AECOM

HY623/251

Stenhouse Mill Lane Bridge

Principal Inspection Report

July 2018

60577064

Prepared for: The City of Edinburgh Council

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EXECUTIVE SUMMARY

This is the Principal Inspection report of HY623/251 Stenhouse Mill Lane Bridge based on a “touching distance” inspection of all visible and accessible structural elements above ground level.

The superstructure is comprised of steel RSJ girders with a pressed steel trough deck and concrete infill footway. The substructure is comprised of stone masonry abutments and masonry / concrete wingwalls.

The structure is generally in fair condition; the pressed steel trough deck and south abutment are in poor condition.

Defects identified in this report should be used as a baseline to monitor condition during future general and principal inspection works.

Recommendations

High priority:

- Repair undermined section of south abutment and dislodged stone at the south-west wingwall

Medium priority:

- Consider feasibility study to investigate repair/replacement of the heavily corroded and delaminated trough deck. Consider installing effective waterproofing system in conjunction with any repair works carried out.
- Report discharge of sewage into watercourse to SEPA from open headed weep joint at south-west wingwall.

Low priority:

- Blast clean metallic elements comprising the superstructure and reapply metallic paint system.
- Repair service pipe bracket bolted connection with deck soffit.
- Remove overgrown vegetation obscuring 2No. wingwalls.

1 INTRODUCTION

1.1 Brief

The City of Edinburgh Council commissioned AECOM to undertake a Principal Bridge Inspection of HY623/251 Stenhouse Mill Lane Bridge as part of a Principal Bridge Inspection (PBI) programme. The objective of the inspection was to record the nature and condition of the structural components.

A General Bridge Inspection photographic record, dated February 2017, was made available to AECOM by the client. The inspection covers the topside of the structure only. No other archive information was provided.

1.2 Bridge Inspection

The bridge inspection was undertaken in accordance with the requirements set out in BD 63/07 (DMRB 3.1.4) and the Inspection Manual for Highway Structures (Highways Agency).

2 LOCATION PLAN

Stenhouse Mill Lane Bridge is located in Longstone within the South-West Council locality, City of Edinburgh. The bridge carries a footpath and spans across Murray Burn.

It is located at grid reference E: 321409, N: 670996. The location of the bridge is shown in Figure 1.

Figure 1 – Stenhouse Mill Lane Bridge (HY623/251)

3 DESCRIPTION OF STRUCTURE

3.1 General Description

Stenhouse Mill Lane Bridge is a single span steel deck type bridge with no skew. The superstructure is supported between masonry abutments. There are three splayed masonry wingwalls and one mass concrete wingwall at the corners of the bridge forming the sides of the watercourse. Several service pipes span between abutments parallel to the main span.

The structure carries a pedestrian footpath connecting Longstone Road and Stenhouse Mill Lane over the Murray Burn watercourse.

The clear span between abutments is 4.100m. The minimum headroom clearance measured from water level to the service pipes spanning beneath the bridge soffit is 1.450m. The bridge has a slight downward slope as you travel from north to south.

No record drawings were available to AECOM at the time of writing. The construction date of the bridge is unknown.

3.2 Superstructure (Deck Elements)

3.2.1 *Primary Deck Elements*

2No. rolled steel joist (RSJ) edge main girders span longitudinally between masonry abutments and support secondary deck elements.

3.2.2 *Secondary Deck Elements*

A pressed steel trough deck spans transversely between the bottom flanges of edge main girder. The trough deck supports concrete infill forming the bridge surfacing and walkway. The composition of the concrete infill is not known.

3.3 Load Bearing Sub-Structure

3.3.1 *Foundations*

The foundations of the north abutment/wingwalls were exposed above water level and were comprised of mass masonry spread footings. The foundations of the south substructures were buried and were therefore not confirmed though are assumed to be of a similar type.

3.3.2 *Abutments*

Both abutments are comprised of stone masonry for their full height.

The north abutment is comprised of coursed cut stone. The lower half of the south abutment is comprised of coursed dry stone masonry; the upper half is comprised of coursed cut stone.

3.3.3 *Piers*

Not applicable - there are no piers associated with the structure.

3.4 Durability Elements

3.4.1 *Superstructure Drainage*

Not applicable - No drainage was identified at the superstructure.

3.4.2 *Substructure Drainage*

- 1No. drainage pipe weep hole at the south abutment.
- 2No. open head joint weep holes at missing mortar joints between stone blocks at the south abutment/south-west wingwall.
- 1No. drainage pipe weep hole at the south-west wingwall.
- No drainage identified at the north substructures.

3.4.3 *Waterproofing (Superstructure and Substructure)*

The bridge waterproofing, if present, is buried and was therefore not confirmed.

3.5 Safety Elements

3.5.1 *Parapets*

The parapets over the bridge and approach restraint system are comprised of wrought iron railings 1.200m in height from the footway.

3.5.2 *Carriageway Surfacing*

Not applicable – there is no carriageway associated with this structure.

3.5.3 *Footpaths and Verges*

The footpath surfacing over the bridge is comprised of concrete. The footpath is 1.120m wide between parapets. There are no verges associated with this structure.

3.6 Other Bridge Elements

3.6.1 *Inverts*

Not applicable - there is no invert associated with the structure. The bridge passes over the Murray Burn watercourse.

3.6.2 *Spandrel Walls*

Not applicable - there are no spandrel walls associated with the structure.

3.6.3 *Wing Walls*

There are wingwalls at each corner of the bridge.

- The south-east wingwall and approach wall are comprised of mass concrete for their full height. The approach wall also supports the back wall of the Longstone Inn pub.
- The south-west wingwall is comprised of masonry dry stone construction. The south-west approach wall is comprised of coursed rubble and supports the back wall of the Jaflong takeaway restaurant.
- The north-east and north-west wingwalls and approach walls are comprised of coursed cut stone and random rubble.

3.6.4 *Retaining Walls*

Not applicable – there are no retaining walls associated with the structure.

3.6.5 *Services*

- 5No. service pipes span beneath the bridge between abutments. Of these, 3No. are self-supporting and 2No. are supported at midspan by a metallic bracket fixed to the pressed trough deck.
- 1No. self-supporting service pipe spans parallel and adjacent to the west elevation of the bridge between wingwalls.
- 1No. drainage pipe is fixed along the south-west approach/wingwall and originates from the nearby property.
- All service pipes are fixed into the masonry abutments/wingwalls at their supports with cementitious mortar surround.

4 CONDITION REPORT

4.1 Maintenance History

4.1.1 *Routine/Cyclical Maintenance*

There are no previous Principal Inspection reports by the City of Edinburgh Council that were made available to AECOM for this structure.

Photographs from a previous General Inspection dated 6th February 2017 was made available to AECOM. The inspections were confined to the topside of the bridge only.

There is no comparison of condition made between defects identified in any prior reports or condition noted from previous Principal Inspection surveys.

4.1.2 *Description of the Inspection*

A topside daytime inspection was undertaken on the 14th May 2018 with access gained on foot. All areas of the topside of the bridge are publically accessible and un-trafficked. No pedestrian or traffic management was required. The weather at the time of the inspection was dry and sunny.

An underside daytime inspection was undertaken on 19th June 2018 with access to the watercourse gained by ladder. Access to the soffit and elevations of the superstructure and substructures was gained on foot from the watercourse. The weather at the time of the inspection was dry and overcast.

Topside and underside works included a general dimension survey and touching distance condition survey of all visible and accessible elements with a photographic record taken. A probing scour survey was undertaken to identify scour at the substructures.

4.1.3 *Structure Monitoring*

No structure monitoring is associated with the structure.

4.2 Superstructure (Deck Elements)

4.2.1 *Primary Deck Elements*

<u>West main edge girder (RSJ)</u>

- Fair condition.
- The metallic paint system at the top flange, upper surface of the bottom flange and outer face of the web is typically intact with minor chips and cracks (Photograph 14).
- Typically 1mm historical pitting section loss identified to the outer face of the web, underside of the top flange outstand and upper face of the bottom flange outstand throughout (Photograph 15).
- 50 to 80mm wide band of paint loss, surface corrosion and leachate staining/stalactites along the inner edge of the bottom flange soffit along the full span (Photograph 16 and Photograph 17).

- Typically 2mm historical pitting section loss to the full width of the soffit of the bottom flange (Photograph 16 and Photograph 17).
- Isolated 150mm length of delamination across 130mm width of the bottom flange soffit from the south abutment (Photograph 18).
- The inner face of the girder could not be accessed and was not examined.

East main edge girder (RSJ)

- Fair condition.
- The metallic paint system at the top flange, upper surface of the bottom flange and outer face of the web is typically intact with minor chips and cracks (Photograph 19).
- Typically 2mm historical pitting section loss identified to the outer face of the web, 1mm underside of the top flange outstand and upper face of the bottom flange outstand (Photograph 19).
- 50 to 80mm wide band of paint loss, surface corrosion and leachate staining/stalactites along the inner edge of the bottom flange soffit along the full span. 1mm section loss to the full width of the flange soffit throughout (Photograph 20 and Photograph 21).
- Isolated 300mm length of delamination and 2mm pitting section loss across the full width of the bottom flange soffit from the south abutment (Photograph 22).
- 4mm section loss to upper surface of the bottom flange and to a 90mm high band to the outer face of the web along a length of 1000mm starting 100mm from the south support (Photograph 23).
- Knife edge corrosion with a typical residual thickness of 6mm to the outer edge of the top flange outstand along a length of 300mm from the south support (Photograph 24).
- The inner face of the girder could not be accessed and was not examined.

4.2.2 *Secondary Deck Elements*

Pressed trough deck

- Poor condition.
- Widespread breakdown of metallic paint system, corrosion throughout and leachate staining/deposits to approximately 30-40% of the deck area. Water ingress is clearly an issue and appears to be the primary cause of the defects identified (Photograph 6 to Photograph 7).
- Widespread delamination and heavy section losses throughout. Several large sections of deck have delaminated and separated from the parent steel and are hanging loose from the deck soffit. (Photograph 25 to Photograph 28). The residual thickness of the remaining deck section could not be identified.

4.3 Load Bearing Sub-Structure

4.3.1 *Foundations*

The foundations at the north abutment were in good condition with no observable defects (Photograph 8).

The foundations at the south abutment were not visible at the time of inspection. There is a large section of missing masonry at the base of the abutment (see section 4.3.2).

4.3.2 *Abutments*

North abutment

- Fair condition.
- 40% loss of pointing, particularly concentrated at the east side of the abutment (Photograph 8).
- Cracked infill concrete surrounding the service pipes at support (Photograph 29).
- 150mm wide band of leachate staining originating from the deck soffit to the abutment face (Photograph 30).

South abutment

- Poor condition as the abutment has been undermined.
- 1400mm x 600mm area of missing masonry at the base of the abutment. Several masonry stones have been dislodged into the river bed (Photograph 11 and Photograph 31 - Photograph 32).
- Cracked concrete infill surrounding the service pipes and leachate staining beneath to the masonry abutment face (Photograph 33).
- 5mm separation between abutment and south-east masonry wingwall (Photograph 34).
- Moderate vegetation growth from the bearing area of the east main girder (Photograph 24).

4.3.3 *Piers*

Not applicable - there are no piers associated with this structure.

4.4 Durability Elements

4.4.1 *Superstructure Drainage*

Not applicable - there is no superstructure drainage associated with this structure.

4.4.2 *Substructure Drainage*

- Fair condition.
- 1No. weep pipe at the south-west wingwall is misaligned with the outlet at the wingwall face (Photograph 35).
- An open head joint weep hole at the south abutment/south-west wingwall was observed to discharge sewage directly into the watercourse which is an environmental concern (Photograph 36).
- Drainage pipe weep hole at south abutment appears unblocked (Photograph 11).

4.4.3 *Waterproofing (Superstructure and Substructure)*

The waterproofing, if present, is buried and was not inspected. Water ingress is clearly a widespread problem as exhibited by the poor condition of the trough deck.

4.5 Safety Elements

4.5.1 *Parapets*

- The parapets and approach fences are generally in fair condition.
- The metallic paint system is generally intact with normal weathering except at the north-east approach fence where the paint system has broken down along 60-70% of its length
- 2No. railings at the north-east approach fence have buckled out of shape (Photograph 37).

4.5.2 *Carriageway Surfacing*

Not applicable – there is no carriageway associated with this structure.

4.5.3 *Footpaths and Verges*

- Generally in fair condition.
- Odd areas of minor cracking to the footway surface (Photograph 3).
- 100mm band of minor vegetation along the deck edges along the full span (Photograph 3).

4.6 Other Bridge Elements

4.6.1 *Inverts*

Not applicable - there are no inverts associated with the structure. The watercourse beneath the structure is natural. Several stones originating from the south abutment and south-west wingwall have dislodged into the watercourse (Photograph 31).

4.6.2 *Spandrel Walls*

Not applicable - there are no spandrel walls associated with the structure.

4.6.3 *Wing Walls*

North-west wingwall

- Fair condition.
- 75% obscured by overgrown vegetation (Photograph 9).

North-east wingwall

- Fair condition.
- 50% obscured by overgrown vegetation (Photograph 10).
- 50% loss of pointing.

South-east wingwall

- Fair condition (Photograph 13).
- 5mm separation between concrete wingwall and masonry abutment (Photograph 34).

South-west wingwall

- Fair condition (Photograph 12).
- Dislodged stone at base of wingwall (Photograph 38).

4.6.4 *Retaining Walls*

See section 4.6.3.

4.6.5 *Services*

No member of the inspection team was qualified to inspect the service pipes but they appear to be in fair condition.

- There are several areas of heavy leachate deposits and stalactites to the service pipes beneath the bridge soffit.
- The bolted connection at the bracket supporting 2No. service pipes from the deck has separated from the deck soffit by 10mm vertically (Photograph 39).

4.6.6 *Signs*

Not applicable - there are no signs associated with this structure.

5 CONCLUSIONS AND RECOMMENDATIONS

The superstructure was found to be in fair condition with the exception of the trough deck which is in poor condition and requires repair.

The substructure was found to be in fair condition with the exception of the south abutment which has been undermined and has a significant area of missing stone at the base of the abutment which requires repair.

Defects identified in this report should be used as a baseline to monitor condition during future General and Principal Inspection works.

Recommendations

High priority:

- Repair undermined section of south abutment and dislodged stone at the south-west wingwall.

Medium priority:

- Consider feasibility study to investigate repair/replacement of the heavily corroded and delaminated trough deck. Consider installing effective waterproofing system in conjunction with any repair works carried out.
- Report discharge of sewage into watercourse to SEPA from open headed weep joint at south-west wingwall.

Low priority:

- Blast clean metallic elements comprising the superstructure and reapply metallic paint system.
- Repair service pipe bracket bolted connection with deck soffit.
- Remove overgrown vegetation obscuring 2No. wingwalls.

APPENDIX A – PHOTOGRAPHS

Photograph 1: East elevation

Photograph 2: West elevation

Photograph 3: View over bridge looking north

Photograph 4: Watercourse looking west

Photograph 5: Watercourse looking east

Photograph 6: Deck soffit looking north

Photograph 7: Deck soffit looking south

Photograph 8: North abutment

Photograph 9: North-west wingwall

Photograph 10: North-east wingwall

Photograph 11: South abutment

Photograph 12: South-west wingwall

Photograph 13: South-east wingwall

Photograph 14: Typical condition of west main girder outer face (looking south). Paint system in fair condition with chips and minor cracks

Photograph 15: West main girder outer face (looking south). 1mm section loss typical

Photograph 16: Soffit of west main girder looking south. 50-80mm wide band of paint loss, surface corrosion and leachate staining. 2mm section loss typical

Photograph 17: Soffit of west main girder looking north. 50-80mm wide band of paint loss, surface corrosion and leachate staining. 2mm section loss typical

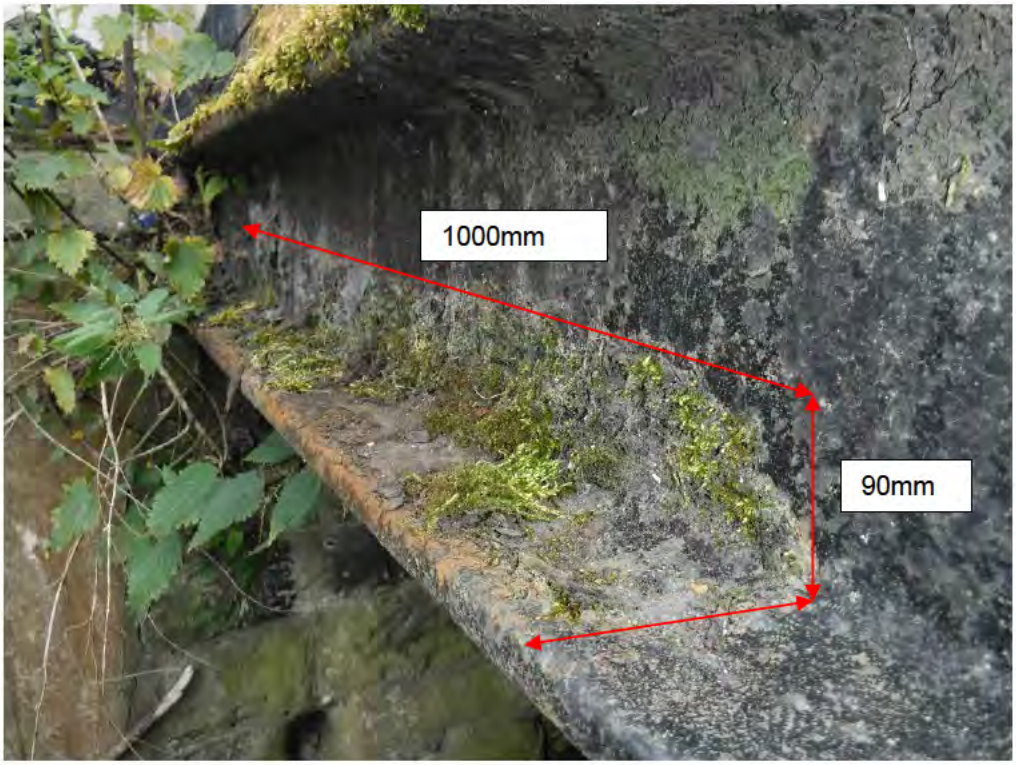
Photograph 18: 150x130mm area of delamination to west main girder adjacent to south support

Photograph 19: East main girder outer face looking north. Typical 1-2mm historical pitting section loss

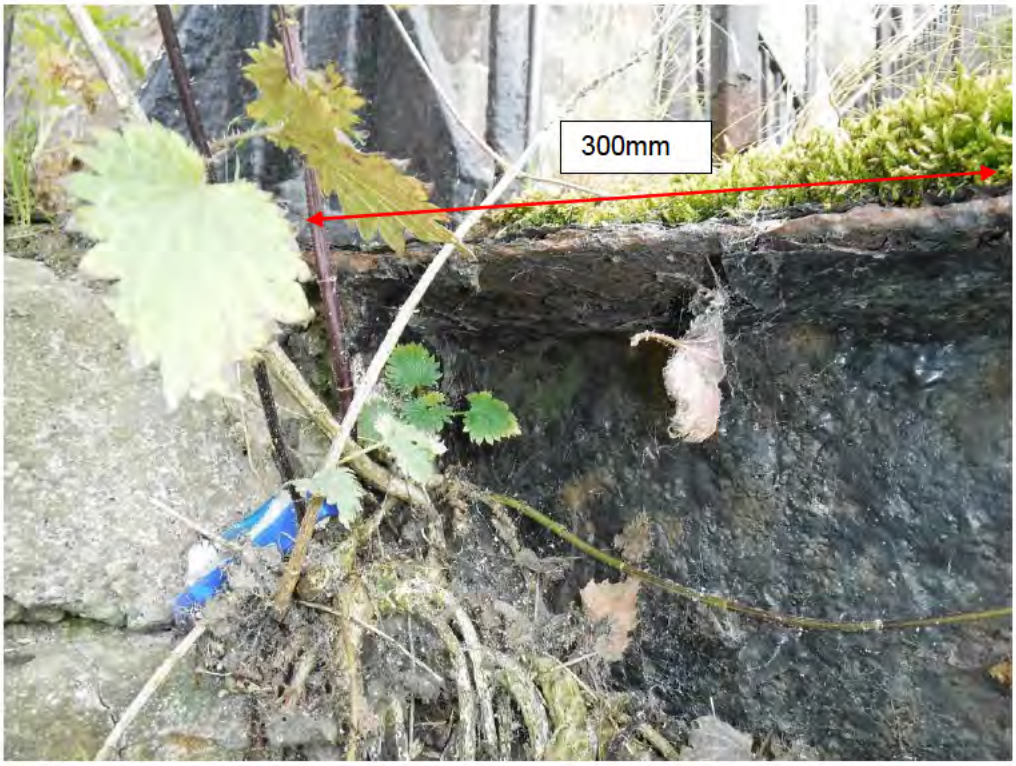
Photograph 20: Soffit of east main girder looking north. 50-80mm band of paint loss, surface corrosion and leachate across full span. 1mm section loss typical

Photograph 21: Soffit of east main girder looking south. 50-80mm band of paint loss, surface corrosion and leachate across full span. 1mm section loss typical to full flange width

Photograph 22: East main girder - Isolated 300mm length of delamination and 2mm pitting section loss across the full width of the bottom flange soffit from the south abutment



Photograph 23: East main girder - 4mm section loss to 1000x90mm area along upper surface of bottom flange and web



Photograph 24: East main girder at south support – Knife edge corrosion to top flange outstand. 6mm residual thickness

Photograph 25: Delaminated section of deck separated from soffit, 40mm displacement

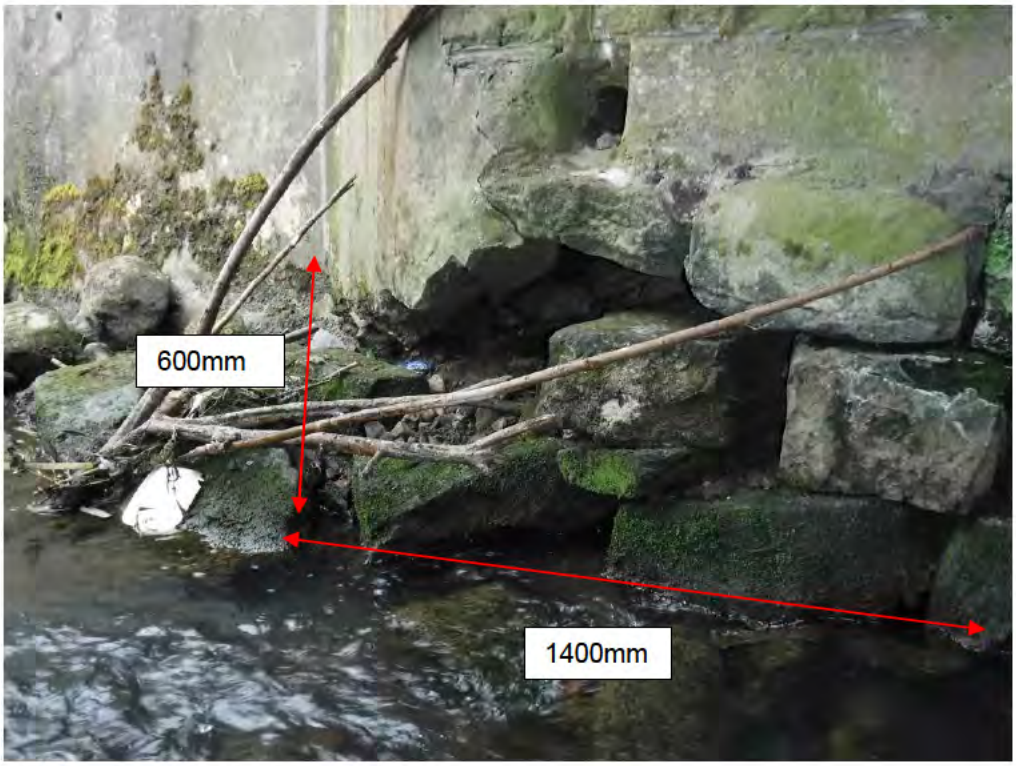
Photograph 26: Delaminated section of deck separated from soffit, 50mm displacement

Photograph 27: Trough deck in poor condition. Widespread corrosion and delamination

Photograph 28: Trough deck in poor condition. Widespread corrosion and delamination

Photograph 29: North abutment – cracked concrete infill surrounding service pipes

Photograph 30: Leachate staining to north abutment



Photograph 31: South abutment – base undermined and large area of missing and dislodged masonry

Photograph 32: South abutment – base undermined and a large area of missing and dislodged masonry

Photograph 33: South abutment - Cracked concrete infill surrounding the service pipes and leachate staining beneath to the masonry abutment face

Photograph 34: 5mm separation between south abutment and south-east wingwall

Photograph 35: South-west wingwall – weep pipe misaligned with outlet

Photograph 36: South-west wingwall – open headed joint weep hole discharging sewage directly into Murray burn watercourse

Photograph 37: North-east approach fence – paint system broken down and 2No buckled railings

Photograph 38: South-west wingwall – dislodged stone at base

Photograph 39: Service pipe bracket connection – dropped by 10mm. Not loose to touch

APPENDIX B – PRINCIPAL INSPECTION PROFORMA

version 2

CITY OF EDINBURGH COUNCIL
PLACE
INFRASTRUCTURE - STRUCTURES

General Rating Score	
Good	
Fair	✓
Poor	

Principal Inspection

Structure Name: Stenhouse Mill Lane Bridge

Structure Ref/No: HY623/251

Inspected by: **Inspection Date: 14th May 2018 & 19th June 2018**

No. of construction forms in bridge/span*: 1

Form 1 of 1 for this Structure

Span 1 of 1

Photographs: Yes

Structure Owner: City of Edinburgh Council

All above ground elements inspected: Yes

No	Element Description	S	Ex	Def	W	P	Cost	Comments/Remarks
1	Aprons							
2	Invert/river bed	2	C	7 2	N			Several dislodged masonry stones from south abutment and south-west wingwall in river bed.
3a	Abutments (incl. arch springing)	4	D	7.1	Y	H	£1,000	1400mm x 600mm area of missing masonry at the base of the south abutment. Several masonry stones have been dislodged into the river bed
		4	D	3 6				
3b	Abutments (incl. arch springing)	2	C	5.1	N			North abutment 40% loss of pointing, cracked infill concrete surrounding service pipes, 150mm wide band of leachate
		2	D	3 2	N			South abutment Cracked concrete surrounding service pipes and leachate staining Moderate vegetation growth at the bearing area of the east main girder
4	Foundations	4	D	6 5				See section 3a
5	Pier/column/cutwaters							
6	River training works							
7	Batter paving							
8	Wing walls	2	D	3 2	N			North-west wingwall 75% obscured by vegetation North-east wingwall 50% obscured by overgrown vegetation 50% loss of pointing South-east wingwall 5mm separation between wingwall and abutment South-west wingwall Dislodged stone at base of wingwall (see section 3a & 4)
9	Embankments							
10	Primary deck element (Deck elements) (Table 2)	3	E	1.1	Y	L	£2,500	Pitting section loss to main girders throughout. Maximum loss measured at 4mm, typically at 1-2mm. Paint loss and surface corrosion/delamination particularly at the bottom flanges and at support.
		4	D	4.1				
11	Secondary deck element/s - Pressed trough deck	4	D	4.1	Y	M	£5,000	Severe loss of section and delamination affecting the majority of the trough deck. The metallic paint system has largely broken down.
		4	E	1 2				
12	Half Joints							
13	Spandrel wall							
14	Bearing plinth/shelf							
15	Bearings							
16	Cross-head/capping beam							
17	Drainage	2	D	8.1	N			1No. Drainage pipe at the south-west wingwall is misaligned with the wingwall face. Other drainage pipes at substructures appear functional.
		3	-	-	Y	M	£0	Open headed weep joint at south-west wingwall observed to be discharging sewage directly into watercourse
18	Vegetation	3	E	5 2	Y	L	£100	Vegetation obscuring inspection of north wingwalls
		2	B	5.1	N			Isolated vegetation growth at south bearing area of east main girder
19	Waterproofing	2	D	14.1, 14.2	Y	M	see 11	Waterproofing if present has failed throughout. Water ingress causing severe corrosion to pressed trough deck.
20	Movement/expansion joints							
21	Painting							See 10, 23 & 11
22	Copes							
23	Painting: parapets	4	C	4.1	Y	L	See 10	The metallic paint system is generally intact with normal weathering except at the north-east approach fence where the paint system has broken down along 60-70% of its length
24	Impact Damage							

25	Parapets	2	C	13.2	N			2No. railings at the north-east approach fence have buckled out of shape.
26	Surfacing / Footway / Verge	2	C	5.1	N			100mm band of minor vegetation along the deck edges along the full span
		2	C	9.4	N			Odd areas of minor cracking to the footway surface
27	Signs							
28	Lighting							
29	Services	2	B	1 3	Y	L	£100	The bolted connection at the bracket supporting 2No. service pipes from the deck has separated from the deck soffit by 10mm vertically
30	General Comments							
	Total						£8,700	
31	Primary Deck Element Form(Table G.4)							4
32	Primary Deck Element Material(Table G.6)							E
33	Secondary Deck Element Form(Table G.5)							25
34	Secondary Deck Element Material(Table G 6)							E
35	Deck Area (Span * Width)							Square Span = 4.100m Width =1.120m Area = 4 592m^2

S – severity, Ex – extent, Def – defect, W – work required, P – work priority

INSPECTOR'S COMMENTS

Name: **Signed:** **Date 03/07/2018**

ENGINEER'S COMMENTS

	The superstructure was found to be in fair condition with he exception of the trough deck which is in poor condition and requires repair. The substructure was found to be in fair condition with he exception of the south abutment which has undermined and has a significant area of missing stone at the base of the abutment which requires repair.

Name: **Signed:** **Date**

WORK REQUIRED

Ref No	Suggested Remedial Work	Priority	Estimated Cost	Action/Work Ordered
3a	Repair undermined section of south abutment	H	£1,000	
10	Blast clean + reapply paint system to all metallic elements comprising the structure	L	£2,500	
11	Feasibility study / repair of trough deck and installation of effective deck waterproofing system	M	£5,000	
17	Report discharge of sewage from open headed weep joint at south-west wingwall to SEPA	M	£0	
18	Remove vegetation at north wingwalls to faciliate wingwall inspection	L	£100	
29	Repair service support bracket connection with trough deck	L	£100	

Date Work Processed __/__/20__

Name _____ **Signed** _____

APPENDIX C – DEFECTS SCHEDULE

N

P38
P12
P35
P36
P2
P4
P15
P14
SERVICE PIPE
P9

WEST MAIN GIRDER

P18
P16
P17
5No. SERVICE PIPES BELOW DECK

1120mm FOOTWAY

P6
P11
P33
P3
P25 + 26
P39
P28
P29
P8
P27
P30
P7

4100mm CLEAR SPAN

P31
P22

EAST MAIN GIRDER

P24
P32
P34
P23
P21
P19
+ P20
P10

P5
P1

P37

KEY DIMENSIONS

CLEAR SPAN = 4100mm

FOOTWAY WIDTH = 1120mm

MIN CLEAR TO SERVICES = 1450mm

PARAPET HEIGHT = 1200mm

HY623-251 STENHOUSE MILL LANE BRIDGE

PLAN