Transport for London
London Overground

Inspection for Assessment Report

East London Line

Bartlett tunnel

Examination Date: **19 August 2009**

Report Ref: **ELM-TEC-206-04-09-0315** Issue **01**

Revision	Description	Examiner	Checked	Approved	Date
01	First issue	[redacted]			2009

Mott MacDonald

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1 Synopsis

1.1 Inspection

A reconnaissance survey was carried out on 26 March 2009 and a full survey was carried out by Mott MacDonald on 19 August 2009. There were no observed defects considered to have any immediate safety implications.

1.2 Structure information

The tunnel consists of a vertical, hexagonal shaft, approximately 7.5m in diameter and 11m deep and a 130m long cast iron lined tunnel approximately 4m in diameter. The shaft was constructed using slurry trench walls, the thickness of which is not known. The tunnel has no invert slab.

1.3 Conclusions

The tunnel and shaft are in reasonable condition, though the supporting framework to the shaft capping slab shows signs of deterioration.

2 Structure information

Asset Information

Asset Label	TT418
Asset Name	Bartlett (Experimental) Tunnel
Asset Type	Tube tunnel
Asset Group	Tunnel
NR Structure Category	E
Asset Owner	London Overground
Maintenance Authority	London Overground
Sensitive Structure	No

Location Information

Route	East London Line
Line	Northbound and Southbound
ELR Ref	ELL
ELL LCS Code	M166
LCS Descriptor	Surrey Quays to New Cross
Project Start Chainage	N/A
Project Finish Chainage	N/A
Metreage within LCS Code	N/A
OS Reference (start)	TQ 354 794
OS Reference (finish)	TQ 354 794
Local Authority	LB Lewisham

Technical Information

Asset description:	Cast Iron lined tunnel 12'7" (3.8m) diameter, approximately 130m long. Tunnel invert is approximately 12m below ground level at start
Items crossed:	N/A
Items carried:	Passes under East London Line at far end of tunnel
Shaft construction	6 No slurry trench walls forming a hexagon. It is not known what the thickness of the concrete walls is

Examination Information

Examination Date(s)		19 / 08 / 09
Examiner(s)		B Stewart
Company		Mott MacDonald Ltd
Date of previous Examinations *(where known)*	Detailed Exam	No record
	Visual Exam	20/11/01
	Addit'nl Exam	n/a
Current Examination Interval *(where known)*	Detailed Exam	1
	Visual Exam	Not known
	Addit'nl Exam	n/a

Assessment Information

Date of assessment	Not known
Assessment Standard	Not known
Result	Not known
Notes and extent of any failure	Not known

Access and H&S Issues / Requirements

Type of access provided for examination	Entry to overall site compound. Entry to fenced-off top of shaft. Unlocking padlocked cover to shaft Existing staircase down shaft Water in tunnel pumped out Confined space equipment
Access provider	BBCJV
Restricted access (e.g. obstructions)? *(if so, provide details)*	Base of shaft not cleaned out, still some debris preventing inspection of base slab. Some water/silt remaining in tunnel invert
Any change in obstructions from previous examination? *(if so, provide details)*	Tunnel now pumped out, providing access along tunnel

Specialist PPE or other equipment required? *(if so, provide details)*	Confined space equipment necessary. Lighting
Details of notable site specific risks	Confined space. Water in tunnel invert requires pumping out prior to inspection of tunnel
Other relevant access / H&S issues	None

3 Inspection details

An inspection of the internal faces of the tunnel and shaft was undertaken by Mott MacDonald on 19 August 2009.

The inspection of all visible components was carried out from the tunnel invert, the shaft invert and from the access ladder in the shaft. The inspection was to determine the condition of the components and a photographic record was produced for the inspection records.

A survey to establish the tunnel's alignment was due to be carried out shortly after the inspection.

3.1 Details of inspection

The tunnel and shaft are in reasonable condition, though the supporting framework to the shaft capping slab shows signs of deterioration.

Defects and observations are recorded in the table below and photographically in Appendix B.

Bartlett Experimental Tunnel TT418	
Element	**Description of Defects**
Capping slab to shaft	The concrete capping slab is in a good condition. The upper surface is covered in a thin layer of soil with some vegetation. There is some cracking that has allowed root penetration through the slab. (See Figure 1 and Figure 2) Over approximately ¾ of the area of the slab it is supported on a timber deck supported by a steel grillage. The timbers are approximately 300mm thick, but they show extensive signs of rotting, especially at the exposed ends next to the access stairs. (See Figure 3 and Figure 4) The steel grillage members have extensive surface corrosion but there appears to be little section loss.
Walls to shaft	The walls were cast in slurry trenches, leaving the rough faces that are visible in the shaft. Some of the joints between the walls were not fully concreted, leaving partial gaps for some of the thickness. There are some signs of water leakage through these joints. (See Figure 5 to Figure 7)
Base slab to shaft	The concrete base slab was covered with a layer of mud and debris restricting inspection. (See Figure 8)
Access stairs in shaft	The access stairs consist of three flights and two landings of open galvanised steelwork. The steelwork is in good condition, though the fastening bolts into the concrete walls are showing some signs of corrosion. (See Figure 9)
Cast iron lining segments	The dimensions of the segments were confirmed as those shown on Drawing 448/3 (in Appendix C). The segment width was 20” (508mm), the radial and circumferential flanges were 1” (25mm) thick and 3” (76mm) deep. (See Figure 10 to Figure 15) There was no invert slab in the tunnel. Before pumping out, the tunnel contained water to a depth of approximately 0.75m at the shaft, increasing to a depth of 1.5m at the far end. The areas under water had an accumulation of silt on them but less corrosion than those areas just above the water line. (See Figure 16 and Figure 17) Much of the protective coating on the segments had failed, leading to widespread surface corrosion, though no significant loss of section was observed.

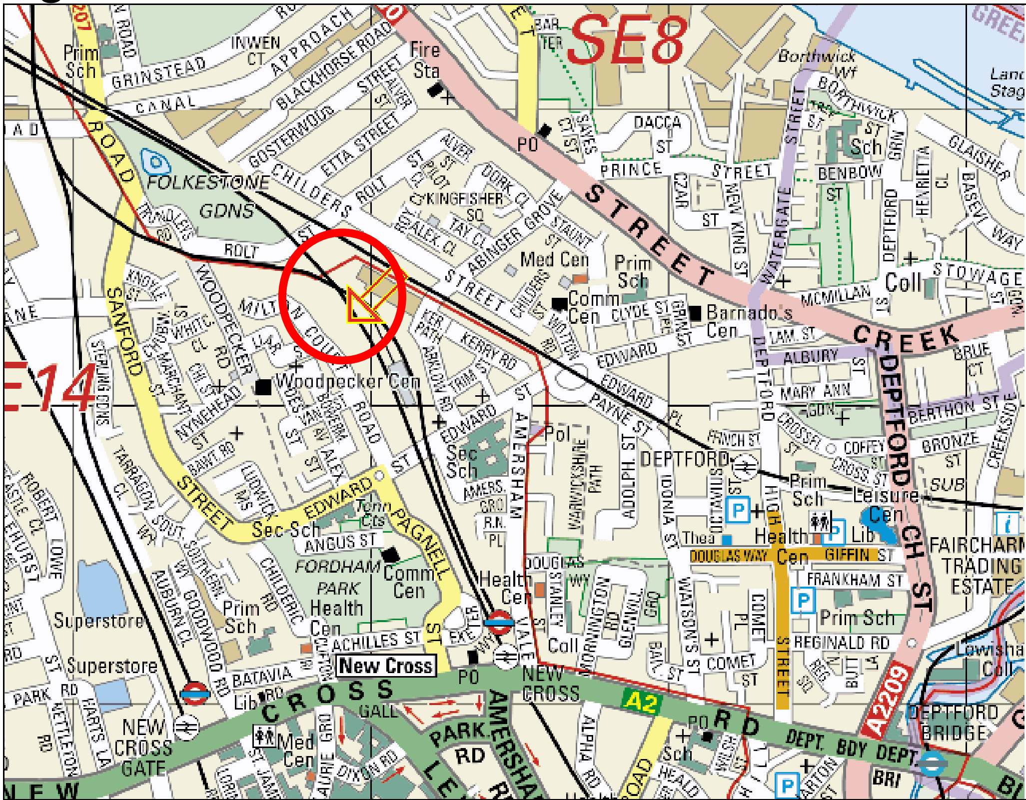
Bartlett Experimental Tunnel TT418	
	The exposed surfaces of the lining bolts were corroded. There was no evidence of any loss of section in the bolt shanks. Some bolts in the circumferential joints were missing or mis-aligned and not tightened (see Figure 18). The end face of the tunnel consists of the cutter head of the tunnelling machine. As the machine was abandoned at the end of the drive, the face is fully retained behind the pressure bulkhead (see Figure 19).

4 Recommendations

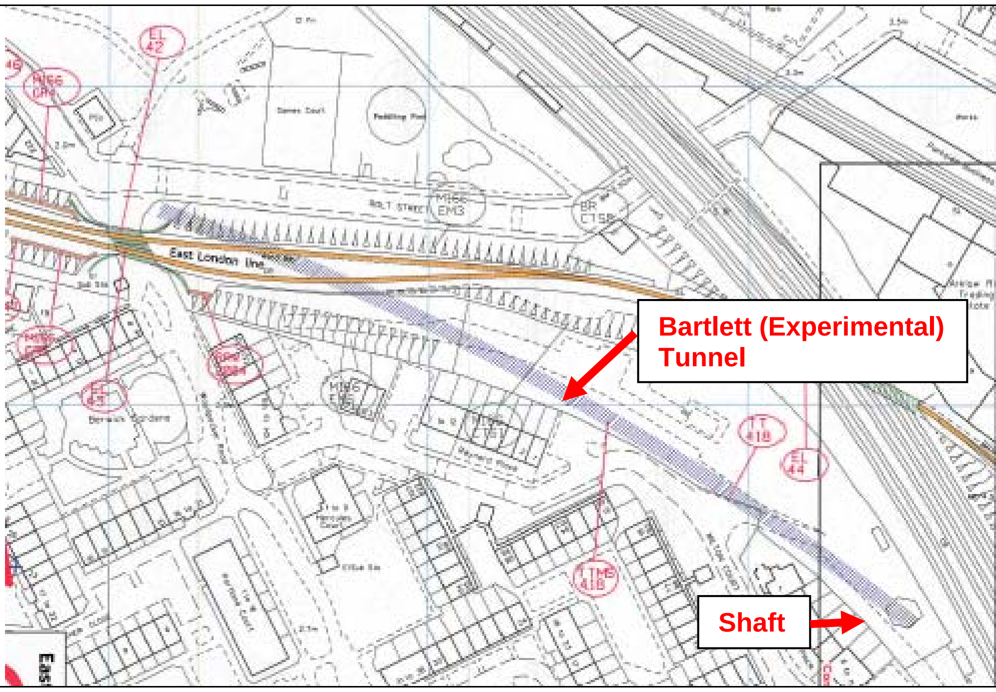
The tunnel and shaft should either be maintained in a condition safe enough to permit further inspections; made safe and abandoned; or an alternative use found for it. For the first two options the following actions are proposed:

1. The supporting steelwork and timber to the shaft capping slab need attention. The reinforcement details of the concrete capping slab are not known, so the allowable level of deterioration of the supporting structure cannot be quantified. Therefore, it is recommended that the timber elements of the capping slab supports are replaced with a more durable material, to allow for the permanently moist shaft environment. It may be possible to locally remove the timber; provide permanent, discrete supports between the steel beams and the concrete slab and then remove the remainder of the timber. The steel beams would then be repainted.
2. The tunnel and shaft will remain as deteriorating assets of little value. Some consideration should therefore be given to the option of filling them. This would remove the need for regular inspection and maintenance to preserve the support the tunnel provides to the overlying ground and any adjacent structures.

Appendix A Location Plans & General Arrangement



Location Plan, showing tunnel access shaft



Asset Location Plan, showing tunnel and access shaft

View of end of tunnel from shaft before pumping out

View of end of tunnel from shaft after pumping out

Appendix B Inspection Photographs

Figure 1 Soil and vegetation on top of shaft capping slab

Figure 2 Underside of capping slab, showing some root penetration through crack

Figure 3 View of underside of slab, showing steel grillage and timber decking

Figure 4 View of timbers and steel grillage supporting concrete slab

Figure 5 Rough surface finish on shaft walls

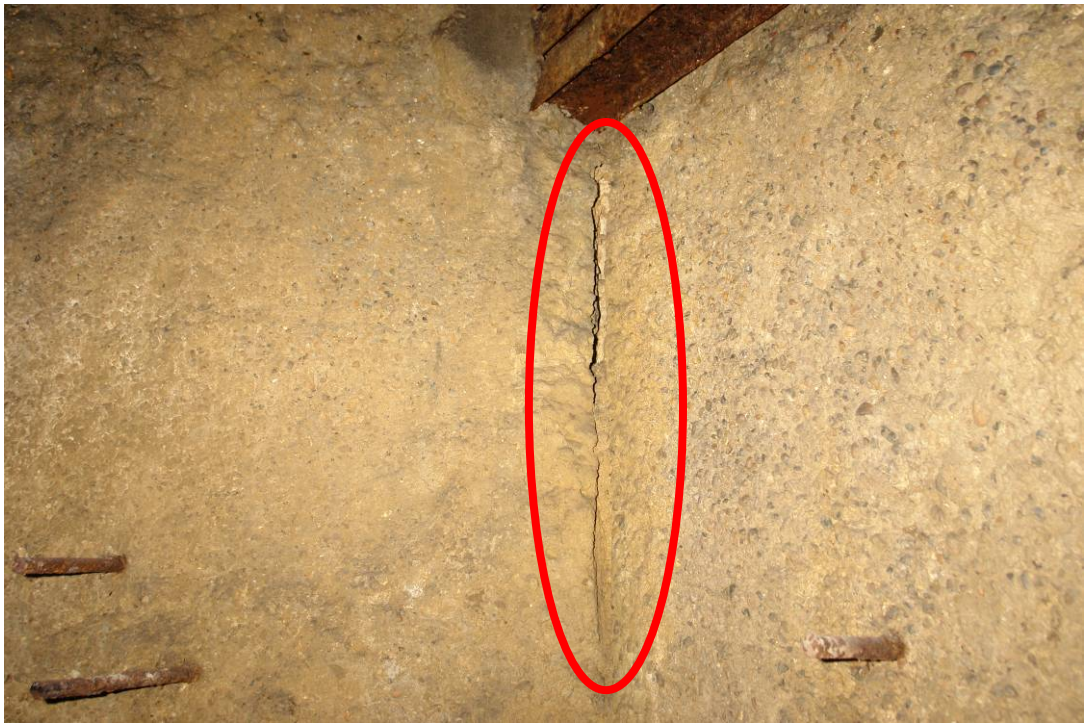


Figure 6 Gap in joint between wall panels

Figure 7 Signs of leakage through joints between walls

Figure 8 Base slab of shaft covered in mud and debris

Figure 9 Access stairs and landings in shaft

Figure 10 View of tunnel at shaft portal

Figure 11 View of segments at shaft portal

Figure 12 Packing between segments on circumferential joint

Figure 13 Typical segment identification marks; note segment numbering scheme, counting from portal

Figure 14 Timber packers for circumferential joints

Figure 15 View of tunnel at far end (segment No 250) including part of tunnelling machine

Figure 16 Higher levels of silting towards further end of tunnel (segment No 180)

Figure 17 Rear of abandoned tunnelling machine (segment No 230); note water level at approximately 1.5m depth

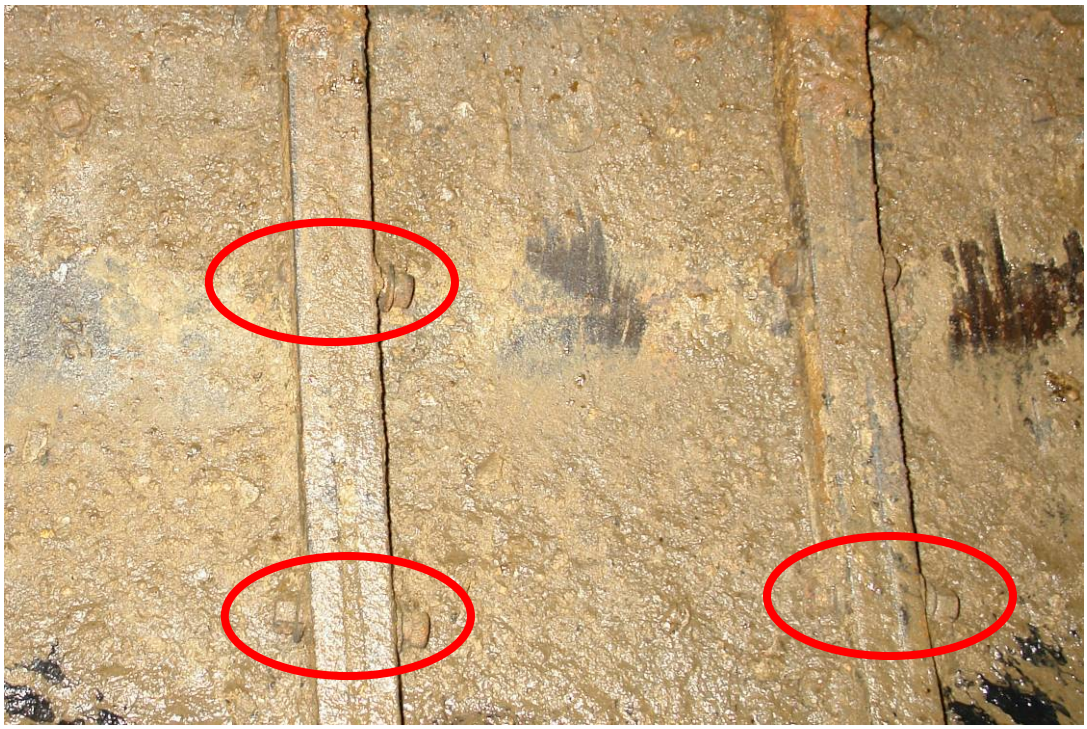


Figure 18 Mis-aligned bolts on circumferential joints

Figure 19 Pressure bulkhead of tunnelling machine retaining end face of tunnel

Appendix C Drawing of Tunnel Lining