

Granulated blast furnace slag (GBFS) is a waste product from iron and steel production that is usually destined for landfill. Blast-furnaces are fed with a controlled mixture of iron-ore, coke, and limestone, and operated at a temperature of about 1,500°C. When iron-ore, coke and limestone melt in the blast furnace, two products are produced - molten iron and molten slag. Molten slag is lighter and floats on the top of the molten iron. The molten slag comprises mostly silicates and alumina from the original iron ore, combined with some oxides from the limestone. Granulating the slag involves cooling the molten slag through high-pressure water jets. This rapidly quenches the slag and forms granular particles no bigger than 5 mm. The rapid cooling prevents the formation of larger crystals, and the resulting granular material (GBFS) comprises around 95% non-crystalline calcium-alumino-silicates - ideal for use as a cement replacement material.

HR Cement imports and grinds high specification GBFS material to produce **Eco-Cem**. The result is high-performance **Eco-Cem** - a ground granulated blast furnace slag that is used to replace General Purpose (GP) cement and produce low-carbon concrete.

COMPOSITION & MATERIALS

97% - Ground granulated blast furnace slag (GGBFS)

3% - Natural gypsum

SPECIFIED PROPERTIES

The table below shows the relevant specified properties of AS3582.2 and typical values achieved by **Eco-Cem**.

Property		AS3582.2	Typical Eco-Cem
Loss on Ignition	% max	6.0	<1%
Sulphide sulphur	% max	1.5	0.8
Magnesia	% max	15	6.1
Alumina	% max	18	13.9
Total iron	% max	1.5	0.5

PHYSICAL PROPERTIES

The table below shows the relevant physical requirements **Eco-Cem**.

Property		Typical Eco-Cem
Specific Density	-	2.80 - 2.90
Bulk Density (loose)	kg/m ³	0.99 - 1.10
Bulk Density (packed)	kg/m ³	1.16 - 1.20
Fineness	% >45 micron	2 - 4

BENEFITS OF CONCRETE WITH ECO-CEM

Chemical Resistance: The higher density and lower porosity of concrete made with **Eco-cem** makes the concrete more resistant to chloride, sulphate and acid attack and is ideal for harsh environments, from marine and infrastructure projects to roading and floors.

Low Shrinkage: Concrete made with **Eco-Cem** has lower shrinkage performance.

Durability: Concrete produced with **Eco-Cem** has better resistance to wear and tear.

Reduced Thermal Expansion: **Eco-Cem** is ideal for large concrete pours as it reduces the risk of thermal cracking.

Reduced Alkali Aggregate Reactions: **Eco-Cem** helps to minimise the risk of alkali-silica reaction in concrete.

SUSTAINABILITY

HR Cement is committed to developing market-leading processes that help our environment. **Eco-Cem** is the result of years of research and testing. **Eco-Cem** is the best low carbon alternative available in New Zealand and we're proud to make it locally in Mount Maunganui.

Eco-Cem can be substituted for standard GP cement resulting in lower carbon concrete. The carbon footprint of concrete can be reduced by 40 - 70% compared with concrete made with GP cement alone.

SUSTAINABILITY (continued)

Eco-Cem has the following additional sustainability benefits:

By utilising a by-product, **Eco-Cem** requires no quarrying of virgin material or mineral extraction.

Replacing Portland cement with **Eco-Cem** helps in reducing CO₂ emissions and in conserving non-renewable resources such as limestone.

Studies have shown an increase of 20 percent in the reflection of sunlight by concrete made with with GGBS such as Eco-cem. This reduces the "heat island" effect in urban developments.

USES OF ECOCEM

Eco-Cem is typically combined with GP cements such as Xtra-Cem in the concrete mixer. Combinations of **Eco-Cem** and Portland cement are recommended for many applications from driveways to precast, cast in situ beams to house floors. When compared with the use of concrete made from standard Portland cement at the same cement content, the following differences may be noticed:

Slower early strength development and potentially higher long-term strength.

Extended setting times, particularly in cold weather.

Improved workability retention.

Extra care is required with curing concrete to realise the full potential strength and durability of the concrete.

Lighter in colour. Freshly exposed concrete may exhibit a blue-green tinge. This tinge will fade and disappear with exposure to the atmosphere, leaving the light colour associated with concrete made using **Eco-Cem**.

CONCRETE PROPERTIES

The strength development of Portland cement concrete is affected by several factors such as the physical and chemical properties of the cement and Eco-cem, water to cement ratio, admixtures, curing and environmental conditions.

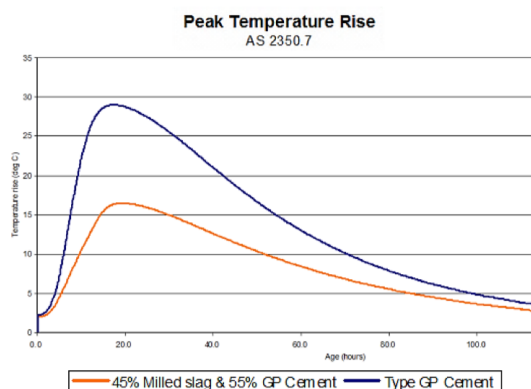
STANDARDS

HR Cement Eco-Cem complies with requirements specified in Australian Standard AS3582.2 :2016.

ECO-CEM
High Performance, Low Carbon

TEMPERATURE PROFILE

The following graph compares the temperature profiles of a blend of **Eco-cem** (45%) and GP Type cement (55%) and GP cement only. The peak temperature rise occurs up to 5 hours later and is typically 15°C lower for **Eco-cem** / cement blends than for type GP cement. **Eco-cem** is especially suited for low heat applications.



COMPATIBILITIES

HR Cement Eco-Cem is compatible with:

Portland Cements complying with NZS3122 & NZS3123.

Admixtures that comply with NZS 3113 and AS 1478.

Fly ashes complying with AS 3582.1

Amorphous silica complying with AS3582.3 or

DELIVERY

HR Cement Eco-Cem is supplied in bulk quantities (tonnes).

CONCRETING PRACTICES

The character of structural concrete is largely determined by the water-cement ratio. The amount of cement in relation to the amount of aggregate is especially critical for a durable, strong concrete.

Good concreting practices are required for proper, durable, and strong concrete. Proper proportioning, batching, mixing, placing, consolidating, finishing, and curing, as well as proper subgrade preparation, formwork, uniform slump and other special techniques, are critical to achieving the desired results.

A minimum curing period of seven days is recommended for all uses of **Eco-Cem** with GP cement such as Xtra-cem. The concrete should be maintained in a continually moist condition when this is practical during this time.

CONCRETING PRACTICES con't

Water sprays, wet sand or moisture retaining techniques, such as clear polyethylene sheets or curing compounds are recommended.

Curing should begin upon the completion of surface finishing or in accordance with manufacturer's instructions where proprietary curing compounds are used.

For normal class concrete, curing can produce a compressive strength up to 100% greater than concrete not subjected to curing. Water application or moisture retaining curing is more effective for lower grades of concrete.

MIX DESIGN

Mix design is influenced by many different factors. It is recommended that trials be conducted to determine the optimum cement & **Eco-cem** contents for specific classes of concrete. For further information consult: **NZS 3101 – Concrete Structures Standard**.

Our ready-mix concrete retailers can help you find a balance between performance and maximising the low-carbon benefits. Concrete mix designs can be customised allowing you to manage construction aspects, including set time, strength gain, finishing, cost and any Green Star or ISC goals. It's not only the earth friendly choice, it's denser, more durable, and designed to last.

The designer need only specify the concrete type, strength and target **Eco-Cem** percentage, either maximum or a set percentage. The contractor can then work with the concrete producer to establish the best mix for the application.

Concrete made with **Eco-Cem** can satisfy all Exposure Classification requirements of Table 3.6 within NZS 3101.

Exposure classes A & B: Any **Eco-Cem** concrete meets this standard.

Exposure Classification C: Concrete containing 65% Eco-

ACID SOLUBLE SULPHATE

Acid-soluble sulphate is the sulphate (expressed as SO₃) that dissolves in dilute acid per the standard test method, so it measures only the sulphate available to the concrete and excludes the sulphur bound in slag sulphides and other acid-insoluble forms that "total SO₃" would count. NZS 3101 caps this at 5% by mass of binder, and at a maximum of 0.5% from Eco-cem, with 65% GGBFS replacing most of the Portland cement (which carries the main gypsum-derived sulphate), the mix comes to roughly 1-2% acid-soluble sulphate, comfortably inside the limit.

AVAILABILITY & COST

HR Cement Eco-Cem is available for delivery throughout New Zealand.

Please contact the **HR Cement** Office (see below) for pricing information.

STORAGE, HANDLING AND SAFETY

For comprehensive safety, storage, handling and disposal information please consult the **HR Cement - Safety Data Sheet for Eco-Cem**.

TECHNICAL SERVICES

Technical services are available by contacting the **HR Cement** office (see below).

CERTIFICATION

Upon request **HR Cement** can provide technical reports demonstrating that **Eco-Cem** meets or exceeds applicable AS/NZ Standards.

PRODUCT DISCLAIMER

*The information contained in this product data sheet is for general guidance only and should not be relied upon for specific projects. Cement performance results quoted are indicative only of this product. A wide range of variable factors influence actual performance. End users should seek professional advice for their project. To the extent permissible by the law of New Zealand, **HR Cement Ltd** will not be liable for any losses due to reliance on the information contained in this sheet or for losses due to inappropriate use of these products.*

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High Performance, Low Carbon