

Cementing history

First invented in Roman times, cement has undergone a chemical revolution to deliver the Portland cement used extensively today.

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Used extensively in the building industry, cement is a substance that sets and hardens, and can bind other materials together. It is used to make mortar and concrete.

Cements are classed as hydraulic or non-hydraulic. Hydraulic cements set and harden after being combined with water. They then keep their strength, even if they get wet. Earlier non-hydraulic cements, on the other hand, need to be kept dry after setting in order to keep their strength.

Hydraulic cement dates back to Roman times, when it was made from burnt lime mixed with naturally occurring pozzolana (a reactive silica-rich volcanic ash). The burnt lime was made from burning limestone, chalk or some other source of calcium carbonate, such as shellfish shells. This mixture could set in the absence of air, allowing for underwater foundations and mass concrete applications.

However, this knowledge was lost in the Middle Ages. Pozzolans were forgotten, and so was the need to burn lime at a temperature high enough to achieve good reactivity.

Modern cement

The modern history of cement starts with John Smeaton's 1756 Eddystone Lighthouse, which used a cement made from Welsh limestone, mixed with Italian pozzolana. The limestone naturally included clay, which improved the strength of the cement. Effectively, Smeaton had rediscovered the lost Roman technology.

By 1850, three types of cement that would set in a damp atmosphere were available – natural cements, artificial cements and Portland cements.

Natural cements, produced in Britain and America, were made by burning stone that contained a mixture of lime, alumina and silica. The British products were often (incorrectly) called 'Roman cement'.

Artificial cements were made by mixing water and limestone with clay, burning it at between 1,100°C and 1,300°C and then grinding it. This was the method used by Joseph Aspdin's 1824 'Portland cement' – named for its resemblance to the high quality Portland stone.

It was not until 1845, however, that the true Portland cements were available, requiring firing temperatures of about 1,370°C to have as complete a reaction as possible between the lime and silica.

Early cement kilns were intermittent or batch production, with the first continuous kiln coming from Germany in 1880. The first successful rotary kiln, based on 'wet' slurry, was not in operation until 1900, and it took until the 1960s for the less energy intensive 'dry' process to be brought into production.

Imported cement

Cement was available in New Zealand soon after European settlement. Bethune and Hunter of Wellington auctioned '20 casks cement' on 19 April 1841, presumably imported from England. On 15 September 1842, the company of Ridgways, Guyton, and Co., also of Wellington, was advertising for sale 'Roman cement in puncheons, barrels, and half barrels'. It is likely that, even then, the ready availability of timber limited the demand for cement – a situation that continues to the present day.

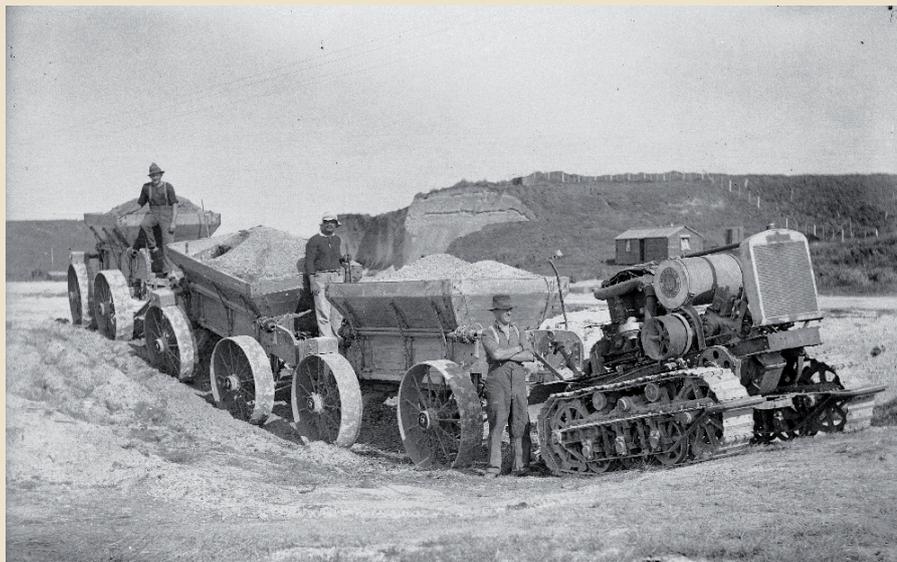
New Zealand cement manufacture

Traditional mortar, used for bonding masonry and brickwork, was a mixture of sand and burnt lime. Lime was being burnt in the Nelson district in 1843, in Otago after 1849, in Kapiti about 1865 and in Northland by 1867.

The 1880 Royal Commission into Local Industries promoted the encouragement of the cement industry. The following years saw cement manufacture begin in Northland and Otago, creating the ancestors to our current cement producers.

Northland cement

In 1866, the Warkworth hydraulic lime works was established by Nathaniel Wilson. Wilson started experimenting with the manufacture of Portland cement in 1883, and by 1886, it



Tractor, wagons and workers at a cement works on Limestone Island, Whangarei about 1925. (Photo: FN Jones Collection, Alexander Turnbull Library, Wellington, Ref: G-29026-1/2.)

was being used to build the New Plymouth gaol.

In a series of regular advertisements starting in 1888, hardware merchant Peter Hutson & Co. of Wellington was advertising the availability of both English and New Zealand cement, noting that Wilson's cement 'has been proved during the last 18 months to be equal, and in many cases to be superior, to the imported cement'.

Although the production details took some time to be resolved, Wilson's production grew strongly and, in the early 1900s, following an overseas visit, the company set up the then revolutionary technology of rotary kilns and tube mill. The Warkworth plant closed in 1928, and production moved first to Whangarei and then Portland, 8 km south of Whangarei where production continues.

The Golden Bay Cement Works Limited was established in Tarkohe, Golden Bay in 1910. The company invested over £50,000 (about \$7 million in 2007) in the plant, including an electrical rotary kiln, the factory and the wharf. It merged with Wilson's in 1988 to become Golden Bay Cement.

Otago cement

Cement manufacture in the South Island was started by James MacDonald (also spelt McDonald) outside Dunedin. MacDonald had been burning lime at Sandymount, on the Otago Peninsula, for many years – his 1865 kilns can still be seen.



Unloading bags of cement at the Nelson Street Store, about 1952. (Photo courtesy Fletcher Challenge Archives Ref. 6242P/19.)

Work on the Dunedin plant began about October 1886, and the cement was being advertised for sale from 31 December 1886. The business ran into financial difficulties and, in 1888, was sold to the Milburn Lime and Cement Company. In 1890, the plant was moved to reclaimed land at Pelichet Bay, Dunedin. This was closed in 1929 when a new cement plant was established at Burnside, Dunedin, which, in turn, closed in 1988.

In 1958, the New Zealand Cement Company started a new plant at Westport, merging with Milburn in 1963 to form New Zealand Cement Holdings Limited. The Westport plant grew, ultimately taking

over from the Burnside plant. In 1968, the company took over the Southland Cement Company Ltd, which had started in 1957. The company now forms part of the Swiss company Holcim.

McDonald's cement continues to hold pride of place in central Dunedin – the Robert Burns statue in the Octagon may have been designed and cast in Edinburgh by Sir John Steell and placed on a pedestal of Scottish granite, but sits on a hidden base of artificial stone made using McDonald's cement.

Plants near wharves

New Zealand is a nation of coastline and sea. Building the early plants close to shipping wharves enabled ships to be used to transport cement from the place of production to the distribution facilities in the main ports. In early days, the cement was bagged and transported by ship, rail or road. Bulk carriers soon provided a less labour-intensive way to transport the large amounts of cement needed for a developing country, and they still form the central core of the distribution network.

Cement today

There are still two cement plants in New Zealand – Holcim's Cape Foulwind plant, near Westport, and Golden Bay Cement's plant at Portland. Cement ships still transport product to bulk storage depots around the country. In March 2008, Holcim received planning permission for a new cement plant at Weston, 5 km northwest of Oamaru. ◀