AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

COMMITTEE ON MATERIALS & PAVEMENTS

2018 Annual Meeting – Cincinnati, OH
Wednesday August 8, 2018
10:15 – 12:00 AM EST

TECHNICAL SUBCOMMITTEE 3C
Hardened Concrete

I. Call to Order and Opening Remarks Meeting called to order by the Chair at 10:14 am.

A. Brief summary of activities

2018 Group 1 release

- 2 new standards published:
  - TP 109-18 – Vibrating Kelly Ball (VKelly) Penetration in Fresh Portland Cement Concrete)
  - PP 89-18 – Grinding the Ends of Cylindrical Concrete Specimens
- 4 revised standards published: T 23, T 97, PP 84, and T 359
- 2 provisional standards moved to full Standards:
  - TP 109, now T 379 – Nonlinear Impact Resonance Acoustic Spectroscopy (NIRAS) for Concrete Specimens with Damage from the Alkali–Silica Reaction (ASR)
  - TP 110 now T 380 – Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures Miniature Concrete Prism Test, MCPT)

II. Roll Call

Membership (Attachment #1)

Voting Members:

Member states present: TN, VA, AL, AZ, CT, DC, FL, ID, IL, KS, MD, MI, MO, MT, ME, NV, NH, NY, OH, OK, ON, PA, WA

As a reminder, there are some new guidelines in the AASHTO Information Guidelines about how to become a friend of a committee.

Brian	Egan (Chair)	TN
Charles (Andy)	Babish (Vice-Chair)	VA
Scott	George	AL
Richard	Giessel	AK
Paul	Burch	AZ
Robert	Lauzon	CT
Wasi	Khan	DC
Harvey	DeFord	FL
Brian	Ikehara	HI
Mike	Santi	ID
Brian	Pfeifer	IL
Richard	Barezinsky	KS

John	Staton	MI
Brett	Trautman	MO
Ross (Oak)	Metcalfe	MT
Mick	Syslo	NE
Darin	Tedford	NV
Denis	Boisvert	NH
Donald	Streeter	NY
Daniel	Miller	OH
Kenny	Seward	OK
Becca	Lane	Ontario
Timothy	Ramirez	PA
Jose	Lima	RI

Woody	Hood	MD		Danny	Lane	TN
John	Grieco	MA		Kurt	Williams	WA

III. Approval of Technical Subcommittee Minutes

Meeting date: Midyear Webinar November 14, 2017 (Attachment #2)

Motion: MO

Second: NY

No discussion.

No opposed.

IV. Old Business

A. COMP Ballot Items

1. **Item No. 11** – Dual Ring Test Using Inner Concrete Ring (Fall 2016 Ballot)- 3 Negative votes persuasive, yet to receive revisions from original author.

   Since there has been no activity on this standard for over a year, it will be shelved until there is interest again. Vice Chair to follow-up with Author (Jason Weiss, Oregon State University).

   There has been no activity on this for over two years, so the Chair will sunset this.

2. **Item No. 13** – Make PP 65 a Full Standard (Now R-80)- some edits to Table 6 and Figure 3 are not in the printed version and are still needed. TF 16-01 – to report on significant digits.

   Different zones (1, 2, and 3) in Figure 3 were not published and separation lines in Table 6 – editorial change.

   Editorial edits (Identifying Zones 1, 2, and 3 in Figure 3 and adding lines the table 6) were made (by Brett Trautman) to make the tables easier to understand. Brett Trautman (MO) is the steward for this standard.

   ASTM C1778 update (AASHTO R 80):

   - Looking at clarifying Fig. 1
   - Working on correcting terminology for alkali content and alkali loading; making changes to the structure classification tables and clarify categories for risk
   - They are not changing their significant digits

3. After Fall 2017 Rolling ballot, several editorial revisions were corrected prior to printing and several "non-editorial" items included in the May TS 3C ballot.

B. TS Ballots

- TS 3C 2018 Spring Ballot
- 3 Items were balloted, ALL passed TS ballot

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

Item #	Description	Results	Comments
1	T 358, It was discovered that the Precision statements and the reference document for the Precision statements were incorrect. This TS ballot revises the Precision statement and identifies the correct reference document. See V. New Business, D. Correspondence on pages 7 and 8 of the Minutes.	Affirmative: 22 of 28 Negative: 0 of 28 No Vote: 6 of 28	
2	T 380 This ballot item revises a reference in Section 2.1 and revises a mold size in section 4.1.1 See V. New Business, B. AASHTO re:source/CCRL on page 7 of Minutes.	Affirmative: 22 of 28 Negative: 0 of 28 No Vote: 6 of 28	
3	PP 89 This TS ballot makes revisions to sections 1.2, 2.1, 3.4,4.1,5.1, 5.2, 5.3, 6.1, 6.5, and 6.6. Revisions are in response to comments made on Rolling Ballot #1 in the fall 2017. See Item #21 of minutes page 6 of 8.	Affirmative: 22 of 28 Negative: 0 of 28 No Vote: 6 of 28	PA Affirmative with comment: 1) The proposed revisions have not been added to the published version of PP 85-18. It is recommended to add these proposed revisions to the most current version of PP 85 before going to a SOM ballot; otherwise, there may be a lot of editorial comments.

Motion to move T 358, T 380, and PP89 to full COMP ballot:
Motion: OK
Second: MO
No discussion.
No opposed.

C. Task Force Reports

1. **TF 16-01:** PP 65/R 80 significant digits and notes/equations for Figure 3 (FHWA – Ahlstrom, PA – Horwhat [retired], MO – Trautman)

Lines was drawn, and then equations were determined based on those lines… is there any significance to having the equations since they are based on a line that no one is totally sure how the line was drawn?

Brett will get in touch with the ASTM subcommittee and see if they have any interest in adding the equations.

2. **TF 17-01**: T358 Resolve P&B statement (TN – Egan, NY – Streeter, FL – Ruelke, Clemson University – Mike Jackson, FHWA – Jussara Tanesi) (Attachment #3)

It was brought the subcommittee's attention that the precision and bias statements are referencing something completely different than surface resistivity.

The TF decided to go with the original numbers from the original report.

V. New Business

A. Research Proposals (John Stanton, MI, Research Liaison)
   1. Quick turnaround RPS
   2. Full NCHRP RPS-
      - FY 2019 Funded of interest to the TS 3C
         - Project 10-103, Problem D-11, *Benchmarking Accelerated Laboratory Tests for ASR to Field Performance: Consideration of Cement and Alkali Contents and Influence of SCMs*

           Andy Naranjo (TX) is on the panel
         - Project 10-104, Problem D-13, *Evaluating Use of Unconventional Fly Ash Sources in Highway Concrete*

   No research proposals submitted.

   ASR Mitigation

   The Chairs of 3a and 3c might team up together and send out a survey to the two groups and figure out what people are doing when/if they run into ASR.

   Larry Sutter (Michigan Tech) suggested that we need to get a really good feel for what states are dong with ASR, and whether or not they're using R80. If states aren't using/following R80, why? If there are issues with R80, we should figure out what they are, and how to address the problems and improve the standard so people are actually using it.

   M85 is going to full committee ballot and the changes in M85 will put a little more emphasis on R80.

B. AASHTO Technical Service Programs Items None.

C. NCHRP Issues (see attachment)

D. Correspondence, calls, meetings None.

E. Presentation by Industry/Academia

1. *National Implementation Activities and Performance Engineered Mixtures (PEM) Pooled Fund Update* by Mike Praul (Senior Concrete Engineer, FHWA) (Attachment #6)
2. *PEM (PP 84) Updates and Affiliated Standards* by Cecil Jones (Diversified Engineering Services) (Attachment #7)

   Motion to move PP 84 to a concurrent ballot:
   Motion: NE
   Second: NY
   No discussion.
   No opposed.

   Summary of proposed changes outlined in the referenced attached presentation are;
   - removal of restrained shrinkage language, put in appendix for users applying to concrete other pavement concrete
   - edited SAM criteria
   - editorial clarifications

3. *Accelerated Determination of Potentially Deleterious Expansion of Concrete Cylinders Due to ASR* by Anol Mukhopadhyay (Texas A&M/TTI) (Attachment #8)

F. Proposed New Standards

G. Proposed New Task Forces

- Jason Weiss proposed changes, Task Force TF 18-01 (Implementation of Changes to PP 84 (Developing Performance Engineered Concrete Pavement Mixtures), TP 119, T 365, and other PP 84 related standards)

o changes to TP 119, Electrical Resistivity of a Concrete Cylinder Tested in a Uniaxial Resistance Test (up for reconfirmation) and T 365, Quantifying Calcium Oxychloride Amounts in Cement Pastes Exposed to Deicing Salts (Attachment #4)
  Jason Weiss agreed to hold a webinar for TS and TF members to learn more about the proposed changes to TP 119 and T 365. A webinar will be scheduled in late summer or fall.

  Don Streeter (NY) volunteers to be the lead of the Task Force Group.
  Other volunteers include: James Krstulovich (IL), John Staton (MI), Matt Romero (OK), Dan Miller (OH), Mike Praul (FHWA), Peter Wu (GA), Brian Hunter (NC) and Cecil Jones (DES).

H. Standards Requiring Reconfirmation

- T 024M/T 024-15, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- T 148-15, Measuring Length of Drilled Concrete Cores
- T 178-15, Portland-Cement Content of Hardened Hydraulic-Cement Concrete
- T 198-15, Splitting Tensile Strength of Cylindrical Concrete Specimens
- T 277-15, Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

- T 336-15, Coefficient of Thermal Expansion of Hydraulic Cement Concrete
- T 356-15, Determining Air Content of Hardened Portland Cement Concrete by High-Pressure Air Meter
- T 357-15, Predicting Chloride Penetration of Hydraulic Cement Concrete by the Rapid Migration Procedure
- TP 119-15, Electrical Resistivity of a Concrete Cylinder Tested in a Uniaxial Resistance Test – NY has already learned that not preparing the specimens correctly lead to some strange numbers, so preparation should be clarified. Will either be reconfirmed as is or revised with changes as recommended by TF 18-01.

I. COMP Ballot Items (including any ASTM changes/equivalencies/harmonization)

- Will submit the three (3) TS 3C spring ballot items to COMP
- PP 84 (concurrent)

J. Technical Subcommittee 3C – Standard Stewards – (Attachment #5)

Since Stewards have not come forward voluntarily, Chair has decided to assign standards to the voting members of TS3c. See Attachment #5A.

VI. Open Discussion

T22: Has there been any discussion about harmonizing with C39 about types of cylinder breaks? Chair is not aware of any harmonization efforts in this area. The Chair asked the steward (FL DOT) to look into this issue and report back to the committee at the mid-year meeting. No one is aware of any reason NOT to harmonize with the ASTM standard. Colin Lobo made the suggestion to look at the tolerance on the age of testing between T22 and C39.

VII. Adjourn at 11:56 pm.

Motion: NY
Second: VA
No discussion.
No opposed.

Attachment #1

Technical Subcommittee 3C (TS 3C)- Hardened Concrete, Voting Members

Brian	Egan (Chair)	Tennessee Department of Transportation	brian.egan@tn.gov
Charles (Andy)	Babish (Vice-Chair)	Virginia Department of Transportation	andy.babish@vdot.virginia.gov
Scott	George, P. E.	Alabama Department of Transportation	georges@dot.state.al.us
Richard	Giessel	Alaska Department of Transportation and Public Faci	richard.giessel@alaska.gov
Paul	Burch	Arizona Department of Transportation	pburch@azdot.gov
Robert	Lauzon	Connecticut Department of Transportation	robert.lauzon@ct.gov
Wasi	Khan	District of Columbia Department of Transportation	wasi.khan@dc.gov
Harvey	DeFord	Florida Department of Transportation	harvey.deford@dot.state.fl.us
Brian	Ikehara	Hawaii Department of Transportation	brian.ikehara@hawaii.gov
Mike	Santi	Idaho Transportation Department	mike.santi@itd.idaho.gov
Brian	Pfeifer	Illinois Department of Transportation	brian.pfeifer@illinois.gov
Richard	Barezinsky	Kansas Department of Transportation	rick.barezinsky@ks.gov
Woody	Hood	Maryland Department of Transportation	whood@sha.state.md.us
John	Grieco	Massachusetts Department of Transportation	John.Grieco@dot.state.ma.us
John	Staton	Michigan Department of Transportation	statonj@michigan.gov
Brett	Trautman	Missouri Department of Transportation	brett.trautman@modot.mo.gov
Ross (Oak)	Metcalfe	Montana Department of Transportation	rmetcalfe@mt.gov
Mick	Syslo	Nebraska Department of Transportation	Mick.Syslo@nebraska.gov
Darin	Tedford	Nevada Department of Transportation	dtedford@dot.nv.gov
Denis	Boisvert	New Hampshire Department of Transportation	Denis.Boisvert@dot.nh.gov
Donald	Streeter	New York State Department of Transportation	donald.streeter@dot.ny.gov
Daniel	Miller	Ohio Department of Transportation	daniel.miller@dot.ohio.gov
Kenny	Seward	Oklahoma Department of Transportation	kseward@odot.org
Becca	Lane	Ontario Ministry Of Transportation	Becca.Lane@ontario.ca
Timothy	Ramirez	Pennsylvania Department of Transportation	tramirez@pa.gov
Jose	Lima	Rhode Island Department of Transportation	jose.lima@dot.ri.gov
Danny	Lane	Tennessee Department of Transportation	danny.lane@tn.gov
Kurt	Williams	Washington State Department of Transportation	willikr@wsdot.wa.gov

Technical Subcommittee 3C (TS 3C)- Hardened Concrete, Non-Voting Members

Anne	Holt	Ontario Ministry Of Transportation	anne.holt@ontario.ca
Carole Anne	MacDonald	Ontario Ministry Of Transportation	Caroleanne.macdonald@ontario.ca
Cecil	Jones	Diversified Engineering Services, Inc.	cecil.jones@nc.rr.com
Chad	Clawson	AASHTO	cclawson@aashto.org
Colin	Lobo	NRMCA	clobo@nrmca.org
Daniel	Tobias	Illinois Department of Transportation	daniel.tobias@illinois.gov
Desna	Bergold	D B Consulting and Associates, LLC	desna@dbconllc.com
Eric	Carleton, P.E.	National Precast Concrete Association	ecarleton@precast.org
Hannah	Schell	Ontario Ministry Of Transportation	Hannah.Schell@ontario.ca
Jan	Prowell	Cement and Concrete Reference Laboratory	jprowell@astm.org
Jesus	Sandoval-Gil	Arizona Department of Transportation	jsandoval-gil@azdot.gov
John	Melander	Slag Cement Association	John.Melander@slagcement.org
John	Giannini	Connecticut Department of Transportation	john.giannini@ct.gov
Katheryn	Malusky	AASHTO	kmalusky@aashto.org
Larry	Sutter	Michigan Technological University	llsutter@mtu.edu
Matthew	Bluman	AASHTO Re:source	mbluman@aashtoresource.org
Paul	Tennis	Portland Cement Association	ptennis@cement.org
Prasad	Rangaraju	Clemson University	prangar@clemson.edu
Sonya	Puterbaugh	AASHTO Re:source	sputerbaugh@aashtoresource.org
Steven	Ingram	Alabama Department of Transportation	ingrams@dot.state.al.us
Steven	Tritsch	Iowa State University	stritsch@iastate.edu
Ken	Nwankwo	Wisconsin Department of Transportation	Kenneth.Nwankwo@dot.wi.gov
Steven	Lenker	AASHTO Re:source	slenker@aashtoresource.org
Maria	Knake	AASHTO Re:source	mknake@aashtoresource.org
William	Bailey	Virginia Department of Transportation	bill.bailey@vdot.virginia.gov
Sean	Parker	Oregon Department of Transportation	Sean.P.Parker@odot.state.or.us

ATTACHMENT #2

AASHTO
THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

SUBCOMMITTEE ON MATERIALS

2017 Midyear Meeting Webinar
Tuesday, November 14, 2017
2:00 – 4:00 PM EST

TECHNICAL SECTION 3C
Hardened Concrete

I. Call to Order and Opening Remarks

Call to order at 2:05pm EST

II. Roll Call (Voting Members Only)

Brian	Egan (Chair)	TN	Present	Ross "Oak"	Metcalfe	MT	Present
Charles	Babish (VC)	VA	Not present (NP)	Mick	Syslo	NE	Present
Richard	Giessel	AK	NP	Denis	Boisvert	NH	Present
Steven	Ingram	AL	NP	Darin	Tedford	NV	Present
Paul	Burch	AZ	Present	Donald	Streeter	NY	Present
Robert	Lauzon	CT	NP	Daniel	Miller	OH	NP
Wasi	Khan	DC	NP	Kenny	Seward	OK	Present
Michael	Bergin	FL	Present	Becca	Lane	ON	Present
Brian	Ikehara	HI	Present	Greg	Stellmach	OR	NP
Michael	Santi	ID	NP	Timothy	Ramirez	PA	Present
Brian	Pfeifer	IL	Present	Jose	Lima	RI	NP
Richard	Barezinsky	KS	NP	Danny	Lane	TN	Present
John	Grieco	MA	NP	Darren	Hazlett	TX	NP
Woody	Hood	MD	Present	Kurt	Williams	WA	Present
John	Staton	MI	Present				
Brett	Trautman	MO	Present				

All attendees listed (compiled from email and the webinar attendance list):
Tim Ramirez (PA)
Denis Boisvert (NH)
Brett Trautman (MO)

Rick Bradbury (ME)
Anne Holt (MTO)
Carol Anne MacDonald (MTO)
David Jones (WA)
Michael Rigby (AZ)
John Melander (Slag and Cement Association)
Mick Syslo (NB)
Monica Flournoy (GA)
Lawrence Sutter (MI Tech University)
Jan Prowell (CCRL)
Don Streeter (NY)
Brian Ikehara (HI)
Michael Bergin (FL)
Greta Smith (AASHTO)
John Staton (MI)
Lyndi Blackburn (AL)
Brian Johnson (AASHTO)
Kevin Burns (WA)
Dan Tobias (IL)
Curt Turgeon (MN)
Scott Seiter (OK)
Larry Sutter
Michael Benson
Brian Egan
David Jones
Cecil Jones
Oak Metcalfe
Colin Lobo
Scott Andrus
Matt Needham
Craig Wilson
Wally Heyen
Darin Tedford
Mladen Gagulic
Wesley Glass
Sonya Puterbaugh (AASHTO)

III. Approval of Technical Section Minutes

A. Approval of Annual Meeting Minutes, Phoenix, AZ, August 9, 2017 **ATTACHMENT #1**

Motion to approve minutes by Oklahoma, 2nd by Pennsylvania, No Discussion, No opposing, Motion Passes and Minutes Approved

IV. Old Business

A. SOM Ballot Items

1. Item No. 11- Dual Ring Test Using Inner Concrete Ring (Fall 2016 Ballot)- 3 Negative votes persuasive, yet to receive revisions from original Author

Since there has been no activity on this standard for over a year, it will be shelved until there is interest again. Vice Chair to follow-up with Author (Jason Weiss, Oregon State University)

2. Item No. 13- make PP 65 a Full Standard (Now R-80)- some edits to Table 6 and Figure 3 are not in the printed version and are still needed. TF 16-01 – to report on significant digits.

Different zones (1, 2, and 3) in Figure 3 were not published and separation lines in Table 6 – editorial change.

3. Rolling Ballot #1, Fall 2017- Hardened Concrete, Items 15-23

Item Number:	**15**
Description:	Concurrent ballot item to add new Provisional Standard (TP xxx), Vibrating Kelly Ball (VKelly) Penetration in Fresh Portland Cement Concrete. The item is currently Appendix 4 (X4) in PP 84, Developing Performance Engineered Concrete Pavement Mixtures. See p. 4, Item #8 in Appendix C, and Appendix F of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments:

Pennsylvania DOT (Timothy L Ramirez) (tramirez@pa.gov) Affirmative with comments:

1) In Section 2.1, shouldn't the year designation be included for T 183 since it is a withdrawn or discontinued standard? This standard was withdrawn/discontinued sometime between 1974 and 1978 as the 1974 AASHTO Published standards included AASHTO T 183-72, but the 1978 AASHTO Published standards did not include AASHTO T 183. If AASHTO T 183 is to be referenced, the year designation would be very helpful to know, so that the user knows how far back in published standards they need to look for this reference. If this reference to T 183 is just to indicate we had a similar test once upon a time (i.e., Note 1 of this standard), then perhaps remove T 183 from Section 2.1 and include T 183 as a subsection reference in Section 11 REFERENCES of this standard.
2) In Section 2.2, similar comment to previous comment, but regarding the withdrawn ASTM C360. Should it be listed as "C360-92" or listed as a subsection in Section 11 REFERENCES?

3) In Section 4.2, should "38 mm [1.5 in.]" be "37.5 mm [1.5 in.]"?

4) In Section 5.1.1.4, should specific tolerances be included for the mass/weight of the Steel Kelly ball to account for slight variations or for wear due to use? By the current specified mass/weight, some tolerance is built in due to rounding to the nearest 0.1 kg (1 lb), but is this enough?

Missouri DOT (Dave D Ahlvers) (david.ahlvers@modot.mo.gov) An affirmative vote with a few comments:

1) In Section 6.3, it indicates that a level surface is created. No information is provided on how this is done. Recommend adding some wording to describe how this is to be achieved.

2) In Section 8.1, recommend defining the variables used in the mentioned equation, Ds = Rs - Ri.

3) In Section 8.2, recommend defining the variables used in the mentioned equation, Dt = Rt - Rs.

4) In Section 9.4, recommend removing the words, "without remixing" to avoid possible confusion with Section 7.3.

Chair/Vice Chair comments:

PADOT comment #1) Most recent version was 1977. Most documents do not reference the year to avoid obsolescence. Will check with AASHTO editors to help make this decision, #2) Most recent version was 1999. Most documents do not reference the year to avoid obsolescence. Will check with AASHTO editors to help make this decision, #3) Will be revised, #4) 30 ± 0.1 lb (13.61 ± 0.05 kg)

MDOT Comment #1) Clarifying language will be added, #2) Ds will be added, Rs and Ri defined in sections 7.1.4 and 7.1.3, #3) Dt and Rt defined in sections 8.2 and 7.2.2, #4) This will be corrected.

Proposed Editorial changes were acceptable to PA (Ramirez) and MO (Trautman)

Item Number:	**16**
Description:	SOM ballot item to revise section 5.3 of T 23, Making and Curing Concrete Test Specimens in the Field, to be consistent with ASTM See p. 2, Item #1 in Appendix C, and Appendix G of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments:

Pennsylvania DOT(Timothy L Ramirez) (tramirez@pa.gov) Editorial comment:

1) In Section 5.3, last line, suggest revising from "(greater lengths is allowed)" to "(greater lengths are allowed)".

Oklahoma DOT (Kenny R Seward) (kseward@odot.org) The end of the additions to 5.3 should be either (greater length is allowed) or (greater lengths are allowed), not (greater lengths is allowed).

Missouri Department of Transportation (Dave D Ahlvers) (david.ahlvers@modot.mo.gov) Affirmative vote with an editorial comment:1) In Section 5.3, the last sentence, it states, '(greater lengths is allowed)'. Recommend changing to, '(greater lengths are allowed)'.

Chair/Vice Chair comments- Agree, editorial change will be made before printing

Item Number:	**17**
Description:	SOM ballot item to revise section 5.3, 5.4, 6.1 and various notes in T 97, Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading), to be consistent with ASTM. See p. 2, Item #2 in Appendix C, and Appendix H of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: None

Item Number:	**18**
Description:	SOM ballot item to revise section 10 in T 97, Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading), to include updated precision and bias statements derived after a multi-lab study completed in accordance with ASTM C670.

	(Note- The ASTM C78 was balloted and passed with this new precision statement. The RR# xxx will be available after October 1 and will be included in the standard before publishing) See p. 2, Item #3 in Appendix C, Appendix D, and Appendix I of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: **Pennsylvania DOT (Timothy L Ramirez) (tramirez@pa.gov)** Technical comments:

1) In Table 1, the second row for 100 mm [4 in.] has a very specific modulus of rupture of 6.9 MPa [1000 psi]; whereas all the other rows include a range (e.g., 4.1 to 5.5 MPa [600 to 800 psi]), how is the user to use the second row? If they have a 100 mm [4 in.] beam depth with a modulus of rupture of somewhere between 5.5 and 6.9 MPa [800 and 1000 psi], when does the acceptable difference of 17.1% become 31.8%? Is this at 6.2 MPa [900 psi], halfway between the two rows for 100 mm [4 in.] beam depths? More guidance should be provided here due to the significant increase in acceptable percentage difference of 17.1% to 31.8%.

Editorial comment:

2) In Table 1, table footnotes should be superscript small letters, not superscript numbers. Revise Table 1 superscript "1" to superscript "a" so this reference is not confused with the numbered references at end of standard.

Chair/Vice Chair comments: Table 1 was presented as is due to the available data when determining the Precision of the test results. The author of the P&B report has provided the following explanation as to why the Precision table is as written:

We had 3 mixes with the following averages:

Mix	*4 by 4 by 14 in.*	*6 by 6 by 21 in.*
2	*986*	*935*
3	*816*	*785*
4	*609*	*580*

So, we had 2 mixtures between 600 and 800 psi and one mixture around 1,000 psi. I would expect that the variability results obtained for mixture 2 (around 1,000 psi) would apply to mixtures above 1,000 psi but, since we didn't have any other mixture above that value, we can't for sure affirm that the variability is for 1,000 and above.
In appendix J of the ASTM report, I explained what the possible reasons for the multilaboratory precision of the 1,000 psi 4 by 4 in. beams was much higher.
One of the main reasons was the use of the Rainhart machine. When you look at table J.3, you see that the COV when Rainhart machine is eliminated is 8.8 % for mix 2, while for the labs using Rainhart, that number was 16.3%. As the MR decreases, the difference in COV between all other machines and Rainhart, significantly decreases. On the same appendix, I explain several contributors for the bad performance (in terms of variability) of the Rainharts : Calibration, reading accuracy, effect of size, load capacity.

We agree with the Editorial comment and will correct before printing

Technical Explanation and Editorial change acceptable to PA(Rameriz). It is recognized that users will have some interpretation needed for test results between 800-999 psi and > 1000 psi.
The full ASTM Research Report/Interlaboratory Study (ILS 1265) is available upon request.

After the webinar, the Chairman found a typographical error in TABLE 1. The coefficient of variation for the 100 mm, 4.1 to 5.5 MPa Modulus of Rupture, will be revised from 6.0 to 6.1 to properly reflect the results in the ASTM Research Report.

Item Number:	**19**
Description:	SOM ballot item to revise multiple sections, notes, and Appendices in PP 84, Developing Performance Engineered Concrete Pavement Mixtures. (Note- If ballot Item #1 passes and becomes a Provisional Standard, editorial changes will be made to sections 2.1, 6.8, Table 3, Appendix X4 and X6 and as needed for proper reference). See p. 3, Item #5 in Appendix C, and Appendix J of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: None

Future changes to PP84 discussed by Cecil Jones. It is expected to have several proposed changes for the spring 2018 Technical Section ballot.

Item Number:	**20**
Description:	SOM ballot to revise T 359, Pavement Thickness by Magnetic Pulse Induction. See p. 4, Item #6 in Appendix C, and Appendix K of the minutes
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: None

Item Number:	**21**
Description:	SOM ballot item to add a new Provisional Practice (PP xxx), Grinding the Ends of Cylindrical Concrete Specimens. See p. 4, Item #7 in Appendix C, and Appendix L of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments:

Tennessee DOT (Brian K. Egan) (brian.egan@tn.gov) In 1.2 and 4.1 There should be an option for a single cylinder grinding machine. In 4., There should be wording to make sure that the grinding machine can accommodate various standard cylinder and core sizes. (i.e. 4" or 6" cylinders, 3.70" cores) In Section 5, References to R18 should be removed and the appropriate annex of R18 should be updated with this equipment specifying concrete cylinder grinder.

Washington State DOT (Kurt R Williams) (willikr@wsdot.wa.gov) Suggest consideration be given to adding ASTM C 1604 Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete to this method in sections 2.2, 3.4, 6.1, 6.5.1 and 6.6?

Chair/Vice Chair comments: Agree, however these are considered "Technical changes" and need to be balloted. Will be balloted this spring.

Item Number:	**22**
Description:	SOM ballot item to move TP 109, Nonlinear Impact Resonance Acoustic Spectroscopy (NIRAS) for Concrete Specimens with Damage from the Alkali Silica Reaction (ASR), to a full standard. See p. 6 and Appendix M of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: None

Item Number:	**23**
Description:	SOM ballot item to move TP 110, Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures (Miniature Concrete Prism Test, MCPT), to a full standard. See p. 6 and Appendix N of the minutes.
Decisions:	Affirmative: 44 of 51 Negative: 0 of 51 No Vote: 7 of 51

Comments: None

B. Task Force Reports

1. TF 16-01- PP 65/R 80 Significant Digits and notes/ equations for Figure 3 (FHWA (Ahlstrom), PA (Horwart), MO (Trautman))

Haven't had a chance to get together on this issue yet (the only outstanding issue left). Brett and Colin are going to follow up with Gina. Bob Horwart (PA) has retired. ASTM with supposedly same Significant Digit issue.

V. New Business

A. Research Proposals (Research Liaison: John Stanton (MI))

1. 20-7 RPS
2. Full NCHRP RPS

B. AASHTO Re:source/CCRL

1. TP 110- "Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures Miniature Concrete Prism Test, MCPT" Brian Johnson e-mail (Attachment 2)

Section 4.1.1 states the mold sizes shall have a square cross section of 50.0 ± 0.7 mm (2.00 ± 0.03 in.), however the molds are only able in 51 mm dimensions. Believe this to be a metric soft rounding issue when the standard was first written. **ATTACHMENT #2**

There will be a technical section ballot to revise mold sizes (and change reference from M210 to R70) .

C. NCHRP Issues

D. Correspondence, calls, meetings

1. T 358 "Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration", formally TP 95.

The Precision and Bias Statements in TP 95 (published in 2011) , and now T 358, reference to ASTM Research Report (RR) C-9-1004. RR C-09-1004 is for "Inter-laboratory Study to Establish Precision Statements for ASTM Standard Test Method for Determining the Chloride Permeability of Concrete". This report is what established the P&B in ASTM C1202 and AASHTO T 277 "Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration". The P&B values are not the same reported in RR-C-09-1004, nor could the printed values be supported anywhere. Therefore the current P&B in T 358 are determined to be incorrect.

After some researching, FDOT provided the report "Results of Round-Robin Testing for the Development of Precision Statements for the Surface Resistivity of Water Saturated Concrete (2011)" for the P&B for T358. Concerns are: the statistics for P&B may be incorrect, and the data was collected from samples that were cured in lime saturated water, and T 358, Section 8.1/Note 2 states that " moist cure in a 100% RH moist room is the preferred curing method", and Section 5.2, notes that "lime water curing on average reduces resistivity by 10%". Therefore if the statistics are "correct", would the P&B be correct for moist room cured cylinders? **ATTACHMENT #3**
Mike is going to contact some of the people involved in this research (they are still working in the corrosion lab). Don will also join the group with looking into this issue.

This will become a Task Force (TF 17-01).

E. Presentation by Industry/Academia
F. Proposed New Standards
G. Proposed New Task Forces
H. Standards Requiring Reconfirmation

I. SOM Ballot Items (including any ASTM changes/equivalencies)
1. PP xxx, "Grinding the Ends of Cylindrical Concrete Specimens", revise to include reference to ASTM 1604 and single grinding machine (see Ballot #21 comments above)
2. TP 110/ New Standard number "Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures Miniature Concrete Prism Test, MCPT"- revise section 4.1.1 mold size to 50.8 ±0.07 mm and revise reference from M 210 to R 70.

These will be sent to TS ballot.

J. Standard Stewards- Assignment of standards to State/Industry
  i. Volunteers **ATTACHMENT #4**
  STILL in need of Volunteers

VI. Open Discussion

Referencing withdrawn/outdated/obsolete standards:

Evan Rothblatt via Brian Johnson: No need to reference the date on withdrawn/obsolete standards. Maybe the last date can be referenced in Significance and Use?
Oak: From the EC meeting in August, if there's no date, then it's assumed to be last published version.
Cecil: It's assumed to be the last published date.
Tim (PA): Aren't we replacing these standards? Include it in the references anyway so that the reader knows what the new standard is based on.

VII. Adjourn at 3:06pm EST.

Attachment #3

Task Force 17-01, TN- Egan, NY- Streeter, et al., FL-Ruelke, et al. , Clemson U.- Mike Jackson, FHWA- Jussara Tanesi

T 358- Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration

Precision History

October 2017-

- TS Chair was made aware of an apparent discrepancy in the precision statement as currently written in AASHTO T 358- Standard Method of Test for Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration.

-Specifically, the "Precision and Bias" statement in T 358 , formally TP 95, are likely incorrect and does not state the correct ASTM Research Report. TP 95 was first published in 2011 and the reference to ASTM Research Report (RR) C-9-1004 was included in the original, as it is with the current T 358.

- RR C-09-1004 is for "Inter-laboratory Study to Establish Precision Statements for ASTM Standard Test Method for Determining the Chloride Permeability of Concrete". This report is what established the P&B in ASTM C1202 and AASHTO T 277 "Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration".

- Mike Jackson has completed research for the Precision statements and completed 2 different reports, 1) " Results of Round Robin testing for the Development of Precision Statements for the Surface Resistivity of Water Saturated Concrete". This was presented at AAHTO TIG and attached as "Jackson TIG Lead states Round Robin Results.pdf". It does not appear that any data was removed based on the "hcrit and kcrit" statistical analysis required in ASTM C802 and 2) "Precision Statements for the Surface Resistivity of Water Cured Concrete Cylinders in the Laboratory" and was presented to the ASTM Journal and is also attached. In this study a statistical analysis was complete using the "hcrit and kcrit" and some lab results were discarded. Obviously the 2 reports have different P&B statements since the data is different based on the analysis, but the second report's P&B is more in line with the ASTM C802.

- Mike provided the TF with all the raw data and statistical data. Jusarra did a separate, independent statistical analysis using software and following her interpretation of ASTM C 802.

- Jussara's analysis was similar to Mike's with some comments. One of the comments was that only a single brand manufacture was used. That was reviewed and commented on page 20 of the ASTM report. Another concern was the difference in the confidence level used. Jussara used 0.5% as required in ASTM C802, but Mike used 1.0% (Not being a statistician, I don't know how much affect that has on the results/data) Also, Jussara removed all data point above, or below, the hcrit and kcirt values, whereas Mike only removed what he considered outliers. Jussara indicated that is what ASTM does, remove all points above and below the h and k crit. (ASTM C802 section 9.5 and 10.4 provides

"guidance" on what data points should be removed and not be used in the analysis. To me, it is still somewhat subjective).

Following is the comparison of the data:

			COV within lab	COV between lab	Precision d2s within lab	Precision d2s between lab
28d	Mike		4.28	8.52	11.98	23.86
	Jussara	average all mixes	4.40	7.50	12.32	21.00
	Jussara	Best fit line (std dev vs average)	4.98	8.46	13.94	23.69
		R2 of best fit			0.84	0.7

			COV within lab	COV between lab	Precision d2s within lab	Precision d2s between lab
56d	Mike		4.14	11.48	11.59	32.14
	Jussara	average all mixes	4.33	8.96	12.12	25.09
	Jussara	Best fit line (std dev vs average)	4.66	9.61	13.05	26.91
		R2 of best fit			0.86	0.82

			COV within lab	COV between lab	Precision d2s within lab	Precision d2s between lab
91d	Mike		4.29	11.01	12.01	30.83
	Jussara	average all mixes	4.39	10.32	12.29	28.90
	Jussara	Best fit line (std dev vs average)	4.87	11.39	13.64	31.89
		R2 of best fit			0.81	0.88

- After reviewing all the data (avoiding "analysis paralysis" and "statistical rabbit holes"), the TF agreed to use the original statistical data provided by Mike Jackson in the "Precision Statements for the Surface Resistivity of Water Cured Concrete Cylinders in the Laboratory" report. This is what was voted on, and passed the TS Spring Ballot, Item #1.

13. PRECISION AND BIAS[2]

Precision:

Single-Operator Precision—The single-operator coefficient of variation of a single test result has been found to be 4.3 percent (Note 5). Therefore, the results of two properly conducted tests by the same operator

on concrete samples from the same batch and of the same diameter should not differ by more than 12.1 % percent of their average (Note 5).

Multilaboratory Precision—The multilaboratory coefficient of variation of a single test result has been found to be 11.5 percent (Note 5). Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 32.5 percent of their average (Note 5).

Note 5—These numbers represent, respectively, the (1s percent) and (d2s percent) limits as described in ASTM C670. The precision statements are based on the variations in tests on twelve different concrete mixtures, each tested in triplicate in 13 laboratories. All specimens were 100-by-200-mm (4-by-8-in.) cylinders cured in a lime water bath and tested using meters manufactured by CNS Farnell Ltd. at 28, 56, and 91 days.

The percentage cited represents the (d2s percent) limit based on the value for the multilaboratory coefficient of variation.

Bias—The procedure of this test method for measuring the resistance of concrete to chloride ion penetration has no bias because the value of this resistance can be defined only in terms of a test method.

ATTACHMENT #4

Brian Egan

From: Weiss, William Jason <Jason.Weiss@oregonstate.edu>
Sent: Wednesday, June 20, 2018 11:52 AM
To: Brian Egan; 'Cecil L. Jones, PE' (Cecil.Jones@nc.rr.com)
Subject: FW: Pore Solution Standard, Pore Solution Resistivity Temperature Correction Standards, LTDSC revision
Attachments: Task 1.2a-clean.pdf; Task 1.5-wjw-edit-clean.pdf; Task 1.2c-done.pdf; Task 1.6b-wjw-rev180603.pdf; Task 1.6a-wjw-rev180603.pdf; Task 1.3r.pdf; Task 1.7-wjw-simplified.pdf

***** This is an EXTERNAL email. Please exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email - STS-Security. *****

Brian

I thought these may provide a good look at the updated drafts of these documents I mentioned in the earlier email

I think they are pretty straight forward but am glad to discuss and to draft a cover memo presentation to help move this ahead

To avoid overloading anyone I am thinking it may be good for us to package these into smaller work plans

Package 1 – resistivity and formation factor
Task 1.3 – Revised TP119
Task 1.2a, c pore solution measurement and temperature corrections

Package 2 – Salt and Freeze thaw
Task 1.5 Revised 365
Task 1.6a, b Measuring pore volume and degree of saturation
Task 1.7 Measuring air void infilling rate (S2)

It may also be good to have a smaller group to work on updating the surface resistivity. I would be glad to help/lead this but will need some input from SOM members. I am thinking maybe we could set up a monthly conference call to go through the document and then the updates.

Would it help to have some sort of a short video on how these are used. We do have videos on the tests if that helps

Thanks

Jason

Brian Egan

From: Weiss, William Jason <Jason.Weiss@oregonstate.edu>
Sent: Wednesday, June 20, 2018 11:39 AM
To: Brian Egan
Cc: Cecil.Jones@nc.rr.com; 'Tanesi, Jussara CTR (FHWA)'; 'Duval, Richard (FHWA)'
Subject: AASHTO Test Method Question

Brian

I hope all is well.

I was on a phone call last week with folks from Federal Highway Administration (Jussara and Richard Duvall) discussing some standard test methods that have been written for potential use in the performance engineering mixtures and performance related specification works. Ultimately it would be expected that these would be referenced in the PP 84 document.

I believe we are nearing the completion of these documents there are clean versions it could be put forward to ballot.

There are two packages of documents (each with about three tests) that I would like to discuss with you.

The first set of documents is related to formation factual resistivity. It includes an update to TP119, a pore solution resistivity test, and a temperature correction test.

The second set of documents related to freeze-thaw and salt damage. It includes an update to TP 365, a pore volume, a degree of saturation, an a test on rate of air void filling.

There is also question on what existing specification for surface resistivity. If it may be possible to set up a small task group that I could work with to determine whether we can were to improve the existing test method. As this is not a document I have drafted I would want to make sure we work with a good cross section of users to make sure that what we are adding is clear and does not alter some other use. It is primiarly around avoiding alkali leaching and improving sample conditioning. Ultimately this would be closer to the revisions for TP 119.

It would be helpful to me if we could talk about timeline to get these to you, to ballot them, to resolve these and to move ahead.

I would also like to discuss the best way to get this information to you and a best way to provide a cover memo etc that could talk how these documents work together and with PP-84.

The idea would not be that this is a long item but more that this would just provide clarity. This may be able to be shared at the August meeting for example so that they are ready for documents coming.

I am happy to give a call to discuss if there is a time that is good for you.

Thanks

Jason

Package #1

Standard Method of Test for

Electrical Resistivity of a Concrete Cylinder Tested in a Uniaxial Resistance Test

AASHTO Designation: TP 119-15 (2017)[1]

AASHTO

Technical Section: 3c, Hardened Concrete

Release: Group 1 (April 2017), Last Revised 6/17/2018

1. SCOPE

1.1. This test method covers the determination of the electrical resistivity of concrete to provide a very rapid indication of its resistance to ionic transport (e.g., the penetration of chloride ions). This test method is applicable to types of concrete where correlations have been established between this test procedure and long-term durability performance.

Task 1.2a Standard Method of Test for

Quantifying Electrical Resistivity of Cementitious Pore Solution

1. SCOPE

1.1. This test method covers the procedure for quantitative determination of the electrical resistivity of cementitious pore solution.

Task 1.2c: Standard Practice for

Determination of Temperature Corrections for Resistivity Measurements using Activation Energy of Conduction

1. SCOPE

This test method covers the determination of activation energy of conduction to provide a parameter to be used in temperature corrections in concrete resistivity and pore solution measurements.

Package #2

Task 1.5 – Revision of Standard Method of Test for

Quantifying Calcium Oxychloride Formation Potential of Cementitious Pastes Exposed to Deicing Salts

AASHTO Designation: T 365-17

Technical Section: 3c, Hardened Concrete

Release: Group 1 (April 2017)

1. SCOPE

1.1. This test method covers the procedure for quantitative determination of the formation potential for calcium oxychloride amounts formed in cement pastes exposed to chloride-based deicing salts, particularly calcium and magnesium chloride. The amount of calcium oxychloride that forms is an indicator for potential susceptibility of these mixtures to undergo damage when exposed to chloride-based deicing salts in field.

Task 1.6a - Standard Method of Test for Determining the

Total Pore Volume in Hardened Concrete Using Vacuum Saturation

1. SCOPE

1.1. This test method covers the procedure for determination of the total pore volume in hardened concrete using vacuum saturation. The values stated in SI units are to be regarded as the standard, with exception of the pressure values given in units of Torr, that can be used as standard.

Task 1.6b Standard Method of Test for Determining the

Degree of Saturation of Hydraulic-Cement Concrete

1. SCOPE

1.1. This test method is used to determine the degree of saturation of hydraulic cement concrete by measuring the mass of the conditioned specimen, the oven dry mass and the saturated surface dry mass of the specimen.

Task 1.7 Standard Method of Test for Determining the

Determining the Secondary Rate of Absorption of Water by Hydraulic-Cement Concrete

1. SCOPE

1.1. This test method is used to determine the secondary rate of absorption of water by hydraulic cement concrete. An increase in the mass of a specimen is measured. The specimen is initially conditioned by oven drying. One surface of the oven dry specimen is immersed in water and the mass of the sample is measured for 7 days.

Attachment #5A

Technical Section 3C- Hardened Concrete Properties- Standard Stewards

Designation	Title	Steward	DOT/Affiliate	Phone/e-mail
~~R 39-17~~	~~Making and Curing Concrete Test Specimens in the Laboratory~~	Moved to TS 3B- Summer 2017		
R 72-16	Match Curing of Concrete Test Specimens	Scott George	Alabama DOT	georges@dot.state.al.us
R 80-17	Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction	Brett Trautman	Missouri DOT	573-751-1036 Brett.Trautman@modot.mo.gov
R 81-17	Static Segregation of Hardened Self-Consolidating Concrete (SCC) Cylinders	James Krstulovich	Illinois DOT	217-524-7269 James.Krstulovich@Illinois.gov
T 22-17	Compressive Strength of Cylindrical Concrete Specimens	Tim Ruelke	Florida DOT	Timothy.Ruelke@dot.state.fl.us
~~T 23-17~~	~~Making and Curing Concrete Test Specimens in the Field~~	Moved to TS 3B- Summer 2017		
T 24M/T 24-15	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	Timothy Ramirez	Pennsylvania DOT	tramirez@pa.gov
T 97-17	Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)	Tim Ruelke	Florida DOT	Timothy.Ruelke@dot.state.fl.us
T 140-97 (2016)	Compressive Strength of Concrete Using Portions of Beams Broken in Flexure	Richard Giesssel	Alaska DOT	richard.giessel@alaska.gov
T 148-15	Measuring Length of Drilled Concrete Cores	Mick Syslo	Nebraska DOT	Mick.Syslo@nebraska.gov
T 160-17	Length Change of Hardened Hydraulic Cement Mortar and Concrete	Dan Miller	Ohio DOT	daniel.miller@dot.ohio.gov
T 161-17	Resistance of Concrete to Rapid Freezing and Thawing	John Staton	Michigan DOT	statonj@michigan.gov
T 177-17	Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)	Paul Burch	Arizona DOT	pburch@azdot.gov
T 178-15	Portland-Cement Content of Hardened Hydraulic-Cement Concrete	Robert Lauzon	Connecticut DOT	robert.lauzon@ct.gov
T 198-15	Splitting Tensile Strength of Cylindrical Concrete Specimens	Wasi Khan	District of Columbia DOT	wasi.khan@dc.gov
T 231-17	Capping Cylindrical Concrete Specimens	Mike Santi	Idaho DOT	mike.santi@itd.idaho.gov
T 259-02 (2017)	Resistance of Concrete to Chloride Ion Penetration	Richard Barezinsky	Kansas DOT	rick.barezinsky@ks.gov
T 260-97 (2016)	Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials	Woody Hood	Maryland DOT	whood@sha.state.md.us

T 276-17	Measuring Early-Age Compression Strength and Projecting Later-Age Strength	Oak Metcalf	Montana DOT	rmetcalfe@mt.gov
T 277-15	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration	John Staton	Michigan DOT	statonj@michigan.gov
T 323-03 (2016)	Determining the Shear Strength at the Interface of Bonded Layers of Portland Cement Concrete	Denis Boisvert	New Hampshire DOT	Denis.Boisvert@dot.nh.gov
T 332-07 (2016)	Determining Chloride Ions in Concrete and Concrete Materials by Specific Ion Probe	Becca Lane	Ontario MOT	Becca.Lane@ontario.ca
T 334-08 (2016)	Estimating the Cracking Tendency of Concrete	Dan Miller	Ohio DOT	daniel.miller@dot.ohio.gov
T 336-15	Coefficient of Thermal Expansion of Hydraulic Cement Concrete	Brett Trautman	Missouri DOT	573-751-1036 Brett.Trautman@modot.mo.gov
T 356-15	Determining Air Content of Hardened Portland Cement Concrete by High-Pressure Air Meter	Jose Lima	Rhode Island DOT	jose.lima@dot.ri.gov
T 357-15	Predicting Chloride Penetration of Hydraulic Cement Concrete by the Rapid Migration Procedure	Andy Babish	Virgina DOT	andy.babish@vdot.virginia.gov
T 358-17	Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration	Darrin Tedford	Nevada DOT	(775) 888-7784 DTedford@dot.nv.gov
T 359-16	Pavement Thickness by Magnetic Pulse Induction	Brian Egan	Tennessee DOT	Brian.Egan@tn.gov
T 363-17	Evaluating Stress Development and Cracking Potential due to Restrained Volume Change Using a Dual Ring Test	Darrin Tedford	Nevada DOT	(775) 888-7784 DTedford@dot.nv.gov
T 364-17	Determination of Composite Activation Energy of Aggregates due to Alkali-Silica Reaction (Chemical Method)	Kurt Williams	Washington DOT	willikr@wsdot.wa.gov
T 365-17	Quantifying Calcium Oxychloride Amounts in Cement Pastes Exposed to Deicing Salts	Matt Romero Kenny Seward	Oklahoma DOT	kseward@odot.org
T 379- 18	Nonlinear Impact Resonance Acoustic Spectroscopy (NIRAS) for Concrete Specimens with Damage from Alkali-Silica Reaction (ASR)	John Grieco	Massachusettes DOT	John.Grieco@dot.state.ma.us
T 380-18	Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures (Miniature Concrete Prism Test, MCPT)	Mick Syslo Wally Heyen	Nebraska DOT	Mick.Syslo@nebraska.gov wally.heyen@nebraska.gov

~~PP 54-06 (2015)~~ Now R 72-17	~~Match Curing of Concrete Test Specimens~~			
~~PP 58-12 (2015)~~ Now R 81-17	~~Static Segregation of Hardened Self-Consolidating Concrete (SCC) Cylinders~~			
~~PP 65-11 (2016)~~ Now R 80-17	~~Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction~~			
~~TP 109-14 (2016)~~ Now T 379	~~Nonlinear Impact Resonance Acoustic Spectroscopy (NIRAS) for Concrete Specimens with Damage from Alkali-Silica Reaction (ASR)~~			
~~TP 110-14 (2016)~~ Now T 380	~~Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures (Miniature Concrete Prism Test, MCPT)~~	~~Mick Syslo~~ ~~Wally Heyen~~	~~Nebraska DOT~~	~~Mick.Syslo@nebraska.gov~~ ~~wally.heyen@nebraska.gov~~
TP 119-15	Electrical Resistivity of a Concrete Cylinder Tested in a Uniaxial Resistance Test	Donald Streeter	New York DOT	donald.streeter@dot.ny.gov
PP 84- 17	Performance Engineered Concrete Pavement Mixtures	Donald Streeter	New York DOT	donald.streeter@dot.ny.gov
PP 89-18 (New 2018)	Standard Practice for Grinding the Ends of Cylindrical Concrete Specimens	Michael Doran Brian Egan	Tennessee DOT	michael.doran@tn.gov
TP 129-18 (New 2018)	Standard Method of Test for Vibrating Kelly Ball (VKelly) Penetrati Grinding the Ends of Cylindrical Concrete Specimenson in Fresh Portland Cement Concrete	Brian Pfeifer James Krstulovich	Illinois DOT	Brian.Pfeirer@Illinois.gov 217-524-7269 James.Krstulovich@Illinois.gov

Attachment #6

Update on Performance Engineered Mixtures (PEM)

MICHAEL F. PRAUL, PE
SENIOR CONCRETE ENGINEER
PAVEMENT MATERIALS TEAM

U.S. Department of Transportation
Federal Highway Administration
Office of Infrastructure

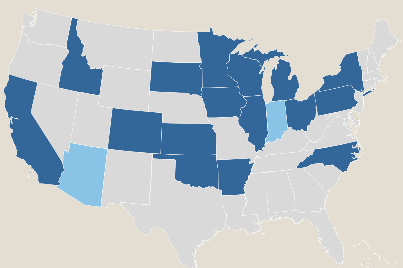
All images FHWA unless otherwise noted

PEM Pooled Fund Partners

- FHWA
- State Departments of Transportation (DOTs)
- Industry (American Concrete Pavement Association, Portland Cement Association, National Ready Mixed Concrete Association, others)

Image Pixabay

Pooled Fund Participants



16 States + FHWA & Industry (July 2018)

Pooled Fund Emphasis

- Implementation
- Education and Training
- Adjustments in specifications based on field performance
- Continued development of a knowledge base relating early age properties to performances

Recent PEM Activity

- PEM TAC Meeting--Chicago, February 2018
- Presentations and industry discussions at spring meetings of NRMCA and PCA--Houston, March 2018
- Presentations and discussion at National Concrete Consortium—Coeur D'Alene, April 2018
- Shadow Testing and Open Houses: Colorado (May), Minnesota (July), Iowa (August)
- Website development
- Active projects in Wisconsin, Michigan, and New York

Looking Ahead

- PP-84-19 to AASHTO COMP Technical Section 3C
- South Dakota shadow testing (I-90), Sept 2018
- Pennsylvania shadow testing and workshops, Sept 2018
- PEM TAC meeting, Sept 2018
- Ongoing website updates

Actively seeking states/projects for 2019 shadow testing and open houses

Image Pixabay

PEM Implementation Incentive Funds

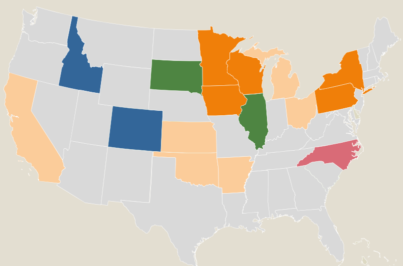
- Available to pooled fund participating states
- $40,000 for two or more new tests in the mix design/approval process (shadow testing acceptable)
- $20,000 for one or more new tests in the acceptance process (shadow testing acceptable)
- $20,000 for requiring an "enhanced" QC Plan from the contractor
- $20,000 for requiring the use of control charts
- Report required within 4 months of construction

PEM Incentive Implementation Funds

- Five states: Categories A, B, C, and D
- One state: A, B, D
- Two states: A, B
- Six states: Currently considering/working on application
- Two states: No submittal (no concrete paving)

- Kudos to Maria Masten and Minnesota!
- Kudos to Don Streeter and New York!

Implementation Incentive Funding



A, B, C, D
A, B, D
A, B
Considering/Preparing
No applicable project

Questions?

Image Pixabay

- Contact info

Michael.Praul@dot.gov

207-512-4917

Attachment #7

Performance Engineered Mixtures – PP 84-19

AASHTO COMP Meeting
Technical Section 3c
Cincinnati, Ohio
August 8, 2018

Cecil L. Jones, PE
Diversified Engineering Services, Inc.

PP 84 – What it is

- An AASHTO Provisional Standard Practice
  - Expected to have changes
  - Additional research possible
  - Ready to be used and shared
  - Definitive instructions for performing specific operations that does not produce a test result

PEM – Delivering concrete to survive the environment


Standard Practice for
Developing Performance Engineered Concrete Pavement Mixtures
AASHTO Designation: PP 84-17
Tech Section: 3c, Hardened Concrete
Release: Group 1 (April 2017)

Acknowledgements

- Development Team
  - Dr. Peter Taylor, Director CP Tech Center
  - Cecil Jones, Diversified Engineering Services, Inc.
  - Dr. Jason Weiss, Oregon State University
  - Dr. Tyler Ley, Oklahoma State University
  - Dr. Tom VanDam, NCE
  - Mike Praul, FHWA
  - CP Tech Center
- Industry Participants/Reviewers
  - Champion States & ACPA Chapter Execs
  - ACPA National
  - PCA
  - NRMCA

PP 84 – What it is

- Target performance characteristics rather than means and methods
  - Tell the contractor what you want, not how to do it.
  - Test for properties that matter
  - Test methods must accurately predict performance

- PP 84 – What it is
- PP 84 – What it is not
- What is happening now?
- Proposed changes for 2019
- What's Next?



PP 84 – What it is

- Equitable risk allocation
  - Agency assumes all risk with prescriptive
  - Balanced risk allocation with performance
  - Contractor innovation rewarded
  - Economy improvement possible

PP 84 – What it is

- Includes prescriptive and performance measures
  - Agency selects best fit
  - Multiple choices exist for most properties
- Respects agency traditions and knowledge
  - Keep existing requirements that make sense based on local knowledge and experience

PEM is a Framework that allows agencies to measure the right properties at the right time during mixture qualification, process control, and/or acceptance

What's Happening Now?

- Shadow Testing and Open Houses
  - Colorado in May
  - Minnesota in July
  - Iowa in July/August
  - Pennsylvania TBD
- Comparative Testing with CP Tech & South Dakota planned for September

It's all About Choices

Section	Property	Specified Test	Specified Value	Mixture Qualification	Acceptance	Selection Details	Special Notes
6.3 Concrete Strength							
6.4 Reducing Unwanted Slab Warping and Cracking Due to Shrinkage (If Cracking is a Concern)							
6.5 Durability of Hydrated Cement Paste for Freeze-Thaw Durability							
6.6 Transport Properties							
6.7 Aggregate Stability							
6.8 Workability							

What's Happening Now?

- FHWA Mobile Laboratory Demonstrations
  - Shadow projects
  - elsewhere
- Changes to the document
  - Some changes for 2019
  - Planning for 2020 underway

PP 84 – What it is not

- A one size fits all solution
- A "drop in" specification
- A specification
- Intended to overrule agency culture and traditions
- A mandate to change

Proposed Changes for 2019

- Received Stakeholder feedback
  - Industry
  - National Concrete Consortium agencies
  - PEM Team discussions
- Changes predominately editorial
  - Clarified some sections
- Some technical changes
  - Restrained shrinkage
  - SAM

Proposed Changes for 2019

- Editorial examples
  - Clarified flexibility (e.g. “other SHA approved methods”, “if required by the SHA”, etc.)
  - Changed calibration to correlation of flexural and compressive strengths in Table 2
  - Accepted stakeholder suggestions regarding clarity of several sections
  - Simplified and clarified some items in appendices and commentary

What's Next?

- Consider concurrent ballot
- Planning for 2020 revisions under discussion
- Incorporate lessons learned into revisions
- May include new/revised methods
- Move from methods in appendices to stand alone standards
- Suggestions welcomed

Proposed Changes for 2019 Cracking

- Removed restrained shrinkage
  - T 334, T 363, and Modeling (in Appendix X.1)
  - Pavements not typically restrained
  - Kept in Appendices for those interested in PEM for other structures
  - Note making reference to location of cracking tendency under restraint if interested

Thank You

Proposed Changes for 2019 SAM

- SAM criteria
  - Proportioning (6.5.1.3) – Air 4% or greater and SAM equal or less than 0.02 (using TP 118)
  - Removed maximum air with SAM
  - Field Acceptance (7.1.2) – Air 4% or greater and SAM equal to or less 0.25 (using TP 118)
  - Reject concrete if SAM above 0.30

Accelerated Determination of Potentially Deleterious Expansion of Concrete Cylinder Due to Alkali-Silica Reaction (Accelerated Concrete Cylinder Test, ACCT)

Anol Mukhopadhyay, PhD, PG, Research Scientist / Graduate Faculty

Kai-Wei (Victor) Liu, PhD, EIT, Assistant Transportation Researcher

Proposed AASHTO Test Method
8^{th} August, 2018

TEXAS A&M UNIVERSITY

Texas A&M Transportation Institute

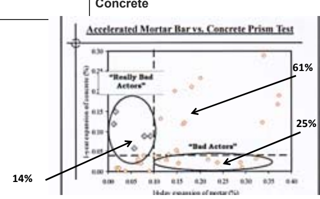
1

Agenda

- Some of the limitations of the Current Test Methods
- Proposed New Test Method
- Accelerated Concrete Cylinder Test (ACCT)
  - Procedure
  - Data Processing and Calculation
  - Results
- Differences, Benefits, and Challenges

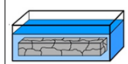
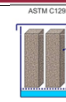
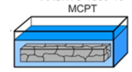
Growing Demand for a Rapid and Reliable ASR Test Method

Test Methods	Time	Some of the Limitations
C 1260 (Accelerated mortar bar, AMBT)	14 day	Severe test conditions (1N NaOH, 80°C) Crushing / sieving False positives/negatives Not for evaluating job concrete mix
C 1293 (Concrete Prism Test, CPT)	1-2 yrs	Better reliability but long duration Alkali boosting / alkali leaching (35-40%) Not for evaluating job concrete mix Mismatch w/ exposure block
Exposure block	> 5 yrs	High reliability but long duration Alkali boosting
AASHTO R80 / ASTM C1778	Approaches for Reducing the Risk of Deleterious AAR in Concrete	



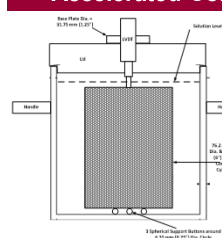
3

ASTM C 1260 VS C 1293 VS MCPT

	ASTM C1260 	ASTM C1293 	AASHTO T380-18 MCPT 
Specimen size	Mortar bar 1 x 1 x 11.25"	Concrete Prism 3 x 3 x 11.25"	Concrete prism 2 x 2 x 11.25"
Temperature	80°C	38°C	60°C
Alkali boost	No	Yes (1.25% Na_2O_e)	Yes (1.25% Na_2O_e)
Cement alkali	< 0.6% Na_2O_e	0.9±0.1% Na_2O_e	0.9±0.1% Na_2O_e
Soak solution	1N NaOH	-	1N NaOH
Cement content, lb/cy	-	708±17	708
Aggregate gradation requirement	Fine aggregate #4-#8: 10% #8-#16: 25% #16-#30: 25% #30-#50: 25% #50-#100: 15%	Coarse aggregate 19-12.5 mm: 33.3% 12.5-9.5 mm: 33.3% 9.5 mm-#4: 33.3%	Coarse aggregate 12.5 - 9.5 mm: 57.5% 9.5 mm - #4: 42.5%
w/c	0.47	0.42 – 0.45	0.45
Coarse aggregate factor	-	0.7±0.02	0.65

4

Proposed New AASHTO Test Method Accelerated Concrete Cylinder Test (ACCT)



- Concrete cylinder = 3 inch x 6 inch
- Coarse aggregate factor = 0.76
- Cement content = 6 ± 0.4 sacks/cy (563 ± 38 lb/cy)
- Cement alkali content = 0.8 ± 0.05% Na_2O_e
- Concrete alkali loading = 4.5 lb/cy
- w/c = 0.45
- Soak solution = pore solution
- Temperature = 60°C

5

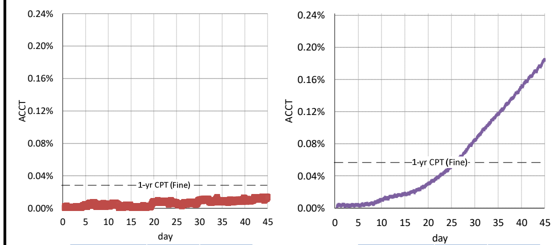
Procedure

1. Cast concrete cylinders and keep the cylinders (w/ mold and lid) in a moisture room for **7 days** (ASTM C470)
2. Demold and measure the height of the cylinder (L0) using a caliper
3. Place the cylinder inside the container and add soak solution until the cylinder is immersed (the alkali concentration of soak solution shall equal to pore solution alkalinity (PSA) of the tested concrete specimens in order to prevent alkali leaching.)
4. Screw the lid onto the container
5. Place the container-lid system in the oven
6. Insert the LVDT through the center hole of the lid and tighten the screw
7. Close the oven and set up the oven temperature at 60°C followed by length change measurement through data acquisition - computer

Soak Solution Determination

- Specimens NOT containing SCMs
  - NIST model (e.g., http://ciks.cbt.nist.gov/poresolncalc.html)
- Specimens containing SCMs
  - Pore solution extraction [some SCMs (especially some fly ashes) may or may not contribute soluble alkalis in pore solution]
  - If extraction techniques is not available
    - NIST model + available alkalis (ASTM C311)
- Add an additional 1 g of $Ca(OH)_2$ per liter in order to saturate the solution.
- Soak solution = PSA
  - Prevent alkali leaching
  - may have the ability to pick up the effects of cement alkalis as well as soluble alkalis from SCMs

Determination of ASR aggregate reactivity (45 days) (ACCT & ASTM C1293)

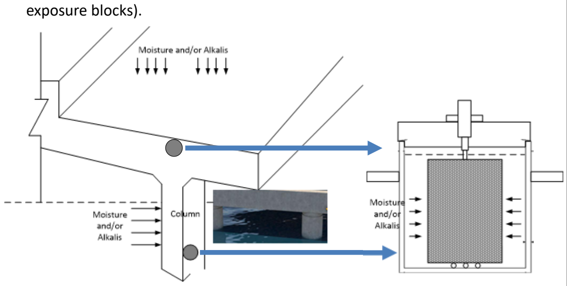


Aggregate	C1293	C1260
Fine	0.035	0.079
Coarse	0.027	0.012

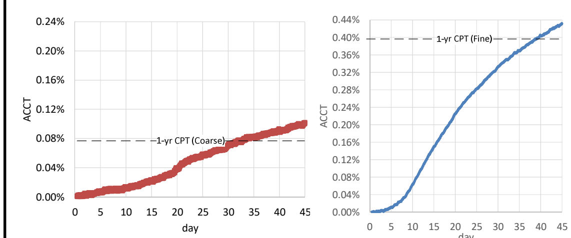
Aggregate	C1293	C1260
Fine	0.058	0.317
Coarse	0.027	0.012

ACCT Testing Conditions: Similar to Testing a Hypothetical Concrete Cylinder in Field Concrete

- A hypothetical concrete specimen inside concrete structure receives constant supply of alkalis and/or moisture from the surroundings to sustain ASR. ACCT simulates this condition. However, CPT creates opposite situation (i.e., alkali leaching) and as a result it takes longer time in one hand and it may leads to create case of underestimation (mixes passed by CPT but failing in the exposure blocks).



Determination of ASR aggregate reactivity (45 days) (ACCT & ASTM C1293)



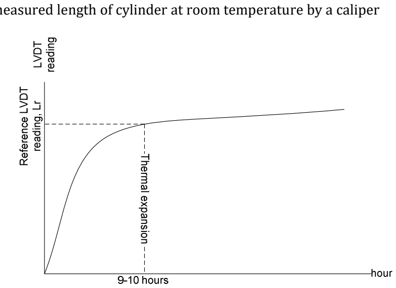
Aggregate	C1293	C1260
Fine	0.035	0.079
Coarse	0.078	0.417

Aggregate	C1293	C1260
Fine	0.391	0.381
Coarse	0.027	0.012

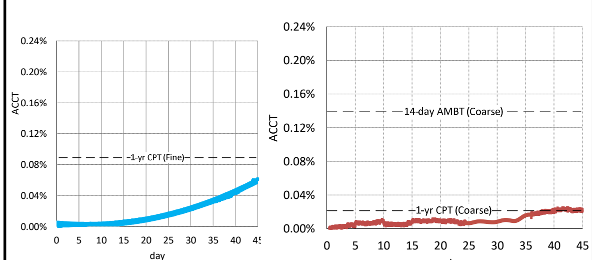
Data Processing and Calculation

$$Length\ change\ (\%) = \frac{Ls - Lr}{L0}$$

$Lr =$ *the reference LVDT reading*
$Ls =$ *the subsequent LVDT readings of Lr*
$L0 =$ measured length of cylinder at room temperature by a caliper

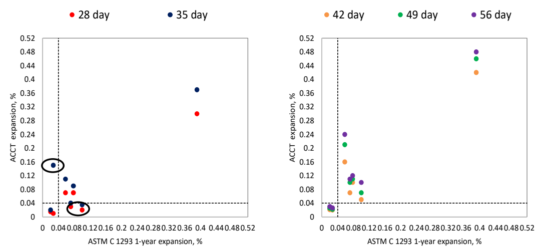


Determination of ASR aggregate reactivity (45 days) (ACCT & ASTM C1293)

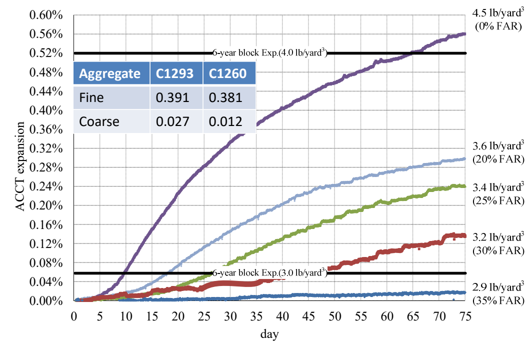


Aggregate	C1293	C1260
Fine	0.100	0.182
Coarse	0.027	0.012

Aggregate	C1293	C1260
Fine	0.035	0.079
Coarse	0.020	0.140



Evaluation of Job Mix (75 days) (ACCT & Exposure blocks)



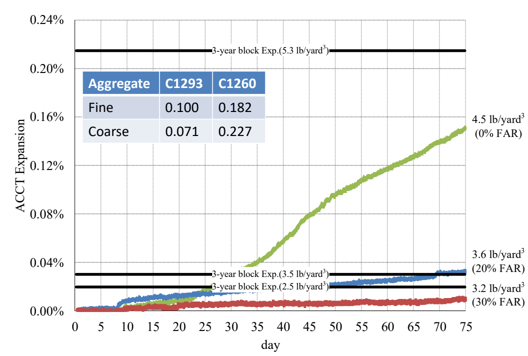
Repeatability (Within the Lab)

The expansion corresponding to three replicas were used to calculate the coefficient of variation (COV). The majority of expansion-based COV is within 10 percent after the 28-day expansion for the tested mixes at the level of alkalinity 4.5 lb/cy

ACCT method - Acceptable repeatability (within the lab)

Day	28	35	42	49
COV%	10	8-9	7-8	6-8

Evaluation of Job Mix (75 days) (ACCT & Exposure blocks)



ASR Aggregate Reactivity in ACCT

Aggregate Reactivity	45-day Expansion in ACCT, %
Nonreactive	< 0.04
Slow Reactive	0.04 - 0.12
Moderate Reactive	0.12 - 0.24
Highly Reactive	> 0.24

AASHTO R80-17 / ASTM C1778

Differences, Benefits, and Challenges

	ACCT	AMBT	CPT	MCPT
Specimen size	Concrete cylinder 3 x 6"	Mortar bar 1 x 1 x 11.25"	Concrete prism 3 x 3 x 11.25"	Concrete prism 2 x 2 x 11.25"
Temperature	60C	80C	38C	60C
Alkali boost	No (4.5 lb/cy)	No	Yes (8.9 lb/cy)	Yes (8.9 lb/cy)
Cement alkali	0.8±0.05% Na_2O_e	< 0.6% Na_2O_e	0.9±0.1% Na_2O_e	0.9±0.1% Na_2O_e
Soak solution	PSA	1N NaOH	-	1N NaOH
Cement content, lb/cy	563±38	-	708±17	708
Aggregate gradation requirement	As received	Fine aggregate #4-#8: 10% #8-#16: 25% #16-#30: 25% #30-#50: 25% #50-#100: 15%	Coarse aggregate 19-12.5 mm: 33.3% 12.5-9.5 mm: 33.3% 9.5 mm-#4: 33.3%	Coarse aggregate 12.5 - 9.5 mm: 57.5% 9.5 mm - #4: 42.5%
w/c	0.45	0.47	0.42 – 0.45	0.45
Coarse aggregate factor	0.76	-	0.7±0.02	0.65
Testing duration	45-75 days	14 days	1-2 years	56-84 days
Ease of testing	Automatic data collection	Comparator	Comparator	Comparator
Benefits	No aggregate crushing, Low alkali loading, Reliability – high, Job mix	Rapid		
Challenges/Limitations	Cost	Crushing Aggregates, Severe test Conditions, No job mix	Longer testing duration, Alkali leaching, High alkali loading, Mismatch w/ exposure blocks	High alkali loading, Severe soak solution

18

Summary

- Measuring length change of a cylindrical concrete specimen immersed in a soak solution of chemistry equal to concrete pore solution at 60ºC (140°F).
- No leaching and at the same time penetration of ions from soak solution to the specimen is negligible – This is an aggravating factors in C 1260 and MCPT.
- As-received aggregates directly from stockpiles are used to make concrete for the ACCT method – coarse aggregate (CA) with up to 1" max. aggregate size can be used without any crushing to make 3 x 6 inches – in case of CA with higher than 1 inch max. size need very minimum crushing – However, more aggregate crushing with variable extent is involved to maintain gradation requirements in CPT and MCPT.
- ACCT is capable to test concrete specimens at varying alkali loadings (i.e., ≤ 4.5 lb/cy).

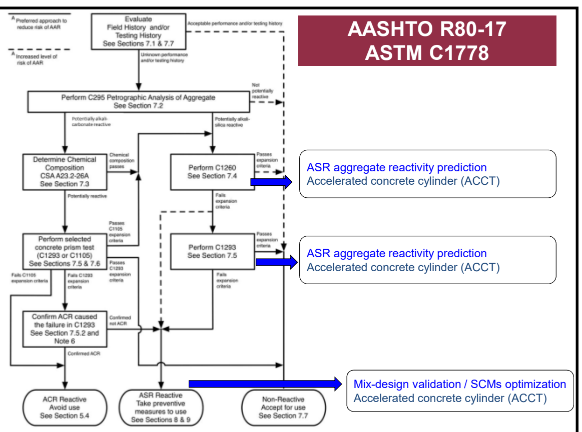
Summary

- ➢ The effect of cement alkalis as well as soluble alkali contributions from SCMs on ASR expansion – Chance to detect by the ACCT.
- ➢ This test method is intended to detect the alkali silica reactivity of an aggregate or assess the effectiveness of mitigation measures of SCMs - SCMs from a specific source can be tested individually or in combination with SCMs from other sources.
- ➢ Aggregate reactivity (45 days) and job mix (75 days)

- ➢ **A test method of this type can be used as an alternative to ASTM C 1293.**

20

AASHTO R80-17 ASTM C1778



Research Projects: Acknowledgements

Texas Department of Transportation (TxDOT)

- ➢ **Implementation Project, (Sep, 18 – August, 19)**

Research Team
- ➢ Anol Mukhopadhyay – PI
- ➢ Member – Kai-Wei (Victor) Liu

Texas Department of Transportation (TxDOT)

- ➢ **Project 0-6656-01 – Further Validation of ASR Testing and Approach for Formulating ASR Resistant Mix, (Sep, 15 – August, 18)**

Research Team
- ➢ Anol Mukhopadhyay – PI
- ➢ Mostafa Jalal– Graduate Student
- ➢ Members – Kai-Wei (Victor) Liu, Dan Zollinger, Andrew Wimsatt

Texas Department of Transportation (TxDOT)

- ➢ **Project 0-6656 - ASR Testing: A New Approach to Aggregate Classification and Mix Design verification, (Sep, 10 – August, 13)**

Research Team
- ➢ Anol Mukhopadhyay – PI
- ➢ Kai-Wei (Victor) Liu– Graduate Student
- ➢ Members – Dan Zollinger, Andrew Wimsatt

22

Publications

Mukhopadhyay, A. K., K. W. Liu, and M. Jalal (2018). Further Validation of ASR Testing and Approach for Formulating ASR-Resistant Mix Concrete. Project Summary Report TxDOT/0-6656-01-S, Texas Department of Transportation and Texas A&M Transportation Institute.

Mukhopadhyay, A. K., K. W. Liu, and M. Jalal (2018). Further Validation of ASR Testing and Approach for Formulating ASR-Resistant Mix Concrete. FHWA/TX-18/0-6656-01-1, Texas Department of Transportation and Federal Highway Administration.

Liu, K. W., and A. Mukhopadhyay (2015). Accelerated concrete-cylinder test for alkali-silica reaction. ASTM Journal of Testing and Evaluation 44(3): 1-10.

Mukhopadhyay, A. K., and K. W. Liu (2014). ASR testing: A new approach to aggregate classification and mix design verification. Project Summary Report TxDOT/0-6656-S, Texas Department of Transportation and Texas A&M Transportation Institute.

Mukhopadhyay, A. K., and K. W. Liu (2014). ASR testing: A new approach to aggregate classification and mix design verification. Technical Report FHWA/TX-14/0-6656-1, Texas Department of Transportation and Federal Highway Administration.

23

ACCT: Test Parameter Optimization

- **Why 7 days curing**
  - ACCT was testing with 1, 7, 14 and 28 day curing – slight increase of expansion with increasing curing age - 7 days - good representation and save time – Pozzolanic index test in ASTM C 618 specifies meeting 7 or 28 days strength index
- **Why 3 x 6 inches**
  - The max. aggregate size (1 inch) for the tested coarse aggregates in the study allows using the 3 x 6 inches concrete cylinder as the lowest possible dimension.
  - The expansion difference between 3x6 and 4x8 inches specimens was found to be smaller
  - the effect of specimen dimension has been studied in a similar set up, i.e., use of LVDT to measure length change of mortar cylinder in 1N NaOH solution [M Pour-Ghaz, R Spragg, J Castro, and J Weiss, 2012 – negligible difference was observed between specimens of different dimensions

Why testing period of 45 and 75 days
- ACCT with less than 40 days vs ASTM C 1293 – not 100% match – Aggregates identified as nonreactive by C1293 but reactive by ACCT and vice versa
- But satisfactory correlation between ACCT and C 1293 with the ACCT testing period of 45 and 50 days – was adequate to evaluate the ASR reactivity in ACCT with the expansion limit of 0.04% at alkali level of 4.5 lb/cy
- It has been found that an additional 30 days is recommended to ensure the effectiveness of mitigation measures for job concrete mix with slowly reactive aggregate

ACCT: Test Parameter Optimization

- **Soak solution quantity (solution to solid ratio 3 vs. 0.3)**
  - Acceleration effects with S/C = 3 (larger quantity of solution)
  - A highly reactive aggregate reaches the expansion limit of 0.04% within 10 days with s/c = 3 and within 14 days with s/c = 0.27.
  - For slowly reactivity aggregate, the time to reach the expansion of 0.04% increases from 21 days to 42 days when the s/c decreases from 3 to 0.3.

- **Why 4.5 lb/cy?**
  - Based on the data generated in projects with varying alkali loading (3 to 8.9 lb/cy), the ACCT with relatively low alkali loadings including, but not limited to 4.5 lb/cy and 60°C can effectively be used to pass/fail a concrete mix in a relatively short time
  - eliminate alkali boosting
  - Close to field alkalinity