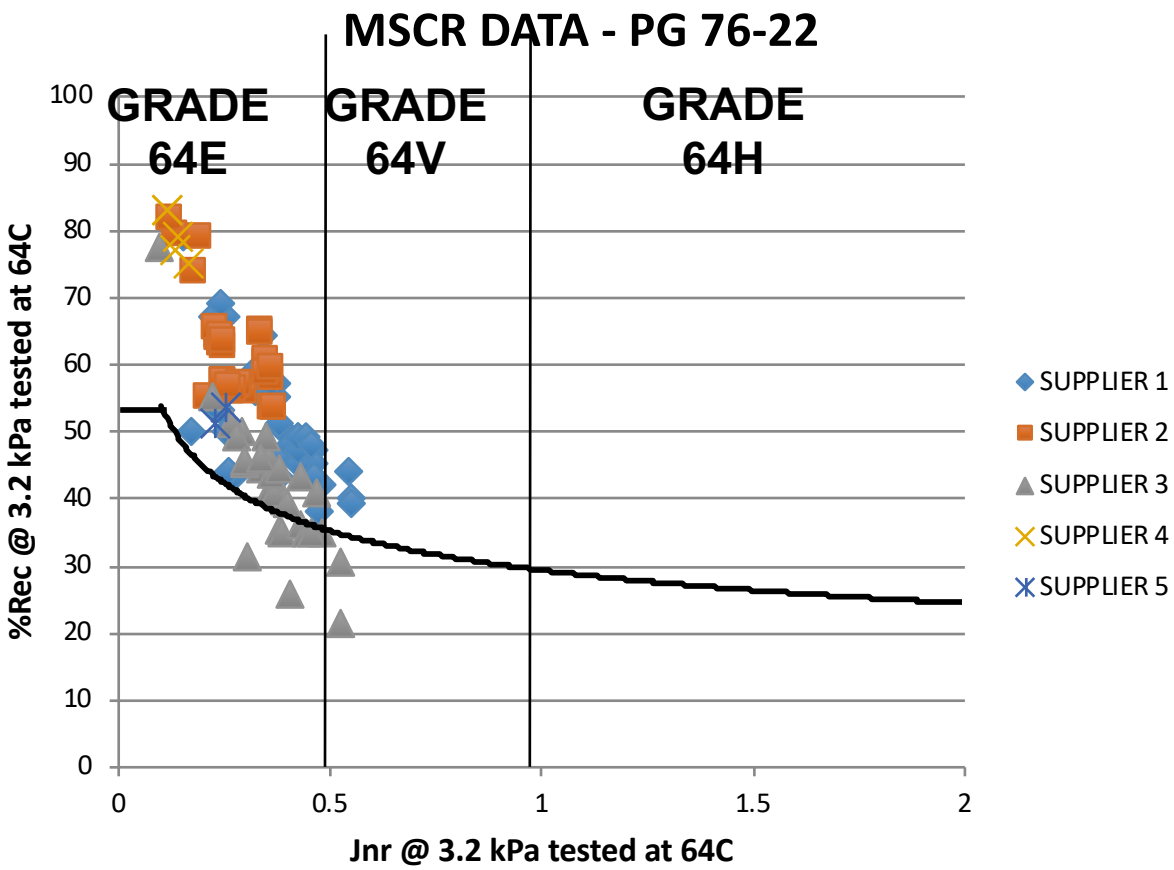
- ASMG
- Bitumar (3)
- Heritage
- Irving
- Marathon
- Midland
- McAsphalt
- Pike
- Suit-Kote
- CTDOT
- DelDOT
- MDSHA
- MEDOT
- NHDOT
- NJDOT
- NYSDOT
- PennDOT
- VTAOT
- FHWA
- Rutgers
- UCONN

Delta Tc / Extended Aging ILS

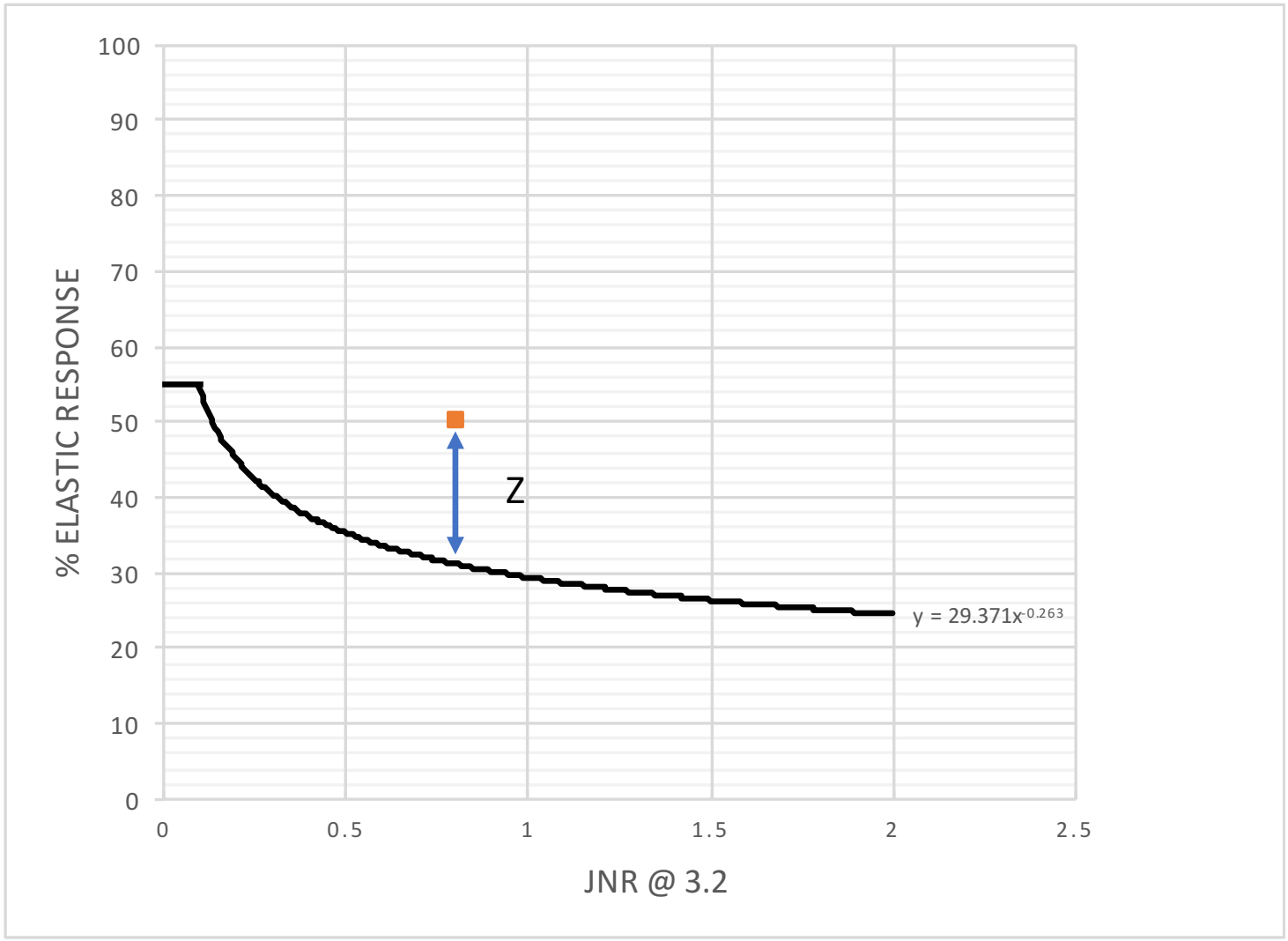
- Objectives:
  - Familiarize labs with these procedures and the impact on lab operations
  - Determine differences in aging methods
  - Build confidence in the ΔT_c parameter and steer the DOT's away from restrictive (prescriptive) specs

Jnr Difference

- Drafted a letter to AASHTO SOM TS-2b regarding removal of Jnr diff for all binders with Jnr $\leq$ 0.5
- Participated in January meeting
- Made changes to spec (electronic version) to be used for ballot to the tech section
- Passed TS ballot
  - Affirmative: 26 of 29
  - Negative: 0 of 29
  - No vote: 3 of 29
- Going to Comp ballot – likely to pass


MSCR DATA - PG 76-22
GRADE 64E
GRADE 64V
GRADE 64H
100
90
80
70
60
50
40
30
20
10
0
%Rec @ 3.2 kPa tested at 64C
0
0.5
1
1.5
2
Jnr @ 3.2 kPa tested at 64C
SUPPLIER 1
SUPPLIER 2
SUPPLIER 3
SUPPLIER 4
SUPPLIER 5

Z-Factor


100
90
80
70
60
50
40
30
20
10
0
% ELASTIC RESPONSE
0
0.5
1
1.5
2
2.5
JNR @ 3.2
Z
y = 29.371x-0.263

Lab Study

- % Recovery Curve was developed using binders manufactured to meet AASHTO M 320
- Binder today may be a little different
- Test procedure has changed slightly
- Blend current binders at different polymer dosages
  - Three blends at Jnr < 0.5
  - Three blends at 0.5 < Jnr <1.0
  - One blend at 1.0 < Jnr < 2.0
- Determine Jnr at 0.1 and 3.2 kPa and % recovery (Z factor)
- Determine Jnr difference
- True grade M 320
- Report phase angle
- Elastic recovery – AASHTO T 301?

Testing Schedule

- Seven blends total – preferably using plant produced binders
  - Three E-grades – Jnr < 0.5 kPa^{-1}
  - Three V-grades – 0.5 < Jnr < 1.0 kPa^{-1}
  - One H-grade – 1.0 < Jnr < 2.0 kPa^{-1}
- One of the blends should be the blend currently being used to supply
- Know the polymer dosage in each blend

Testing Schedule

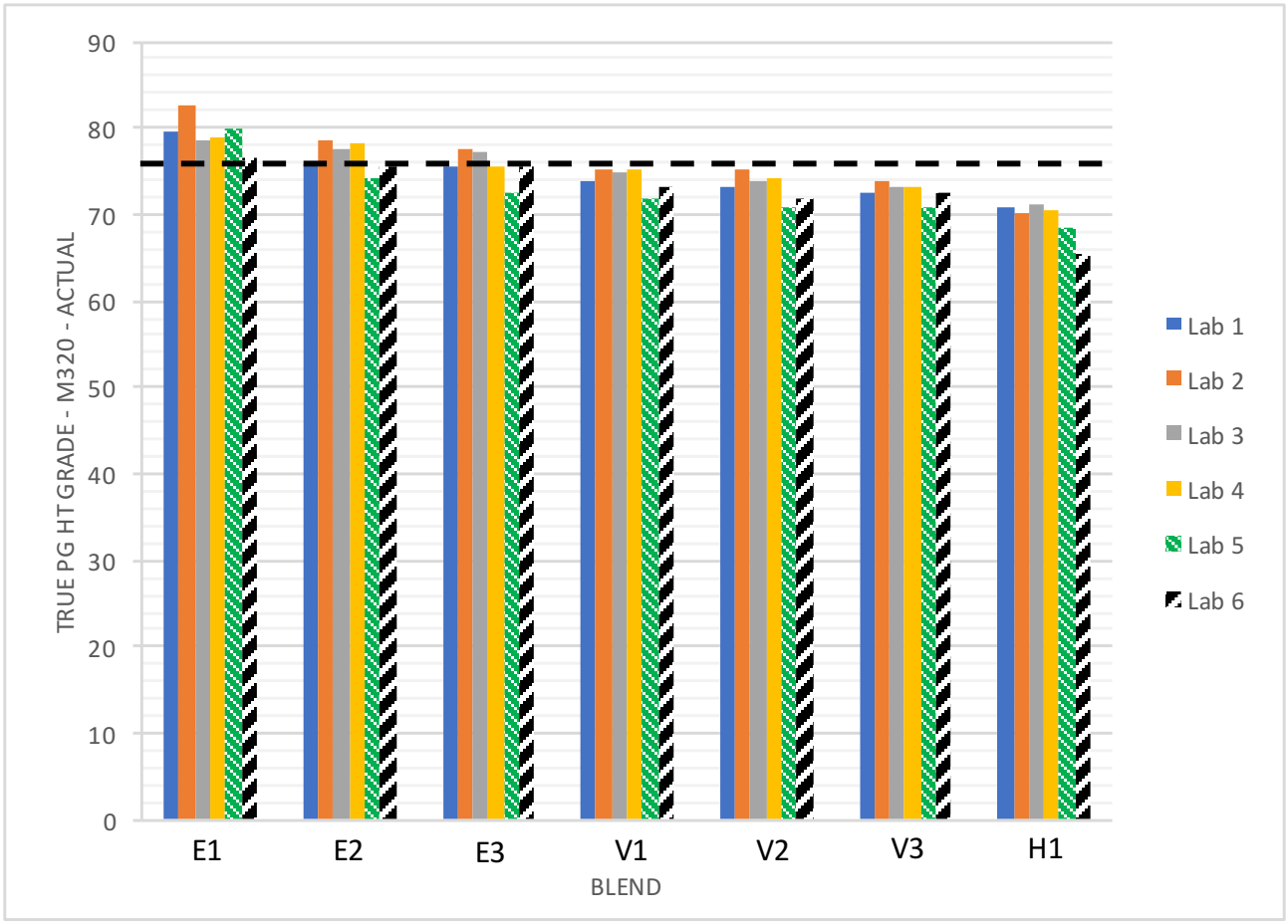
- For each blend report:
  - Using RTFO material
    - Jnr @ 0.1 kPa
    - % Recovery @ 0.1 kPa
    - Jnr @ 3.2 kPa
    - % Recovery @ 3.2 kPa
    - Jnr difference
  - Test temperatures to be at grade and +6C

- For each blend report:
  - Using Original and RTFO materials
    - G*
    - Phase angle
    - G*/sin delta
  - Test temperatures shall be at grade and +6C, +12C, +18C
    - True grading
    - I.e. PG 64E-22 – testing temperatures shall 64C, 70C, 76C, and 82C (if needed)

  - Using RTFO materials
    - Elastic recovery – AASHTO T 301

PG 64E-22								
		Binder Blend						
TEST METHOD		**E1**	**E2**	**E3**	**V1**	**V2**	**V3**	**H1**
RTFO Residue	**Temperature**							
Jnr @ 0.1 kPa								
% recovery @ 0.1 kPa								
Jnr @ 0.1 kPa	64							
% recovery @ 0.1 kPa								
Jnr difference								
Jnr @ 0.1 kPa								
% recovery @ 0.1 kPa								
Jnr @ 0.1 kPa	70							
% recovery @ 0.1 kPa								
Jnr difference								
Original Residue								
G*								
Phase angle	64							
G*/sin delta								
G*								
Phase angle	70							
G*/sin delta								
G*								
Phase angle	76							
G*/sin delta								
G*								
Phase angle	82							
G*/sin delta								
RTFO Residue								
G*								
Phase angle	64							
G*/sin delta								
G*								
Phase angle	70							
G*/sin delta								
G*								
Phase angle	76							
G*/sin delta								
G*								
Phase angle	82							
G*/sin delta								
Elastic Recovery								

True HT Grade Based On Actual

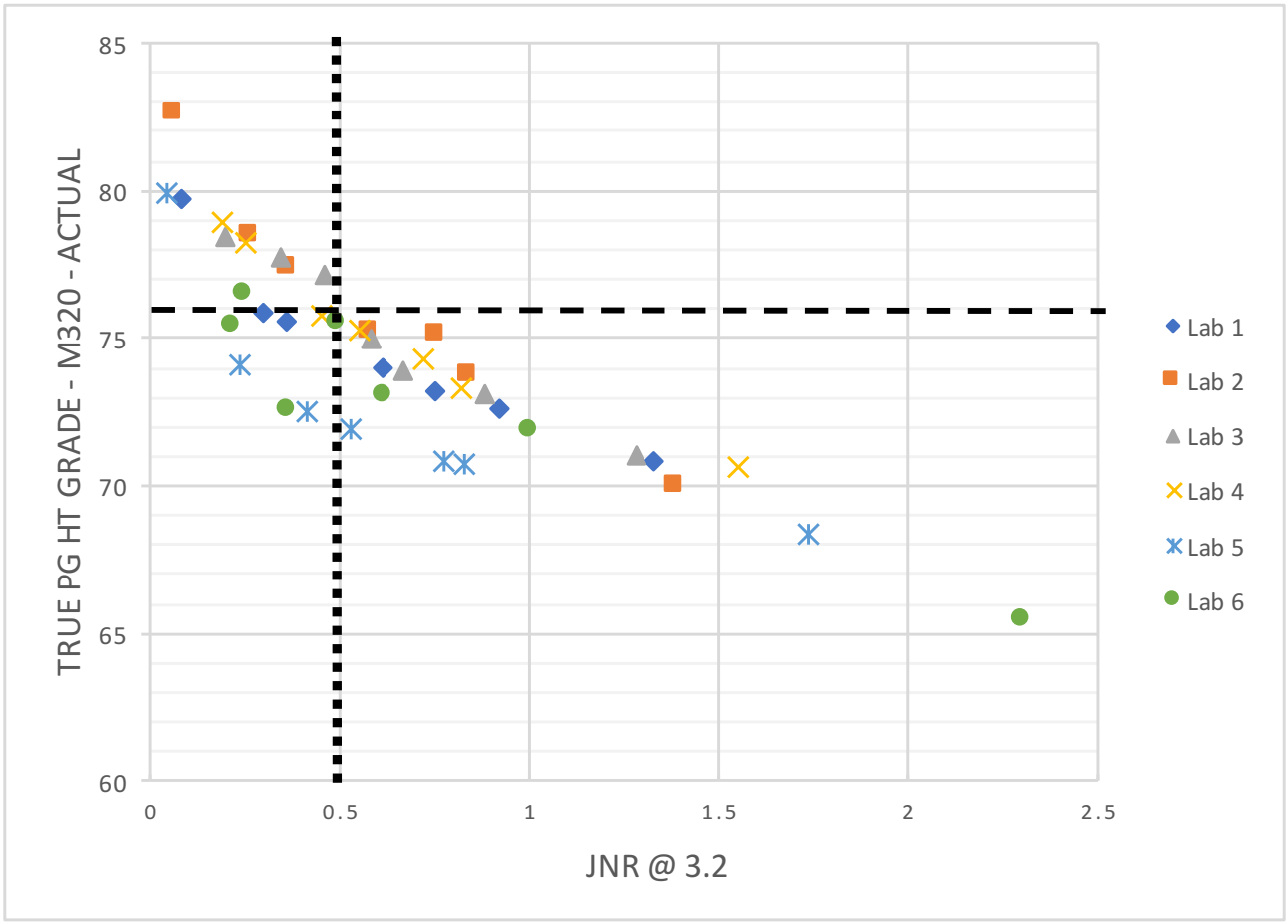


		E1	E2	E3
Lab 1 PG64E 22	PG HT-original	82.9	76.9	76.0
	PG HT-RTFO	79.7	***75.8***	***75.5***
	PG HT-actual	79.7	***75.8***	***75.5***
Lab 2 PG64E 22	PG HT-original	82.6	80.7	79.5
	PG HT-RTFO	83.4	78.5	77.4
	PG HT-actual	82.6	78.5	77.4
Lab 3 PG64E 22	PG HT-original	81.0	79.6	77.8
	PG HT-RTFO	78.4	77.7	77.1
	PG HT-actual	78.4	77.7	77.1
Lab 4 PG64E 22	PG HT-original	80.6	79.3	76.0
	PG HT-RTFO	78.9	78.2	***75.7***
	PG HT-actual	78.9	78.2	***75.7***
Lab 5 PG64E 28	PG HT-original	84.0	***75.3***	***73.6***
	PG HT-RTFO	79.9	***74.1***	***72.5***
	PG HT-actual	79.9	***74.1***	***72.5***
Lab 6 PG64E 28	PG HT-original	82.6	78.6	79.6
	PG HT-RTFO	76.5	***75.5***	***75.4***
	PG HT-actual	76.5	***75.5***	***75.4***

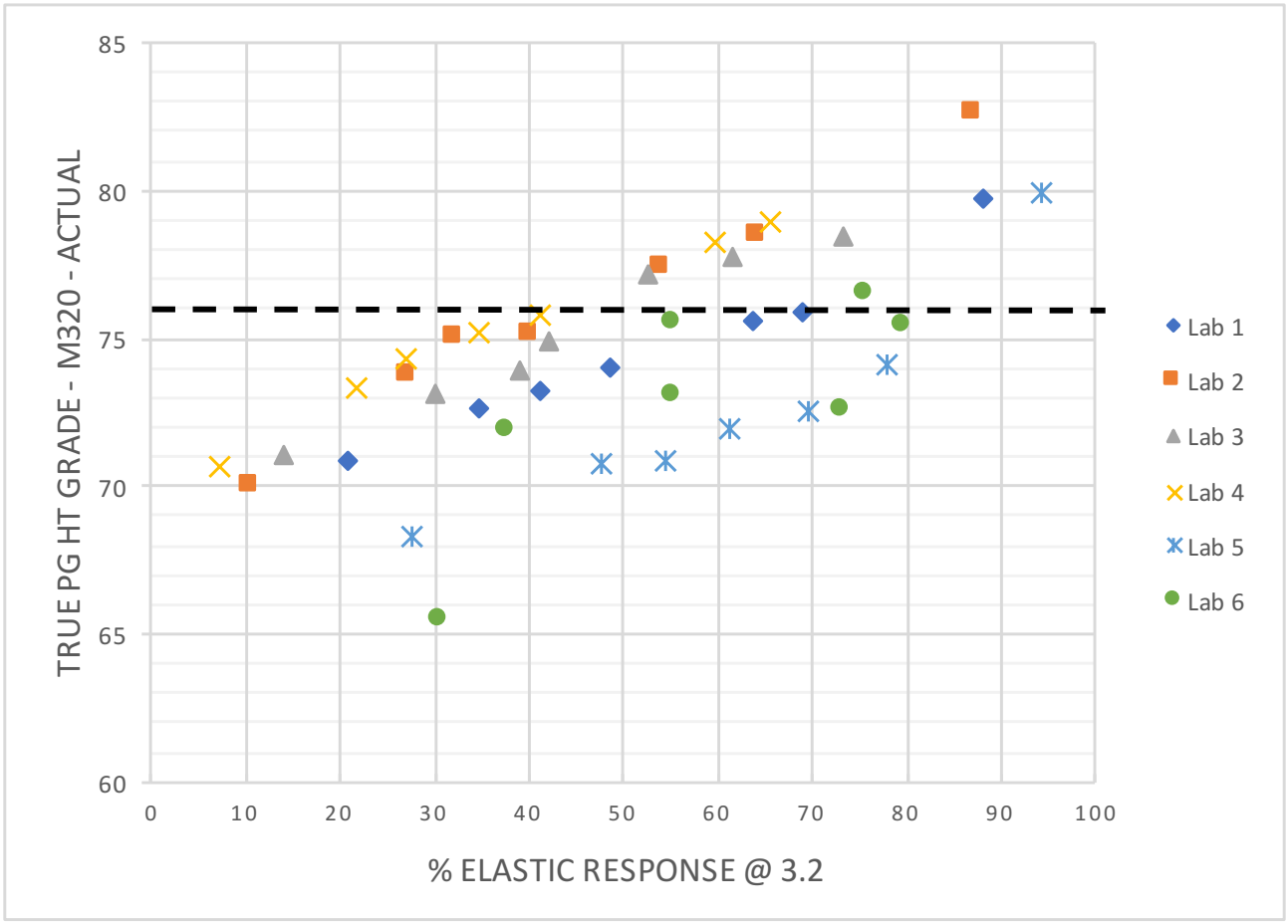
Current Production

LAB	BLEND	TRUE PG HT GRADE
1 – PG 64E-22	E2	75.8
2 – PG 64E-22	E1/E2	82.6/78.5
3 – PG 64E-22	E2	77.7
4 – PG 64E-22	E2/E3	78.2/75.7
5 – PG 64E-28	E2/E3	74.1/72.5
6 – PG 64E-28	E1	76.5

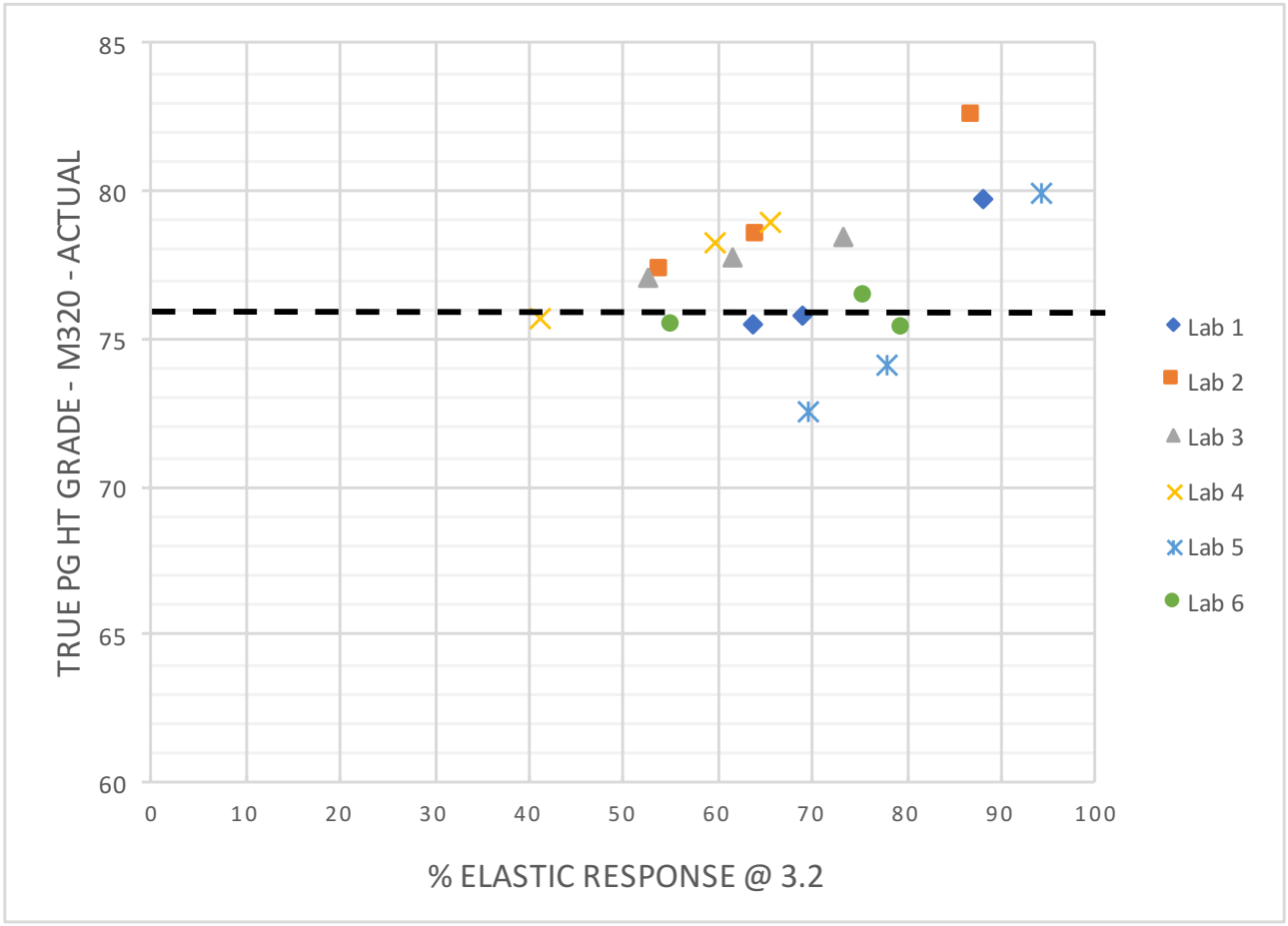
Jnr – All Blends



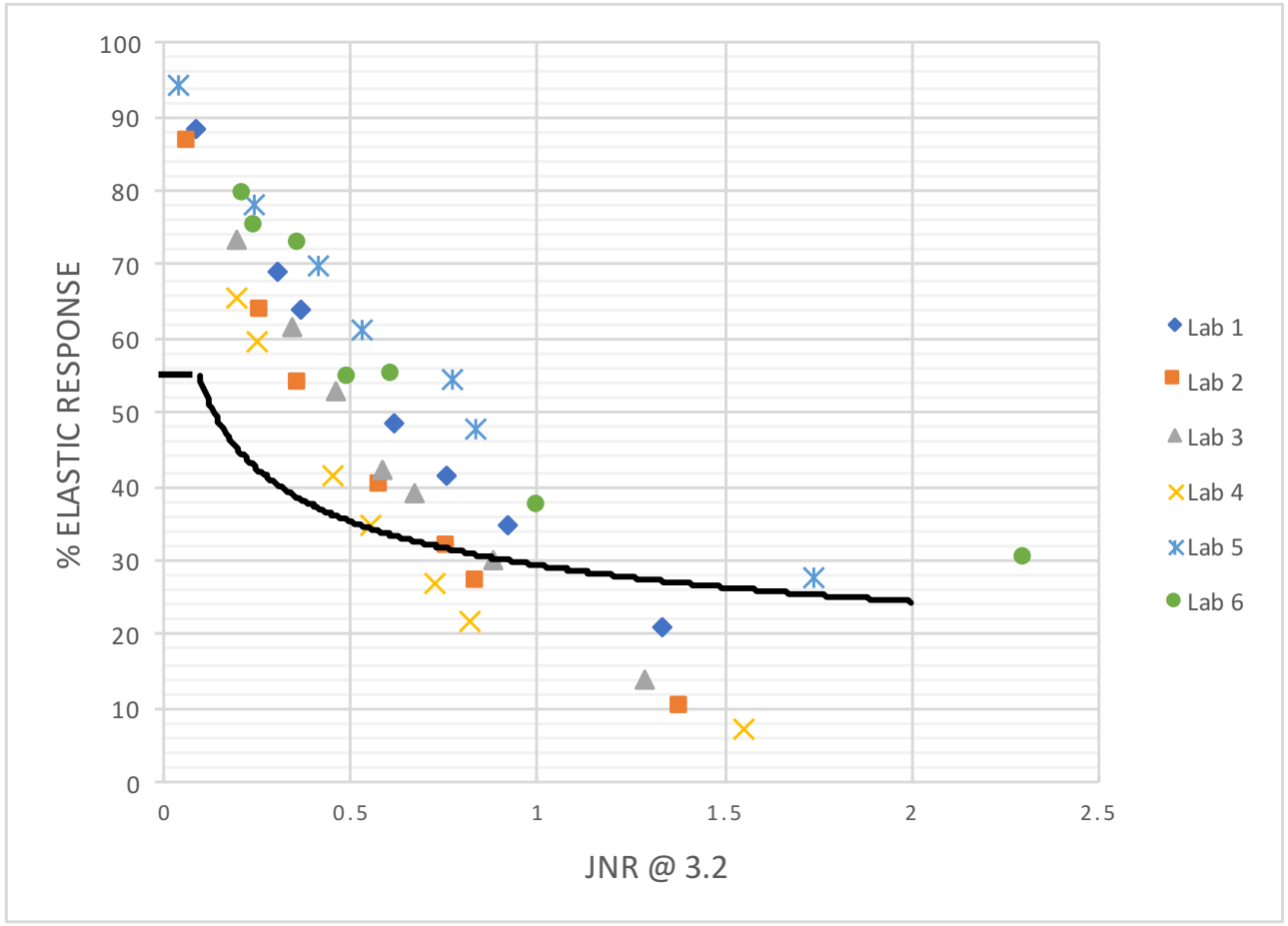
Elastic Response – All Blends



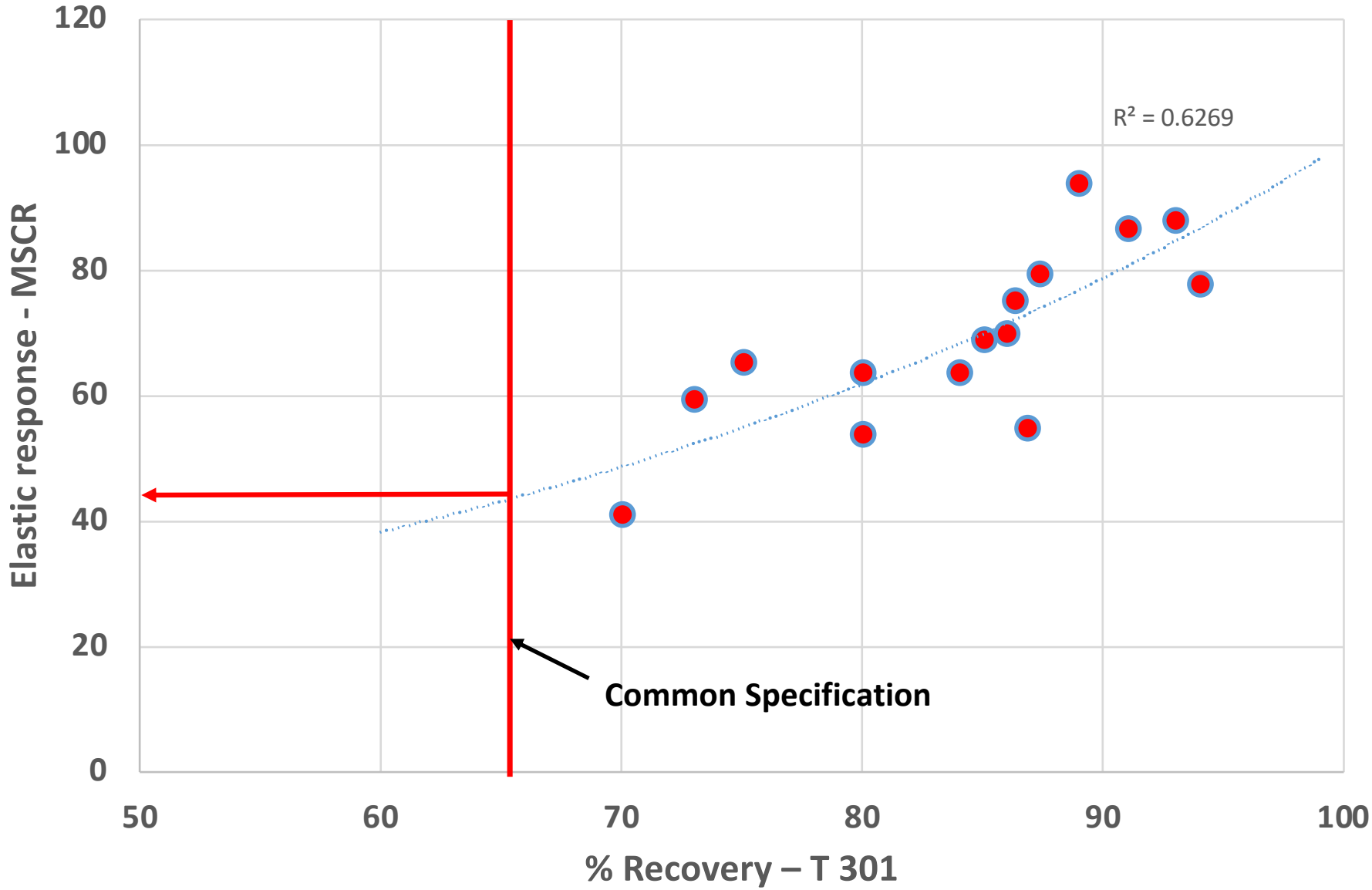
Elastic Response – E Grades Only



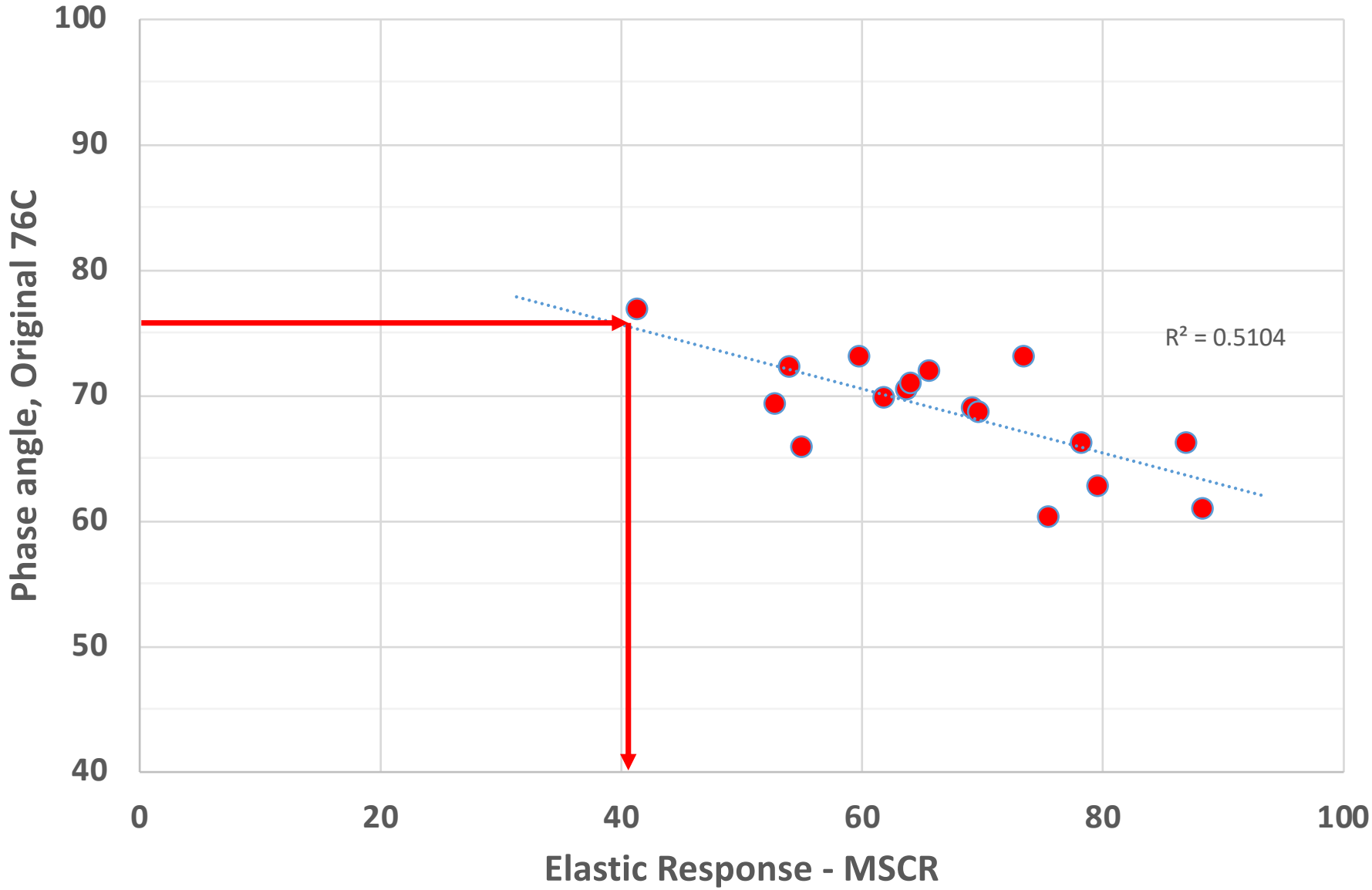
Jnr vs. Elastic Response - 2018



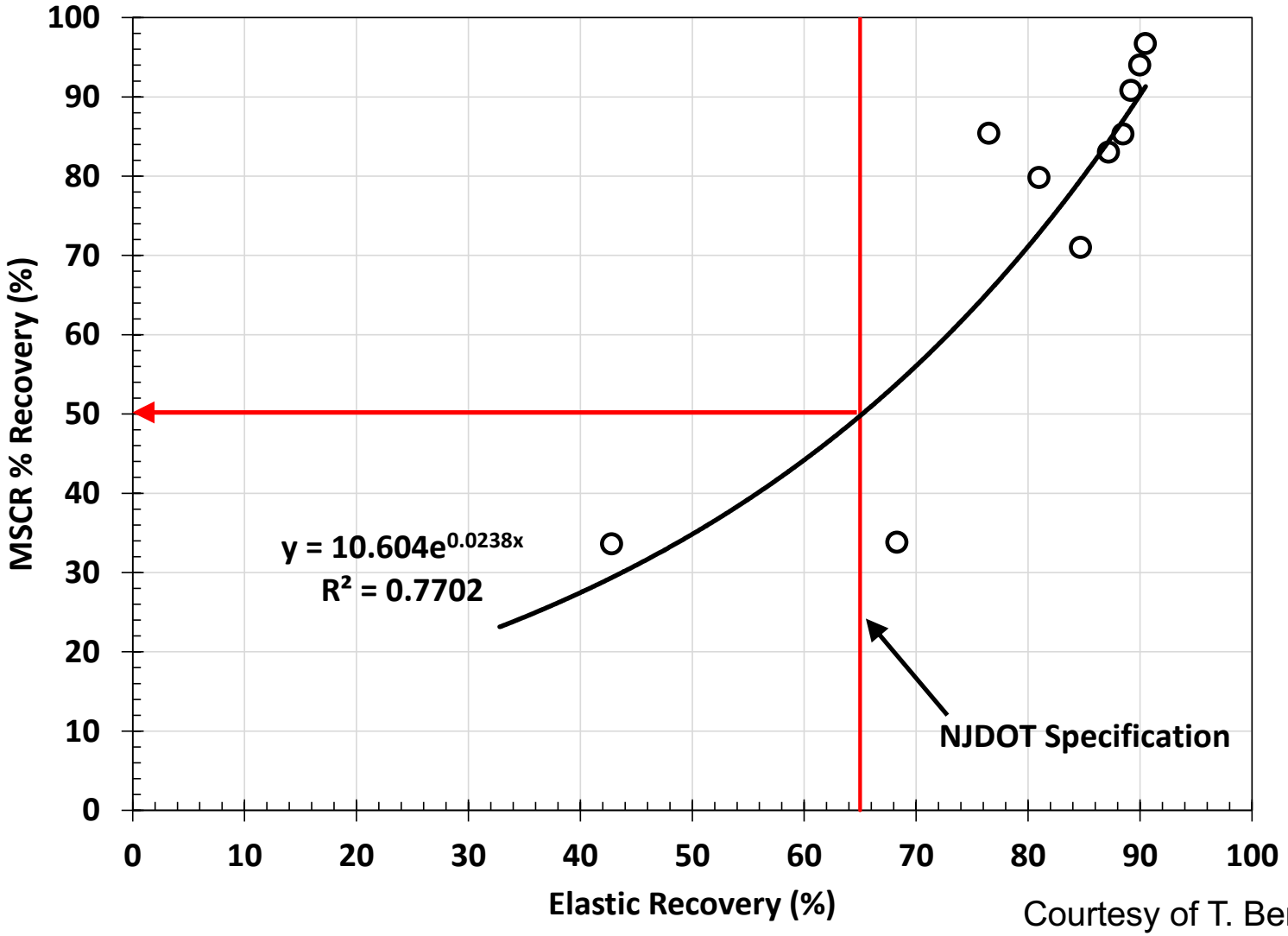
T 301 vs. MSCR Recovery – E Grades Only



Phase Angle vs. MSCR Recovery – E Grades Only

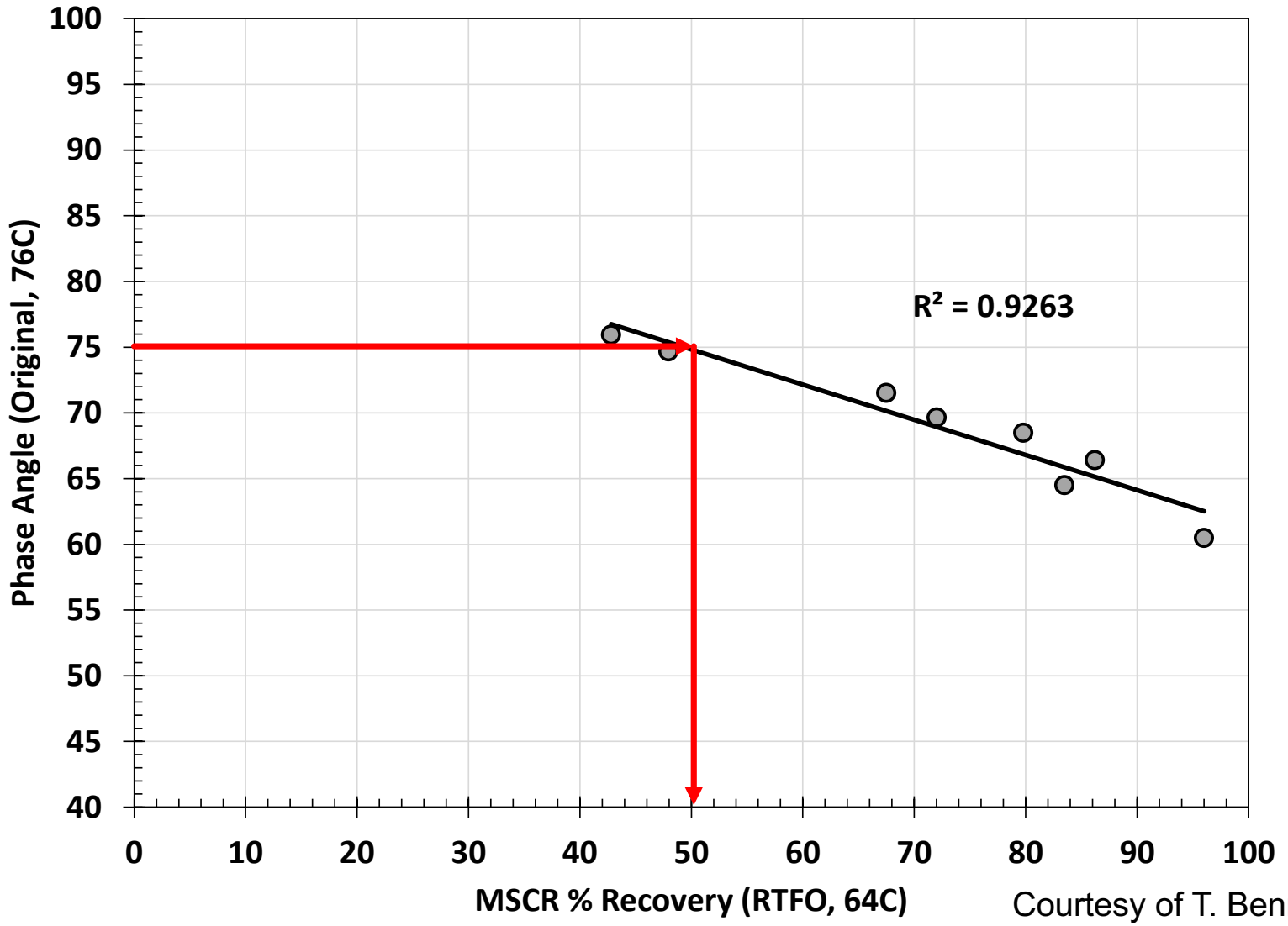


MSCR % Recovery vs RTFO Elastic Recovery



Courtesy of T. Bennert

MSCR % Recovery vs Original Phase Angle



Courtesy of T. Bennert

Current Production

LAB	BLEND	Elastic Recovery T 301
1 – PG 64E-22	E2	85
2 – PG 64E-22	E1/E2	91/84
3 – PG 64E-22	E2	n/a
4 – PG 64E-22	E2/E3	73/70
5 – PG 64E-28	E2/E3	94/86
6 – PG 64E-28	E1	86

Current Production

LAB	BLEND	Phase Angle
1 – PG 64E-22	E2	69.1
2 – PG 64E-22	E1/E2	66.3/71.1
3 – PG 64E-22	E2	69.9
4 – PG 64E-22	E2/E3	73.2/77
5 – PG 64E-28	E2/E3	66.2/68.7
6 – PG 64E-28	E1	60.4

Binder Committee Agenda

- Delta Tc/Extended Aging ILS
- PG 76-xx vs. PG 64E-xx
  - Z-factor
- QSM vs. QC Plans
  - NTPEP/AASHTO Activities

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Questions?

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