

WHAT ARE BLENDED CEMENTS?

ACI 116, Cement and Concrete Terminology¹, defines blended cements as hydraulic cements "consisting essentially of an intimate and uniform blend" of a number of different constituent materials. They are produced by "intergrinding portland cement clinker with the other materials or by blending portland cement with the other materials or a combination of intergrinding and blending."



IS blended cement (33 percent slag content) was used to produce a noticeably lighter concrete masonry unit on the right.

Blended cement containing slag cement is most commonly specified under ASTM C595, Type IS or Type I (SM).

HOW IS SLAG CEMENT USED IN BLENDED CEMENTS?

Slag cement can be used to produce blended cement that complies with ASTM C595, Standard Specification for Blended Hydraulic Cements². Type I (SM), or slag-modified portland cement, contains less than 25 percent slag by mass of the finished cement. Type IS, portland blast-furnace slag cement, contains between 25 and 70 percent slag by mass of the finished cement. These cements are often produced by blending the pre-ground constituents at the cement plant, or in terminals equipped with blending equipment.

Blended cements produced by intergrinding of the constituent materials use granulated blast-furnace slag, the glassy granular material that results in slag cement when ground to a fine powder. Slag granules are added to the grinding mill along with portland cement clinker and the materials are ground simultaneously.

Slag cement can also be used as a constituent in hydraulic cements produced under ASTM C1157, Standard Performance Specification for Hydraulic Cement³.

Blended cement may allow a concrete producer to take advantage of benefits of slag cement despite storage constraints.

WHAT ARE THE BENEFITS OF BLENDED CEMENTS?

Blended cements can be produced to provide the benefits in performance that are also available when slag cement is used as a separate component of the concrete mix. By varying the proportions of the blend, attributes such as sulfate resistance and resistance to alkali silica reaction can be attained with blended cement. A blend designed for a specific project requirement can also be produced. For concrete producers, blended cement may allow them to take advantage of the benefits of slag cement despite storage constraints.

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CAN OTHER MATERIALS BE USED WITH BLENDED CEMENTS?

Concrete can be produced with blended cement containing slag plus other cementitious materials (most commonly fly ash or silica fume) added at the batch plant. These are considered ternary systems. Ternary systems can be designed to attain performance characteristics that may be difficult to achieve in a binary system.



Airport paving at Spirit of St. Louis Airport in Chesterfield, MO, placed with blended cement (Type 1 (SM)) and Class C Fly Ash added separately.

HOW ARE THE CEMENTS BLENDED?

There are a number of systems that are used to make blended cements. Some systems are capable of "on-demand" blending, while others may blend the materials in a fixed percentage into a storage silo. All of the systems meter the constituent products in the desired proportions, and then blend them to a uniform mixture. In most cases proportions can be adjusted to produce blends that optimize the desired properties in concrete.

As with all concrete mixtures, trial batches should be performed to verify concrete properties. Results may vary due to a variety of circumstances, including temperature and mixture components, among other things. You should consult your slag cement professional for assistance. Nothing contained herein shall be considered or construed as a warranty or guarantee, either expressed or implied, including any warranty of fitness for a particular purpose.

References

1. ACI 116R-00, Cement and Concrete Terminology, American Concrete Institute, Farmington Hills, Michigan, 2000.
2. ASTM C595-03, Standard Specification for Blended Hydraulic Cements, American Society for Testing and Materials, West Conshohocken, PA, 2003.
3. ASTM C1157-02, Standard Performance Specification for Hydraulic Cement, American Society for Testing and Materials, West Conshohocken, PA, 2003.

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About the Slag Cement Association...

The Slag Cement Association is the leading source of knowledge on blast-furnace slag-based cementitious products. We promote the increased use and acceptance of these products by coordinating the resources of member companies. We educate customers, specifiers and other end-users on the varied attributes, benefits and uses of these products.



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