Suggested Specifications for Slag Cement in Concrete

Slag cement is a raw material that is used in a wide variety of commercial and architectural concrete construction applications. This information sheet is intended to provide guidance to specifiers in the absence of slag cement specifications, or for the addition of slag cement to an existing specification.

Slag cement should be used as a pound for pound replacement for a portion of the portland cement in a concrete mixture. Depending on the desired properties or application, various replacement levels can be used. Table 1 lists suggested replacement levels for a variety of common applications.

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.

As with all concrete mixtures, trial batches should be performed to verify concrete properties.

Slag cement should be used as a pound for pound replacement for portland cement in a concrete mixture.

Table 1: Suggested Slag Cement Replacement Levels

Concrete Application	Slag Cement
Concrete paving	25-50%
Exterior flatwork not exposed to deicer salts	25-50%
Exterior flatwork exposed to deicer salts with w/cm ? 0.45	25-50%
Interior flatwork	25-50%
Basement floors	25-50%
Footings	30-65%
Walls & columns	25-50%
Tilt-up panels	25-50%
Pre-stressed concrete	20-50%
Pre-cast concrete	20-50%
Concrete blocks	20-50%
Concrete pavers	20-50%
High strength	25-50%
ASR mitigation	25-70%
Sulfate resistance	
Type II equivalence	25-50%
Type V equivalence	50-65%
Lower permeability	25-65%
Mass concrete	50-80%

Percentages indicate replacement for portland cement by mass. These replacement rates are recommended for individual applications and are based on historical performance. Variations in material sources and environmental conditions may require alternate substitution rates. Consult your slag cement supplier for additional assistance.

For General Use

Cementitious Materials

1. Portland cement shall conform to the requirements in ASTM C-150[1] or ASTM C-1157[2].
2. Slag cement shall conform to the requirements in ASTM C-989[3].
3. Blended cement shall conform to the requirements in ASTM C-595[4].
4. Pozzolans shall conform to the requirements in ASTM C-618[5].
5. Silica fume shall conform to the requirements in ASTM C-1240[6].
6. The water-cementitious materials ratio (W/CM) shall be calculated by dividing the weight of water by the weight of portland cement, plus slag cement plus pozzlans.

Suggested Specifications

For Special Exposures and Applications

Exposure to Sulfates

1. For moderate exposure where ASTM C150, Type II cement is required, a Type I with 25 to 50 percent slag cement (by mass of cementitious material) can be used.
2. For severe exposure where ASTM C150, Type V cement is required, a Type I or a Type II cement with 50 to 65 percent slag cement (by mass of cementitious material) can be used.
3. For very severe exposure an ASTM C150 Type V cement with a minimum of 50 percent slag cement (by mass of cementitious material) can be used.
4. The sulfate resistance of the concrete shall be confirmed by testing in accordance to ASTM C-1012[7].

Mass Concrete

1. For mass concrete placements, the percentage of portland cement to be replaced shall be 50 to 80 percent (by mass of cementitious material).
2. Thermal properties of the concrete shall be verified prior to construction to ensure conformity to project requirements.

Alkali-Silica Reactivity

1. When using reactive aggregate, slag cement shall be used at replacement levels between 25 and 70 percent (by mass of cementitious material).
2. Mitigation of ASR shall be verified by testing in accordance to ASTM C-1260[8].
3. If the specific slag/portland cement mixture is shown to mitigate ASR in accordance with ASTM C-1260, low alkali cement is not necessary.

Exposure to Deicing Salts

1. Concrete exposed to deicing salts shall have a W/CM ratio of 0.45.
2. Concrete shall have an adequate air - void system as defined in ACI 201.2R[9].
3. Proper finishing and curing practices, in accordance with ACI 302[10] and ACI 308[11] shall be followed.
4. Slag cement replacement can be 25 to 50 percent (by mass of cementitious material).

Freeze - Thaw Durability

1. Concrete shall have a W/CM of 0.45.
2. Concrete shall have an adequate air - void system as defined in ACI 201.
3. Slag cement replacement can be 25 to 80 percent (by mass of cementitious material).

References

1. ASTM C150-02a, Standard Specification for Portland Cement, American Society for Testing and Materials, West Conshohocken, PA, 2003.
2. ASTM C1157-02, Standard Performance Specification for Hydraulic Cement, American Society for Testing and Materials, West Conshohocken, PA, 2003.
3. ASTM C989-99, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars, American Society for Testing and Materials, West Conshohocken, PA, 2003.
4. ASTM C595-03, Standard Specification for Blended Hydraulic Cements, American Society for Testing and Materials, West Conshohocken, PA, 2003.
5. ASTM C618-03, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete, American Society for Testing and Materials, West Conshohocken, PA, 2003.
6. ASTM C1240-03, Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout, American Society for Testing and Materials, West Conshohocken, PA, 2003.
7. ASTM C1012-02, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution, American Society for Testing and Materials, West Conshohocken, PA, 2003.
8. ASTM C1260-01, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method), American Society for Testing and Materials, West Conshohocken, PA, 2003.
9. ACI 201.2R-01, Guide to Durable Concrete, American Concrete Institute, Farmington Hills, Michigan, 2001.
10. ACI 302.1R-96, Guide to Concrete Floor and Slab Construction, American Concrete Institute, Farmington Hills, Michigan, 1996.
11. ACI 308.1R-98, Standard Specification for Curing Concrete, American Concrete Institute, Farmington Hills, Michigan, 1998.

SKYWAY CEMENT COMPANY

Eagle Materials

As with all concrete, proper finishing and curing is essential to ensure resistance to deicer scaling.

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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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