Indian Cement Industry
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INDIAN CEMENT INDUSTRY

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Chapter - 1

INDIAN CEMENT INDUSTRY

1.1 History of Cement

It must be interesting to know how cement is made today vis-à-vis 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 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 Wakefield to manufacture Portland cement, some of which was 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 industry 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 industry—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.

1.2 Where It Is Heading?

The boom-and-bust syndrome normally characterizes a typical cyclical industry. A huge potential market and rapid growth in the early stages lead to a surge in interest and a flurry of research. The projected
growth rates point to a lucrative market. The buoyant markets and huge profits raked in by players tempt more players into the market. Capacities increase in excess of demand and a glut in capacity is created.

Competition increases, prices fall and margins come under pressure. Capacity addition comes to a halt; weaker players shut shot or sell off to larger ones. Demand catches up and the cycle is repeated all over again. Perhaps, of all the cyclical industries, the Indian cement industry exhibits this boom-and bust cycle most visibly. Consider the following:

### 1.3 Temptation

A huge potential market, easy availability of raw material and cheap labour leads to a flurry of activity and a surge in interest. The easiest way to estimate the potential that exists is the per capita consumption of cement, which is abnormally low in India at 85 kegs as against a world average of 256 kegs and the Asian average of 200 kegs. Although the growth of the industry depends more on the level of consumer spending rather than on the per capita consumption, nevertheless, it serves as an easy benchmark to estimate the potential that exists.

### 1.4 Fuel to Fire

The projected growth rates in demand (based on the potential per capital consumption growth or other demand drivers like the expected GDP growth rate) fuels stock market rallies. Consider the boom in
cement stocks in 1994. Every cement company was attracting valuations it never dreamt about. Scarcity induced by lower capacities and to a large extent on non-availability of power, drove cement prices to the hilt. The kind of money minted by most cement companies as well as investors in that period drove strategists to plan enormous increase in capacity. This explains why capacity creation starting 1994, was so enormous.

1.5 The Rush

The amounts of profits that are being raked tempt more players into the industry. Contagious enthusiasm sweeps the industry and suddenly there is a glut of new players. Capacities start increasing at a rate greater than the demand growth rates. A scenario of excess supply to demand becomes imminent. Average annual capacity addition during the three year period 1994-95 to 1996-97 was 8.33 mt., while that for the five years till 1994-95 was just 3.3 mt. Against demand growth rate of 8 per cent capacity addition rose at over 10 per cent during 1995-96 and 1996-97, and over 9 per cent in 1997-98.

1.6 The Anguish

With competition increasing and growth in supply exceeding demand growth, prices begin to fall. This is also the time when players realize that Greenfield capacity addition would be to their own detriment. Consolidation within the industry starts. Most of the players weakened during the excess supply induced recession sell off to larger and stronger players. Hostile takeovers are also witnessed during this period as the
only way to expand is by take-over. The slew of takeovers in the last two years culminating in Gujarat Ambuja taking a stake in ACC, the largest cement company in India bears ample testimony to this fact. Till now, over 12 mt. has changed hands, excluding Indian Rayons transfer of 3 mt to group company Grasim.

1.7 How cement is made?

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 pre heater/claimer. The pre heater is a group of cyclones placed over one another wherein material comes down and hot gases goes up heating the material and calcimine it in the process.
Calcinations mean 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 1600°C. 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 laniary 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 flyash/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.

1.8 How concrete is made?

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 meter (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 per cent of the total volume, the shrinkage potential is probably of the order of 10-20 per cent of the corresponding value for the paste component acting alone.

1.9 Types of Cement

- **Ordinary Portland Cement (OPC):**
  
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.

- **Portland Pozzolona Cement (PPC):**
  
  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.

- **Portland Blast Furnace Slag Cement (PBFSC):**
  
  It is made by grinding granulated blast furnace slag, steel industry 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.

- **White Cement:**
  Basically it is OPC: Clinker using fuel oil (instead of coal) and with iron oxide content below 0.4 per cent to ensure whiteness. Special cooling technique is used. It is used to enhance aesthetic value, in tiles and for flooring. White cement is much more expensive than grey cement.

- **Specialized Cement:**
  Oil Well Cement: is made from clinker with special additives to prevent any porosity.

- **Rapid Hardening Portland 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 nonsaponifibale oil to impart waterproofing properties.

### 1.10 Uses of Cement

1. Ordinary Portland Cement (OPC) - 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. 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 (Flyash, 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 flyash/burntclay/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.
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 industry 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.

4. Masonry Cement— Exclusively meant for masonry works and plaster only.

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 pre-stressed concrete product, slip form, cooling tower and pill tower.

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

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.

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 limited to 1 per cent. Variety of colors can be obtained by the addition of pigments.

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

10. High alumina cement— The chemical composition is designed in such a manner that the total alumina content is at least 32 per cent. This cement is ideally suited for high temperature castable refractory.

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 – 3700 Min-
1.11 Cement Industry in India

The cement industry is a basic industry that helps in building physical infrastructure and thereby country's industrial base. It has been playing a vital and significant role in the development of human civilization. Cement is a basic construction material and plays crucial role in the development of social, industrial and commercial infrastructure, which are considered prime engines of economic development? It is used in the construction of buildings, houses, dams, meds, offices, factories and bridges. Per capita cement consumption is considered as an important index of a country's economic growth.

Fineness India is the second largest producer of cement in the world. No wonder, India's cement industry is a vital part of its economy, providing employment to more than a million people, directly or indirectly. Ever since it was deregulated in 1982, the Indian cement industry has attracted huge investments, both from Indian as well as foreign investors.

India has a lot of potential for development in the infrastructure and construction sector and the cement sector is expected to largely benefit from it. Some of the recent major government initiatives such as development of 98 smart cities are expected to provide a major boost to the sector.

Expecting such developments in the country and aided by suitable government foreign policies, several foreign players such as Lafarge-Holcim, Heidelberg Cement, and vicat have invested in the country in the recent past. A significant factor which aids the growth of this sector is the
ready availability of the raw materials for making cement, such as limestone and coal.

India is the second-largest cement producing country in the world after China. The country’s cement production was 300 million tons in 2010; the figure is expected to double to reach almost 550 million tons by 2020, as per estimates by the Cement Manufacturers Association (CMA). As of 2011, there were 137 large and 365 mini cement plants in India.

The Indian cement industry is globally competitive with lowest energy consumption and CO2 emissions. Apart from fulfilling domestic cement requirements, the industry also exports cement and clinker to around 30 countries across the globe.

In India, cement demand emanates from four key segments — housing, accounting for 67%; infrastructure for 13%; commercial construction for 11%; and industrial sector for 9%. The cement industry has evolved in the form of clusters across the country due to the location of limestone reserves in certain states. Presently, there are seven clusters, namely the Satna cluster in Madhya Pradesh; Chandrapur in north Andhra Pradesh and Maharashtra; Gulbarga in north Karnataka and east Andhra Pradesh; Chanderia in south Rajasthan, Jawad and Neemuch in Madhya Pradesh; Bilaspur in Chattisgarh; Yerraguntla in south Andhra Pradesh and Nalgonda in central Andhra Pradesh.

During 2009-10, the Indian cement industry grew at a robust rate of 12.7%, according to CMA. With the government promoting construction activities across the country through various stimulus packages for building roads, bridges, houses, etc., the Indian cement
industry added a capacity of 37 million tons in 2009-10, which is the highest capacity ever added in any single year so far.

The government’s focus on building infrastructure is likely to continue in the near future and the Indian cement industry is expected to sustain an even higher growth rate of 15% over the coming years.

The Indian cement industry is a mature and world class industry in terms of production, technology, process efficiencies and product quality and variety. Unlike most other cement producing countries, it has a unique record of maintaining continuous annual growth rate of 7 to 8 percent over the past two decades and the growth is likely to continue with the same vigor into the next century.'

The growth of Indian cements industry can be classifies into two phases, namely (i) pre-planning era and (ii) planning era.

- **Pre-Planning Era**

  The inception of Indian cement industry dates back to 1904 when Portland Cement was manufactured by a small cement factory at Waterman pet in Madras by South Indian Industrial Limited with a potential capacity of 10,000 metric tons per annum. But owing to technical defects and inadequate supply of raw materials, this plant collapsed within no time. Between 1912 and 1913, three cement plants were established one each at Porbandar (Kathiawar), Katni (Madhya Pradesh) and Bundi (Rajasthan).

  The First World War gave a fillip to the cement industry. By the year 1924, there came into existence ten cement factories in India with an installed capacity of 5.6 lacks tons, but the actual production of cement
being half of the installed capacity outstripped the demand for it. To end the rate war, the Government of India referred the working of the cement industry to the Tariff board.' In the year 1925, in order to do away with competition, cement producers formed Cement Manufacturers' Association with the responsibility of regulating prices. Indian Cement Manufacturers' Association formed Concrete Association of India in 1927 to propagate the usage of cement. Subsequently, the Cement Marketing Company of India was formed in 1930 to take care of sales and distribution of cement.

New factories were established and installed capacity rose to 14.7 lakh tons and production rose to 8.6 lakh tons in 1935. In 1938, war clouds began gathering over Europe and the very survival of Indian cement industry was in doubt. The turning point in the Indian cement industry was the amalgamation of eleven cement 'companies to form Associated Cement Companies Limited (ACC) by pooling their technical know-how, adopting common marketing and pricing policies in the year 1936.' In the year 1937, Dalmia-Jain group entered cement industry. The first public sector cement plant was established in the year 1938, in the name of Mysore Iron and Steel Works at ~hadrawati?With a view to contain the competition, both ACC and Dalmia-Jain Group set up a joint selling organization.

During the Second World War, cement was declared as an essential commodity under the Defense of India Rules (DIR) and subsequently was brought under price and distribution control.'* Partition had an adverse effect on the industry. Out of 24 factories with annual
capacity of 2.7 million tons, India retained 19 factories with annual production capacity of 2.1 million tons. This resulted in severe shortage of cement. By the beginning of 1950, the installed capacity increased to 28.2 lakh tons with 21 producing units in aggregate.

- **Planning Era**

  After Independence, the National Government embarked upon a policy of rapid industrialization supported by the powerful force of planned development. In the year 1956, the Government promulgated Cement Control Order and entrusted State Trading Corporation with the monopoly of domestic and imported cement distribution and introduced system of Freight Pooling. In 1961, Cement Manufacturers Association (CMA) was formed. Golden Jubilee of Indiari, cement was celebrated in the year 1964. Cement Corporation of Concrete India was established in the year 1965.

  ACC set up the central Research station in 1968 to stimulate technology. The CMA and Council of Scientific and Institutional Research (CSIR) established jointly Cement Research Institute in 1968. The Government announced on February 28, 1982, the policy of partial decontrol of cement, which gave a tremendous boost to the cement industry. March 1, 1989 was a remarkable day in the history of cement industry as on that day the Government proclaimed decontrol of price and distribution on cement. Mergers and acquisitions in the industry gained momentum from 1997-98 onwards. The year 1999-2000 witnessed a phenomenal 15 per cent growth in cement production.
1.12 Market Size

Cement demand in India is expected to increase due to government’s push for large infrastructure projects, leading to 45 million tonnes of cement needed in the next three to four years1.

India's cement demand is expected to reach 550-600 million tonnes per annum (MTPA) by 2025. The housing sector is the biggest demand driver of cement, accounting for about 67 per cent of the total consumption in India. The other major consumers of cement include infrastructure at 13 per cent, commercial construction at 11 per cent and industrial construction at nine per cent.

To meet the rise in demand, cement companies are expected to add 56 million tons (MT) capacity over the next three years. The cement capacity in India may register a growth of eight per cent by next year end to 395 MT from the current level of 366 MT. It may increase further to 421 MT by the end of 2017. The country’s per capita consumption stands at around 190 kg.

The Indian cement industry is dominated by a few companies. The top 20 cement companies account for almost 70 per cent of the total cement production of the country. A total of 188 large cement plants together account for 97 per cent of the total installed capacity in the country, with 365 small plants account for the rest. Of these large cement plants, 77 are located in the states of Andhra Pradesh, Rajasthan and Tamil Nadu.
1.13 Investments

On the back of growing demand, due to increased construction and infrastructural activities, the cement sector in India has seen many investments and developments in recent times.

According to data released by the Department of Industrial Policy and Promotion (DIPP), cement and gypsum products attracted Foreign Direct Investment (FDI) worth US$ 3.1 billion between April 2000 and September 2015.

Some of the major investments in Indian cement industry are as follows:

Birla Corporation Ltd, a part of the MP Birla Group, has agreed to acquire two cement assets of Lafarge India for an enterprise value of Rs 5,000 crore (US$ 750 million).

Dalmia Cement (Bharat) Ltd has invested around Rs 2,000 crore (US$ 300 million) in expanding its business in North East over the past two years. The company currently has three manufacturing plants in the region — one in Meghalaya and two in Assam.

JSW Group plans to expand its cement production capacity to 30 MTPA from 5 MTPA by setting up grinding units closer to its steel plants.

UltraTech Cement Ltd has charted out its next phase of Greenfield expansion after a period of aggressive acquisitions over the last two years. UltraTech has plans to set up two Greenfield grinding units in Bihar and West Bengal.
UltraTech Cement Ltd bought two cement plants and related power assets of Jaiprakash Associates Ltd in Madhya Pradesh for Rs 5,400 crore (US$ 810 million).

JSW Cement Ltd has planned to set up a 3 MTPA clinkerisation plant at Chittapur in Karnataka at an estimated cost of Rs 2,500 crore (US$ 375 million).

Andhra Cements Ltd has commenced the commercial production in the company’s cement plants – Durga Cement Works at Dachepalli, Guntur and Visakha Cement Works at Visakhapatnam.

1.14 Problems of Cement industry

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

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. Power shortage– Power is an important infrastructure, which the cement industry needs. The cement industry 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.
3. Location problems – 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 form Northern and Eastern regions. These factors lead do heavy transport cost.

4. Shortage of coal – Coal shortage affects production of cement industry resulting in idle capacity and under utilization of capacity. Coal requirement by the industry today, stands at 13mt, which is just 6 per cent of the total cost produced in India. As a result, industry 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 industry. 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 8 mt by rail in 1996.

5. Non-availability of railway wagons— Non-availability of railway wagons leads to considerable delay in bringing in the raw materials and in dispatching the cement to various potential markets. Sending cement by open railway wagons leads to pilferage and damage by rain. 55 per cent of cement is dispatched by rail and 45 per cent by road.

6. Defective method of transport— Methods of cement bagging and its transportation in India are primitive which marketing inefficient and uneconomical. Hardly any quantity of cement at present is handled in bulk.

7. Negligible share in world trade— India’s share in world trade is negligible. Currently, India exports only about 3.5 lakh tones in a year.

8. Technological obsolescence— The industry is in need of change in the production process. There is a need for conversion from wet process to dry process. Apart from a modernization programme involving Rs. 300 crore, latest technologies for, computerized control systems, X-ray analyzers, pollution control devices, captive power plants, upgrading quarry operations, etc, have all been adopted by the industry.

Quality – In order o meet the challenge of globalization, the Indian cement industry will have to adopt the ISO 9000/IS 14000
series of standards and the Total Quality Management (TQM) system.

So far, only about 10 per cent of cement plants have gone in for this international certification. Cement manufactured in India is subjected to quality assurance checks within the plant, and further scrutinized and certified by the autonomous Bureau of Indian Standards (BIS).

India is one of the few counties to have set up a limit of 0.5 percent by weight, for chloride ions in cement for use in long span reinforced concrete and priestesses concrete structures.

With eco-labeling and ISO-labeling, becoming major issues in several countries, the Indian cement industry will have to conform to stiff norms for international and environmental acceptance.

9. Cost factor— The single major item of expenditure is the cost of fuel (viz. furnace oil/LSHS), which constitutes at least 60 per cent of the variable cost. The industry has to find some means to reduce consumption of fuel oil if it is to survive in the long term. Modern packing material will have to be introduced, which are strong enough, but at the same time cheaper to counter the increasing price of jute and paper. Quality improvement and usage applications are major thrusts of the R & D effort, to benefit usage in India and abroad. Identified areas for future research and development include coal beneficiaries, quality modulation, improved burners etc.
1.15 **Government Initiatives**

In the 12th Five Year Plan, the Government of India plans to increase investment in infrastructure to the tune of US$ 1 trillion and increase the industry's capacity to 150 MT.

The Cement Corporation of India (CCI) was incorporated by the Government of India in 1965 to achieve self-sufficiency in cement production in the country. Currently, CCI has 10 units spread over eight states in India.

An expert appraisal committee under Ministry of Environment, Government of India, has provided approval to India Cements to double its capacity and set up a 40 megawatt (MW) power plant at one of its facilities in Tamil Nadu. The proposed expansion project will come up at Dalavoi in Ariyalur district.

The Competition Commission of India (CCI) has approved the proposed acquisition of cement plants of Jaypee Cement Corporation Ltd, comprising an integrated cement unit at Sewagram and grinding unit at Wanakbori in Gujarat by Ultratech Cement Ltd.

Giving impetus to green initiatives, Goa State Pollution Control Board (GSPCB) has signed a memorandum of understanding (MoU) with Vasavadatta Cement, a company with its plant in Karnataka. The cement manufacturer will use the plastic waste collected from Goa as fuel for its manufacturing plant.

In order to help the private sector companies thrive in the industry, the government has been approving their investment schemes. Some such initiatives by the government in the recent past are as follows:
The Government of Tamil Nadu has launched low priced cement branded 'Amma' Cement. The sale of the cement started in Tiruchi at Rs 190 crore (US$ 2.85) a bag through the Tamil Nadu Civil Supplies Corporation (TNCSC). Sales commenced in five go downs of the TNCSC and will be rolled out in stages with the low priced cement available across the state from 470 outlets.

The Government of Kerala has accorded sanction to Malabar Cements Ltd to set up a bulk cement handling unit at Kochi Port at an investment of Rs 160 crore (US$ 24 million).

The Andhra Pradesh State Investment Promotion Board (SIPB) has approved proposals worth Rs 9,200 crore (US$ 1.38 billion) including three cement plants and concessions to Hero Moto Corp project. The total capacity of these three cement plants is likely to be about 12 MTPA and the plants are expected to generate employment for nearly 4,000 people directly and a few thousands more indirectly.

India has joined hands with Switzerland to reduce energy consumption and develop newer methods in the country for more efficient cement production, which will help India meet its rising demand for cement in the infrastructure sector.

The Government of India has decided to adopt cement instead of bitumen for the construction of all new road projects on the grounds that cement is more durable and cheaper to maintain than bitumen in the long run.
1.16 Road Ahead

The cement industry in India is globally competitive as the industry continues to witness positive trends such as cost control, continuous technology up gradation and increased construction activities.

Major cement manufacturers in India are also increasingly using alternate fuels, especially bio energy, to fire their kilns. This is not only helping to bring down production costs of cement companies, but is also proving effective in reducing emissions.

With the ever-increasing industrial activities, real estate, construction and infrastructure, in addition to the onset of various Special Economic Zones (SEZs) being developed across the country, there is remain a growing demand for cement.

The eastern states of India are likely to be the newer and virgin markets for cement companies and could contribute to their bottom line in future. In the next 10 years, India could become the main exporter of clinker and gray cement to the Middle East, Africa, and other developing nations of the world. Cement plants near the ports, for instance the plants in Gujarat and Visakhapatnam, will have an added advantage for exports and will logistically be well armed to face stiff competition from cement plants in the interior of the country.

A large number of foreign players are also expected to enter the cement sector, owing to the profit margins and steady demand. In future, domestic cement companies could go for global listings either through the FCCB route or the GDR route.
With help from the government in terms of friendlier laws, lower taxation, and increased infrastructure spending, the sector will grow and take India’s economy forward along with it.

### 1.17 Company-wise List of Cement Plants

<table>
<thead>
<tr>
<th>No.</th>
<th>Company Name</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>ACC Limited</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acc Ltd. Damodhar Cement Works</td>
<td>West Bengal</td>
</tr>
<tr>
<td>3</td>
<td>Bargarh Cement Works</td>
<td>Orissa</td>
</tr>
<tr>
<td>4</td>
<td>Chaibasa Cement Works</td>
<td>Jharkhand</td>
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<tr>
<td>6</td>
<td>Gagal Cement Works-I</td>
<td>Himachal Pradesh</td>
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<tr>
<td>7</td>
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<td>Jamul Cement Works</td>
<td>Chhatisgarh</td>
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<td>9</td>
<td>Kudithini Cement Works</td>
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<tr>
<td>10</td>
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<tr>
<td>11</td>
<td>Lakheri Cement Works</td>
<td>Rajasthan</td>
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<tr>
<td>12</td>
<td>Madhukkarai Cement Works</td>
<td>Tamil Nadu</td>
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<tr>
<td>13</td>
<td>New Wadi Cement Works</td>
<td>Karnataka</td>
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<tr>
<td>14</td>
<td>Sindri Cement Works</td>
<td>Jharkhand</td>
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<tr>
<td>15</td>
<td>Thondebhavi Cement Works</td>
<td>Karnataka</td>
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<tr>
<td></td>
<td>Tikaria Cement Works</td>
<td>Uttar Pradesh</td>
</tr>
</tbody>
</table>
16. Vizag Cement Works  Andhra Pradesh
17. Wadi Cement Works  Karnataka

2. Adhunik Cement Ltd
   1. Adhunik Cement Ltd  Meghalaya

3. Aditi Industries
   1. Aditi Industries  Assam

4. Ambuja Cement Ltd
   1. Ambuja Cements Ltd (Unit: Ambuja Nagar)  Gujarat
   2. Ambuja Cements Ltd (Unit: Bhatapara II)  Chhattisgarh
   3. Ambuja Cements Ltd (Unit: Bhatapara)  Chhattisgarh
   4. Ambuja Cements Ltd (Unit: Bhatinda) (G)  Punjab
   5. Ambuja Cements Ltd (Unit: Dadri) (G)  Uttar Pradesh
   6. Ambuja Cements Ltd (Unit: Darlaghat)  Himachal Pradesh
   7. Ambuja Cements Ltd (Unit: Farakka) (G)  West Bengal
   8. Ambuja Cements Ltd (Unit: Magdalla) (G)  Gujarat
   9. Ambuja Cements Ltd (Unit: Maratha)  Maharashtra
   10. Ambuja Cements Ltd (Unit: Nalagarh)( G)  Himachal Pradesh
   11. Ambuja Cements Ltd (Unit: Rabriyawas)  Rajasthan
   12. Ambuja Cements Ltd (Unit: Rauri)  Himachal Pradesh
   13. Ambuja Cements Ltd (Unit: Roorkee) (G)  Uttarakhand
   14. Ambuja Cements Ltd (Unit: Ropar) (G)  Punjab
   15. Ambuja Cements Ltd (Unit: Sankrail) (G)  West Bengal
5. Anjani Portland Cement Ltd
   1. Anjani Portland Cement Ltd  Andhra Pradesh

6. Asian Concretes Cement Ltd
   1. Asian Concretes Cement Ltd  Himachal Pradesh

7. Bagalkot Cement & Inds.Ltd
   1. Bagalkot Cement & Inds.Ltd  Karnataka

   1. Bharti Cement Corpn. Pvt. Ltd  Andhra Pradesh

9. Bhavya Cement Ltd
   1. Bhavya Cement Ltd  Andhra Pradesh

10. Binani Cement Ltd
    1. Binani Cement Ltd - Sikar  Rajasthan
    2. Binani Cement Ltd - Sirohi  Rajasthan

11. Birla Corporation Ltd
    1. Birla Cement - Raebareli  Uttar Pradesh
    2. Birla Cement Works & Chanderia  Rajasthan
    3. Birla- Durga Hitech Cement  West Bengal
    4. Birla- Durgapur Cement Works  West Bengal
    5. Birla Vikas & Satna Cement Works  Madhya Pradesh

12. Calcom Cement Ltd
    1. Calcom Cement Ltd  Assam
13. Cement Corporation of India Ltd

<table>
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<td>Cement Corporation of India Ltd- Bokajan</td>
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<td>Cement Corporation of India Ltd- Tandur</td>
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<td>Cement Corporation of India Ltd-Akaltara</td>
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<td>7.</td>
<td>Cement Corporation of India Ltd-Chakhi Dadri</td>
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<td>Cement Corporation of India Ltd-Kurkunta</td>
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14. Cement Manufacturing Co.Ltd

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<td>Cement Manufacturing Co.Ltd - Jaintia Hills</td>
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<tr>
<td>2.</td>
<td>Cement Manufacturing Co.Ltd - Megha T &amp; E Ltd</td>
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15. Century Textiles & Inds.Ltd

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<td>2.</td>
<td>Century Cement - Manikgarh</td>
<td>Maharashtra</td>
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<td>3.</td>
<td>Century Cement - Raipur</td>
<td>Chhatisgarh</td>
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16. Chettinad Cement Corpn. Ltd
   1. Chettinad Cement - Ariyalur    Tamil Nadu
   2. Chettinad Cement – Karikali    Tamil Nadu
   3. Chettinad Cement - Puliyur    Tamil Nadu
   4. Chettinad Cement -Kallur    Karnataka

17. Dalmia Cement (Bharat) Ltd
   1. Dalmia Cement (Bharat) Ltd- Ariyalur    Tamil Nadu
   2. Dalmia Cement (Bharat) Ltd- Dalmiapuram    Tamil Nadu
   3. Dalmia Cement (Bharat) Ltd- Kadapa    Andhra Pradesh

18. Decan Cement Ltd
   1. Decan Cement Ltd    Andhra Pradesh

19. Green Valliey Industries Limited
   1. Green Valliey Industries Limited    Meghalaya

20. Gujarat Sidhee Cement Ltd
   1. Gujarat Sidhee Cement Ltd    Gujarat

21. Heidelberg Cement India Ltd
   1. Heidelberg Cement India Ltd- Ammasandra    Karnataka
   2. Heidelberg Cement India Ltd- Damoh    Madhya Pradesh
   3. Heidelberg Cement India Ltd- Jhansi    Uttar Pradesh
   4. Heidelberg Cement India Ltd- Raigad    Maharashtra
22. Hemandari Cement Ltd
   1. Hemandari Cement Ltd                               Andhra Pradesh

23. India Cements Ltd
   1. The India Cements Ltd- Chilamkur Works            Andhra Pradesh
   2. The India Cements Ltd- Dalavoi                    Tamil Nadu
   3. The India Cements Ltd- Parli                      Maharashtra
   4. The India Cements Ltd- Raasi Cement               Andhra Pradesh
   5. The India Cements Ltd- Sankari Durg               Tamil Nadu
   6. The India Cements Ltd- Sankarnagar                Tamil Nadu
   7. The India Cements Ltd- Trinetra                   Rajasthan
   8. The India Cements Ltd- Visaka Cement              Andhra Pradesh
   9. The India Cements Ltd- Yerraguntla                Andhra Pradesh
  10. The India Cements Ltd. - Vallur                   Tamil Nadu

24. J. S. W Cement Ltd
   1. J. S. W Cement Ltd                                Maharashtra

25. J.K. Cement Ltd
   1. J.K. Cement Ltd- Gotan                           Rajasthan
   2. J.K. Cement Ltd- Jharli                          Haryana
   3. J.K. Cement Ltd- Mangrol                          Rajasthan
   4. J.K. Cement Ltd- Muddapur                         Karnataka
   5. J.K. Cement Ltd- Nimbahera                        Rajasthan
26. Jagdamba Industries Limited
   1. Jagdamba Industries Limited
      West Bengal

27. Jaiprakash Associates Ltd
   1. Jaypee Cement - Bela
      Madhya Pradesh
   2. Jaypee Cement - Rewa
      Madhya Pradesh
   3. Jaypee Cement - Baga(Himachal)
      Himachal Pradesh
   4. Jaypee Cement - Bagheri
      Himachal Pradesh
   5. Jaypee Cement - Bakaro
      Jharkhand
   6. Jaypee Cement - Balaji
      Andhra Pradesh
   7. Jaypee Cement - Bhilai
      Chhattisgarh
   8. Jaypee Cement - Bhilai (c lk)
      Madhya Pradesh
   9. Jaypee Cement - Dalla
      Uttar Pradesh
  10. Jaypee Cement - Kutch
      Gujarat
  11. Jaypee Cement - Panipat
      Haryana
  12. Jaypee Cement - Roorkee
      Uttarakhand
  13. Jaypee Cement - Sadva Khurd
      Uttar Pradesh
  14. Jaypee Cement - Sidhee
      Madhya Pradesh
  15. Jaypee Cement - Sikandarabad
      Uttar Pradesh
  16. Jaypee Cement - Wanakbori
      Gujarat
  17. Jaypee Cement- Ayodhya
      Uttar Pradesh
  18. Jaypee Cement- Chunar
      Uttar Pradesh
19. Jaypee Cement- Durga Cement Works  Andhra Pradesh
20. Jaypee Cement- Visaka Cement Works  Andhra Pradesh

28. Jammu & Kashmir Cements Ltd

29. JK Lakshmi Cement Ltd
   1. JK Lakshmi Cement Ltd- Jharli  Haryana
   2. JK Lakshmi Cement Ltd- Kalol  Gujarat
   3. JK Lakshmi Cement Ltd- Sirohi  Rajasthan

30. K. J. S. Cement Ltd
   1. K. J. S. Cement Ltd  Madhya Pradesh

31. K.C.P. Ltd
   1. The K.C.P. Ltd- Muktyala  Andhra Pradesh
   2. The K.C.P. Ltd.- Macherla  Andhra Pradesh

32. Kakatiya Cement & Sugar Industries Ltd
   1. Kakatiya Cement & Sugar Industries Ltd  Andhra Pradesh

33. Kalyanpur Cements Ltd
   1. Kalyanpur Cements Ltd  Bihar

34. Kamdhenu Cement Ltd
   1. Powercon Cement Ltd  Uttar Pradesh

35. Kesoram Cement
   1. Kesoram Cement- Basant Nagar  Andhra Pradesh
   2. Kesoram Cement- Vasavadatta  Karnataka
36. Khyber Industries (P) Ltd
   1. Khyber Industries (P) Ltd   Jammu & Kashmir

37. Lafarge India (P) Ltd
   1. Lafarge India (P) Ltd- Arasmeta Cement   Chhatisgarh
   2. Lafarge India (P) Ltd- Jojobera   Jharkhand
   3. Lafarge India (P) Ltd- Mejia   West Bengal
   4. Lafarge India (P) Ltd- Sonadih   Chhatisgarh

38. Lanco Industries Ltd
   1. Lanco Industries Ltd   Andhra Pradesh

39. Madras Cements Ltd
   1. Madras Cements Ltd- Alathiyur I & II   Tamil Nadu
   2. Madras Cements Ltd- Ariyalur   Tamil Nadu
   3. Madras Cements Ltd- Jayanthipuram   Andhra Pradesh
   4. Madras Cements Ltd- Kolaghat   West Bengal
   5. Madras Cements Ltd- Ramasamyraja Nagar   Tamil Nadu
   6. Madras Cements Ltd- Salem   Tamil Nadu
   7. Madras Cements Ltd- Uthiramerur   Tamil Nadu

40. Malabar Cements Ltd
   1. Malabar Cements Ltd- Palakkad   Kerala
   2. Malabar Cements Ltd- Pallipuram   Kerala

41. Mancherial Cement Ltd
   1. Mancherial Cement Ltd   Andhra Pradesh
42. Mangalam Cement Ltd
   1. Mangalam Cement Ltd & Neershree  Rajasthan

43. Mawmluh Cherra Cements Ltd
   1. Mawmluh Cherra Cements Ltd  Meghalaya

44. Meghalaya Cements Ltd.
   1. Meghalaya Cements Ltd.  Meghalaya

45. My Home Inds. Ltd.
   1. My Home Industries Ltd  Andhra Pradesh
   2. My Home Industries Ltd-Vizag  Andhra Pradesh

46. OCL India Ltd
   1. OCL India Ltd- Kapilas  Orissa
   2. OCL India Ltd- Rajgangpur  Orissa

47. Orient Cement
   1. Orient Cement- Devapur  Andhra Pradesh
   2. Orient Cement- Jalgaon  Maharashtra

   1. Panyam Cement & Mineral Industries Ltd.  Andhra Pradesh

49. Parasakti Cement Ltd
   1. Parasakti Cement Ltd  Andhra Pradesh

50. Penna Cement Industries Ltd
   1. Penna Cement Industries Ltd- Boyareddypalli  Andhra Pradesh
   2. Penna Cement Industries Ltd- Ganeshpahad  Andhra Pradesh
3. Penna Cement Industries Ltd- Tadipatri Andhra Pradesh
4. Penna Cement Industries Ltd- Tandur Andhra Pradesh

51. Prism Cement Ltd.
   1. Prism Cement Ltd. - I & II Madhya Pradesh

52. Purbanchal Cement Ltd
   1. Purbanchal Cement Ltd Assam

53. Rain Cements Ltd
   1. Rain Cements Ltd- UN -I Andhra Pradesh
   2. Rain Cements Ltd- UN- II- Line I Andhra Pradesh
   3. Rain Cements Ltd- UN II- Line II Andhra Pradesh

54. Reliance Cement Company Private Limited
   1. Reliance Cement Company Private Limited Maharashtra

55. RNB Cements (P) Ltd
   1. RNB Cements (P) Ltd Meghalaya

56. Sagar Cement Ltd
   1. Sagar Cement Ltd Andhra Pradesh

57. Sanghi Cement Ltd
   1. Sanghi Cement Ltd Delhi

58. Sanghi Industries Ltd
   1. Sanghi Industries Ltd Gujarat

59. Saurashtra Cement Ltd
   1. Saurashtra Cement Ltd Gujarat
60. Shree Cement Ltd
   1. Bangur Cement - A Unit of Shree Cement  Bihar
   2. Shree Cement Ltd - Jaipur  Rajasthan
   3. Shree Cement Ltd- Khushkhera  Rajasthan
   4. Shree Cement Ltd- Ras  Rajasthan
   5. Shree Cement Ltd- Roorkee  Uttarakhand
   6. Shree Cement Ltd- Suratgarh  Rajasthan
   7. Shree Cement Ltd.- Beawar  Rajasthan

61. Shree Digvijay Cement Co. Ltd
   1. Shree Digvijay Cement Co. Ltd  Gujarat

62. Shree Jagjothi Cement Ltd
   1. Shree Jagjothi Cement Ltd  Tamil Nadu

63. Shriram Cement Works
   1. Shriram Cement Works  Rajasthan

64. Tamil Nadu Cements Corpn. Ltd.
   1. Tamil Nadu Cements Corpn. Ltd.- Alangulam  Tamil Nadu
   2. Tamil Nadu Cements Corpn. Ltd.- Ariyalur  Tamil Nadu

65. Tata chemicals Ltd
   1. Tata chemicals Ltd  Gujarat

66. Ultra Tech Cement Ltd
   1. UltraTech - AP Cement Works  Andhra Pradesh
   2. UltraTech - Hirmi Cement Works  Chhatisgarh
3. UltraTech - Gujarat Cement Works
   Gujarat

4. UltraTech - Jafrabad Cement Works
   Gujarat

5. UltraTech - Magdalla Cement Works
   Gujarat

6. UltraTech - Panipat Cement Works
   Haryana

7. UltraTech - Rawan Cement Works
   Chhatisgarh

8. UltraTech - Aditya Cement Works
   Rajasthan

9. UltraTech - Aligarh Cement Works
   Uttar Pradesh

10. UltraTech - Arakkonam Cement Works
    Tamil Nadu

11. UltraTech - Awarpur Cement Works
    Maharashtra

12. UltraTech - Bathinda Cement Works
    Punjab

13. UltraTech - Dadri Cement Works
    Uttar Pradesh

14. UltraTech - Ginigera Cement Works (G)
    Karnataka

15. UltraTech - Hotgi Cement Works
    Maharashtra

16. UltraTech - Jharsuguda Cement Works
    Orissa

17. UltraTech - Kotputli Cement Works
    Rajasthan

18. UltraTech - Rajashree Cement Works
    Karnataka

19. UltraTech - Ratnagiri Cement Works
    Maharashtra

20. UltraTech - Reddipalayam Cement Works
    Tamil Nadu

21. UltraTech - Vikram Cement Works
    Madhya Pradesh

22. UltraTech - West Bengal Cement Works
    West Bengal

67. Uma Cement Industries

1. Uma Cement Industries
   Jammu & Kashmir
68. Viket Sagar Cement
   1. Viket Sagar Cement Andhra Pradesh

69. Wonder Cement Ltd
   1. Wonder Cement Ltd Rajasthan

70. Zuari Cement Ltd
   1. Zuari Cement Ltd.- Chennai Tamil Nadu
   2. Zuari Cement Ltd.- Krishnanagar Andhra Pradesh
   3. Zuari Cement Ltd.- Sri Vishnu Cement Andhra Pradesh
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