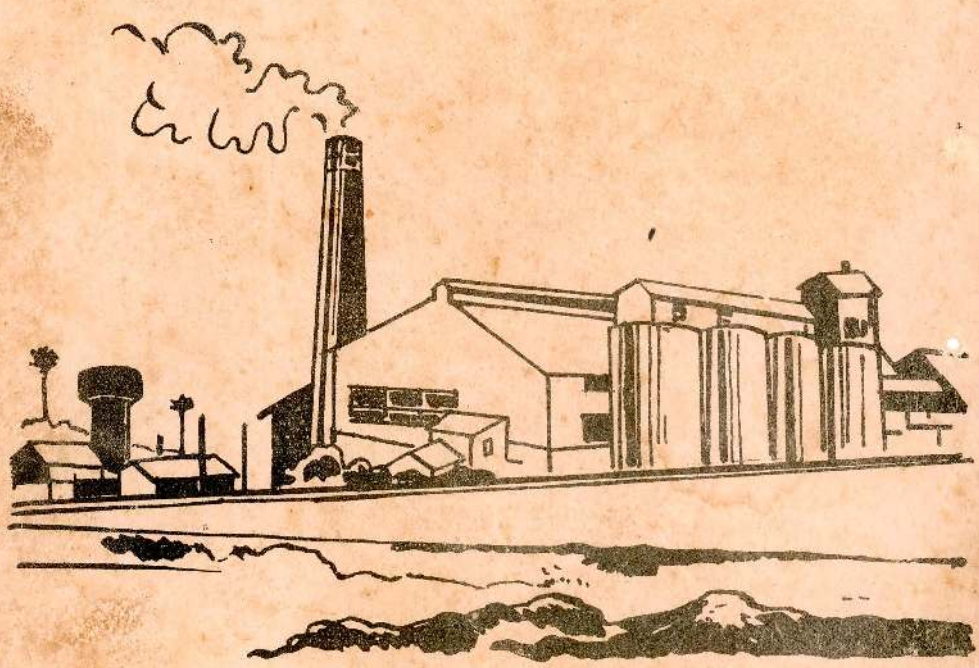
M. Thillainathan
CEYLON

CEMENT INDUSTRY



CEYLON CEMENT CORPORATION

(A State Industrial Corporation)

CEYLON CEMENT CORPORATION

CEMENT INDUSTRY

INTRODUCTION

From early times cements of some kind or other have been used for binding together bricks, stones and other materials used in construction, but it is probable that the Romans were the first people deliberately to make cements with hydraulic properties, and, as their structures testify, they had considerable knowledge of calcareous cements.

In Ceylon such materials have been used in the construction of religious and secular buildings since the introduction of Buddhism into the island in the third century B.C. Portland cement, used in modern construction, however, is of comparatively recent origin, having been first patented in 1824 by Joseph Apsdin, an English Civil Engineer. He called it Portland Cement on account of its resemblance to Portland stone.

Cement industry in Ceylon dates back to 1950, in which year the first cement factory was established at Kankesanturai by the Government. Since 1954 the factory has been managed by an all Ceylonese staff and it is to their credit that the efficiency of production has improved. The present annual average output is approximately 80,000 tons.

In November, 1956 the management of the cement industry was transferred from the Department of Industries to the Kankesan Cement Works Corporation under the Government Sponsored Corporations Act No.19 of 1955. On 1st January 1959, this was superseded by the Ceylon Cement Corporation, established under the State Industrial Corporations Act No.49 of 1957, with a view to expanding this industry on an island wide basis.

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Cement manufacture is the first major government industrial enterprise. It is one of the most successful industries in the public sector yielding a steady and substantial annual profit. Kankesan cement which is produced to British Standard Specifications surpasses the latter by a very liberal margin. It is being used in special structural work requiring high quality cement. The price is comparative with the best imported brands, and the demand for Kankesan cement exceeds the supply. The current production is approximately one-fourth of the total cement consumption of the island.

RAW MATERIALS

There are two principal raw materials required for cement manufacture.

1. Calcareous materials

   This group includes deposits of limestone, chalk, marls, marble and marine shells.

2. Argillaceous materials

   This group includes clays, shales and slates.

The calcareous raw material constituent for cement manufacture is available in Ceylon, in adequate quantity and of suitable quality in the Miocene stratum extending from the Jaffna Peninsula along the north west coast of Ceylon to approximately twelve miles north of Puttalam. The deposit occurs as an outcrop at Kankesanturai where the existing cement plant is located and at Aruakalu, approximately eighteen miles north of Puttalam, the raw material source for the second cement plant. Narrow seams of crystalline limestone occur in the central region of Ceylon but these are inadequate in quantity and contain too high a proportion of magnesia. Coral deposits occur in the south west of Ceylon but the quantities available are inadequate for the purpose of a cement industry.

Distribution of limestone in Ceylon is as shown in Figure I.

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රූප 1 - සිමෙන්ති නිෂ්පාදනය සඳහා සුදුසු හුණුගල් පිහිටීම

சீமேந்து உற்பத்திக்கு தொழிலுக்கான சுண்ணக்கல்
கிடைக்குமிடம் காட்டும் படம் - இல. 1.

MAP OF CEYLON

SHOWING LIMESTONE SUITABLE FOR CEMENT MANUFACTURE.

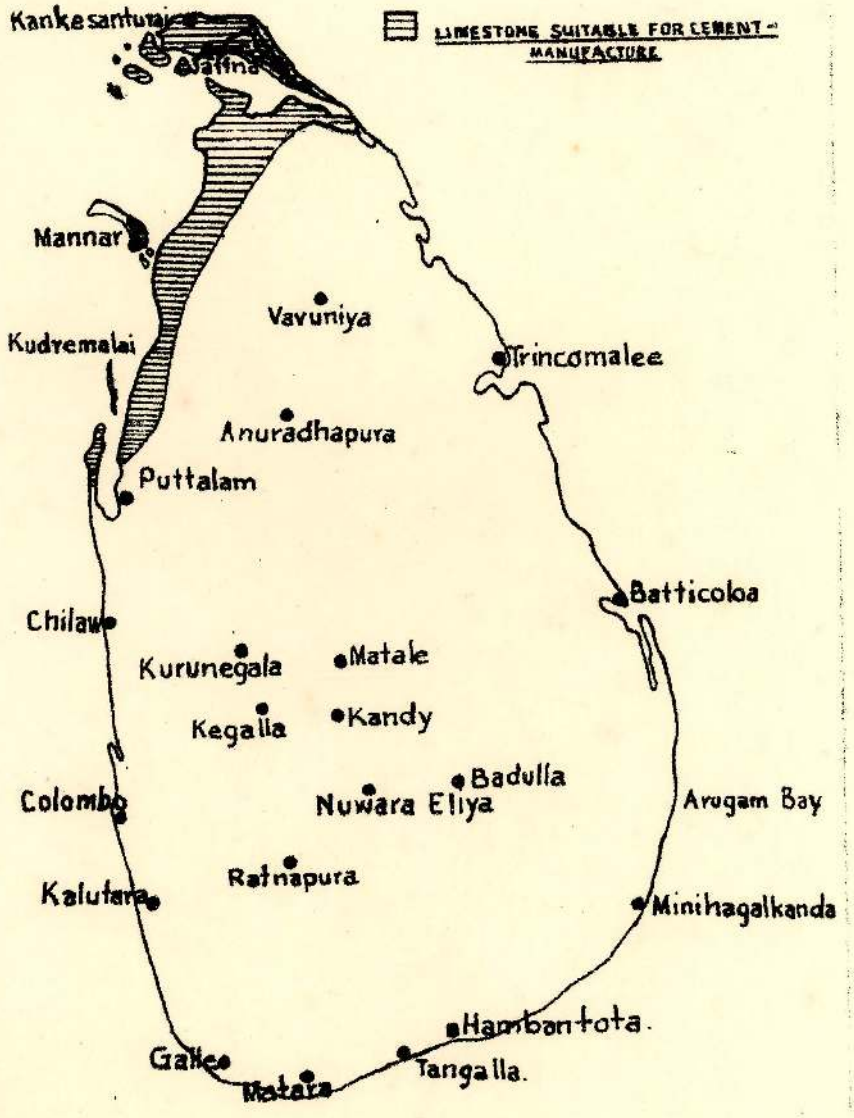


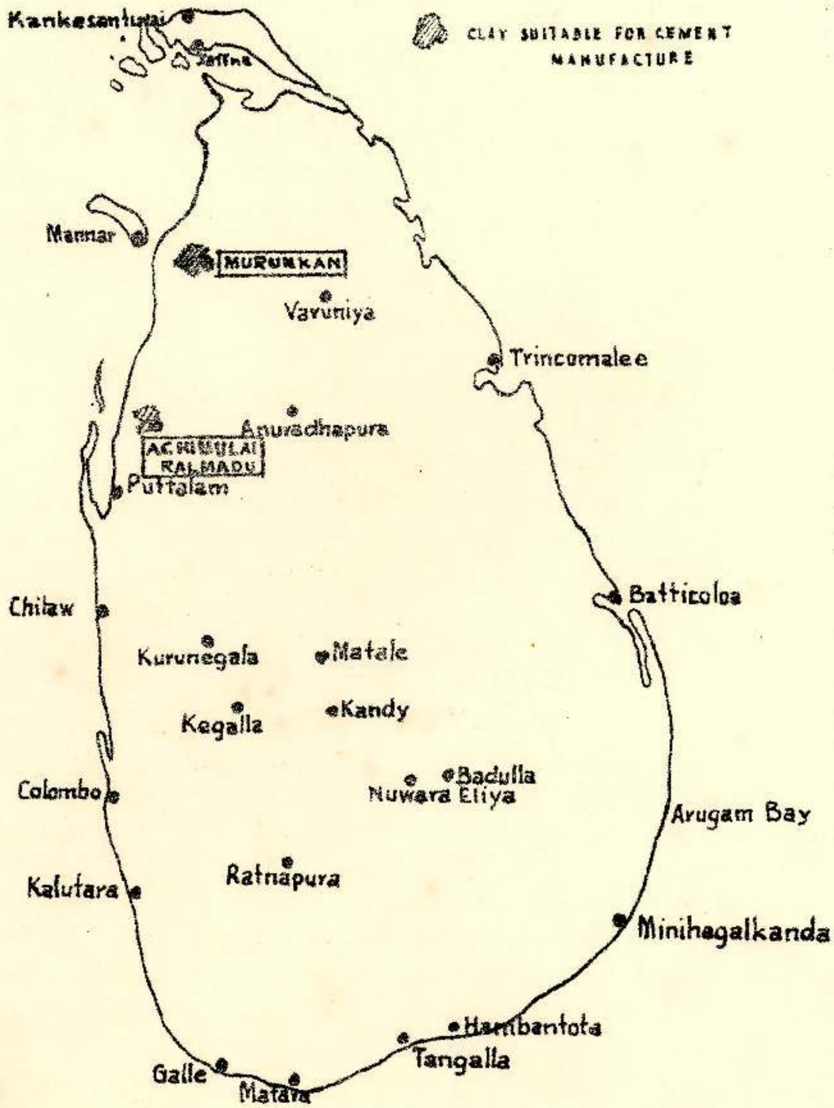
Figure 1

අංක 2 - සිමෙන්ති නිෂ්පාදනයට සුදුසු මැටි [illegible]

சீமெந்து உற்பத்தித் தொழிலுக்கான களி
கிடைக்கும் இடங்கள் காட்டும் படம் - இல. 2.

MAP OF CEYLON

SHOWING PROVED CLAY DEPOSITS SUITABLE FOR CEMENT MANUFACTURE.



The argillaceous constituent is found abundantly is the sedimentary clays on the flood plains of rivers. Such clay deposits however are extremely scarce in the north and the nearest source of suitable clay for the Kankesanturai plant is at Murunkan in the proximity of the Giant Tank. The distribution of clay suitable for cement manufacture is as shown in Figure II.

The total moisture free raw material required is approximately 1.6 times the cement output, the loss being mainly that of carbon dioxide in the process of manufacture. Of this approximately 80% represents limestone and 20% clay of the requisite quality. Gypsum, a minor constituent, required to the extent of 3% to 4% of cement produced, is normally imported.

Limestones are usually won by open cut methods. Heights of quarry faces selected depend on type of deposit and formations. The overburden of soil and organic material is removed and the rock itself is then drilled and blasted.

Power shovels are used for digging and loading the broken stone into dumper trucks, and railway wagons for transport to the Works. Clay is excavated from shallow lying deposits using dragline excavators and loaded into railway wagons or dumper trucks for transport to the Works.

Manufacture of Cement

In broad outline the manufacturing process comprises :

(a) Preparation of the raw materials,

(b) Proportioning, mixing and fine grinding the raw materials to obtain an intimate mixture,

(c) Burning to a state of incipient fusion,

(d) Grinding the resulting clinker (with the addition of a small quantity of gypsum) to a fine powder, and

(e) Packing and despatch.

All manufacturing processes are subject to stringent chemical control.

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Two processes are employed for the manufacture of Portland Cement.

1. The dry process, where the raw materials limestone and clay are ground dry to a 'raw meal'.

2. The wet process, where the raw materials are ground with water to form a 'slurry'.

From this stage the process of manufacture is substantially the same for wet or dry process. The dry process is the method of manufacture adopted in Ceylon as it is ideally suited for Ceylon where fuel economy is a prime consideration and where the cement industry on account of raw material location has necessarily to be sited in places where water is scarce.

Process of Manufacture

The limestone is fed into a crusher where it is crushed to a size of about 3/4 to 1 inch and stored. The clay is fed into a clay cutter where it is cut into shreds, dried in a rotary drier and then stored.

Overhead cranes transport the dried limestone and clay from storage to their respective mill feed hoppers.

Table feeders located under the mill feed hoppers give approximate proportioning of the limestone and clay to produce the desired mix.

This limestone and clay mixture in the ratio of approximately 3.6 is to 1 is fed into a Ball Mill where the limestone clay mixture is ground to a fine powder called "Raw Meal".

The raw meal is then pumped to homogenising silos, where the fine adjustment of chemical composition is effected.

Analysis is known of the meal in each silo, and with independently controlled extractors on each silo perfect blending can be obtained and adjustments are made to ensure

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that raw meal for kiln feed is of the correct analysis. The blended raw meal is fed into the rotary kiln which is a long steel cylinder supported by tyres on rollers and rotated at slow speed. It is set on an incline of about 1 in 25 and lined with refractory material. The raw meal supply is controlled by a feeder synchronised with the kiln speed.

Heat is provided by special burners designed for atomised liquid fuel or alternatively for pulverised coal.

Rotation, assisted by the inclined setting, causes the raw meal to travel slowly down the kiln. During this journey it meets with ever increasing temperatures. This causes first evaporations of the water then the dissociation of the calcium carbonate, and finally at a temperature of about 2500° F partial fusion takes place in the clinkering zone. The reactions in this zone gives rise to the formation of silicates and aluminates of calcium which possess chemical and physical properties vastly different from the original limestone and clay. This partially fused material is called "clinker" and consists of nodules ranging from 1/2 in. to 3 in. in size.

The white hot "clinker" passes from the kiln to a cooler where it is cooled and thence by a conveyance system to storage.

The next part of the process is grinding of clinker to produce cement. Here the milling plant is similar to that used for raw grinding. A small amount of gypsum is added with the cement mill feed (usually 3 to 5%). This is to control the setting time, as without it cement will have a flash set.

The product is ground to a specified fineness.

From the cement milling department cement is conveyed or pumped to storage silos.

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Cement is drawn as required from the storage silos into a packing plant, in which bags are packed and sealed automatically and discharged on conveyors to road or rail trucks.

Cement is also transported in bulk in special road or rail wagons.

ECONOMICS

Cheap bulk transport is an essential requirement for a heavy industry such as cement not only for the distribution of the finished product but also for inward supplies, principally fuel. Heavy rail freight costs are at present an important element in the operational costs of the Kankesanturai plant, on account of its distant location. However, there was no other alternative when the first cement plant was established. The expansion programme provides for coastal shipping between the north and the south based on harbour projects at Kankesanturai and Galle. The second cement plant at Puttalam will be based entirely on rail transport. Hence, the railway line is being reopened from Bangadeniya to Puttalam and will be extended a further eighteen miles to Aruakalu, the source of the raw material. The introduction of bulk transportation of finished cement both by road and rail to principal consuming centres and to major construction sites, will result in a reduction of distribution costs.

Fuel is the principal item of cost in the manufacture of cement and in the absence of local resources the cement industry is solely dependent on imported liquid fuel, whose cost has been aggravated by internal rail freight as well as by a heavy import duty. The current consumption of liquid fuel with a calorific value of 18,500 BTU lb. is approximately 12½% of the output of cement. This percentage is expected to diminish to less than 10% when the modernisation and expansion scheme for the plant is completed.

Next to fuel, power is the most important item of cost. Cement is a heavy power consuming industry taking approximately 120 kWH per ton of production. For the present

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stage of expansion at Kankesanturai, the maximum demand will rise to 7,500 kVA. This additional power requirement has to be generated thermally, and hence high power costs will continue. The further stage of expansion at Kankesanturai will increase the maximum demand by another 5000 kVA and it is expected that the 132 kV hydro line will be brought up to Jaffna by this time. The power requirements of the Puttalam plant as well as the Terminal Grinding & Packing Plant at Galle will be met from hydro sources. A heavy power consuming industry such as cement with a high load factor will be an asset to the public power supply by taking up a considerable portion of off-peak load.

EXPANSION OF THE CEMENT INDUSTRY IN CEYLON

The Ten Year Plan, which was formulated sometime back accorded the highest priority to the expansion on the cement industry. The manufacture of cement, is not a new activity in Ceylon. For over a decade, a dry process plant has been operating in Kankesanturai. It has been a notable commercial success yielding a profit of nearly Rs.4½ millions per annum before appropriation for income tax, at the same time providing a high quality essential commodity. In order to meet the current and future demands this plant has to be modernised and expanded and additional plants set up. The development of the cement industry has been facilitated by its integration under the Ten Year Plant with the programmes for the expansion of power, rail and harbour facilities.

The current consumption of Portland Cement in the Island is approximately 300,000 tons per annum of which approximately 80,000 tons are produced locally. This consumption is less than the current demand, as is evident from the scarcity of cement which continues to be a regular feautre. The projected demand for cement has been estimated in the Ten Tear Plan at approximately one million tons in 1968. (vide Figure II).

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Hence, the ten year target for cement production is Ceylon was set at this figure :

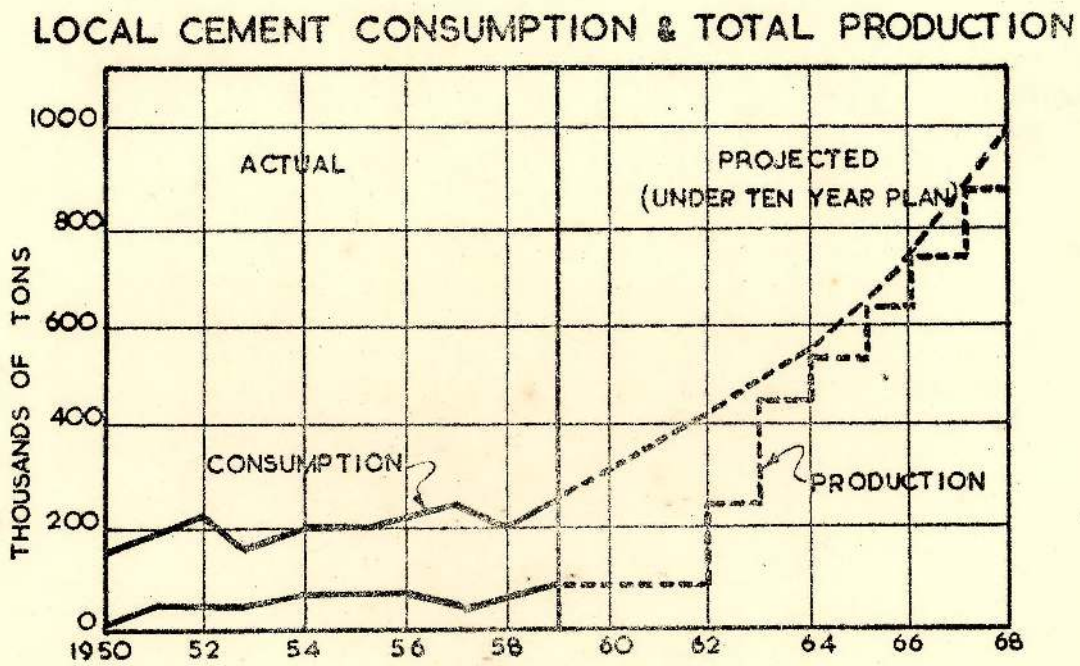

Figure III

The development projects currently under execution are :-

(i) The expansion of the Kankesan Cement Works from its present output of approx. 80,000 tons per annum to an output of approx. 300,000 tons per annum of cement clinker. Approximately 200,000 tons of this clinker

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will be ground to finished cement at Kankesanturai for distribution by road and rail in bulk as well as bag packed. The output at Kankesanturai will be stepped up to over 500,000 tons in the next stage of expansion.

(ii) The Terminal Grinding & Packing Plant at Galle - To this plant will be transported coastwise approximately 100,000 tons of cement clinker from the expanded plant at Kankesanturai. This quantity of clinker will be ground to finished cement for distribution in bulk as well as bag packed for consumption in the southern sector. Besides the economies of transport there will be a reduction in respect of power costs. Final grinding is the principal power consuming operation in cement manufacture and the power requirements will be met from the hydro supply at approx. half the cost of generating the same thermally at Kankesanturai. Until self sufficiency is attained with the further stages of expansion at Kankesanturai and Puttalam, the difference between local consumption and local production will be imported in the form of clinker rather than as finished cement. The Terminal Grinding & Packing Plant is capable of being stepped up in stages to 300,000 tons per annum.

(iii) Work is in progress on the establishment of a second cement plant in the Puttalam district for an initial output of 200,000 tons per annum, with provision for a next stage of expansion to 400,000 tons per annum. The preliminary geological surveys and raw materials have been completed. Substantial progress has been made in site studies as well as preparation of project designs and plant specifications. Construction work is expected to commence in 1963.

An equitable system of Islandwide distribution will be put into operation from these three plants. The cement requirements of the northern and easter regions will be met directly from Kankesanturai and of the south, from Galle. The requirements of the western and central sectors will be met from the Puttalam Plant.

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Besides these three main cement manufacturing projects, the development plan includes the setting up of a number of plants for the manufacture of prefabricated concrete, inclusive of low cost housing units. Unlike cement plants which are capital intensive, the prefabricated concrete industry will be labour intensive. It is also intended to establish a research station for cement and concrete covering the requirements not only of the technology of cement manufacture but also of the applications of cement.