

Non-Intrusive Pipeline Condition Assessment



Advanced Engineering Solutions Limited are pipeline engineers providing services in a wide range of technologies for the water, gas and oil industries. A particular specialisation is in pipeline management, including the provision of inspection, condition assessment, likelihood of failure prediction and optimised maintenance strategies. The major customer base for AESL are operators of 'low pressure' pipelines, that is pipelines where external or internal loading or a combination of these can be sufficient to cause failure.

Major issues with large diameter 'low pressure' pipelines are related to their age, variability in design, construction, materials standards, maintenance history, and often their remote geographical location. They are of high value and the engineering requirement is to ensure operation without supply disruption with minimum investment. AESL have developed and patented pipeline inspection equipment and processes, and statistical and structural modelling techniques to allow pipeline performance to be predicted.



INSPECTION TOOL AND PDA OUTPUTS



LARGE DIAMETER PIPELINE INSPECTION

Pipeline Condition Assessment – Ferrous Pipelines

AESL do not require internal access to these pipelines but inspect externally using a range of both commercially available ultrasonic and purpose designed magnetic inspection tools. The inspection process provides sizing and imaging of pipe wall deterioration including all significant individual internal and external defects. For non-metallic pipe systems, for which standard NDT techniques are not available, then pipe wall samples are required.

Full pipe wall inspection on these pipelines using pig mounted systems is generally not possible. Thus local inspection is used and AESL has developed statistical models to predict the condition of long lengths of pipeline, based on selective external local inspection.

Condition assessment involves developing an understanding of the current pipeline performance capability under the applied loads. The process provides prediction of remaining life based on leakage and structural failure criteria, and thus helps to define immediate and long-term maintenance requirements and prediction of future investment requirements.

The deterioration of a pipeline is governed by the quality and condition of any protective coating (the corrosion protection) and its working environment (the corrosion drivers). The AESL inspection process includes a detailed assessment of pipe coating, the condition and the surrounding ground where pipes are buried. The pipe wall inspection results provide appropriate input to the statistical modelling techniques.

Pipeline Inspection

The first requirement of the AESL methodologies is to determine where best to selectively inspect the pipeline. The customer may select critical sections of pipeline where the potential consequence of failure are very significant, in terms of supply loss, accessibility for repair, etc.

The AESL patented magnetic inspection tools are purpose designed to allow easy, rapid and safe use on the range of ferrous pipeline diameters from 3" upwards. The output from the tools is processed to provide an image of internal and external corrosion and defect dimensions and locations. The inspection tools are equipped with GPS location systems and 'Blue Tooth' communications technology to allow immediate transfer of site location and inspection data to the AESL offices. The use of a GPS location system allows the outputs from each inspection to be directly 'mapped', allowing comparison of the performance of nearby pipelines as an input to risk assessments.

The statistical models developed for the pipeline assessment process allow predictions of the current pattern, scale and numbers of individual external and internal pitting defects. The corrosion patterns and severity are also used in structural modelling techniques which consider the potential for brittle fracture, crushing, and bending failure due to the applied combination of internal and external loading. Structural modelling is used, based on the original pipeline design standards and current deterioration levels to determine stress regimes.

Condition Assessment Outputs

The condition assessment outputs provided to the customer can include:

- Assessment of coating quality.
- Assessment of local soil corrosivity.
- Trench side identification of significant pipe wall defects, allowing immediate repairs where necessary.
- Numeric and visual representation of pipe wall deterioration.
- Definition of operating factor of safety.
- Predictions of the current and future potential for leakage (from individual defects).
- Prediction of current and future potential for structural failure.
- Definition of appropriate remedial measures and time criticality.

Since inspection requirements are limited, this approach to condition assessment is economically viable for a wide range of pipelines.

Please Contact Malcolm Wayman at: Advanced Engineering Solutions Limited
South Nelson Road
South Nelson Industrial Estate
Cramlington, Northumberland
NE23 1WF
United Kingdom
Tel: +44(0) 1670 739999 Fax: +44(0) 1670 717999
Email: m.wayman@aesengs.co.uk