LAFARGE

SF™ Cement

Developed to meet the strength and durability needs of high performance concrete.

Eliminates the need for specialized handling equipment.

LAFARGE

The shotcrete used for the project contained Lafarge SF Cement in order to reduce rebound, reduce permeability, and increase strength.

Shotcrete
Cement Storage Dome, Lafarge Plant, Bath, ON

Lafarge SF Cement constitutes a significant advance in concrete material technology. A portland silica fume cement, SF Cement was developed to meet the customer's need for high performance concrete. Lafarge was the first to introduce this type of cement in the North American market.

Lafarge SF™ Cement

Lafarge SF Cement, a portland silica fume cement, was developed to meet the customer's needs for high performance concrete. Lafarge was the first to introduce this type of cement in the North American market in 1983.

Lafarge SF Cement is produced by blending portland cement and silica fume. Silica fume, made up of spherical particles 100 times finer than cement particles, is a by-product from the manufacturing of silicon and ferro-silicon alloys.

Each stage of the production process is monitored through a quality assurance program to ensure uniformity and consistent high performance. Users of Lafarge SF Cement can depend on a product with a constant ratio of silica fume to cement.

Lafarge SF Cement conformance
Prior to the introduction of Lafarge SF Cement to the North American market, three years of extensive testing was conducted to confirm its performance in concrete. Since then, Lafarge SF Cement has been used in many projects requiring large volumes of concrete in North America and abroad.

Lafarge SF Cement meets the requirements of ASTM C 1157 Standard Performance Specification for Hydraulic Cement Type GU, C 595 Standard Specification for Blended Hydraulic Cements Type I (PM), AASHTO M 240 Standard Specification for Blended Hydraulic Cement Type I (PM) and CSA A 3001 Type GUb.

Properties of concrete made with SF Cement
The durability characteristics of concrete can be significantly improved when using Lafarge SF Cement.

Lafarge SF Cement is highly recommended for structures exposed to de-icing salts, chloride ions and sea water, as well as for concrete pipes, water treatment plants, pulp and paper mills and concrete structures exposed to mild chemical attack.

Enhanced physical properties
Compressive strength: Lafarge SF Cement can be used to produce concrete with a significantly higher compressive strength than normal concrete.

While the one day strength is comparable to that of normal concrete, the 28-day strength is significantly higher. Lafarge SF Cement, combined with a superplasticizer and low water/cement ratio, enables the production of high performance concrete.

Lafarge SF Cement creates a dense micro-structure with superior strength and durability.

Ease of handling
Lafarge SF Cement is handled like normal portland cement and, therefore, eliminates the need for the specialized equipment normally associated with handling silica fume.

On the Cover

Prestressed Concrete
Stoney Trail Bridge, Calgary, AB

Resistance to the effects of heavy traffic, de-icing chemicals, freeze/thaw and protection from corrosion of the reinforcement were all required.

High Strength Concrete
BCE Place, Toronto, ON

Strengths up to 100 MPa (14,500 psi) allow for the reduction of column cross-sectional areas, resulting in more usable space within a structure.

The Confederation Bridge

Seven different types of concrete incorporating SF Cement were required to provide various combinations of the following properties:

- low permeability to chloride ions
- high-early-strength (for post-tensioning)
- high resistance to ice-abrasion
- low heat rise in massive sections
- underwater placement (tremie concrete)
- slip-forming
- high density for ballast
- resistance to freezing and thawing, and sea water attack (all exposed concrete)
- pumping (most concrete)
- high flow in congested areas
- controlled set

All concrete materials were tested to demonstrate that the concrete produced would have the maximum possible durability to meet the 100-year design life requirement. The tests on trial mixes that were developed included the following:

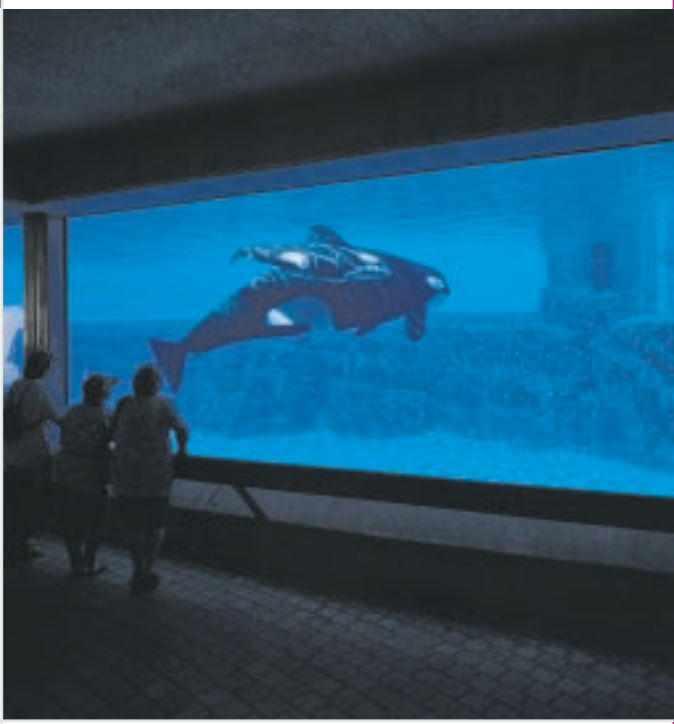
- rapid freezing and thawing tests
- de-icer salt scaling tests
- chloride penetration by ponding
- abrasion resistance testing
- water permeability testing
- creep and shrinkage tests at various ages of loading

Concrete containing Lafarge SF Cement has the workability required to be easily pumpable due to the fine spherical particles of silica fume, which act as a lubricant.

High Performance Bridge Deck
Highway Overpass, Buffalo, NY

Lafarge Blended Cements provide a significant contribution to sustainable construction. The use of these materials in concrete production consumes less energy and offers improved efficiency and building performance. These materials can also be used to help achieve LEED (Leadership in Energy and Environmental Design) points in the USGBC's (U.S. Green Building Council) and CaGBC's (Canada Green Building Council) LEED programs.

The 12.9 km (8 miles) long Confederation Bridge connects Prince Edward Island with New Brunswick in Eastern Canada. The main structural elements, consisting of piers and girders, were precast on land at facilities located on both sides of the bridge and moved into place with a floating crane. A total of 450,000 m^3 (590,000 yd^3) of concrete was produced with 220,000 tonnes (240,000 tons) of Lafarge SF Cement.



The ingress of chloride ions from salt water is reduced by the low permeability that is achieved in this concrete.

High Performance Concrete
Whale Tanks, Marineland, Niagara Falls, ON

Lafarge SF Cement was used in order to provide the high flexural strengths, defect-free surface, freeze/thaw durability and low permeability required for this application.

High Performance Roller Compacted Concrete
Intermodal Transfer Facility, Dorval, QC

Lafarge SF™ Cement

Properties of "Fresh Concrete"

Water requirements – Concrete mixes containing this cement may require more water for a given slump. Water reducers and/or high range water reducers are recommended.

Air Content – When changing mix ingredients, it is prudent and recommended to check air-entraining dosage and adjust as necessary.

Workability – This cement may reduce workability of high cement content concrete mixes with equal slump.

Bleeding – Concrete containing this cement can have reduced bleed water.

Segregation – There is no segregation issue related to this product.

Heat of Hydration – Concrete containing high cement contents may result in elevated heat of hydration. Precautions may be required.

Setting Time – Setting time of SF Cement is generally equivalent to other cements.

Finishability – Finishability of high cement content concrete mixes can be affected by the use of these products. Mixes may be "sticky" compared to portland only mixes. Precautions should be taken.

Pumping – Pumpability of concrete containing this cement is generally equivalent or better than other concretes.

Proportioning – Use of this cement does not require special proportions; however, in order to achieve specific properties, reducing the water-cement ratio may be required. Mix proportions should be adjusted as necessary.

Curing – Proper curing of all concrete is essential. Special attention to curing is necessary and should begin immediately after finishing. Surface cracking will occur if the concrete is allowed to prematurely dry.

Properties of "Hardened Concrete"

Strength – Proper use of this cement enhances concrete strength. This is applicable to compressive and flexural strengths.

Drying Shrinkage – In order to achieve desirable properties, water reducers and/or high-range water reducers are normally used in conjunction with this cement. Therefore, concrete generally has reduced drying shrinkage.

Permeability and Absorption – With proper use, concrete containing this cement is less permeable and has a lower absorption rate.

Concrete Color – Concrete made with this cement is generally darker in color.

Alkali-Aggregate Reactivity – Test data suggests that silica fume enhances the ability of other supplemental cementitious materials (SCM's) to mitigate aggregate reactivity. The ability to mitigate ASR should be confirmed using actual project materials.

Resistance to Sulfate Attack – This cement can be used as part of a system to improve the resistance of concrete to sulfate attack. This cement, individually, should not be considered as adequate protection against sulfate attack.

Corrosion of Embedded Steel – There is a direct relationship between permeability and corrosion resistance. Therefore, corrosion can be lessened as a result of lower permeability as described above.

Carbonation – With properly designed, finished and cured concrete, carbonation should not be a concern.

Freeze-Thaw Resistance – Properly designed, finished and cured concrete with an adequate air-void system has equivalent resistance to freeze-thaw conditions.

Deicer Scaling – Properly designed, finished and cured concrete with an adequate air-void system has equivalent resistance to deicer scaling.

Chemical Resistance – Reduced permeability as described above can improve chemical resistance.

Applicable Specifications

Produced to meet the applicable requirements of the following specifications:
ASTM C 595 "Standard Specification for Blended Hydraulic Cements" - Type I (PM)
AASHTO M 240 "Standard Specification for Blended Hydraulic Cements" - Type I (PM)
ASTM C 1157 "Standard Performance Specification for Hydraulic Cement" - Type GU
CSA A3001 "Cementitious Materials for Use in Concrete" - Type GUb

General Statement

This cement is generally used in high performance applications, where enhanced strengths or durability properties are required. To achieve these and other special properties, particular care is needed when proportioning, batching, placing, finishing and curing concrete containing these products. For further technical assistance, contact your concrete professional or Lafarge's Technical Services Group by contacting your nearest Lafarge Cement sales office.

Precautions

Direct contact with wet cement should be avoided. If contact occurs, the skin should be washed with water as soon as possible. Exposure can cause serious, potentially irreversible tissue destruction in the form of chemical (caustic) burns. If cement gets into the eyes, immediately rinse thoroughly with water and seek medical attention. For more information, reference the applicable Lafarge Material Safety Data Sheet (MSDS). The MSDS should be consulted prior to use of this product and is available upon request and online at www.lafarge-na.com.