MANASEER

Crete

What's Inside

Sections

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About
ManaseerCrete™

ManaseerCrete™ is a new engineered, mechanically and chemically activated natural fine pozzlanic material, free from heavy metals such as arsenic, lead, mercury, cadmium, chromium and selenium .ManaseerCrete™ is a natural pozzolanic material & it can be used as a replacement or additive material, which highly improves the characteristics of concrete, ManaseerCrete™ is in full compliance with ASTM C618 specifications for pozzolans used in concrete. The American Society for Testing Materials (ASTM) defines pozzolan as **"**a siliceous and aluminous material that in itself possesses little or no cementitious value, but that will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperature to form compounds having cementitious properties**"**.

ManaseerCrete™
Usage

ManaseerCrete™ can be utilized in variety of applications,the pozzolanic property of ManaseerCrete™ gives it the ability to add superior properties when mixed with Portland cement.

It is recommended to be used in the following applications:

Ready Mix Concrete

- Mass Concrete Foundations and Sections Due to Low Heat of Hydration.
- High Quality Finishes.
- Potentially Alkali-reactive Aggregates.
- Sulfate-Bearing Environments.
- Water Retaining Structures.
- Chloride-Bearing Environments.
- Effluent Treatment Plants.
- Marine Environments.
- High temperature environment as strength development will be accelerated while in cold weather shall be used with care.

Construction Chemicals

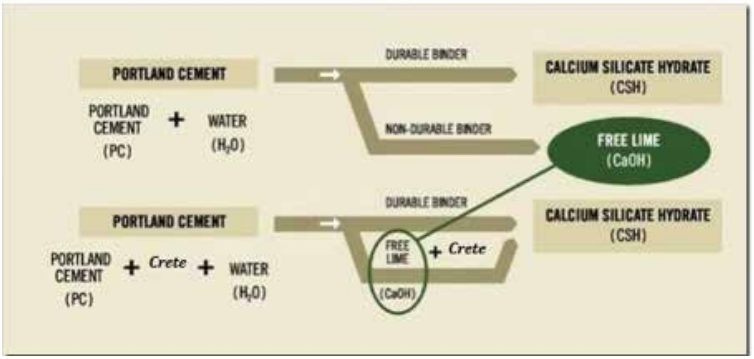
- Self-Leveling Screed.
- Non Shrink Grout.
- Anchoring Grout.
- Water Proofing.
- Floor Hardeners.
- Dark Color Tile Grout.
- Tile Adhesives.
- Repair Mortars.
- Cosmetic Mortars.
- Admixture.

How ManaseerCrete™ Works with Portland cement in Concrete:

Portland cement is manufactured with CaO, some of which is released in a free state during the hydration reaction. This liberated lime forms the necessary ingredient for reaction with reactive Manaseercrete™ silicates to form strong and durable cementing compounds no different from those formed during hydration of ordinary Portland cement.

HYDRATION PRODUCTS OF CEMENTING BINDERS

Through pozzolanic activity, ManaseerCrete™ combines with free lime to produce the same cementitious compounds formed by the hydration of Portland cement.



Chemical comparison of ManaseerCrete™ and Portland cement

The chemical composition of ManaseerCrete™ is very similar to that of Portland cement.

- The same compounds exist in ManaseerCrete™ and Portland cement.
- ManaseerCrete™ compounds are amorphous (glassy) due to rapid cooling.
- Cement compounds are crystalline because of slow cooling.

- The main difference between ManaseerCrete™ and Portland cement is the relative quantity of each of different compounds. Portland cement is rich in lime CaO while ManaseerCrete™ is low. Reactive silicates are high in ManaseerCrete™ while Portland cement has smaller amounts.

TYPICAL CHEMICAL COMPOUNDS IN MANASEERCRETE™ AND PORTLAND CEMENT (OPC)

CHEMICAL COMPOUND	MANASEERCRETE™	CEMENT(OPC)	UNIT
SiO_2	45.79	19.55	%
Al_2O_3	13.91	4.68	%
Fe_2O_3	14.48	4.34	%
CaO	8.55	62.79	%
MgO	9.50	1.72	%
SO_3	0.76	2.94	%
Na_2O	2.70	0.44	%
K_2O	0.93	0.40	%
Cl	0.010	0.035	%

Effect of **ManaseerCrete™** on the properties of fresh concrete

Decreasing Concrete Bleeding

Bleeding is a particular form of segregation, in which some of the water from the concrete comes out to the surface of the concrete and accumulates , the biggest factor in bleeding rates is the water to cement ratio. A higher ratio can lead to excessive bleeding , the cement type and fine aggregates can play a role in determining the bleed rate. The fewer fines you have in your mix, the more bleeding will occur , the use of supplementary cementitious materials can decrease bleeding rates especially when using finer blends.ManaseerCrete™ can be effective in reducing bleeding rates and control the speed of migration of water to the surface while inhibiting the settling of solid particles.

ManaseerCrete™ is able to reduce the concrete bleeding by reducing the number of capillary tubes and number of voids in the cement paste, by this way ManaseerCrete™ prevents the chemical attacks and the aggressive processes on the surface of concrete.

Effects of Bleeding on Concrete:

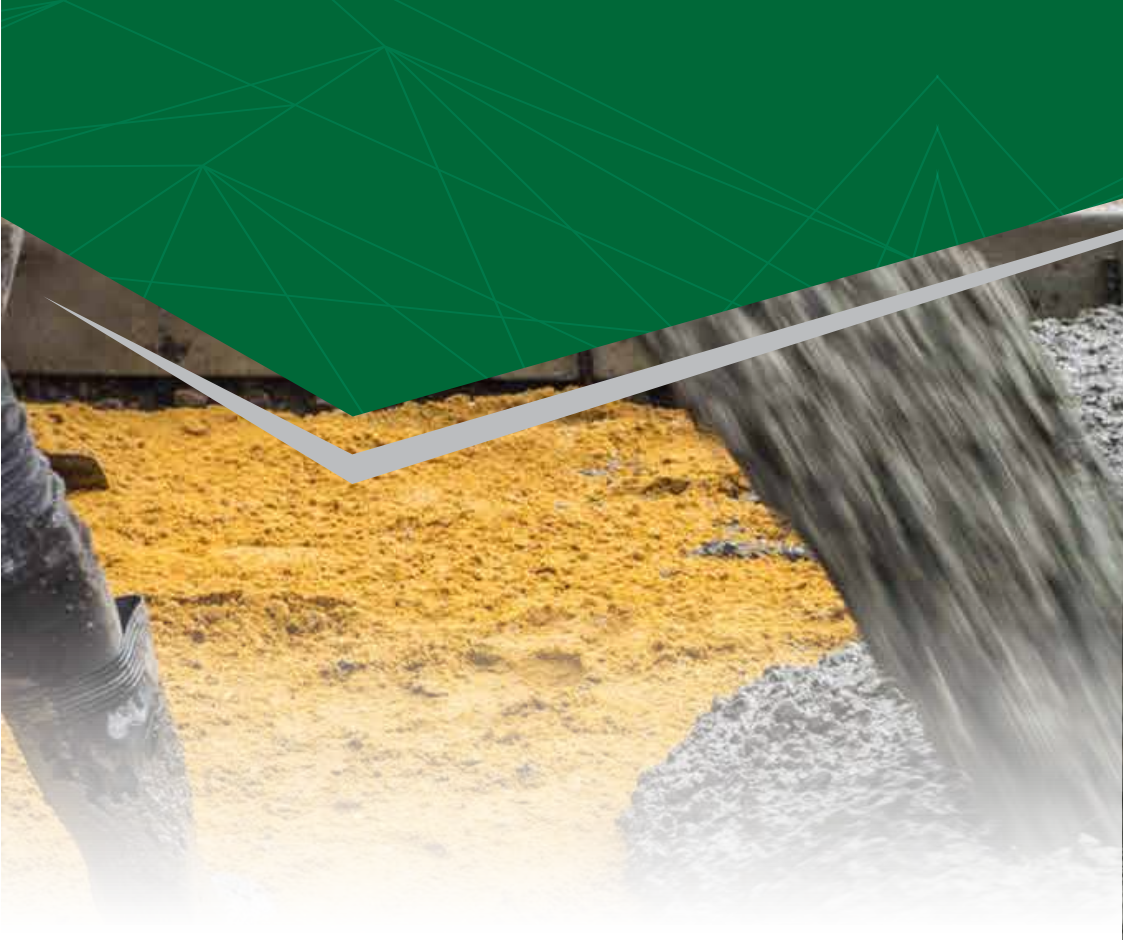
- Due to bleeding concrete loses its homogeneity.
- Bleeding is responsible for causing permeability in concrete.
- In the process of bleeding (i.e. while water is in the process of coming towards the top) sometimes water gets accumulated below the aggregate. This accumulation of water creates water voids and reduces bonds between the aggregate and cement past , as a result the strength of concrete is reduced.
- Similarly, water that accumulates below the reinforcing bars, particularly below the cranked bars, reduces the bond between the reinforcement and concrete.

Increasing Setting Time

Setting of concrete is the process of transformation of concrete from a plastic state to a hardened state. Setting is entirely dependent on the setting of cement, that's why the type of cement used highly influences the setting time.
The main factor which affects the setting time of concrete is the water cement ratio, when the water cement ratio is reduced, the initial and final setting times are increased.
adding ManaseerCrete™ to concrete mixtures leads to slightly increasing the setting time of concrete which is beneficial for distant transport of concrete and improves surface finish.

Decreasing Heat of Hydration

Reaction between Portland cement and water is an exothermic reaction that generates energy in the form of heat. This heat is referred to as the heat of hydration that results in raising concrete temperature. When higher cement percentages are used in the mixture, more heat of hydration is generated, because it consists of Tricalcium Silicate and Tricalcium Aluminate compounds. These compounds generate high values of heat when the hydration reaction is initiated. Adding ManaseerCrete™ to concrete mixtures leads to a lower heat of hydration, since Manaseercrete™ will replace a portion of cement, as cement contains Tricalcium Silicate and Tricalcium Aluminate compounds, and these chemical compounds generate high values of heat. On the other hand ManaseerCrete™ reduces the water demand in the concrete mix therefore, the quantity of water and the microstructural space available for hydration will be reduced. Thus, reduced heat of hydration will protect the concrete from thermal cracking.



ManaseerCrete™ helps to minimize the effect of hot weather without losing any strength and durability features. Since ManaseerCrete™ is able to reduce the heat of hydration, there is no need for cooling systems such as chilled water or shaved ice for concrete mixes that include ManaseerCrete™ in hot regions, therefor, ManaseerCrete™ is recommended for the usage in high temperature environments.

Improving Workability

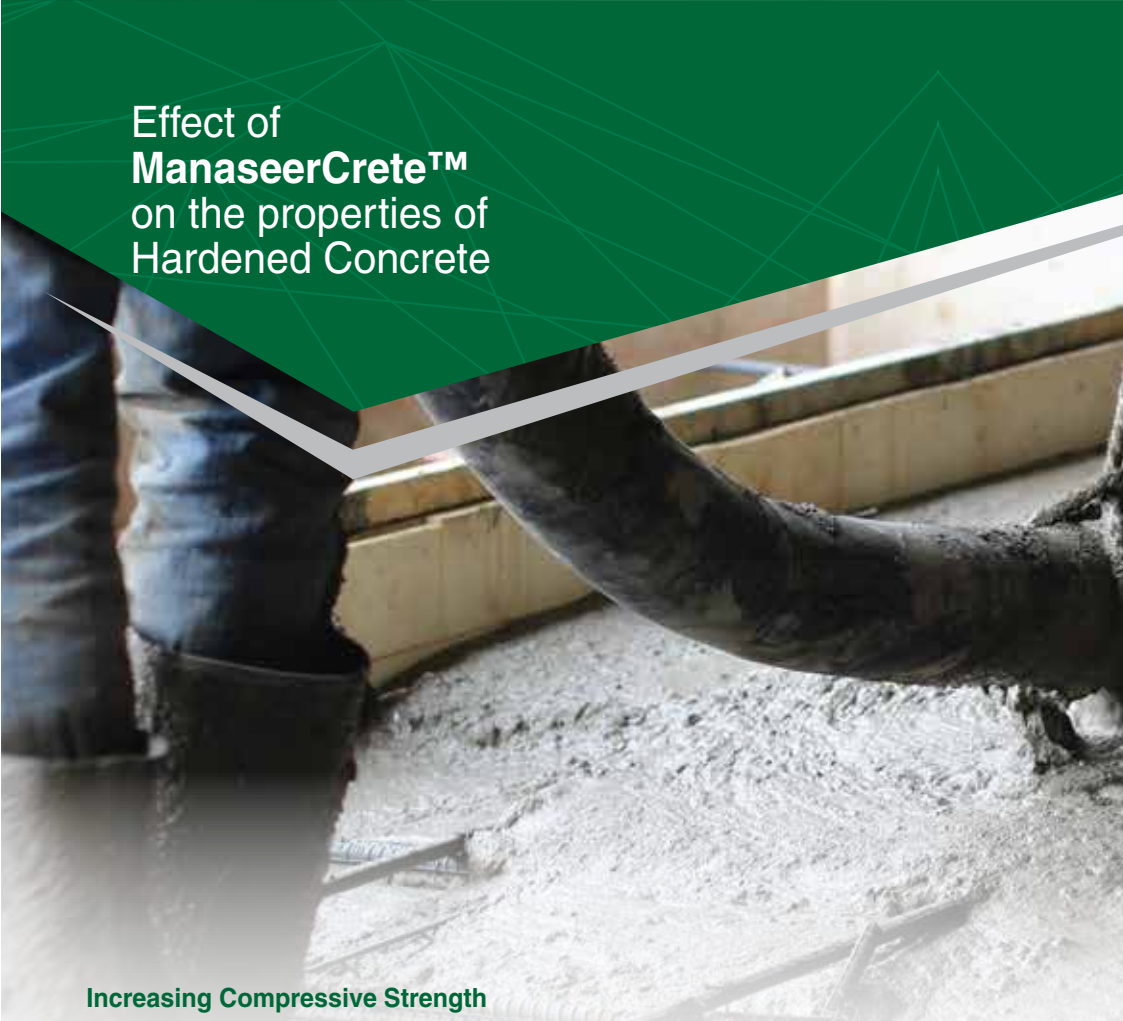
Workability of concrete can be defined as the ease at which concrete is mixed, transported, placed, compacted, and surface finished. It is one of the most important properties of fresh concrete, and it is dependent on the contents of concrete, which are the cement, aggregate, water and admixtures.

Concrete is considered workable if it has these certain properties:

- To have the ability of handling it without segregation.
- To have the ability of placing it without loss of homogeneity.
- To have the ability of compacting it with specified effort.
- To have the ability of finishing it without difficulty.

Water of convenience is reduced when ManaseerCrete™ is added to the mix. The plasticizing action results in water reduction in the fresh concrete, and obtaining the same levels of slump as the ordinary Portland cement. Reduced water of convenience at the same level of slump creates a more cohesive concrete, and as a result decreasing the occurrence of costly segregation. When ManaseerCrete™ is combined with Portland cement, concert's pumpability is slightly improved, and concrete pumping requires less energy, which result in less pumps maintenance and extension of pumps life cycle.

Effect of **ManaseerCrete™** on the properties of Hardened Concrete



Increasing Compressive Strength

Compressive strength is one of the most important properties of concrete; it could be defined as the capacity of concrete to withstand loads applied to it. The compressive strength is measured by applying a force on a specimen of concrete, the maximum load it could bear prior to failure is known as the compressive strength.The strength gain rate of concrete in the first seven days is very high, but afterwards it starts slowing. This strength gain is contributed by the Portland cement, which produces cementitious products upon reacting with water. ManaseerCrete™ possesses active silicates that react with the calcium hydroxide freed during the hydration process, and produces more cementitious products that result in acquiring higher compressive strengths ,when using ManaseerCrete™ in concrete mixes, it is expected that the rate of strength gain will be lower than conventional concrete in the first seven days. After seven days the Concrete with Manaseercrete™ rate of strength gain is highly accelerated, and will exceed that of the conventional concrete. This rate of strength gain is continuous over time, producing dramatically higher ultimate strengths than ordinary cement.

Durability & Permeability of Concrete

Durability of concrete is defined as concrete's ability to withstand severe weather conditions, hostile chemical attacks, and any natural impact it may undergo while maintaining its required properties.

Permeability of concrete is defined as the rate of flow of water through concrete.
Permeability and durability of concrete can be significantly enhanced by using ManaseerCrete™, owing to the pozzolanic reaction, whereas it reacts with free lime, producing more cementitious compounds that results in higher density, and strength values. It also reduces water demand, which leads to the reduction of internal voids, and bleeding channels in concrete , each one of these factors plays a major role in producing a concrete of low permeability and high durability.

Reducing Alkali / Silica Reactivity

Alkali/ silica attack is a reaction that takes place when reactive silicates present in aggregates react with alkalis from any source, it causes an excessive expansion to concrete. Which causes surface ruptures, in addition to interior stresses that might lead to cracking and weakening of concrete.

ManaseerCrete™ reacts with and binds alkalis present in cement and aggregates, thus stopping the reaction from happening. Enabling fresh concrete paste to maintain its volume after hardening.

Increasing Resistance to Freezing and Thawing

Freeze/thaw deterioration has been and continues to be a problem in the areas of cold weathers. Freeze/thaw cycles begin when water enters the voids in concrete and freezes, the expansion of water upon freezing increases the volume of concrete, the extremely high pressure generated exceeds concrete's capacity to resist it, causing it to be forced apart from within.

Manaseercrete™ helps decrease freeze/thaw deterioration by reacting with calcium hydroxide, reducing the amount of calcium hydroxide leached out during the hydration process. Thereby, reducing voids and channels caused by the leaching of calcium hydroxide, that water could penetrate concrete through.

Increasing Resistance to Sulfate Attack

Precautions usually have to be made to protect Portland cement from sulfates that come from various sources such as soils, ground water, and sewage. Using Manaseercrete™ in the concrete mix helps provide the required sulfate resistance.
Sulfate Attack is a Two-Phased Process.

Sulfate attack consists of two reactions, the first one that takes place when sulfate reacts with calcium hydroxide to produce Calcium Sulfate (gypsum), the second one happens when aluminate compounds from Portland cement react with sulfates and calcium to form a compound called ettringite. Both Gypsum and ettringite are very fragile and cause weakness in concrete's structure. Manaseercrete™ reacts with unbound calcium hydroxide, and prevents foreign materials containing sulfates from penetrating concrete, accordingly forbidding the sulfate attack from occurring.

Manaseercrete™ effectively retards this sulfate deterioration in three important ways:

1. Manaseercrete™ reacts with unbound calcium hydroxide, and in return it wouldn't be available for the sulfate reaction.
2. Using Manaseercrete™ will produce a less permeable concrete,preventing Sulfates from entering concrete.
3. Using less amounts of Portland cement and replacing a percentage of it with Manaseercrete™, result in fewer amounts of aluminums available for the sulfate reaction.

Benefits of **ManaseerCrete™**

Readymix producers, engineers, architects, developers and contractors are all interested in using ManaseerCrete™ to improve the key properties of concrete, such as compressive strength, durability and permeability while maintaining economic feasibility.

ReadyMix Producers

There are various reasons for readymix concrete producers to be interested in ManaseerCrete™:

- Producing a more consistent finished product that will guarantee customer's acceptance.
- Giving the ready mix producer the advantage of offering a wider range of designs to suit every customer's need .
- Giving high compressive strength at low W/C ratios .
- Increasing setting time .
- Increasing compressive strength when using as addition .

Engineers and Architects

Engineers and architects will detect that ManaseerCrete™ provides the following advantages:

• Providing the client with a high quality, and more durable finished concrete.
• Producing a flexible, high strength concrete that could be used in thinner sections, curves, arches and other architectural shapes composed of complex shapes.
• Adding ManaseerCrete™ to the concrete ensures later-age strength gain, and long-lasting durability.
• Enhancing the aesthetic appearance of the finished concrete.
Developers, Contractors, Owners.

Developers, contractors and owners are provided with the following benefits when using ManaseerCrete™:

•The high workability of concrete contributed by ManaseerCrete™ results in speeding up the process of construction, which could be beneficial to both contactors and owners.
• Giving concrete the ability to accommodate more complex designs.
• Reducing concrete's maintenance costs by providing a more durable concrete, that is capable of resisting the mechanical and chemical impacts it may undergo.

Environmental benefits of **ManaseerCrete™** use in Concrete

A lot of environmental benefits are obtained when using ManaseerCrete™, the most important benefits are those associated with the reduction of cement consumption. Which translates into reducing the carbon footprint of cement production, and saving raw materials such as limestone, and coal.

Cement manufacturing is an industry that consumes a lot of energy. The calcination reaction that the clay, limestone, and other ingredients undergo, occurs at very elevated temperatures (up to 1450 °C). Combustion of Large amounts of fossil fuels is required to reach this temperature, and as a consequence high quantities of greenhouse gases are emitted. It is believed that about 1 ton of CO2 is emitted when manufacturing 1 ton of cement. Minimizing the quantity of cement used by replacing a portion of it with Manaseercrete will contribute to a better, cleaner environment.
ManaseerCrete™ is advatengous over other pozzolans because it is free from heavy metals such as: (• Mercury • Lead • Arsenic • Selenium • Chromium • Cadmium)
All of these heavy metals are toxic and lead to a lot of dangerous diseases such as Cancer (especially lung and stomach Cancer), nervous system damage, delay of brain development (especially for children), irritation of skin, and inflammation of nose and eye. ManaseerCrete™ is a safe material to be used without any harming effects on the human health.

The following determination was carried out on ManaseerCrete™ pozzolan and Portland cement.

- Determination of Sulfur trioxide (SO3) content according to ASTM C114
- Determination of Silicon dioxide (SiO2), Aluminum dioxide (Al2O3) and Iron dioxide (Fe2O3) according to ASTM C114
- Loss on Ignition test according to ASTM C311 and ASTM C114
- Determination of Moisture content according to ASTM C311
- Determination of Fineness according to ASTM C311 and ASTM C430.
- Determination of Strength Activity Index according to ASTM C311 and ASTM C109.
- Determination of Water Requirement according to ASTM C311.
- Determination of Autoclave Expansion according to ASTM 151.

This table below shows a list of the effects and enhancements that are added by using ManaseerCrete™, and the recommended applications for it.

ManaseerCrete™ effects	Applications
• Reduction heat of Hydration	• High temperature environments • Mass concretes (Rafts ,Shear walls ,Dams, Retaining walls , Solid slabs)
• Reduction of water requirements	• Mass concrete • High temperature environments • Sites lacking water needs
• High ultimate strength	• Footings • Columns ,load bearing elements • Shear walls , Retaining walls • Shells • Pre-stressed concrete
• Provision of needed time for the casting and Placement	• Retardation of setting time • For far destinations and high temperature environments
• More better Soundness	• In marine environments • Submerged structures • Soil stabilization works
• Reduction of Bleeding	• effective especially in hot weather environments • enhancement of early age strength
• Internal cracks are reduced	• Mass concrete • marine environments • hot weather conditions

• Providing high finishability	• For floors , plastering walls • Improving the finishing of rectangular or square sections due to of increase of setting time
• little effect on plastic shrinkage cracking	• Due to the less bleeding effect ManaseerCrete has a lower tendency toward PSC
• Freeze-Thaw Resistance	• Pavements (HMA , bituminous , concrete) • Environments where Temperature difference between night and day is high
• Deicer-scaling resistance	• For Freeze-Thaw Environment • Improved with lower w/c ratio
• Reduction of Drying shrinkage and creep	• obtaining high crack control • Providing resistance to long term deflections • Beneficial in Cantilevers and suspended elements
• Reduction of permeability and absorption	• For walls and floors of Factories • Foundations Prone to sulfate attacks • Structural elements such as tie beams and wall footings in contact with moist soils • Reduction in Soundness of elements Prone to permanent contact with water • Marine Environments
• Control of Alkali-Aggregate reactivity	• Soil enhancement and stabilization works • Concrete pavements where large amounts of aggregate are used in Pavements layers

• Provision of sulfate resistance	• Marine Environment • Open Channels • Water carrying pipes • Culverts • Bridge footings • Wastewater treatment plants and sewers
• Reduction of corrosion of Embedded steel	• marine environments • water tanks and wells , by preventing segregation and honeycomb appearance
• Reduction of carbonation process	• Increasing the compressive strength • preventing the occurrence of efflorescence • aesthetically finished concrete • enhancement of both structural and architectural aspects)
• Provides chemical Resistance (by reducing permeability)	• marine environments • water treatment plants • slabs on grade for factories and concrete pipes
• Good rutting resistance and superior friction properties	• Used Especially in HMA pavements where it resists stripping and rutting
• Provision of weight lightness	• Insulation uses • Structural uses
• Large volume occupancy with low mass	• Mass concrete applications • Used as filling material

This table below shows results of the required chemical and physical tests according to the ASTM C-618

Required Test	Result	Conformity Criteria
Sulfur trioxide (SO_3)	0.76 %	4.0 % max
Silicon Dioxide (SiO_2) , Aluminum Oxide (Al_2O_3) ,Iron Oxide (Fe_2O_3)	73.79 %	70 % min
loss on Ignition	0.5 %	10.0 % max
Moisture Content	0.057 %	3.0 %
Fineness (retained on 45 µm (No. 325) sieve)	5 %	34.0 %
Strength Activity Index		
With Portland cement , at 7 days min , percent of control	84.4 %	75 %
With Portland cement , at 28 days min , percent of control	Comply	75 %
Water Requirement	99 %	115 %
Autoclave Expansion	0.06 %	0.8 %

Building for future generations

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