

SLAGCEM

PORTLAND SLAG CEMENT (CEM II/B-S 42.5N)
BLAST FURNACE CEMENT (CEM III/A 42.5L) and (CEM III/B 32.5N - LH/SR)



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SLAGCEM is the brand name of the high quality Portland Slag Cement / Blast Furnace Cement produced by blending Ground Granulated Blast Furnace Slag (GGBS) with Ordinary Portland Cement (CEM I).

CERTIFICATIONS

Portland Slag Cement is certified to CEM II/B-S 42.5N (21% to 35% Blast Furnace Slag). Blast Furnace Cement is certified to CEM III/A 42.5L (36% to 65% Blast Furnace Slag) as well as CEM III/B 32.5N - LH/SR (66% to 80% Blast Furnace Slag). CEM III/B 32.5N - LH/SR is certified as Low Heat (LH) and Sulfate Resistance (SR) Cement.



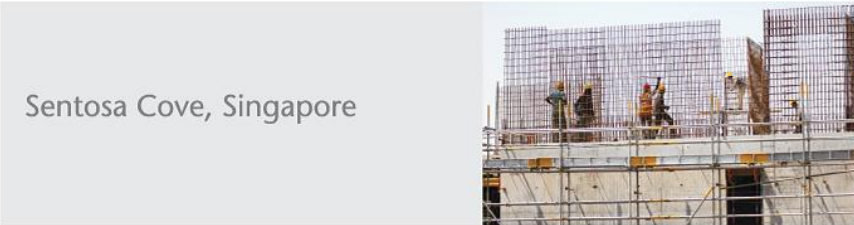
APPLICATIONS

Portland Slag Cement is suitable for applications in moderate heat of hydration, moderate sulfate resistance, water retaining structures, basement and other structures which require moderate low heat of hydration.

Blast Furnace Cement is suitable for applications in marine environment, mass concreting, sulfate environment, water retaining structures, basement and other structures which require low heat, sulfate resistance and chloride resistance.



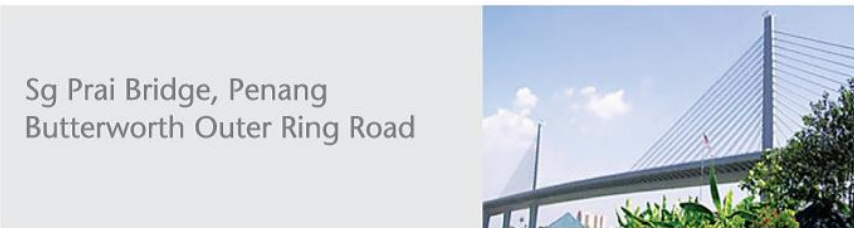
Besut Barrage, Terengganu



Sentosa Cove, Singapore



Upgrade of Sabak Bernam –
Changkat Jering Road



Sg Prai Bridge, Penang
Butterworth Outer Ring Road



Sentosa Integrated Resort,
Singapore

BENEFITS AND SELECTION OF PORTLAND SLAG CEMENT AND BLAST FURNACE CEMENT BASED ON RECOMMENDATIONS OF THE BRITISH STANDARD

BS 8500-1:2015, TABLE A.4, DURABILITY FOR REINFORCED OR PRESTRESSED ELEMENTS WITH INTENDED WORKING LIFE OF AT LEAST 50 YEARS (EXTRACTS)

Exposure Class	Nominal cover mm	Compressive Strength Class	Maximum w/c ratio	Minimum cement or combination content	Cement / Combination
XS3	80 +ΔC	C55	0.35	380	CEM I, IIA, IIB-S
		C30			IIIA
	70 +ΔC	C30	0.55	320	IIIA ≥46% GGBS
		C25			IIIB
	50 +ΔC	C50	0.35	380	IIIA
		C40			IIIA ≥46% GGBS
	45 +ΔC	C35	0.45	360	IIIB
		C50			IIIA ≥46% GGBS
		C45	0.35	380	IIIB

1. ΔC, to accommodate fixing precision (nominally at 5mm to 15mm).
2. OPC concrete is ONLY allowed for nominal cover of 80mm +ΔC. Cement with higher GGBS content (≥46%) are recommended for marine structures in XS3 exposure class.
3. XS3 = Tidal, splash and spray zones.

BS 8500-1:2015, Table A.12 LIMITING VALUES OF COMPOSITION AND PROPERTIES FOR CONCRETE WHERE A DC-CLASS IS SPECIFIED (EXTRACTS)

* DC-class	Max. w/c ratio	Min. cement or combination content (kg/m ³) for max. 20mm aggregate size	Cement and combination types
DC-2	0.55	320	IIB-V+SR, IIIA+SR, IIIB+SR, IVB-V
	0.50	340	CEM I, IIA-S, IIA-V, IIB-S, IIB-V, IIIA, IIIB
	0.45	360	IIA-L - 42.5
	0.40	380	IIA-L - 32.5
DC-3	0.50	340	IIIB+SR
	0.45	360	IVB-V
	0.40	380	IIB-V+SR, IIIA+SR
DC-4	0.45	360	IIIB+SR
	0.40	380	IVB-V
DC-4m	0.35	380	IIB-V+SR, IIIA+SR
	0.45	360	IIIB+SR

1. Please refer to BS 8500-1:2015, Table A.2 and Table A.10 for details on selection of DC classes.
2. *DC-class stands for Design Chemical class.
3. CEM IIIB+SR (Sulfate Resisting) is cost effective cement for concrete under chemical attack.



PROPERTIES

Portland Slag Cement, CEM II/B-S 42.5N

Tests	Units	Specification MS EN 197-1 : 2014	Test Results
Chemical Composition			
Sulfate content (SO ₃)	%	3.5 max.	2.9
Chloride (Cl ⁻)	%	0.10 max.	0.01
Physical Properties			
Compressive Strength			
Mortar Prisms : 2 days	MPa	10 min.	16.1
(1:3:0.5) : 28 days	MPa	42.5 < x < 62.5	53.3
Setting Time - Initial	mins	60 min.	225
Soundness	mm	10 max.	1

Blast Furnace Cement, CEM III/A 42.5L

Tests	Units	Specification MS EN 197-1 : 2014	Test Results
Chemical Composition			
Loss On Ignition (LOI)	%	5.0 max.	0.2
Insoluble Residue (IR)	%	5.0 max.	0.3
Sulfate content (SO ₃)	%	4.0 max.	2.5
Chloride (Cl ⁻)	%	0.10 max.	0.01
Physical Properties			
Compressive Strength			
Mortar Prisms : 7 days	MPa	16 min.	26.1
(1:3:0.5) : 28 days	MPa	42.5 < x < 62.5	52.8
Setting Time - Initial	mins	60 min.	230
Soundness	mm	10 max.	1

Blast Furnace Cement, CEM III/B 32.5N

Tests	Units	Specification MS EN 197-1 : 2014	Test Results
Chemical Composition			
Loss On Ignition (LOI)	%	5.0 max.	0.7
Insoluble Residue (IR)	%	5.0 max.	0.2
Sulfate content (SO ₃)	%	4.0 max.	2.5
Chloride (Cl ⁻)	%	0.10 max.	0.01
Physical Properties			
Compressive Strength			
Mortar Prisms : 7 days	MPa	16 min.	26.1
(1:3:0.5) : 28 days	MPa	32.5 < x < 52.5	40.0
Setting Time - Initial	mins	75 min.	280
Soundness	mm	10 max.	1



HEALTH AND SAFETY

Skin contact with wet cement, fresh concrete or mortar may cause irritation dermatitis or burns. It is recommended to use Personal Protective Equipments which include eye, hand, skin protection and dust masks. First aid treatment should involve the immediate bathing of the affected area with water.



ENVIRONMENTAL BENEFITS

As granulated blast furnace slag is a by-product from the steel manufacturing process, by using GGBS to replace 30%, 50% and 70% of cement, significant amount of CO₂ emission will be eliminated.



Certification nos.
022-037 & 022-039

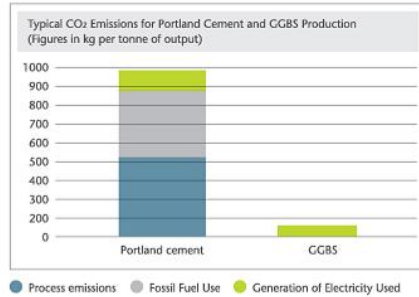


SIRIM
Eco-Label nos.
EL000002 & EL000005

GREEN LABEL SINGAPORE / SIRIM ECO-LABEL

Both Portland Slag Cement and Blast Furnace Cement are certified as eco-friendly cement by the Singapore Environment Council and SIRIM QAS International Sdn. Bhd.

CO₂ emissions for GGBS and cement production



AVAILABILITY

Portland Slag Cement and Blast Furnace Cement are available in bulk from YTL Westport & Pasir Gudang cement plants.

QUALITY ASSURANCE

Portland Slag Cement and Blast Furnace Cement are produced under stringent quality assurance, environmental management, health & safety and energy management systems. It is certified to MS ISO 9001, MS ISO 14001, OHSAS 18001 & MS ISO 50001.

TYPICAL SPECIFICATIONS FOR MARINE WORKS

Requirement	Reinforced Concrete
Intended working life of structure	120 years
Minimum cover to reinforcement	External faces 40mm / Internal faces 25mm
Applicable exposure classes (excluding DC-class) as defined in BS 8500-1	XS3
Minimum cement content (kg/m ³)	380 kg/m ³
Maximum free water/cement ratio	0.40
Permitted group or type and class of cement or combination	Type III/A and III/B Blast furnace cement with 36% to 65% slag (CEM III/A) or with 66% to 80% slag (CEM III/B)
Consistence class	S3 (Slump = 80 - 170mm)



REQUIREMENTS FOR TEMPERATURE CONTROL AS PER BS 8500-1 : 2015

Clause A.8.2
Delayed Ettringite Formation

Where the heat of hydration or accelerated curing is likely to take the concrete temperature above 70°C, the potential for Delayed Ettringite Formation should be considered.

LAND TRANSPORT AUTHORITY (LTA) SINGAPORE, SPECIFICATION FOR CONCRETE

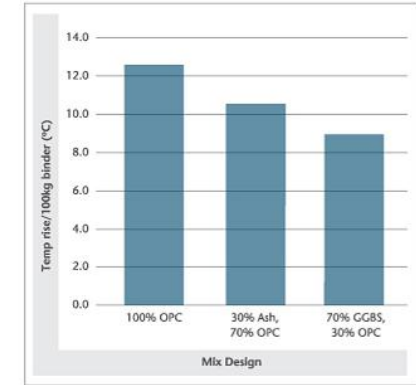
Clause 11.11
Concreting of thick sections

1. Maximum temperature shall not exceed 70°C.
2. When GGBS is used at not less than 60%, maximum temperature shall not exceed 75°C.

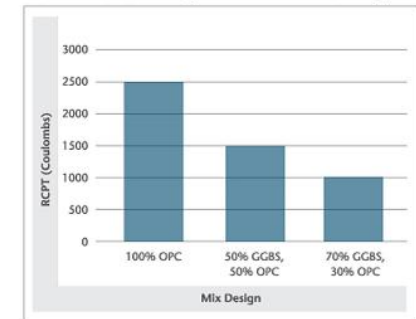
SPECIFICATIONS ON TEMPERATURE OF CONCRETE FOR A DAM PROJECT

1. For normal structural concrete, the maximum temperature in the core after placing shall not exceed 65°C.
The temperature differential between the surface and core of any section after placing shall not exceed 30°C.
2. For massive concrete placements, the maximum temperature in the core after placing shall not exceed 50°C.
The temperature differential between surface and core of any section after placing shall not exceed 20°C.

Benefits of SLAGCEM For Temperature Rise Temp Rise/100kg Binder (Semi Adiabatic)

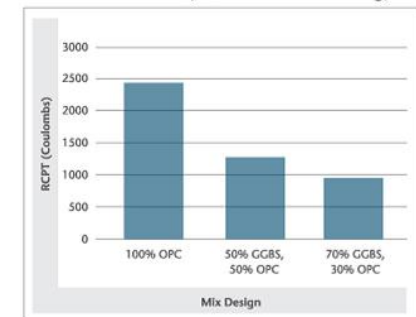


RCPT Results @ 28D (Binder Content = 500kg)



* RCPT = Rapid Chloride Permeability Test

RCPT Results @ 56D (Binder Content = 500kg)



* RCPT = Rapid Chloride Permeability Test