JSW CEMENT LIMITED

WELCOMES YOU

CEMENT LIMITED

Unity in Diversity- The JSW Group

The JSW Group lead by dynamic & Visionary leadership of Shri. Sajjan Jindal, today is a dynamic business conglomerate with a high growth in diverse fields; Steel, Energy, Minerals & Mining , Aluminum, Infrastructure & logistics, Cement & Information technology. From Steel plant to what it is today ; a US$ 3.7 billion entity the group has docked itself into the league of big guns.

The man architect of JSW- late Shri Om Prakash Jindal

Om Prakash Jindal , the group founder set the ball rolling of what would later become a billion dollar, multilocation and multiproduct industrial empire. To begin with started to trade in steel pipes, later established a manufacturing plant rolling out steel pipes, bends and sockets.

JSW CEMENT LIMITED

NANDYAL WORKS- A.P

PRODUCT OF JSW CEMENT

PORTLAND SLAG CEMENT

(IS:455-1989)

POTRTLAND SLAG CEMENT

- ***WHAT IS SLAG?***

- ***"Slag"*** *is a non-metallic product consisting essentially of glass containing silicates and Alumino Silicates of lime. It is the by -product obtained in the manufacture of pig Iron in blast furnaces at around 1400° to 1500°C in the molten form.The granulated slag is obtained by rapidly chilling (Quenching) the molten ash from the furnace by means of water or steam and air.*

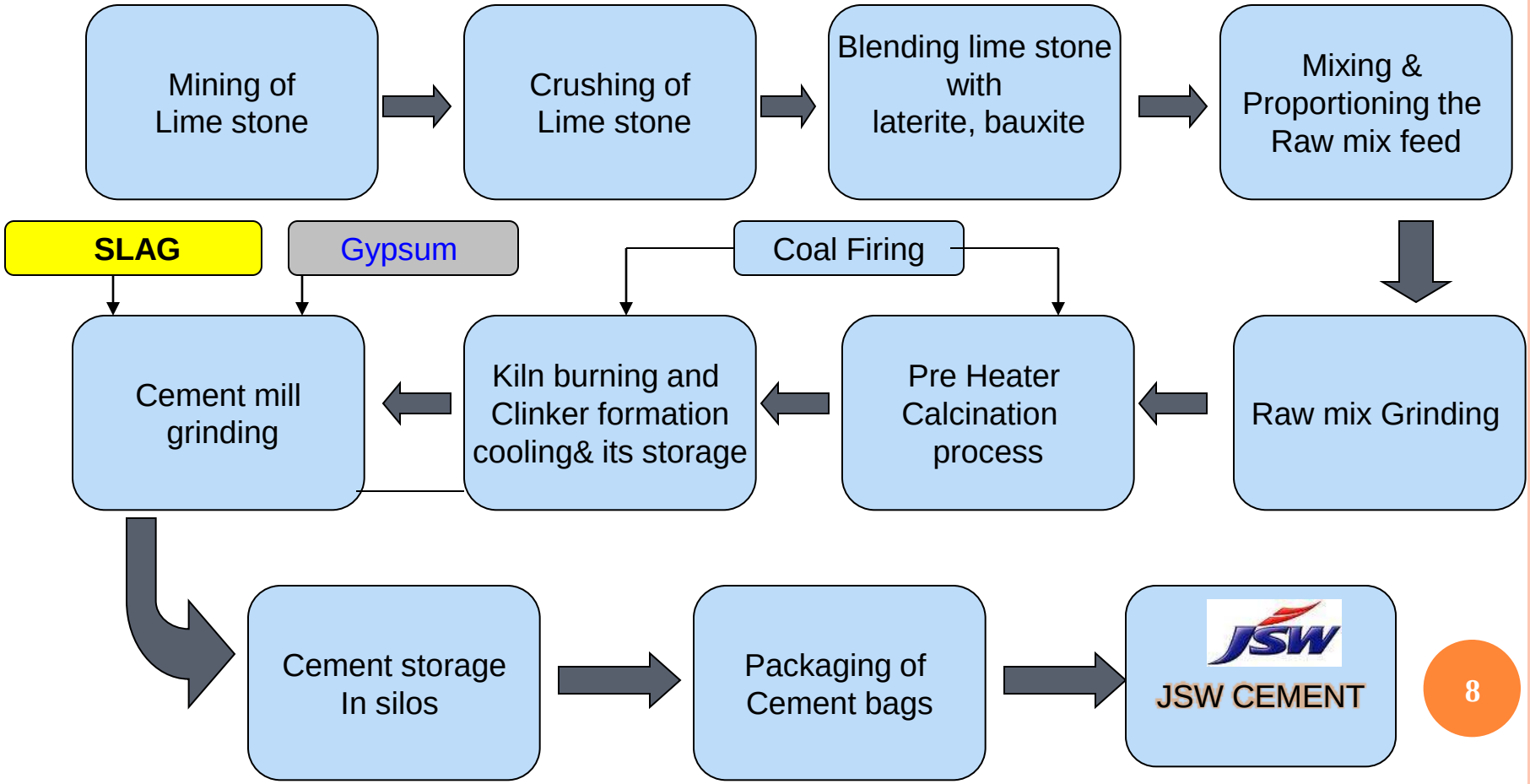
WHAT IS PORTLAND SLAG CEMENT?

Portland Slag cement is manufactured by either inter- grinding the Portland cement clinker, Gypsum and granulated slag or blending the ground granulated blast furnace slag (GGBS) with Ordinary Portland cement by means of mechanical blenders.

BIS SPECIFICATION FOR SLAG CEMENT

SLAG CEMENT IS MANUFACTURED AS PER BIS SPECIFICATION IS 455 – 1989 AND THE QUANTITY OF SLAG TO BE ADDED SHALL BE IN THE RANGE OF 25%TO70%.

MANUFACTURING OF JSW CEMENT



MAJOR COMPOUNDS IN CEMENT

S.NO	Name of Compound	Abbreviation	Oxide composition	Approx. (%)	Function
1	Tri calcium silicate	C_3S	$3CaO,SiO_2$	45 to 55	Responsible for early strength (1 to 7 days.)
2	Di calcium silicate	C_2S	$2CaO,SiO_2$	20 to 30	Responsible for later strength
3	Tri Calcium Aluminate	C_3A	$3CaO,Al_2O_3$	6 to 10	C3A increases rate of hydration of C3S. It gives flash set in absence of Gypsum
4	Tetra Calcium Alumino- ferrate	C_4AF	$4CaO, Al_2O_3,Fe_2O_3$	15 to 20	It hydrates rapidly but its contribution to strength is uncertain and generally very low.

CEMENT HYDRATION MECHANISUM

OPC

CEMENT + WATER

↓

C- S-H + Ca(OH)2

↓

Ca(OH)2 + CO2(Humidity)

↓

CaCO3(In Soluble)+Humidity

↓

Calcium Bi Carbonates (Soluble)

↓

LEACHING OF CONCRETE

PSC

CEMENT+ WATER

↓

C-S-H + Ca(OH)2

↓

Ca(OH)2 + (Slag)

↓

C-S-H

↓

DURABILITY

QUALITY COMPARISION OF JSW CEMENT

S.NO	Physical Requirements.	IS8112:1989 (OPC-43Gr.)	JSW CEMENT (PSC)	IS 455:1989 (PSC)
1	Fineness (M^2/kg)	225 Min.	390	225
2	Soundness			
A)	Lee-chatilier (mm)	10 Max	0.5	10 Max
B)	Autoclave (%)	0.8 Max	0.06	0.8 Max
3	Setting Time (Minutes)			
A)	Initial	30 Min	180	30 Min
B)	Final	600 Min	240	600 Min.
4	Comp. Strength (Mpa.)			
A)	3 Days	23.0	24.0	16.0
B)	7 Days	33.0	38.0	22.0
C)	28 Days	43.0	54.0	33.0

ADVATAGES OF JSW CEMENT

- *Max. Reduction in heat of hydration,*
- *High ultimate strength,*
- *High Impermeability,*
- *Excellent resistance to Chloride penetration,*
- *Excellent resistance to Sulphate attacks,*
- *Low risk of Cracking,*

ADVATAGES OF JSW CEMENT

- *Improves workability,*
- *Better compatibility with admixtures,*
- *Better finish,*
- *Ease for pumping,*
- *Better resistance against Alkali- Silica reaction,*
- *Eliminates Leaching,*
- *Minimise Shrinkage*

PROPERTIES OF SLAG AND FLY ASH

Concrete Properties:

Slag cement is a more uniform product than fly ash. As a result, concrete made with slag cement will generally have more uniform properties than concrete made with fly ash.

Plastic Properties:

<u>Water Reduction.</u> The use of either material should result in a reduction of the required water content to reach a given consistency. This effect with slag cement is due to its influence on paste characteristics and absorption. With fly ash, this is primarily due to the particle shape and size distribution. This allows for small reductions in water reducing admixtures.

PROPERTIES OF SLAG AND FLY ASH

Air Entrainment. *Air contents can vary depending on any number of factors. Carbon content variability in fly ash is one of the major causes of fluctuating air contents. Slag cement does not contain carbon and does not cause instability in the entrained air content.*

Time of Set. *Time of initial set is influenced by the use of slag cement and fly ash. Concrete made with slag cement can have faster set times than concrete made with fly ash.*

Pumpability and Finishability. *Pumpability with slag cement and fly ash is generally improved largely due to the addition of fines to the matrix. Finishability is also improved.*

PROPERTIES OF SLAG AND FLY ASH

Hardened Properties

Strength.

At 28 days, both slag cement and Fly Ash will achieve higher strength than straight Portland cement in concrete mixtures.

Permeability.

At normally specified replacement levels, concrete made with slag cement will have lower permeability than concrete made with fly Ash when tested according to ASTM 1206 (rapid chloride permeability test).

Sulfate Attack and Alkali-Silica Reaction (ASR).

Slag cement and fly ash will both provide protection against sulfate attack and ASR.

PROPERTIES OF SLAG AND FLY ASH

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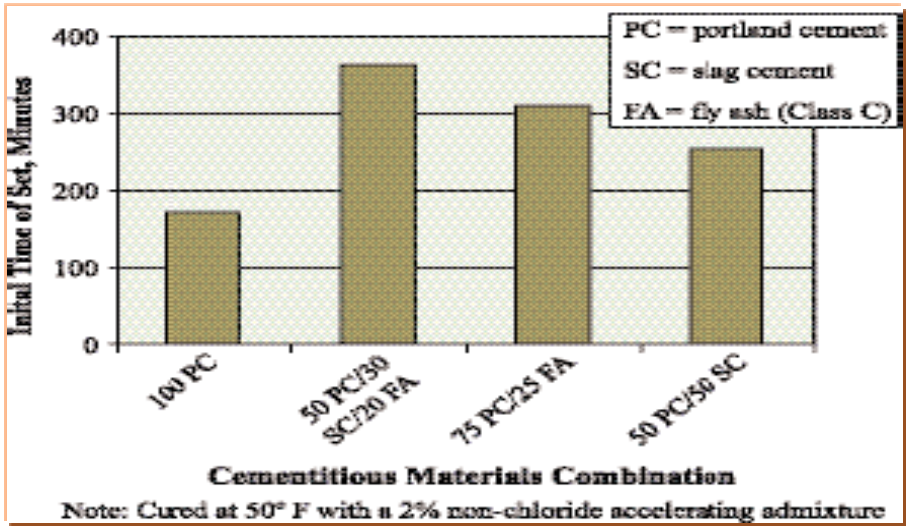


COMPOSITION AND CONSISTENCY

Slag and fly ash are the two most common secondary cementaceous materials used in concrete. Most concrete produced today includes one or both of these materials. For this reason their properties are frequently compared to each other by mix designers seeking to optimize concrete mixtures.

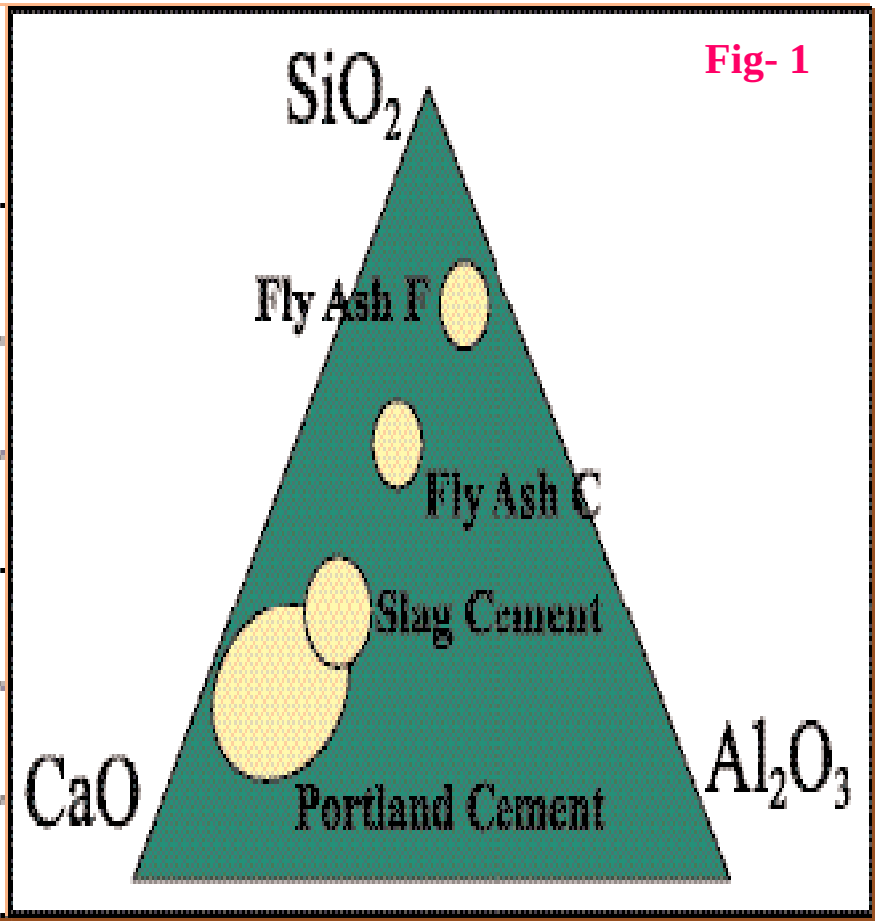
While chemical similarities exist, these materials have different effects on concrete. These differences are based in part on the proportion of oxides in each material .The ternary diagram, shown in Figure 1 shows that slag cement is more closely related to Portland cement than fly ash.

COMPOSITION AND CONSISTENCY

Table 1: Typical Chemical Oxides for Various Cementitious Materials

	Portland Cement	Slag Cement	Fly Ash C	Fly Ash F
CaO	65	45	25	3
SiO_2	20	33	37	58
Al_2O_3	4	10	16	20
Fe_2O_3	3	1	7	10
MgO	3	6	7	1

Fig- 1



COMPOSITION AND CONSISTENCY

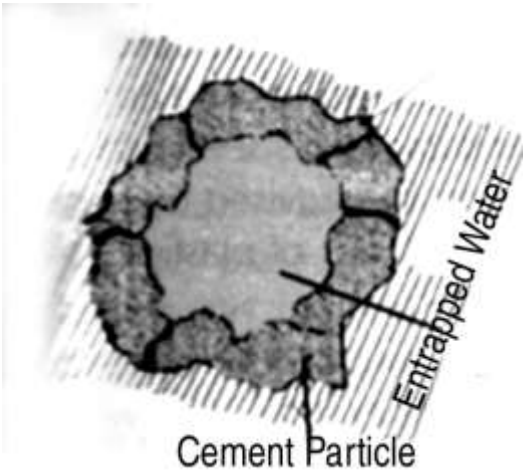
This is one reason why slag cement can be used in much larger amounts. Both are used as a replacement for a portion of the Portland cement. Slag cement replaces as much as 50 percent in normal concrete (and up to 70 percent in special applications such as mass concrete).

Fly -Ash is usually limited to 20 or 30 percent. Slag cement is the co-product of a controlled process, iron production, which results in a very uniform composition from source to source. Fly ash is a byproduct of electric power generation that varies from source to source.

MECHANISM OF GGBS -IMPROVES THE PROPERTIES OF CONCRETE

- **Dispersion of Cement Particles**
- **Particle Packing Effect**
- **Secondary Reaction**
- **Long term Strength development**

Flocculated



Dispersed

ROLE OF SLAG FOR SOUND CEMENT CHEMISTRY

❖**Reduction in heat of hydration and minimization of Thermal cracks.**

❖**Absorption of surplus lime released out of OPC to form in to secondary hydrated mineralogy.**

❖**Pore refinement and grain refinement due to the secondary hydrated mineralogy, thus contributing for impermeability and enrichment of Transition zones.**

❖ **Improved impermeability of the concrete resulting in increased resistance against the ingress of moisture and gasses.**

❖ **The failure of Moisture and gasses to go through the Densified concrete resulting in the Durability enhancement.**

Diffusion of chloride ions at 25^0 C Cement paste

Cement	Diffusivity 10^{-9} $Cm^{2/g}$
OPC	44.7
PPC(70:30)	14.7
PSC(35:65)	**4.1**

HEAT OF HYDRATION

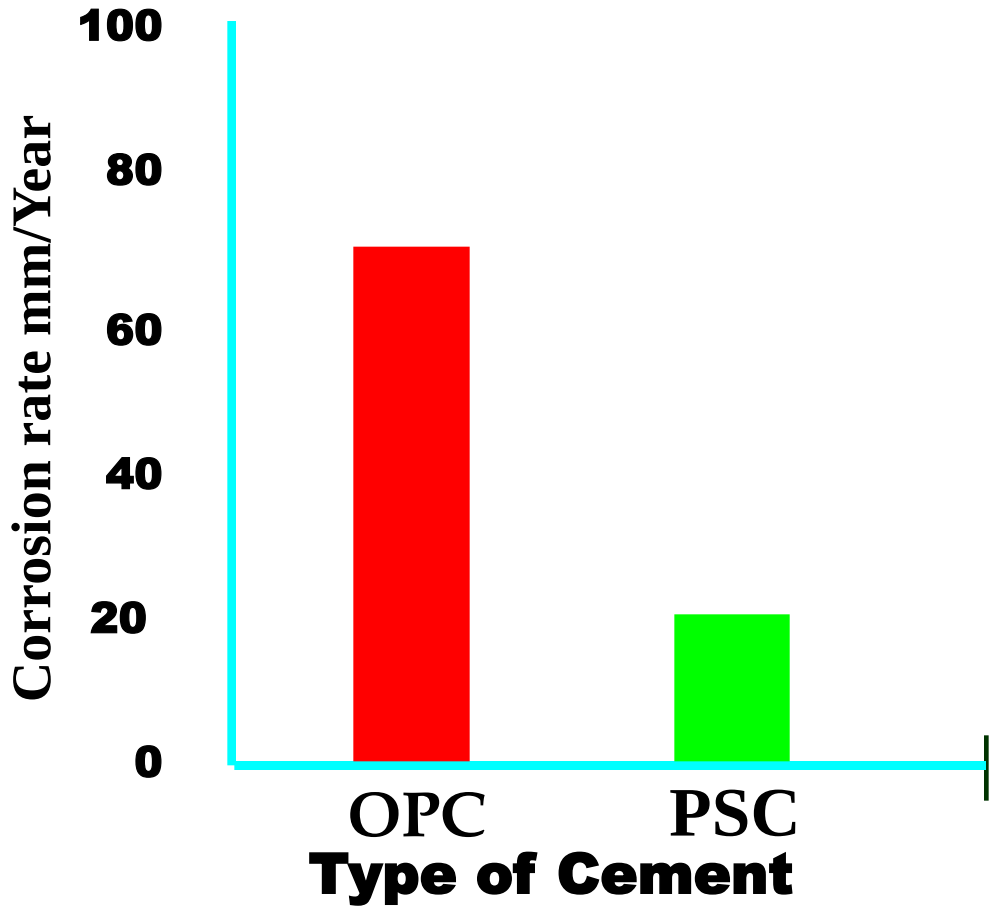
Type of cement	Heat of Hydration KJ/Kg 7 days	28 days
OPC	300	350
PSC (70%Slag)	**195**	**225**
PPC (30% Fly-ash)	210	270

STRENGTH COMPARISION OF OPC, PPC & PSC

Strength kg/cm2	**OPC (43)**	**PPC**	**PSC**
3 day	34	31	26
7 day	41	41	40
28 day	**52**	**54**	**57**

Corrosion of reinforcement

OPC v/s PSC



BLENDED CEMENTS TO RESIST SULPHATE ATTACK

Sulphate in Soil as SO_3, %	In ground water,g/l	Type of cement to be used
< 0.2	< 0.3	OPC/PPC/PSC (Min. cement=280kg/m^3)
0.2 to 0.5	0.3 to 1.2	OPC/PPC/PSC (Min. cement=330kg/m^3)
0.5 to 1.0	1.2 to 2.5	PPC/PSC (Min. cement=350kg/m^3)

- *Low C3A cement(SRC) was not recommended In marine environment, As C3A is important to trap chloride ions entering the concrete.*

- *Similar recommendations exist in IS 456 in case chloride is encountered along with Sulphates in soil or ground water:*

- *Portland Slag cement with more than 50% slag is recommended in place of SRC.*

TYPICAL COMPOSITION OF OPC,PPC & PSC

Constituents (%)	OPC	PPC (with 30% flyash)	PSC (with50% G.G.B.S)
Silica(SiO_2)	2.22	37.40	27. 68
Alumina(Al_2O_3	5.14	13.08	12. 59
Iron Oxide($Fe_2O_{3)}$	4.75	04.61	01. 92
Calcium Oxide(CaO)	61.05	44.29	47. 63
Magnesium Oxide(MgO)	1.26	01.00	06. 64
Sulphur Trioxide (SO_3	0.67	01.86	00. 31
Sodium Oxide(Na_2O)	0.13	0.22	00. 17
Potassium Oxide(K_2 O)	0.56	0.76	00. 73
Insoluble Residue (IR)	0.08	30.50	01. 15
Loss on ignition	1.80	01.51	00. 37

GOOD QUALITY SLAG(G.G.B.S)

1. **Fineness: Typically about 300 M^2/Kg**
2. **Manganese Oxide: Max.5.5%**
3. **Magnesium Oxide:Max.17.0%**
4. **Sulphide sulphur : Max. 2.0%**
5. **Glass content : Min. 85%**
6. **Insoluble Residue: Max. 5%**

MAINTAINING CONSISTENCY IN QUALITY IS THE STRENGTH OF JSW CEMENT

- *A modern sophisticated plant,*
- *Latest manufacturing Technology,*
- *Advanced Quality control Systems,*
- *High quality lime stone.*

REQUIREMENTS OF GOOD CONCRETE

- **STRENGTH** : Ability to carry designed load.
- **DURABILITY:** Ability to withstand to a variety of physical and Chemical attacks .

HOW TO ACHIVE IT?

By Using

JSW CEMENT

SLAG CEMENT A PROVEN PRODUCT

- Construction of Parliament Library Building, New Delhi by L&T, ECC Group
- Construction of LNG Storage Tanks in Dahej, Gujarat by Afcons
- Worli-Sion Sewerage line by Dywidag, Germany
- Construction of Flyover in Sea Coast by Vizag Port
- ***Construction world class projects in Dubai***
- Construction of oil storage Tanks by L&T ECC for Chennai Petroleum Corporation, Chennai

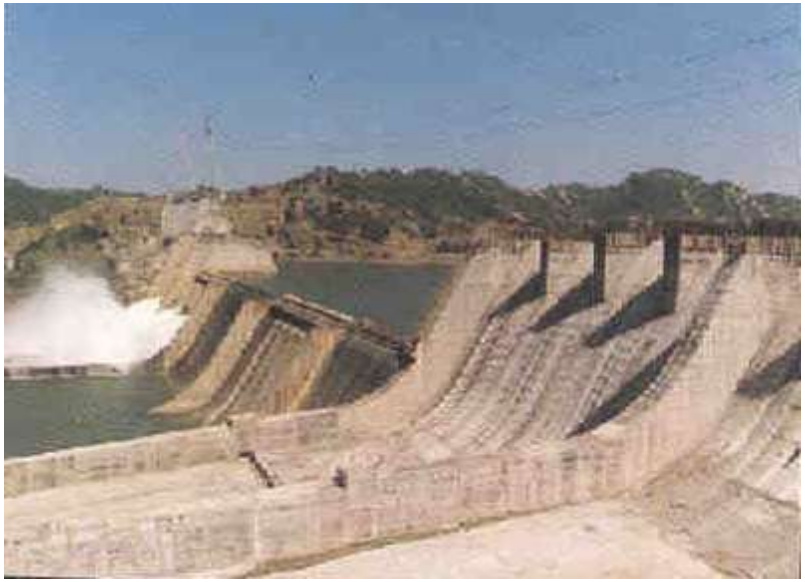
Worli-Bandra sewage outlet pipeline Use of GGBS (70% replacement)

SALHUS HIGH BRIDGE NORWAY

Mono tower cable stayed bridge super structure for the main span of 163 m. Mix Slag cement 450 kg + silica fume 35 kg+ LWA 570 kg+ water 195 kg effective w/b ratio 0.32. In situ density 1920 kg/cu.m.. Average strength 73.5 MPa.

Sardar Sarover Narmada Nigam Dam / Power House / Canals

Blended cements are extensively used



SIMHADRI THERMAL POWER PROJECT OF NTPC

- Capacity : 2 X 500 MW
- Two Natural Draft Cooling Towers
- Height : 165 mts.
- (Biggest in Asia and Sixth biggest in the world)
- Construction Company : NBCC
- Cement used : 60% GGBS + 40% OPC

SELECTION OF CEMENT FOR THE EURO TUNNEL

- Connecting France and U.K.
- 37 KM under sea
- Designed for 120 years
- High performance concrete used

- *Low C3A cement(SRC) was not recommended In marine environment, As C3A is important to trap chloride ions entering the concrete.*

- *Similar recommendations exist in IS 456 in case chloride is encountered along with Sulphates in soil or ground water:*

Portland Slag cement with more than 50% slag is recommended in place of SRC.

ESTEEMED CUSTOMER LIST

- Lafarge Aggregates & Cement Ltd.
- NTPC
- Hyderabad Industries
- Ultratech /Grasim Industries Ltd
- RMC India Ltd.
- IJM Concrete Limited
- Afcons Infrastructure Ltd
- Gammon India Limited
- My Home Ready Mix India Pvt Ltd.
- Annapurna Constructions Ltd
- Jayabheri Group of Constructions and like many more…..

PSC is the Superior Cement for Making Durable Constructions.