

9160000 BITUMINOUS MATERIALS  
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

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Comments: (5-23-18)

MM Section 3.4: 3.4.8.2.1 regarding reporting of Specification Compliance and Quality Control test results. The verbiage in red states that results from SC and QC testing shall be reported within 5 days and 24 hours of sampling, respectively. I think that these time limits should apply based on completion of testing for both SC and QC testing (not the sampling time), but perhaps state that sampling should be performed within, say, 24, 48, or 72 hours after batch creation at the manufacturing facility. To determine the "within XX hours after batch creation" time frame, it would be a good idea to give thought to business days as to when to start the clock on this (think holidays when no one is at work).

Response:

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Comments: (5-23-18)

916-2.3 (testing requirements in table).The inclusion of 40-hr PAV DTc for virgin binder would be a positive step in the right direction, but I do not believe it goes nearly far enough and leaves plenty of room for gaming the system to yield more of the same premature failures. What is the primary objective? Longer-lasting pavements? Elimination of premature failures caused by reduced asphalt fracture resistance? If DTc at 40 hours PAV is important to the agency, why is it only important for the virgin binder component? That component may only comprise 70% - 80% of the overall binder content in the mixture. AASHTO PP 78-17 proposes measuring DTc of the blended (extracted) binder when RAS is included. A minimum DTc of -5 after 40-hrs PAV is also required there. Since RAS reduces DTc, this spec actually demands better virgin binder than what is being proposed here in 916. It seems, though, that the proposed FDOT spec and AASHTO 78-17 are aimed at eliminating or restricting certain additives or components rather than aimed at achieving high-performance binders and pavements. Shouldn't we be measuring DTc and other properties on the extracted binder, regardless of whether it contains RAP, RAS, REOBs, or the next inferior additive that you can't predict will exist? Why would we, as an industry, place restrictions on RAS binder and virgin binder while ignoring RAP binder? Once clever folks understand that you can actually use ANY cheap additives to save money as long as they are added to the RAP pile, that's exactly what will happen. After all, no one is measuring those properties. The inferior fracture resistance properties of RAP binder can no longer be ignored, because these properties have a major affect on the final blended binder properties and long-term pavement performance, particularly in terms of top-down cracking. The way to solve this is to measure the final blended (or extracted) properties of the binder approved in the mix design. In my opinion, it accomplishes little to require such strict properties for virgin binder while literally allowing ANY properties of the RAP binder component (even a DTc of -50 before

aging would be perfectly fine...as long as it's in the RAP binder and not the virgin!). You may also want to consider restricting properties such as loss in BBR (bottom grade) over an extended aging period of 40 hours or more, particularly if measuring the binder properties of a RAP blend. This is because DTc can lose its predictive power if the bottom grade of the blend is already poor. For example, if you have a 30% RAP blend with a bottom grade of -16, it may be that DTc is -4 (S-value failure temps of -20 and m-value failure of -16). Is this better than -22 grade with -28 S-value failure temp and -22 m-value failure temp? Although the former has a better DTc (-4), it should be considered that this binder is still more brittle and susceptible to fracture according to m-value criteria, alone. I prefer to consider and restrict both properties in conjunction with one another and only on the final blended binder, which is all that matters in the end.

Response:

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 Greg Sholar

Comments: (5-30-18)

916-2.3 Table Superpave PG Asphalt Binder: Suggest the highlighted change below to avoid confusion regarding negative numbers.

Pressure Aging Vessel Residue (AASHTO R28-12)		
Dynamic Shear Rheometer, AASHTO T315-12 (2016)	$G^* \sin \delta$ , 10 <sup>3</sup> rad/sec.	Maximum 5000 kPa (f, g)
Creep Stiffness, AASHTO T313-12 (2016)	S (Stiffness), @ 60 sec. m-value, @ 60 sec.	Maximum 300 MPa Minimum 0.300
$\Delta T_c$ , ASTM D7643-16	40 hours PAV aging S (Stiffness), @ 60 sec. m-value, @ 60 sec.	Maximum -5.0°C $\Delta T_c \geq -5.0^\circ\text{C}$

Response: (change will be made)

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Comments: (6-7-18)

The specification changes of REOB limitations and 40-hour PAV  $\Delta T_c$  are being made in an attempt to address recent complaints of soft pavement one day after laying down. As a company, we believe it is important to implement changes based on thorough investigations, and analysis of data from robust studies.

The assumption REOB is the reason for the soft pavement issue is speculation. REOB, in various dosages, has been used for years without any reported issues. The fact that binder is only a small fraction of the pavement, coupled with the fact that the complaint of soft pavement has only

surfaced recently, leads one to the reasonable conclusion that the REOB may not be the cause of the soft pavement. All of the other components of the pavement, and the mix-design itself, would need to be investigated. Without the data to back up the specification changes we cannot be sure the proposed changes will have their intended effects. If the investigation and data analysis reveal REOB to be responsible for the soft pavement, the appropriate measures should be taken. We are not in agreement with the specification changes suggested by the FDOT. The 10% limitation of REOB is unnecessary. REOBs, like asphalt binders, vary in physical, chemical and performance characteristics. When these two are blended together a unique binder is produced. While some of these binders are high quality, others are not. This is often not due to the quantity of REOB in a binder, but rather the quality and interaction of the components in the binder. We, like Asphalt Institute, "...encourage the continued development of performance-related specifications to replace recipe-type binder specifications..." (Asphalt Institute IS-235). Furthermore, limiting a specific additive, without significant testing of any other additive, is not recommended. As such, if the FDOT chooses to enact a formulation-based specification, the proposed limitations on REOBs should be expanded to also include VGOs, antistrips, bio-additives, and any other binder additive used in the production of lower grade binders (PG 58-22, PG 52-28). The addition of the  $\Delta$ TC specification is particularly perplexing, as it does not address the supposed problem of soft pavement. The complaint was about soft pavement after 24-48 hours of aging, so one would expect the addition of a test covering that same 24-48 hour aging. Instead, the proposed 40-hr PAV simulates 15-20 years of aging. Therefore, it does not appear that the proposed 40-hr PAV specification addresses the observed problem. Since the RTFO simulates plant mixing and laying down, it would be more appropriate to use a RTFO test specification to prevent a future soft pavement issue. It is our recommendation that a study on softening point and/or penetration of RTFO aged binders be considered, to determine the specification, if any, needed to prevent soft pavement. Moreover, the addition of the  $\Delta$ TC specification to all binder grades is too broad. If determined to be necessary, the  $\Delta$ TC specification should be limited to only lower grade binders (PG 52-28, PG 58-22) produced using additives. It should be noted that the addition of the  $\Delta$ TC specification to all binder grades adversely affects small producers and laboratories more than larger producers and laboratories. Determining  $\Delta$ TC is time consuming, costly and labor intensive. Terminals with small tanks run specification compliance testing more frequently and small labs often have less equipment and technicians. Running the testing required to determine  $\Delta$ TC will come at a greater cost to those businesses because of the quantity of tests ran and the additional equipment and labor needed to complete testing. The addition of the  $\Delta$ TC specification could inhibit some companies' ability to offer competitive prices. This comment is limited due to the lack of information distributed by the FDOT. A report on the investigation into the soft pavement, along with the data that correlates the soft pavement issue with excessive REOB in asphalt binder, the data that led to the REOB limitation of 10%, and the data that correlates  $\Delta$ TC specification to the soft pavement issue, has not been widely disseminated. Tangential to the specification changes, we have concerns about the quantity and quality of RAP and RAS used in pavements. As the quantity increases, and quality decreases in RAP/RAS, more pressure is put on the binder to meet performance requirements, which may be beyond its capabilities. Prior to making any changes to the specifications, the most prudent course of action would be to attempt to pinpoint the root cause of the soft pavement. Again, we believe it is important to implement changes based on thorough investigations, and analysis of data from robust studies. That being said, we have several questions that have arisen because of the proposed changes and would like answers to these prior to enforcing this change.

1. With current information on hand, REOBs have been used for many years without any reported issues in many states. Please provide data indicating REOBs as a problem?

Response:

2. Please provide a list of jobs that have failed in the last 5 years in this state because of the use of REOBs.

Response:

3. How do you propose to handle a binder when a neat asphalt (no REOBs) meets current specification, but fails proposed ΔTC specification?

Response:

4. 40 hr. PAV stiffens the binder. Provide data showing ΔTC correlates to soft pavement?

Response:

5. Currently all the testing is performed on the raw asphalt. What effect does anti-strip have on the 40 hour ΔTC? Thank you for the opportunity to comment on the proposed specification changes.

Response:

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Comments: (6-12-18)

Regarding the REOB Limit of 10%, I'm concerned that that may be too high and difficult to mix into the asphalt and keep homogeneous. Perhaps 5% would be more manageable. Regarding the ΔTc requirement, this is not practical as a routine certification test. The test is time consuming and would add another 24+ hours on to the aging and testing. I think the test could be useful for forensics or perhaps annual qualification but not for routine certification. There also needs to be a better understanding of what the data means and how it's applied to higher modules binders.

Response:

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Comments: (6-13-18)

Upon review of the suggested revisions for Section 916 the following concerns have arisen within our group at Associated Asphalt:

1. Capping REOB/VTAE at 10% is not a bad idea, our concern surrounds how the DOT will police this specification maximum. It seems that in past conversations testing has been done at a local 3rd party lab, it also sounds as if that lab is tying a percentage amount to samples based on testing that is done. Our current understanding, as Asphalt Institute Members and AI technical committee members, is that zeroing in on an actual percent based of the available test methods is impossible unless actual blank samples of the REOB/VTAE source and the asphalt source are used to “Zero” the equipment. We have been told by contractors in FL that we have 10-15% in samples; some of these samples contain less than 5% of the material but could have Sulfur scavengers that have Zinc in them for H2S encapsulation. This Zinc can and other additives can show as REOB/VTAE if not known. I would question the test methods accuracy in all scenarios and if it is going to be used to penalize suppliers it would seem to be a stretch in confidence of the test and the lab testing.

**Response:**

2. All varieties of REOB/VTAE are not created equal, some sources are much more pure than others. They all impact performance differently and much of that also depends on the starting quality of the neat PG asphalt.

**Response:**

3. Without a test method that can pick up on actual percentage how is the DOT going to arrive at a number for each shipment to ensure that one supplier is not using while others are abiding? REOB/VTAE can be 1/3 to 1/2 of the cost of Neat asphalt binders and without an absolute way of measuring quantity this creates an unlevel playing field for those that abide vs those that push the envelope.

**Response:**

4. Going to 40hour PAV is going to require investments in equipment for labs and suppliers, this is fine but why couple this with the maximum % (of which there is no way to evaluate or police as explained above). 40hr PAV is industry standard performance equivalent at this time so why not just specify this and not maximum percent?

**Response:**

5. If the 40 Hour PAV is added to specification compliance testing the current 5 day reporting window for data will need to be adjusted, there is no way to take a sample and get it turned in 5 or less days when you have a 40 hour cure required on the PAV.

**Response:**

6. Reviewing the link

<http://www.fdot.gov/programmanagement/Implemented/URLinSpecs/Files/Section3.5-051018.pdf>

In section 3.5.6.2 of the Asphalt Binder document it states that suppliers need to submit SC test results to indicate passing materials for materials approval, it also adds that the percentage of REOB/VTAE shall be reported. The dosage rate of REOB/VTAE will likely depend on the

starting characteristics of the binder being treated and the characteristics of the REOB/VTAE. If capped at 10% the number may drift from zero to ten depending on the PG spec values need for final grade compliance and the starting binder numbers. For example a stiff 64-22 may take 10% REOB to soften to a 58-22 while a 64-22 that with a 1.01 OBDSR may only take 2%. Would the 58-22 be the only grade needed for approval? How would we handle the dosage difference? DO we need to get approved for 100/0, 99/1,98/2,97/3,96/4,95/5,94/6,93/7,92/8,91/9,90/10 blends and report the blend based on what is needed to meet the requirements in 916-2? It would appear that there is a great deal of gray area in this specification and that the test methods used to validate actual % REOB may not be as accurate as what FDOT has been told. The concepts in this specification adjustment all are sound but the ability to enforce a maximum percent spec is going to be nearly impossible. Our fear is that delta Tc will dictate supply and with no way of validating % REOB that is trustworthy that the maximum is going to create an unlevel playing field in the market and allow for non-quality oriented suppliers to utilize marginal materials at a higher dosage than others.

Response:

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Comments: (6-14-18)

My concern is fully implementing delta Tc with the 40h PAV requirement. This is very time consuming and will delay shipping as our lab performs multiple tests and generates COAs for multiple customers, routinely. Is it possible to use a 20h PAV residue to calculate this property as a first step, before moving forward with the 40h test? Also, we have not used this property to evaluate all of our binders. If one should fail to meet the delta Tc requirement, I don't know what modifications (if any) are allowed by FDOT to get the binder on spec. I'm not sure how much this would increase binder costs or, if modifications are not allowed, reduce the number of approved suppliers for each grade. Is this being implemented because of the use of REOB in Florida?

Response:

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Comments: (6-14-18)

Based on the data I have seen at binder ETG and various industry meetings, I am of the opinion that using REOB at a level sufficient to result in a  $\Delta T_c$  of  $-5^{\circ}\text{C}$  or lower after 40 hours of PAV aging will result in pavement distresses such as excessive non-load related cracking. As to the duration, possible in a 4 to 5 year time frame. My general feeling is that the industry may be tending toward  $-5$  to  $-6^{\circ}\text{C}$  differential as the "red light" zone for use levels and performance prediction after 20 hours of PAV, I have even heard some ultra conservative folks indicate they

preferred  $-3^{\circ}\text{C}$  as the maximum differential. Texas DOT, for example, implementing a “maximum” differential of  $-6^{\circ}\text{C}$  after 20 hours of PAV aging.

My primary concern with how this is specified in the proposed specification is not the limits but how it is specified, e.g. “Maximum”  $-5.0^{\circ}\text{C}$ . I am of the opinion that this is going to add confusion if not foot noted or specified in a different manner. We know that the value is actually a differential and the negative sign indicates that m-value (or relaxation) is the controlling factor, however, maximum could be taken to indicate that  $-6, -7, -8\dots^{\circ}\text{C}$  numerical values are actually passing numbers as  $-5$  is a greater numeric value. “Maximum” may be appropriate with respect to differential as long as the specification is footnoted to indicate that the value is a numeric differential and the negative sign indicates m-value controlled performance. This may also cause concern with some binders (long shot) if someone were to have a binder that performs such that they have a positive number (stiffness or s-controlled binder) with values of 5 or greater. I don’t think these binders are currently available but that doesn’t mean that someone might develop an aging improving additive that improves low temperature durability which might have higher positive differentials. I am not throw mud into things here, just trying to consider what might happen. Therefore, perhaps you should consider using a “Minimum Numerical Value”  $-5^{\circ}\text{C}$  in this case, any binder greater than  $-5$  after 40 hours of PAV would be passing so  $-5, -4, -3\dots 1, 2, 3$ , etc. This should probably still be clarified in a foot note.

In my opinion, using  $-5^{\circ}\text{C}$  as the limit would actually limit the use levels to much less than 10%, typically on the level of 5% or less (which I am in favor of because frankly I am of the opinion that REOB is NOT binder and never will be, I stop at that so that I don’t preach) I have doubts that any binder containing 10% REOB will meet the 40 hour PAV  $\Delta\text{Tc}$  value of greater than  $-5^{\circ}\text{C}$ . (Minimum  $-5$  numerical value). I have indicated to our company that should the use of REOB be considered, that it should not be considered as a property modifier and I prefer no more than 3% which, frankly, is nothing more than a way to dispose of REOB and perhaps provide economic benefits.

Another concern is binders which do not contain REOB but may be restricted by the  $\Delta\text{Tc}$  limit of  $-5^{\circ}\text{C}$  for the 40 hour PAV. There are non-REOB containing binders which have been used and may be being used currently that might fail this criteria and still provide adequate performance. You may have some push back from some of these suppliers with this specification. In this case the REOB content limit may be important, whether it be 5%, 10% or whatever, perhaps there should be a verification test for content of REOB (XRF) or an indication that the  $-5^{\circ}\text{C}$  is limited to REOB containing binders? Not sure what you can do here.

There is enough research out to indicate that excessive use of REOB is not a good thing and content should be limited. I have already indicate that opposed to 0%, my general feeling is that 3% may be an appropriate limit, but I could be pushed to 5% if desirable properties are not met. Florida’s LTPP bind climate versus products specified my allow a little tolerance here? I also caution that there are other non-REOB oils which may cause poor performance if used in excess as well as other additives such as recycled asphalt shingle (while asphalt, not so sure we should be allowing this in our pavements personally do not agree with the binder replacement argument from my previous experience working in the roofing membrane manufacturing industry)

Lastly, if implementation of a  $\Delta\text{Tc}$  limit proves to be a major nightmare use levels restrictions of REOB with  $\Delta\text{Tc}$  monitoring might not be a bad idea. Again there are methods to determine

REOB content and use levels that could be employed. A 5% REOB specification should be acceptable to anyone though I know you will get the argument of just specify performance and let the supplier produce the product. The AI white paper indicated that 10% might be okay but I truly think this is too much and have seen some suppliers who were pro 10% back off of this level because they have seen related issues.

**Response:**

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Kevin Hardin  
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**Comments: (6-14-18)**

I thank for the opportunity to provide comments on the propose new specification changes for section 916 regarding REOB content and the  $\Delta T_c$  low temperature parameter.

It should be recognized that these proposed changes are intended to improve the materials used in our asphalt roads. REOB – With my experience in REOB use and blending there have been issues with getting the REOB uniformly dispersed within the asphalt binder. With some binders the blending may require a significant time to achieve consistent test results. Suggest each supplier using REOB submit a control chart showing test result versus time in hours.

Also I have asked the Heritage Group in Indianapolis if they could quantify the amount of REOB present in asphalt binder. The response from the laboratory manager at Heritage was “I spoke w/ our chemist and his biggest concern would be the constituency of samples from batch to batch, producer to producer, and effects of the used oil source on metal content. He also mentioned that you would want to target metals that are not present in asphalt.

So at this point, I would say that we are not comfortable making an estimate of VTAE content in a binder sample based on the metal content.” Cryrstal Clean, (<http://www.crystal-clean.com/>) is a producer of REOB and is part of the Heritage group. In my opinion you can identify if REOB is present or absent in asphalt binder however you cannot determine the REOB content.

How can the 10% REOB maximum content to be measured or verified?  $\Delta T_c$ , 40 hour PAV – I do not think we are prepared for the implementation of the parameter for the following reasons:

- 1) South Florida Materials / Vecenergy asphalt terminal has asked our asphalt suppliers if they could supply asphalt binder meeting the proposed  $\Delta T_c$  40 hour PAV requirement. The answer was that they do not know if they can.
- 2) Florida at this time would be the only state DOT requiring the  $\Delta T_c$  40 hour PAV. I think the refineries will have to make a decision to on if they need to change crude supplies and refinery operations for the supply of one state. This could lead to supply problems. There needs to be at least several states to have the same specification requirement. This happened with the adoption of non SHRP grade of PG 67-22 in the south eastern states.
- 3) The additional testing for  $\Delta T_c$  40 hour PAV will probably require additional lab equipment to be purchased. In our laboratory a quick estimate would be \$55,000.
- 4) Along with the extra lab equipment it will require extra labor to perform the testing. Each sample will require an extra 24 hours of lab testing time. The specification applies to all the binder grades so for SFMC it would be an additional 168 - 240 hours of testing.
- 5) IF the  $\Delta T_c$  40 hour PAV specification was proposed to limit the REOB content then I suggest this specification only be required of REOB containing asphalt binders.
- 6) I have not seen data on if the current binders being supplied into Florida are meeting the  $\Delta T_c$  40 hour PAV parameter. I think the FDOT should implement an information gathering period on

the current binders as to if they meet the requirement. Then present the data to the binder suppliers. Currently we don't know what test results FDOT has seen from the suppliers.  
7) Again, I don't think this parameter is quite ready for Florida as a specification.  
Thanks for considering my comments in the face of these two proposed specification changes.  
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**Response:**

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**Comments: (6-14-18)**

The Asphalt Contractors Association of Florida, Inc. has a vested interest in ensuring quality binders with short and long-term performance are used in Florida.  
Regarding the limitation of REOB and the inclusion of DeltaTc test, we understand the Department's position needing to address this issue. There doesn't appear to be nationwide consensus on the use of Delta Tc as a certification test. This test may delay shipment of products due to the extended testing time required (40 hours). Limiting the REOB percentage to 10% or less may not resolve the long term performance issue. Until such a time as there is an adequate science based agreement on how to handle this REOB, the ACAF, Inc. recommends a ban on its use.  
We recommend an industry panel consisting of FDOT, Binder suppliers, and contractors to meet ASAP to develop a short and long-term course of action to ensure the Department gets a quality binder in the 916 specifications. Any changes to the specification can be initiated in a FDOT materials memo prior to inclusion in the standard specifications.  
We will be discussing this at an industry forum on June 15th (1 day past the deadline of this spec change) and do hope the Department considers the discussion that will occur in the resolution of this issue.

**Response:**

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