

Tunnel Principal Inspection Report

Islington Tunnel

Regents Canal

RE-007-005

Inspection Date: 01/12/2020
Assessor: Jonathan Muir
Position: Senior Surveyor (Tunnels & Confined Spaces)
Signature: *J. Muir*

Checked by: Peter Simpson
Position: Principal Engineer (Tunnels, Culverts & Locks)
Signature: *Peter Simpson*

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Executive Summary

Islington Tunnel is a medium sized, one-way working tunnel without towpaths. The tunnel is constructed in brickwork and is a grade II listed structure. There are no open air shafts. The length of the tunnel is 875m with 5.4m minimum headroom and 5.18m minimum width. The tunnel is in poor condition with significant areas of spalled and deteriorating brickwork lining above water level within the tunnel, a length of deep missing brickwork below water level near the east end and old movement in the portals with a temporary repair at the east end. The tunnel was subject to lining repairs in the year 2000 and further repairs are now recommended as part of a High-Risk Asset project.

Assessment

Name:	Islington Tunnel
Inventory number:	RE-00629
Functional Location:	RE-007-005
National Grid Reference:	531265 183370 – Centre of Tunnel
	531697 183289 – East Portal
	530836 183449 – West Portal
Location:	Islington, London
Date of Construction:	Between 1814 and 1818
Construction Engineer:	James Morgan
Heritage status:	Grade II Listed
Length:	875m
Min. width:	5.18m
Min. headroom:	5.4m
Depth of cover:	2 – 15m
Towpaths:	S0 – one-way working, no towpaths
Air Shafts:	0
Construction shafts:	6
Construction material:	Brick
Condition Grade:	D
Consequence of Failure:	5
Serviceability Grade:	1
P.I. date:	01/12/2020
Inspector(s):	Jonathan Muir (Senior Surveyor) Peter Simpson (Principal Engineer)
Next P.I. due:	5 years (2025/26) under AIP 2019

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Introduction

This Principal Inspection was undertaken from a workboat with scaffold platform and was a tactile inspection. A view over the surface was also undertaken.

The weather on the day of inspection was dry and cool.

The assessment/inspection history is listed below:

Date of original assessment (above WL):	05/11/1984 – 13/11/1984
Date of original assessment (below WL):	09/12/1986 – 10/12/1986
Principal Inspection dates: (above water level inspections with the tunnel in water unless otherwise stated)	24/01/1989
	19/02/1991 – below water level
	12/11/1991
	09/02/1994
	07/12/2005
	14/12/2010
	01/12/2015
	01/12/2020

General Description

Comment:	Date:
Original construction	Between 1814 and 1818
Old brick patch and gunite repairs	Unknown
Infill brick repairs to West Portal	1981
Temporary repair to circumferential crack at ch.1m consisting of four bolted stainless steels plates	1999
Patch and sprayed concrete repairs due to spalled brickwork (repairs improved the condition grade to C)	Feb/Mar 2000

Islington Tunnel is a medium size, one-way operating tunnel without towpaths. The tunnel is predominantly lined in brickwork with lengths of masonry lining in the lower sidewalls (at water level). There are no open air shafts within the tunnel but six possible or probable construction shafts have been identified.

The tunnel is a grade II listed structure.

Work on Islington Tunnel was commenced in 1814 but was suspended due to lack of funds when the tunnel was two-thirds complete. Construction recommenced in August 1817 and most of the tunnel was finished in 1818. The navigation was fully opened on 1st August 1820.

The tunnel is 875m in length and 5.18m wide at normal water level. There is approximately 2.0 - 2.3m water depth below normal water level and approximately 5.4 - 5.6m of headroom above normal water level. The normal water level is at 20.93m A.O.D and the depth of cover over the tunnel ranges from 2m to 15m.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

The tunnel is located in an urban area with many road crossings including the A1 (Islington High Street) and the B515. A London Underground Victoria Line tunnel and a major Thames Water water main pass beneath the canal tunnel.

The canal tunnel is orientated in a general east to west direction with the grab chain and fender on the north side.

Ground investigation around both tunnel portals was carried out in January 1983.

Ground Penetrating Radar and probe hole drilling investigations were carried out in 1996 to investigate for possible shaft locations, lining thickness and overbreak consistency.

BW Technical Services carried out a tunnel investigation in 1999 and the geotechnical report forms part of a comprehensive tunnel report.

The history of some of the initial construction issues and the detail of the specific defects are discussed below.

In clay soils such as the London Clay found at Islington Tunnel it was frequently reported that exposure of the clay during initial construction, even for a short time, resulted in swelling and heaving of the clay. On occasions the clay could force the recently constructed brickwork down before the lime mortar had had time to set, forcing the mortar out of the joints and causing the bricks to grind together along their edges. This would result in spalling brickwork where the brickwork faces are sheared off due to the compressive forces on the bricks.

A report by John Morgan (Construction Engineer) in March 1816 refers to the use of larger timbers and 'polings' above the arch used to support the ground. The ground was unable to support its own weight and every fourth or fifth construction length (construction lengths typically 2m between construction joints) was reportedly reinforced with additional brickwork (presumably on the extrados) generally where the tunnel passed under buildings.

'Malm-paviours' (a type of brick made from marly clay) were used instead of 'Stocks Bricks' because the latter were of insufficient strength to support the weight of the soil. Extra timber centres had to be provided to allow gradual settlement of the arch and centres were repeatedly crushed.

The arch lining comprises of rings of brickwork, 410mm to 620mm thick (from 1996 GPR survey and subsequent 1999 drilling/ground investigation) with general thicker brickwork in the crown in the construction shaft areas. The London Clay is typically in close proximity or in contact with the extrados of the lining (with a possible 300- 500mm thick band of backfilled overbreak – from GPR survey but not discovered by core drilling).

The 1999 Ground Investigation was undertaken to determine the cause of failure of the tunnel lining in a number of locations and provide recommendations of suitable remedial works.

At each location investigated the tunnel lining was observed to be damaged in the crown and shoulders of the tunnel. This is believed to indicate that the tunnel lining has taken up increased vertical load from overlying ground.

From the original 1984 detailed tunnel survey, masonry blocks at water level were noted through approx. 50% of the tunnel length. The presence of these blocks is considered to be due to encountering poor ground conditions during construction possibly requiring some form of additional temporary support to combat these ground conditions. All previous areas of damage in the tunnel (spalled brickwork, not boat erosion) correlate to an area of masonry blocks and over half the areas of damage coincide with the ends of the sections where masonry was employed.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

It is postulated that the failure mechanism is progressive loading in the crown due to the closing of the overbreak and swelling of the London Clay preferentially in the de-stressed zone above the tunnel. This has had the effect of pushing the crown downwards and causing slight hinging in the shoulders, pushing them out and increasing the compressive stress on the inner skin of lining. This increase in compressive stress in the inner skin has exceeded the brickwork strength. As individual bricks become damaged (spall) the compressive stress is concentrated on a progressively smaller cross-sectional area of brickwork thus accelerating the deterioration.

There are various old, small-scale brickwork patch repairs within the tunnel, the majority of which appear to be due to boat erosion in the lower sidewalls. There are also extensive areas of old gunite repairs which are assumed to be due spalled brickwork in the crown and shoulders and boat erosion/perished brickwork in the lower sides of the arch.

The most recent repairs were undertaken in February/March 2000 and included brickwork and sprayed concrete relining across the crown and shoulders over short lengths of tunnel to repair areas of spalled brickwork.

The engineering brickwork repairs consisted of one skin of brickwork in stretcher and header courses, the header courses providing brick bonding back to the existing second skin lining. The sprayed concrete repairs consist of pinned mesh with shotcrete covering. Sprayed concrete repairs were used in preference to brickwork where the repair area coincided with a probable construction shaft area. Below water repairs were initially identified as part of the works but were not undertaken, however the tunnel was regarded to be in reasonable condition following the above water repairs.

The East Portal is a large, flat faced wall, constructed largely in brickwork with pilasters either side of the tunnel, a string course between the pilasters, wingwalls to either side of the pilasters and an upstand parapet wall along the full length of the wall. The spandrel wall between the pilasters contains some ornate feature brickwork with radiating recessed brickwork channels and a masonry key stone in the crown. There are two masonry blocks in the tunnel arch ring on the south side of the tunnel (lower left-hand side as viewed from the front) and some new brickwork repairs to the north side (lower right-hand side).

The East Portal has a history of movement and there is a long standing open circumferential crack within the tunnel around ch.1m from the portal.

The portal wall is leaning, and the evidence suggests that the portal was rotating steadily at approx. 1mm/year about a point just above water level up to the introduction of a temporary stabilising scheme in 1999. This scheme involved the installation of four stainless steel plates bolted to the lining across the circumferential crack at ch.1m. (Originally installation of 9no. plates was planned but poor-quality brickwork prevented bolting in many parts of the intrados). However, movement has continued as can be seen from gaps in the mortar joints around the staples and further intermittent monitoring. The movement appears to be progressive and continuing at a similar rate as before.

The portal was subject to borehole investigation in 1983 with evidence of counterforts found behind the wall. The thickness of the portal was determined to be 400mm thick at parapet level increasing by approx. 100mm every 1m below retained ground level.

The 1996 Ground Penetrating Radar survey was extended to include the East Portal and the survey suggested a force is being applied to the top of the spandrel over the left-hand side (south side) of the

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

portal. This is considered to be due to the instability of the retained ground behind the portal and there are also some large trees growing in the ground behind the parapet.

The vertical cracks in the portal face were plotted on an elevation drawing in June 1980 and there are old mortar tell tails dating from 1971. This proves the defects are long standing and monitoring of some form has been undertaken for a considerable length of time although the records of the monitoring do not appear to be well documented.

A 1819 plan suggests that the first 15 to 20m of the tunnel from the east end may have been constructed as cut and cover, there are some damp deposits on the tunnel lining around ch.15 – 25m that could mark the boundary between made and natural ground but there is no other strong evidence.

The west portal is of similar construction to the east portal but the ground behind the wall is level with the top of the wall. The narrow strip of land above the portal is now fenced off and used as an allotment garden.

There is a masonry key stone in the tunnel crown as on the east portal and masonry blocks in the lower arch ring; some of these blocks have been repaired / replaced with new masonry blocks presumably due to boat damage which is evident in the remaining original blocks.

The recessed brickwork channels in the spandrel have been infilled with new yellow brickwork (work undertaken in 1981) in this portal. This 'repair' was affected due to concerns about cracking to the intrados of the tunnel arch.

There are major vertical cracks in both wing walls which have been present for a considerable length of time and have been subject to repeated monitoring schemes. The cracks are open and displaced in parts and the structural integrity of the wall is compromised. However, the movement appears to be largely historic with only slight movement noted through the intermittent monitoring.

There are wide scale old pointing repairs to the portal.

There are stop plank grooves to this end of the tunnel and a short length of towpath/pedestrian guard rail on the north side of the tunnel.

The 1819 report identifies that there was a short extension to the tunnel at the west end, evidence in the tunnel seems to confirm this with a step in the invert at ch.870.5m; a strong construction joint in the tunnel arch and outward splayed lining from this point to the West Portal. Borehole investigation undertaken in 1983 also provides evidence for this extension and shows the presence of a possible counterfort wall behind the portal. From the borehole investigation it was concluded that the portal increases in thickness to the base of the wall. Shallow trial pits were dug to locate the foundation but unfortunately no notes from these trial pits were recorded and the construction of the foundations remains unknown.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal



West Portal

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Inspection boat at east end (scaffold tower partially disassembled)

Observations

Tunnel (Above Normal Water Level)

A full and comprehensive conditional assessment of the tunnel lining is contained in the tunnel details sheets which are updated after each Principal Inspection.

Above water level features are listed below:

Chainage (m)	Location	Description	Observations 01/12/2020
0	East Portal	Measurements from East end	
1	Full arch	Open circumferential movement crack with stainless steel plate repair	Possible slight further movement.
0 - 875	Full arch	Extensive boat erosion in sidewalls (see detail sheets)	Minor further boat damage.
0 - 875	Full arch	Extensive spalled brickwork in the crown and shoulders (see detail sheets)	Extensive trimming to leave the lining tight.
875	West Portal	End of tunnel	

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

The tunnel was regarded to be in reasonable condition following the repairs in 2000 but due to areas of deteriorating spalled brickwork above water level, missing brickwork below water level and cracks near the portals (and in the portals) it is now assessed to be in poor condition again.

The tunnel is predominantly lined in brickwork with lengths of masonry lining in the lower sidewalls (at water level).

Many of the existing areas of spalled brickwork required some form of trimming to leave the lining tight and the condition has deteriorated since the last P.I. The deterioration of the lining in these areas appears to be the same as displayed in the areas which have required repair in the past.

There are extensive old gunite repairs and boat erosion in the arch side walls. Some of the gunite has de-bonded and broken off to reveal the original perished brickwork behind.

There is an existing circumferential crack at ch.1m in from the East Portal. This crack is open with further movement evident since the installation of the stainless-steel panels (open mortar joints around the panels).

There are extensive areas of damage due to boat erosion in the sides of the arch.

Some boat erosion is evident in the pigment coloured shotcrete repair areas which protrude slightly into the tunnel profile across the crown and shoulders.



Ch.1m LHS – Circumferential crack with plate repair (with further movement noted since installation)

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.1m Crown – Circumferential crack



Ch.1m RHS – Circumferential crack with bolted plate repairs

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.1m RHS – Circumferential crack



Ch.160m RHS – Grab chain hanging loose (this is a widescale issue)

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.257m LHS – Damp, soft, perished brick faces, and soft mortar



Ch.282m RHS – Damp, soft, perished brick faces, and soft mortar

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.282m LHS – Damp, soft, perished brick faces, and soft mortar



Ch.301m RHS – Fiberoptic cable pipe hanging down and corroded/missing. Grab chain hanging loose.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.327m LHS – Missing shotcrete repair revealing spalled brickwork behind the repair



Ch.476m Crown – Spalled brickwork, trimmed on PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.604m Crown – Spalled brickwork outside new brickwork repair



Ch.690m RHS – Spalled brickwork, trimmed on PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.690m LHS – Spalled brickwork, trimmed on PI



Ch.810m RHS – Spalled brickwork, trimmed on PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.842m LHS – Spalled brickwork, trimmed on PI



Ch.849m RHS – Spalled brickwork, trimmed on PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.849m LHS – Spalled brickwork, trimmed on PI



Ch.849m LHS – Spalled brickwork, trimmed on PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.873m LHS – Circumferential crack



Ch.873m LHS – Circumferential crack

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Ch.873m RHS – Circumferential crack



Ch.873m RHS – Circumferential crack

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Towpath(s)

There are no towpaths through Islington Tunnel.

For the purposes of self-rescue in the event of an emergency resulting in abandonment of a boat, a grab chain with fender protection is provided on the north side of the tunnel. The towpath approaching the tunnel is also on the north side of the canal.

Tunnel (Below Normal Water Level)

The lining below normal water level was viewed through the water which was reasonably clear to approximately 0.5m below water level on the day of the inspection. No new areas of missing lining were noted but there is a significant missing area, up to three skins deep, in the first 25m from the east end. In the remainder of the lining below water level there are areas of perished brickwork with occasional areas of missing front skin brickwork and extensive areas of recessed mortar joints.

Below water level repairs have previously been identified but not undertaken to date. The erosion is probably due to the passage of deep draught commercial boats in the past although the rate of deterioration has slowed down since regular deep draught traffic ceased.

Air Shaft(s)/Construction Shaft(s)

There are no air shaft in Islington Tunnel, but possible/probable former construction shafts have been identified. The detailed investigation into the shaft locations is discussed in the 1999 Ground Investigation report.

Location	Description	Observations 01/12/2020
Ch.71.5m	Possible former construction shaft	No significant change
Ch.196.3m	Probable former construction shaft	No significant change
Ch.328.5m	Probable former construction shaft	No significant change
Ch.457.5m	Probable former construction shaft	No significant change
Ch.654.5m	Probable former construction shaft	No significant change
Ch.762.5m	Probable former construction shaft	No significant change

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Portals

Both portals are grade II listed.

The schedule of portal features is listed below:

Location	Description	Observations 01/12/2020
East Portal	Missing brickwork in arch ring (first panel on south side of keystone – 5 missing bricks). Fine cracks in the front face brickwork and inside the arch.	No further missing brickwork since last PI
East Portal - South wingwall	Two significant but old vertical movement cracks (North and South cracks). Some ivy growth on the front face.	Cracks appear to be similar to the last PI with old, redundant mortar tell-tails
East Portal parapet	Open vertical joints/crack in upper wall above the north side of the tunnel which continues through the rear of the parapet.	Crack appears similar to the last PI
East Portal parapet	Slight vertical crack near the centre of the wall in the front face.	Crack appears similar to the last PI
SE Portal – North wingwall	Two significant but old vertical movement cracks (North and South cracks) which extend to the top of the wall. One diagonal crack in the lower wall between the two full height cracks. Heavy graffiti on the wall.	Cracks appear to be similar to the last PI. Graffiti has increased.
West Portal	Brick infill repairs to the recessed channels, brick patch repairs and re-pointing.	Repairs dating from 1981
West Portal – South wingwall	Two significant but old, displaced, vertical movement cracks (North and South cracks). Some ivy growth on the front face.	Cracks are displaced but appear to be similar to the last PI.
West Portal – North wingwall	Two significant but old, displaced, vertical movement cracks (North and South cracks including broken tell-tails). Heavy graffiti on the wall.	Cracks are displaced but appear to be similar to the last PI. Graffiti has increased.
West Portal – North wingwall	Old, vertical movement to north section of wingwall with ivy growth and sapling growth on the front face.	Open mortar joints but condition appears to be similar to the last PI

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

A section of five loose bricks were trimmed from the front face of the East Portal arch ring on the PI in 2005 (in the first panel of voussoir brickwork to the south side of the keystone) and there are hairline radial cracks in the portal face and a circumferential hairline crack within the tunnel. This has created a small area of brickwork which could become loose and fall out in an uncontrolled manner. This defect is not considered to affect the structural stability of the portal but is a safety related issue with a recommendation to repoint the spandrel and patch repair the small missing areas.

A similar series of hairline cracks are present through the first brickwork panel to the north side of the keystone; however, there is no loss of brickwork in this area at present. There are also hairline cracks in some of the other voussoir panels. There is one further missing brick on the edge of one of the recessed channels on the north side of the tunnel, near to the pilaster.

The mortar condition has deteriorated to a sandy and powdery consistency in a large proportion of the voussoir panels and the bonding of the brickwork courses is compromised.

There are vertical cracks in both wing walls to the East Portal with further cracks in the parapet above the tunnel. The cracks are all noted on a Portal Survey dating from June 1980 and are long standing defects. The whole wall is generally leaning (estimated at 100mm horizontal movement at the top of the wall) and there are some large trees growing immediately behind the portal.

The rear of the parapet wall contains recessed mortar joints and one of the cracks in the north wing wall continues through the rear of the parapet. One section of the wall has been covered with render and there is a services cover at ground level immediately behind this section of the parapet.

The east portal is regarded as in poor condition due to the defects mentioned above together with the temporarily repaired circumferential crack at ch.1m within the tunnel intrados.

The West Portal is constructed similarly to the East Portal, but the recessed channels have been infilled with brickwork and the faces have been repointed.

There is a masonry key stone in the tunnel crown as on the east portal and masonry blocks in the lower arch ring; some of these blocks have been repaired / replaced with new masonry blocks presumably due to boat damage which is evident in the remaining original blocks.

There are major vertical cracks in both wing walls which have been present for a considerable length of time and have been subject to repeated monitoring schemes. The cracks are open and displaced in parts and the structural integrity of the wall is compromised. However, the movement appears to be largely historic with only slight movement noted through the recent monitoring. The tell-tails are now damaged and ineffective.

There are open mortar joints in the brickwork above the string course and some of the courses are slightly pushed with some evidence of old vegetation damage.

There are wide scale old pointing repairs to the portal.

The west portal is also considered to be in poor condition due to the old vertical movement cracks.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal



East Portal – circumferential crack to the intrados of the arch on the south side of the tunnel

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – circumferential crack to the intrados of the arch on the north side of the tunnel



East Portal – Missing bricks in first panel to the south of the keystone

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal parapet – Slight crack near the centre of the wall



East Portal – Crack to the north side of the spandrel

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – Crack extends through the parapet on the north side of the spandrel (old tell-tails present)



East Portal – Crack extends through the parapet on the north side of the spandrel

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – North wingwall



East Portal – North wingwall – Old, vertical movement crack (south crack)

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – North wingwall – Old, vertical movement crack (south crack)



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – North wingwall – Old, movement cracks (North crack extending up to the top of the wall)



East Portal – North wingwall – North crack

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – North wingwall – North crack



East Portal – Rear of the parapet wall from the south side

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – rear of the parapet wall from the north side



East portal from the south side – wall is leaning

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – South wingwall



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – South wingwall – Old, vertical movement crack (North crack extending up to the top of the wall, including old tell tails at mid wall height)



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – South wingwall – Old, vertical movement crack (North crack extending up to the top of the wall)



East Portal – South wingwall – Old, vertical movement crack (South crack extending up to the top of the wall)

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



East Portal – South wingwall – Old, vertical movement crack (South crack extending up to the top of the wall)



East Portal – Access steps on south side

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – Brickwork repairs to the spandrel



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – South wingwall



West Portal – South wingwall

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – South wingwall – Old, vertical movement crack (South crack extending up to the top of the wall)



West Portal – South wingwall – South crack is slightly displaced near the base of the wall

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – South wingwall – South crack is displaced at the top



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – South wingwall – Base of an old, vertical movement crack (North crack extending up to the top of the wall)



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – South wingwall – North crack displaced near the top of the wall.



A photograph of a brick tunnel entrance. The tunnel is built with red bricks and has a large, dark, arched opening. To the left of the entrance, there is a wall covered in graffiti, including a large, stylized white tag that reads 'LADY'. The surrounding area is overgrown with green vegetation.

Islington Tunnel

- Tunnel: 200m
- Internal width: 10' 6" (3.2m)
- Internal height: 14' 6" (4.4m)
- Depth: 14' 6" (4.4m)
- Approximate time to travel through the tunnel: 14 mins
- You are strongly advised to wear a buoyancy aid (life jacket) when entering the tunnel
- Canoe and kayak users must wear a life jacket
- Canoe and kayak users must wear a life jacket
- Canoe and kayak users must wear a life jacket
- Canoe and kayak users must wear a life jacket
- Canoe and kayak users must wear a life jacket

Canal & River Trust

West Portal

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – North wingwall



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – North wingwall – Old, vertical movement crack (South crack extending up to the top of the wall with old tell-tails present)



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – North wingwall – South crack – Tell-tails are broken



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – North wingwall – Old, vertical movement crack (North crack extending up to the top of the wall with old tell-tails present)



West Portal – North wingwall – North crack – Tell-tails are broken

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – North wingwall – North crack – Wall is displaced near the top



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – Crack through north end of the north wing wall with vegetation growing on the wall.



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – Vegetation growth



Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



West Portal – Allotment garden above the wall

Tunnel Safety Features & Signs

There are new tunnel information and safety signs at both ends of the tunnel. The signs at the east end are of a different design to those at the west end. Many of the signs are covered in graffiti, rendering some signs illegible.

The grab chain and fender are located on the north side of the tunnel and there are a series of three encased fibreoptic cables attached under the fender.

The fender is intact, but the grab chain is broken and hanging loose over a long length. The fibreoptic cable ducting is extensively corroded and at least two short sections are missing leaving the cable exposed. Another section of ducting near the west end is hanging loose.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Tunnel sign at the East Portal



Towpath diversion sign at the East Portal

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Canal sign near the east end



Tunnel sign on the east side of Bridge 38 (Frog Lane Bridge)

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel



Tunnel sign at the West Portal (on the offside of the canal)



Tunnel safety sign on the towpath at the west end.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Surface

A walk over the surface revealed no new development over the line of the tunnel.

Severity & Extents Assessment

Tunnel Section (Above WL)	Severity	Extent
0 – 25m	4	3
25 – 50m	3	3
50 – 75m	3	3
75 – 100m	4	3
100 – 125m	3	3
125 – 150m	3	2
150 – 175m	3	3
175 – 200m	3	3
200 – 225m	3	2
225 – 250m	3	4
250 – 275m	4	4
275 – 300m	4	4
300 – 325m	4	3
325 – 350m	3	3
350 – 375m	3	3
375 – 400m	3	3
400 – 425m	3	4
425 – 450m	3	3
450 – 475m	3	3
475 – 500m	3	3
500 – 525m	3	2
525 – 550m	3	2
550 – 575m	3	3
575 – 600m	3	3
600 – 625m	3	4
625 – 650m	3	3
650 – 675m	3	3
675 – 700m	4	3
700 – 725m	3	3
725 – 750m	3	3
750 – 775m	4	3
775 – 800m	3	4
800 – 825m	4	4
825 – 850m	4	4
850 – 875m	4	3

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

The below water elements have not been scored but the east end is in poor condition with missing brickwork up to three skins deep over a reasonable length.

Element	Severity	Extent
East Portal – Spandrel wall	4	2
East Portal - wingwalls	4	3
Air shaft(s)	7	7
Towpath(s)	7	7
West Portal - Spandrel wall	2	2
West Portal - Wingwalls	4	3

Inspection Summary

Discussion

Islington Tunnel is the subject of a high-risk asset review by consequence of the current poor condition grade (grade D) and high consequence of failure grade (grade 5). Following this Principal Inspection, the poor condition grade has been confirmed, with significant deterioration of the brickwork lining above water level noted.

The most recent repairs in the tunnel date from the year 2000 and consist of new brick panel repairs, where the front face of brickwork has been replaced, and reinforced sprayed concrete repairs which sit proud of the existing lining under probable former construction shaft areas. Both types of repair were installed due to spalling of the original brickwork causing loss of section and followed a ground investigation study. However, similar defects are evident within other sections of the tunnel and deterioration has now advanced to the point where repairs are once again required.

Further long-standing defects also require treatment in order to improve the structural integrity of the tunnel. Both Portals have suffered from movement in the past with circumferential cracks within the ends of the tunnel and vertical cracks in the portal faces and wingwalls. A temporary stabilising scheme consisting of four stainless steel plated bolted across the circumferential crack at the east end was installed in 1999. Further movement is evident since this repair, but the extent of the movement has not been quantified as monitoring has not been consistent. Stabilisation works are recommended and were included in a Priority Project for the tunnel however, this project was deferred and is likely to be superseded by the High-Risk Asset project.

Vegetation growth also affects both portals with some ivy growth on the front faces and large trees growing immediately behind the parapet wall of the East Portal and small trees and ivy growth on the West Portal. Poor pointing and open cracks are likely to suffer further damage if this vegetation continues to take hold and develop.

Both Portals are listed structures. There are some previous repairs to the voussoir brickwork in the spandrel of the West Portal, the East Portal contains some missing and cracked brickwork in the voussoirs in the crown of the arch. Patch repairs are identified in this location to prevent further deterioration and improve visitor safety.

Below water level repairs have previously been identified and there are areas of missing and perished brickwork in the sidewalls below water level throughout the tunnel. There are also extensive areas of recessed mortar in the sidewalls and this erosion is probably due to the passage of deep draught

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

commercial boats in the past although the rate of deterioration has slowed down since regular deep draught traffic ceased.

A particularly poor section of sidewall exists below water level on the south side of the tunnel in the first 25m from the east end. Here the missing brickwork is up to three skins in depth.

An underwater sonar survey was conducted in 2019 to check for the extent of missing brickwork and deterioration of the lining since the last dewatered survey in 1991. This survey appeared to show little change and, as part of the High-Risk Asset project, it is recommended that a schedule of repairs is created using the original dewatered survey.

The grab chain is hanging loose over a considerable length of the tunnel and requires re-connecting.

The fibreoptic cables ducts are corroded and at least two sections are missing, exposing the cable (such as at ch.300m). The ducting is hanging down near the west end also. The ducting requires repair or replacement and re-fixing.

Recommendations

Review of uncompleted existing notifications (review undertaken on 01/12/2020):

The list of current ZX notifications is given below.

The amount of graffiti within the tunnel and particularly on the tunnel portals and signs has increased since the last PI, ZX notifications have been raised for this aspect but have not been individually reviewed as part of this PI.

There are numerous ZX notifications for the cracks on the Portals with measurement results included up to 2010. As most of the tell-tails are now damaged and have not been monitored for some time, these notifications are not reviewed as part of this PI.

There are notifications for brickwork repairs; as these will form part of the High-Risk Asset project they have not been reviewed here, but these aspects are commented on in the discussion.

Notifications for operational signage have not been reviewed as part of this PI as this forms part of the visitor risk assessment and the tunnel PPM.

Notification	Description	Created on
16395456	RE-007-005 Principal Inspection	17/04/2020
12271723	graffiti inside islington tunnel	06/01/2013
12271726	N Crack in N W/W of W Portal	06/01/2013
12271727	Brickwork repairs east portal	06/01/2013
12271728	Brickwork facings perished 5years	06/01/2013
12271729	Long term brickwork on Tunnel Crown	06/01/2013
12271731	Underwater Probing	06/01/2013

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

12271732	Circumferential Crack- W Portal	06/01/2013
12271733	Circumferential Crack- E Portal	06/01/2013
12271734	S Crack in N W/W of W Portal	06/01/2013
12301705	Cracks W/Walls of East Portal	26/01/2013
14337473	Emergency exit signs need checking	26/09/2016
14914838	Unpowered craft in Islington signage	13/09/2017
16398108	Crack on tunnel entrance wall	13/05/2020
16398109	Graffiti on west tunnel entrance	13/05/2020

New recommendations:

Compile a schedule of repairs above and below water level prior to commencing the High-Risk Asset project. This will involve a detailed survey of the lining by the CRT Tunnel team using a workboat with a scaffold platform.

Notification: 16671081	Title: Movement of Portals
Description: Commence detailed monitoring	Coding: Condition - Measure
Date: 01/12/2020	Priority: 1 year
Comments 01/12/2020:	
Both Portals contain old movement cracks, and the East Portal is leaning with a temporary repair to the open circumferential crack within the intrados of the tunnel.	
Recommendations:	
Procure a detailed survey of the Portals and commence seasonal monitoring (four times per year initially).	

Ensure PPM is undertaken to include vegetation clearance around the portals and signs, graffiti removal from the portals and signs, replacement of damaged signs, installation of signs which comply with the tunnel safety standards and repairs to the grab chain and fibre-optical network ducting.

Condition Grade

The tunnel is assessed as **Condition code D** (poor condition) as there are multiple defects including spalled and deteriorating brickwork above water level in the tunnel, deep missing brickwork below water level near the east end and old movement of both portal walls including temporary type repairs at the east end. The tunnel is recommended for repair and is subject of a High-Risk Asset review.

Tunnel Principal Inspection Report
RE-007-005, Islington Tunnel

Consequence of Failure Grade

The tunnel is assessed as **Consequence of Failure code 5** as the tunnel is in a densely populated area with major transport links crossing the line. Given the local geology any collapse in the tunnel would cause ground movement on the surface.

Serviceability Grade

The serviceability of the tunnel is assessed as **Serviceability code 1** as there are no restrictions on boat movements (self-regulated, one-way operation working on a line-of-sight principle). However, there is a proposal to install traffic light operation at this tunnel to control boat movements.

References

Islington Tunnel, Geotechnical Report, Project Ref. CG98124 by Graham Holland, Principal Geotechnical Engineer, 1999.