



Asset Care Counts

August 2014

## Condition Assessment of Cast Iron Cement Lined Pipe

Australia has many tens of thousands of kilometres of buried cast iron cement lined (CICL) piping commonly used for both water and sewage. Up to 1980, the pipe was grey flake graphite iron but after 1980 it was ductile iron. CICL pipe laying started before 1900 and peaked in the late 1970's. The older grey flake graphite iron pipe is now reaching the end of its service life. For utility providers, to manage these assets effectively and keep them in service, it is important to quantitatively understand their condition.

### Corrosion of CICL Pipes

Grey flake graphite CICL loses wall strength by a corrosion process called "graphitisation". In this process the iron corrodes to form hydrated iron oxides (rust) that replace the iron, within the stable graphite matrix of the cast iron. The cast iron maintains its shape but its strength is compromised.



Figure 1 – Pipe samples analysed

### Traditional Assessment

The existing methodology, to measure the depth of graphitisation and thus remaining thickness of pipe, is to physically examine a cross-section microscopically, or by removing the graphitisation by mechanical means and then measuring the remaining wall thickness.

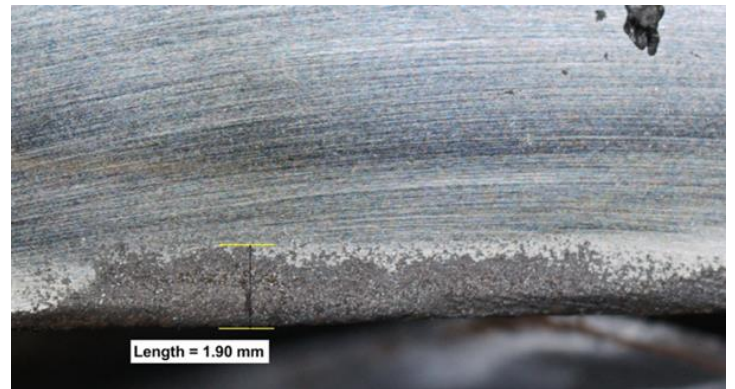


Figure 2 – Micrograph showing depth of graphitisation

Ultrasonic thickness (UT) measurement of the remaining intact iron is not suitable as the graphitisation absorbs / scatters the signal. The speed of sound is slower in the graphitised media which results in inflated wall thickness measurements.

Eddy current is also unsuitable as the error margin increases with the depth of graphitisation.

## A Better Way – Magnetic Induction

ALS has developed a graphitisation thickness measurement technique using magnetic induction that is able to measure the depth of graphitisation. As there is often variability in the degree of graphitisation, partial degradation is determined by correcting against a calibration cross-section.

ALS was able to assist our client via undertaking a conditional assessment on a buried CICL pipe laid in the early 1950's. Cement lining thickness, remaining protective alkalinity of the lining and the nominal thickness of the cast iron (and loss of thickness from graphitisation) was determined on two supplied samples.



Figure 3 – Measurement of the concrete lining showing loss of alkalinity

This innovative conditional assessment was able to show the state of this timeworn pipe, particularly the extent of graphitisation on the external surfaces of the pipe. The results enabled the client to gain an appreciation of the remaining service life of their asset and make appropriate plans for its upkeep and maintenance.

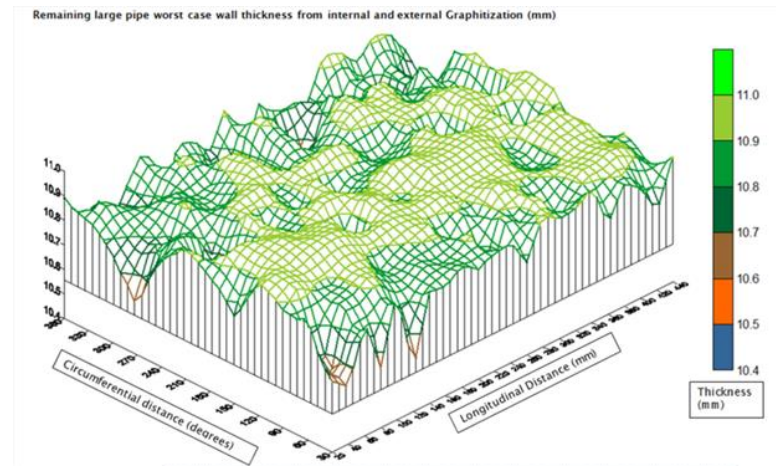


Figure 4 – Isometric plot of the remaining wall thickness

## Our Concrete Diagnostics Team

ALS have a specialised concrete diagnostics team who take a holistic **Engineering Led Approach** to concrete.

This team is part of ALS Industrial's larger integrity group – offering a range of expertise in structures and materials.

For further information or to enquire about concrete diagnostics please contact:

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