HOW PORTLAND CEMENT IS MADE AT BERRIMA

BLUE CIRCLE SOUTHERN CEMENT WORKS is a member of the Boral Group of companies. Situated at Berrima (150 kms south of Sydney) supplying much of that cities annual requirement of over one million tonnes per year. Cement, direct from Berrima, is despatched in large quantities to Canberra, the South Coast and most parts of N.S.W.

Cement making (not to be confused with concrete mixing) is basically a very simple process. Carefully measured quantities of limestone, shale, iron ore and occasionally sand are blended together, ground to a fine powder and fused at a very high temperature in a rotary kiln. The fused material is called clinker which is cooled and then ground with a small amount of gypsum in a ball mill and produces the finished cement powder.

Limestone, with a high level of calcium carbonate, is the primary raw material in cement. Chalk or coral can also be used. For Berrima, the limestone comes from Blue Circle Southern's own quarry at Marulan, 70 km to the south. It is a high grade stone which is won by blasting and then crushed before being transported by rail to the cement works. Shale, the second basic ingredient, is quarried on the works site itself. The small quantity of iron ore required in the making of cement is obtained from outside resources. Sand is supplied locally when required for the fine correction of the mix.

Berrima employs two quite different methods of preparing the raw materials before they enter the kiln. They are called the WET PROCESS and the DRY PROCESS. In the wet process the raw materials are ground with water which produces slurry. This slurry is pumped into the back-end of the rotating kiln and as it slowly moves towards the hot end of the kiln (i.e. the fusion zone) it passes through a heat exchange section made up of festooned chains fixed to the inside of the kiln shell. The water dries out and with the gradual increase in heat, chemical changes occur and finally fusion takes place. Nearly half the kiln energy is used in drying the slurry before fusion takes place and when the new kiln was installed the dry process was introduced to conserve energy. For the dry process, raw materials are ground to a fine powder in a vertical raw mill. This dry ground meal is then stored in a large blending silo. From here it is conveyed by an air slide to the top of the preheater tower which contains four cyclone stages. The raw meal falls by gravity through each interconnected cyclone and as it does so, the hot gases from the kiln pass through the cyclones and heats the raw meal to approx. 1000 C. From the bottom cyclone the hot meal enters the rotating kiln and begins its journey towards the fusion zone. As the hot clinker leaves the kiln it passes through satellite coolers and then conveyed to storage. The clinker fuses at a temperature 1750 C and is cooled at 120 c.

Berrima's plant capacity is 1.2 million tonnes of clinker per annum . Sixty per cent of this output is transported by rail to a grinding plant at Maldon where it is converted to cement. The remaining clinker is ground at Berrima and services the Canberra and South Coast markets.

Continuous upgrading using the latest technology has been a feature of Berrima's development. The kilns at Berrima are equal to the most modern in the world. With the aid of the latest electronic controls, video display units and computer back up systems the quality of cement for which Berrima is noted has been maintained. A chemical and physical testing laboratory operates the latest x-ray fluorescent spectrometer to maintain quality levels at each stage of process

Environmental aspects of the cement works at Berrima are foremost in the company's development plans. Dust collectors are located at all possible emission points. Water run-off from the plant filters through settling ponds and noise levels are reduced by sound proof enclosures built around noisier equipment. An extensive tree planting and landscaping programme was started in 1976 and is designed to blend the works complex with the natural surroundings in the area.

HISTORY OF PORTLAND CEMENT

Although the history of Portland cement dates from the discovery by an Englishman, Joseph Aspdin, in 1824, the origin of cementing materials goes back to the days when man first realised his need for shelter. In the beginning, man used mud for this purpose, but as population increased - and with -it the domestic needs the culture of the people - more permanent and commodious structures became necessary.

Builders turned to local materials for their requirements and used limestone, gypsum, marble, and even basalt and granite. Blocks of these were roughened, grooved and dovetailed, so that when put together, they became stable to resist wind and weather. Before long, however, builders began to seek a material which would bind stones together without fitting and so began the development of cements.

In the early Egyptian era, the cementing material was obtained by burning gypsum, which was quarried in a very impure state and very roughly burnt. The early Egyptians were not acquainted with the use of lime, although limestone was more abundant and more accessible than gypsum. Lime was used at a very early period by the Greeks and earlier still in Crete.

The early Romans borrowed the idea from the Greeks and made extensive use of lime-bearing cement, not only ;in their buildings, but in roads, bridges and aqueducts. The results of their craft are still being uncovered.

The words cement and concrete were derived from the Romans. Cement was originally Caementum - a rough, unhewn stone or chips of marble from which a kind of mortar was made. Concrete comes from the word 'concretus,' meaning 'growing together'. With their cement, the Romans made loose stones 'grow together' into single rock-like mass.

Most of the foundations of buildings in the Forum in Rome were a form of concrete, these foundations being placed to a depth of as much as twelve feet. The great Roman baths built about 27 B.C., the Colosseum, and the huge Basilica of Constantine are other examples of early Roman architecture in which concrete was used.

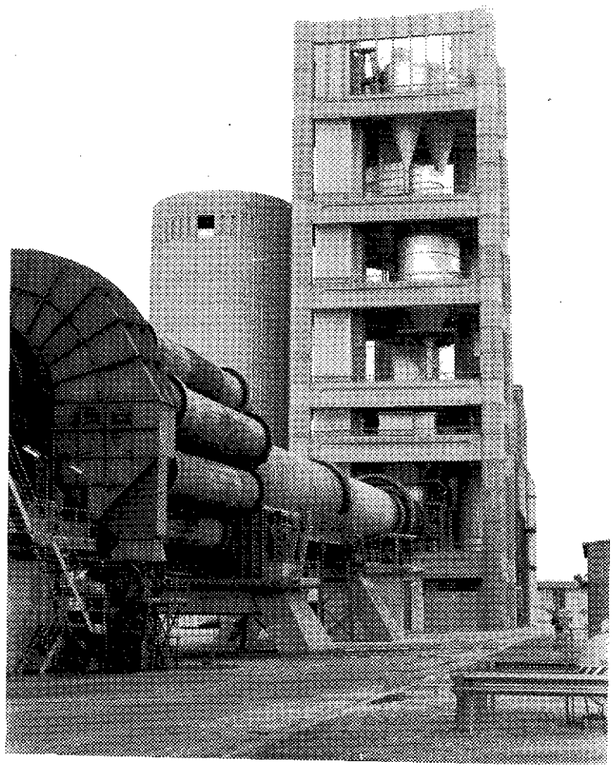
The Romans achieved their greatest success in making a cement by mixing slaked lime with a volcanic rock or sand called Pozzolana, named after the place where it was first found, Possuoli, near Mount Vesuvius. This, it is believed, was the first hydraulic cement - cement capable of hardening under water.

However, not until 1756 did some serious research result in the development of better cements. In that year the English Engineer, John Smeaton, produced a stronger cement by burning a limestone containing considerable proportions of clayey impurities. Other investigations and improvements were made by Bryan Higgins, Bergmann, Joseph Parker, L.J. Vicat, J.F. John, James Frost and I.C. Johnson. Traditionally, but perhaps unfairly to others, the invention of the prototype of today's Portland cement is credited to the English mason Joseph Aspdin, who, in 1824, obtained a patent and gave the product its name, because in colour the mortar produced from it resembled a natural building stone obtained from the Isle of Portland, off the English Coast. The contribution to Johnston and Aspdin were primarily the important step of preparing a synthetic mixture of lime and clay without depending on raw materials found in nature which might contain such elements in desirable proportions. However, even these early pioneers did not realise that a much superior product, as made today, could be produced at higher kiln temperatures.

A major breakthrough in technology occurred in the 1880's by the development of the shaft kiln which was adapted from the bottle kiln but arranged for continuous operation and with a much better economy. Fuel and raw materials were fed together at the top. In 1877 the first rotary kiln was patented in England. In 1885 another Englishman, Frederick Ransome, took out a better known patent on a rotary cement kiln and his first kilns were eighteen inches in diameter and fifteen feet long. Over the years, rotary kilns have developed in size. Kiln outputs of over 2000 tonnes of cement clinker per day are commonplace. Modern materials handling equipment, more efficient combustion techniques, and computers to control the process operation and quality control, have made large outputs possible with improved quality and economy of costs.

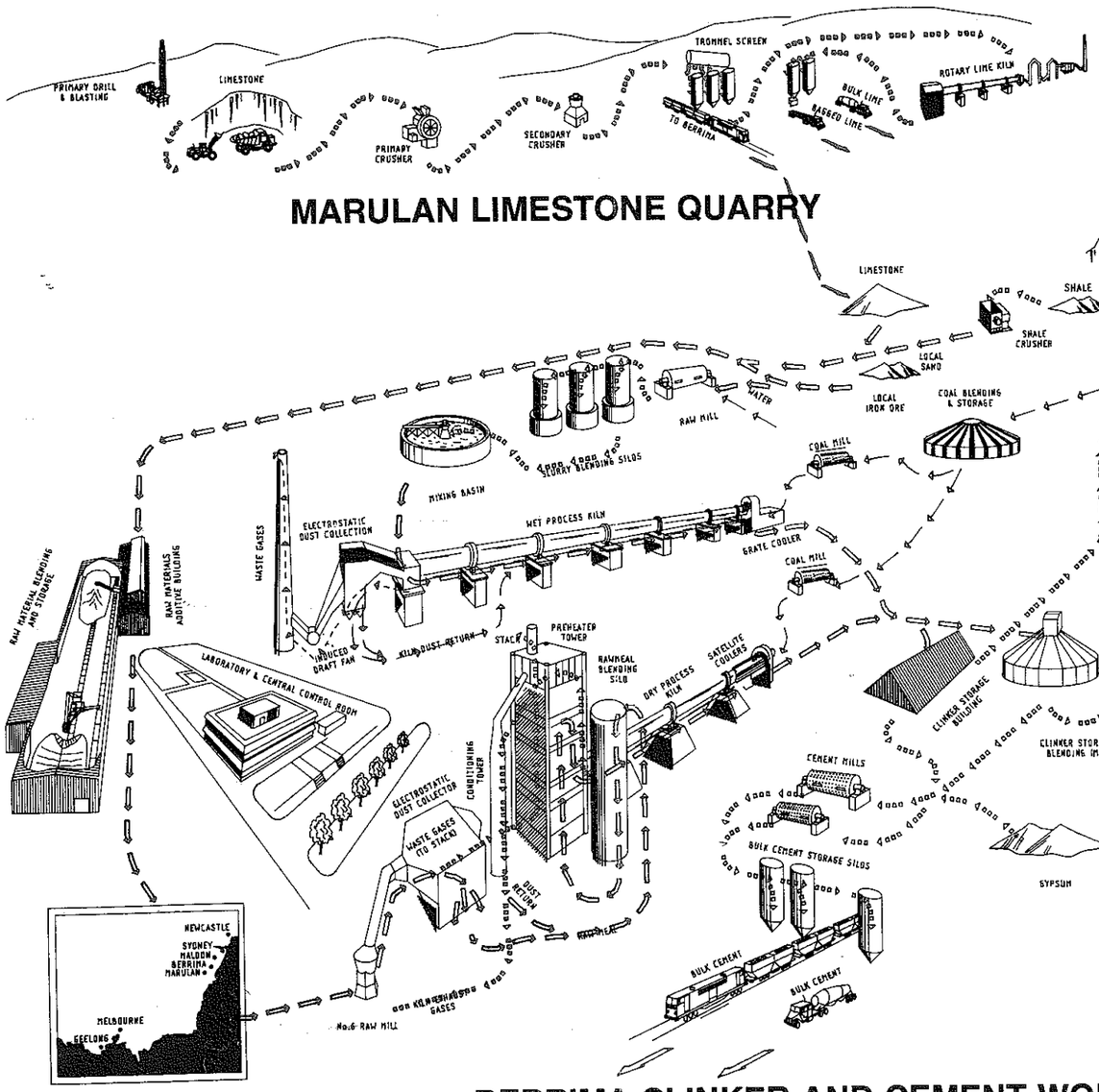
BLUE CIRCLE SOUTHERN

THE CEMENT MANUFACTURING PROCESS AT BERRIMA WORKS



Building Australia on a firmer Foundation

THE MARULAN - BERRIMA - MALDON PRODUCTION LINE



BERRIMA CLINKER AND CEMENT WORKS

MALDON CEMENT WORKS