AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

COMMITTEE ON MATERIALS & PAVEMENTS

2018 Annual Meeting – Cincinnati, Ohio
Tuesday, August 7, 2018
3:15 – 5:00 PM EST

TECHNICAL SUBCOMMITTEE 3a
Hydraulic Cement and Lime

TS 3a 2017 Annual Meeting Summary		
Meeting Date:	8-Aug-17	
Items approved by the TS for TS/Subcommittee/Concurrent Ballot		
Standard Designation	**Summary of Proposed Changes**	**TS Only, COMP Only or Concurrent? (TS / S / C)**
M85	TS Ballot Item 1 – *Replace Low-alkali definition*	COMP Only
M85	TS Ballot Item 2 - *Modify Heat of Hydration Requirements*	COMP
M240	TS Ballot Item 3 - *Completion of Option R removal in M240*	COMP
M240	TS Ballot Item 4 - *Revise Type MH and LH Heat of Hydration Provisions*	COMP
M240	TS Ballot Item 5 - *Remove Section 9.3, 11.1.13 and referenced information in Table 4*	COMP
M85	TS Ballot Item 6 - *Remove reference to T98M/T98 Turbidimeter Fineness*	COMP
M85	TS Ballot Item 7 - *Revise Figure X1.1*	COMP
M327	Item 1 Concurrent - *Revisions to M327/C465*	Concurrent
T133	Item 2 Concurrent – *T133 Updates for ASTM Equivalency*	Concurrent
T192	Item 3 Concurrent – *T192 Updates for ASTM Equivalency*	Concurrent
New Task Forces Formed: None		
Task Force Name	**Summary of Task**	**Names of TF Members**
ASR Task Force	ASR Task force was dissolved.	
Research Liaison:	Don Streeter (NY) volunteered as the TS 3a Research Liaison.	
Other Action Items:		
Reconfirmation of M303		
Lyndi Blackburn requested to be added as a voting member of TS 3a.		

I. Call to Order and Opening Remarks – Staton Meeting called to order at 3:16pm.

Staton (MI) Chair and Trautman (MO) Vice Chair
AASHTO Liaisons – Puterbaugh (AASHTO) and Knake (AASHTO)
Sergeant at Arms – Blackburn (AL)
Research Liaison – Vacant

II. Roll Call - Trautman

AASHTO Technical Subcommittee 3a Voting Members - 24					
John	Staton	MI	Donald	Streeter	NY
Brett	Trautman	MO	James	Williams, III	MS
Brian	Egan	TN	John	Grieco	MA
Richard	Barezinsky	KS	Kurt	Williams	WA
Brian	Pfeiffer	IL	Paul	Farley	WV
Daniel	Miller	OH	Brian	Ikehara	HI
Jose	Lima	RI	Curt	Turgeon	MN
Kenny	Seward	OK	Harvey	DeFord	FL
Robert	Lauzon	CT	Richard	Bradbury	ME
Mladen	Gagulic	VT	Brian	Hunter	NC
Joseph	Robinson	PA	Carol Anne	MacDonald	ON
Changlin	Pan	NV			
Charles	Babish	VA			

States in attendance: MI, MO, TN, KS, IL, OH, OK, VT, NV, VA, NY, MN, FL, ME, NC, ON

III. Approval of Technical Subcommittee Mid-Year Minutes – Attachment 1
Motion to approve: OK
Second: NY
No discussion
No opposed
Mid-year meeting minutes were approved

IV. Old Business

A. COMP Ballot Items
1. Outstanding items from Mid-Year Meeting
In fall 2017, all seven SOM ballot items and five concurrent ballot items passed. Five balloted standards were also re-confirmed. Everything went well, and there were no outstanding items from the mid-year meeting in November.

B. TS Ballots (May 3-24, 2018) – All TS ballot items passed with no negative votes. Attachment 2
1. M85 – Item 1 – *Replace Low-alkali definition*
There were some auto-formatting problems with the numbering of the tables per ballot response.
2. M85 – Item 2 – *Modify Heat of Hydration Requirements*
There were some auto-formatting problems with the numbering of the tables per ballot response.
3. M240 – Item 3 – *Completion of Option R removal in M240*

No comments.

4. M240 – Item 4 – *Revise Type MH and LH Heat of Hydration Provisions*
   There were some auto-formatting problems with the numbering of the tables per ballot response.
5. M240 – Item 5 – *Remove Section 9.3, 11.1.13 and referenced information in Table 4 Rationale*
   There were some auto-formatting problems with the numbering of the tables per ballot response.
6. M85 – Item 6 – *Remove reference to T98M/T98 Turbidimeter Fineness*
   No comments.
7. M85 – Item 7 – *Revise Figure X1.1*
   No comments.

   Motion to send these items to a full COMP ballot this fall:
   Motion: NY
   Second: TX
   No discussion
   No opposed
   These will move onto a full COMP ballot this fall.

C. Task Force Reports
   1. TF 09 – 1 – Harmonization Task Group Update – Naranjo (TX) or Streeter (NY) (presentation attached)
   2. ASR Task Group Update – Ahlstrom (FHWA)
      This task group was started back when the provisional standard was being worked on for ASR, now it's a full standard that is under the umbrella of TS 3c so it is recommended that this task force dissolves.

      Motion to dissolve task force:
      Motion: OK
      Second: OH
      No discussion
      No opposed
      ASR Task Force has fulfilled its objectives and is therefore dissolved.

V. New Business

A. Research Proposals – Don Streeter (NY) volunteered as the research liaison.
   1. Quick Turnaround RPS – No updates
   2. Full NCHRP RPS – No updates

B. AASHTO Update – NTPEP, TC3, Re:source, etc….
   No updates

C. NCHRP Issues – Hanna (NAS) (see attached *Overview of NCHRP Research Programs for AASHTO Committees*)

   Related projects that are underway and upcoming:
   1. Project 18-17: Entrained Air Void System for Durable Highway Concrete
   2. Project 20-05: Concrete Technology for Transportation Applications (NCHRP Synthesis Topic 49-09)
   3. Project 10-103: Benchmarking Accelerated Laboratory Tests for ASR to Field Performance: Consideration of Cement and Alkali Contents and Influence of SCM's
   4. Project 10-104: Evaluating Use of Unconventional Fly Ash Sources in Highway Concrete
   5. Project 18-19: Rating Concrete Permeability Based on Resistivity Measurements

6. Project 20-7 (427): Updating the Thermometer Requirements for AASHTO

D. Correspondence, calls, meetings
   None

E. Presentation by Industry/Academia –
   1. *Proposal for M327/C465* by Paul Tennis (Portland Cement Association) (see attached presentation)

      Discussion: This proposal was submitted to, discussed by, and approved by the Joint AASHTO/ASTM Harmonization Task Group (JAAHTG). The Chair has been sent the revised version of the text, but the rest of the committee has not seen the revised text until now. Paul Tennis presented on the topic and the group engaged in discussion. The Chair proposed there be a voice vote in efforts to approve the proposal and send it on to a fall concurrent ballot.

      Motion to send this proposal to a concurrent ballot:
      Motion: TX
      Second: NY
      No opposed
      No discussion
      Proposal for M327/C465 will move onto a concurrent ballot this fall.

F. Proposed New Standards
   None

G. Proposed New Task Forces
   None

H. Standards Requiring Revision or Reconfirmation –
   1. M303 – *Standard Specification for Lime for Asphalt Mixtures*, Reconfirmation – Attachment 3

   2. T133 – *Standard Method of Test for Density of Hydraulic Cement,* Revision – Attachment 4
      The Chair compared the current revisions in ASTM to the AASHTO standard and noticed that there was a discrepancy in one of the formulas between AASHTO T133 and its ASTM equivalent C188—it is unknown if this change is simply editorial in nature and the outcome is the same, or if the change in the formula would constitute a major change. The Technical Subcommittee should confirm the changed formula to make sure it is, in fact, editorial in nature or if this is a major change. No comments from the Technical Subcommittee.

      The Chair will either compare the formulas off line or seek out a technical expert to assist. If the two standards are deemed equivalent, the standard will move forward and be balloted for equivalency, as was initially intended (no motion necessary). However, if a technically difference is found between the two standards, the revisions will have to be balloted next year.

I. COMP Ballot Items (including any ASTM changes/equivalencies) –
   1. T192 – *Standard Method of Test for Fineness of Hydraulic Cement by the 45-um (No. 325) Sieve* – Attachment 5
      All editorial changes will be balloted for equivalency (no motion necessary).

VI. Open Discussion

1. Awards and Accomplishments
   None

2. *Performance Engineered Concrete Mixtures (PEM) Pooled Fund* by Mike Praul (presenting on behalf of Gina Ahlstrom – FHWA) (see attached presentation)
3. Other

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.

Dr. Larry Sutter with Michigan Technological University suggested that we need to get a good feel for what states are doing regarding ASR, and whether they're using R80. If states aren't using/following R80, why? If there are issues with R80, we should figure out what are the concerns, and figure out how to address the problems in efforts to improve the standard so people will use it.

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

Turner Fairbanks Research Center (TFRC) is looking at the chemistry of ASR gels, and next year they may have a test that looks at ASR gels in a completely different way (since currently, no tests really address the gel nature of the ASR gel).

VII. Adjourn

Motion to adjourn: OK
Seconded: NY
The meeting was adjourned at 4:48 pm

Attachment 1 – Mid-Year Meeting Minutes

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

COMMITTEE ON MATERIALS & PAVEMENTS

Mid-Year Web Meeting (Webinar)
Minutes
Monday, November 20, 2017
1:00 - 3:00 PM EST

TECHNICAL SECTION 3a
Hydraulic Cement and Lime

I. Call to Order and Opening Remarks - Staton

John Staton (MI) Chair and Brett Trautman (MO) Vice Chair
AASHTO Liaisons – Sonya Puterbaugh (Re:source) and Maria Knake (Re:source)
Sergeant at Arms – Lyndi Blackburn (AL)

II. Roll Call – Introductions were made by voting members, other states, and friends. The following signified their attendance:

Paul Burch (AZ)	Darin Tedford (NV)	Anne Holt (Ontario)
Monica Flournoy (GA)	Daniel Miller (OH)	Gina Ahlstrom (FHWA)
Daniel Tobias (IL)	Merrill Zwanka (SC)	Sonya Puterbaugh (AASHTO)
Rick Barezinsky (Kansas)	Brian Egan (TN)	Maria Knake (AASHTO)
John Staton (MI)	Andy Naranjo (TX)	Jan Prowell (CCRL)
Brett Trautman (MO)	Brian Lee (UT)	John Melander
Oak Metcalfe (MT)	Scott Andrus (UT)	Paul Tennis (PCA)
Don Streeter (NY)	Andy Babish (VA)	Colin Lobo (NRMCA)

III. Approval of Technical Section Minutes Annual Meeting 2017

A motion was made by New York and a second by Ohio. The motion passed unopposed.

IV. Old Business

A. Rolling Ballot 1 – <u>SOM Ballot Items</u>:

1. Item 1 – SOM Ballot: Remove M85 Reference to C186 (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

2. Item 2 – SOM Ballot: Revise M85 Chloride Content Language. (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

3. Item 3 – SOM Ballot: Revise M240 to include Reporting of Alkali Content of Natural Pozzolan (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

4. Item 4 –SOM Ballot: Revise M240 to add new note on ASR in Section 4.3 (Affirmative 44, Negative 0, No Vote 7) **(Editorial Comment from PA)**

PA suggested that Section 4.3.5 Note 6- suggested revising "Special characteristics" to "Special properties" to coincide with Section 4.3 terminology. It was decided that this suggestion would go to the Harmonization Task Group for discussion. The task group will report back with suggestions.

5. Item 5 – SOM Ballot: Revise M240 by deleting Type LH Drying Shrinkage Requirement (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

6. Item 6 – SOM Ballot: Revise M240 by revising Type MS and HS Compressive Strength Limits (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

7. Item 7 – SOM Ballot: Revise M240 Note 6 to Harmonize with C595 Note 6 (Affirmative 44, Negative 0, No Vote 7) **(Editorial Comment from PA)**
   PA suggested that Section 4.3.5 Note 6- suggested revising "Special characteristics" to "Special properties" to coincide with Section 4.3 terminology. It was decided that this suggestion would go to the Harmonization Task Group for discussion. The task group will report back with a suggestions.

B. Rolling Ballot 1 – <u>Concurrent Ballot Items</u>:

1. Item 8 – Concurrent Ballot: Revise R70 to update for ASTM Equivalency (Affirmative 44, Negative 0, No Vote 7)
   Item passed.

2. Item 9 – Concurrent Ballot: Revise T106 to update for ASTM Equivalency (Affirmative 43, **Negative 1**, No Vote 7) **(Technical Comment regarding 5.6.1 Note 2 from PA, Editorial comment from PA, OK and TN regarding referencing subsequent notes if Note 2 is added to 5.6.1)**
   Pennsylvania's negative indicated that the wording used in Note 2 sounded like mandatory language. PA OK, and TN also had editorial comments on this standard.

   Pennsylvania agreed to withdraw the negative if the following changes were made:

   Section 5.6.1: *"Tampers shall be checked for conformance to the design and dimensional requirements of this test method at least <u>once</u> every six months."*
   Note 2: *"A visual inspection of the tamper should be performed each day before use to confirm that the end is flat and at a right angle to the long axis of the tamper. Rounded or peeling tampers should not be used."*

   Colin Lobo of NRMCA mentioned that ASTM is considering not allowing worn tampers (ie. rounded or peeling). This change would be in agreement with the change being considered by ASTM if that is the case. Mr. Lobo will forward the contact information for the Chair of the ASTM committee to the Chair for further discussions regarding AASHTO/ASTM equivalency language. The Chair will then contact Tim Ramirez from PA to further discuss the anticipated equivalency language in efforts to attain consensus.

3. Item 10 – Concurrent Ballot: Revise T107 to update for ASTM Equivalency (Affirmative 44, Negative 0, No Vote 7) **(Editorial comment from PA)**
   Editorial changes will be made as suggested.

4. Item 11 – Concurrent Ballot: Revise T154 to update for ASTM Equivalency (Affirmative 44, Negative 0, No Vote 7) **(Technical comments from PA, Editorial Comment from TN)**
   There were several comments received. Many of the comments were in regard to SI vs. English Units. The Chair will send this to an AASHTO consultant (Greta Smith) to review the unit use and consistency in the standard.

5. Item 12 – Concurrent Ballot: Revise M327 to move note 1 to the body of the standard to make it mandatory language to match a change being made with ASTM. Cast Administrative Negative in coordination with ASTM fall balloting of this item. (Affirmative 44, Negative 0, No Vote 7)
   Item passed

C. Reconfirmation Ballot Items: T129, T132, T218, T219, T232, T353 (Affirmative 21, Negative 0, No Vote 3)
   No negatives were received, all reconfirmations passed.

D. TS Ballot Items – none
E. Task Force Reports
   1. TF 09 – 1 – Harmonization Task Force Report – Naranjo/Melander
   A brief report was presented by Andy Naranjo on the Task Force. The task force is working on parallel ballot items to coordinate changes with ASTM standards. Parallel ballot items of revision to ASTM standards have passed C01 Main Ballot with no unresolved technical negatives. One administrative negative is in place to coordinate timing of changes to harmonized standards AASHTO M 85/ASTM C150, AASHTO M 240/ASTM C595, M 327/ASTM C465.

   Future activities:
   AASHTO M 85/ASTM C150 and AASHTO M 240/ASTM C595
   - Heat of Hydration Requirements – replace C186 with C1702 and revise Type MH limits

   AASHTO M 85 & ASTM C150
   - Cement alkali requirements
   - Example mill test chloride reporting
   - Direct determination of phases

   AASHTO M 240 & ASTM C595
   - Chloride content reporting
   - Complete removal of Option R-related provisions (Section 11.1.12 and Table 5)
   - Pozzolan alkali reactivity requirements
   - Refinements to Table 4

   AASHTO M 240/ASTM C595 &AASHTO M 327/ASTM C465
   - Delete reference to turbidimeter test method (T 98/C115) for fineness requirements

V. New Business - Staton

A. Research Proposals
   The chair mentioned that the Tech Section is still in need of a Research Liaison
   1. 20-7 RPS – none
   2. Full NCHRP RPS – none
B. Re:source/CCRL – Re:source – Jan Prowell – no updates
C. NCHRP Issues – no updates
D. Correspondence, calls, meetings/Presentation by Industry/Academia – no updates
E. Proposed New Standards – none
F. Proposed New Task Forces – none

G. Standards Requiring Reconfirmation – none
H. COMP Ballot Items (including any ASTM changes/equivalencies) – none

VI. Open Discussion - Group

VII. Adjourn – The meeting adjourned at 1:43 PM EST.

Attachment 2 – Item IV.B – TS Ballot Items

Item #: 1

Ballot Action: **Revise AASHTO M 85, Standard Specification for Portland Cement**

Description: **Replace Low-alkali definition**

Rationale: Alkali-silica reaction (ASR) is a potentially deleterious expansive reaction between alkalies in concrete pore solution and certain reactive aggregates. When ASR was first identified as a distress mechanism in the 1940s, tests with cements with equivalent alkali contents below 0.60% by mass were shown to minimize the risk for reaction. This was the origin of the current optional limit in M 85. However, those tests were performed with a narrow mortar mix design and subsequent research over many years has shown that limiting the cement alkali content to 0.60% is not sufficient to control deleterious ASR with all aggregates, nor in all concrete mix designs.

ASR is a concrete phenomenon and best-practice solutions are based on concrete mix designs, including use of appropriate types and amounts of supplementary cementing materials, controlling *concrete* alkali loading, and some lithium-based admixtures. Relying on low-alkali cements for ASR control may be effective for some aggregates in some concrete mix designs, but generally is outdated and potentially misleading, depending on variables such as aggregate reactivity and concrete cement content. AASHTO R 80, the standard practice for reducing risk of ASR in concrete, provides more information.

This ballot proposes to remove the low-alkali definition from AASHTO M 85 and replace it with a requirement to report the equivalent alkali content of the cement in order to facilitate alkali loading calculations for concrete, and to reference AASHTO R 80 for additional guidance on mitigating ASR. This is consistent with the effort within AASHTO COMP and ASTM Committees C01 and C09 to eliminate multiple and often confusing ASR-related criteria in various material specifications and to provide a single standard with unified guidance to address the potential for deleterious ASR in concrete construction. AASHTO M 240 and M 302 already refer to AASHTO R 80 for guidance on ASR.

This proposal is based on M 85-18. Proposed additions are shown underlined in red font and proposed deletions are shown in ~~red strikethrough~~ font. Other text is shown for information only. Note, footnote, table, and section numbers will be revised editorially as needed.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C150.

Detailed Changes:

Standard Specification for

Portland Cement

AASHTO Designation: M 85-18

AASHTO

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 327, Processing Additions for Use in the Manufacture of Hydraulic Cements
- R 71, Sampling and Amount of Testing of Hydraulic Cement
- R 80, Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction
- T 98M/T 98, Fineness of Portland Cement by the Turbidimeter

Table 1—Standard Chemical Requirements[a]

Cement Type	Applicable Test Method	I and IA	II and IIA	II(MH) and II(MH)A	III and IIIA	IV	V
Aluminum oxide (Al_2O_3), max, %	T 105	—	6.0	6.0	—	—	—
Ferric oxide (Fe_2O_3), max, %	T 105	—	6.0[c]	6.0[b, c]	—	6.5	—
Magnesium oxide (MgO), max, %	T 105	6.0	6.0	6.0	6.0	6.0	6.0
Sulfur trioxide (SO_3),[d] max, %	T 105						
When (C_3A)[e] is 8% or less		3.0	3.0	3.0	3.5	2.3	2.3
When (C_3A)[e] is more than 8%		3.5	[f]	[f]	4.5	[f]	[f]
Loss on ignition, max, %	T 105						
When limestone is not an ingredient		3.0	3.0	3.0	3.0	2.5	3.0
When limestone is an ingredient		3.5	3.5	3.5	3.5	3.5	3.5
Insoluble residue, max, %	T 105	1.5	1.5	1.5	1.5	1.5	1.5
Equivalent alkalies ($Na_2O + 0.658\ K_2O$), %	T105	[g]	[g]	[g]	[g]	[g]	[g]
Tricalcium silicate (C_3S),[e] max, %	See Annex A	—	—	—	—	35[b]	—
Dicalcium silicate (C_2S),[e] min, %	See Annex A	—	—	—	—	40[b]	—
Tricalcium aluminate (C_3A),[e] max, %	See Annex A	—	8	8	15	7[b]	5[c]
Sum of $C_3S + 4.75C_3A$, max, %[~~g~~h]		—	—	100[b,~~h~~i]	—	—	—
Tetracalcium aluminoferrite plus twice the tricalcium aluminate ($C_4AF + 2(C_3A)$), or solid solution ($C_4AF + C_2F$), as applicable, max, %	See Annex A	—	—	—	—	—	25[c]

[a] See Note 2.

[b] Does not apply when the heat of hydration limit in Table 4 is specified.

[c] Does not apply when the sulfate resistance limit in Table 4 is specified.

[d] It is permissible to exceed the values in the table for SO_3 content, provided it has been demonstrated by ASTM C1038/C1038M that the cement with the increased SO_3 will not develop expansion exceeding 0.020 percent at 14 days. When the manufacturer supplies cement under this provision, supporting data shall be supplied to the purchaser. See Note ~~6~~7.

[e] See Annex A for calculation.

[f] Not applicable.

[g] Report on manufacturer's reports. See Note 5

[~~g~~h] See Note ~~5~~6.

[~~h~~i] In addition, 3-day heat of hydration testing by ASTM C1702 shall be conducted at least once every 6 months. Such testing shall not be used for acceptance or rejection of the cement, but results shall be reported for informational purposes.

Note 5— The standard composition requirements in Table 1 require reporting of equivalent alkalies. Cements with a maximum of 0.60% equivalent alkalies were historically designated as "low-alkali cements" and recommended for use with aggregates susceptible to alkali-silica reaction (ASR). However, low-alkali cements (in the absence of other mitigation measures) may not be effective in mitigating ASR. Guidance on formulating concrete mixtures, including calculating alkali loading using equivalent alkali content of cement to minimize the potential for ASR, is provided in Practice R 80.

Table 2—Optional Chemical Requirements[a]

Cement Type	Applicable Test Method	~~I and IA~~	~~II and IIA~~	~~II(MH) and II(MH)A~~	III and IIIA	~~IV~~	~~V~~	Remarks
Tricalcium aluminate (C_3A),[b] max, %	See Annex A	—	—	—	8	—	—	For moderate sulfate resistance
Tricalcium aluminate (C_3A),[b] max, %	See Annex A	—	—	—	5	—	—	For high sulfate resistance
~~Equivalent alkalies ($Na_2O + 0.658K_2O$), max, %~~	~~T 105~~	~~0.60[c]~~	~~0.60[c]~~	~~0.60[c]~~	~~0.60[c]~~	~~0.60[c]~~	~~0.60[c]~~	~~Low-alkali cement~~

[a] These optional requirements apply only if specifically requested. Availability should be verified. See Note 2.

[b] See Annex A for calculation.

~~[c] Specify this limit when the cement is to be used in concrete with aggregates that are potentially reactive and no other provisions have been made to protect the concrete from deleteriously reactive aggregates. Refer to ASTM C33/C33M for information on potential reactivity of aggregates.~~

ABC Portland Cement Company
Qualitytown, NJ

Plant: Example | Cement Type: II(MH) | Date: March 9, 2002xx

Production Period: March 2, 2002xx–March 8, 2002xx

STANDARD REQUIREMENTS
M 85, Tables 1 and 3

CHEMICAL

Item	Spec. Limit	Test Result
SiO_2 (%)	[a]	20.6
Al_2O_3 (%)	6.0 max	4.4
Fe_2O_3 (%)	6.0 max	3.3
CaO (%)	[a]	62.9
MgO (%)	6.0 max	2.2
SO_3 (%)	3.0 max	3.2
Loss on ignition (%)	3.5 max	2.7
Na_2O (%)	[a]	0.19
K_2O (%)	[a]	0.50
Equivalent alkalies, Na_2O_{eq} (%)	[a]	0.52
Insoluble residue (%)	1.5 max	0.27
CO_2 (%)	[a]	1.2
Limestone (%)	5.0 max	3.5
$CaCO_3$ in limestone (%)	70 min	79
Inorganic processing addition (ground, granulated blast-furnace slag)	5.0 max	3.0
Potential phase compositions (%)[b]		
C_3S	[a]	59
C_2S	[a]	10
C_3A	8 max	5
C_4AF	[a]	10
$C_4AF + 2(C_3A)$	[a]	20
$C_3S + 4.75\ C_3A$, (%)	100 max	83

PHYSICAL

Item	Spec. Limit	Test Result
Air content of mortar (volume %)	12 max	8
Fineness (m^2/kg) (Air permeability)	260 min 430 max	377
Autoclave expansion (%)	0.80 max	0.04
Compressive strength (MPa)	Min:	
1 day	[a]	
3 days	7.0	23.4
7 days	12.0	29.8
28 days	[a]	
Time of setting (minutes) (Vicat)		
Initial	Not less than 45 Not more than 375	124
Heat of hydration (kJ/kg) ASTM C1702		
3 days	[c]	245
ASTM C1038 mortar bar expansion (%)	[d]	0.010[e]

[a] Not applicable.
[b] Adjusted per Annex A1.6.
[c] Test result represents most recent value and is provided for information only.
[d] Required only if percent SO_3 exceeds the limit in Table 1, in which case expansion shall not exceed 0.020 percent at 14 days.
[e] Test result for this production period not available. Most recent test result provided.

OPTIONAL REQUIREMENTS
M 85, Tables 2 and 4

CHEMICAL

Item	Spec. Limit	Test Result
~~Equivalent alkalies (%)~~	~~[f]~~	~~0.52~~
Chloride (%)	[f]	0.020

[f] Limit not specified by purchaser. Test result provided for information only.

PHYSICAL

Item	Spec. Limit	Test Result
False set (%)	50 min	82
Compressive strength (MPa)		
28 days	28.0 min	39.7[c]

We certify that the above-described cement, at the time of shipment, meets the chemical and physical requirements of M 85-xx or (other) ________________ specification.

Signature: ______________________ Title: ______________________

Figure X1.1—Example Mill Test Report

ABC Portland Cement Company
Qualitytown, NJ

Plant: Example

Cement Type: II(MH)
Production Period: March 2, 2002–March 8, 2002

Date: March 9, 2002

Additional Data

	Limestone	Inorganic Processing Addition Data
Type	—	Ground, Granulated Blast-Furnace Slag
Amount (%)	3.5	3.0
SiO_2 (%)	12.9	33.1
Al_2O_3 (%)	3.0	10.9
Fe_2O_3 (%)	1.0	1.1
CaO (%)	43.5	44.4
SO_3 (%)	0.6	0.2

	Base Cement Phase Composition
C_3S (%)	63
C_2S (%)	11
C_3A (%)	5
C_4AF (%)	11

We certify that the above-described data represents the materials used in the cement manufactured during the production period indicated.

Signature: ______________________ Title: ______________________

Figure X1.2—Example Additional Data Report

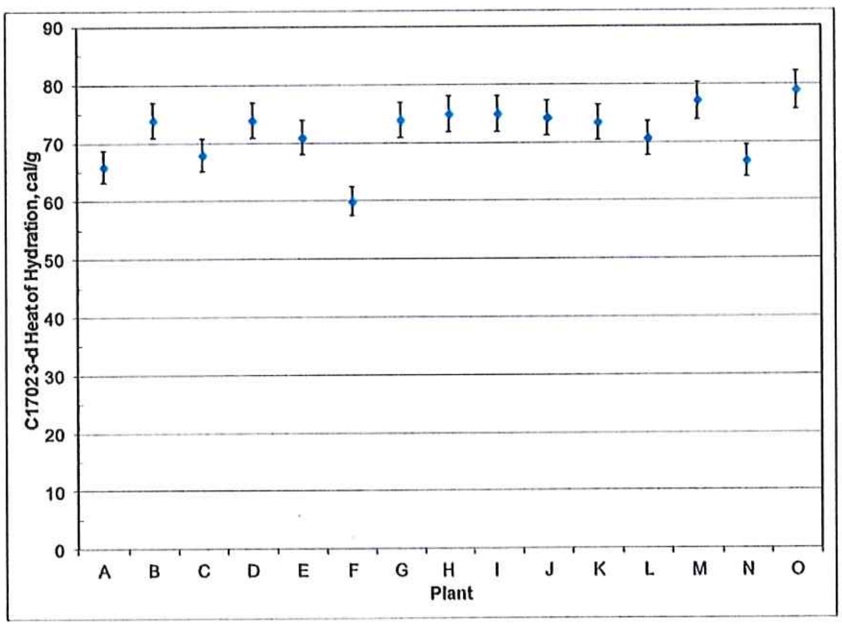
Item #: 2

Ballot Action: **Revise AASHTO M 85, Standard Specification for Portland Cement**

Description: **Modify Heat of Hydration Requirements**

Rationale: This ballot proposes to revise alternatives for specifying heat of hydration requirements for portland cements. Proposed Type II(MH) requirements would permit meeting either the current requirements based on the so-called "heat index" (the sum of C_3S and 4.75 C_3A) or new limits based on ASTM C1702. Although other variables impact concrete temperature rise, C1702 is a performance indicator for cement heat of hydration. The proposal would modify text to the footnotes of Table 1 indicating that the heat index requirement does not apply when the cement complies with the C1702-based heat of hydration limits in Table 4. Corresponding changes are included in footnotes of Table 4. The limit on fineness of Type II(MH) cement is also modified so that cements meeting C1702 heat of hydration requirements would not have a maximum Blaine fineness.

The proposal would raise the C1702 limit for Type II(MH) in Table 4 to reflect characteristics of Type II(MH) cements available in the marketplace. Data from 15 plants producing Type II(MH) cements are provided in the following figure:



(Bars on the data points indicate the single operator precision of C1702, Method A of 4.1%.) These data show that existing Type II(MH) cements have average 3-day C1702 heat of hydration values of between about 60 and 79 cal/g (between 251 and 331 kJ/kg). Therefore, it is proposed that the optional limit for Type II(MH) cements be maximum of 80 cal/g (335 kJ/kg) at 3-days, based on C1702.

In addition, strength limits for Type II(MH) cement would be made consistent, whether heat of

hydration requirements are satisfied by meeting the C1702 limit or the heat index limit.

This ballot item is based on AASHTO M 85-18. Only additions to text shown underlined and deletions shown in ~~strikethrough font~~ are being balloted. Other text is included for information only. Where necessary, tables, figures, notes, footnotes, and section numbers will be renumbered editorially.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C150.

Detailed Changes:

Standard Specification for

Portland Cement

AASHTO Designation: M 85-18

AASHTO

Table 1—Standard Chemical Requirements[a]

Cement Type	Applicable Test Method	I and IA	II and IIA	II(MH) and II(MH)A	III and IIIA	IV	V
Aluminum oxide (Al_2O_3), max, %	T 105	—	6.0	6.0	—	—	—
Ferric oxide (Fe_2O_3), max, %	T 105	—	6.0[c]	6.0[b, c]	—	6.5	—
Magnesium oxide (MgO), max, %	T 105	6.0	6.0	6.0	6.0	6.0	6.0
Sulfur trioxide (SO_3),[d] max, %	T 105						
When (C_3A)[e] is 8% or less		3.0	3.0	3.0	3.5	2.3	2.3
When (C_3A)[e] is more than 8%		3.5	[f]	[f]	4.5	[f]	[f]
Loss on ignition, max, %	T 105						
When limestone is not an ingredient		3.0	3.0	3.0	3.0	2.5	3.0
When limestone is an ingredient		3.5	3.5	3.5	3.5	3.5	3.5
Insoluble residue, max, %	T 105	1.5	1.5	1.5	1.5	1.5	1.5
Tricalcium silicate (C_3S),[e] max, %	See Annex A	—	—	—	—	35[b]	—
Dicalcium silicate (C_2S),[e] min, %	See Annex A	—	—	—	—	40[b]	—
Tricalcium aluminate (C_3A),[e] max, %	See Annex A	—	8	8	15	7[b]	5[c]
Sum of $C_3S + 4.75C_3A$, max, %[g]		—	—	100[b, h]	—	—	—
Tetracalcium aluminoferrite plus twice the tricalcium aluminate ($C_4AF + 2(C_3A)$), or solid solution ($C_4AF + C_2F$), as applicable, max, %	See Annex A	—	—	—	—	—	25[c]

[a] See Note 2.

[b] Does not apply when the cement complies with the heat of hydration limit in Table 4 ~~is specified~~.

[c] Does not apply when the sulfate resistance limit in Table 4 is specified.

[d] It is permissible to exceed the values in the table for SO_3 content, provided it has been demonstrated by ASTM C1038/C1038M that the cement with the increased SO_3 will not develop expansion exceeding 0.020 percent at 14 days. When the manufacturer supplies cement under this provision, supporting data shall be supplied to the purchaser. See Note 6.

[e] See Annex A for calculation.

[f] Not applicable.

[g] See Note 5.

[h] In addition, 3-day heat of hydration testing by ASTM C1702 shall be conducted at least once every 6 months. Such testing shall not be used for acceptance or rejection of the cement, but results shall be reported for informational purposes.

Table 2—Standard Physical Requirements

Cement Type[a]	Applicable Test Method	I	IA	II	IIA	II(MH)	II(MH)A	III	IIIA	IV	V
Air content of mortar, volume, %[b]	T 137										
Maximum		12	22	12	22	12	22	12	22	12	12
Minimum		—	16	—	16	—	16	—	16	—	—
Fineness, specific surface, m^2/kg											
Air permeability test:	T 153										
Minimum		260	260	260	260	260	260	—	—	260	260
Maximum		—	—	—	—	430[c]	430[c]	—	—	430	—
Autoclave expansion, Max, %	T 107M/T 107	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Strength, not less than value shown for ages indicated below[d]:											
Compressive strength, MPa (psi)	T 106M/ T 106										
1 day		—	—	—	—	—	—	12.0 (1740)	10.0 (1450)	—	—
3 days		12.0 (1740)	10.0 (1450)	10.0 (1450)	8.0 (1160)	10.0 (1450) ~~7.0[e] (1020)[e]~~	8.0 (1160) ~~6.0[e] (870)[e]~~	24.0 (3480)	19.0 (2760)	—	8.0 (1160)
7 days		19.0 (2760)	16.0 (2320)	17.0 (2470)	14.0 (2030)	17.0 (2470) ~~12.0[e] (1740)[e]~~	14.0 (2030) ~~9.0[e] (1310)[e]~~	—	—	7.0 (1020)	15.0 (2180)
28 days		—	—	—	—	—	—	—	—	17.0 (2470)	21.0 (3050)
Time of setting, minutes (alternative methods):[f]											
Gillmore test:	T 154										
Initial set, minutes, not less than		60	60	60	60	60	60	60	60	60	60
Final set, minutes, not more than		600	600	600	600	600	600	600	600	600	600
Vicat test:[g]	T 131										
Time of setting, minutes, not less than		45	45	45	45	45	45	45	45	45	45
Time of setting, minutes, not more than		375	375	375	375	375	375	375	375	375	375

[a] See Note 2.

[b] Compliance with the requirements of this specification does not necessarily ensure that the desired air content will be obtained in concrete.

[c] Maximum fineness limits do not apply if the sum of $C_3S + 4.75C_3A$ is less than or equal to 90, or the cement complies with the heat of hydration limit in Table 4.

[d] The strength at any specified test age shall be not less than that attained at any previous specified test age.

[e] ~~When the optional heat of hydration in Table 4 is specified.~~

[f] The purchaser should specify the type of setting-time test required. In case he does not so specify, the requirements of the Vicat test only shall govern.

[g] The time of setting is that described as initial setting time in T 131.

Table 3—Optional Physical Requirements[a]

Cement Type	Applicable Test Method	I and II	IA and IIA	II(MH)	II(MH)A	III and IIIA	IV	V
False set, final penetration, minutes, percent	T 186	50	50	50	50	50	50	50
Heat of hydration								
Isothermal conduction calorimetry:	ASTM C1702							
3 days, max, kJ/kg (cal/g)		—	—	~~255 (60)~~ 335 (80)[b]	~~255 (60)~~ 335 (80)[b]	—	200 (50)[c]	—
7 days, max, kJ/kg (cal/g)		—	—	—	—	—	225 (55)[c]	—
Strength, not less than values shown:								
Compressive strength, MPa (psi), 28 days	T 106M/ T 106	28.0 (4060)	22.0 (3190)	28.0 (4060)	22.0 (3190)	—	—	—
				~~22.0[b]~~	~~18.0[b]~~	—	—	—
				~~(3190)[b]~~	~~(2610)[b]~~	—	—	—
Sulfate resistance, 14 days, max, % expansion[d]	ASTM C452/ C452M	—[e]	—[e]	—[e]	—[e]	—	—	0.040
Turbidimeter test	T 98M/T 98							
Minimum		150	150	150	150	—	150	150
Max		—	—	245[f]	245[f]	—	245	—

[a] These optional requirements apply only if specifically requested. Availability should be verified. See Note 2 in Section 4.

[b] The limit for the sum of ~~the tricalcium silicate and 4.75 times the tricalcium aluminate~~ $C_3S + 4.75C_3A$ in Table 1 shall not apply when the cement complies with this ~~optional~~ limit ~~is requested~~. ~~These strength requirements apply when the optional heat of hydration requirement is requested.~~

[c] ~~When the heat of hydration limit is specified, it shall be used instead of t~~The limits of C_3S, C_2S, C_3A, and Fe_2O_3 ~~listed~~ in Table 1 shall not apply when the cement complies with this limit.

[d] When the sulfate resistance is specified, it shall be used instead of the limits of C_3A, $C_4AF + 2(C_3A)$, and Fe_2O_3 listed in Table 1.

[e] Cement meeting the high sulfate resistance limit for Type V is deemed to meet the moderate sulfate resistance required of Type II and Type II (MH).

[f] Maximum fineness limits do not apply if the sum of $C_3S + 4.75C_3A$ is less than or equal to 90, or the cement complies with the heat of hydration limit.

Item #: 3

Ballot Action: **Delete Section 11.1.12 and Table 5 of AASHTO M 240**

Description: **Completion of Option R removal in M 240**

Rationale:

Section 11.1.12 and Table 5 were inadvertently left in when M 240 was revised to remove Option R (AASHTO 2016 SOM Ballot 1, Item 5). The proposal to remove Option R passed and this ballot proposes to remove those sections for completeness. There are no references in M 240 to either Table 5 or Section 11.1.12.

This ballot item is based on AASHTO M 240-18. Only additions to text shown **underlined in red** and deletions shown in ~~red strikethrough font~~ are being balloted. Other text is included for information only. Where necessary, tables, figures, notes, footnotes, and section numbers will be renumbered editorially.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C595.

DETAILED CHANGES:

Delete Section 11.1.12 and Table 5. The page footnote on Pyrex glass will also be removed as it is no longer referenced. Renumbering of subsequent sections and Table 6 will be done editorially.

Standard Specification for

Blended Hydraulic Cement

AASHTO Designation: M 240M/M 240-18[1]

AASHTO

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11. TEST METHODS

11.1. *Determine the applicable properties enumerated in this specification in accordance with the following test methods:*

11.1.1. *Chemical Analysis*—T 105, with the special provisions noted therein applicable to blended cement analyses.

11.1.2. *Fineness by Sieving*—T 192.

11.1.3. *Fineness by Air-Permeability Apparatus*—T 153.

11.1.4. *Autoclave Expansion*—T 107M/T 107, except that, in the case of portland blast-furnace slag cement IS (≥70) or ternary blended cement IT (S ≥ 70), the test specimens shall remain in the

moist cabinet for a period of 48 h before being measured for length, and the neat cement shall be mixed for not less than 180 s nor more than 210 s.

11.1.5. *Time of Setting*—T 131.

11.1.6. *Air Content of Mortar*—T 137, using the actual specific gravity of the cement, if it differs from 3.15 by more than 0.05, in calculating the air content.

11.1.7. *Compressive Strength*—T 106M/T 106.

11.1.8. *Heat of Hydration*—ASTM C186.

11.1.9. *Normal Consistency*—T 129, except that in the case of portland blast-furnace slag cement IS(≥70) or ternary blended cement IT(S ≥ 70), the paste shall be mixed for not less than 180 s or more than 210 s.

11.1.10. *Specific Gravity*—T 133.

11.1.11. *Water Requirement*—The mass of mixing water added to the six-cube batch in accordance with T 106M/T 106, as a percentage of the total cementing ingredients.

~~11.1.12. *Mortar Expansion of Blended Cement*—ASTM C227, using crushed Pyrex Code 7740[2] glass as aggregate and the grading prescribed in Table 5.~~

~~**Table 5**—Aggregate Grading Requirements for Mortar Expansion Test~~

~~Sieve Size~~		~~Mass, %~~
~~Passing~~	~~Retained on~~	
~~4.75-mm (No. 4)~~	~~2.36-mm (No. 8)~~	~~10~~
~~2.36-mm (No. 8)~~	~~1.18-mm (No. 16)~~	~~25~~
~~1.18-mm (No. 16)~~	~~600-μm (No. 30)~~	~~25~~
~~600-μm (No. 30)~~	~~300-μm (No. 50)~~	~~25~~
~~300-μm (No. 50)~~	~~150-μm (No. 100)~~	~~15~~

11.1.13. *Mortar Expansion of Pozzolan for Use in Pozzolan-Modified Portland Cement Types IP(<15) and IP(<15)-A or Ternary Blended Cement Types IT(P < 15) and IT(P < 15)-A*—Using the pozzolan and the clinker or cement that are to be used together in the production of the blended cement, prepare portland-pozzolan cements Types IP(<15) and IP(<15)-A or ternary blended cement types IT(P < 15) and IT(P < 15)-A containing 2.5, 5, 7.5, 10, 12.5, and 15 mass percent of the pozzolan. These blends shall be tested in accordance with ASTM C227 using a sand judged to be a nonreactive by the mortar bar test in ASTM C227. The expansion of the mortar bars shall be measured at 91 days, and all six blends shall meet the expansion requirement in Table 4.

11.1.14. *Activity Index with Portland Cement*—Test in accordance with Annex A.

11.1.15. *Sulfate Resistance*—See ASTM C1012/C1012M.

11.1.16. *Loss-on-Ignition of Pozzolan*—ASTM C311.

12. TESTING TIME REQUIREMENTS

12.1. The following periods from time of sampling shall be allowed for the completion of testing:

3-day test	8 days
7-day test	12 days
14-day test	19 days
28-day test	33 days
8-week test	61 days

[1] In essential equivalence with ASTM C595/C595M-17.

[2] ~~Pyrex Code 7740 glass is available as lump cullet from the Corning Glass Works, Corning, NY; this is the sole source of supply of the apparatus known to the ASTM committee at this time. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.~~

Item #: 4

Ballot Action: **Revision of M 240 Standard Specification for Blended Hydraulic Cements**

Description: **Revise Type MH and LH Heat of Hydration Provisions.**

Rationale:

ASTM C186 is the referenced test method in M 240 for determining heat of hydration, but has been criticized for using hazardous chemicals, being relatively variable, and because testing equipment is not readily available. ASTM C1702 exhibits better precision, eliminates the use of hazardous chemicals required by C186, and uses testing equipment that is readily available. Test Method C1702 is proposed as a replacement for C186 for these reasons. A change to remove references to C186 from AASHTO M 85 has previously been approved.

The limits proposed for MH-designated cements are the same as those proposed in a current ballot in M 85 Table 4 for Type II(MH) cements and those for LH-designated cements are the same as those for M 85 Table 4 for Type IV cements. Note that no 7-day reporting requirement is proposed for MH-designated cements to harmonize with Table 4 requirements in M 85 for Type II(MH) cements.

Detailed changes:

1. Remove C186 from Section 2, Referenced Documents, from Table 3, and 11.1.8.
2. Add C1702 to Referenced Documents, Table 3 and 11.1.8.
3. Include 3-d C1702 maximum limits of 335 kJ/kg (80 cal/g) for MH-designated cements, 200 kJ/kg (50 cal/g) for LH-designated cements, and 7-d C1702 limits of 225 kJ/kg (55 cal/g) for LH-designated cements.

This ballot item is based on AASHTO M 240-18. Proposed additions are underlined and proposed deletions are shown in ~~strikethrough~~ font. Only changes so indicated are being balloted. Other text is provided only to provide context for the proposed changes.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C595.

Standard Specification for

Blended Hydraulic Cement

AASHTO Designation: M 240M/M 240-18

AASHTO

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2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 85, Portland Cement

- M 201, Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
- M 327, Processing Additions for Use in the Manufacture of Hydraulic Cements
- R 71, Sampling and Amount of Testing of Hydraulic Cement
- R 80, Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction
- T 105, Chemical Analysis of Hydraulic Cement
- T 106M/T 106, Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
- T 107M/T 107, Autoclave Expansion of Hydraulic Cement
- T 129, Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
- T 131, Time of Setting of Hydraulic Cement by Vicat Needle
- T 133, Density of Hydraulic Cement
- T 137, Air Content of Hydraulic Cement Mortar
- T 153, Fineness of Hydraulic Cement by Air Permeability Apparatus
- T 192, Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve

2.2. *ASTM Standards*:

- C51, Standard Terminology Relating to Lime and Limestone (as used by the Industry)
- ~~C186, Standard Test Method for Heat of Hydration of Hydraulic Cement~~
- C219, Standard Terminology Relating to Hydraulic Cement
- C226, Standard Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
- C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
- C311/C311M, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
- C563, Standard Test Method for Approximation of Optimum SO_3 in Hydraulic Cement
- C688, Standard Specification for Functional Additions for Use in Hydraulic Cements
- C821, Standard Specification for Lime for Use with Pozzolans
- C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
- C1038/C1038M, Standard Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water
- C1157/C1157M, Standard Performance Specification for Hydraulic Cement
- C1702, Standard Test Method for Measuring Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry
- *Manual of Cement Testing*, *Annual Book of ASTM Standards*, Volume 04.01

Table 1—Physical Requirements for Blended Cements with Special Properties

Special Property Designation[a]	Applicable Test Method	A	MS	HS	MH	LH
Heat of hydration, max, kJ/kg [cal/g]:						
~~7 days~~	~~ASTM C186~~	—	—	—	~~290 [70]~~	~~250 [60]~~
~~28 days~~		—	—	—	~~330 [80]~~	~~290 [70]~~
3 days	ASTM 1702	—	—	—	335 [80]	200 [50]
7 days		—	—	—	—	225 [55]

11. TEST METHODS

11.1.8. Heat of Hydration—~~ASTM C186~~ C1702.

Item #: 5

Ballot Action: **Revision of M 240 Standard Specification for Blended Hydraulic Cements**

Description: **Remove Section 9.3, 11.1.13, and referenced information in Table 4**

Rationale

The rationale for the revision to remove is based on the following:

1. Absence of provenance for the requirement, and
2. Densified silica fume is often delivered to and blended at a concrete batch plant, where M 240 requirements do not apply. There is little evidence that this concrete is more likely to suffer damaging ASR than concrete produced from a M 240-compliant cement. It then follows that the M 240 requirement is not needed.

Background

Specification M240, Section 9.3 and Table 4 describes a requirement for pozzolan (alkali reactivity of pozzolan) used to make blended cement types IP(<15), IT(P<15), IP(<15)-A, and IT(P<15)-A. The test procedure in section 11.1.13 calls for testing length change of mortar-bar specimens according to a modified version of Method C227. The test specimens are made using the manufacturer's ground clinker at six levels of pozzolan replacement ranging from 2.5% to 15%. The modification involves the required use of a non-ASR-reactive fine aggregate instead of the usual potentially reactive aggregate or Pyrex glass (C441). Note that this non-reactive aggregate feature is not the usual configuration of C227. The criterion is that expansion of all six replacement levels must be ≤0.05% after 91 days.

The requirement first appeared in the 1979 version of the specification C595. There is no information in the 1979 version on the problem this limit is intended to solve. Also, there is no information on the precision and bias of the revised C227 used in the evaluation.

Discussion

The term "alkali reactivity of pozzolan" is undefined in the M 240 and also in terminology standards ASTM C125 and ASTM C219. The Task Group on this ballot item went to considerable effort to determine the original reasoning for the requirement and the basis for the test method and acceptance limits. There seems to be no published information on this prior to the publication of the 1979 version. There must have been committee correspondence and ballot items on the matter, but these have apparently expired. Inquiries made to ASTM members who were active when this requirement would have been under development revealed no useful information. The TG is also unaware of any use of C227 (outside of this standard) requiring non-reactive aggregates to test pozzolan.

From examination of the various parts of the requirement it appears that the purpose is to identify pozzolans that might have properties that would cause them to react to cement alkalis much like an alkali-silica-reactive fine aggregate would react, and cause damaging expansion in concrete. The concern appears to be only for pozzolans used in cement replacement levels of ≤15% (by mass).

The ≤15% criterion suggests the phenomenon of concern might be the long-standing and well documented "pessimum-pozzolan effect" that can occur when **reactive aggregates** are in use in concrete. Low levels of pozzolan have been identified as sometimes causing an enhanced expansion of the reactive aggregate in the concrete. A minimum cement replacement level of 15% is commonly cited in construction specifications addressing this phenomenon. The pessimum-pozzolan effect does not appear to be basis for the current M 240 requirement since non-reactive aggregate is required for the testing.

The search for pertinent information on the provenance representing the period before and leading up to the first publication of the requirement revealed nothing that would seem to support the requirement. Some papers published a number of years after the requirement was adopted do focus on the ASR-like nature of agglomerates in densified silica fume, as follows.

Shayan et. al. (1994)[1]. reported on petrography steam cured (75°C) concrete containing 10% densified silica and concluded that agglomerates 40-100μ diameter persisted in the concrete and appeared to acted like reactive aggregates, although expansion with non-reactive aggregates was small.

Marusin and Shotwell (2000)[2]. Petrography on a significantly cracked concrete containing light weight aggregate and densified silica fume revealed evidence of ASR gel near the larger silica fume agglomerates (100 - 800μ). It was concluded that these could have contributed to the overall damage to the structure, however other variables also seemed to also be involved.

Diamond and Sahu (2004)[3]. Reported alkali-silica gel associated with silica fume agglomerates, but whether or not these were causing distress varied. Sea water seems to enhance problems.,.

Diamond and Sahu (2006)[4]. Silica fume agglomerates always persisted to some degree in concrete after mixing, but concluded that this resulted in ASR-like damage to concrete only under especially unfavorable conditions.

Maas, et. al. (2007)[5]. Densified silica fume did not increase expansion non-reactive aggregate, but did result in slight increase when used with some reactive aggregates. These

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[1] A. Shayan, G.W. Quick, and C.J. Lancucki. 1994. "Morphological, Mineralogical and Chemical Features of Steam-cured Concretes Containing Densified Silica Fume and Various Alkali Levels." *Advances in Cement Research*, Vol. 5, No. 20. Was not practical to obtain full paper. Comments based on abstract.
[2] Marusin, S. and Shotwell, L. 2000. "Alkali-Silica Reaction in Concrete Caused by Densified Silica Fume Lumps: A Case Study, *Cement, Concrete, and Aggregates* Vol 22 No.2, pp 90-94
[3] Diamond, S., S.Sahu, and N. Thaulow. 2004. "Reaction Products of Densified Silica Fume Agglomerates in Concrete. *Cement and Concrete Research* Vol 34, pp 1625 – 1632.
[4] Diamond, S. and S. Sahu. 2006. "Densified Silica fume: Particle Sizes and Dispersion in Concrete." *Materials and Structures* Vol 39, pp 849-859.
[5] Maas, A., J. Ideker, and M. Juenger. 2007. "Alkali Silica Reactivity of Agglomerated Silica Fume." *Cement and Concrete Research* Vol 37, pp166-174.

were all mortar-bar tests.

Efforts to identify case histories in which pozzolans conclusively caused damaging ASR like reactions in the absence of reactive aggregate did not reveal very much. One case of possible silica fume agglomeration causing damage was verbally reported by an former USN employee concerning the Ford Island Bridge (Hawaii). A discussion with a petrographer familiar with that case indicated that this damage was not unequivocally implicated. The structure was apparently made with precast concrete, potentially could have suffered DEF, and it was exposed to sea water, which could have also made some contribution.

The most recent of the above publications is 2007. Densified silica fume has a long history of used in cast-in-place concrete when the silica fume and cement (and other materials) are all batched at the job site. These materials would probably not have been tested for compliance with AASHTO M 240 or ASTM C595. We could find no reports of negatively impacted service life.

DETAILED CHANGES: Remove Sections 9.3, 11.1.13, and relevant parts of Table 4, as follows.

Standard Specification for

Blended Hydraulic Cement

AASHTO Designation: M 240M/M 240-18

AASHTO

Table 1—Requirements for Pozzolan for Use in Blended Cements and for Slag for Use in Portland Blast-Furnace Slag Cement Type IS(<25) and Ternary Blended Cement Type IT(S < 25)

Pozzolan	Applicable Test Method	
Fineness: Amount retained when wet-sieved on 45-µm (No. 325) sieve, max, %	T 192	20.0
~~Alkali reactivity of pozzolan for use in Types IP (<15); IT (P < 15); IP (<15)-A; and IT (P < 15)-A cements, 6 tests, mortar bar expansion at 91 days, max, %~~	~~ASTM C227~~	~~0.05~~
Slag or pozzolan activity index with portland cement, at 28 days, min, %	See Annex A	75.0
Loss on ignition of pozzolan, max, %: Natural pozzolan Fly ash Silica fume	ASTM C311	10.0 6.0 6.0

9.3 Pozzolan for use in the manufacture of portland-pozzolan cement, Type IP(<15) and IP(<15)-A, or ternary blended cements Type IT(P < 15) and Type IT(P < 15)-A, shall meet the requirements of Table 4 when tested for mortar expansion of pozzolan as described in Section 11.1.13. If the alkali content of the clinker to be used for the production lots changes by more than 0.2 percent total as equivalent Na_2O, calculated as $Na_2O + 0.658\ K_2O$, from that of the clinker with which the acceptance tests were carried out, the pozzolan shall be retested to show compliance with the requirements of Table 4.

11.1.13 *Mortar Expansion of Pozzolan for Use in Pozzolan-Modified Portland Cement Types IP(<15) and IP(<15)-A or Ternary Blended Cement Types IT(P < 15) and IT(P < 15)-A*—Using the pozzolan and the clinker or cement that are to be used together in the production of the blended cement, prepare portland-pozzolan cements Types IP(<15) and IP(<15)-A or ternary blended cement types IT(P < 15) and IT(P < 15)-A containing 2.5, 5, 7.5, 10, 12.5, and 15 mass percent of the pozzolan. These blends shall be tested in accordance with ASTM C227 using a sand judged to be a nonreactive by the mortar-bar test in ASTM C227. The expansion of the mortar bars shall be measured at 91 days, and all six blends shall meet the expansion requirement in Table 4.

Item #: 6

Ballot Action: **Revise AASHTO M 85, Standard Specification for Portland Cement**

Description: **Remove reference to T 98M/T 98 Turbidimeter Fineness**

Rationale:

The Wagner Test, AASHTO T 98, is a fineness test that is rarely used. The Cement and Concrete Reference Laboratory data below indicates that the test method has not been common for some time and no laboratories in the CCRL PSP program have reported Wagner fineness data for the last few years. In practice, AASHTO T 153, the Blaine fineness test is the test method used for fineness determinations. In 2018, ASTM Committee C01 withdrew the parallel standard ASTM C115, Fineness of Portland Cement by the Turbidimeter.

This proposal would remove references to T 98 from M 85 in order to simplify the provisions of the standard to remove the reference to the withdrawn standard. T 153 is already referenced in M 85, with mandatory limits for several cement types, and no change is proposed to those requirements.

Portland Cement CCRL Proficiency Sample Program (PCP)

CCRL Sample #	Year	Number of Paricipating Labs by ASTM Test Method		
		C115	C204	C430
161-162	2006	14	249	230
163-164	2007	15	252	233
165-166	2007	15	260	243
167-168	2008	15	268	248
169-170	2008	12	240	223
171-172	2009	14	253	231
173-174	2009	13	251	233
175-176	2010	11	248	241
177-178	2010	9	236	224
179-180	2011	9	251	234
181-182	2011	6	240	225
183-184	2012	5	245	232
185-186	2012	7	242	229
187-188	2013	5	245	232
189-190	2013	5	242	228
191-192	2014	5	242	232
193-194	2014	4	230	218
195-196	2015	3	241	225
197-198	2015	2	238	225
199-200	2016	2	251	237
201-202	2016	**	243	224
203-204	2017	**	250	233
205-206	2017	**	237	222

** None of the CCRL PCP participants reported Wagner fineness data

This ballot item is based on AASHTO M 85-18. Only additions to text shown underlined in red and deletions shown in ~~red strikethrough font~~ are being balloted. Other text is included for information only. Where necessary, tables, figures, notes, footnotes, and section numbers will be renumbered editorially.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C150.

Detailed Changes:

Standard Specification for

Portland Cement

AASHTO Designation: M 85-18

AASHTO

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 327, Processing Additions for Use in the Manufacture of Hydraulic Cements
- R 71, Sampling and Amount of Testing of Hydraulic Cement
- ~~T 98M/T 98, Fineness of Portland Cement by the Turbidimeter~~
- T 105, Chemical Analysis of Hydraulic Cement
- T 106M/T 106, Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
- T 107M/T 107, Autoclave Expansion of Hydraulic Cement
- T 131, Time of Setting of Hydraulic Cement by Vicat Needle
- T 137, Air Content of Hydraulic Cement Mortar
- T 153, Fineness of Hydraulic Cement by Air Permeability Apparatus

Table 1—Optional Physical Requirements[a]

Cement Type	Applicable Test Method	I and II	IA and IIA	II(MH)	II(MH)A	III and IIIA	IV	V
False set, final penetration, minutes, percent	T 186	50	50	50	50	50	50	50
Heat of hydration								
Isothermal conduction calorimetry:	ASTM C1702							
3 days, max, kJ/kg (cal/g)		—	—	255 (60)[b]	255 (60)[b]	—	200 (50)[c]	—
7 days, max, kJ/kg (cal/g)		—	—	—	—	—	225 (55)[c]	—
Strength, not less than values shown:								
Compressive strength, MPa (psi), 28 days	T 106M/ T 106	28.0 (4060)	22.0 (3190)	28.0 (4060)	22.0 (3190)	—	—	—
				22.0[b] (3190)[b]	18.0[b] (2610)[b]	—	—	—
Sulfate resistance, 14 days, max, % expansion[d]	ASTM C452/ C452M	—[e]	—[e]	—[e]	—[e]	—	—	0.040
~~Turbidimeter test~~	~~T 98M/T 98~~							
~~—Minimum~~		~~150~~	~~150~~	~~150~~	~~150~~	—	~~150~~	~~150~~
~~—Max~~		—	—	~~245[f]~~	~~245[f]~~	—	~~245~~	—

[a] These optional requirements apply only if specifically requested. Availability should be verified. See Note 2 in Section 4.

[b] The limit for the sum of the tricalcium silicate and 4.75 times the tricalcium aluminate in Table 1 shall not apply when this optional limit is requested. These strength requirements apply when the optional heat of hydration requirement is requested.

[c] When the heat of hydration limit is specified, it shall be used instead of the limits of C_3S, C_2S, C_3A, and Fe_2O_3 listed in Table 1.

[d] When the sulfate resistance is specified, it shall be used instead of the limits of C_3A, $C_4AF + 2(C_3A)$, and Fe_2O_3 listed in Table 1.

[e] Cement meeting the high sulfate resistance limit for Type V is deemed to meet the moderate sulfate resistance required of Type II and Type II (MH).

~~[f] Maximum fineness limits do not apply if the sum of $C_3S + 4.75C_3A$ is less than or equal to 90.~~

9. TEST METHODS

9.1 *Determine the applicable properties enumerated in this specification in accordance with the following methods:*

9.1.1 *Air Content of Mortar*—T 137;

9.1.2 *Chemical Analysis*—T 105;

9.1.3 *Strength*—T 106M/T 106;

9.1.4 *False Set*—T 186;

9.1.5 *Fineness by Air Permeability*—T 153;

~~*9.1.6* *Fineness by Turbidimeter*—T 98M/T 98;~~

Item #: 7

Ballot Action: **Revise AASHTO M 85, Standard Specification for Portland Cement**

Description: **Revise Figure X1.1**

Rationale: A comment on a previous ballot noted an inconsistency in the example mill test report in Figure X1.1. Some information reported on manufacturer's reports is not listed in tables of M 85, as implied by the headings in the example mill test report. For example the chloride reporting requirement is not included in Tables 2 or 4 of M 85.

This ballot proposes to simplify the non-mandatory example report to avoid any potential confusion.

This ballot item is based on AASHTO M 85-18. Only additions to text shown **underlined in red** and deletions shown in ~~**red strikethrough font**~~ are being balloted. Other text is included for information only. Where necessary, tables, figures, notes, footnotes, and section numbers will be renumbered editorially.

This proposal has been developed by TS 3a TF09-1, the Joint AASHTO-ASTM Harmonization Task Force, and a parallel proposal is being considered by ASTM Committee C01 for ASTM C150.

Detailed Changes:

Standard Specification for

Portland Cement

AASHTO Designation: M 85-18

AASHTO

ABC Portland Cement Company
Qualitytown, NJ

Plant: Example | Cement Type: II(MH) | Date: March 9, 2002

Production Period: March 2, 2002–March 8, 2002

STANDARD REQUIREMENTS
M 85~~, Tables 1 and 3~~

CHEMICAL

Item	Spec. Limit	Test Result
SiO_2 (%)	[a]	20.6
Al_2O_3 (%)	6.0 max	4.4
Fe_2O_3 (%)	6.0 max	3.3
CaO (%)	[a]	62.9
MgO (%)	6.0 max	2.2
SO_3 (%)	3.0 max	3.2
Loss on ignition (%)	3.5 max	2.7
Na_2O (%)	[a]	0.19
K_2O (%)	[a]	0.50
Insoluble residue (%)	1.5 max	0.27
CO_2 (%)	[a]	1.2
Limestone (%)	5.0 max	3.5
$CaCO_3$ in limestone (%)	70 min	79
Inorganic processing addition (ground, granulated blast-furnace slag)	5.0 max	3.0
Potential phase compositions (%)[b]		
C_3S	[a]	59
C_2S	[a]	10
C_3A	8 max	5
C_4AF	[a]	10
$C_4AF + 2(C_3A)$	[a]	20
$C_3S + 4.75\ C_3A$, (%)	100 max	83

PHYSICAL

Item	Spec. Limit	Test Result
Air content of mortar (volume %)	12 max	8
Fineness (m^2/kg) (Air permeability)	260 min 430 max	377
Autoclave expansion (%)	0.80 max	0.04
Compressive strength (MPa)	Min:	
1 day	[a]	
3 days	7.0	23.4
7 days	12.0	29.8
28 days	[a]	
Time of setting (minutes) (Vicat)		
Initial	Not less than 45	124
	Not more than 375	
Heat of hydration (kJ/kg) ASTM C1702		
3 days	[c]	245
ASTM C1038 mortar bar expansion (%)	[d]	0.010[e]

[a] Not applicable.
[b] Adjusted per Annex A1.6.
[c] Test result represents most recent value and is provided for information only.
[d] Required only if percent SO_3 exceeds the limit in Table 1, in which case expansion shall not exceed 0.020 percent at 14 days.
[e] Test result for this production period not available. Most recent test result provided.

OPTIONAL REQUIREMENTS
M 85~~, Tables 2 and 4~~

CHEMICAL

Item	Spec. Limit	Test Result
Equivalent alkalies (%)	[f]	0.52
Chloride (%)	[f]	0.020

[f] Limit not specified by purchaser. Test result provided for information only.

PHYSICAL

Item	Spec. Limit	Test Result
False set (%)	50 min	82
Compressive strength (MPa)		
28 days	28.0 min	39.7[e]

We certify that the above-described cement, at the time of shipment, meets the chemical and physical requirements of M 85-xx or (other) __________________ specification.

Signature: ______________________________ Title: ______________________________

Figure X1.1—Example Mill Test Report

Attachment 3 – Item V.H.1 – M303 Reconfirmation

Standard Specification for

Lime for Asphalt Mixtures

AASHTO Designation: M 303-89 (2014)

AASHTO

Technical Section: 3a, Hydraulic Cement and Lime

Release: Group 1 (April)

1. SCOPE

1.1. This specification covers two types of lime to be used for reducing water susceptibility in asphalt mixtures.

1.1.1. *Type I*—High calcium-hydrated lime containing maximum magnesium content, calculated as magnesium oxide, of 4 percent by mass. Compliance with chemical composition requirements shall be determined by use of T 219 (see Note 1).

Note 1—Magnesium oxide content may be determined by ASTM C25.

1.1.2. *Type II*—Magnesium or dolomitic lime containing magnesium, calculated as magnesium oxide, greater than 4 percent but no more than 36 percent by mass. Compliance with chemical composition requirements shall be determined by use of ASTM C25 (see Note 2).

Note 2—Except that Section 2, "Samples for Analysis," is excluded.

1.2. The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- T 218, Sampling Hydrated Lime
- T 219, Testing Lime for Chemical Constituents and Particle Sizes
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage

2.2. *ASTM Standards*:

- C25, Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
- D1075, Standard Test Method for Effect of Water on Compressive Strength of Compacted Bituminous Mixtures

Field (

3. CHEMICAL LIMITS

3.1. Types I and II lime, when sampled and tested by procedures prescribed herein, shall conform to the following requirements. (See Tables 1 and 2.)

3.2. Type II lime, when tested in accordance with ASTM C25, shall conform to the requirements listed in Table 2.

Table 1—Types I and II Requirements

Min total active lime content, percent by mass	90
(Percent by mass $Ca(OH)_2$ + percent by mass $Ca(O)^a$)	
Max unhydrated lime content, percent by mass CaO	7
Max "Free Water" content, percent by mass H_2O	3

[a] No more than 7 percent by mass calcium oxide (unhydrated lime) will be allowed in determining total active lime content.

Table 2—Type II Requirements (when tested by ASTM C25)

Calcium and magnesium oxide content of ignition residue, min, percent[a]	96
Carbon dioxide (as received basis), max, percent	4
Unhydrated calcium oxide (as received basis), max, percent	7

[a] Ignition to constant mass shall be performed utilizing an electric muffle furnace operating at 1000–1100°C [1800–2000°F].

4. PHYSICAL REQUIREMENTS

4.1. Types I and II lime shall conform to the following particle size requirements when tested according to T 219:

Maximum residue retained on a 600-µm (No. 30) sieve, percent by mass	3
Maximum residue retained on a 75-µm (No. 200) sieve, percent by mass	20

5. PACKAGING AND MARKING

5.1. When the lime is delivered in bags, the name and brand of the manufacturer and type shall be plainly identified thereon. A bag shall contain a nominal mass of 25 kg (50 lb), and all bags shall be in good condition at the time of inspection. When lime is delivered in bulk, information regarding type and manufacturer shall be contained in the invoice accompanying the shipment.

6. INSPECTION

6.1. Every facility shall be available to the purchaser for careful sampling and inspection of the lime at either the plant or at the worksite as specified by the purchaser.

7. REJECTION

7.1. The lime shall be rejected if it fails to meet any of the requirements of this specification.

7.2. In the case of bag lime, bags varying more than 5 percent from the specified mass may be rejected. If the average mass of bags in any shipment as shown by weighing 50 bags taken at random is less than that specified, the entire shipment may be rejected.

8. METHODS OF SAMPLING AND TESTING

8.1. *The sampling and testing of lime shall be in accordance with the following standard methods of AASHTO or ASTM:*

8.1.1. *Sampling*—T 218.

8.1.2. *Chemical Analysis for Type I Lime*—T 219.

8.1.3. *Chemical Analysis for Type II Lime*—ASTM C25.

8.1.4. *Physical Requirements*—Quantity of lime required to correct water susceptibility can be determined from test results obtained in accordance with T 283 or ASTM D1075.

9. KEYWORDS

9.1. Hydrated lime; lime; lime for asphalt.

Attachment 4 – Item V.H.2 - T133 Equivalency

Standard Method of Test for

Density of Hydraulic Cement

AASHTO Designation: T 133-16

Technical Section: 3a, Hydraulic Cement and Lime

Release: Group 1 (April 2016)

ASTM Designation: C188-14

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Method of Test for

Density of Hydraulic Cement

AASHTO Designation: T 133-18

AASHTO

Technical Section: 3a, Hydraulic Cement and Lime

Release: Group 1 (April)

ASTM Designation: C188-14

1. SCOPE

1.1. This method covers determination of the density of hydraulic cement. Its particular usefulness is in connection with the design and control of concrete mixtures.

1.2. The density of hydraulic cement is defined as the mass of a unit volume of the solids.

1.3. The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standard*:

- T 105, Chemical Analysis of Hydraulic Cement

2.2. *ASTM Standards*:

- C125, Standard Terminology Relating to Concrete and Concrete Aggregates
- C219, Terminology Relating to Hydraulic Cement
- C604, Test Method for True Specific Gravity of Refractory Materials by Gas-Comparison Pycnometer
- C604, Test Method for True Specific Gravity of Refractory Materials by Gas-Comparison Pycnometer
- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- D2638, Test Method for Real Density of Calcined Petroleum Coke by Helium Pycnometer

Commented [SJF(1]: Reference included in C188.

3. TERMINOLOGY

3.1. *Definitions*—For definitions of terms used in this test method, refer to ASTM C125 and C219.

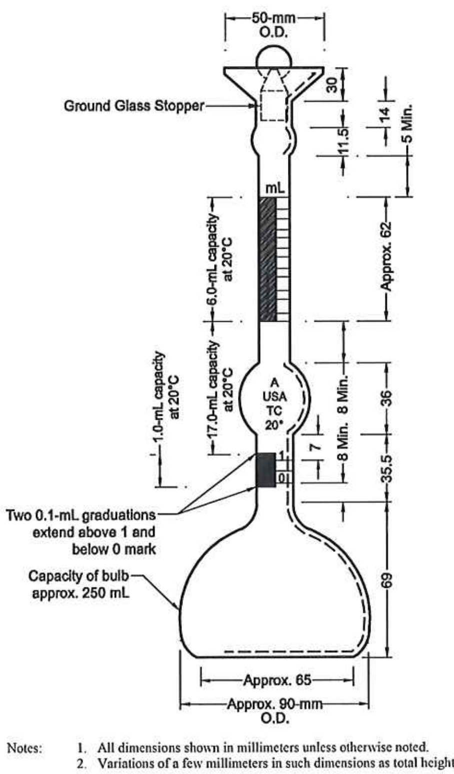
4. SIGNIFICANCE AND USE

4.1. This test method provides a procedure for the determination of density of hydraulic cement samples using non-instrumental techniques.

5. APPARATUS

5.1. *Le Chatelier Flask—The standard flask*—Is circular in cross section with shape and dimensions conforming essentially to Figure 1 (see Note 1). The requirements in regard to tolerance, inscription and length, spacing, and uniformity of graduation will be rigidly observed. There shall be a space of at least 10 mm between the highest graduation mark and the lowest point of grinding for the glass stopper.

Note 1—The design is intended to ensure complete drainage of the flask when emptied and stability of standing on a level surface as well as accuracy and precision of reading.



Notes:
1. All dimensions shown in millimeters unless otherwise noted.
2. Variations of a few millimeters in such dimensions as total height of flask, diameter of base, etc., are to be

expected and will not be considered sufficient cause for rejection. The dimensions of the flask shown in Figure 1 apply only to new flasks and not to flasks in use which meet the other requirements of this test method.

Figure 1—Le Chatelier Flask for Density Test

5.1.1. The material of construction shall be best quality glass, transparent and free of striae. The glass shall be chemically resistant and shall have small thermal hysteresis. The flasks shall be thoroughly annealed before being graduated. They shall be of sufficient thickness to ensure reasonable resistance to breakage.

5.1.2. The neck shall be graduated from 0 to 1 mL and from 18 to 24 mL in 0.1-mL graduations. The error of any indicated capacity shall not be greater than 0.05 mL.

5.1.3. Each flask shall bear a permanent identification number and the stopper, if not interchangeably ground, shall bear the same number. Interchangeable ground-glass parts shall be marked on both members with the standard-taper symbol, followed by the size designation. The standard temperature shall be indicated, and the unit of capacity shall be shown by the letters "mL" placed above the highest graduation mark.

5.2. Kerosene, free of water, or naphtha, having a density greater than 0.7391 mL at 23 ± 2°C shall be used in the density determination.

5.3. The use of alternative equipment or methods for determining density is permitted provided that a single operator can obtain results within ±0.03 g/cm^3 of the results obtained using the flask method.

5.3.1. The following alternative methods using helium for density determination is permitted:

5.3.1.1. The methodology as described in ASTM C604. Sections of the standard relating to grinding the sample shall be omitted because cement is already a powder.

5.3.1.2. The methodology as described in ASTM D2638. Sections of the standard relating to grinding the sample shall be omitted because cement is already a powder.

Commented [SJF(2]: Included in C188.

6. PROCEDURE

6.1. Determine the density of cement on the material as received, unless otherwise specified. If the density determination on a loss-free sample is required, first ignite the sample as described in the test for loss on ignition in Section 18 of T 105.

6.2. Fill the flask (see Note 2) with either of the liquids specified in Section 5.2 to a point on the stem between zero and the 1-mL mark. Dry the inside of the flask above the level of the liquid, if necessary, after pouring. Record the first reading after the flask has been immersed in the water bath (see Note 3) in accordance with Section 6.4.

Note 2—It is advisable to use a rubber pad on the table top when filling or rolling the flask.

Note 3—Before the cement has been added to the flask, a loose-fitting, lead-ring weight around the stem of the flask will be helpful in holding the flask in an upright position in the water bath, or the flask may be held in the water bath by a buret clamp.

6.3. Introduce a quantity of cement, weighed to the nearest 0.05 g (about 64 g for portland cement) in small increments at the same temperature as the liquid (see Note 2). Take care to avoid splashing and make sure the cement does not adhere to the inside of the flask above the liquid. A vibrating apparatus may be used to accelerate the introduction of the cement into the flask and prevent the cement from sticking to the neck. After all the cement has been introduced, place the stopper in the flask and roll the flask in an inclined position (see Note 2), or gently whirl it in a horizontal

circle to free the entrapped air from the cement until no further air bubbles rise to the surface of the liquid. If a proper amount of cement has been added, the level of the liquid will be in its final position at some point of the upper series of graduations. Take the final reading after the flask has been immersed in the water bath in accordance with Section 6.4.

6.4. Immerse the flask in a constant-temperature water bath for sufficient periods of time to avoid flask-temperature variations greater than 0.2°C between the initial and final readings.

7. CALCULATION

7.1. The difference between the first and final readings represents the volume of liquid displaced by the mass of cement used in the test.

7.2. Calculate the cement density, p, as follows (see Notes 4 to 6):

$$p = M/V$$

where:

p = density of cement, g/cm^3,
M = mass of cement, g, and
V = displaced volume of liquid, cm^3

Note 4—The displaced volume in milliliters is numerically equal to the displaced volume in cubic centimeters.

Note 5—Density in megagrams per cubic meter (Mg/m^3) is numerically equal to grams per cubic centimeter (g/cm^3). Calculate the cement density, p, to three decimal places and round to the nearest 0.01 g/cm^3.

Note 6—In connection with proportioning and control of concrete mixtures, density may be more usefully expressed as specific gravity, the latter being a dimensionless number. Calculate the specific gravity as follows:

Sp gr = cement density/water density at 4°C

where the density of water at 4°C 1 g/cm^3.

8. PRECISION AND BIAS

8.1. The single-operator standard deviation for portland cements has been found to be 0.012.[1] Therefore, the results of two properly conducted tests by the same operator on the same material should not differ by more than 0.03.[1]

8.2. The multilaboratory standard deviation for portland cements has been found to be 0.037.[1] Therefore, the results of two properly conducted tests from two different laboratories on samples of the same cement should not differ by more than 0.10.[1]

8.3. Because there is no accepted reference material suitable for determining any bias that may be associated with T 133, no statement on bias is being made.

9. KEYWORDS

9.1. Density; hydraulic cement; specific gravity.

[1] These numbers represent 1s and d2s limits described in ASTM C670.

Attachment 5 – Item V.I.1 – T192 Equivalency

Standard Method of Test for

Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve

AASHTO Designation: T 192-11 ~~(2015)~~ (2018)

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Technical Section: 3a, Hydraulic Cement and Lime

Release: Group 1 (April)

ASTM Designation: C430-~~08~~ 17

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AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Method of Test for

Fineness of Hydraulic Cement by the 45-μm (No. 325) Sieve

AASHTO Designation: T 192-11 (2015) (2018)

Technical Section: 3a, Hydraulic Cement and Lime

Release: Group 1 (April)

ASTM Designation: C430-08 17

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1. SCOPE

1.1. This test method covers the determination of the fineness of hydraulic cement by means of the 45-μm (No. 325) sieve.

1.2. The values stated in SI units are to be regarded as the standard. The inch-pound equivalents of SI units may be approximate.

1.3. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. *ASTM Standards*:

- C125, Terminology Relating to Concrete and Concrete Aggregates
- C219, Terminology Relating to Hydraulic Cement
- E11-15, Standard Specification for Wire-Cloth Sieves for Testing Purposes
- E161, Standard Specification for Precision Electroformed Sieves
- E177, Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods

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3. TERMINOLOGY

3.1. *Definitions*:

3.2. For definitions of terms used in this test method, refer to Terminology ASTM C125 and C219.

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3.4. APPARATUS

Commented [SJF(2]: Renumbered Sections 4 through 10.

3.1.4.1. *Sieve*:

~~3.1.1.~~4.1.1. *Sieve Frame*—The sieve frame shall be of metal not subject to corrosion by water and shall be circular, either 51 ± 6 mm (2.0 ± 0.25 in.) in diameter when woven-wire cloth is mounted in the frame, or 76 ± 6 mm (3.0 ± 0.25 in.) in diameter when an electroformed sheet is mounted in the frame. The depth of the sieve from the top of the frame to the cloth or sheet shall be 76 ± 6 mm (3.0 ± 0.25 in.). The frame shall have either side walls of 89 ± 6 mm (3.5 ± 0.25 in.) in total height, or legs at least to 12.0 mm (0.5 in.) in length, sufficient to allow air circulation beneath the sieve cloth or electroformed sheet.

~~3.1.2.~~4.1.2. *Sieve Cloth or Electroformed Sheet*—The sieve frame shall be fitted with either a 45-μm (No. 325) stainless steel AISI Type 304 woven-wire sieve cloth, conforming to the requirements of ASTM E11-15, or a 45-μm electroformed reinforced nickel sieve sheet conforming to the requirements of ASTM E161, with the exception that the number of openings shall be 71 ± 2 per linear cm (180 ± 5 per linear in.).

~~3.1.3.~~4.1.3. *Cloth or Sheet Mounting*:

~~3.1.3.1.~~4.1.3.1. *Woven-Wire Cloth Mounting*—Type 304 stainless steel woven-type cloth shall be mounted in the frame without distortion, looseness, or wrinkling. For a sieve fabricated by soldering the cloth to the frame, the joint shall be made smooth to prevent the cement from catching in the joints between the sieve cloth and the frame. Two-piece sieves shall clamp tightly on the cloth to prevent the cement from catching in the joints between the sieve cloth and the frame.

~~3.1.3.2.~~4.1.3.2. *Electroformed Sieve Sheet Mounting*—Electroformed reinforced nickel sieve sheet shall be mounted in the frame without distortion, looseness, or wrinkling. The joint between the sieve cloth and the frame shall be made smooth with a material impervious to water.

~~3.2.~~4.2. *Spray Nozzle*—The spray nozzle (see Figure 1) shall be constructed of metal not subject to corrosion by water and shall be to 17.5 mm (0.69 in.) in inside diameter with a central hole drilled in line with the longitudinal axis, an intermediate row of eight holes drilled 6 mm (0.23 in.) center-to-center at an angle of 5 degrees from the longitudinal axis, and an outer row of eight holes drilled center-to-center at an angle of 10 degrees from the longitudinal axis. All holes shall be to 0.5 mm (0.02 in.) in diameter. The spray nozzle shall be checked at least every 6 months to ensure that the flow rate is between 1500 and 3000 g/min at 69 ± 3 kPa (10 ± 0.4 psi).

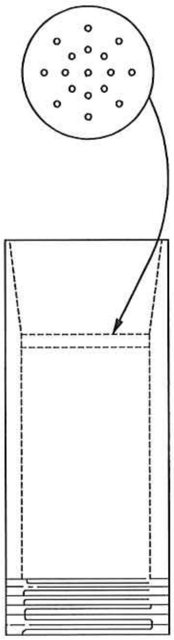

Figure 1—Spray Nozzle with Seventeen 0.51-mm (0.02-in.) Holes

3.3.4.3. *Pressure Gauge*—The pressure gauge shall be 76 mm (3 in.) minimum diameter, shall be graduated in 7 kPa (1 psi) increments, and shall have a maximum capacity of 207 kPa (30 psi). The accuracy at 69 kPa (10 psi) shall be ± 2 kPa (0.25 psi).

4.5. CALIBRATION OF 45-µM (NO. 325) SIEVES

4.1.5.1. Place 1.000 g of the current lot of National Institute of Standards and Technology standard sample No. 114 or No. 46h on the clean, dry, 45-µm (No. 325) sieve and proceed as in Section 56. The sieve correction factor is the difference between the test residue obtained and the assigned residue value indicated by the electroformed sheet sieve fineness specified for the standard sample, expressed as a percentage of the test residue (see Note 1 and Table 1).

Note 1—It should be observed that the sieve correction, as specified, is a factor to be multiplied by the residue obtained and that the amount to be added to or subtracted from the residue in any given test is therefore proportional to the amount of residue.

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Table 1—Example of Determination of Sieve Correction Factor

Residue on 45-µm (No. 325) sieve, Sample No. 114 or No. 46h	=	12.2%
Residue for a 1-g sample	=	0.122 g
Residue on sieve being calibrated	=	0.093 g

Difference	=	+ 0.029 g
Correction factor = 0.029/0.093 × 100 = +31.18	=	+31.2%

~~5.~~6. PROCEDURE

~~5.1.~~6.1. Place a 1.000-g sample of the cement on the clean, dry, 45-µm (No. 325) sieve. Wet the sample thoroughly with a gentle stream of water. Remove the sieve from under the nozzle and adjust the pressure on the spray nozzle to 69 ± 4 kPa (10 ± 0.5 psi). Return the sieve to its position under the nozzle and wash for 1 min, moving the sieve with a circular motion in a horizontal plane at the rate of one motion per second in the spray. The bottom of the spray nozzle should extend below the top of the sieve frame about 12 mm (0.5 in.). Immediately on removing the sieve from the spray, rinse once with about 50 cm^3 of distilled or deionized water, using caution not to lose any of the residue, and then blot the lower surface gently on a damp cloth. Dry the sieve and residue in an oven or over a hot plate (see Note 2), supporting the sieve in such a manner that air may pass freely beneath it. Cool the sieve, then brush the residue from the sieve and weigh on an analytical balance capable of reproducing results within 0.0005 g.

Note 2—Care should be taken not to heat the sieve hot enough to soften the solder.

~~6.~~7. CLEANING OF 45-µM (NO. 325) SIEVES

~~6.1.~~7.1. *Frequency of Cleaning and Calibration*—Sieves fitted with woven-wire sieve cloth shall be cleaned after no more than five determinations. Sieves fitted with an electroformed reinforced sieve sheet having 71 openings per linear centimeter shall be cleaned after no more than three determinations. Both types of sieves shall be recalibrated after no more than 100 determinations.

~~6.2.~~7.2. *Acceptable Cleaning Procedures*—One option for cleaning is to place the sieve in a low-power (150-W maximum power input) ultrasonic bath containing an appropriate laboratory cleaning solution. The bath is to be operated for sufficient time (approximately 10 to 15 min at room temperature) to remove particles lodged in the openings. Be apprised that electroformed sieve sheets containing more than 71 openings per linear centimeter may well be damaged by ultrasonic cleaning. An option for cleaning that does not require an ultrasonic bath can also be employed. Immerse the sieve in a bath of appropriate laboratory cleaning solution heated to just below boiling point. Cover with a watch glass to reduce evaporation. Continue this soaking for a time sufficient to loosen lodged particles with a rinse following the bath. Overnight soaking in similar but unheated cleaning solutions is also acceptable, provided a rinse following the bath is able to wash away lodged particles. Cleaning or rinsing with dilute hydrochloric or acetic acid solutions is to be avoided. Appropriate cleaning solutions are restricted to soap or detergent-type solutions.

~~7.~~8. CALCULATION

~~7.1.~~8.1. Calculate the fineness of the cement to the nearest 0.1 percent as follows:

$$R_c = R_s \times (100 + C) \quad (1)$$

$$F = 100 - R_c \quad (2)$$

where:

F = fineness of the cement expressed as the corrected percentage passing the 45-µm (No. 325) sieve;

R_c = corrected residue, percent;

R_s = residue from the sample retained on the 45-µm (No. 325) sieve, g; and

C = sieve correction factor (determined as prescribed in Section 4), which may be either plus or minus.

Table 2—Example of Determination of Sieve Correction Factor

Sieve correction factor, C	= +31.2%
Residue from sample being tested, R_s	= 0.088 g
Corrected residue, R_c	= 0.088 × (100 + 31.2)
	= 11.5%
Corrected amount passing, F	= 100 − 11.5%
	= 88.5%

~~8.~~9. PRECISION AND BIAS

~~8.1.~~9.1. *Normal-Fineness Product*—The multilaboratory precision has been found to be ±0.75 percent (1s) as defined in ASTM E177; therefore, results of properly conducted tests from two different laboratories on identical samples of cement should agree 95 percent of the time within ±2.1 percent.

~~8.2.~~9.2. *High-Fineness Product*—The multilaboratory precision has been found to be ±0.50 percent (1s) as defined in ASTM E177; therefore, results of properly conducted tests from two different laboratories on identical samples of cement should agree 95 percent of the time within ±1.4 percent.

Note 3—The use of outside threads instead of inside threads as shown in Figure 1 is permissible.

~~8.3.~~9.3. Because there is no accepted reference material suitable for determining the bias for the procedure in this test method, no statement on bias is being made.

~~9.~~10. KEYWORDS

~~9.1.~~10.1. Fineness of hydraulic cement.

Updated July 2018

Overview of NCHRP Research Programs for AASHTO Committees

Background

The National Cooperative Highway Research Program (NCHRP) was created in 1962 to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide. NCHRP is administered by the Transportation Research Board (TRB) and sponsored by the member departments of the American Association of State Highway Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA).

The State DOT's fund NCHRP on a voluntary basis through their Federal-Aid Highway apportionment of State Planning and Research (SPR) funds. Each state's contribution to the program amounts to 5 ½ percent of its SPR apportionment.

AASHTO committees provide NCHRP program selection committees with critical advice in deciding the direction of the research program and determining which projects should be funded. As such, research proposals submitted by AASHTO committees typically carry more weight with the selection committees than those submitted by individual departments. The members of the AASHTO committees can play a critical role in the development of a more effective transportation program by participating on research panels and representing the voice of their technical discipline.

The AASHTO Committee Role

Each AASHTO committee is responsible for preparing research proposals and reviewing ongoing research in their areas of expertise. The Chair of each committee must ensure that their research proposals are submitted by their deadline of each specific research program. Depending on the program, the group that decides which projects receive funding may be the AASHTO Special Committee on Research and Innovation (R&I) or an NCHRP panel that has been set up to review the proposals.

Panels of experts from public agencies, private industry, and academia direct the research projects that are funded, and panel members may be nominated from AASHTO committees and from individual State DOT's. The goal of each panel is to have a diverse group of knowledgeable person to guide the research and to ensure that the usable products are developed as a result.

There are several NCHRP research and implementation programs that are of interest to the AASHTO councils and committees:

- NCHRP Research Program
- Committee Support Program (NCHRP 20-123)
- Off-Cycle, Time-Sensitive Research Needs
- Implementation Program (NCHRP 20-44)
- Domestic Scan Program (NCHRP 20-68)
- Synthesis Program (NCHRP 20-05)
- Legal Problems Arising Out of Highway Programs (NCHRP 20-06)

These programs are discussed in more detail on the following pages.

NCHRP Research Programs

The National Cooperative Highway Research Program (NCHRP) in an applied, contract-research program that develops near-term, practical solutions to problems facing transportation agencies.

The AASHTO Special Committee on Research and Innovation (R&I) solicits research needs statements annually from three authorized sources:

1. CEO's of the AASHTO member transportation departments
2. Chairs of AASTHO committees and subcommittees
3. Federal Highway Administrator

When proposed research needs statements are received, evaluations are performed by FHWA and NCHRP. These evaluations are send to the submitters in mid-November, and submitters have until early December to comment on the evaluations or withdraw the proposed research needs statement. NCHRP also has evaluation panels for some of the more popular subject area, such as bridges, materials, and traffic and safety. In these cases, the collective thoughts of the panel are conveyed back to the submitter instead of the FHWA and NCHRP evaluations.

Submitters are strongly encouraged to do a literature search before submitting new research proposals to make sure the problem hasn't already been solved or in the process of being studied. TRB's Transportation Research International Documentation (TRID) database, which combines the records from TRB's Transportation Research Information Services (TRIS) Database and the OECD's Joint Transport Research Centre's International Transport Research Documentation (ITRD) Database, is available online at http://trid.trb.org/ and the Research in Progress database can be found at http://rip.trb.org/search/.

R&I meets annually in Spring to determine which new proposed needs statements should be programmed and which completed or ongoing projects should receive additional funding for further work, based on the available funding for the given fiscal year.

Starting in 2018, research proposals are due to TRB, nchrp@nas.edu, by **November 1.** TBR will not accept proposals after this date. On-time submissions are required to ensure that there is enough time to TRB, FHWA, and the AASHTO research committees to conduct appropriate reviews after they are submitted.

- NCHRP web site: http://www.trb.org/crp/nchrp.asp
- Full list of funded NCHRP projects: http://www.trb.org/CRP/NCHRP/NCHRPProjects.asp
- Hints on preparing research needs statements: http://www.trb.org/ResearchFunding/AppendixAWritingaResearchStatement.aspx

Committee Support Program (NCHRP Project 20-123) – *NEW*

$1.5 million per year is available to help committees and councils conduct their business, such as developing research agenda/roadmaps, holding workshops and peer exchanges, conducting strategic planning, and preparing scoping studies for and/or incorporating NCHRP research results into updates of technical documents. These funds are not for research; research should come through the other programs. This new program will be overseen by a panel of cross-discipline AASHTO members, which is being established now, along with the business processes for the program.

- Submit proposals to: TBD
- Deadline: TBD

Off-Cycle, Time-Sensitive Research Needs

$2.0 million per year is available for off-cycle, time-sensitive research requests, which can be submitted at any time during the year and will be reviewed and responded to by the Special Committee on Research and Innovation on a rolling basis. The urgency of the need should be explained in the research proposal.

- Submit proposals to: Lori Sundstrom at lsundstrom@nas.edu
- Deadline: No due day, proposals reviewed on an on-going basis

Implementation Program (NCHRP Project 20-44)

"Accelerating the Application of NCHRP Research": $2.0 million per year is available for implementation activities related to NCHRP research projects. These funds can be requested by an NCHRP panel, state DOT, or AASHTO committee or council to support dissemination and implementation of NCHRP research results. Please see: http://www.trb.org/nchrp/nchrpimplementationsupportprogram.aspx.

AASHTO Domestic Scan Program (NCHRP Project 20-68)

The Domestic Scan Program is similar to the International Scan Program except that the tour covers sites in the US, or may consist of a workshop, seminar, peer exchange, or webinar that brings participants to a central location. Topics are selected by the NCHHRP 20-68 project panel based on the following criteria:

- interest to a broad national spectrum of people and agencies
- complexity and hands on topics that lend themselves to exploration by on-site visits
- limit in focus to a few key item/issues due to the limited time available on the tour
- non-redundant to previous or ongoing research or work
- variety that will appeal to a broad constituency across functional areas

State DOT's and AASHTO committees are solicited each year.

- Submit proposals at: http://web.transportation.org/nchrp/20-68A/
- Deadline: Scan proposals are due to AASHTO headquarters in the **fall** of each year; see the web site for the specific date: http://web.transportation.org/nchrp/20-68A/Blank.aspx

Synthesis Program (NCHRP Project 20-05)

NCHRP Project 20-05, *Synthesis of Information Related to Highway Problems*, searches out and synthesizes useful knowledge from all available sources and prepares concise reports on specific topics. These reports provide current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report provides a compendium of the best knowledge available on those measure that have been found to be the most successful in resolving specific problems.

Projects in this program are selected on the basis of:

- addressing problems that are widespread enough to generate broad interest

- timeliness and criticality with respect to safety, economic, or social impact
- appropriateness if current practice is non-uniform or inconsistent from agency to agency, or it the validity of some practices appears to be questionable
- quality and quantity of useful available information, indicative of the need to organize and compress that which has already been learned and written on the topic
- non-redundant to previous or ongoing research and work that might render the results to be obsolete

The Synthesis Program web site is: http://www.trb.org/SynthesisPrograms/SynthesesNCHRP.aspx. The TRB staff person is Jo-Allen Gause, and proposals are due to TRB as follows:

- Submit proposals at: http://www.trb.org/SynthesisPrograms/SynthesisProposalForm.aspx
- Deadline: January 31 each year

Legal Problems Arising Out of Highway Programs (NCHRP Project 20-06)

A major and continuing need of state highway and transportation departments involves assembling, analyzing, and evaluation operating practices, administrative procedures, and legal issues associated with highway and transportation projects. Individual state legal experiences can be compared and made available for possible wider application. Research to identify and evaluate legal options facilitates the handing of both immediate and long-range needs of engineering, planning, and administrative aspects of transportation programs.

NCHRP Project 20-06 was established in 1968 and is a continuing project under the direction of the TRB staff Counsel for Legal Research. Numerous legal and right of way problems affecting the operations and the services and facilities provided by the state transportation agencies have been researched since the beginning of the project. Results are made available to state transportation departments and other public and private agencies through publication of Legal Research Digests and Selected Studies in Transportation Law (SSTL). See: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=508

- Submit proposals to: Gwen Chisolm-Smith, gsmith@nas.edu

Joint AASHTO–ASTM Task Group on Harmonization of Cement Specifications C150/M 85, C595/M 240, C465/M 327

AASHTO TS 3a Report
August 2018

Mission

To evaluate existing provisions of AASHTO and ASTM hydraulic cement standards, and to develop recommendations for improvements to these standards, such that they better meet the collective needs of AASHTO members and ASTM user, general interest, and producer members.

Task Group Participants

Name/*Organization*	Name/*Organization*
Andy Naranjo, Cochairman *Texas DOT*	Justin Morris *Louisiana DOTD*
Jim Pierce, Cochairman *Bureau of Reclamation (Ret)*	Toy Poole *CTLGroup*
Dale Deford (Jose Armenteros) *Florida DOT*	Don Streeter *New York DOT*
Doug Hooton *University of Toronto*	Larry Sutter *Michigan Tech*
Al Innis *LafargeHolcim*	Paul Tennis *PCA*
James Krstulovich *Illinois DOT*	Brett Trautman *Missouri DOT*
Colin Lobo *NRMCA*	Steve Wilcox *Argos USA*
John Melander *Consultant*	

John Staton, Michigan DOT, Chair TS 3a

Current Activities

- Recent items passed and included in 2018 editions of ASTM standards
  - C150/M85 Remove reference to C186
  - C150/M85 Revise chloride content language
  - C595/M240 Report alkali content of natural pozzolan
  - C595/M240 New note on ASR in Section 4.3
  - C595/M240 Revise Type MS & HS strength limits
  - C595/M240 Delete Type LH drying shrinkage requirement
  - C465/M327 move Note 1 into body of standard

Additionally, Note 6 of M 240 was revised to be consistent with C595 Note 6

Current Activities – Status of C150/M 85 Items to ASTM & AASHTO

Description	ASTM Ballot Status	AASHTO Ballot Status
Report Na_2Oeq & remove low-alkali option	C01(18-02) Item 1 (concurrent with C01.10) Passed – 2 neg to resolve	TS 3a(18-01) Item 1 Passed – No neg Scheduled for Fall 2018 COMP Ballot
Revise Type II(MH) HOH limits	C01.10(17-03) Item 2 Passed – 1 neg to resolve	TS 3a(18-01) Item 2 Passed – No neg Scheduled for Fall 2018 COMP Ballot
Remove reference to Wagner Turbidimeter	Scheduled for C01.10 & C01 concurrent Ballot after June meeting	TS 3a(18-01) Item 6 Passed – No neg Scheduled for Fall 2018 COMP Ballot
Revise Appendix Fig X1.1	Scheduled for C01.10 & C01 concurrent Ballot after June meeting	TS 3a(18-01) Item 7 Passed – No neg Scheduled for Fall 2018 COMP Ballot

Current Activities – Status of C595/M 240 Items to ASTM & AASHTO

Description	ASTM Ballot Status	AASHTO Ballot Status
Complete removal of option R provisions	C01(18-02) Item 2 Passed – No neg	TS 3a(18-01) Item 3 Passed – No neg Scheduled for Fall 2018 COMP Ballot
Remove pozzolan alkali-reactivity requirement	C01(18-02) Item 3 Passed – No neg	TS 3a(18-01) Item 5 Passed – No neg Scheduled for Fall 2018 COMP Ballot
Replace MH and LH C186 HoH limits with C1702 limits	C01.10(17-03) Item 3 Passed – 1 neg to resolve	TS 3a(18-01) Item 4 Passed – No neg Scheduled for Fall 2018 COMP Ballot

Future Business

- AASHTO M 85 & ASTM C150
  - Direct determination of phases
- AASHTO M 240 & ASTM C595
  - Chloride content reporting
  - Refinements to Table 3 footnote on C1012 tests
  - Density and relative density
- C465/M 327
  - Inorganic processing additions fineness limits

Questions ?

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

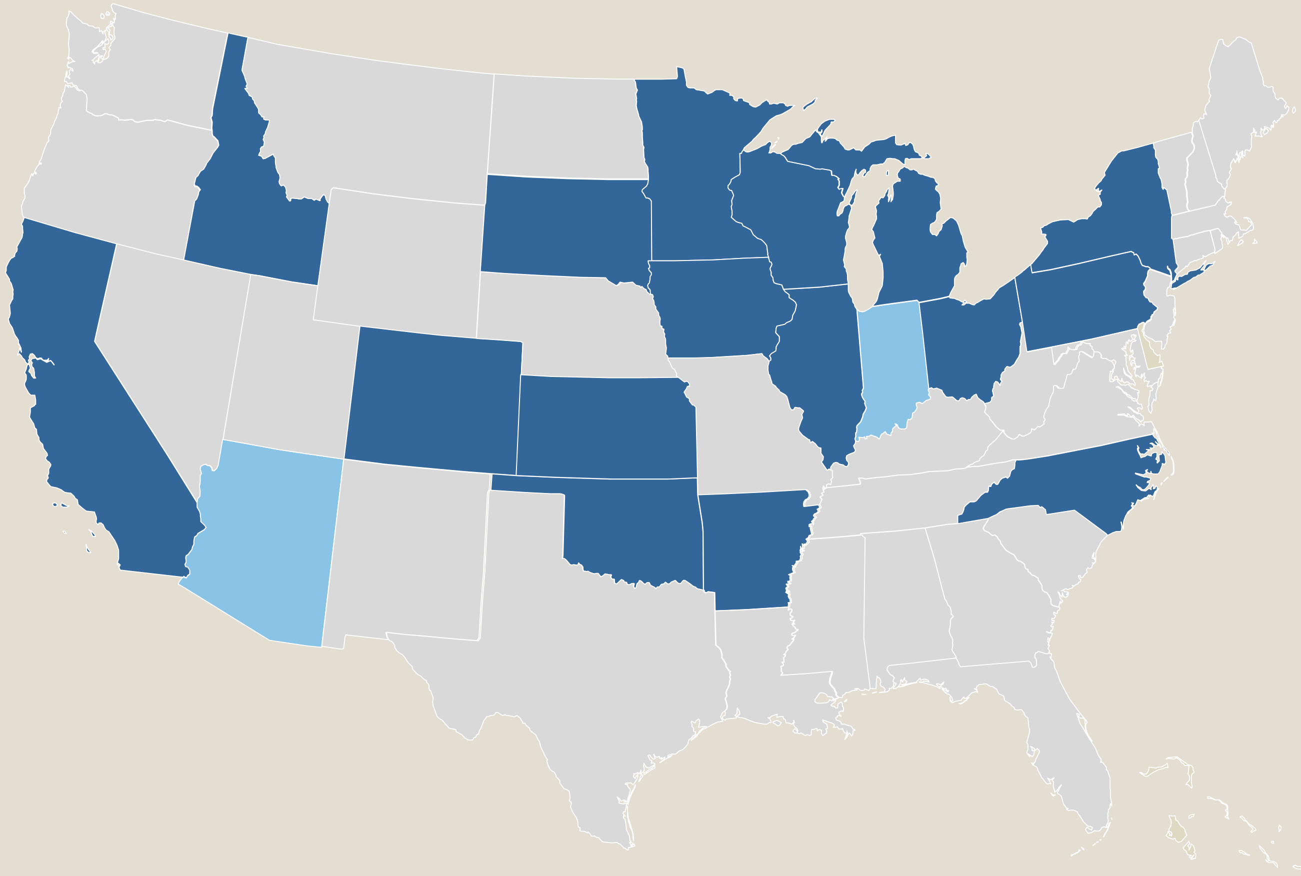
All images FHWA unless otherwise noted

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

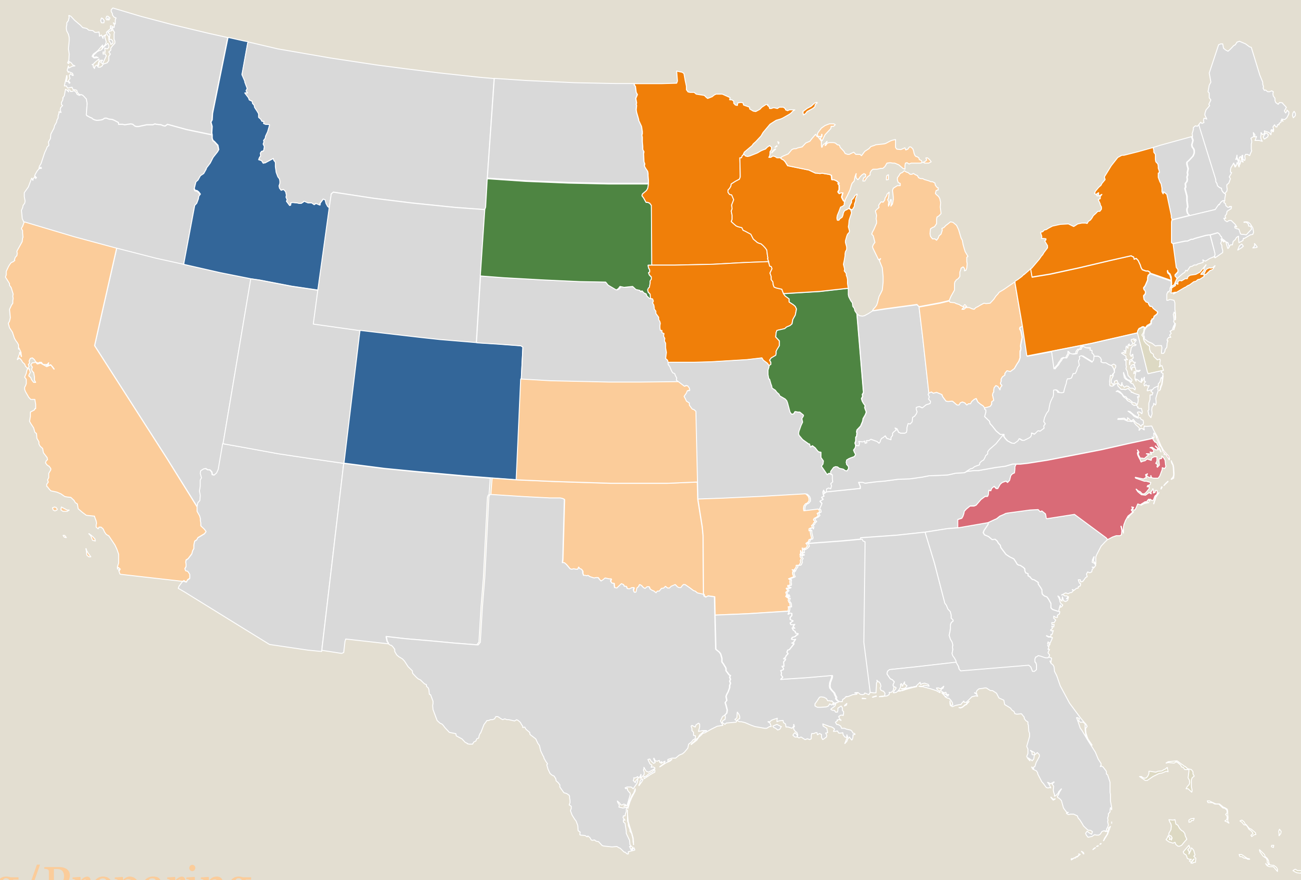
- Available to pooled fund participating states
- $40,000 for two or more new tests in the mix design/approval process (shadow testing acceptable)
- $20,000 for one or more new tests in the acceptance process (shadow testing acceptable)
- $20,000 for requiring an "enhanced" QC Plan from the contractor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


END OF THE ROAD
MILE 92.5
DENALI NATIONAL
PARK AND PRESERVE

Questions?

Image Pixabay

- Contact info

Michael.Praul@dot.gov

207-512-4917

Proposal on AASHTO M 327/ ASTM C465

TS 3a Meeting August 7, 2018

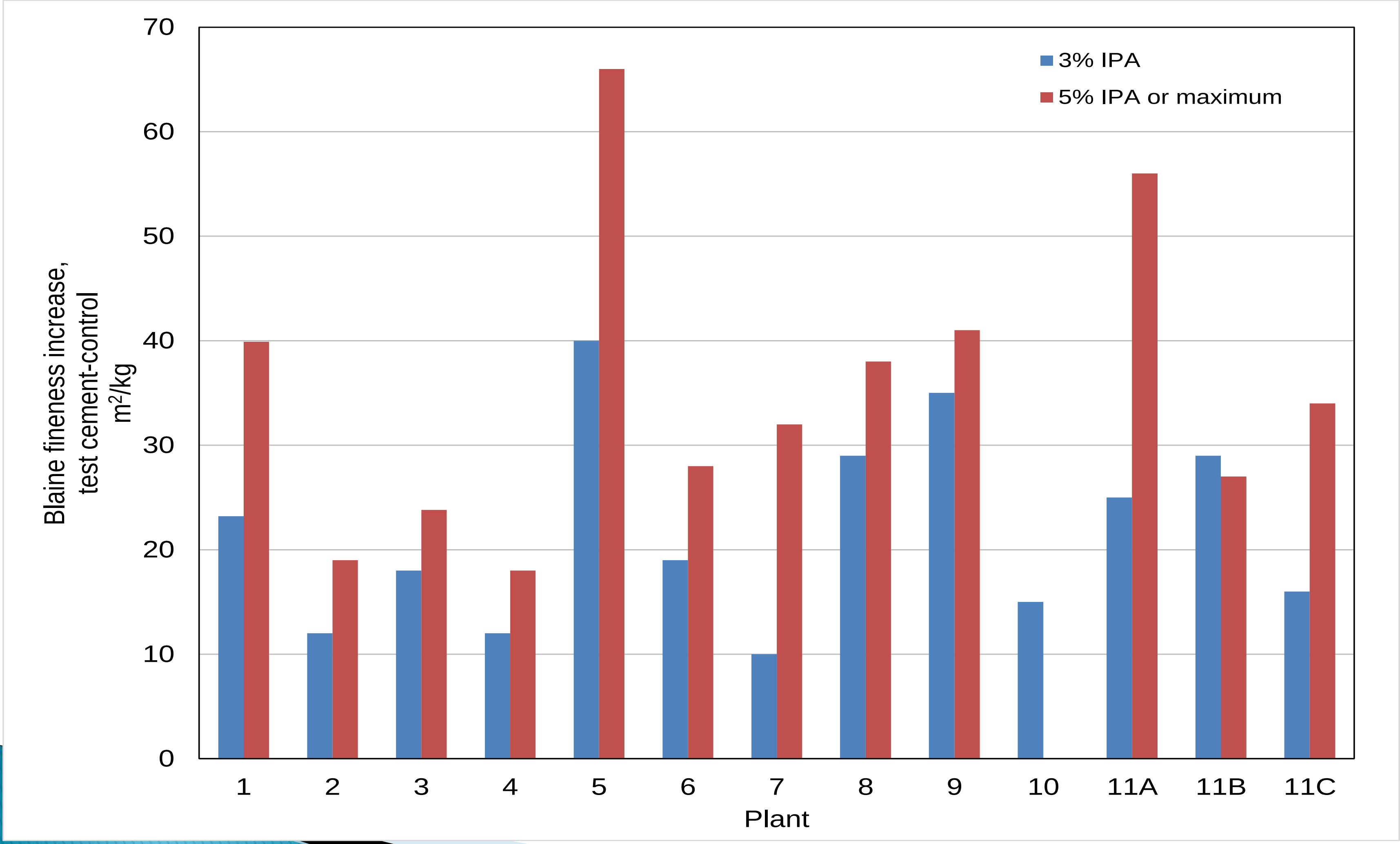
AASHTO M 327/ASTM C465 Provisions on Blaine

- 3.1.6 The two companion cements to be made from any one clinker shall be ground to the same fineness within 13 m^2/kg

The Issue

- Some inorganic processing additions (IPAs) have finenesses 800 – 1000 m^2/kg
- Introducing even 3% of some IPAs raises the Blaine by ~ 22 m^2/kg on average

Data



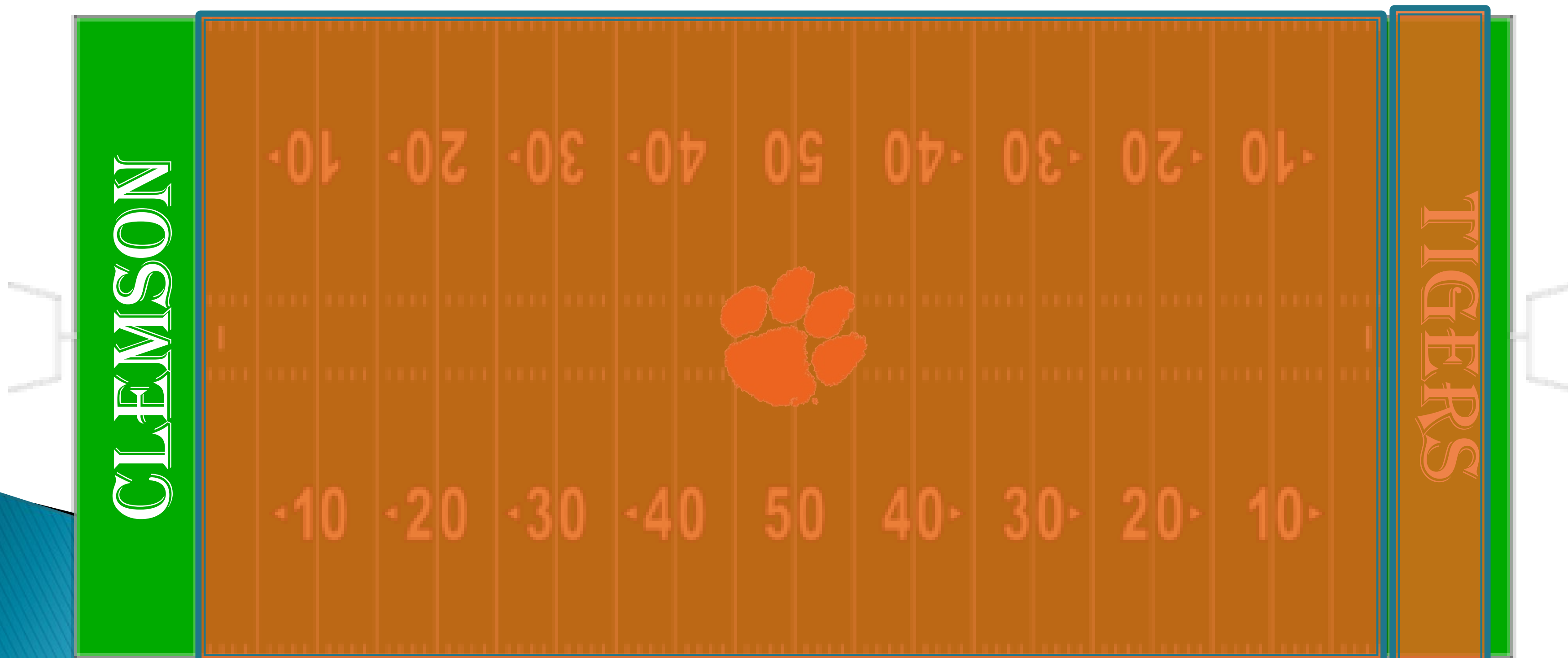
70
60
50
40
30
20
10
0
3% IPA
5% IPA or maximum
Blaine fineness increase, test cement-control m2/kg
1
2
3
4
5
6
7
8
9
10
11A
11B
11C
Plant

The Proposal

- When IPA $< 2\%$, fineness within 13 m^2/kg
- When IPA $\geq 2\%$ fineness within 32 m^2/kg

Fineness

- Football field: 5330 yd^2 or 4457 m^2
- 400 m^2/kg:
  - About 25 lb cement ≈ goal line to goal line
    - 32 m^2/kg: 80% of one endzone



Other C465/M 327 Provisions

- Other provisions of C465/M 327 *not* proposed for change
  - Cement
    - NC, setting, AET, SO_3 content
  - Mortar
    - Strength, AEA dosage, drying shrinkage
  - Concrete
    - Compressive and flexural strength

Other C465/M 327 Provisions

Difference from Control	Plant A		Plant B		Plant C		Plant D		Average		Limit
	3%	Max or 5%	3%	Max or 5%	3%	Max or 5%	3%	Max or 5%	3%	Max or 5%	
Blaine (m^2/kg)	11	20	12	15	9	27	10	43	10.5	26.3	<13
NC (%)	0	0.3	0	0.7	0	0.3	−0.2	0.1	−0.1	0.4	<1.0
VIS (mins)	−8	15	5	10	−5	−5	55	10	12	8	<60
VFS (mins)	−1	9	0	5	−5	−5	75	0	17	2	<60
Grand average Strengths	93	98	102	101	101	100	103	102	100	100	>95

Next Steps

- Discussed by JAAHTG
- Revisions incorporated
- Recommended for consideration

- Ballot?