

## Business Case – Capital Expenditure less than \$500,000

### Crack Detection

#### Business Case Number 276

## 1 Project Approvals

TABLE 1: BUSINESS CASE – PROJECT APPROVALS

<b>Prepared By</b>	Nigel Lindeman, Senior Mechanical Engineer, APA Group
<b>Reviewed By</b>	Anthony Jones, Pipeline and Asset Management Engineer, APA Group
<b>Approved By</b>	Craig Bonar, Manager East Coast Grid Engineering, APA Group

## 2 Background

The APA Morwell to Dandenong Pipeline (MDP) is one of Victoria's oldest pipelines built in 1955. This pipeline was originally used for the transportation of manufactured gas from Morwell to Melbourne and then recommissioned to transport natural gas in 1970. The 450mm diameter pipeline is 127km long with a varying pipe wall thickness of 7.95mm and 9.94mm. The pipeline is manufactured out of SAA A33 grade D steel and operates at an MAOP of 2760kPa.

During the recent pipe recoating and slabbing project at Narre-Warren Cranbourne Rd a number of small fatigue cracks were detected along the weld seam at top of the pipeline.

The test results revealed a cluster of cracks in the longitudinal weld directly below the wheel path of the vehicle traffic. All but one anomaly found were removed with a linisher with the larger anomaly determined to be a crack located in the transvers direction (running circumferentially across the longitudinal weld). It appears that the main cause of the crack formation was due to cyclic bending stress due to traffic loads where the pipeline has shallow cover.



Further investigation was carried out with ultrasonic non-destructive testing to determine the extent of the crack. Results confirmed the crack was 4.5mm deep and approximately 12mm long across the longitudinal seam weld.



Engineering assessment recommended installing a Type B fully welded split sleeve to encase the crack for pressure retainment. This repair sleeve provides strength to fully support the pipeline and reinforce the longitudinal stresses in the axial direction along the pipeline required for a crack found in the circumferential direction.

There is the potential of additional fatigue cracks existing on the MDP at all road crossings where cover is shallow. A list has been established of additional crossings to be excavated and inspected.

It is recommended to inspect the low cover road crossings on the pipeline. The survey found three crossing to be 1m and below (Hutchinson Drive, Lynbrook (0.8m), Gardner and Hulman Road, Drouin (1m) and Weebar Rd, Drouin (1m). All other crossings were found to have pipeline cover of 1.1m and above.

Another method of crack initiation is Stress Corrosion Cracking (SCC). There is a risk based model to determine SCC susceptibility and APA has a policy on how to mitigate SCC. There is a gap in the technology for certain pipe

## CRACK DETECTION

sizes. The Brooklyn – Ballan pipeline was inline inspected in 2016 without a crack detection tool. The result of this is the need for Direct Assessment of selected five locations in high consequence areas.

To ensure the security of supply of the MDP a recommendation is to carry out no-destructive inspections on the low cover crossings to determine if the Narre-Warren Cranbourne Rd is an isolated case or if there is a systemic fatigue cracking issue with this pipeline.

- Where a pipeline has developed fatigue cracking there is the possibility that the cracks could propagate the depth of the pipe wall and develop a gas leak in the pipeline which has the potential of gas fire or gas explosion.
- Non-destructive inspection is used to determine if fatigue cracking is evident by means of Magnetic particle and Ultrasonics inspections. The proposed three low cover locations are recommended as a starting point for inspection to determine if there are further fatigue crack issue or if the Narre-Warren Cranbourne Rd cracks were an isolated case.
- If no cracks are found on the proposed three low cover crossing then there is a high degree of confidence that the Narre-Warren Cranbourne Rd was an isolated case due to the heavy traffic and very low cover.
- If further fatigue cracks are found in any of the proposed three low cover crossings the next step would be to assess and repair the cracks in question and then re-assess the quantity of further inspection to be carried out on the pipeline.
- Timing of the issue:
  - It is assumed the fatigue cracking on the Narre-Warren Cranbourne Rd has developed over many years of increased traffic over a low cover roadway.
  - The crack found at Narre-Warren Cranbourne Rd was determined to a depth of 4.5mm deep and 12mm long. As the crack depth is over half the pipe wall thickness there is the risk that a gas leak could occur. It is less likely to be an issue at the proposed three low cover location due to the roads carrying less traffic with pipeline covers greater than the Narre-Warren Cranbourne Rd crossing,
  - It is recommended that the proposed additional inspections be carried out within the 2016-2017 financial year period.
  - The inspections will be completed in the 2016-2017 period unless further cracks are found and additional repairs and inspection are required. If pipeline repairs or further inspections are required, this will be in addition to this business case.
- General
  - In the current period all road crossings pipeline depths have been measured along the entire pipeline length and a short list of 3 crossings having low cover depth of 1.2m and below have been selected to be excavated and inspected.

## 3 Risk Assessment

TABLE 2: RISK RATING

Risk Area	Risk Level
Health and Safety	Moderate
Environment	Negligible
Operational	Low
Customers	Negligible
Reputation	Low
Compliance	Low
Financial	Negligible
<b>Final Untreated Risk Rating</b>	<b>Moderate</b>

## 4 Options

### 4.1 Option 1 – Do Nothing

- There is a risk that fatigue cracking may be an issue on this pipeline and to do nothing may jeopardise the public safety and security of supply of the pipeline.
- Depending on the amount of fatigue cracking found the cost involved with a gas leak would incorporate the reduction of pressure in the system a dig up and installing a temporary repair sleeve and then the installation of a Type B fully welded sleeve. The estimated cost would be in the order of \$100K per repair, or if a fire or an explosion there is the potential of the public injury and the cost of reputation to APA.

### 4.2 Proposed Solution – Inspect for cracking

#### 4.2.1 What is the Proposed Solution?

The proposed solution would be to establish if fatigue cracking is a systemic problem on the pipeline by inspection of the low cover crossings to establish if fatigue crack issues extend beyond the cracks found at Narre Warren Cranbourne Rd. The pipeline inspections will provide APA with a high degree of reliability that the pipeline is safe to continue operating and that the fatigue cracks found at Narre-Warren Cranbourne Rd was an isolated case due to very low cover and increased traffic.

The Direct Assessment of five locations on the Brooklyn – Ballan pipeline (BBP) for SCC evaluation.

#### 4.2.2 Why are we proposing this solution?

- The proposed solution would be to establish if fatigue cracking extend three other low cover crossings or if the fatigue crack issue found at Narre-Warren Cranbourne Rd was an isolated case. The pipeline inspections will provide APA with a high degree of reliability that the pipeline is safe to continue operating and that the fatigue cracks found at Narre-Warren Cranbourne Rd was due to very low cover and increased traffic.
- The inspections proposed will ensure the pipeline can continue to operate safely and maintain the integrity of the service to the customers. The inspections also reduce the associated risks to the security of the pipeline and safety to the public and customers that would otherwise be present if fatigue cracking extended to other crossing along the pipeline.

## CRACK DETECTION

- The BBP is capable of incurring SCC and thus direct assessment of five locations is to be conducted in high consequence areas.

### 4.2.3 Consistency with the National Gas Rules

Consistent with the requirements of Rule 79 of the National Gas Rules, APA considers that the capital expenditure is:

- Prudent – The expenditure is necessary in order to maintain and improve the safety of services and maintain the integrity of services to customers and personnel and is of a nature that a prudent service provider would incur.
- Efficient – The field work will be carried out by the external non-destructive testing contractor that has been used to date, who has demonstrated specific expertise in assessing pipelines in a safe and cost effective manner. The expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur
- Consistent with accepted and good industry practice – Addressing the risks associated with pipe wall cracking of below ground transmission pipelines is accepted as good industry practice. In addition, the reduction of risk to as low as reasonably practicable in a manner that balances cost and risk is consistent with Australian Standard AS2885.
- To achieve the lowest sustainable cost of delivering pipeline services – The sustainable delivery of services includes reducing risks to as low as reasonably practicable and maintaining reliability of supply.

### 4.2.4 Forecast Cost Breakdown

The unit rate for underground inspections of this nature is \$32k each.

TABLE 3: PROJECT COST ESTIMATE,

	Total
Quantity	8
Unit Cost	\$32,604
<b>Total</b>	<b>\$260,832</b>