BORAL CEMENT

Product Data Sheet

Enviroment®

Enviroment® is Ground Granulated Blast Furnace Slag (GGBFS) which complies with AS 3582.2 as supplementary cementitious material. It can be used as a partial Portland cement replacement to enhance the characteristics of concrete.

BENEFITS AND TYPICAL APPLICATIONS

Partial replacement of Portland cement with Enviroment® in concrete applications contributes to sustainable construction due to the less energy-intensive manufacturing process and use of iron slag, a by-product of iron and steel-making.

When blended in concrete, Enviroment® produces performance characteristics such as strength, durability and aesthetic appeal, making it suitable for a range of applications.

Enviroment® shows greater later-stage strength characteristics, though strength development is slower to mature than a mix using General Purpose cement alone. This characteristic improves stablisation due to the additional time allowed for placing and compacting materials.

Use of Enviroment® can improve durability through reduced permeability, making it suitable for climates such as near sea water and sewerage plants. The reduced permeability also mitigates the risk of alkaline-silica reaction (ASR) caused by reactive aggregates.

Inclusion of Enviroment® in mass concrete pours reduces the heat of hydration which can mitigate or reduce the likelihood of thermal cracking.

Aesthetically, adding Enviroment® to a concrete mix lightens the colour of the hardened concrete making it ideal for decorative applications. Please contact our technical team to discuss any specific considerations if using Enviroment® for aesthetic characteristics in special concrete mixes, eg. high slump concrete.

CEMENT PROPERTIES

The following table provides a typical example of Enviroment® properties.

Enviroment® Cement		AS 3582.2 GGBFS
CHEMICAL PROPERTIES	**TYPICAL**	**REQUIREMENT**
Sulphide sulfur (as SO_3), %	<1.4	<1.5
Magnesia (MgO), %	<6.0	<15.0
Alumina ($Al2O_3$), %	<14.0	<18.0
Chloride Ion content, %	≤0.01	<0.1
PHYSICAL PROPERTIES		
Fineness index (m^2/kg)	400 - 470	
Specific Density	2.85 - 2.95	
Bulk Density (packed)	1.05 - 1.15	
Bulk Density (loose)	0.95 - 1.05	

The data is based on product tested under laboratory conditions.

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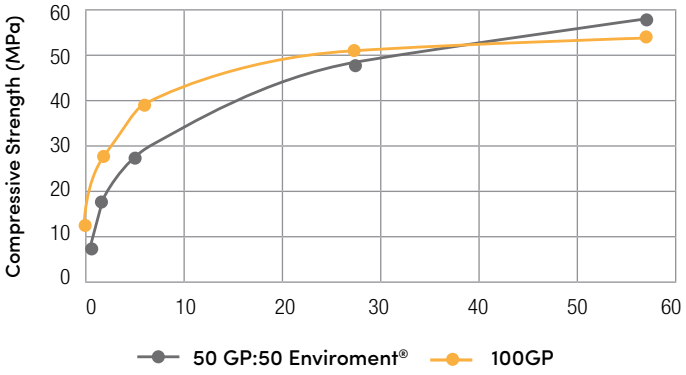
COMPRESSIVE STRENGTH DEVELOPMENT

Partial replacement of General Purpose cement with Environment® in concrete mixes will improve the strength of the latter.

The graph below shows that the initial strength gain is slower for the mix with 50% Enviroment® though the concrete will ultimately achieve strengths exceeding that of a mix using General Purpose cement alone.

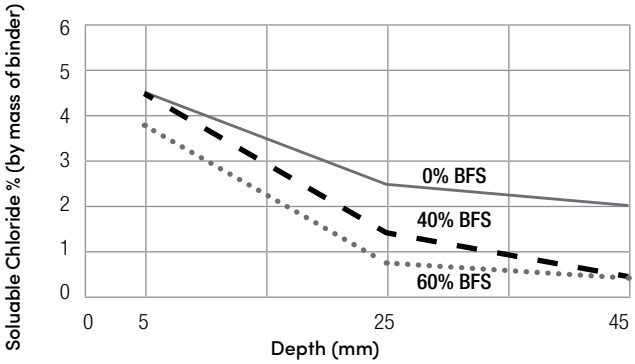


The data is based on product tested under laboratory conditions.

DURABILITY

Chloride ion permeability

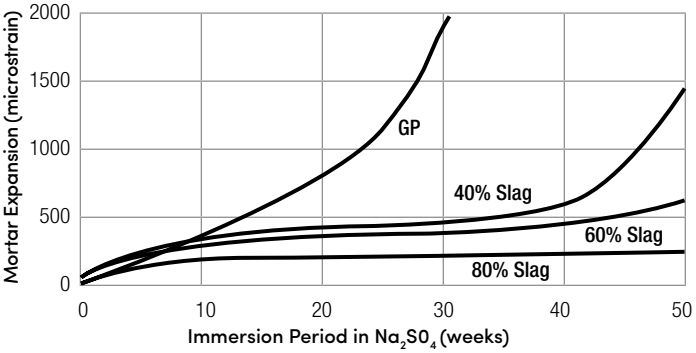
Chloride ions may be found within the materials used in concrete manufacture or from environmental sources such as from sea water. Regardless of the source, chloride ions will eventually penetrate the body of concrete. The rate of penetration is impacted by the permeability of the concrete. The below graph shows how the depth of chloride ion penetration is reduced when GGBFS is used as 40% and 60% cement replacement. As a result, resistance to chloride attack is improved.



Data sourced from Cement Concrete & Aggregates Australia (CCAA) Part II. Constituents of Concrete, Supplementary Cementitious Materials 2020.

Sulfate resistance

Sulfate attack to concrete paste causes expansive compounds that may cause cracking. Decreasing concrete permeability is a key element to increase concrete sulfate resistance. As shown below, when GGBFS replaces General Purpose cement at 40%, 60% and 80% mix proportions, the mortar expansion as a result of sulfate attack decreases, especially for prolonged immersion periods.



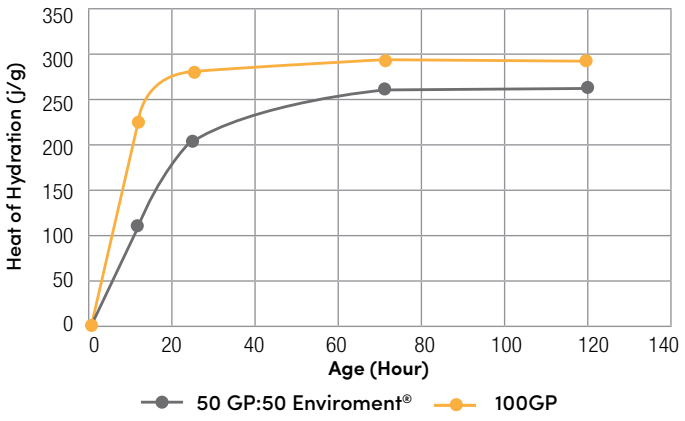
Data sourced from Cement Concrete & Aggregates Australia (CCAA) Part II. Constituents of Concrete, Supplementary Cementitious Materials 2020

COMPATIBILITY

Enviroment® may be mixed with appropriate quantities of other Supplementary Cementitious Materials (SCMs) complying with AS 3582, such as fly ash and/or silica fume.

HEAT OF HYDRATION PROFILE

Replacing General Purpose cement with Enviroment® reduces the heat of hydration and the blend can be used for low heat applications. The below graph shows the reduced heat generated from hydration of the mix with 50% General Purpose cement and 50% Enviroment® in comparison to 100% General Purpose cement.



The data is based on product tested under laboratory conditions.

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MIX DESIGN

Dense, fully compacted concrete is essential to maximise both the strength and durability. Careful selection of mix components is essential and reference should be made to AS 3600 – Concrete Structures when selecting the required strength and other concrete performance criteria. Our technical team is available for mix design advice, see contact details below.

AVAILABILITY

Enviroment® is available in bulk bags and bulk.

CLEAN UP AND STORAGE

- Clean all tools and equipment with water promptly after use.
- Clean up by vacuum or using wet methods. Avoid dry sweeping.
- If spilled, prevent product from entering drains and waterways, however this product is non-toxic to aquatic organisms when present as a cured solid.

All cement-based products need to be stored sealed in a cool, dry environment, under cover and off the ground wherever possible. Contact with moisture, including humid conditions, will cause hydration to commence and reduce shelf life considerably. It is recommended to dispose of any cement-based products more than 12 months old.

SAFE HANDLING

This product is generally safe to handle, however safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating.

The Hexavalent Chromium content in this product is expected to be very low in slag (<< 20 ppm) due to reducing conditions during manufacture. The product also may contain trace levels of Respirable Crystalline Silica.

Avoid generating dust wherever possible. Use dust capture or otherwise use in well ventilated areas. When cutting or abrading concrete keep it wetted with water to avoid creating hazardous dust.

Wear safety glasses or dust-proof goggles when handling material to avoid contact with eyes. Wear PVC, rubber, or cotton gloves when handling material to prevent skin contact. Wash product off unprotected skin immediately with water. Where an inhalation risk exists, wear a minimum Class P1 respirator.

For further safety information consult the Safety Data Sheet for the product available at www.boral.com.au/cement

PRODUCT SUPPORT

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