

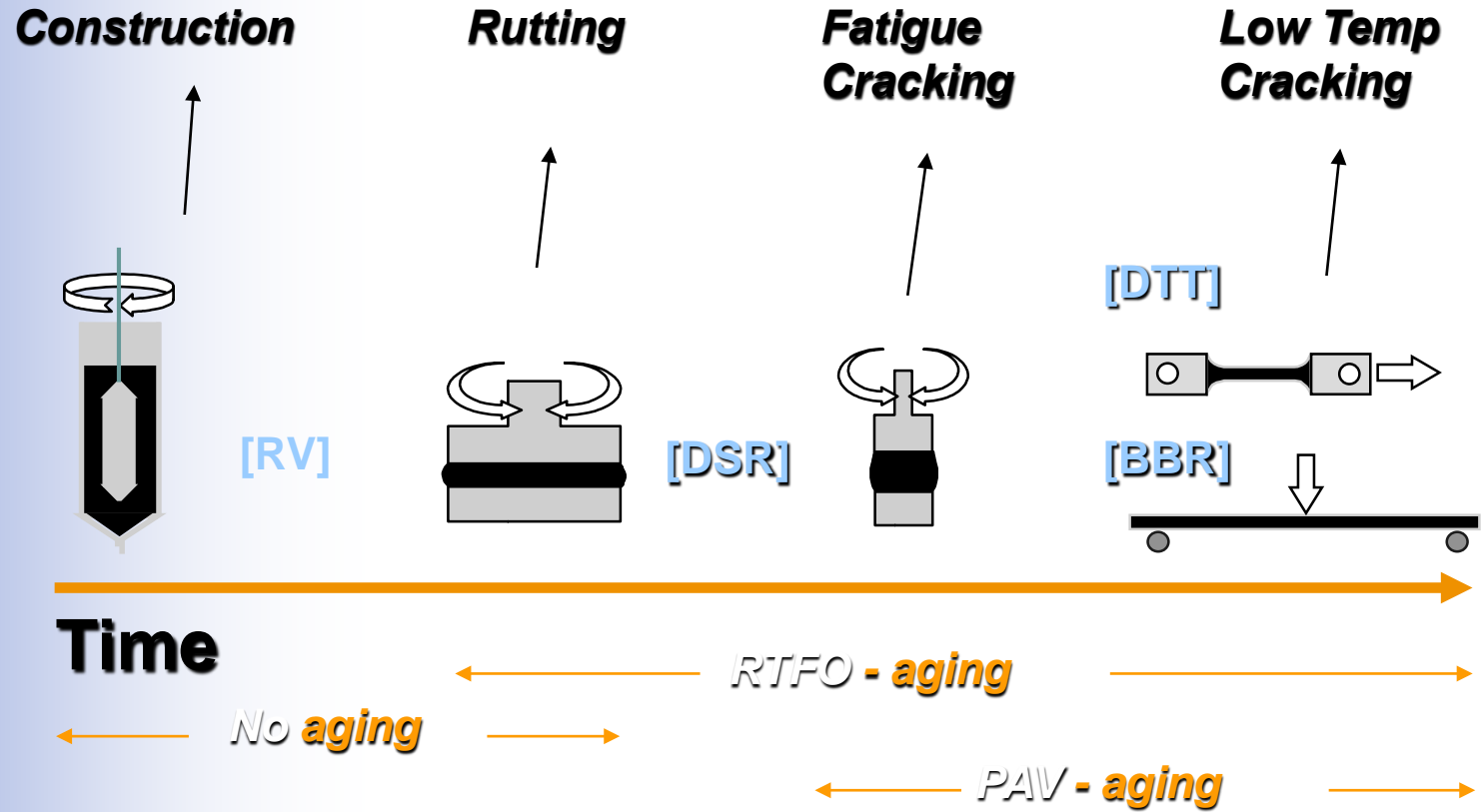
# Asphalt Binders and Aging 20Hr or 40Hr PAV

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# Superpave Binder Specification



# Raveling

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# Fatigue Cracking

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# Low Temperature Cracking

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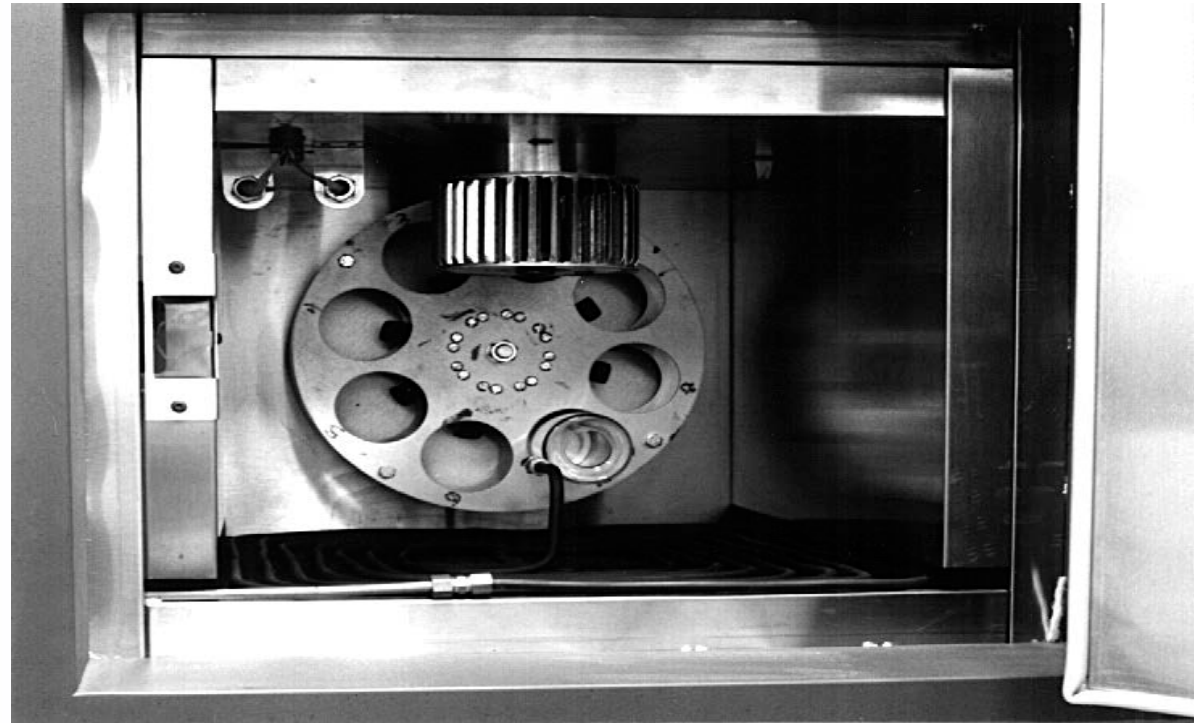


# Superpave Conditioning

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RTFOT –  
Short  
term  
aging

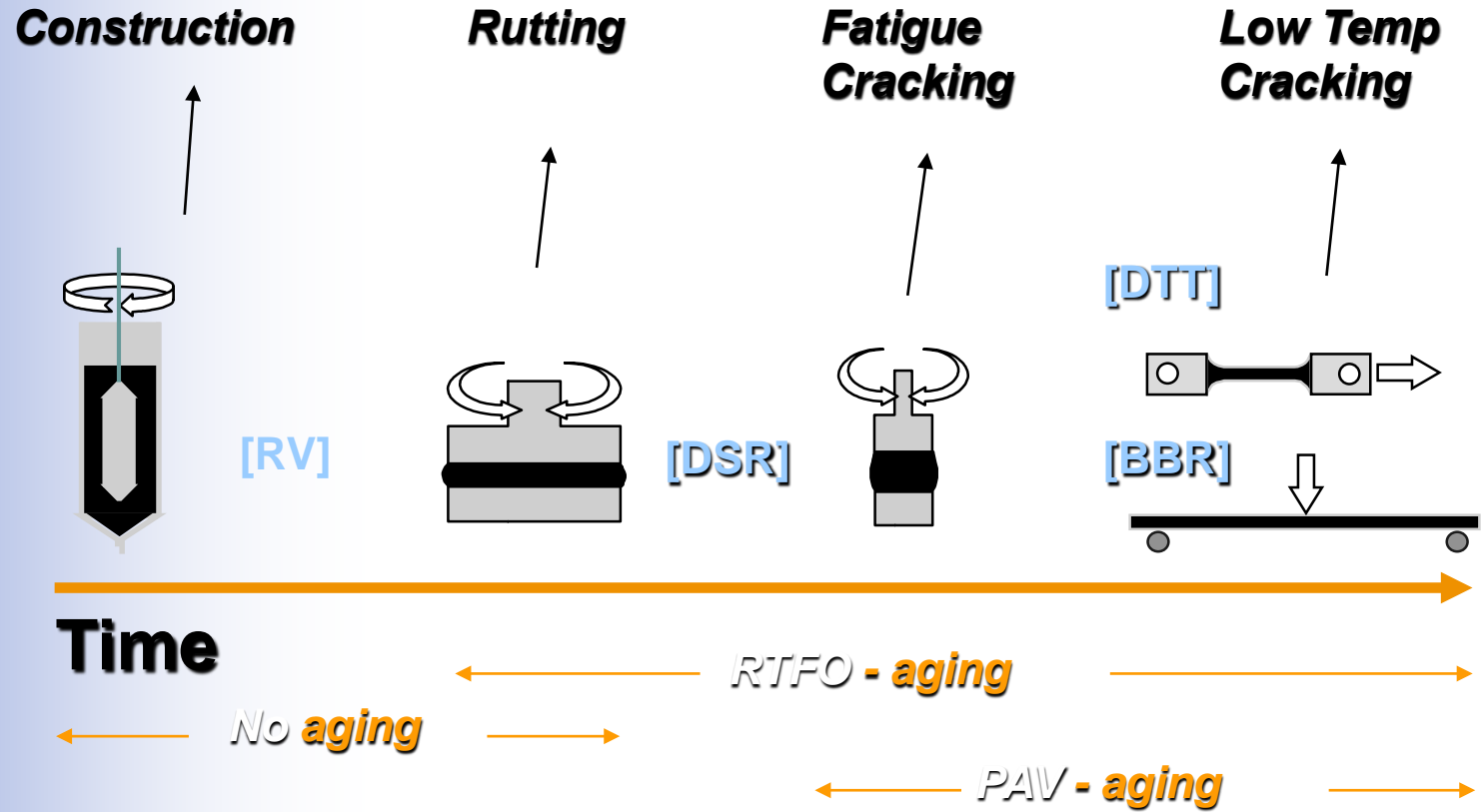


# Aging Long Term

- Current PAV 20 hrs at 100 C, 100 psi.
- 20 hr PAV mandates two days for binder classification.



# Superpave Binder Specification





# Current Aging approaches

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- Current 20 hour PAV does not represent long enough aging condition to identify critical conditions
  - Extend 20 hour PAV to 40 hour PAV
    - Longer time to grade
  - Use thinner films in the PAV
    - Reduced material for testing
  - Use extremely thin films in an oven.
    - Very small amounts of material special testing 4mm DSR

# Binder Aging

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- Longer Aging times being look at to identify embrittlement.
  - Are Longer times needed?
  - Longer time to grade binders
- Can aging ratios identify the same issues?
  - More tests
  - Same time for grading binder

# Task Group Goals

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- Using an indicator can the 40 hour PAV be estimated from the 20 hour PAV
- This would be used as an indicator not a direct measure.
- If the estimated 40 hour PAV acceptable extended aging not needed.
- If the estimated 40 hour is not acceptable actual 40 hour testing needed.

# $\Delta T_c$ 20 and 40 hour PAV

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- Can we determine where the 40hr PAV value we go based on the 20hr PAV?
- Look at the 20hr value and the change from original to 20hr.

# $\Delta T_c$

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- There are clear indications that the 20hr PAV and the change from original provides clear indications if 40 hr PAV will fail.
- Rate of change of RTFOT to 20hr PAV  $(RTFOT \Delta T_c - 20hr PAV)/20hr$  projected to 40hr

# Prediction of 40hr $\Delta T_c$

To predict 40hr  $\Delta T_c$  determine rate of change RTFOT to 20hr PAV  $(\Delta T_c \text{ RTFOT} - \Delta T_c \text{ 20hr PAV})/20\text{hr}$  , to predict 40hr  $\Delta T_c$

Age	$\Delta T_c, ^\circ\text{C}$													
RTFO	0.5	1.0	-2.6	1.7	2.8	2.3	-1.3	1.3	0.6	1.9	0.4	1.3	1.7	1.6
20 hr. PAV	-3.3	-0.9	-7.0	-1.0	1.7	-0.5	-4.8	-0.9	-2.7	0.8	-3.1	-0.5	-0.7	-2.3
40 hr. PAV	-6.1	-1.4	-12.4	-2.3	0.8	-4.7	-7.6	-2.6	-5.8	-2.6	-8.7	-2.9	-2.2	-8.4
predicted	-7.1	-2.8	-11.4	-3.8	0.6	-3.3	-8.3	-3.0	-6.0	-0.3	-6.6	-2.3	-3.1	-6.2
diff	1.1	1.4	-1.0	1.5	0.2	-1.4	0.7	0.5	0.2	-2.3	-2.1	-0.6	0.9	-2.2

# Asphalt Binder Aging

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- Are longer aging times needed?
- Binder aging ratios may capture the same issues without longer aging times.
- There are issues with measuring  $\Delta T_c$  on RTFOT material.

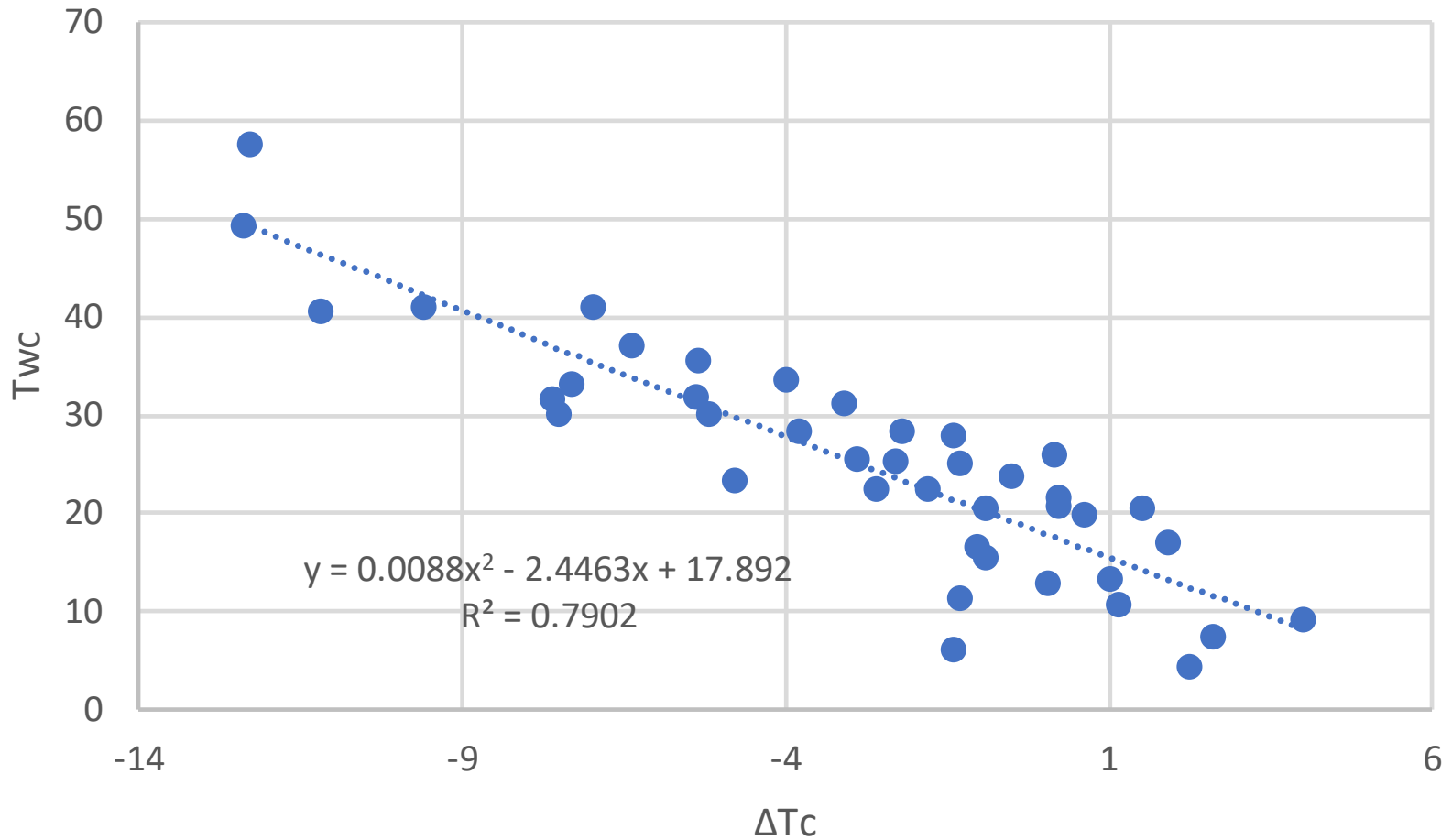
# Alternate criteria for evaluation

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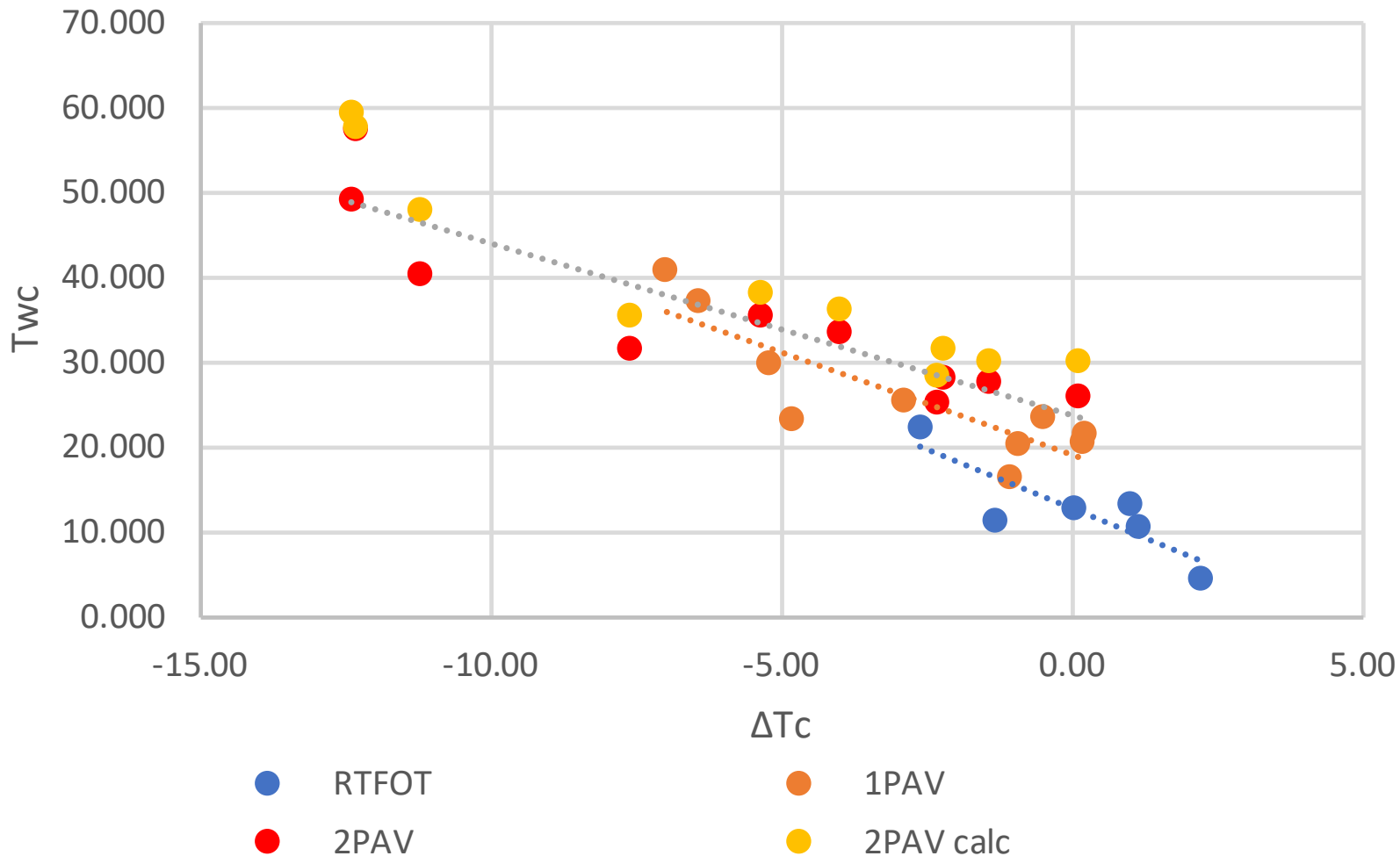
- Are other criteria that provide similar data to  $\Delta T_c$ ?
- The cross over temperature  $T_{wc}$  may provide similar information.
- The cross over temperature – Temperature measured at 10 radians/s where the phase angle is 45 degrees or tan delta is 1. This is where the Retardation and Relaxation modulus is equal.



# Mathy, Ergon Data RTFOT 1 and 2 PAV comparison.

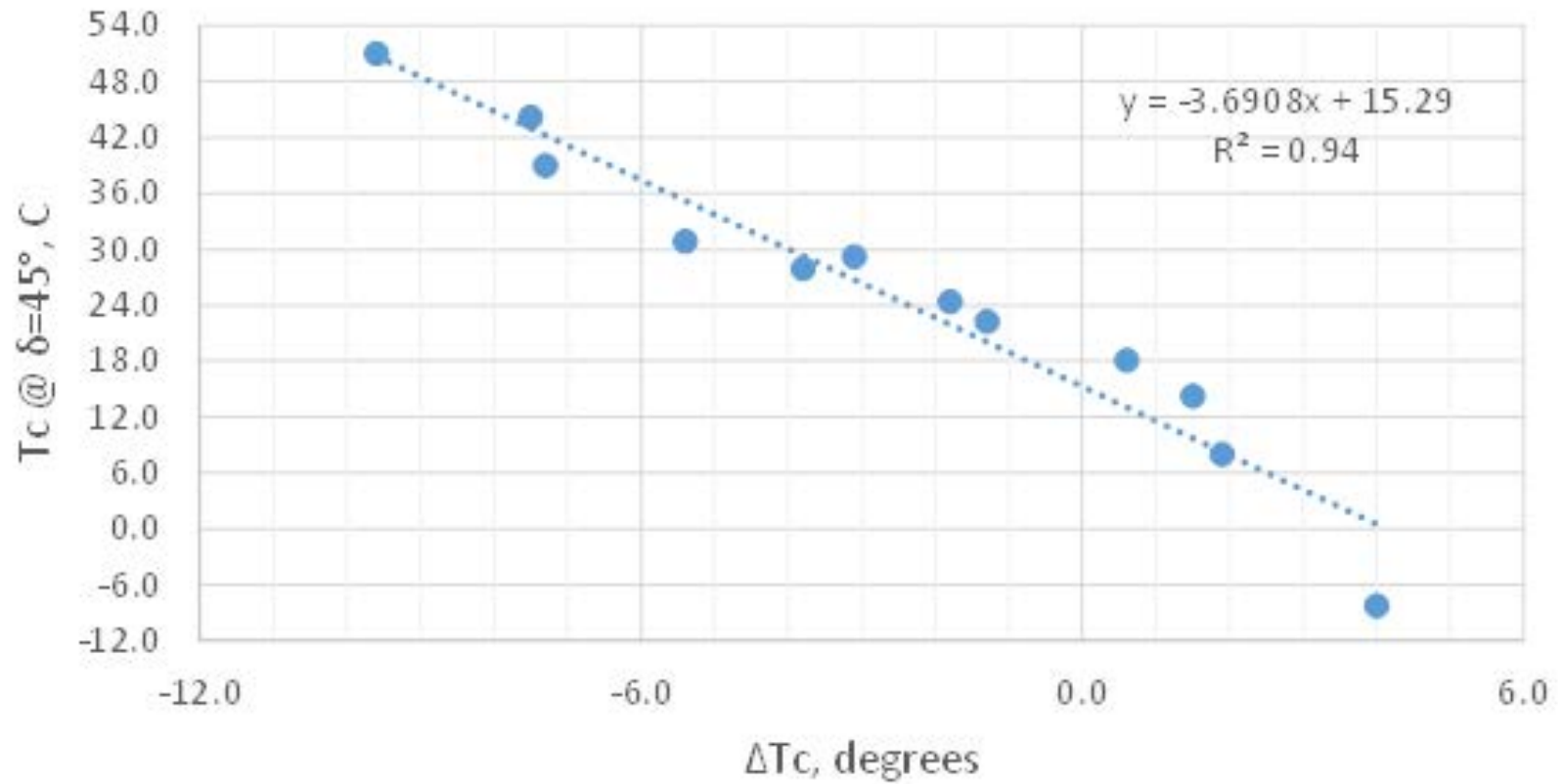


# Mathy, Ergon Data RTFOT 1 and 2 PAV comparison.

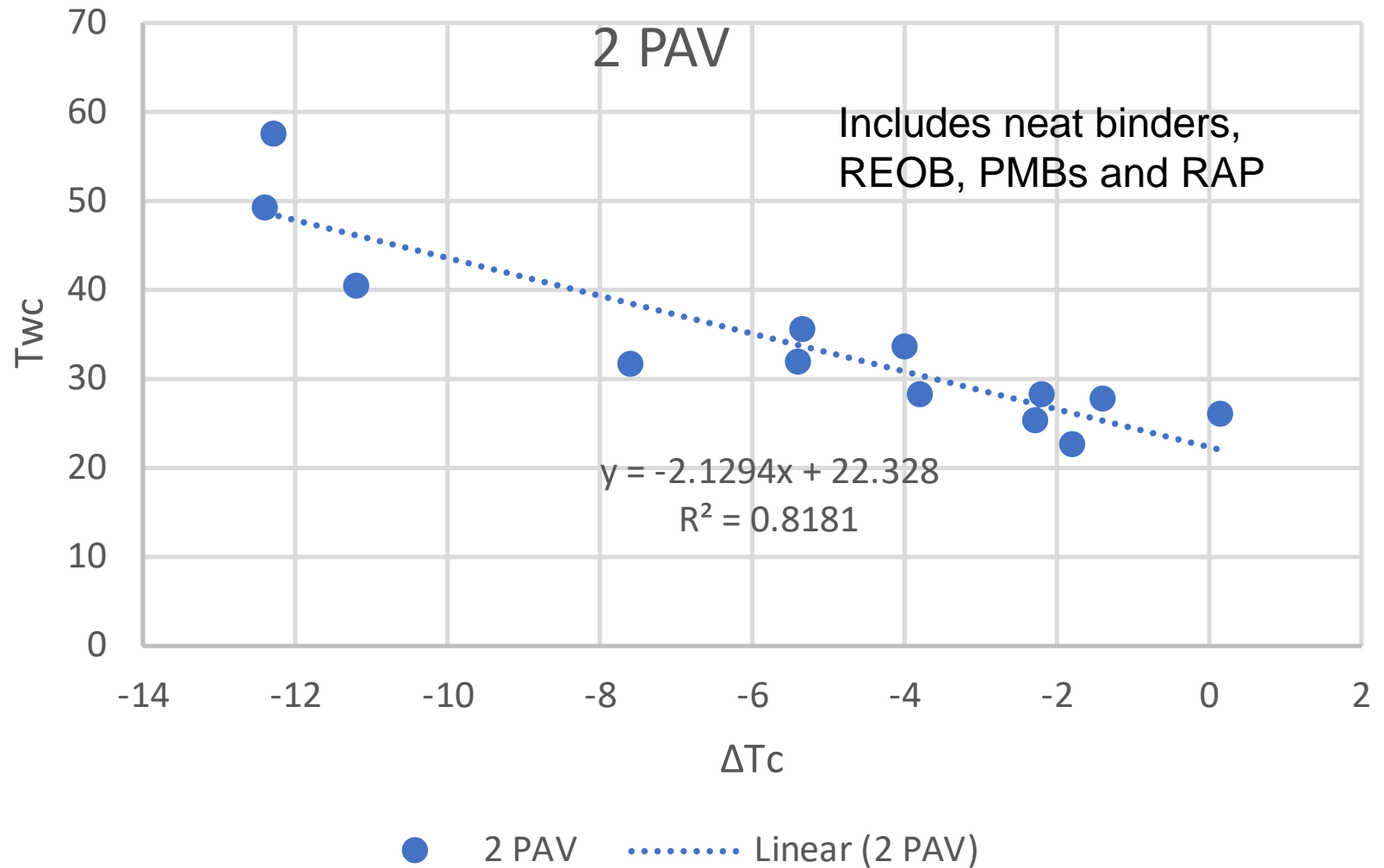


# Data from Original Anderson Paper.

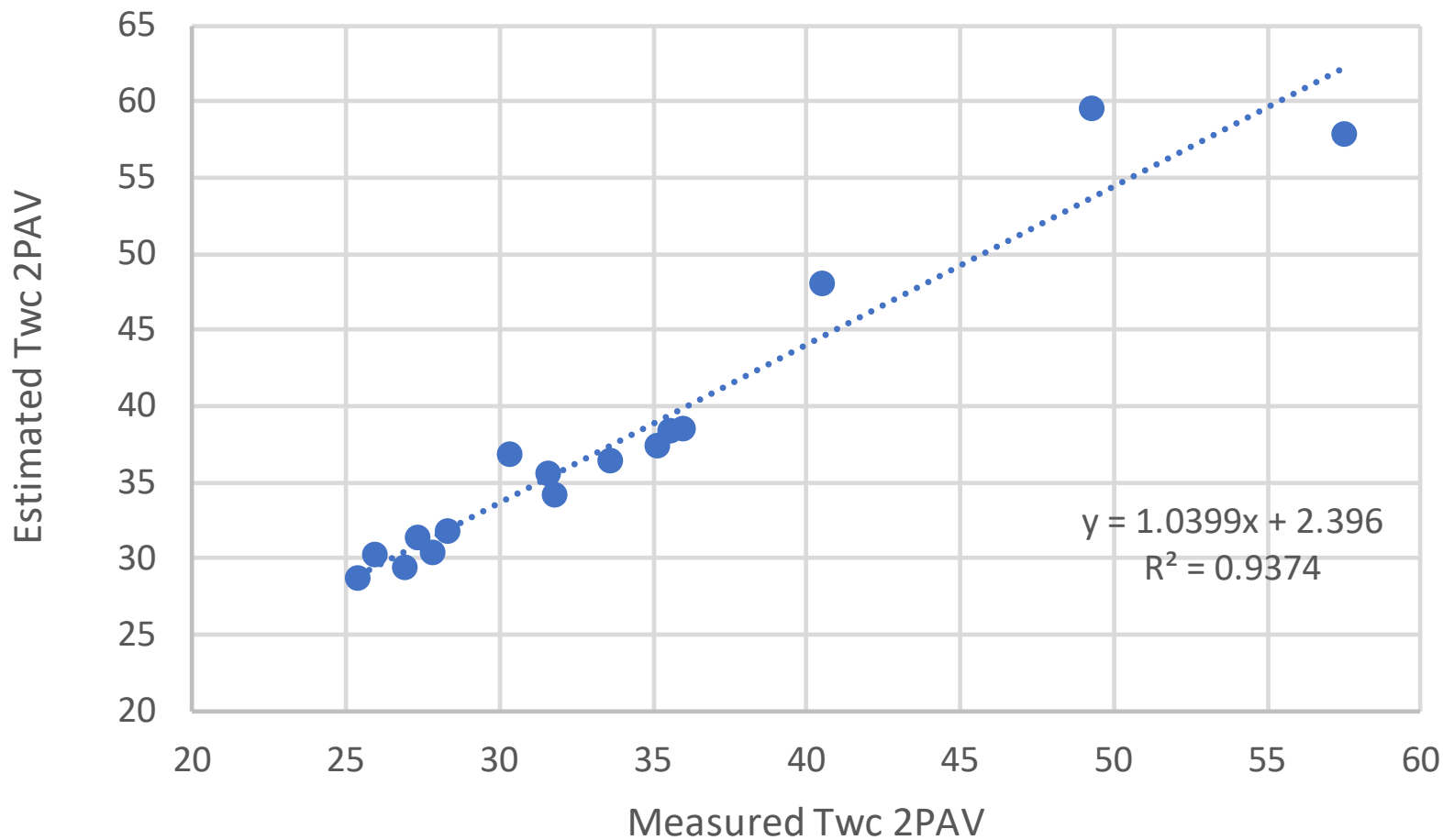
AAPT 06-01 Asphalt Binders



# Comparison of 2PAV $T_{wc}$ and $\Delta T_c$



# Twc correlates well with $\Delta T_c$ and estimated Twc matches Est Twc



# Status

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- There is a close relationship between cross over temperature and  $\Delta T_c$ .
- Cross over temperature  $T_{wc}$  is easy to measure on RTFOT material.
- $\Delta T_c$  is difficult to measure on RTFOT material.

# Status

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- Set limit on  $\Delta T_c$  for 20hr PAV and estimate 40hr PAV using the  $T_{wc}$ .
- If  $\Delta T_c$  is bad at 20hr PAV sample fails.
- If  $\Delta T_c$  is very good at 20hr PAV no issue.
- If  $\Delta T_c$  is questionable and 40hr calculated from  $T_{wc}$  good no issue
- If  $\Delta T_c$  is questionable and 40hr calculated from  $T_{wc}$  need to run 40hr PAV.

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**Thank You**

**Discussions**