Richmond Line Alliance (N849) Project Alert: N849 - 183



| Project: | Richmond Line Duplication Project – Stage 1 | Project No: | N849 | | |
|------------------|---|-------------|------|--|--|
| Date: | 30 October 2009 | Time: | n/a | | |
| Location: | Quakers Hill to Schofields | | | | |
| INCIDENT DETAILS | | | | | |

Incident Title: High Pressure Water Impact on Underground Cables

Description of
Incident:On 22 September 2009 RLA Site team conducted a water pressure test on eight sample cables provided
by RailCorp using the three different water lance tips currently accessible to RLA potholing teams:

- 1. Jet tip (Number 4 type)
- 2. Fan tip
- 3. Rotary tip (Turbo type)

The sample cables provided included 10 pair & 100 pair communication cables, 6 core & 25 core signalling cables, a fibre optic cable, a 1 pair solid core signalling power cable and other signalling cables. The results of the trial found that water pressure from the jet and fan tip that exceeded 2400psi penetrated the sheathing around all the cables supplied for the test.

Trials undertaken using the rotary type lance tips did not cause damage to the sheathing of the various cables supplied for the trial tests using 2400psi.

On 14 October 2009 further tests were undertaken on four types of single mode optic fibre (SMOF) cables using the rotary tips at increased pressures between 2400psi and 3000psi. These tests identified damage to a SMOF cable at 2850psi.

See attached pictures and reports.

Immediate actions taken:

 RLA General Superintendent instructed site Potholing teams to discontinue the use of Jet and Fan tips during non destructive excavation (NDE) operations using high pressure water and to only use the Turbo or Rotary type nozzles at a maximum pressure of 2400psi during these operations

| Incident Classification: | Safety and Health: Class 1 Class 2 Potential Class 1 / 2 Damage (Near Miss) Environmental: Class 1 Class 2 Class 3 Property Damage: Quality / Workmanship: Community: | | |
|-----------------------------|--|--|--|
| Contributing Factors: | • Primary – Jet and Fan type tips used in non-destructive excavation operations can cause damage to the outer sheathing of multiple types of cables if the pressure is greater than 2400psi | | |
| Key Lessons: | 1. RLA potholing teams are not to use jet or fan type tips while undertaking non destructive excavation operations and are only to deploy the use of Turbo or rotary type tips for future potholing operations on the Richmond Line Duplication Project. | | |
| | 2. RLA potholing teams are to use a maximum pressure of 2400psi to avoid the potential for damage to cable services on the project. | | |
| | As outlined in the conclusion of attached report - Do not pothole with a jet (#4) or a fan tip nozzle. Only use a turbo tip on the RLA site. In addition 'Do not exceed 2400psi operating pressure'. | | |
| Circulation: | N849-AMT; N849-WPT, K2RQ, LCPL Branch, TIDC, RailCorp | | |

BRIEFING RECORD

For sharing the lessons learnt

Date:

Time:

Supervisor:

| No. | Name | Company | Signature |
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Test of different Nozzle types used in Non Destructive Excavation on various Cable types

23 September 2009

Objective: The experiment was to test the impact of Non-destructive Excavation (NDE) using high pressure water nozzle tips on direct buried cables.

The following nozzle tips were used in the experiment.

1. Jet Tip (Number 4)



2. Fan Tip



3. Turbo (Rotary) Tip



The following Cable types were used in the experiment

- Cable 1 Red and Black Signaling Cable
- Cable 2 100 pair 0.09M Jelly filled Communications
- Cable 3 25 Core Signaling
- Cable 4 6 Core Signalling
- Cable 5 Optus Fibre Optic Cable (636)
- Cable 6 10 Pair Jelly filled communications
- Cable 7 1 Pair track Signals + Signaling solid core power (7.70LV)
- Cable 8 Signaling solid core power (7085 LV)

The water pressure used in the experiment was 2500 psi



<u>Results</u>

Results for No.4 Tip at a distance of 25mm from cables

| 4mm Cutting Tip at 25mm Distance | | |
|----------------------------------|-------------|--|
| Cable No. | | |
| 1 | Penetration | |
| 2 | Penetration | |
| 3 | Penetration | |
| 4 | Penetration | |
| 5 | Penetration | |
| 6 | Penetration | |
| 7 | Penetration | |
| 8 | Penetration | |

Results for Fan Tip at a distance of 25mm from cables

| Washing (Fan) Tip at 25mm | | | |
|---------------------------|-------------|--|--|
| Distance | | | |
| Cable No. | | | |
| 1 | Penetration | | |
| 2 | Penetration | | |
| 3 | Penetration | | |
| 4 | Penetration | | |
| 5 | Penetration | | |
| 6 | Penetration | | |
| 7 | Penetration | | |
| 8 | Penetration | | |

Results for Turbo Tip at a distance 25mm from cables

| Rotor (Turbo) Tip at 25mm Distance | | |
|---------------------------------------|-----------|--|
| Cable No. | | |
| 1 | No Effect | |
| 2 | No Effect | |
| 3 | No Effect | |
| 4 | No Effect | |
| 5 | No Effect | |
| 6 | No Effect | |
| 7 | No Effect | |
| 8 | No Effect | |



Photos from experiment on cable 1, 5 and 7



Cable 1 – Fan Tip



Cable 1 – Jet Tip



Cable 1 – Turbo Tip



FOC – Fan Tip



FOC – Jet Tip



FOC – Turbo Tip



Cable 7 – Fan Tip



Cable 7 – Jet Tip



Cable 7 – Turbo Tip

Conclusion:

RLA will not undertake non – destructive potholing with a jet (No.4) or a fan tip nozzle and will only use a turbo (rotary) tip or similar on the RLA project with maximum water pressure of 2400psi.



Second Test conducted by RLA using a Turbo (Rotary) Nozzle with higher pressures

14 October 2009

Objective: To determine the pressure required to damage varying types of fibre optic cable (FOC) with a turbo (rotary) tip using higher pressure from the non-destructive excavation (NDE) unit.

Method:

Four types of single mode optical fibre (SMOF) cable were used in the test (detailed below).

Each cable was sprayed from a distance of 5mm (direct), 25mm and 100mm. At each distance the pressure of the NDE unit was increased between 2400 PSI and 3000 PSI

The pressure was recorded if any penetration or damage was recorded

Results:

| <u>Turbo Nozzle</u> | | | | | |
|---------------------|--------------------------|----------------|-----------|-----------|-----------|
| Fibre Optic Cables | | | Results | | |
| Cable | | Cable Diameter | | | |
| No. | Description | (mm) | 5mm | 25mm | 100mm |
| 1 | 48 smof Rodent Resistant | 18 | No Effect | No Effect | No Effect |
| 2 | 72 smof Rodent Resistant | 20 | No Effect | No Effect | No Effect |
| 3 | 24 smof | 15 | No Effect | Damaged | No Effect |
| 4 | 12 smof | 11 | No Effect | No Effect | No Effect |

Cables 1, 2 and 4 did not experience any visible damage between the pressure ranges 2400 – 3000psi

Cable 3 experienced visible surface damage at a distance of 25mm at a pressure of 2850psi. The water penetrated the outer layer of the FOC but no further damage was noted.

Due to the method of securing the cables, accurate results could not be obtained for cable 4. It was noted that the cable vibrated excessively when the pressurised hose was focused on the cable at a pressure of 2600 PSI. While no visible damage was recorded, internal damage may have occurred.



Photos from experiment on SMOF cables



Cable 1 – 48 SMOF rodent resistant



Cable 3 - 24 SMOF



Cable 2 – 72 SMOF rodent resistant



Cable 4 – 12 SMOF

Conclusion:

For all future non-destructive excavation activities RLA potholing teams will only use a rotary nozzle (or similar) at a maximum pressure of 2400psi.