Updates on Cementitious Material Specifications

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What's new?

Not New – AASHTO/ASTM Harmonization

Materials	Specifications	Harmonized
Portland Cement	AASHTO M 85, ASTM C150	YES
Blended Cement	**AASHTO M 240, ASTM C595**	***NO***
Coal Ash	AASHTO M 295, ASTM C618	YES
Slag Cement	AASHTO M 302, ASTM C989	YES
Natural Pozzolans	**AASHTO M 359**, ASTM C1945	YES
Silica Fume	AASHTO M 307, ASTM C1240	in progress
SCM Performance	**AASHTO M 363**, ASTM C1912	YES

Current initiatives for AASHTO & ASTM Specifications

- Performance specification for SCMs – a.k.a. "The AASHTO/ASTM Pilot"
- Natural pozzolan specifications
- Changes to the blended cement specifications

Performance Specification ASTM C1912 (AASHTO M 363)

- ASTM C1912 *Standard Specification for Supplementary Cementitious Material for Use in Concrete*
- **AASHTO Equivalent – AASHTO M 363M/M 363** *published August 2026*
- A new pathway to specify emerging materials and off-spec conventional materials
- Uses new standard tests for reactivity and for foam index
- No limits on composition or scope limitations on the origin of material – measure and report key material properties

Performance Specification ASTM C1912 (AASHTO M 363)

- **"The AASHTO/ASTM Pilot"**
  - First standard (recently) to be developed in one organization and shared with the other
  - Process is for AASHTO COMP, or ASTM C01 or C09, to identify standards to be in common – one side develops a draft
  - With approval by applicable technical committees *AND* the AASHTO/ASTM staff leadership, a standard can move between organizations
  - Each organization approves the document through their process
  - Differences reconciled through harmonization

Standard Specifications for Natural Pozzolans

- ASTM C1945 *Standard Specification for Natural Pozzolan for Use in Concrete*
- **AASHTO Equivalent – AASHTO M 359** *published August 2026*
- Covers all natural pozzolans, raw or activated, including calcined materials
- Intent is to eventually delete Class N from AASHTO M 295 (ASTM C618) making those standards coal ash only
- Includes tests not used in AASHTO M 295 (ASTM C618)

Standard Specifications for Natural Pozzolans

- AASHTO M 359 (ASTM C1945) Compared to AASHTO M 295 (ASTM C618)
  - Chemical requirements – SO_3 increased to 5.0% to match coal ash
  - LOI - Report only
- Added New Tests
  - ASTM C1897 – Method A – Heat of Hydration - Report only
  - ASTM C1897 – Method B – Bound Water
    - Limit at 7-days, min 3.6 g/100g dry SCM
- Balloting to drop "raw and calcined" from title (i.e., all natural pozzolans) and to include mechano-chemical processed SCMs
- Balloting to include ASTM C1952 bulk resistivity

Raw or Calcined or Not? Still a Natural Pozzolan.

calcined, *adj—heated to a temperature less than the melting point so as to bring about a decomposition, phase transition, or removal of a volatile fraction of a solid material. (ASTM C125)*

5. Materials and Manufacture

5.1 It is permitted to process natural pozzolans or their precursors to meet the requirements of this specification.

- NOTE 1—Processing may include, but is not limited to, one or more of the following ~~unit~~ operations: grinding, drying, sieving, de-agglomeration, ~~and~~ sizing, and by thermal methods, chemical, or mechanical-chemical methods.

New Standard Tests – Resistivity (Permeability)

- Historically, SCM specifications have focused on strength as the key performance measure
- SCMs are most often used for improving durability including ASR mitigation and improving sulfate resistance
- Durability improvements are linked in part to reducing permeability
- ASTM C311 includes test methods for the effectiveness of an SCM in controlling ASR or contributing to sulfate resistance
  - The ASTM C311 ASR test is depreciated and not cited in ASTM specifications
  - Measuring the material properties impacting ASR in concrete is more useful

New Standard Tests – Resistivity (Permeability)

- ASTM C1952 *Standard Test Method for Determination of Bulk Resistivity Index of Mortar Cubes using Bulk Electrical Resistivity Measurements*

  - Bulk electrical resistivity is used as an indicator of pore size, volume, distribution, and connectivity – *higher resistivity indicates lower permeability*

  - Test performed on the same mortar cube specimen used for SAI

  - The bulk resistivity index is the ratio of resistivities measured on the test and control specimens, respectively, expressed as a percentage

  - Being balloted currently (2026) for inclusion in ASTM SCM specifications

Changes to AASHTO M 240/ASTM C595 *to be published August 2026*

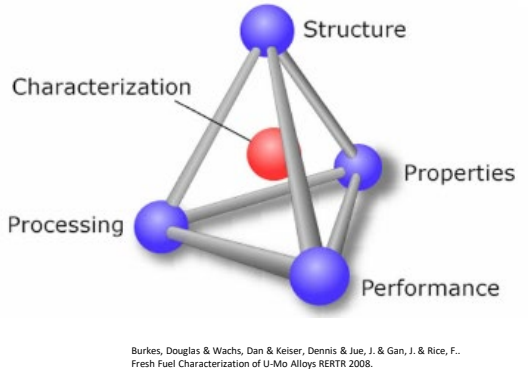
- **ASTM approved changes to Types IT, IP, and IS**
- **Changes permit up to 15% limestone in those blend types**
- **These changes have also been approved by AASHTO**
- Limestone now IS **NOT** counted as one of the blending ingredients
- Examples: IT(L10)(S30)(P15); IP(P30)(L10)
  - IT(L10)(S30)(P15) comprises portland cement plus 10% limestone + 30% slag + 15% pozzolan
    - i.e., 45% portland or ~ 42% clinker
  - IP(P30)(L10) comprises portland cement plus 10% limestone + 30% pozzolan – used to be a IT(P30)(L10)

Changes to ASTM C595

Designation: C595/C595M – 24

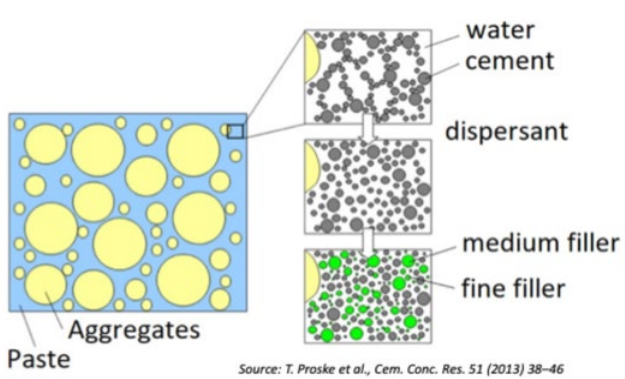
Standard Specification for Blended Hydraulic Cements

- ***Even with updates to Type IT, LC3 and HFLW blends are still limited***
- For the blended hydraulic cement specification, a new **Type IC** has been approved by ASTM
- **Maximum 70% pozzolan + slag + limestone; balance is portland cement or clinker**
- **30% maximum limestone**
- Can blend in any combination: limestone, pozzolan (e.g., coal ash, natural pozzolan, silica fume) or slag cement



Burkes, Douglas & Wachs, Dan & Keiser, Dennis & Jue, J. & Gan, J. & Rice, F.. Fresh Fuel Characterization of U-Mo Alloys RERTR 2008.

High-Filler Low-Water (HFLW)



Source: T. Proske et al., Cem. Conc. Res. 51 (2013) 38–46

Limestone Calcined Clay Cement LC3

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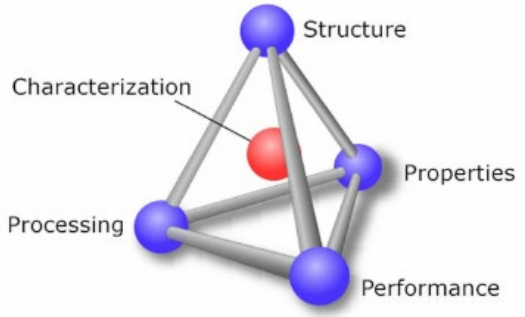
Changes to ASTM C595

Designation: C595/C595M – 24

Standard Specification for Blended Hydraulic Cements

- **<u>Must meet all other applicable requirements of the specification</u>**
- Type IC will directly support development of LC^3 or HFLW blends as part of existing blended cement specifications
- Not approved by AASHTO
- ASTM C595 is currently NOT harmonized with AASHTO M 240 based on rejection of Type IC
- **ASTM will publish Type IC in August**



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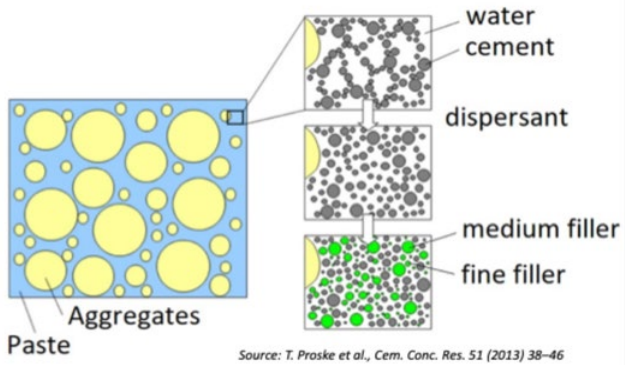

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Limestone Calcined Clay Cement LC^3

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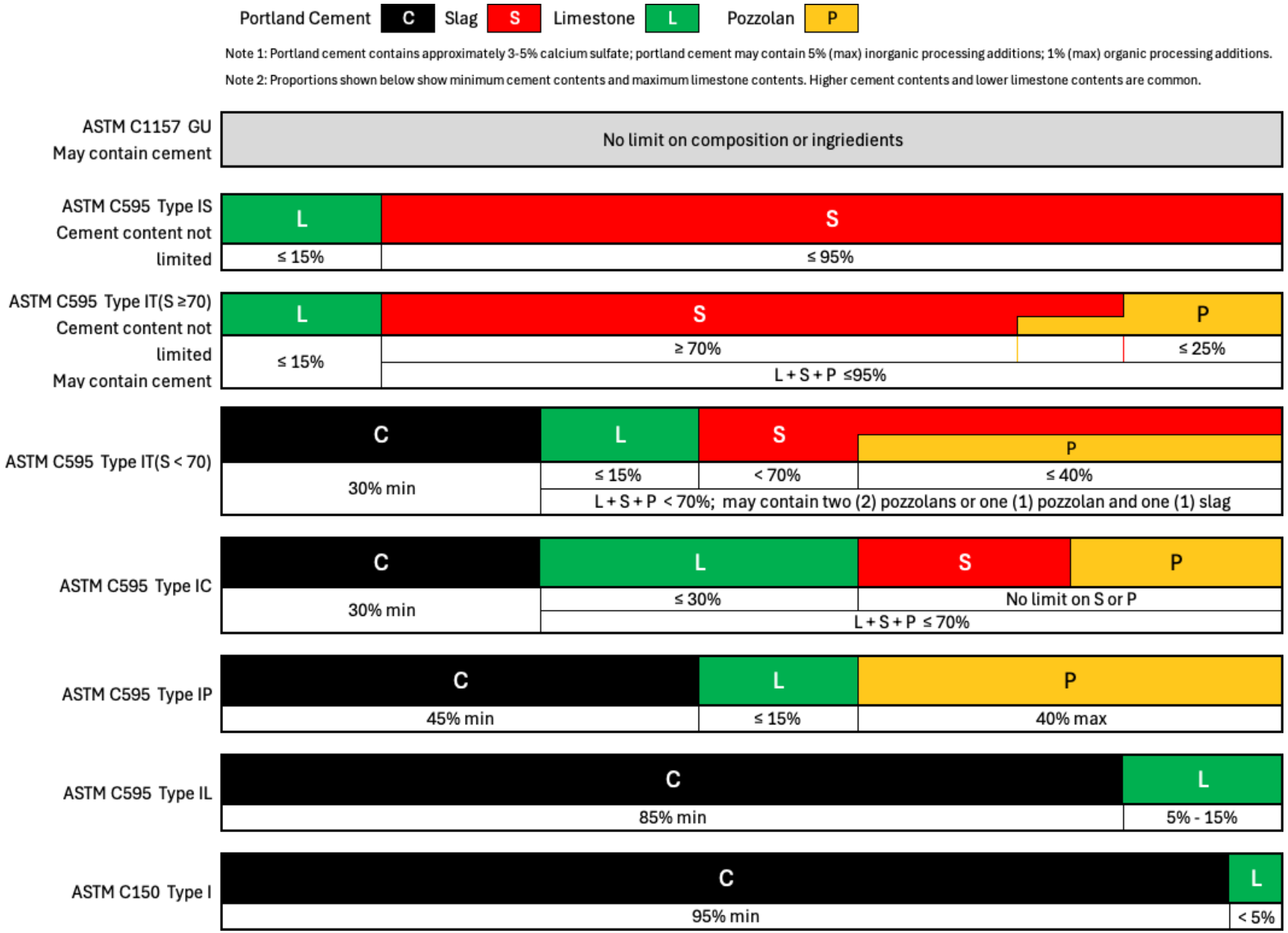
Comparison of Common GU Cement Types (includes changes to be published in 2026)



All blends must meet LOI requirements and depending on the blend type additional chemical requirements such as MgO, sulfate, sulfide, and insoluble residue contents.

All blends must meet prescribed physical requirements depending on the blend type.

Blends shown by color bars are one possible blend meeting limits prescribed for each blend type and are chosen to illustrate minimum portland cement contents and maximum limestone contents for each blend type.

Source: L. Sutter

Closing Thoughts

- Significant progress has been made at AASHTO and ASTM
- There is currently a specification path for practically every known material; additional standards may evolve e (e.g., organic-based cements)
- Harmonization has bridged most gaps between AASHTO and ASTM
- Will work towards harmonization of AASHTO M 240 and ASTM C595
- Field experience will hopefully sway opinion
- Demonstrations of new materials is critical for success

Questions?

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