



Harmonization

Changes to
ASTM C 150 and AASHTO M 85

TTCC/NCC Fall Meeting

Harmony (by definition)

- Agreement, accord, tranquility

i.e., life is best when our desires are in harmony with those of our neighbors



Harmonization Goal

Have Consistent Requirements that Meet Collective Needs

1. Ensure concrete performance
2. Provide means of measuring compliance
3. Provide consistent material
4. Use simple reliable testing and sampling methods
5. Provide flexibility for optimization of available natural resources and manufacturing technology and accommodate various user requirements
6. Ensure understandable communication between buyer and seller

Who?

Harmonization Task Group

AASHTO

Don Streeter, NYDOT
Co-Chair

Mike Bergin, FLDOT

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Todd Tracy, INDOT

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ASTM

Jim Pierce, Bu-Rec
Co-Chair

Al Innis, Holcim (US) Inc.

Colin Lobo, NRMCA

John Melander, PCA

Doug Hooton, U. Toronto

Toy Poole, USACE



Why did it work?

- Agreed upon a goal
- Trust among the members
- Technical data was used to make decisions
- Each side respected the needs of others

AASHTO-ASTM Harmonization Summary

Provision	AASHTO M 85-04	ASTM C 150-04a	AASHTO M 85-09 ASTM C 150-09
Max Fineness (Blaine): Single Sample Average of 5	420 [I, II, IV, V] 400 [I, II, IV, V]	No Limit No Limit	430 [II(MH)*, IV] None
Type II Max. C ₃ S	58	No Limit	Type II(MH) 4.75 C ₃ A + C ₃ S ≤ 100
Processing Additions Max.	1%	No Prescriptive Limit	Organic ≤ 1% Inorganic ≤ 5%
Use of Limestone	Not permitted	Up to 5%	Up to 5%, modified Section 5
Type II Min. SiO ₂	20%	No Limit	No Limit
Table I Footnote D	Ambiguous	Ambiguous	Improved Clarity

*Exemption for low heat index Type II(MH) 4.75 C₃A + C₃S ≤ 90

Fundamentals

What changed?

Portland cement is:

→ Clinker

→ Gypsum

Up to 5% limestone

Up to 5% processing addition

What did not change?

→ No change in chemical requirements

→ No change in physical requirements

Two Type II Cements

○ New Type II (MH)

Moderate heat and sulfate resistance

- Maximum Blaine – $430\text{M}^2/\text{Kg}$
- Heat Index – $\text{C}_3\text{S} + 4.75 \text{C}_3\text{A} \leq 100$
- C_3A – maximum 8%

○ Type II

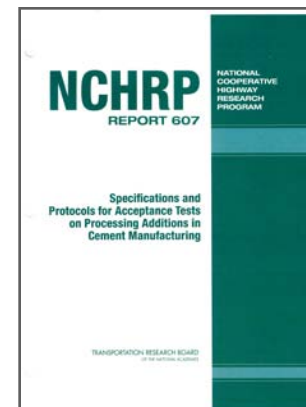
Moderate sulfate resistance

- No Blaine maximum or heat index
- C_3A – maximum 8%

Processing Additions

- Previously
 - AASHTO limited to 1%
 - ASTM had no limit
 - Both required ASTM C 465 certification testing
 - No distinction between organic and inorganic additions

➔ NCHRP Research Report 607



Processing Additions

Now

- ASTM C 465 revised to include requirements for *Inorganic* (IPA) and *Organic* (OPA) Processing Additions
- AASHTO M 327 adopted with identical requirements to C 465
- ASTM C 150 and AASHTO M 85 limits
 - OPAs: up to 1% by mass and qualify
 - IPAs: up to 5% by mass and qualify if > 1%
 - No more than one IPA used

Processing Additions

- New mandatory reporting requirements
 - Inorganic processing addition major oxides
 - CaO , SiO_2 , Al_2O_3 , Fe_2O_3 , SO_3
 - Amount of processing addition
 - Bogue phase composition adjusted for processing addition and limestone
- New recommended reporting
 - Type of processing addition
 - Base cement Bogue phase composition
- Continue to report limestone amount used, CO_2 content of limestone, and CaCO_3 of limestone

ASTM C 465 / AASHTO M 327

- Both organic (OPA) and inorganic processing additions (IPA) required to meet ASTM C 465 / AASHTO M 327
 - IPA qualifies at each plant;
OPA can be qualified 'globally'
- Qualification consists of testing cements with processing addition compared to a control
 - Normal consistency, time of setting, autoclave expansion
 - Mortar compressive strength, drying shrinkage, AEA content
 - Concrete compressive and flexural strength

Processing Additions

- Bogue phase composition
 - Base cement is clinker and calcium sulfate
 - Calculate Bogue using base cement chemistry and traditional Bogue equations (no limestone correction)
 - Calculate and report adjusted Bogue composition
 - Limestone and processing additions correction

Processing Additions

- Example adjusted Bogue:
 - Base cement C_3S is 65% by mass
 - 3.5% limestone used
 - 4% slag
 - Reported C_3S content is:
 - $65\% \times (1.0 - 0.035 - 0.040) = 60\%$
- Repeat for C_2S , C_3A , C_4AF

New Business

- New method to measure heat of hydration
 - A better way of addressing Bogue composition
- ➔ Your input



Questions?
