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CHAPTER :- 2

PROFILES OF CEMENT INDUSTRIES.

2.1 INTRODUCTION :-

History is the record of changes in man and nations. The past few decades were just one of these momentous times which changed the very face of the world. In fact, they were the years of revolution in the geographical, political and economic areas were achieved and new innovation and alignments were brought made and remade day-by-day and year-by-year.

It must be interesting to know how cement is made today visa-a-visa the historical background. Ever since civilizations stepped in the earth, people sought a material that would bind stones into a solid, formed mass. The Assyrians and Babylonians used clay for this purpose, and the Egyptians advanced to the discovery of lime and gypsum mortar as a binding agent for building such structures as the Pyramids. The Greeks made further improvements and finally the Romans developed cement that produced structures of remarkable durability. The secret of Roman success in making cement was traced to the mixing of slaked lime with pozzolana, a volcanic ash from Mount Vesuvius. This process produced cement capable of hardening under water. During the Middle Ages this art was lost and it was not until the scientific spirit of inquiry revived that we rediscovered the secret of hydraulic cement — cement that will harden under water. Most of the building foundations in the Roman Forum were constructed of a form of concrete, placed in some
locations to a depth of 12 feet. The great Roman baths built about 27 B.C., the Coliseum, and the huge Basilica of Constantine are examples of early Roman architecture in which cement mortar was used. Portland cement today, as in Aspdin’s day, is a predetermined and carefully proportioned chemical combination of calcium, silicon, iron, and aluminum. Natural cement gave way to Portland cement, which is a predictable, known product of consistently high quality. Aspdin established a plant in used in 1828 in the construction of the Thames River Tunnel. But it was almost 20 years later when J.D. White and Sons set up a prosperous factory in Kent that the Portland cement industries saw its greatest period of early expansion, not only in England, but also in Belgium and Germany. Portland cement was used to build the London sewer system in 1859-1867. Thomas A. Edison was a pioneer in the further development of the rotary kiln. In 1902, in his Edison Portland cement Works in New village, N.J., he introduced the first long kilns used in the industries—150 feet long in contrast to the customary 60 to 80 feet. Today, some kilns are more than 500 feet long. Parallel improvements in crushing and grinding equipment also influenced the rapid increase in production. Since grinding process consumes most of the energy various grinding systems like ball mill/vertical roller mill/Roller presses has been the result of technological developments. Blending takes place in silos with air blown in from the bottom to aerate the contents. Various new designs were also developed to increase the efficiency of mixing.

India is the world's second largest producer of cement after China, with cement companies adding nearly eight million tons (MT)
capacity in April 2009, taking the total installed capacity to 219 MT. A few of the leading manufactures are the Ultra Tech/Grasim combine Dalmia cements. India cements, Holeim etc. With the boost given by the government to various infrastructure profits, road networks and housing facilities, growth in the cement consumption is anticipated in the coming years.

Infrastructure is backbone of any economy which is Petroleum, Fertilizer, Iron, Steel, Coal- Banking, Insurance, Power and cement etc. The cement Industries is one of the core industries of the nation. Because cement is a fundamental requirements of all constructions activities. Cement is used in housing, bridges, roads, industrial construction etc. as well as cement is basic material which is used in all types of construction.

In ancient time buildings were constructed with sand stone, bricks, lime, gypsum and in special case marbles were used for this purpose. The house of ordinary citizens was usually made of mud and that same times of special type of wood fire. In some cases lime and Pozzolana were used for getting beautiful finish for the interior surface. There were very skilled builders and masons who hate created excellent and beautiful building, temples and bathing Ghats thousands of years ago, still they are famous for their work and art.

In old day various types of building materials were used for construction of public historical and religious buildings send, stone, mortar, bricks, lime, gypsum, and in special case marbles were used for this purpose the house of the ordinary citizens were usually made of mud and that some times of special types of think bricks backed by means of
wood fire. In few cause lime and puzzling were used for getting beautiful finish for the interior surface these were very good builders and masons who have created temples, buildings and bathing Ghats thousand of year ago, still testing to the high standard architectural design and construction in ancient India. 60% the total plans outlay goes forwards construction of which cement is the important and main input the importance of cement accelerates with development of the country. Hence if there is development, it will be reflected in the seas of construction of factors building and bridges that demand of cement will be more and more. Indian has become one of the largest consumers of cement in the world.

The story of the investment post land is not easy dissent angle. However, during 18\textsuperscript{th} century slowly and gradually new types of material and cement developed in Europe. Jama frost patented cement in 1811 and established works at swanscomde, the first in the London district. However history says manufacture of cement of cement in 1824, Joseph Aspadin a British stone mason, obtain a patent for a cement Aspadin first patent is dated 21\textsuperscript{st} October, 1824, the patented on artificial made by calcinations of an argillaceous lime stone kwon as Part land cement because it resemble a stone quarried on the isle of Portland near England with this investment Aspadin laid the foundation for today's Portland cement Industries.

Cement is a powdered material with water forms a paste that hardens slowly. It is made by various types of raw materials. The prominent raw material composed in the mixture is calcium carbonates as limestone and other alumina silicates as clay or shale. During the sintering process chemical reaction takes place produces nodules called
clinkers which consists. When the clinker is pulverized with a small amount of gypsum as a reader, the resulting powder is called Portland cement.

Cement is a main material for all types of construction works and it is widely used in construction from smallest building to largest structures like dams, bridge, irrigation works, industrial complex etc. In short it can be said that cement as well as steel are sinequa-non for that development of construction activities in the country.

2.2 HISTORY OF CEMENT INDUSTRIES :-

In the 18th century a big effort started in Europe to understand some limes hydraulic properties are unknown. John Smeaton often referred to as “father of civil engineering in England” concentrated his work in this field.

The French Engineer Louis Vicat, inspired by the work of Smeaton and Parker, began a study of hydraulic limes in 1812 (published in 1818 as “Recherché experiment ales sure les chaux de construction”). He reported that in the absence of naturally occurring argillaceous components in limestone, quality hydraulic limes could be prepared by the calcinations of fixed ratios of clay proportioned with quicklime.

In 1818 an English patent was granted to Maurice Leger for “Improvement method of making lime”.

In 1822, the production of “British cement” had been started by James Frost at Swahscombe based on a patent for “a new cement or artificial stone”.

The invention of Portland cement is generally credited to Joseph
Aspedin, an English Bricklayer in 1824. It involves a double kilning such as was described by Vicat.

In 1838 a young chemical engineer, Isaac Johnson, burned the cement raw material at high temperature until the mass was nearly vitrified producing the modern Portland cement.

In 1898 Atlas Portland cement company according to Lewis improved the design by using what is called a rotary kiln, this improvement was a big revolution in the cement industries because the new kiln could produce 200 cement barrels per day compared to a shaft kiln which produced only 40 to max 80 barrels per day; in addition to quick improvement in this new design regarding the mixing, grinding equipments for raw material, grinding equipments for coal, belt conveyor using mix kind of fuel such as natural gas (1904, Iola Portland cement, Iola Kansas).

In 1899 Atlas cement Company improved the technology of the rotary Kiln and fuel economy by replacing fuel oil with powdered coal dust. Furthermore, modifications to the kiln were made by addition of two auxiliary clinker coolers, in which the first hot discharged clinker coolers. In which the first hot discharged clinker was received as it fell from the kiln and air flowing over it was heated and helped to ignite the coal dust in the rotary kiln.

The new clinker produced from the new kiln technology was different than the old clinker especially from the setting time (much faster setting time). The French chemist Pierre Giron solved this problem by adding gypsum to the cement in order to control the setting time.

After 1900 there was rapid growth in both rotary kiln and auxiliary equipment technology in the United States. Coal grinding mills
were developed and coal burning in cement kilns became the predominant combustion process in the industries. All the equipments related to cement production crusher, raw mill, belt conveyors, bucked elevators were improved.

Improvement in the following fields pertaining to cement manufacturing from material science technology has been an ongoing process for 200 years.

2.3 CEMENT INDUSTRIES IN INDIA :-

2.3.1 PRIOR TO INDEPENDENCE :-
2.3.2 AFTER INDEPENDENCE :-
2.3.3 PERIOD OF RESTRICTION (1969-1982) :-
2.3.4 PARTIAL CONTROL (1982-1989) :-
2.3.5 AFTER LIBERALIZATION :-
2.3.6 FUTURE TRENDS:-

2.3.1 PRIOR TO INDEPENDENCE :-

The first endeavor to manufacture cement dates back to 1889 when a Calcutta based company endeavored to manufacture cement from Argillaceous (kankar).

But the first endeavor to manufacture cement in an organized way commenced in Madras. South India Industries Ltd began manufacture of Portland cement in 1904. But the effort did not succeed and the company had to halt production.

Finally it was in 1914 that the first licensed cement manufacturing unit was set up by India cement Company Ltd at Porbandar, Gujarat with
an available capacity of 10,000 tonnes and production of 1,000 installed. The First World War gave the impetus to the cement industries still in its initial stages. The following decade saw tremendous progress in terms of manufacturing units, installed capacity and production. This phase is also referred as the nascent stage of India cement Industries.

During the earlier years, production of cement exceeded the demand. Society had a biased opinion against the cement manufactured in India, which further led to reduction in demand. The government intervened by giving protection to the Industries and by encouraging cooperation among the manufacturers.

In 1927, the Concrete Association of India was formed with the twin goals of creating a positive awareness among the public of the utility of cement and to propagate cement consumption.

2.3.2 AFTER INDEPENDENCE :-

The growth rate of cement was slow the period after independence due to various factors like low prices, slow in additional capacity and rising cost. The government intervened several times to boost the industries increasing prices and providing financial incentives. But it had little impact on the industries.

In 1956, the price and distribution control system was set up to ensure fair prices for both the manufacturers and consumers across the country and to reduce regional imbalances and reach self sufficiency.

2.3.3 PERIOD OF RESTRICTION (1969-1982) :-

The cement industry in India was severely restrained by the government during this period. Government hold over the industry was
through both direct and indirect means. Government intervened directly by exercising authority over production, capacity and distribution of cement and it intervened indirectly through price control.

In 1977 the government authorized higher prices for cement manufactured by new units or through Capacity increase in existing units. But still the growth rate was below par.

In 1979 the government introduced a three tier price system. Prices were different for cement produced in low, medium and high cost plants.

However the price control did not have the desired effect. Rise in input cost, reduced profit margins meant the manufactures could not allocated funds for increase in capacity.

2.3.4 PARTIAL CONTROL (1982-1989) :-

To give impetus to the cement industries, the Government of India introduced a quota system in 1982. A quota of 66.60% was imposed for sales to Government and small real estate developers. For new units and sick units a lower quota at 50% was effected the remaining 33.40% was allowed to be sold in the open market.

After changes had a desired effect on the industries. Profitability of the manufacturers increased substantially, but the rising inputs cost was a cause for concern.

2.3.5 AFTER LIBERALIZATION :-

In 1989 the cement industry was given complete freedom, to gear it up to meet the challenges of free market competition due to the impending policy of liberalization. In 1991 the industry was de licensed.

This resulted in an accelerated growth for the industry and
availability of state of the art technology for modernization. Most of the major players invested heavily for capacity expansion.

To maximize the opportunity available in the form of global markets, the industries laid greater focus on exports. The role of the government has been extremely crucial in the growth of the industries.

2.3.6 FUTURE TRENDS :-

- The cement industries expected to grow steadily in 2009-2010 and increase capacity by another 50 million tons in spite of the recession and decrease in demand from the housing sector.
- The industries experts project the sector to grow by 9 to 10% for the current financial year provided India's GDP grows at 7%.
- India ranks second in cement production after China.
- The major Indian cement companies are Associated cement Company Ltd (ACC), Grasim Industries Ltd. Ambuja cements Ltd. J. K cement Ltd and Madras cement Ltd.
- The major players have all made investments to increase the production capacity which leads to a positive outlook for the industries.
- The housing sector accounts for 50% of the demand for cement and this trend is expected to continue in the near future.\(^1\)

2.4 INDUSTRIES OVERVIEW: CONSTRUCTION MACHINERY:-

The demand for new construction equipment in India increased from USD 1.4 billion in 2003 to USD 1.7 billion in 2004. Demand is expected to increase to USD 2.1 billion by the end of 2005.
During the following three years, the Indian construction equipment industries are projected to grow 20 per cent each year. Similarly, U.S. imports that now stand at USD 81 million are expected to grow 27 per cent in each of the coming three years.

Since the onset of “economic liberalization” that occurred during Indian fiscal years (FY) 1996-97, the Government of India has adopted industrial policy changes that have permitted deregulation. Consequently, Indian companies have restructured and modernized. Except for a few strategic industries, the private sector can establish joint ventures with foreign firms. Now, the Government of India allows majority foreign equity ownership for such ventures. Joint ventures with higher-level participation can also be considered if there are substantial benefits to the Indian economy. In particular, the GOI also encourages infrastructure ventures involving the private sector. These initiatives have opened huge market and investment opportunities for the private sector. Many global players are developing industrial and infrastructure projects either individually or jointly with leading Indian firms.

2.5 INDUSTRIES OVERVIEW : CEMENT PRODUCERS :-

India was the fourth largest producer of cement in the world with 115 large plants with installed capacity of 96 Mt/yr belonging to 57 companies, 300 mini cement plants each with less than 2,00,000 t/yr overall installed capacity in 2002 was about 105 Mt/yr.

Redland PLC, based in the United Kingdom, was negotiating with the Birla Group to set up a joint venture to produce ready-mix concrete for the Delhi area, which has been undergoing considerable growth. If
realized, then both companies would have a 50 per cent equity share.

2.6 MEANING OF CEMENT :-

Cement may define as adhesive substance of uniting fragments or masses of solid matter to a compact whole cement bears a chemical relationship to each other, consisting, as they do mixtures which contain compounds of lime a their principal constituents the term "cements" in this restricted sense then equivalent to "calcareous cements" but it may be allowed to include certain compounds of magnesium.

In the most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The word "cement" traces to the Romans, who used the term opus caementicium to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. The volcanic ash and pulverized brick additives that were added to the burnt lime to obtain a hydraulic binder were later referred to as cementum, cimentum, cadent and cement.

Cement used in construction is characterized as hydraulic or non-hydraulic. Hydraulic cements (e.g., Portland cement) harden because of hydration, chemical reactions that occur independently of the mixture's water content; they can harden even underwater or when constantly exposed to wet weather. The chemical reaction that results when the anhydrous cement powder is mixed with water produces hydrates that are not water-soluble. Non-hydraulic cements (e.g., lime and gypsum plaster) must be kept dry in order to retain their strength.
The most important use of cement is the production of mortar and concrete—the bonding of natural or artificial aggregates to form a strong building material that is durable in the face of normal environmental effects.

Concrete should not be confused with cement, because the term cement refers to the material used to bind the aggregate materials of concrete. Concrete is a combination of a cement and aggregate.²

2.7 DEFINITION OF CEMENT :-

Cement is often confused with concrete. Cement is a finely ground, usually grey colored mineral powder. When mixed with water, cement acts as a glue to bind together the sand, gravel and crushed stone to from concrete the most widely used construction material in the world.

Cement is a hydraulic made of finely ground nonmetallic, inorganic material, when mixed with water it forms a paste that sets and hardness by hydration which retains its strength and stability even under water.¹

Cement is produced by grinding and mixing of argillaceous and calcareous materials like clay and limestone and then burning the mix at very high temperature (approx 1450 C) for calcinations.

The Calcined product is known as Clinker. The clinker is cooled and small quantity of Gypsum is added which is finally grounded.

Cement is a mixture of limestone, clay, silica and gypsum. It is a fine powder which when mixed with water sets to a hard mass as a result of hydration of the constituent compounds. It is the most commonly used construction material.³
Cement is often confused with concrete. Cement is a finely ground, usually grey colored mineral powder. When mixed with water, cement acts as a glue to bind together the sand, gravel and crushed stone to form concrete, the most widely used construction material in the world.\(^4\)

### 2.8 HOW CEMENT IS MADE?

Cement is usually gray. White cement can also be found but it is usually more expensive than gray cement.

- Cement mixed with water, sand and gravel, forms concrete.
- Cement mixed with water and sand, forms cement plaster.
- Cement mixed with water, lime and sand, forms mortar.

Cement powder is very, very fine. One kilo (2.2 lbs) contains over 300 billion grains, although we haven't actually counted them to see if that is completely accurate! The powder is so fine it will pass through a sieve capable of holding water.

**Tip:** Cement should be stored in a dry area. If it gets wet or damp the powder will turn into a hard lump.

#### An example of how cement can be made

1.) Limestone is taken from a quarry. It is the major ingredient needed for making cement. Smaller quantities of sand and clay are also needed. Limestone, sand and clay contain the four essential
Elements required to make cement. The four essential elements are calcium, silicon, aluminum and iron.

2.) Boulder-size limestone rocks are transported from the quarry to the cement plant and fed into a crusher who crushes the boulders into marble-size pieces.

3.) The limestone pieces then go through a blender where they are added to the other raw materials in the right proportion.

4.) The raw materials are ground to a powder. This is sometimes done with rollers that crush the materials against a rotating platform.

5.) Everything then goes into a huge, extremely hot, rotating furnace to undergo a process called "sintering". Sintering means: to cause to become a coherent mass by heating without melting. In other words, the raw materials become sort of partially molten. The raw materials reach about 2700° F (1480°C) inside the furnace. This causes chemical and physical changes to the raw materials and they come out of the furnace as large, glassy, red-hot cinders.
6.) The clinker is cooled and ground into a fine gray powder. A small amount of gypsum is also added during the final grinding. It is now the finished product—Portland cement.

The cement is usually shipped in bulk in purpose-made trucks, by rail or even by barge or ship. Some is bagged for those who want small quantities.

Above cement manufacturing process can be classified into the following stages:-

- Raw Material
- Crushing and grinding raw material
- Blending the materials in required proportion
- Burning the prepared mix to form clinker
- Grinding the clinker with gypsum to make cement
Cement manufacturing from the quarrying of limestone to the bagging of cement.

Two main methods of cement manufacturing were prominent, the dry process and the wet process. Dry process now has almost replaced the wet process since wet process consumes high thermal energy for drying the moisture. When rock is the principal raw material, the first step after quarrying in both processes is the primary crushing. Mountains of rock are fed through crushers capable of handling pieces as large as an oil drum. The first crushing reduces the rock to a maximum size of about 6 inches. The rock then goes to secondary crushers or hammer mills for reduction to about 3 inches or smaller. It is then ground in ball mill to fine powder with other ingredients like clay / iron ore / bauxite to create a combination of values for silica / alumina/lime etc. in the mixture. If the process is wet, the grinding goes on in with water so that slurry is resulted after grinding. This slurry is further mixed in mixers and pumped to the kiln. For a dry process kiln, the ground powder is sent to blending silos for
uniform mixing of components added during the grinding stage. This blended material is fed to the preheated / calciner. The preheated is a group of cyclones placed over one another wherein material comes down and hot gases goes up heating the material comes and calcining it in the process. Calcination means liberating carbon dioxide and converting calcium carbonate to calcium oxide. Calciner is nothing but a duct added to give more reaction time to material for calcination. This partially calcined material then comes to the kiln, which is refractory lined rotating tube having burner fitted in the other end. This burner fires coal / oil / natural gas to create a temperature of 1600ºC at the discharge end. As the material in the kiln rolls down towards the discharge end, various reactions take place amongst the components resulting in a mass known as clinker. This clinker is then cooled in coolers. The coolers are either planetary type or grate type. Grate coolers of modern times are much efficient resulting in better heat recuperation and allows reusing this heat in the kiln. The cooled clinker then either goes to storage silo or clinker yard. From the clinker yard it is taken for grinding. In case Ordinary Portland cement is made only gypsum (4-6%) is added before grinding. In case of Portland pozzolona cement additives like fly ash / brick etc. are added. Grinding again is same like for raw material grinding with ball mill or with latest technologies like vertical mill/Roller press etc. The cement powder then taken to packing plant or discharged from silo to a bulk loader directly.

The combination of cement, water, sand, and coarse aggregates (particles of gravel or rushed stone) as normally occurs in the process of concrete mixing is perhaps best described in terms of a simple three-part system:
1. Portland cement + water = cement paste
2. cement paste + sand = mortar
3. Coarse aggregates + mortar = concrete

The cement paste component functions in the first instance to coat and “lubricate” the individual grains of sand, thereby imparting “workability” to the mortar phase. In turn, the mortar serves to lubricate the coarse aggregate particles and so give workability to the fresh concrete. The quantities of cement paste and mortar necessary to achieve adequate levels of workability will depend on the amounts of sand and coarse aggregate present in the concrete, on the associated “grading” of constituent particle sizes, and on the actual level of workability required for the job. If there is insufficient mortar or cement paste the mix will tend to be “harsh” and unworkable. Conversely, too much mortar or cement paste will promote the likelihood of "segregation" effects whereby the coarser aggregate fractions tend to separate out from the remainder of the mix. Contrary to popular belief, concrete does not set and harden through a physical drying-out process. Setting and hardening is due instead to a series of chemical reactions between the Portland cement and water present in the mix; as a result of this so-called hydration process the original cement paste phase is transformed into a sort of “mineral glue” which acts to bind the sand and coarse aggregate fractions together. Most natural aggregates are a good deal stronger than the sort of cement pastes found in typical concretes; i.e. the “mineral glue” tends to function as the weakest link. Accordingly, the strength of a hardened concrete is normally controlled by the strength of its cement paste phase. In turn,
for any given quantity of cement, the associated paste strength is
governed first and foremost by the water content of the original mix;
thus, the lower is the total amount of mix water employed, the greater is
the ultimate strength potential of mortar (and vice versa). Conversely, if
the total mix water is held constant, the higher (or lower) is the
level of cement usage, the higher (or lower) becomes the potential
strength capacity of the cement paste phase. The actual quantity of
cement paste has no real influence here; rather, it is the amount of
cement as compared to the amount of water, which is the main factor.
Concrete aggregates should be relatively clean. (The squeezing of
“dirty” sand will generally produce a noticeable stain on the palm).
Dirty or dusty aggregates tend to require far more mixing water; unless
correspondingly higher levels of cement usage match this additional
“water demand,” strength losses are likely. The presence of dusts, silts,
or clays can also inhibit the degree of bond between individual coarse
aggregate particles and the surrounding mortar, again to the ultimate
detriment of strength; in certain circumstances the adverse effects of
using dirty aggregates any even extend to interference with the normal
processes of cement hydration. It is often supposed that aggregates serve
to “enhance” the strength of concrete. While this rarely applies in
practice, neither is it the case that the aggregate fractions merely
function in the role of cheap fillers. If or when a concrete dries out, the
associated cement paste phase will shrink to some extent; the greater is
the original water content of the cement paste, the higher is its shrinkage
potential. Normal aggregates, on the other hand, show little or no
shrinkage on drying. Accordingly, the greater are the amounts of sand
and coarse aggregate materials present in a concrete mix, the lesser will
be the net influence of paste shrinkage. For a typical concrete in which the combined aggregate fractions generally occupy somewhere between 70-80 percent of the total volume, the shrinkage potential is probably of the order of 10-20 percent of the corresponding value for the paste component acting alone.

2.9 TYPES OF CEMENT :-

The types of cement in India have increased over the years with the advancement in research, development, and technology. The Indian cement industry is witnessing a boom as a result of which the production of different kinds of cement in India has also increased.

2.9.1 ORDINARY PORTLAND CEMENT (O.P.C.) :-
2.9.2 PORTLAND POZZOLONA CEMENT (P.P.C) :-
2.9.3 SPECIAL CEMENT :-

2.9.3.1 RAPID HARDENING CEMENT :-
2.9.3.2 LOW HEAT CEMENT :-
2.9.3.3 WHITE CEMENT :-
2.9.3.4 SULPHATE RESISTANCE CEMENT :-
2.9.3.5 QUICK SETTING CEMENT :-
2.9.3.6 SULPHATE RESISTANT CEMENT :-
2.9.3.7 OIL WELL CEMENT :-
2.9.3.8 CLINKER CEMENT :-
2.9.1 ORDINARY PORTLAND CEMENT (O.P.C.) :-

The Ordinary Portland cement is popularly known as grey cement, which is produced by grinding clinker with 5 per cent gypsum. It is used in all general concrete construction, mass and reinforced concrete. It accounts for about 70.60 per cent of the total production.

This type of cement is manufactured in form of different grades, the most common in India being Grade-53, Grade-43, and Grade-33. OPC is manufactured by burning siliceous materials like limestone at 1400 degree Celsius and thereafter grinding it with gypsum.
OPC gives enough comprehensive strength after soaking in water for 3 days, 7 days and 28 days. This is suitable for all types of modern civil engineering construction.

*Table No. 2.1:* Chemical composition of ordinary Portland cement

<table>
<thead>
<tr>
<th>No.</th>
<th>Particulars</th>
<th>Chemical Formula</th>
<th>Avg. %</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lime</td>
<td>Cao</td>
<td>63</td>
<td>62 to 67</td>
</tr>
<tr>
<td>2</td>
<td>Silica</td>
<td>Sio2</td>
<td>22</td>
<td>17 to 25</td>
</tr>
<tr>
<td>3</td>
<td>Alumina</td>
<td>Al2O</td>
<td>05</td>
<td>3 to 8</td>
</tr>
<tr>
<td>4</td>
<td>Calcium Sulphate</td>
<td>CaSO4</td>
<td>03</td>
<td>3 to 4</td>
</tr>
<tr>
<td>5</td>
<td>Iron Oxide</td>
<td>Fe2O</td>
<td>03</td>
<td>3 to 4</td>
</tr>
<tr>
<td>6</td>
<td>Magnesia</td>
<td>MgO</td>
<td>02</td>
<td>0.1 to 3</td>
</tr>
<tr>
<td>7</td>
<td>Sulphur</td>
<td>SO3</td>
<td>01</td>
<td>1 to 3</td>
</tr>
<tr>
<td>8</td>
<td>Alkalies</td>
<td></td>
<td>01</td>
<td>0.2 to 1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Saurashtra cement ltd. technical division publication)

2.9.2 PORTLAND POZZOLONA CEMENT (P.P.C) :-

It is cheaply manufactured because it uses fly ash/burnt clay/coal waste as the main ingredient. PPC has a lower heat of hydration, which is of advantage in preventing cracks where large volumes are being cast. PPC accounts for 18.3 per cent of the production.

It is grayish in color and made by grinding of lime stone and clay. Burning of lime stone and clay at very high temperature and cooling the resultant product is called clinker, grinding the clinker with of gypsum in
ball mill to a finally ground powder. This is known as Portland cement. This cement is produced by adding 10 to 25% pozzolanic materials to the OPC clinker then grinding together.

Portland Pozzolana cement is manufactured by blending pozzolanic materials, OPC clinker, and gypsum either grinding them together or separately. Today Portland Pozzolana cement is widely in demand for industrial and residential buildings, roads, dams, and machine foundations.

2.9.3 SPECIAL CEMENT :-

2.9.3.1 RAPID HARDENING CEMENT :-

It is similar to OPC, except that it is ground much finer, so that on casting the compressible strength increases rapidly. Water proof cement:

OPC with small portion of calcium stearate or non- saponifibale oil to impart waterproofing properties.

Rapid Hardening Portland cement (RHPC) is a type of cement that is used for special purposes when a faster rate of early high strength is required. RHPC has a higher rate of strength development than the Normal Portland cement.

This type of Portland cement gives the desired strength in 3, 7 and 28 days if soaked in water. But sometimes cement is required high strength in 24 hours as is given by ordinary Portland cement at 3 days. This type of cement is called rapid hardening cement or high early strength cement. This sets and hardens much quickly than ordinary Portland cement.
2.9.3.2 **LOW HEAT CEMENT :-**

This type of cement is used for larger mass concrete works in dams, piers etc. It is necessary to have a much lower heat of hydration, so that chances of developing contraction cracks are minimized. This can be done either by adding some pozzolanic material and granulated blast furnace slag to the cement while grinding or by changing the chemical composition of the cement.

2.9.3.3 **HYDROPHOBIC CEMENT :-**

It is obtained by adding water repellent firm forming substance such as Stearic Acid and Oleic Acid by grinding Portland cement Clinker.

This type of cement reduces wetting ability of cement grains. Hence it impact more time for mixing transporting compacting & finishing etc.

2.9.3.4 **WHITE CEMENT :-**

White cement has registered growth in production and sale in India in the last few years. The white cement sector has been growing at the rate of 11% per year. This has given the Indian cement industry a major boost.

Portland cement is greenish in colour. The colour is due to complex formed with iron oxide present in the cement. It the proportion of iron oxide in the cement is reduced to less than 0.4%, the colour of the cement becomes white. Iron oxide present in cement raw mix helps in improving the burning conditions of cement clinker. White cement is generally used for decorative works only in view of its high cost.
2.9.3.5  SULPHATE RESISTANCE CEMENT :-

Sulphate Resisting Portland cement (SRC) is type of Portland cement in which the quantity of tricalcium aluminates is less than 5% of C3A. It can be used for purposes wherever Portland Pozzolana cement, Slag cement, and Ordinary Portland cement are used.

The use of Portland Sulphate Resisting cement has proved beneficial, particularly in conditions where there is a risk of damage to the concrete from Sulphate attack. The of SRPC is recommended in places where the concrete is in contact with the soil, ground water, exposed to seacoast, and sea water. In all these conditions, the concrete is exposed to attack from Sulphate that is present in excessive amounts, which damage the structure. This is the reason that the use of the SRPC have increased in India.

2.9.3.6  QUICK SETTING CEMENT :-

The percentage of gypsum added is reduced, which accelerate the setting action of this cement is very fast. This type of cement is used for the underwater construction where pumping is involved.

2.9.3.7  OIL WELL CEMENT :-

Oil Well cement as the name suggests, is used for the grouting of the oil wells, also known as the cementing of the oil wells. This is done for both, the off-shore and on-shore oil wells.

As the number of oil wells in India is increasing steadily, the sales of Oil Well cement have also increased. This has boosted the Indian cement industry to a large extent.

Oil well cement is manufactured from the clinker of Portland
cement and also from cements that have been hydraulically blended. Oil Well cement can resist high pressure as well as very high temperatures. OWC sets very slowly because it has organic retarders which prevent it from setting too fast.

2.9.3.8 CLINKER CEMENT :-

Clinker cement has registered a growth over the last few years in India. The Indian cement industry is growing at a rapid pace and this has given a major boost to the production and sale of Clinker cement in India.

The cement industry in India is highly technologically intensive and as a result, the quantity of clinker cement that is produced in India is of a very high grade and is often considered among the best in the world. The production of Clinker cement requires a lot of energy because it needs to be manufactured at the temperature of around 1400-1450 degree Celsius.5

2.10 USES OF CEMENT :-

2.10.1 ORDINARY PORTLAND CEMENT (O.P.C.) :-
2.10.2 BLENDED CEMENT :-
2.10.3 SLAG CEMENT :-
2.10.4 MASONRY CEMENT :-
2.10.5 LOW HEAT PORTLAND CEMENT :-
2.10.6 SULPHATE RESISTANT CEMENT :-
2.10.7 OIL WELL CEMENT :-
2.10.8 WHITE CEMENT :-
2.10.9  SUPER SULPHATE CEMENT :-

2.10.10  HIGH ALUMINA CEMENT :-

2.10.11  GREY PORTLAND CEMENT :-

2.10.1  ORDINARY PORTLAND CEMENT (O.P.C.) :-

Presently Bureau of Indian Standard has classified OPC in three grades based on the strength of cement. These grades are:

1. Grade – 33-IS-269-1989
2. Grade – 43-IS-6112-1989
3. Grade – 53-IS-12269-1987

These types of cement are suited for all modern types of constructions including all kinds of masonry and concrete works such as pre-cast and pre-stressed concrete. They are also suitable for all kinds of repair works in masonry and concreting. The higher the grade of cement used, the greater would be the economy, durability and technical advantages. Moreover construction time is also reduced.

2.10.2  BLENDED CEMENT :-

Mixing Portland clinker, gypsum and other insert materials in suitable proportions and grinding the mixture to get a thorough and intimate mix obtain it.

Portland Pozzolana cement (PPC) – Clinker + Gypsum + Pozzolana (Fly ash, burnt clay etc)

Portland blast furnace slag – cement Clinker + Gypsum + granulated slag

Masonry cement – cement Clinker + Gypsum + Pozzolana (Limestone Powder admixtures etc.)
PPC— Suitable for most of the applications as stated in OPC ideally suited for domestic consumption like plastering, brickwork, mass concerting works like dams, large foundation. This cement enhances the impermeability and cohesiveness of concrete.

As a result durability is enhanced. It also generates low heat of hydration.

It is cheaply manufactured because it uses fly ash / burnt clay / coal waste as the main ingredient. PPC has a lower heat of advantage in preventing cracks where large volumes are being cast. PPC account for 18.3 per cent of the production.

2.10.3 SLAG CEMENT :-

Common application is similar to those of OPC. However besides that it has more sulphate resistance properties than OPC and is suitable for coastal construction. It is made by grinding granulated blast furnace slag, steel industries by product (up to 65%), gypsum (5%) and clinker (balance). PBFSC has a heat of hydration even lower than PPC and is generally used in construction of dams and similar massive construction. It contributes nearly 10 per cent to the total.

2.10.4 MASONRY CEMENT :-

Exclusively meant for masonry works and plaster only.

2.10.5 LOW HEAT PORTLAND CEMENT :-

Grinding and chemical composition are similar to those of OPC. All applications requiring very early strength, very high early removal of from works, very high handling of pre-cast element, high grade precast and prestressed concrete product, slip form, cooling tower and pill tower.
2.10.6 SULPHATE RESISTANT CEMENT :-

The chemical composition is designed in such a manner that C3A content in cement restricted to 5 percent and other chemical constituents are similar to OPC. Used in structures in contact with soil or water having enough sulphate concentration.

2.10.7 OIL WELL CEMENT :-

This is a special kind of cement for use in the drilling of wells to fill the space between the steel lining tubes and the well wall. It sets slowly in order to give the slurry made with it sufficient time to reach the large depths of the oil wells. However, once set it develops strength rapidly and remains stable at high temperature.

2.10.8 WHITE CEMENT :-

It is primarily used for decorative purposes and in manufacture of titles. The raw materials are so chosen that the maximum iron-oxide content is strictly Ltd to 1 per cent. Variety of colours can be obtained by the addition of pigments.

2.10.9 SUPER SULPHATE CEMENT :-

Intergrading makes super sulphate cement, a mixture of 80-85 percent selected granulated slag with 10-15 per cent calcium sulphate and about 5 percent of Portland clinker. It may be applied where high sulphate, acid and organic oil attacks on structure is expected.

2.10.10 HIGH ALUMINA CEMENT :-
The chemical composition is designed in such a manner that the total alumina content is at least 32 percent. This cement is ideally suited for high temperature castable refractory.

2.10.11 GREY PORTLAND CEMENT :-

Chemical composition is similar to OPC expect the following limitations, which ensures very strength, increased cohesiveness and increased durability factor towards chemical attack. All applications where high-strength concrete is required ideally suited for railway prestressed concrete sleepers, bridges and slip form construction.

Description Limits as per IRST -40 OPC as per IS-Spec
LSF 0.8-1.02 0.66-1.02
C3S 45% Min – C3A 10% Max – Fineness 3700 Min-6

2.11 CHARACTERISTICS OF CEMENT:-

2.11.1 SETTING TIME :-

2.11.2 STRENGTH :-

2.11.3 SOUNDNESS :-

2.11.4 FINENESS :-

2.11.5 STANDARD CONSISTENCY :-

2.11.1 SETTING TIME :-

The time interval for which the cement product remains in plastic condition is known as the setting time. The setting of cement can be understood through initial setting and final setting time.

 GameManager INITIAL SETTING :-

The time elapsed between the moments that the water is added to the cement to that the paste starts losing its plasticity.

GameManager FINAL SETTING :-
The time elapsed between the moment the water is added to the cement and time when the paste has completely lost its plasticity and has attained sufficient firmness to resist certain definite pressure. 2 to 4% Gypsum is added during grinding of clinker to provide sufficient time for workability. If Gypsum is not added cement sets quickly.

As per IS: 269, 8112, 12269, 1489.

Initial Setting: min. 30 minute. Final Setting: max. 600 minute.
(Source: Saurashtra cement Ltd. Technical Division Publication)

2.11.2 STRENGTH :-
Strength of cement is not measured on neat cement paste because of cement is carried out with standard sand cement mortar. It is very important characteristics of cement. Strength is measured after 3 days, 7 days and 28 days for OPC in kg/cm² or MPa.

**Table No. 2.2 :- Strength of cement industries in days.**

<table>
<thead>
<tr>
<th>DAYS</th>
<th>33 G OPC</th>
<th>43 G OPC</th>
<th>53 G OPC</th>
<th>PPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days</td>
<td>16 MPa</td>
<td>23 MPa</td>
<td>27 MPa</td>
<td>16 MPa</td>
</tr>
<tr>
<td>7 days</td>
<td>22 MPa</td>
<td>33 MPa</td>
<td>37 MPa</td>
<td>22 MPa</td>
</tr>
<tr>
<td>28 days</td>
<td>33 MPa</td>
<td>43 MPa</td>
<td>53 MPa</td>
<td>33 MPa</td>
</tr>
</tbody>
</table>

1MPa = 1 Kg/cm²

(Source: Saurashtra cement Ltd. Technical Division Publication)
2.11.3 **SOUNDNESS:-**

It is an appreciable change of the volume and thereby loosing or even destroying of the hardened cement structure. It takes a long time to complete the process.

Unsoundness in cement is due to the presence of excess lime which can be tested by Le Chatelier soundness test. If the magnesia content is more than 3% the cement is to be checked for soundness by Autoclave test.

Excess Gypsum (more than 2 to 3%) will also cause the expansion and disruption of set cement structure.

It can be due to excess of lime, excess magnesia, excess sulphate.

As per IS: 269, 8112, 12269, 1489

Autoclave Expansion: max. 0.8% for free magnesia content. Le Chatelier Expansion: max 10 mm for free lime content.

2.11.4 **FINENESS :-**

It is measure of how fine the cement is grounded. It shows the surface area. It is important for setting and strength. Higher the fineness more strength and early setting achieved.

As per IS: 269(OPC 33G), 8112(OPC 43G), 12269(OPC 53G)

Specified: Fineness >225 M²/ Kg.

As per IS: 1489(PPC)

Specified: Fineness >300 M² /Kg.

(Source: Saurashtra cement Ltd. Technical Division Publication)
2.11.5 STANDARD CONSISTENCY :-

It is measure of water required for 33 mm to 35 mm penetration of needle or plunger in Vicat apparatus.

It is require for all further test of cement i.e. setting test, soundness test, strength test. As per IS: 8112 standard consistency varies from 27 ± 2%

2.12 INPUTS OF CEMENT :-

The important inputs for the cement industries are:-

2.12.1 LIME STONE :-

2.12.2 COAL :-

2.12.3 POWER :-

2.12.4 TRASPORTATION :-

2.12.1 LIME STONE :-

Lime Stone is the basic raw material for producing cement. Approximately 1.50 tonnes of limestone are required for making one tonnes of cement. Cement grade lime stone should normally have a minimum of 44 percent of coal content. Generally limestone is available of an average size of about six inches and after feeding into the crusher its size is reduced into small chips of half an inch.

2.12.2 COAL :-

In the manufacture of cement coal is important input as it has a dual function. It is a fuel and raw material and accounts for about 25% of production cost. Cement industries consumes approximately 7% to 8%
of the coal produced in our country. It is the fourth largest user of coal after steel, power and railways.

2.12.3 POWER :-
Cement is a power incentive industry. Production of one of cement requires 120 KW of power. Cement industries consumes about 64% of the total energy generated in the country.

2.12.4 TRANSPORTATION :-
Transportation influences cement production directly as both its input materials and output have to be transported to and from the plants. The main carrier is the railways. More than half of its produce and a good percentage of raw materials have to be moved by rail. About 70% cement traffic normally moves by rail as transportation beyond 220 kms. is economical only by rail.

2.13 GRADE OF CEMENT :-
Grade of cement indicates the minimum compressive strength at the age of 28 days in (MPa) as per the specification of Bureau of Indian Standard i.e. for 43 G OPC cement must give Min. 43MPa compressive strength.

There are mainly three grade cement available in market i.e. 33G, 43G, 53G. It is observed and well recommended that the 43G OPC is very much suitable and sufficient for general construction work like brick work, plastering, RCC structures.

53 Grade is mainly recommended to use for precast and
prestressed civil works like grills, pipes, poles, railway slippers, hollow or soil bricks, concrete road. High early strength is achieved due to higher C3S content. It imparts high heat of hydration so careful & extensive curing after construction is required.

Even it is fact that higher grade cement more C3S than C2S.

C3S produces more heat and Ca(OH)2 (calcium Hydroxide) which is not desirable product in mass concrete because it is soluble in water and get leached out of concrete making concrete porous and thus reduces the durability.

💡 REACTION OF C3S WITH WATER IS AS UNDER :-

\[
2(3\text{CaO.SiO}_2) + 6\text{H}_2\text{O} \rightarrow 3\text{CaO.2SiO}_2.3\text{H}_2\text{O} + 3\text{Ca (OH)}_2 \quad 2\text{C3S} + 6\text{H} \\
^ \wedge \text{C3S}_2\text{H}_3 + 3\text{Ca (OH)}_2(100) + (24) \wedge (75) + (49)
\]

💡 REACTION OF C2S WITH WATER IS AS UNDER :-

\[
2(2\text{CaO.SiO}_2) + 4\text{H}_2\text{O} \rightarrow 3\text{CaO.2SiO}_2.3\text{H}_2\text{O} + \text{Ca (OH)}_2 \quad 2\text{C2S} + 4\text{H} \\
\rightarrow \text{C3S}_2\text{H}_3 + \text{Ca (OH)}_2(100) + (21) \rightarrow (99) + (22)
\]

As per the molecular formula it is evident the more C3S2H3 and less Ca (OH)2 is formed when C2S reacts with water. This is more desirable product which increases durability. The product of C3S will give more comprehensive strength but less quantity of final product as compared to C2S.⁷
2.14 TYPES OF MANUFACTURING PROCESS :-

There are three types widely used for manufacturing process of cement.

2.14.1 WET PROCESS :-

2.14.2 DRY PROCESS :-

2.14.3 SEMIDRY PROCESS :-

*Table No. 2.3 :- Types of Manufacturing process of cement.*

<table>
<thead>
<tr>
<th>WET PROCESS</th>
<th>DRY PROCESS</th>
<th>SEMI DRY PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet grinding</td>
<td>Dry grinding</td>
<td>Dry grinding</td>
</tr>
<tr>
<td>Slurry form</td>
<td>Less Men power</td>
<td>Moisture</td>
</tr>
<tr>
<td>High Manpower</td>
<td>More economical</td>
<td>Costly</td>
</tr>
<tr>
<td>More consumption of</td>
<td>Less Consumption of</td>
<td>Less Costly</td>
</tr>
<tr>
<td>Energy</td>
<td>Energy</td>
<td></td>
</tr>
<tr>
<td>Popular form</td>
<td>More useful</td>
<td>Outdated</td>
</tr>
</tbody>
</table>
2.14.1 WET PROCESS :-

In wet process slurry is formed by adding water to the properly proportioned raw materials. The grinding and blending operation are then completed with the materials in slurry form. For an annual output of one million tons of this process require 2500-4000 persons to be employed. This process consumes more energy so this process is less economical and out dated now a day because of higher energy and man-power requirements.
2.14.2 DRY PROCESS :-

In dry process dry raw materials are ground dry and fed as a dry powder into the kilns. Wet process is replaced by this process all over the world because it is more economical than wet process for an annual output of one million tons of cement this process requires only 650-800 employees.

2.14.3 SEMI DRY PROCESS :-

This process involves dry grinding of raw materials a then moistening these to form nodules before being burnt in the kiln.

2.15 MANUFACTURING PROCESS OF CEMENT :-

The first step in the cement manufacturing process is obtaining raw material. Generally raw materials consisting of combinations of lime stone, shell or chalk, clay, sand or iron ore. It is brought from mine near the plant. Once the raw material to arrive at the cement plant, the materials are proportioned to create cement with a specific chemical composition. Powder is made by 85% lime stone, 13% clay and 2% latrite are crushed in raw mills. After the powder is sent in blending cello and mixed with the help of air pressure. After this it is stored in storage cell.
2.15.1 KILN FEED :-
2.15.2 HEAT TREATMENT :-
2.15.3 PRINTER :-
2.15.4 KILN :-
2.15.5 COOLER :-
2.15.6 CEMENT :-
2.15.1 KILN FEED :-
Crushed and mixed powder of lime stone, clay, iron ore and gypsum are fed into kiln.

2.15.2 HEAT TREATMENT :-
Kiln has three parts like printer, kiln and cooler. First of all whole, rotary, kiln is made of hot woods and with coal.

2.15.3 PRINTER :-
When rotary kiln becomes properly hot and when it starts rotating properly powder is put into the printer. The temperature of printer is 850°C degree within half a minute this powder become 40% calcite.

2.15.4 KILN :-
This powder with 40% calcite comes into kiln; powder is put according to the speed of kiln. If speed is more, more powder is put and it speeds is less, less powder is put. In kiln material is brunt within 40 minutes. The temperature of brunt materials in kiln is 1350°C

2.15.5 COOLER :-
The brunt material from kiln comes into the cooler. In the cooler material becomes cool. In cooler temperature from 1350°C comes down to 100°C this cooling process takes half an hour which is sent to yard. Material which is sent to yard is black colored and called “CLINKER”
which is in solid from clinker is cooled in yard for 3 to 4 days and then it is sent to mill for crushing.

2.15.6 CEMENT :-

Finally with crushed clinker, 3% to 4% gypsum is mixed according to requirement and mixed product obtained is “cement”.

2.16 PROFILE OF SELECTED CEMENT INDUSTRIES:-

2.16.1 AMBUJA CEMENTS LTD:-
2.16.2 GUJARAT SIDHEE CEMENT LTD.:-
2.16.3 SANGHI INDUSTRIES LTD.:-
2.16.4 SAURASHTRA CEMENT LTD.:-
2.16.5 SHREE DIGVIJAY CEMENT COMPANY LTD.: 
2.16.6 ULTRATECH CEMENT LTD:-
## 2.16.1 AMBUJA CEMENTS LTD:  

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Ambuja Cements Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Logo</td>
<td><img src="image1" alt="Ambuja Logo" /> <img src="image2" alt="Ambuja Logo" /> <img src="image3" alt="Ambuja Logo" /></td>
</tr>
<tr>
<td>Date of Establishment</td>
<td>1981</td>
</tr>
<tr>
<td>Market Cap</td>
<td>284881.6872384 (Rs. in Millions)</td>
</tr>
<tr>
<td>Corporate Address</td>
<td>P O Ambujanagar, Taluka Kodinar, Junagadh Dist-362715, Gujarat. <a href="http://www.gujaratambuja.com">www.gujaratambuja.com</a></td>
</tr>
</tbody>
</table>
| Management Details | **Chairperson** - N S Sekhsaria  
**MD** - Onne Van Der Weijde  
**Directors** - A L Kapur, Ajay Kapur, B L Taparia, Bernard Fontana, BL Taparia, Haigreve Khaitan, M L Bhakta, Markus Akermann, N S Sekhsaria, Naresh Chandra, Nasser Munjee, Omkar Goswami, Onne Van Der Weijde, Paul Hugentobler, Rajendra Chitale, Rajendra P Chitale, Rajiv Gandhi, Shailesh Haribhakti, Suresh Neotia |
| Business Operation | Cement & Construction Materials |
| Background | Ambuja Cements was set up in 1986. In the last decade the company has grown tenfold. The total cement capacity of the company is 18.5 million tones. Its plants are some of the most efficient in the world. With environment protection measures that are on par with the finest in the developed world. The company's most distinctive attribute, however, is its approach to the business. Ambuja follows a unique home |
| Financials (2012) | **Total Income** - Rs. 100350.5 Million (year ending Dec 2012)  
**Net Profit** - Rs. 12970.6 Million (year ending Dec 2012) |
| Company Secretary | Rajiv Gandhi |
| Auditors | SR Batliboi & Associates |
### 2.16.2 GUJARAT SIDHEE CEMENT LTD.: 9

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Gujarat Sidhee cement Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Establishment</td>
<td>1973</td>
</tr>
<tr>
<td>Market Cap</td>
<td>549.5385504 ( Rs. in Millions )</td>
</tr>
</tbody>
</table>

**Management Details**

- **Chairperson** - M N Mehta
- **MD** - M S Gilotra

**Business Operation**

- Cement & Construction Materials

**Background**

Incorporated in 1973, Gujarat Sidhee Cement (GSCL) was originally set up as a joint venture between the Gujarat Industrial Investment Corporation (GIIC) and the Mehta Group. However due to differences between the two promoters GIIC disinvested part of its holding in GSCL in favor of the Mehta's. The Mehta group with 38% equity stake in GSCL now exercises control over the company. GSCL's plant is located.

**Financials (2012-raey gnidne)**

- **Total Income** - Rs. 4439.197 Million ( year ending Mar 2012)
- **Net Profit** - Rs. 55.159 Million ( year ending Mar 2012)

**Company Secretary**

- A M Fadia

**Auditors**

- Manubhai & Co
2.16.3 SANGHI INDUSTRIES LTD.:

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Sanghi Industries Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Logo</td>
<td><img src="image" alt="Company Logo" /></td>
</tr>
<tr>
<td>Date of Establishment</td>
<td>1985</td>
</tr>
<tr>
<td>Market Cap</td>
<td>3222.69235 ( Rs. in Millions )</td>
</tr>
<tr>
<td>Corporate Address</td>
<td>Sanghinagar P O, Hayatnagar Mandal, R R District Rangareddy-501511, Andhra Pradesh</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.sanghicement.com">www.sanghicement.com</a></td>
</tr>
<tr>
<td>Management Details</td>
<td>Chairperson - Ravi Sanghi</td>
</tr>
<tr>
<td></td>
<td>MD - Ravi Sanghi</td>
</tr>
<tr>
<td>Business Operation</td>
<td>Cement &amp; Construction Materials</td>
</tr>
<tr>
<td>Background</td>
<td>Sanghi Industries Ltd, formerly known as Sanghi Leathers Pvt. Ltd, a Sanghi group company was formed in the year 1985. The company was initially established with the aim of manufacturing PVC foam leather cloth. Thereafter, it had extended its production process to items like PVC self adhesive tapes, tarpaulins, and cements. Now it is India’s largest single steam cement plant.</td>
</tr>
<tr>
<td>Financials</td>
<td><strong>Total Income</strong> - Rs. 9837.2 Million (year ending Jun 2012)</td>
</tr>
<tr>
<td></td>
<td><strong>Net Profit</strong> - Rs. 818.8 Million (year ending Jun 2012)</td>
</tr>
<tr>
<td>Company Secretary</td>
<td>Anil Agrawal</td>
</tr>
<tr>
<td>Auditors</td>
<td>Haribhakti &amp; Co, Ankit &amp; Co</td>
</tr>
</tbody>
</table>
### 2.16.4 SAURASHTRA CEMENT LTD.: -11

<table>
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<tr>
<th>Company Name</th>
<th>Saurashtra cement ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Logo</td>
<td><img src="image" alt="Company Logo" /></td>
</tr>
<tr>
<td><strong>Date of Establishment</strong></td>
<td>1956</td>
</tr>
<tr>
<td><strong>Market Cap</strong></td>
<td>650.1265255 ( Rs. in Millions )</td>
</tr>
<tr>
<td><strong>Corporate Address</strong></td>
<td>Near Railway Station, Ranavav-360560, Gujarat.</td>
</tr>
</tbody>
</table>

#### Management Details

- **Chairperson** - M N Mehta
- **MD** - M S Gilotra

#### Business Operation

- **Cement & Construction Materials**

#### Background

Saurashtra Cement (SCL) is the flagship company of the Mehta Group, formed in 1956. SCL is one of the leading players in the Indian cement industry, manufacturing Ordinary Portland Cement (OPC) and Pozzolana Portland Cement (PPC). It also added Sulphate Resistant Cement (SRC) and Portland Slag Cement (PSC) to its product range. SCL markets cement under the brand name 'Hathi Cement'. The product is mar.

#### Financials (2012-2013)

- **Total Income** - Rs. 4446.786 Million (year ending Mar 2012)
- **Net Profit** - Rs. -190.874 Million (year ending Mar 2012)

#### Company Secretary

- **V R Mohnot**

#### Auditors

- **Bansi S Mehta & Co**
2.16.5 SHREE DIGVIJAY CEMENT COMPANY LTD.:  

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Shree Digvijay cement company ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Logo</td>
<td><img src="image" alt="Shree Digvijay Cement Logo" /></td>
</tr>
<tr>
<td>Date of Establishment</td>
<td>1939</td>
</tr>
<tr>
<td>Market Cap</td>
<td>1251.1623603 (Rs. in Millions)</td>
</tr>
<tr>
<td>Corporate Address</td>
<td>P O Digvijaygram, Via Jamnagar, Jamnagar-361140, Gujarat. <a href="http://www.digvijaycement.com">www.digvijaycement.com</a></td>
</tr>
</tbody>
</table>
| Management Details         | **Chairperson** - Leonard D’ Costa  
|                           | **MD** - Suman Mukherjee           
| Business Operation         | Cement & Construction Materials    |
| Financials (2012-2013)     | **Total Income** - Rs. 3919.902 Million (year ending Dec 2012)  
|                           | **Net Profit** - Rs. 412.569 Million (year ending Dec 2012)     |
| Company Secretary          | S N Malpani                        |
| Bankers                    | No Bankers Details in A.R          |
| Auditors                   | Deloittee Haskins & Sells          |
### 2.16.6 ULTRATECH CEMENT LTD:

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Ultratech cement Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Logo</td>
<td><img src="image" alt="Ultratech Cement Logo" /> <img src="image" alt="Aditya Birla Logo" /></td>
</tr>
<tr>
<td>Date of Establishment</td>
<td>2000</td>
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<tr>
<td>Market Cap</td>
<td>500722.08169895 (Rs. in Millions)</td>
</tr>
<tr>
<td>Corporate Address</td>
<td>B Wing Ahura Centre, 2nd Floor Mahakali Caves Road, Andheri (East), Mumbai-400093, Maharashtra <a href="http://www.ultratechcement.com">www.ultratechcement.com</a></td>
</tr>
</tbody>
</table>
| Management Details    | **Chairperson** - Kumar Mangalam Birla  
**MD** - S Misra  
| Business Operation    | Cement & Construction Materials |
| Background            | Ultratech Cement was incorporated in 2000 as Larsen & Toubro. Later it was demerged and acquired by Grasim and was renamed as Ultra Tech Cement in 2004. Today UltraTech cement a part of Aditya Birla group, is the country’s largest exporter of cement clinker. UltraTech Cement Ltd has an annual capacity of 52 million tonnes. It manufactures and markets Ordinary Portland Cement. |
| Financials (2012-2013) | **Total Income** - Rs. 204799.4 Million (year ending Mar 2013)  
**Net Profit** - Rs. 26554.3 Million (year ending Mar 2013) |
| Company Secretary     | S K Chatterjee |
| Auditors              | Deloittee Haskins & Sells, GP Kapadia & Co |
2.17 RECOMMENDATION OF CEMENT INDUSTRIES:

For the development of the cement industries, "Working Group on cement Industries was constituted by the Planning Commission for the formulation of X Five Year Plan. The Working Group has projected a growth rate of 10% for the cement industry during the plan period and has projected creation of additional capacity of 40-62 million tones mainly through expansion of existing plants. The Working Group has identified following thrust areas for improving demand for cement;

- Further push to housing development programmers;
- Promotion of concrete Highways and roads; and
- Use of ready-mix concrete in large infrastructure projects.

Further, in order to improve global competitiveness of the Indian cement Industry, the Department of Industrial Policy & Promotion commissioned a study on the global competitiveness of the Indian Industry through an organization of international repute, viz. KPMG Consultancy Pvt. Ltd. The report submitted by the organization has made several recommendations for making the Indian cement Industries more competitive in the international market. The recommendations are under consideration.

2.18 PROBLEMS OF CEMENT INDUSTRIES:

The main impediments to the growth of cement industries in India may be broadly listed as follows:

2.18.1 SHORTAGE OF CAPITAL:
2.18.2 SHORTAGE POWER:
2.18.3 LOCATION :-

2.18.4 SHORTAGE OF COAL :-

2.18.5 INADEQUATE PRODUCTION :-

2.18.6 MANUFACTURING COST :-

2.18.7 OPERATIONAL INEFFICIENCY :-

2.18.8 COST ESCALATION AND RIGID PRICE :-

2.18.9 GOVERNMENT POLICIES, RULES AND REGULATION :-

2.18.10 INFRASTRUCTURAL :-

2.18.11 ADMINISTRATION :-

2.18.1 SHORTAGE OF CAPITAL :-

The cement industry is capital-intensive in nature. On account of its record on declining profitability, it is unable to raise the required finance from the capital market.

2.18.2 SHORTAGE POWER :-

Power is an important infrastructure, which the cement industries needs. The cement industries is being adversely affected with the State Electricity Boards (SEBs), raising costs year after year accompanied by diminishing quality of power supplied, in terms of frequent voltage fluctuations, power cuts and interruptions.

By installing captive power plants the Indian cement industry is today supplementing grid power supply as a result, capacity has crossed 700MW.
2.18.3 LOCATION :-

Cement industries are mainly situated in Western and Southern regions producing about 71 per cent of the total output, while the Northern and Eastern regions account for 29 per cent of total output. The Southern and western regions consume only 57 percent of their total output, while the Northern and Eastern regions consume 43 percent of their total production. There is excess production in the Southern and Western regions while there is excess demand from Northern and Eastern regions. These factors lead do heavy transport cost.

2.18.4 SHORTAGE OF COAL :-

Coal shortage affects production of cement industries resulting in idle capacity and under utilization of capacity. Coal requirement by the industries today, stands at 13mt, which is just 6 per cent of the total cost produced in India. As a result, industries sources say that, cement manufactures are left at the mercy of traders in coal, who charge exorbitant prices. By 2005 AD, the need for coal will go up to 25mt per annum.

The availability and movement of coal has been a perennial problem of the cement industries. Ninety per cent of the coal deposits occur in the four states of Bihar, Orissa, West Bengal and Madhya Pradesh. Barring Madhya Pradesh, none of the other states have any limestone deposits and hence coal has to be hauled over very long distances.

Keeping in view the likely production of 737mt of cement in 2001, coal requirement will have to be doubled to level of 21mt and about 15mt will have to be moved by rail against 8mt by rail in 1996.
2.18.5 INADEQUATE PRODUCTION :-

The main factors responsible for shortfall in production are:

- Drastic power cuts ranging from 20 to 75% in various cement producing states.
- Shortage of coal.
- Inadequate availability of Wagons.
- Ltd availability if furnace oil.

2.18.6 MANUFACTURING COST :-

The major inputs for cement industries are lime-stone; coal, power, and gypsum cement is a high cost industry as a result. Cement has become frightening expensive costs; both manufacturing and non-manufacturing have gone up. It is difficult to control cost.

2.18.7 OPERATIONAL INEFFICIENCY :-

Operational inefficiency affects the cost of production operational inefficiency can be affected by the internal factors as well as external factors of the company.

2.18.8 COST ESCALATION AND RIGID PRICE :-

In the case of all other industries, there was rise in the cost of production of cement. But the special point in the case of cement industry was that some of the major cost rises were due to the government policies. The shortage of wagons for the movement of cement was always a serious.
2.18.9 GOVERNMENT POLICIES, RULES AND REGULATION :-

The various policies rules and regulations of the central and state government not only encourage the industries but have also adversely affected the industries. The various steps taken by government viz., administrated prices of inputs, like in the excise duty increase in railway fright, low off take by government reduction in loading capacity of trucks, compulsory jute bag packaging high electricity duty, sales tax, power tariff etc. adversely affects the industries.

2.18.10 INFRASTRUCTURAL :-

The cement industry is facing various problems but lack of infrastructure facility is one of the main problems faced by the industries infrastructural facility means the facility of availability of adequate quantity and quality of coal railway wagons regularity of power supply, sea-port, bridges, roads and canals, which is of vital importance for optimizing capacity utilization in cement industries because the cement plants are located nearer to the lime stone deposit area, which are not properly connected with rail road, power and communication services which affect to the cement industries.

2.18.11 ADMINISTRATION :-

Administration problem include the workers problem selling and distribution of cement problem etc.
REFERENCES :-

1. INDIAN CEMENT INDUSTRY FORECAST TO 2012, RNCOS online Business research.


3. India Info line Sector Reports Wed, 14-Jan-2004 11:24:07 IST (GMT+5:30)


