AASHTO
THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

SUBCOMMITTEE ON MATERIALS

2016 Annual Meeting – Greenville, SC
Tuesday, August 2, 2016
10:15 AM – 12:00 PM EST

TECHNICAL SECTION 1b
Subsurface Investigation, Soil Instrumentation, Soil Stabilization, and Field Testing of Soils

Meeting Agenda

I. Call to Order and Opening Remarks

II. Roll Call – Membership List

Name	e-mail Address	Affiliation	Designation	Type	Present
Williams, III, James A.	jwilliams@mdot.state.ms.us	Mississippi Department of Transportation	Chair	Voting	
Blackburn, Lyndi D	blackburnl@dot.state.al.us	Alabama Department of Transportation	Vice Chair	Voting	
Johnson, Brian	bjohnson@amrl.net	AASHTO Material Reference Laboratory	Liaison	Non-Voting	
Lacinak, Henry	hlacinak@aashto.org	American Association of State Highway and Transportation Officials	Liaison	Non-Voting	
Rothblatt, Evan	erothblatt@aashto.org	American Association of State Highway and Transportation Officials	Liaison	Non-Voting	
Knake, Maria	mknake@amrl.net	AASHTO Material Reference Laboratory	Member	Non-Voting	
Uherek, Greg	guherek@amrl.net	AASHTO Material Reference Laboratory	Member	Non-Voting	
Lenker, Steven E.	slenker@amrl.net	AASHTO Material Reference Laboratory	Member	Non-Voting	
Davis, Kaye C	chancellork@dot.state.al.us	Alabama Department of Transportation	Member	Non-Voting	
Stolarski, Phil J	phil.stolarski@dot.ca.gov	California Department of Transportation	Member	Voting	
Fontaine, Leo Louis	Leo.Fontaine@ct.gov	Connecticut Department of Transportation	Member	Voting	
Aschenbrener, Tim	timothy.aschenbrener@dot.gov	Federal Highway Administration	Member	Non-Voting	
Lopez, Aramis	aramis.lopez@dot.gov	Federal Highway Administration	Member	Non-Voting	
Rivers, Benjamin	benjamin.rivers@fhwa.dot.gov	Federal Highway Administration	Member	Voting	
Springer, Jack	jack.springer@dot.gov	Federal Highway Administration	Member	Non-Voting	
Voth, Michael D	michael.voth@dot.gov	Federal Highway Administration	Member	Non-Voting	
Horhota, David J	david.horhota@dot.state.fl.us	Florida Department of Transportation	Member	Voting	
Newman, Garth H	garth.newman@itd.idaho.gov	Idaho Transportation Department	Member	Voting	
Frempong, Eric M	efrempong@sha.state.md.us	Maryland Department of Transportation	Member	Non-Voting	
Barot, Sejal	sbarot@sha.state.md.us	Maryland Department of Transportation	Member	Voting	
Tedford, Darin P	dtedford@dot.state.nv.us	Nevada Department of Transportation	Member	Voting	
Boisvert, Denis M.	dboisvert@dot.state.nh.us	New Hampshire Department of Transportation	Member	Non-Voting	
Dusseault, Charles R.	cdusseault@dot.state.nh.us	New Hampshire Department of Transportation	Member	Voting	
Streeter, Donald	donald.streeter@dot.ny.gov	New York State Department of Transportation	Member	Voting	
Seiter, Scott	sseiter@odot.org	Oklahoma Department of Transportation	Member	Voting	
Franco, Colin A	colin.franco@dot.ri.gov	Rhode Island Department of Transportation	Member	Voting	
Zwanka, Merrrill E	zwankame@scdot.org	South Carolina Department of Transportation	Member	Voting	
Smith, Travis W.	travis.w.smith@tn.gov	Tennessee Department of Transportation	Member	Voting	
Heinen, Caroline	caroline.heinen@txdot.gov	Texas Department of Transportation	Member	Voting	
Babish, Charles A.	andy.babish@vdot.virginia.gov	Virginia Department of Transportation	Member	Voting	
Lane, Becca	Becca.Lane@ontario.ca	Ontario Ministry Of Transportation	Associate Member	Voting	
Holt, Anne Lee	anne.holt@ontario.ca	Ontario Ministry Of Transportation	Associate Member	Non-Voting	
Lee, Stephen	stephen.lee@ontario.ca	Ontario Ministry Of Transportation	Associate Member	Non-Voting	
Jones, Cecil L	cecil.jones@nc.rr.com	American Concrete Institute	Friend	Non-Voting	
Savage, David A	davesavage@cmec.org	Construction Materials Engineering Council	Friend	Non-Voting	
Regimand, Ali	aregimand@instrotek.com	InstroTek, Inc.	Friend	Non-Voting	
Reaves, Dick	dreaves@troxlerlabs.com	Troxler Electronic Laboratories, Inc.	Friend	Non-Voting	

III. Approval of Technical Section Mid-Year Webinar Minutes

The Technical Section 1b Mid-Year Webinar was held on Wednesday, February 10, 2016 at 2:00 PM EST. The Mid-Year Webinar Minutes are attached as **Appendix A (Pages 6 - 11)**.

Motion to approve the TS 1b Mid-Year Webinar Minutes: (M/S ,)

IV. Old Business

A. SOM Ballot Items

2015 SOM Ballot Items – Negative Votes and Comments were addressed at the Mid-Year Webinar (See Appendix A). There are no remaining items to be addressed by the TS.

B. TS Ballots

- **TS Ballot TS1b-16-01 to: Revise T 99 and T 180.** Ballot results are included in **Appendix B, Attachment 1 (Pages 12 - 18).**

  Item 1 – Revise T 99 Sections 1.4 and A1 for application of the oversized particle correction.

  Ballot Results: Yes – 15, No Vote – 3, Negative – 0, 2 Comments

  Comment from VA: I believe the suggested wording in section 1.5 of the standard meant to say "above which" rather than "below which."

  Resolution of Comment: The Chairman agrees and will make the change prior to the SOM Ballot.

  Comment from Ontario: Suggest providing an example of a calculation

  Resolution of Comment: If the TS feels that an example calculation for the particle size correction would be helpful, the Chairman will seek a volunteer to draft the example which could be included prior to the SOM Ballot.

  Item 2 – Revise T 180 Sections 1.4 and A1 for application of the oversized particle correction.

  Ballot Results: Yes – 15, No Vote – 3, Negative – 0, 2 Comments

  Comments from VA and Ontario are identical to Item 1, they have been handled in the same way.

  Motion to move the revisions to T 99 and T 180 to SOM Ballot: (M/S ,)

- **TS Ballot TS1b-16-02 to: Revise M 147-65 (2012), Section 1.1 clarifying the term "normal" as it relates to specific gravity and absorption.** Ballot Results are included in **Appendix B, Attachment 2 (Pages 19 – 22).**

  Ballot Results: Yes – 15, No Vote – 3, Negative – 0, 1 Comment

  Comment from Idaho: The sentence following the deleted sentence must also be deleted as it is in the reference to the deleted sentence.

  Resolution of Comment: The Chairman agrees and will make the change prior to the SOM Ballot.

  Motion to move the revisions to M 147 to SOM Ballot: (M/S ,)

C. Task Force Reports

TASK FORCE 10-04:

Development of a new provisional standard for the In-Place Determination of Density and Water Content of Soil and Aggregate by Subsurface Electrical Method. TP 112

- Dennis Anderson, Cecil Jones, Darin Tedford (NV)

  - The Chairman expressed the need for new members for this task force.
  - Dennis Anderson and Cecil Jones presented the work that has gone on this past year and the data collected. They are currently working with eight states, AK, ND, NE, VT, Virginia, NV, MD ID (get list from Cecil). Some data sets from this work were presented. A couple of states commented on this method/equipment as difficult to use of states. A couple of states had good comparisons however, one state reported poor comparisons. Nevada is continuing to do research.
  - Calibration of the gage was questioned and discussed concerning the appropriate method. Dennis discussed the optimized algorithm that has been added and is under beta testing to help with the calibration.
  - Maryland recently used the gage and reported the compaction part did very well with correlation but the moisture did not. Maryland offered to supply their data to Dennis. Scott (OK) commented that the task force should continue based on the 8 states that are working with this new technology.

Action Item - Most members of the original TF are no longer part of SOM. TF members are needed.

Update from Cecil Jones and Dennis Anderson

TASK FORCE 12-01:

Address comments on Technical Section Ballot 12-01 to revise M 147.

- Andy Babish (VA), Jamie Blanton (LA), Scott Seiter (OK), Sejal Barot (MD), and James Williams (MS)

  - Terminology used was vague and not specific.
  - Survey was done to see how many states are using this standard. A fair amount of states are using this standard. . At this point it is believed that minor changes are needed. The task force will work on presenting revised language at a future meeting.
  - There has not been any action from this TF since the last meeting (August 2015). Virginia will look at putting together some language and will distribute to the TF before the summer meeting (August 2016). The Chairman indicated that if the TF could agree on language for the standard, a TS ballot could be done later in the spring and could be discussed at the Summer Meeting.
  - The TF presented proposed changes to M 147 which were balloted (TS1b-16-02). The ballot passed with one comment. It is proposed that the TF be continued to address any comments or negative votes on the upcoming SOM Ballot.

TASK FORCE 12-02:

Address negative votes and comments related to Technical Section Ballot 12-04 to revise T 99 and T 180.

- Garth Newman (WAQTC), Scott Seiter (OK), Jamie Blanton (LA), David Horhota (FL), James Williams (MS)

  - Changes suggested by the task force were balloted and passed, and are currently published.
  - The comment from FL is still outstanding. Florida's comment were with concerns about the mandatory requirement to have two points passed optimum this can be an issue when dealing with a granular material with a relatively flat moisture-density curve. Tim (FL)

suggested that this requirement be made into a note so it would not necessarily be mandatory. Maine and OK were in agreement with the comment from FL.

- Garth mentioned that T 99 was originally developed for a cohesive soil. The two data points are really needed past optimum to define the zero air voids curve.
  Tim indicated that Dave Horhota (FL) would lead the effort to look at some language. The task force will schedule a conference call within the next month or so to look into this issue. (AASHTO staff volunteered offered assist in facilitating this call.)
- There has been no action since the last meeting (August 2015). The chair will work with the TF to get a further discussion going on this issue before the next meeting.

V. New Business

A. Research Proposals
   1. 20-7 RPS
   2. Full NCHRP RPS **(See Appendix C, Pages 23 – 32)**

- *Including the Effects of Shrink/Swell and Frost Heave in Mechanistic Empirical Pavement Design*
  TRB AFS60

- *Development of an In-Situ Test that will Measure Performance Properties of Sub-Grade Soils Stabilized with Cementitious Materials*
  TRB AFS80

- *Sustainable Use of Available Aggregate Sources in Highway Pavements – Best Value Engineering*
  TRB AFP70 – Andrew Dawson and Erol Tutumluer

B. AMRL/CCRL - Observations from Assessments?

- April 2016 AMRL Query regarding standardization of sector-faced mechanical rammers for T 99 and T 180. **See Appendix D (Pages 33 – 34).**

C. NCHRP Issues

D. Correspondence, calls, meetings

E. Presentation by Industry/Academia

- Presentation of the PM Soil-Cement Compaction Device – Overview of Applications for Pavement Design and Construction Quality Assurance. Dr. Isaac Howard – Mississippi State University

- Troxler e-Gauge Update – Dick Reeves/Robyn Myers

- DIGS Effort – Ben Rivers

F. Proposed New Standards

G. Proposed New Task Forces

- New Task Force to address T 310
  - Procedure for Calibration Blocks (Remaining work from TF 11-01)
  - Research inclusion of devices such as the e-Gauge into T 310

H. Standards Requiring Reconfirmation **(See Appendix D, Pages 35 - 37)**

I. SOM Ballot Items (including any ASTM changes/equivalencies) **(See Appendix E, Page 38)**

VI. Open Discussion

VII. Adjourn

Appendix A

AASHTO THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

SUBCOMMITTEE ON MATERIALS

Mid-Year Web Meeting Minutes
Wednesday, February 10, 2016
2:00 pm – 4:00 pm EST

TECHNICAL SECTION 1b
Subsurface Exploration, Soil Instrumentation, Soil Stabilization, and Field Testing of Soils

I. Call to Order and Opening Remarks

Attendees were asked to send an email to bjohnson@amrl.net to signify their attendance in lieu of a formal Roll Call.

The chairman thanked the Friends of the TS for their participation, and thanked all members for a very successful SOM ballot.

II. Roll Call

Williams, III, James A.	Mississippi Department of Transportation	Chair
Blackburn, Lyndi D	Alabama Department of Transportation	Vice Chair
Barnhart, Tracy	AMRL	Liaison
Johnson, Brian	AMRL	Liaison
Lacinak, Henry	AASHTO	Liaison
Rothblatt, Evan	AASHTO	Liaison
Knake, Maria	AMRL	Member
Azari, Haleh	AMRL	Member
Breth, Christopher	AMRL	Member
Uherek, Greg	AMRL	Member
Lenker, Steven E.	AMRL	Member
Cox, Bernard	Alabama Department of Transportation	Member
Davis, Kaye C	Alabama Department of Transportation	Member
Stolarski, Phil J	California Department of Transportation	Member
Lopez, Aramis	Federal Highway Administration	Member
Rivers, Benjamin	Federal Highway Administration	Member
Springer, Jack	Federal Highway Administration	Member
Voth, Michael D	Federal Highway Administration	Member
Aschenbrener, Tim	Federal Highway Administration	Member
Horhota, David J	Florida Department of Transportation	Member
Hasty, Charles Allen	Georgia Department of Transportation	Member
Newman, Garth H	Idaho Transportation Department	Member
Walker, Ronald P.	Indiana Department of Transportation	Member
Smith, Timothy E.	Maryland Department of Transportation	Member
Kaiser, Reid	Nevada Department of Transportation	Member
Tedford, Darin P	Nevada Department of Transportation	Member
Boisvert, Denis M.	New Hampshire Department of Transportation	Member
Burnett, Robert A.	New York State Department of Transportation	Member
Seiter, Scott	Oklahoma Department of Transportation	Member
Franco, Colin A	Rhode Island Department of Transportation	Member
Zwanka, Merrrill E	South Carolina Department of Transportation	Member
Heinen, Caroline	Texas Department of Transportation	Member
Babish, Charles A.	Virginia Department of Transportation	Member

Lane, Becca	Ontario Ministry Of Transportation	Associate Member
Jones, Cecil L	American Concrete Institute	Friend
Savage, David A	Construction Materials Engineering Council	Friend
Pyle, Roger	Pine Test Equipment, LLC	Friend
Reaves, Dick	Troxler Electronic Laboratories, Inc.	Friend

III. Approval of Technical Section Minutes

Motion to approve Minutes (NY) 2nd (RI). Motion carried.

IV. Old Business

A. SOM Ballot Items

Item Number: 6

Description: SOM Ballot item to delete M 92, Wire Cloth Sieves for Testing Purposes, which is identical to ASTM E-11-09. In the interest of cleaning up the historical "Category C" standards, this ballot is to discontinue publishing M 92.

Affirmative 47 of 52
Negative 0 of 52
No Vote 5 of 52

Colorado Department of Transportation Comment	Vote in affirmative. It is assumed the references to AASHTO M92 will be replaced by references to ASTM E11 (for example in T11) AASHTO Publications staff is aware of the deletion of M 92.

The chairman will work with AASHTO publications to ensure that M 92 is replaced with E11 in AASHTO standards.

Item Number 7

Description: SOM Ballot item to revise T 272, Family of Curves â€“ One-Point Method, based on WAQTC recommendations. In addition to deleting information contained in other standards, the revision removes the appendix for developing a family of moisture-density curves. The development of a family of curves is proposed as a new standard practice.

Affirmative 47 of 52
Negative 0 of 52
No Vote 5 of 52

A brief discussion regarding the purpose of the revision to T 272 and the creation of a new recommended practice for development of a family of curves occurred.

Comments from the SOM ballot were editorial in nature and were discussed briefly. Following the meeting, the Chairman and Garth Newman were tasked with addressing specifically the comments/suggestions from Oklahoma.

Editorial comments will be addressed prior to publication.

Arizona Department of Transportation Comment	X-axis data is missing from the maximum dry density curve in Section 8.
Idaho	Delete reference to AASHTO T 224. It has been discontinued due to lack of use.

Transportation Department Comment	
Oklahoma Department of Transportation Comment	Figure 1 comment; question why the "spine" is shown since this is a single moisture density curve and not a family of curves. Why is the half of the curve beyond optimum not shown? Figure 2 comment; suggest removing the random vertical and horizontal lines from the graph. General comment about both figures; The moisture density curves do not extend beyond the optimum (peak). When viewing, comparing (family), or interpreting moisture density curves, we believe it is helpful to see the whole curve.
Oregon Department of Transportation Comment	An editorial note (if we can take care of it as part of this publication) - T224 should be deleted from Section 2 Referenced Documents, because that information is now included as an Annex to T99 and T180. We should also probably add T217, T255, T265 to the list of referenced documents in Section 2 because they are called out in Section 7.4. If we can't take care of those edits with this publication, we should remember them for the next update. The moisture content labels on the bottom of the graph should be included in Figure 1, the same way that they are included in Figure 2.
Pennsylvania Department of Transportation	1. In Section 8.2.1, 1st sentence, revise from "within in 80 to 100" to "within 80 to 100". 2. In Section 8.2.1, last sentence, consider revising from "at adjusted moisture content" to "at an adjusted moisture content" for better readability. 3. In Section 9.1.3, revise from "maximum density" to "maximum dry density".

Item Number 8

Description: SOM Ballot item to adopt a new Standard Practice, R-XX, Developing a Family of Curves. The intent is to replace the Appendix XI of T 272.

Affirmative 47 of 52
Negative 0 of 52
No Vote 5 of 52

Related to Item Number 7. See discussion regarding Oklahoma comment above.

Oklahoma Department of Transportation Comment	Consider adding a definition of "spine" in the terminology section. Suggest removing the random vertical and horizontal lines from the graph. When viewing, comparing (family), or interpreting moisture density curves, we believe it is helpful to see the whole curve. Suggestion for possible future work; it may be helpful to provide guidance (appendix) in understanding which compaction curves "belong" in a family, or whether a single point should be compared with a particular family.
Pennsylvania Department of Transportation Comment	1. In Section 5.7.2, revise from "the points" to "the 80 percent of optimum moisture points".

Item Number 9

Description: SOM Ballot item to revise T 225, Diamond Core Drilling for Site Investigation, to include the definition and use of Triple-Tube Core Barrels. The revisions also provide new language cautioning the use of Single-Tube Core Barrels. These changes are proposed by Task Force 15-01.

Affirmative 46 of 52
Negative 0 of 52

No Vote 6 of 52

This ballot was the result of a TS ballot that received comments regarding the need to update wording regarding single-tube core barrels and to caution against their use. Triple-tube core barrels have been added. The ballot item passed. There was a brief discussion regarding the comment from Tennessee regarding whether or not this should be a test method or a standard practice. For now, the chair has decided to keep this as test method, but will take the comment into consideration for future revisions.

Idaho Transportation Department Comment	Paragraph 3.3.9 as submitted (p. 37 of 42 of minutes) has a typo. The sixth sentence should say: "Triple-tube core barrels are available with reaming shell sizes A, B, N and larger." The wording of the second sentence in Note 3 of Paragraph 4.3 is still unclear. Where it says, "...where the consequence of core quality and natural discontinuities would not adversely impact...", would the meaning be more clear if it was reworded to say "...where the core quality or the presence or quality of natural discontinuities would not adversely impact..."?
New Hampshire Department of Transportation Comment	If section 3.4 allows other abrasive materials for the core bits then should the word 'Diamond' be removed from the title.
Pennsylvania Department of Transportation Comment	1. In Section 3.3.9, next to last sentence, revise from "barrels area available" to "barrels are available".
Tennessee Department of Transportation Comment	Should this be changed from a T (Test Method) to a R (Standard Practice)?

B. TS letter ballots

Reconfirmation Ballot for the following:

- *R 13-12 Conducting Geotechnical Subsurface Investigations*
- *T 207-12 Thin-Walled Tube Sampling of Soils*
- *TP 100-12 Deep Foundation Elements for Bi-Directional Static Axial Compressive Load*
- *TP 112-14 Determining In-Place Density and Moisture Content of Soil and Soil-Aggregate Using Complex Impedance Methodology*

All reconfirmation ballot items passed. There was one minor comment that will be taken care of editorially. The executive council will be providing some future input on the rolling ballots. The chair recognizes that having the reconfirmations mixed in with the other ballots was confusing. There will be survey sent out to the states to garner further feedback on this system.

C. Task Force Reports

TASK FORCE 10-04:

Development of a new provisional standard for the In-Place Determination of Density and Water Content of Soil and Aggregate by Subsurface Electrical Method. TP 112

- Dennis Anderson, Cecil Jones, Jim Pappas (DE), Reid Kaiser (NV), Georgene Geary (GA), Bob Burnett (NY)

  - The Chairman expressed the need for new members for this task force.
  - Dennis Anderson and Cecil Jones presented the work that has gone on this past year and the data collected. They are currently working with eight states, AK, ND, NE, VT, Virginia, NV, MD ID (get list from Cecil). Some data sets from this work were presented. A couple of states commented on this method/equipment as difficult to use of states. A couple of states had good comparisons however, one state reported poor comparisons. Nevada is continuing to do research.

- Calibration of the gage was questioned and discussed concerning the appropriate method. Dennis discussed the optimized algorithm that has been added and is under beta testing to help with the calibration.
- Maryland recently used the gage and reported the compaction part did very well with correlation but the moisture did not. Maryland offered to supply their data to Dennis. Scott (OK) commented that the task force should continue based on the 8 states that are working with this new technology.

  There are several members of the TF that are no longer part of SOM, and were not on the call. It was recommended that new members of the TF be recruited. The chair will review the minutes from the previous meeting to ensure member list is accurate.

TASK FORCE 12-01:

Address comments on Technical Section Ballot 12-01 to revise M 147.

- Andy Babish (VA), Jamie Blanton (LA), Scott Seiter (OK), Sejal Barot (MD), and James Williams (MS)

- Terminology used was vague and not specific.
- Survey was done to see how many states are using this standard. A fair amount of states are using this standard. . At this point it is believed that a minor changes are needed. The task force will work on presenting revised language at a future meeting.

  There has not been any action from this TF since the last meeting. Virginia will look at putting together some language and will distribute to the TF before the summer meeting. The Chairman indicated that if the TF could agree on language for the standard, a TS ballot could be done later in the spring and could be discussed at the Summer Meeting.

TASK FORCE 12-02:

Address negative votes and comments related to Technical Section Ballot 12-04 to revise T 99 and T 180.

- Garth Newman (WAQTC), Scott Seiter (OK), Jamie Blanton (LA), David Horhota (FL), James Williams (MS)

- Changes suggested by the task force were balloted and passed, and are currently published.
- The comment from FL is still outstanding. Florida's comment were with concerns about the mandatory requirement to have two points passed optimum this can be an issue when dealing with a granular material with a relatively flat moisture-density curve. Tim (FL) suggested that this requirement be made into a note so it would not necessarily be mandatory. Maine and OK were in agreement with the comment from FL.
- Garth mentioned that T 99 was originally developed for a cohesive soil. The two data points are really needed past optimum to define the zero air voids curve. Tim indicated that Dave Horhota (FL) would lead the effort to look at some language. The task force will schedule a conference call within the next month or so to look into this issue. (AASHTO staff volunteered offered assist in facilitating this call.)

  There has been no action since the last meeting. The chair will work with the TF to get a further discussion going on this issue before the next meeting.

Other Old Business

There was a brief discussion on Non-nuclear density gauges (e-gauge): There is a need to refine a calibration procedure. A task force in needed to review this issue further. Also, this TF needs to determine if T310 can be modified to be utilized for the e-gauge. A placeholder will be put on the agenda for the summer meeting.

V. New Business

Appendix A

A. Research Proposals
20-7 proposals were ranked last fall, some did not make the cut. Some proposals may be reconsidered by SCOH at the Spring Meeting. If you hear of any other research needs, please bring them forward.

B. AMRL/CCRL Issues
Nothing to report.

C. NCHRP Issues
Nothing to report.

D. Correspondence, calls, meetings/ Presentation by Industry
See discussion about e-gauge/T310 above

E. Proposed New Standards
F. Proposed New Task Forces
G. Standards Requiring Reconfirmation
H. SOM Ballot Items (including any ASTM changes)

VI. Open Discussion

Ben Rivers (FHWA)

- The DIGS effort: this is a data schema standard that ASCE, who maintains this schema, in a HTML format. The group that has been tasked with managing this schema is developing defined inputs for several AASHTO soils tests. At some point how we handle data may be of a bigger discussion point. It may be useful to get somebody from that group to come to the next meeting to present and discuss further. The Chairman asked Ben to follow up with possible presenters for the Summer Meeting.
- A method that has been talked about and out there for a long time: looking at a soil air voids approach for compaction control. It is not much different in terms of looking at moisture density the way proctor does, but it does pay closer attention to air voids, which means that specific gravity of the soil becomes a critical measurement. There is a disconnect between the way we have traditionally controlled compaction and the way that intelligent compaction may look at it in the future. Ben will forward more information the Chairman to consider as a future topic.
- Subsurface investigation manual: Work in this area is continuing. Chairman will continue to keep the TS informed.
- Synthesis on the influence of geotechnical testing and subsurface investigations: Synthesis 484. This document was brought to the attention of the TS. There is great information in here, especially related to characterizing water conditions on a site.

The Chairman updated the committee on the status of the update to the Subsurface Investigation Manual. The target for completion of the research is late 2016.

VII. Adjourn - Meeting adjourned at 3:00 PM EST.

AASHTO Electronic Balloting System

Ballot Detail Report

Ballot Detail	
Ballot Name:	SOM - TS 1b Ballot T 99 and T 180
Ballot Manager:	James A. Williams
Ballot Start Date:	4/19/2016
Ballot Due Date:	5/10/2016

SOM - TS 1b Ballot T 99 and T 180

Item Number:	1
Description:	Revise T 99 Sections 1.4 and A1 for application of the oversized particle correction.
Decisions:	Affirmative: 15 of 18 Negative: 0 of 18 No Vote: 3 of 18

Agency (Individual Name)	Comments	Decision	Responce Attachment
InstroTek, Inc. (Ali Regimand) (aregimand@instrotek.com)			
Federal Highway Administration (Aramis Lopez) (aramis.lopez@dot.gov)			
American Concrete Institute (Cecil L Jones) (cecil.jones@nc.rr.com)			
AASHTO Material Reference Laboratory (Brian Johnson) (bjohnson@amrl.net)			
Construction Materials Engineering Council (David A Savage) (davesavage@cmec.org)			
New Hampshire Department of Transportation (Denis M. Boisvert) (dboisvert@dot.state.nh.us)			
Troxler Electronic Laboratories, Inc. (Dick Reaves) (dreaves@troxlerlabs.com)			
Maryland Department of			

Transportation (Eric M Frempong) (efrempong@sha.state.md.us)	
American Association of State Highway and Transportation Officials (Evan Rothblatt) (erothblatt@aashto.org)	
AASHTO Material Reference Laboratory (Greg Uherek) (guherek@amrl.net)	
American Association of State Highway and Transportation Officials (Henry Lacinak) (hlacinak@aashto.org)	
Federal Highway Administration (Jack H Springer) (jack.springer@dot.gov)	
Alabama Department of Transportation (Kaye C Davis) (chancellork@dot.state.al.us)	
AASHTO Material Reference Laboratory (Maria Knake) (mknake@amrl.net)	
Federal Highway Administration (Michael D Voth) (michael.voth@dot.gov)	
AASHTO Material Reference Laboratory (Steve Lenker) (slenker@amrl.net)	
Federal Highway Administration (Tim Aschenbrener) (timothy.aschenbrener@dot.gov)	
Tennessee Department of Transportation (Travis W. Smith) (travis.w.smith@tn.gov)	Affirmative
Alabama Department of Transportation (Lyndi D Blackburn) (blackburnl@dot.state.al.us)	Affirmative
Maryland Department of Transportation (Sejal Barot) (sbarot@sha.state.md.us)	Affirmative
California Department of	Affirmative

Transportation (phil j stolarski) (phil.stolarski@dot.ca.gov)		
New York State Department of Transportation (Robert A Burnett) (bburnett@dot.state.ny.us)		Affirmative
South Carolina Department of Transportation (Merrrill E Zwanka) (zwankame@scdot.org)		Affirmative
Mississippi Department of Transportation (James A. Williams) (jwilliams@mdot.state.ms.us)		Affirmative
Idaho Transportation Department (Garth H Newman) (garth.newman@itd.idaho.gov)		Affirmative
Florida Department of Transportation (David Horhota) (david.horhota@dot.state.fl.us)		Affirmative
Virginia Department of Transportation (Charles A. Babish) (andy.babish@vdot.virginia.gov)	I believe the suggested wording in section 1.4 of the standard meant to say "above which" rather than "below which": "The person or agency specifying this method may specify a minimum percentage of oversized particles below which (above which?) a correction must be applied. If no minimum percentage is specified, correction for the oversized particles shall be applied to material containing more than 5 percent by weight of oversized particles."	Affirmative
New Hampshire Department of Transportation (Charles R. Dusseault) (cdusseault@dot.state.nh.us)		Affirmative
Rhode Island Department of Transportation (Colin A Franco) (colin.franco@dot.ri.gov)		Affirmative
Nevada Department of Transportation (Darin Tedford)		Affirmative

(dtedford@dot.state.nv.us)		
Ontario Ministry Of Transportation (Becca Lane) (becca.lane@ontario.ca)	Suggest providing an example of a calculation	Affirmative
Federal Highway Administration (Benjamin Rivers) (benjamin.rivers@fhwa.dot.gov)		Affirmative
Texas Department of Transportation (Caroline Heinen) (caroline.heinen@txdot.gov)		No Vote
Connecticut Department of Transportation (Leo Louis Fontaine) (leo.fontaine@ct.gov)		No Vote
Oklahoma Department of Transportation (Scott Seiter) (sseiter@odot.org)		No Vote

Item Number:	**2**
Description:	Revise T 180 Sections 1.4 and A1 for application of the oversized particle correction.
Decisions:	Affirmative: 15 of 18 Negative: 0 of 18 No Vote: 3 of 18

Agency (Individual Name)	Comments	Decision	Responce Attachment
InstroTek, Inc. (Ali Regimand) (aregimand@instrotek.com)			
Federal Highway Administration (Aramis Lopez) (aramis.lopez@dot.gov)			
American Concrete Institute (Cecil L Jones) (cecil.jones@nc.rr.com)			
AASHTO Material Reference Laboratory (Brian Johnson) (bjohnson@amrl.net)			
Construction Materials Engineering Council (David A Savage) (davesavage@cmec.org)			
New Hampshire Department of Transportation (Denis M. Boisvert)			

(dboisvert@dot.state.nh.us)	
Troxler Electronic Laboratories, Inc. (Dick Reaves) (dreaves@troxlerlabs.com)	
Maryland Department of Transportation (Eric M Frempong) (efrempong@sha.state.md.us)	
American Association of State Highway and Transportation Officials (Evan Rothblatt) (erothblatt@aashto.org)	
AASHTO Material Reference Laboratory (Greg Uherek) (guherek@amrl.net)	
American Association of State Highway and Transportation Officials (Henry Lacinak) (hlacinak@aashto.org)	
Federal Highway Administration (Jack H Springer) (jack.springer@dot.gov)	
Alabama Department of Transportation (Kaye C Davis) (chancellork@dot.state.al.us)	
AASHTO Material Reference Laboratory (Maria Knake) (mknake@amrl.net)	
Federal Highway Administration (Michael D Voth) (michael.voth@dot.gov)	
AASHTO Material Reference Laboratory (Steve Lenker) (slenker@amrl.net)	
Federal Highway Administration (Tim Aschenbrener) (timothy.aschenbrener@dot.gov)	
Tennessee Department of Transportation (Travis W. Smith) (travis.w.smith@tn.gov)	Affirmative
Alabama Department of Transportation (Lyndi D Blackburn) (blackburnl@dot.state.al.us)	Affirmative

Maryland Department of Transportation (Sejal Barot) (sbarot@sha.state.md.us)		Affirmative
California Department of Transportation (phil j stolarski) (phil.stolarski@dot.ca.gov)		Affirmative
New York State Department of Transportation (Robert A Burnett) (bburnett@dot.state.ny.us)		Affirmative
South Carolina Department of Transportation (Merrrill E Zwanka) (zwankame@scdot.org)		Affirmative
Mississippi Department of Transportation (James A. Williams) (jwilliams@mdot.state.ms.us)		Affirmative
Idaho Transportation Department (Garth H Newman) (garth.newman@itd.idaho.gov)		Affirmative
Florida Department of Transportation (David Horhota) (david.horhota@dot.state.fl.us)		Affirmative
Virginia Department of Transportation (Charles A. Babish) (andy.babish@vdot.virginia.gov)	Similar to T99, I believe the suggested wording in Section 1.4 of the standard meant to say "above which" rather than "below which": "The person or agency specifying this method may specify a minimum percentage of oversized particles below which (above which?) a correction must be applied. If no minimum percentage is specified, correction for the oversized particles shall be applied to material containing more than 5 percent by weight of oversized particles."	Affirmative
New Hampshire Department of Transportation (Charles R. Dusseault) (cdusseault@dot.state.nh.us)		Affirmative

Rhode Island Department of Transportation (Colin A Franco) (colin.franco@dot.ri.gov)		Affirmative
Nevada Department of Transportation (Darin Tedford) (dtedford@dot.state.nv.us)		Affirmative
Ontario Ministry Of Transportation (Becca Lane) (becca.lane@ontario.ca)	Suggest providing an example of a calculation	Affirmative
Federal Highway Administration (Benjamin Rivers) (benjamin.rivers@fhwa.dot.gov)		Affirmative
Texas Department of Transportation (Caroline Heinen) (caroline.heinen@txdot.gov)		No Vote
Connecticut Department of Transportation (Leo Louis Fontaine) (leo.fontaine@ct.gov)		No Vote
Oklahoma Department of Transportation (Scott Seiter) (sseiter@odot.org)		No Vote

Date: 6/1/2016

AASHTO Electronic Balloting System

Ballot Detail Report

Ballot Detail	
Ballot Name:	SOM - TS 1b Ballot M 147
Ballot Manager:	James A. Williams
Ballot Start Date:	4/19/2016
Ballot Due Date:	5/10/2016

SOM - TS 1b Ballot M 147

Item Number:	1
Description:	Revise M 147-65 (2012), Section 1.1 clarifying the term "normal" as it relates to specific gravity and absorption.
Decisions:	Affirmative: 15 of 18 Negative: 0 of 18 No Vote: 3 of 18

Agency (Individual Name)	Comments	Decision	Responce Attachment
InstroTek, Inc. (Ali Regimand) (aregimand@instrotek.com)			
Federal Highway Administration (Aramis Lopez) (aramis.lopez@dot.gov)			
American Concrete Institute (Cecil L Jones) (cecil.jones@nc.rr.com)			
AASHTO Material Reference Laboratory (Brian Johnson) (bjohnson@amrl.net)			
Construction Materials Engineering Council (David A Savage) (davesavage@cmec.org)			
New Hampshire Department of Transportation (Denis M. Boisvert) (dboisvert@dot.state.nh.us)			
Troxler Electronic Laboratories, Inc. (Dick Reaves) (dreaves@troxlerlabs.com)			
Maryland Department of			

Transportation (Eric M Frempong) (efrempong@sha.state.md.us)	
American Association of State Highway and Transportation Officials (Evan Rothblatt) (erothblatt@aashto.org)	
AASHTO Material Reference Laboratory (Greg Uherek) (guherek@amrl.net)	
American Association of State Highway and Transportation Officials (Henry Lacinak) (hlacinak@aashto.org)	
Federal Highway Administration (Jack H Springer) (jack.springer@dot.gov)	
Alabama Department of Transportation (Kaye C Davis) (chancellork@dot.state.al.us)	
AASHTO Material Reference Laboratory (Maria Knake) (mknake@amrl.net)	
Federal Highway Administration (Michael D Voth) (michael.voth@dot.gov)	
AASHTO Material Reference Laboratory (Steve Lenker) (slenker@amrl.net)	
Federal Highway Administration (Tim Aschenbrener) (timothy.aschenbrener@dot.gov)	
Tennessee Department of Transportation (Travis W. Smith) (travis.w.smith@tn.gov)	Affirmative
Alabama Department of Transportation (Lyndi D Blackburn) (blackburnl@dot.state.al.us)	Affirmative
Maryland Department of Transportation (Sejal Barot) (sbarot@sha.state.md.us)	Affirmative
California Department of	Affirmative

Transportation (phil j stolarski) (phil.stolarski@dot.ca.gov)		
New York State Department of Transportation (Robert A Burnett) (bburnett@dot.state.ny.us)		Affirmative
South Carolina Department of Transportation (Merrrill E Zwanka) (zwankame@scdot.org)		Affirmative
Mississippi Department of Transportation (James A. Williams) (jwilliams@mdot.state.ms.us)		Affirmative
Idaho Transportation Department (Garth H Newman) (garth.newman@itd.idaho.gov)	The sentence following the deleted sentence must also be deleted as it is in reference to the deleted sentence.	Affirmative
Florida Department of Transportation (David Horhota) (david.horhota@dot.state.fl.us)		Affirmative
Virginia Department of Transportation (Charles A. Babish) (andy.babish@vdot.virginia.gov)		Affirmative
New Hampshire Department of Transportation (Charles R. Dusseault) (cdusseault@dot.state.nh.us)		Affirmative
Rhode Island Department of Transportation (Colin A Franco) (colin.franco@dot.ri.gov)		Affirmative
Nevada Department of Transportation (Darin Tedford) (dtedford@dot.state.nv.us)		Affirmative
Ontario Ministry Of Transportation (Becca Lane) (becca.lane@ontario.ca)		Affirmative
Federal Highway Administration (Benjamin Rivers) (benjamin.rivers@fhwa.dot.gov)		Affirmative
Texas Department of Transportation (Caroline Heinen) (caroline.heinen@txdot.gov)		No Vote

Connecticut Department of Transportation (Leo Louis Fontaine) (leo.fontaine@ct.gov)	No Vote
Oklahoma Department of Transportation (Scott Seiter) (sseiter@odot.org)	No Vote

Date: 6/1/2016

Including the Effects of Shrink/Swell and Frost Heave in Mechanistic Empirical Pavement Design

This Research Need was developed for the Joint Technical Committee on Pavements and is adopted by AFS60, Subsurface Drainage Committee

I. PROBLEM TITLE

Unified Model for Shrink/Swell and Frost Heave for Pavement Design

II. RESEARCH NEED STATEMENT

Shrink-swell of expansive clay soils affects pavements from the Gulf of Mexico to the Canadian border including Texas, Oklahoma, Colorado, Arkansas, Louisiana, Mississippi, Alabama, New Mexico, Montana, North Dakota and South Dakota. These states have significant montmorillonite clay minerals and evapotranspiration may exceed precipitation. The impact of the shrink/swell behavior is differential changes in moisture and vertical elevation from the center of the pavement to the paved edge. This variation results in increased pavement roughness over time.

For states in the northern half of the country, frost heave may also significantly affect pavement smoothness, especially when silty soils are present. In these areas, the freezing boundary will extend into the subgrade soils. Moisture will accumulate and freeze into "frost lenses". As long as the subgrade remains frozen, the roadway is able to carry heavy loads. When the lenses thaw in the spring, the liquid water flows downward, leaving a void where the lense existed. The void collapses, causing a pavement failure that extends through the full depth of pavement structure. The frost heave issue affects ride quality in at least 15 states along the northern tier, and may affect additional states at higher elevations or in years with unusually cold winters.

Both the mechanism driving shrink swell in expansive clay soils and the formation of frost lenses during winter are moisture flow processes that impact ride quality of pavements in affected areas. Modelling these moisture flow processes with a mechanistic model would improve the capability of ME Design. Currently frost heave and shrink-swell are "predicted" from other climatic variables like freezing index, average annual precipitation, soil plasticity index and percent passing the number 200 sieve; all of which are used to develop a site factor term. This term, along with the initial IRI for each site and calculated pavement distresses are used to estimate the IRI at time t.

Since the development of the procedure coded in the ME Design software, Lytton et al. (2004) developed a soil vertical movement model for predicting roughness and serviceability of pavements on expansive soils in Texas. This model involves the computation of total vertical movement of the soil, i.e. swelling and shrinkage deformations, due to moisture fluctuations. Lytton et al's model calculates the shrinkage or swelling movement by taking into account the volume changes in the soil due to the seasonal variations in soil suction. This procedure involves a rigorous modeling of the moisture diffusion process that induces changes in soil suction as well as the deformations that occur in response to changes in suction. This procedure is currently implemented in a software program called WINPRES. The WINPRES User Manual (Lytton et al. 2006) presents screenshots of the program interface, description of various

inputs and examples. The WINPRES program includes two major computational modules written in the Fortran programming language:

- Vertical movement model: Computes total shrinkage or swelling.
- Roughness model: Relates total vertical movement to pavement smoothness.

The WINPRES software estimates the equilibrium suction using an empirical relationship developed using field sites in Texas. The Thornthwaite Moisture Index using in WINPRES is also different from that used in Pavement ME-Design. Empirical models are also used to relate the vertical movement to the change in smoothness. The parameters used to estimate these changes are based on the 1993 AASHTO Guide, and include traffic in ESALs, Structural Number, drainage and load transfer coefficients for rigid pavement, and serviceability index.

Since the TAMU shrink/swell model was developed for Texas conditions, the model does not consider the impact of freezing. The phenomenon of frost heave is similar to that the vertical movement in expansive soils and has similar effects on pavement smoothness. Various factors that affect the shrinkage and swelling of expansive soils, such as particle size distribution of subgrade soil, climatic factors, cyclical changes in moisture, moisture transport and vegetation, influence the severity of frost heave.

Therefore, for implementing in the Pavement M-E design, the shrink/swell model must be expanded for frozen conditions and be harmonized with the frost heave model. In other words, a single model should be used to predict pavement smoothness deterioration irrespective of whether the vertical movement caused by frost heave or shrinkage/swelling or both.

The CRREL model is currently implemented in the Pavement M-E Design software. This model predicts the depth of frost and thaw penetration. In addition, the model estimates the vertical heave due to frost formation and vertical settlement due to thawing. A closer examination of the model's source code indicated the following issues and concerns:

- The CRREL frost heave model produces estimates of frost heave but the validity of those estimates is questionable. Hence, the model must be investigated further.
- Irrespective of their precision, the frost heave estimates are not incorporated with the smoothness prediction model. Possible model forms should be investigated further.

In short, the shrink/swell model will require additional work to broaden it to include the development of frozen layers and additional shrink/swell areas. In addition, inclusion of the resultant roughness in the IRI calculations will depend on use of current design parameters and improved and calibrated models. This is substantial new research.

III. RESEARCH OBJECTIVE

The research will provide a unified model to evaluate shrink/swell and frost heave phenomenon and a calibrated model for inclusion in IRI modelling.

It is expected that the following tasks will be required, at a minimum:

1. Literature review of models for shrink/swell and frost heave.

2. Identify variables needed to model these phenomena over the range of geographies and climates.
3. Collect appropriate data sites and populate a database for model development, model calibration, model verification.
4. Determine the best approach to use the results of the unified moisture model to calculate changes in pavement roughness. This model also must be calibrated and verified. Based on the results of the calibration and verification, recommend whether the model should be implemented in Pavement ME-Design

.IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding**:**
$500,000

Research Period**:**
36 months

V. URGENCY, PAYOFF POTENTIAL, AND IMPLEMENTATION

Frost heave related pavement distress not only causes pavement roughness but is also costly to affected agencies. Similarly, agencies having clay soils which shrink and swell have significant costs to mitigate the behavior. This is a significant and costly issue. While it doesn't impact every state, when both shrink/swell and frost penetration are considered together, more than half of the states are or could be effected.

Having effective models can have payoff potential in the hundreds of millions of dollars. Another payoff would be in the improved customer satisfaction of roads that have better ride quality.

The work will result in calibrated models that can be used by both state/provincial and local agencies.

This topic is on the list of identified needs maintained by the Pavement ME-Design Task Force, so the likelihood of implementation is high.

Development of an In-Situ Test that will Measure Performance Properties of Sub-Grade Soils Stabilized with Cementitious Materials

I. Research Problem Statement

Cementitious materials are commonly used to stabilize weak sub-grade soils in order to increase their stiffness, shear and tensile strengths. The increase in these engineering properties results in overall improvement in pavement performance of both rigid and flexible pavements. In the case of rigid pavements, stabilized sub-grades provide uniform support and a stable construction platform. In flexible pavements, sub-grade stabilization results in reduction of rutting, fatigue and longitudinal cracking.

The current state of practice is primarily based on laboratory testing to determine, the type of stabilizer and the amount required for a given situation. Particle size analysis and Atterberg limits tests are used to select the type of stabilizer. The unconfined compressive strength test is used to determine the amount of stabilizer required, to achieve a predetermined design strength based on a curing period of 7 days. The results of the unconfined compressive strength test can be used to estimate the compressive static modulus of elasticity, shear and tensile strengths of stabilized soils.

One major shortcoming of the current state of practice is that there is no easy and reliable field test that can be used on the constructed stabilized sub-grade after the 7 days curing period. Therefore design strengths cannot be verified prior to allowing heavy construction equipment to operate on the stabilized sub-grade. In an attempt to address this shortcoming, agencies have developed very detailed construction specifications. These specifications usually address methods of measuring rates of application, efficiency of pulverization, depth and uniformity of mixing, thickness of compacted layer, density, moisture control, quality of cementitious material and construction equipment required to execute the work. This approach has several shortcomings, some of which are summarized below:

There is no assurance that the finished product will have the required design strength and/or stiffness at the end of 7 days curing period, even if the contractor strictly adhered to the specifications.

There is no way of detecting when the design strengths have been achieved prior to the seven days curing period. This is very critical because there is tremendous pressure to speed up construction. Therefore if the contractor could be allowed to operate heavy equipment as soon as design strengths were obtained, this would shorten construction time and should result in lower bid prices.

The current practice requires considerable oversight from the agencies. Most agencies are experiencing budget short falls and this is resulting in a reduction in the number of employees. Therefore, there is a need to reduce oversight and depend more on measuring the performance of the finished product, which should require less manpower because the amount of inspection is greatly reduced.

The present practice places most of the liability on the agencies. This is because the agencies direct construction procedures and if the contractor adheres strictly to specifications he can not be held accountable for the finished product.

The development of an in-situ test that can directly or indirectly measure the unconfined compressive strength, compressive static modulus of elasticity or resilient modulus will go a long way in addressing these issues. Knowing any one of these engineering properties (although ideally a composite foundation modulus would be measured) will allow verification of design parameters and as a consequence expected pavement performance. In-situ testing will greatly simplify contract administration, because the only thing each agency inspectors will have to do is verify strength / stiffness and depth of stabilized sub-grade. This should reduce agency manpower requirements. It will also shift the liability of achieving the desired performance properties to the contractor. This should provide incentive to the contractors to be innovative and to use sound construction practices. Furthermore, this should facilitate faster construction because the strength / stiffness can be monitored daily and as soon as the design strength is achieved, the contractor can be allowed to operate heavy equipment on the stabilized sub-grade. This could result in considerable cost savings because contractors will not have to wait for 7 days if the strength / stiffness requirements have been met early and, equally importantly, will greatly reduce the likelihood of failure due to the design requirements having not been achieved at 7 days.. In many cases, therefore, the time required to deliver projects will be shortened and this should be reflected in lower bid prices. In all cases, there will be assurance that the as-constructed properties of the stabilized sub-grade are as specified.

II. Research Objective

The objective of this research is to identify or develop an in-situ test that will measure, directly or indirectly, performance based engineering properties of sub-grade soils stabilized with cementitious materials. The equipment must be capable of reliably measuring any one of the following properties: unconfined compressive strength, compressive static modulus of elasticity, and the resilient modulus. The equipment must also be easy to operate, easy to carry around in a station wagon or small pick-up and should not require more than a high school graduate to process and interpret the test results. Equipment requiring back calculation techniques will not be acceptable. The cost of the equipment should not exceed fifteen thousand dollars ($15,000).

1. Perform a national and international literature search to identify potential in-situ testing devices meeting the requirements set forth above.

2. Based on findings of Task 1, develop a screening procedure that will short-list equipment with the highest probability of success.

3. Develop a procedure for using the short-listed in-situ testing equipment to test stabilized soils with known engineering properties. This will help identify equipment with the highest degree of accuracy and repeatability.

4. Use the equipment selected in Task 3 on an actual project. Tests will be performed on stabilized soils that can be cored. Cores will be tested in the laboratory and test results will be compared to results obtained using in-situ tests. In addition, trafficking trials will be undertaken on site to determine true performance under rolling wheels.

5. Analyze all the data collected and recommend an in-situ test.

6. Prepare final report.

III. Estimate of Problem Funding and Research Period

Total funds requested $ 400,000

Research period: 30 months.

IV. Urgency, Payoff Potential, and Implementation

There is considerable pressure for State DOTs to speed up project delivery times. Often sub-grade stabilization requires longer project delivery times because of the time required for curing. This delay is becoming unacceptable and stabilization is being deleted from contracts even when the soils absolutely need it. There is a tremendous need for an in-situ test that can rapidly determine when to allow the contractors to proceed as quickly as possible, as well as being able to identify the rare cases in which the material is sub-standard. Also the State DOTs are experiencing budget shortfalls, and are reducing manpower. Therefore, they plan to use methods that efficiently utilize the available manpower and still ensure quality performance of the finished product. The potential payoff could be high, because if the contractors became innovative and were able to achieve the required design strengths in less than 72 hours, this would cut down on project contract times and result in savings that should show up in lower bid prices. The implementation should be very easy once the equipment has been identified. Training could be in the form of a workshop where each DOT can send a few people and then in turn these people will go back to their respective DOTs and train others.

Sponsoring Committee: AFS80, Cementitious Stabilization

Funding: 0

Date Posted: 12/28/2006

Date Modified: 04/14/2007

Index Terms: Field tests, Cementitious material, Rigid pavements, Flexible pavements, Soil stabilization, Subgrade (Pavements), Pavement design, Pavement performance, Pavements, Compressive strength, Modulus of resilience, Modulus of elasticity,

Cosponsoring Committees:

Subjects

Highways

Design

Pavements

Geotechnology

Sustainable use of available aggregate sources in highway pavements - *Best value engineering*

Description:

In many metropolitan areas, aggregate supply is becoming expensive and less sustainable. Quarry owners will not get permission to open new pits near construction sites while existing quarries close to urban centers are closing or restricted in hours and land take. Limits may be imposed on visual and noise intrusion, further hindering the use of geographically convenient locations. The land that is accessible may not contain rock that is most suited for aggregate production or it may contain lower quality bands of rock that need to be expensively removed.

At the same time, aggregates derived from industrial by-products may be available at close-by locations and most urban areas will, or could, have secondary aggregate production from construction and demolition wastes. Pavement reconstruction, produces further aggregate of variable quality. These aggregates will seldom meet specifications drawn up to regulate supplies from rock quarries. Given that there is a general drive to improve both the economy and sustainability of pavement construction and rehabilitation, these aggregates from secondary sources need to be exploited more so as to consume waste materials beneficially, yet it is essential that they deliver adequate performance. Furthermore, it is desirable that conventional, lower quality natural as well as secondary aggregates are used as much as feasible in pavements so as to reduce consumption of Portland and asphalt cements with their high embodied energies and large carbon footprints.

Objective:

The overall aim of this study is to investigate and define strategies, assessment methods and performance requirements that will enable pavements to be constructed or rehabilitated with available aggregates used in such a way as to best take advantage of their potential, irrespective of their origin and quality. This will be achieved by:

- Detailed literature survey, including review of states' specifications.
- Definition of performance-related characteristics that are generically applicable.
- Pavement design alternatives to demonstrate how aggregates of different qualities, potentially larger top sizes, and unconventional sources may be used more efficiently and more sustainably.
- Drafting of guidelines to show how design can be based on performance-based characterization of aggregates (MEPDG based testing such as gradation, moisture content, acceptable morphological limits and mechanistic response and performance)
- Review of barriers to implementation of the proposals and definition of practical, technical and scientific strategies to overcome them.
- Case studies to demonstrate the applicability of the proposed methodologies.

Potential Benefits:

Approximately 2 billion tons of aggregate are used in US roads every year. Most of this comes from natural sources, often supplied over considerable distances from the jobsite. Given that the cost of supply is a significant proportion of the purchase price of aggregate, any possibility of supply from local sources will have considerable economic benefits in addition to environmental benefits due to the lower haulage needs. Use of both secondary-sourced aggregates and lower quality natural aggregates would, in many locales, allow for more local materials to be used, reducing transportation costs and associated greenhouse gas emissions.

In addition, an estimated 360 million tons of hot and warm mix asphalt is used in the US annually, whereas Portland cement concrete production is around 200 million tons per annum into road pavements. Both asphalt hot mix and Portland cement concrete consume large amounts of energy in their production such that any replacement by unbound aggregate, even in thicker layers, will reduce greenhouse gas emissions significantly as well as generating considerable cost savings. Better quality aggregates could be used to partially replace bound materials, while larger top sizes, e.g. primary crusher run and recycled crushed concrete, and lower quality aggregates often have potential to be used as soil improvement (capping), subbase and lower base layers.

Where aggregates from secondary sources such as industrial by-product streams (ash, slag, etc.) or construction and demolition waste are available, determination of their mechanical potential may allow them to be used in upper base layers as many of these materials exhibit a degree of self-cementation thereby reducing problems of waste disposal and delivering a renewable benefit in place of primary extraction.

The principal beneficiaries would be highway agencies, but society at large would also benefit due to more sustainable resource utilization.

Relationship to the Existing Body of Knowledge:

"Existing research" (see references at the end) has considerably advanced our understanding of the behavior of unbound granular materials whether in- or out of-specification and whether formed of stones derived from geological or anthropogenic sources. However the missing understanding is:

- how to place this knowledge into a pavement design framework;
- how to select the use of a particular candidate in an appropriate design so that it can, indeed, result in a sensible and economical option for achieving end performance and sustainability; and
- how to have workable means of assessing the wide variety of candidate materials in a timely, efficient and reliable manner.

Tasks:

1. Perform literature survey of previous research and of specification and guidance information
2. Review range of material types and key characteristic differences in mechanical performance and characterization requirements (per state or source location)

3. Assess suitability of available performance-related mechanical testing for material types previously identified. Propose and briefly investigate adaptions needed (if any) to ensure suitability.
4. Investigate non-mechanical concerns that might act to prevent utilization (e.g. environmental concerns, health concerns, durability). Using simple tests or established protocols, determine those that are insurmountable and those that can be economically addressed.
5. Draft characterization and assessment aspects of a new protocol for use of aggregates from secondary and marginal sources. Apply these aspects to exemplar materials.
6. Use characterization to design pavement options using the exemplar materials.
7. Perform sustainability and LCA evaluations on alternatives to show how design decisions affect out-turns.
8. Work with cooperating authorities to build test sections of pavements using exemplar materials, developing application aspects of the new protocol on the basis of experience so gained (eventually test some mixes at FHWA using their full-scale facility or at another similar facility).
9. Formulate information into guidelines and protocol for generic implementation.
10. Test the new guidelines and protocol with one or more 'blind' applications, by collaborating authorities, revising these documents in the light of experience so gained.
11. Final reporting.

Follow on and Implementation: The research findings will be publicized through the final project report and scholarly publications and presentations in nationwide conferences and venues to advocate successful transportation agency implementation practices for adopting and utilizing the developed permanent deformation test procedure.

A draft selection protocol will be provided for adoption by agencies.

Relevance: Federal and State DOTs, Researchers, Aggregates Industry

Sponsoring Committee: **AFP70 Aggregates**

Funding: $400,000

Research Period: 36 months

Research Priority: High

RNS Developer: Andrew Dawson and Erol Tutumluer

Date Posted: 03/23/2016

Date Modified: 03/23/2016

Index Terms: Aggregate, Best value, Unbound granular materials, Recycled materials, By-product materials, Low-carbon, Pavement design, Flexible pavements, Base (Pavements), Subbase (Pavements), Sustainability, Economy

Cosponsoring Committees: AFD00(1) Sustainable Pavements

Subjects Highways, Materials, Pavements, Sustainability, Environment

References

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Saeed, A, "Performance-Related Tests of Recycled Aggregates for Use in Unbound Pavement Layers, NCHRP Report 598, 2008, 53p.

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Appendix D

Williams, James

From: Casey Soneira <csoneira@amrl.net>
Sent: Friday, April 22, 2016 9:27 AM
To: Williams, James
Subject: RE: Question on T99 and T180

Thanks for the clarification, James, and sorry for my delayed response. I will relay that information to staff. I agree that there is clarification needed in T99 and T180 in several areas. I believe we will be working on a ballot with some of our suggestions.

I hope you have a great weekend!

Ms. Casey Soneira
LAP Assistant Program Manager
Phone: 240-436-4863
Mobile: 240-575-8368
E-mail: csoneira@amrl.net
Leave us Feedback
In Focus Newsletter

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From: Williams, James [mailto:JWilliams@mdot.ms.gov]
Sent: Monday, April 18, 2016 9:16 AM
To: Casey Soneira <csoneira@amrl.net>
Subject: RE: Question on T99 and T180

Casey,

I believe some clarification to T 99 and T 180 may be necessary. With that said, this is how I interpret the current wording. Section 3.2.2 states the rammer shall have a circular face with a 2.0 in diameter. Section 3.2.3 states that a circular face rammer shall be used, but goes on to say that a sector face may be used as an alternate and it shall have an area equal to that of the circular face rammer. To me, this doesn't mean that the requirement for standardization is only for the circular rammer. Because the sector face is an allowed alternate, the same standardization requirements should apply for both.

This can be easily clarified. I have a couple of TS ballots that I am about to issue. My suggestion is to add a statement to 3.2.3 stating that if a sector face rammer is used, that the dimensions of the sector face should yield a surface area

within 1.5% of the area of a 2" circular face rammer. This is consistent with the diameter tolerance for the circular face rammer. Is this a logical approach?

Thanks,

James

From: Casey Soneira [mailto:csoneira@amrl.net]
Sent: Friday, April 15, 2016 9:42 AM
To: Williams, James
Subject: Question on T99 and T180

Hello James,
I hope this email finds you well! I am reaching out to you because you're the TS-1b chair. I have a question for you concerning the Proctor tests T99 and T180. The question is regarding the standardization requirement of mechanical sector-face hammers. Section 3.2.2 of T99-15 clearly states that a circular-face mechanical rammer be standardized according to D2168. In the following section regarding the use of a sector-face mechanical, the requirement for standardization using D2168 is not mentioned. Is it the correct interpretation that sector-face mechanical rammers do not need to be standardized in the same manner as circular face rammers? Or is the intention of the standard to require a sector-face to be standardized in a similar way, but was just not explicitly stated?

I would appreciate any clarification you could give. I want to make sure that we are interpreting the method the way it is intended, and doing so consistently. Looking forward to getting some clarification on this topic, but please let me know if I should be in contact with someone else. I hope you have a great weekend if I don't hear back!

Thanks,
Ms. Casey Soneira
LAP Assistant Program Manager
Phone: 240-436-4863
Mobile: 240-575-8368
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Tech Section Action Required Summary--Full Standards

TS 1b

Designation No.	Title	ASTM Equiv.	Action Needed
M 057-80 (2012)	Materials for Embankments and Subgrades		Revise or Reconfirm
M 092-10 (2015)	Wire-Cloth Sieves for Testing Purposes	E11-09	No
M 145-91 (2012)	Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes		Revise or Reconfirm
M 146-91 (2012)	Terms Relating to Subgrade, Soil-Aggregate, and Fill Materials		Revise or Reconfirm
M 147-65 (2012)	Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses		Revise or Reconfirm
M 231-95 (2015)	Weighing Devices Used in the Testing of Materials		No
R 013-12 (2016)	Conducting Geotechnical Subsurface Investigations	D420-98(2003)	No
R 045-13	Installing, Monitoring, and Processing Data of the Traveling Type Slope Inclinometer		Revise or Reconfirm
R 075-16	Developing a Family of Curves		No

TS 1b

Designation No.	Title	ASTM Equiv.	Action Needed
T 099-15	Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop		No
T 134-05 (2013)	Moisture-Density Relations of Soil-Cement Mixtures		No
T 135-13	Wetting-and-Drying Test of Compacted Soil-Cement Mixtures		Revise or Reconfirm
T 136-13	Freezing-and-Thawing Tests of Compacted Soil-Cement Mixtures		Revise or Reconfirm
T 180-15	Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop		No
T 191-14	Density of Soil In-Place by the Sand-Cone Method		No
T 206-09 (2013)	Penetration Test and Split-Barrel Sampling of Soils	D1586-11	No
T 207-12 (2016)	Thin-Walled Tube Sampling of Soils	D1587-08	No
T 221-90 (2012)	Repetitive Static Plate Load Tests of Soils and Flexible Pavement Components for Use in Evaluation and Design of Airport and Highway Pavements	D1195/D1195M-09	Revise or Reconfirm
T 222-81 (2012)	Nonrepetitive Static Plate Load Test of Soils and Flexible Pavement Components for Use in Evaluation and Design of Airport and Highway Pavements		Revise or Reconfirm
T 223-96 (2012)	Field Vane Shear Test in Cohesive Soil		Revise or Reconfirm

Tech Section Action Required Summary--Full Standards

TS 1b

Designation No.	Title	ASTM Equiv.	Action Needed
T 225-16	Diamond Core Drilling for Site Investigation		No
T 252-09 (2013)	Measurements of Pore Pressures in Soils		No
T 272-16	One-Point Method for Determining Maximum Dry Density and Optimum Moisture		No
T 298-15	High-Strain Dynamic Testing of Piles		No
T 306-11 (2015)	Progressing Auger Borings for Geotechnical Explorations		No
T 310-13	In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)		Revise or Reconfirm

Appendix E

Tech Section Action Required Summary--Provisional Standards

TS 1b

Designation No.	Title	Pub Yr. 1	Action Needed
TP 100-12 (2016)	Deep Foundation Elements under Bidirectional Static Axial Compressive Load	2012	No
TP 112-14 (2016)	Determining In-Place Density and Moisture Content of Soil and Soil-Aggregate Using Complex Impedance Methodology	2014	No

Appendix F

TS 1b 2016 Annual Meeting Summary		
Meeting Date:	Tuesday, August 2, 2016, 10:15 AM EST	
Items approved by the TS for TS/Subcommittee/Concurrent Ballot		
Standard Designation	**Summary of Proposed Changes**	**TS Only, Subcommittee Only or Concurrent? (TS / S / C)**
T 99	Revise T 99 Section 1.4 and A1 for application of the oversized particle correction.	S
T 180	Revise T 180 Section 1.4 and A1 for application of the oversized particle correction.	S
M 147	Revise M 147 Section 1.1 clarifying the term "normal" as it relates to specific gravity and absorption.	S
New Task Forces Formed:		
Task Force Name	**Summary of Task**	**Names of TF Members**
16-01	Revise T 310 to include a procedure for Calibration Blocks and research inclusion of non-nuclear devices into T 310.	TBD
Research Liaison:	Darin Tedford - NV	
Other Action Items:		