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12.2

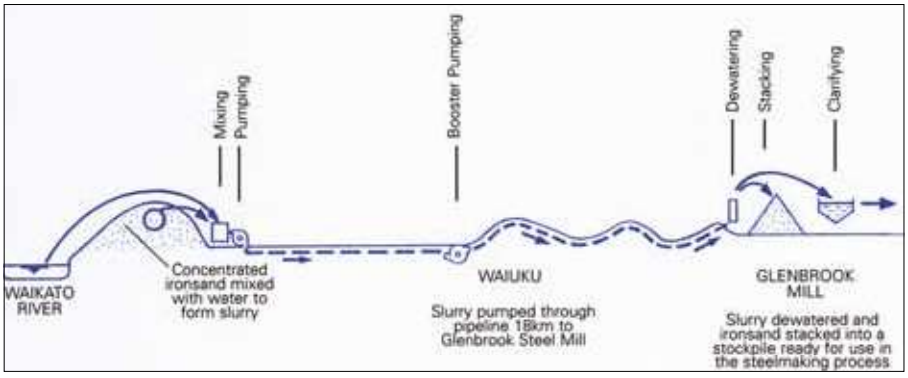
Slurry Transportation Ironsand Concentrate – Mine Site to Glenbrook

by
Sir John Ingram

Slurry transportation from the mine site to Glenbrook began in 1986. This was the world's first polyurethane-lined high pressure underground pipe line with welded flanges transporting dense abrasive coarse material by positive displacement pumps. The project extended the known bounds of slurry pumping technology and was awarded an IPENZ plaque for engineering excellence.

The increase in usage of primary concentrate due to the iron and steel plant expansion (from about 250,000 tonnes per year to over 1.2 million tonnes) meant continuing use of road transport for the 18-kilometre journey was neither economic nor practical. Other options had to be considered. These were: slurry transportation, aerial ropeway, conveyors, pneumatic capsules and railway.

Slurry transportation was initially ruled out, as no slurry systems longer than a few kilometres existed for such abrasive material with its combination of grain size and density. There was reluctance to risk extending the bounds of technology to such an extent for such a vital service.



Diagrammatic illustration of slurry transport system.

NZ Steel leaflet 'Water and Essential Resource', Fig 1

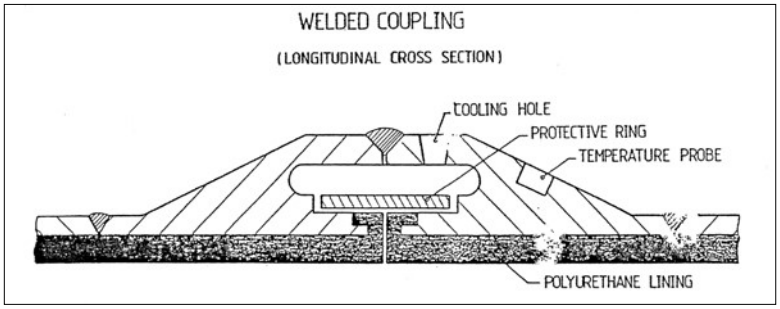


Diagram of welded coupling on the slurry pipeline.

J. H. Ingram paper, Fig. 3

Of the remainder, railway appeared the most practicable and lowest-cost option, particularly as the link would be constructed with New Zealand Rail's capital. Unfortunately the local farmers along the proposed route who did not like the idea of a railway going through their property objected strongly, establishing the Concerned Landowners Association to fight the intention. Negotiations with the association began, and the route was modified as far as possible to avoid particularly sensitive areas such as the artificial lake (known locally as Lake Lollipop) belonging to Mr Heard, the association's president. It soon became clear, however, that an alternative method of transportation had to be found if construction delays were to be avoided.

Following discussions with a favoured contractor it was decided that the slurry alternative, much preferred from an environmental point of view, should be reviewed in the light of significant advances recently made in pumping and pipeline technology. Finally it was agreed that the company would write a specification which met its requirements as regards life, safety, reliability and costs, and that a committee comprising contractor and company engineers would be established to ensure the optimum result.

In due course a contract was let for the design and construction of the slurry system. It involved two Geho positive displacement flexible diaphragm pumps (the diaphragm separating the slurry from the piston and other moving parts), one at the mine site terminal and one about half way to Glenbrook. The requirement of a 25-year life, safe and leak free, demanded a polyurethane lined

Above: Pipeline coupling being prepared by McConnell Dowell.

Courtesy McConnell Dowell Constructors Ltd

Right: Flange joint being welded by McConnell Dowell.

Courtesy McConnell Dowell Constructors Ltd

steel pipe with a welded radiographed pipe joint to provide complete confidence in the integrity of the weld prior to back fill. This joint was a patented world first. To prevent damage to the pipe lining during welding a thermal barrier was built into the forged flange, forming an annulus through which air and water mist were passed to dissipate heat during welding.

The slurry transportation is very successful, an example of amazing ingenuity applied to a complex problem. It is cost effective and low maintenance, with energy consumption of only about eight kilowatt hours per tonne. There is no adverse effect on the environment. After well over 20 years of service, an inspection of the pipe showed no evidence of deterioration of either the lining or the pipe. The pipeline is expected both to meet pressure tests to comply with recertification requirements and to remain in service for many more years.

The Concerned Landowners Association did the company a good turn.

Geho high pressure slurry pumps.

Courtesy NZ Steel Ltd

Ironsand Properties, Primary Concentrate
Bulk Density: 2090 kg/m3
Size range: 45–212 micron

Contractors for Slurry Pipeline
Design, quality assurance, inspection and commissioning: Slurry Systems Pty Ltd
Construction and project management: Mc Connell Dowell Construction Ltd

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