APPENDIX 4-6

PRINCIPLE INSPECTION REPORT

Blackwater Bridge
(CL-R463-002.00)
Principal Inspection Report

MARK MURPHY CONSULTANCY

tli GROUP

Revision A

13th May 2024

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Clare County Council

Blackwater Bridge

(CL-R463-002.00)

Principal Inspection Report

Notice

Document History

Revision	Purpose and Description	Originated	Approved	Date
A	Information	M. Murphy	M. Murphy	13th May 2024

JOB NUMBER:	BR286
DOCUMENT REF:	BR286/02

TABLE OF CONTENTS

1. Introduction

MMConsult following instruction on the 26th April 2024 from Mr. Damien Browne, Senior Electrical Engineer, TLI Group, carried out a Principal Inspection of the structure.

TLI Group are planning on laying ducts and cabling over the bridge as part of the Lackareagh Wind Farm Grid Connection Scheme.

TLI also requested that MMConsult undertake a Structural Assessment of the bridge to determine the load carrying capacity of the arch barrel. The assessment has been undertaken and is included in Section 7 of this report.

The structure was inspected on the 7th May 2024. The inspection and inventory gathering of the structure was carried out in accordance with the following Eirspan Bridge Management Manuals:

- Eirspan Bridge Management System Manual No. 2: Inventory – Revision D, March 2017
- AM-STR-06054 Eirspan Bridge Management System Principal Inspection Manual – February 2017

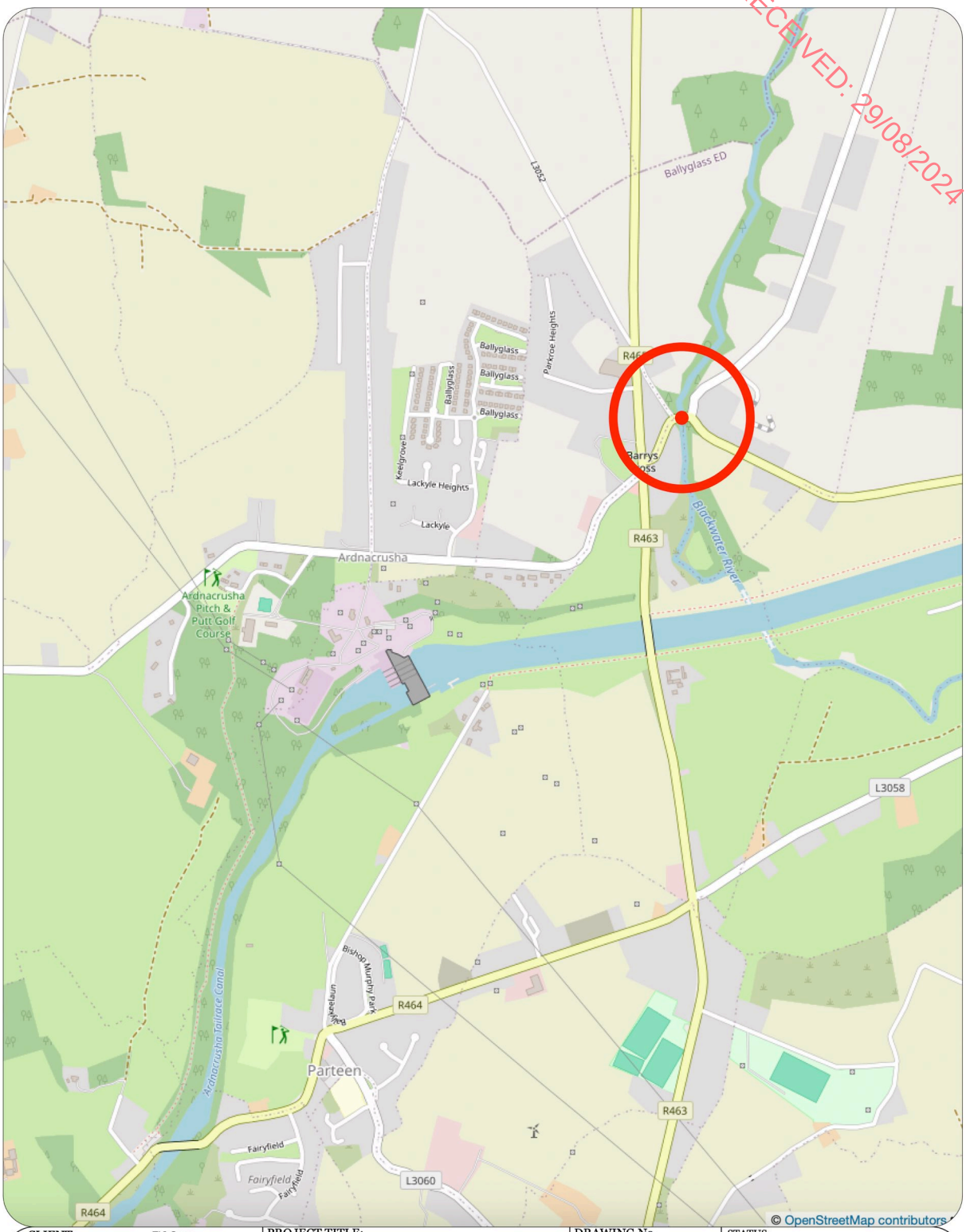
Note: The recommendations in this report do not constitute a design of remedial works. The recommendations given are for information purposes and to give an indication of the costs involved in restoring the structural integrity of the structure. The recommendations are based on the visual Principal Inspection.

2. Inspection Procedure

A non-intrusive visual inspection of the structure was undertaken in accordance with TII System Manual No. 3: Principal Inspection – Revision C, January 2008.

The position, extent and severity of all significant defects were noted. The key dimensions of the structure were also measured. Buried parts of the structure were not inspected. No materials testing or opening-up works were carried out as part of this inspection.

3. Location Map



CLIENT: tli GROUP TLI Group Unit 1, Borg Commercial Park, Monavalley, Tralee, Co. Kerry t: +353 66 71 35710	PROJECT TITLE: **BR286-01 Blackwater Bridge PI**	DRAWING No. SK01	STATUS: **INFORMATION**
CONSULTANT: MMConsult Bridge and Structural Engineers 18, Dealg Bán, Ladysbridge, Co. Cork t: +353 21 462 3515 e: info@mmconsult.ie	DRAWING TITLE: **Location Map**	This drawing is the property of Mark Murphy Consultancy Ltd. and no part of it may be reproduced, used or it's contents divulged without the prior written permission of Mark Murphy Consultancy Ltd.	**REVISION A**

Rev	Date	Description
A	13/05/24	ISSUED FOR INFORMATION

Fig. 1: Blackwater Bridge location map.

4. Inventory

General Information:

Structure Name:	Blackwater Bridge
Eirspan ID:	CL-R463-002.00
Date collected:	7th May 2024
Initials of Inspectors:	MM
Weather Conditions:	Overcast
Temperature:	12°C
Maintaining Agent:	CECC (Clare County Council)
Road ID:	R463
Road name:	R463
Co-ordinates (Irish Grid):	159410E 162426N
Year of construction:	Unknown
Year of reconstruction:	Unknown
Access equipment required:	None

Interested Parties:

Owner:	Clare County Council
Maintaining Authority:	Clare County Council
Inspection Consultant:	Mark Murphy Consultancy
Designer:	Unknown

Passages:

	Primary Passage	Secondary Passage
Type:	Regional Road	River
Name:	R463	Blackwater River
Direction	East -> West	North -> South

Superstructure:

	Principal type	Secondary type
Type of cross section:	Masonry Arch	N/A
Design of elevation:	Arch , one- span	N/A
Material:	Stone Masonry	N/A

Substructure:

	Abutments	Piers
Type:	Solid Wall, integrated wingwalls	N/A
Material:	Limestone	N/A
Foundation:	Unknown	N/A

Geometry of Structure:

Number of spans:	1
Min. span length:	12.22m
Max. span length:	12.22m
Overall length:	12.22m
Width of median:	N/A
Width of footway, left:	N/A
Width of footway, right:	N/A
Width of carriageway	4.20m
Width kerb-to-kerb:	5.10m
Width of soft verge, left:	N/A
Width of soft verge, right:	N/A
Width out-to-out:	5.86m
Minimum parapet height:	0.80m
Bridge curved:	No
Bridge Skew:	0°
Width of approach 1:	6.40m
Width of approach 2:	6.40m
Approach Skew 1:	75°
Approach Skew 2:	75°

Masonry Arch Geometry:

Arch Geometry	Span
Span	12.22m
Springing height above mudline:	0.40m
Rise of arch barrel at crown:	2.44m
Rise of arch barrel at quarter points:	1.64m
Thickness of arch barrel:	0.80m
Average depth of fill:	0.05m
Parapet thickness:	0.38m

Masonry Arch Material:

	Facing Stones	Arch barrel	Spandrel walls
Material:	Limestone	Limestone	Limestone
Stone:	Square	Square	Square
Average joint thickness:	10mm	10mm	10mm
Mortar strength:	Hard	Hard	Hard

Bridge Details:

Type of parapet:	Stone Masonry
Type of safety barrier:	Steel barrier on steel posts
Type of surfacing:	Surface Dressing
Type of expansion joints:	N/A
Fixed bearings on supports:	N/A
Free bearings on supports:	N/A
Fixed bearings in girders:	N/A
Free bearings in girders:	N/A
Technical installations:	O/H Eir line over at SW. Buried Eir at SE. Watermain

Assessment:

Design load:	Unknown
Load capacity:	40/44Tonne GVW
Assessment Consultant:	MMConsult
Load distribution class:	Distribution in two directions
Assessment standards used:	N/A

Additional Notes:

- Giant Hogweed present on riverbanks

5. Condition Rating Summary

#	Component	Condition Rating*	Cost of Works
1	Bridge Surface	2	€15,000
2	Expansion joints	-	-
3	Footway/median	-	-
4	Parapet/Safety Barrier	3	€3,500
5	Embankments/Revetments	1	€0
6	Spandrel Walls/Retaining Walls	1	€0
7	Abutments	1	€0
8	Piers	-	-
9	Bearings	-	-
10	Deck	1	€0
11	Beams/Girders/Transverse Beams	-	-
12	Riverbed	1	€0
13	Other Elements	-	-
14	Structure in General	1	€18,500

Condition Ratings from TII AM-STR-06054 Eirspan Bridge Management System Principal Inspection Manual – February 2017

0 No or insignificant damage.

1. Minor damage but no need of repair.

2 Some damage, repair needed when convenient. Component is still functioning as originally designed. Observe the condition development.

3 Significant damage, repair needed very soon. i.e. within next financial year

4 Damage is critical and it is necessary to execute repair works at once, or to carry out a detailed inspection to determine whether any rehabilitation works are required.

5 Ultimate damage. The component has failed or is in danger of total failure, possibly affecting the safety of traffic. It is necessary to implement emergency temporary repair work immediately or rehabilitation work without delay after the introduction of load limitation measures.

? Unknown.

- Does not exist.

6. Principal Inspection Summary

1. Bridge Surface:	Condition Rating: 2

Description of Damage:

The carriageway of the local road over the structure is in reasonable condition, it is somewhat worn. Vehicle tracking was noted. Potholes are beginning to form at the northeast corner. Traffic yields to ongoing traffic over this narrow bridge. The edges of the carriageway at the parapets are not sealed. Some minor debris and vegetation at the edges.

Cause of Damage: Wear and abrasion.

Recommended Repair Work:

- Resurface the bridge when convenient, including sealing of the edges;
  - Quantity of repair = 85m²
  - Estimated Cost of Repair = €15,000
  - Year of Repair = 2028

Photographs:

Photo P1: Bridge surfacing - general view looking east

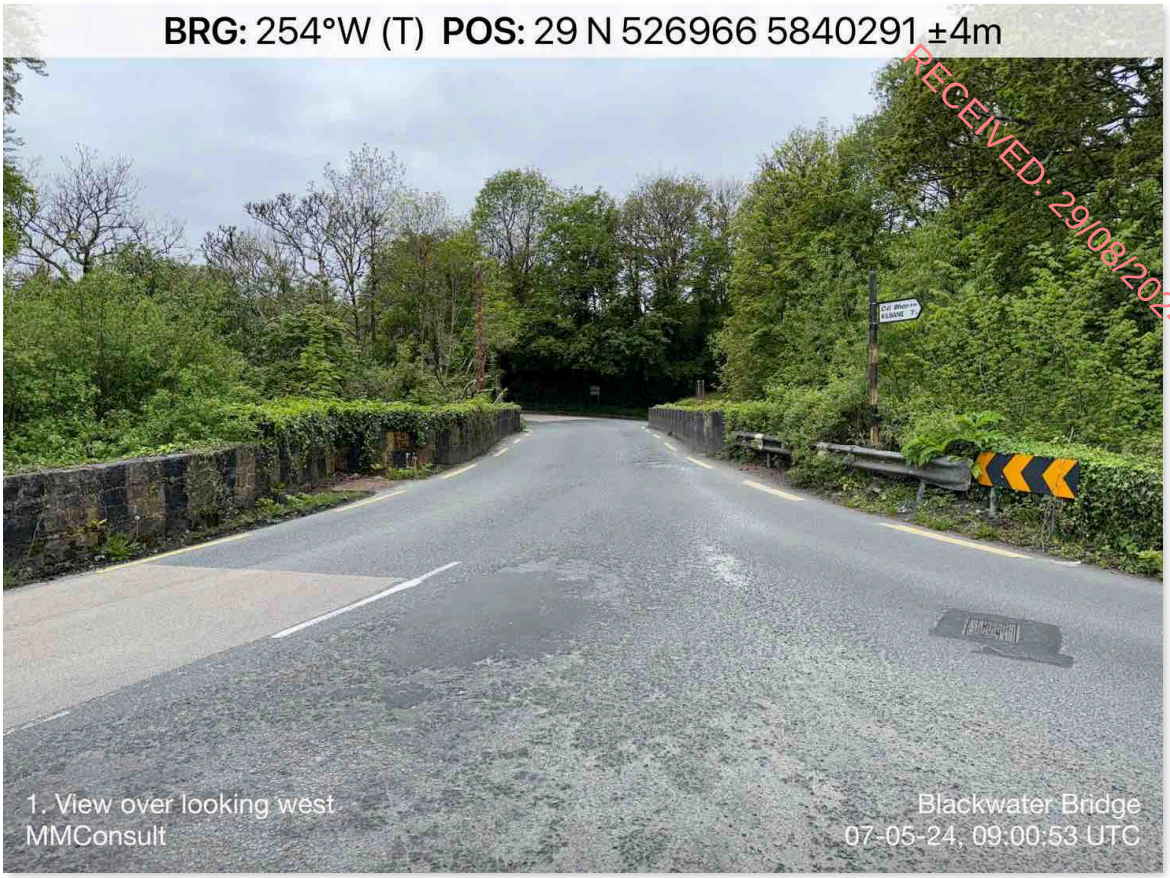


Photo P2: Bridge surfacing - general view looking west

Photo P3: Bridge surfacing - potholes forming at northeast corner

2. Expansion Joints:	Condition Rating: -

There are no expansion joints.

3. Footway/Median:	Condition Rating: -

There are no footpaths.

4. Parapet/Safety Barrier:	Condition Rating: 3

Description of Damage:

Both stone masonry parapets are heavily overgrown on the riverside faces but are largely in good solid condition. Cracked stonework was noted above the crown of the south parapet. There are isolated areas of stone and mortar loss evident.

There are steel road safety barriers at the northeast and northwest corners of the bridge. The north east barrier is loose and there is a non-vertical post to the northwest barrier.

Cause of Damage: Vehicle impact damage, vegetation growth and mortar deterioration.

Recommended Repair Work:

- Routine maintenance to remove/cut back all vegetation growth.

- Masonry repointing:
  - Quantity of repair = 12m^2
  - Estimated Cost of Repair = €1,500
  - Year of Repair = 2026

- Repair steel road safety barriers:
  - Quantity of repair = 8m
  - Estimated Cost of Repair = €2,000
  - Year of Repair = 2025

Photographs:

Photo P4: General view of north parapet

Photo P5: General view of south parapet

Photo P6: South parapet - some cracked stones above the crown

Photo P7: Northwest safety barrier, which is partly loose

5. Embankments/Revetments:	Condition Rating: 1

Description of Damage:

The embankments are heavily overgrown but in solid condition.

Cause of Damage: Vegetation growth

Recommended Work:

- Routine Maintenance to cut back excessive vegetation

Photographs:

Photo P8: View of northwest embankment

6. Spandrel Walls:	Condition Rating: 1

Description of Damage:

The cut-stone spandrel walls are heavily overgrown, the visible sections appear to be largely in good solid condition. We would recommend that all vegetation be removed and a comprehensive inspection of the large retaining/spandrel walls be undertaken.

Cause of Damage: Vegetation growth

Recommended Work:

- Routine maintenance to remove/cut back all vegetation growth. Reinspect walls.

Photographs:

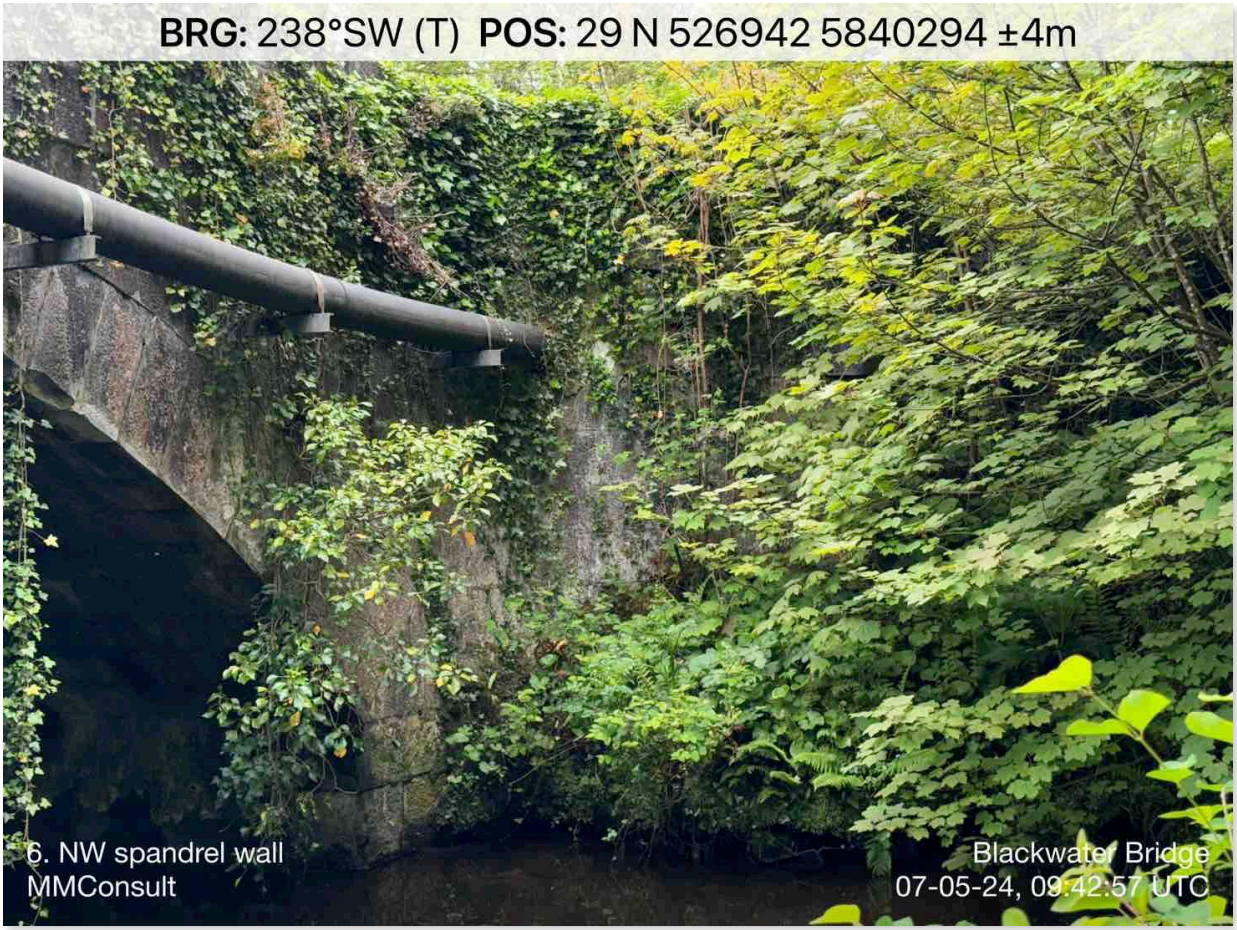


Photo P9: View of northwest spandrel wall extensively overgrown

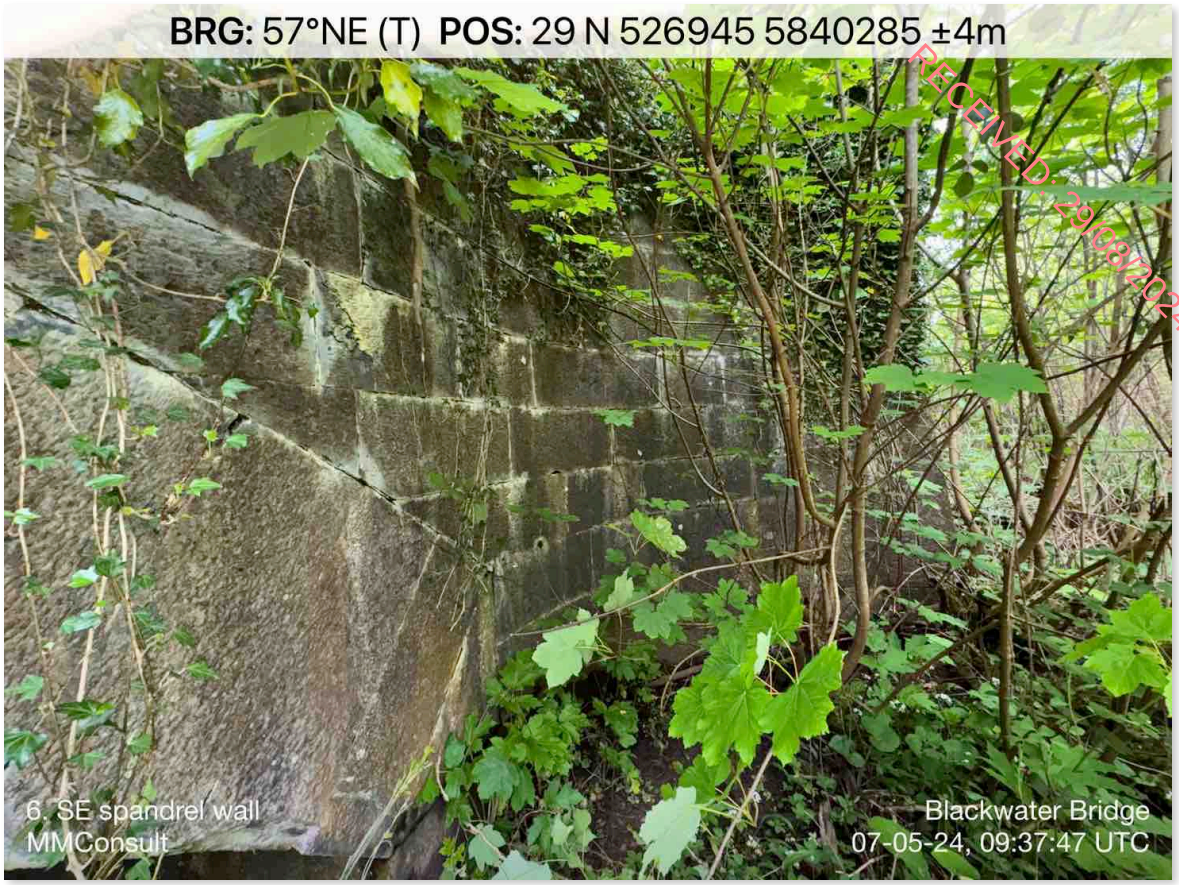


Photo P10: View of southeast spandrel wall noting vegetation

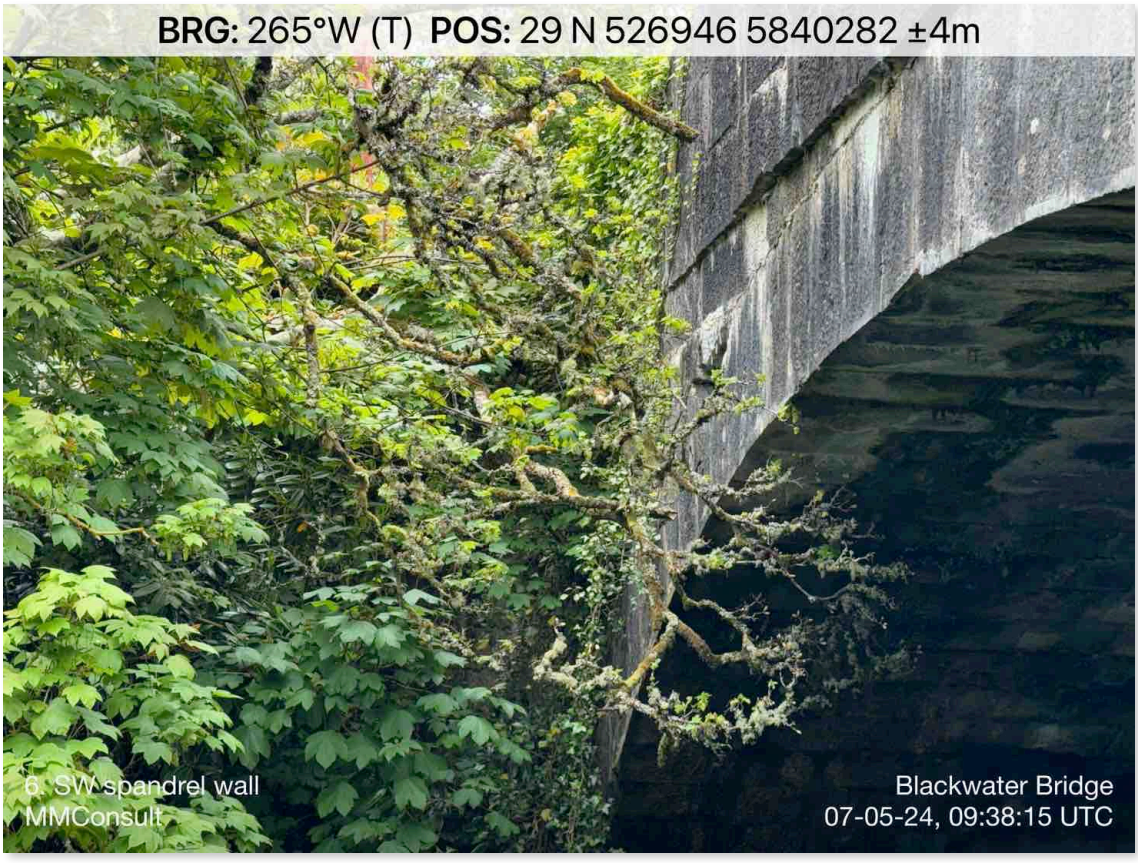


Photo P11: View of southwest spandrel wall

7. Abutments:	Condition Rating: 1

Description of Damage:

Both cut-stone abutments are in good solid condition, although heavily stained. There are minor areas of missing stonework and mortar.

Cause of Damage: Water penetration

Recommended Repair Work:

- None required at present

Photographs:

Photo P12: General view of the east abutment

Photo P13: General view of the west abutment

8. Piers:	Condition Rating: -

There are no piers associated with the structure.

9. Bearings	Condition Rating: -

There are no bearings associated with the structure.

10. Deck	Condition Rating: 1

Description of Damage:

The arch is largely in good condition. There is evidence of extensive water penetration in the form of calcite staining and stalactites. Some crushing of the stonework of the arch barrel was noted at the south end near the crown of the arch.

Cause of Damage: Localised excessive loading

Recommended Repair Work:

- None at this stage

Photographs:

Photo P14: General view of arch barrel from east side

Photo P15: General view of arch barrel from southeast corner

Photo P16: View of arch barrel separation from the spandrel wall at the crown at the south end

11. Beams/Girders/Transverse Beams	Condition Rating: -

There are no beams/girders/transverse beams associated with the structure.

12. Riverbed:	Condition Rating: 1

Description of Damage:

The riverbed is in good condition.

Cause of Damage: None

Recommended Repair Work:

- None

Photographs:

Photo P17: View of scour hole in riverbed below the bridge

13. Other Elements	Condition Rating: 1

Description of Damage:

There is a watermain strapped to the north spandrel wall and arch barrel. The bracket supports are in good condition

Cause of Damage: None

Recommended Repair Work:

- None

Photographs:

Photo P18: View of scour hole in riverbed below the bridge

14. Bridge Structure in General:	Condition Rating: 1

Summary:

The cut-stone bridge is largely in good solid condition. Extensive vegetation removal is required and some repair work to the surfacing, parapets and safety barrier is required.

For general views of the structure refer to photos P19 and P20.

Photographs:

Photo P19: General view of the structure - north elevation.

Photo P20: General view of the structure - south elevation.

7. Structural Assessment

An assessment of the arch structure was carried out in accordance with the TII Stage 1 Assessment of Road Bridges and Structures (AM-STR-06002-02) and the methods outlined in the UK Highways Agency Design Manual for Roads and Bridges (BA16/97 & BD21/01). The arch structure was assessed using the MEXE analysis.

The assessment found that the structure was capable of carrying the required 40T ALL (Assessment live Loading) and is deemed adequate in accordance with AM-STR-06002.

The assessment of the arch barrel was carried out using the modified MEXE method outlined in BA16/97.

Based on a visual inspection and the recommendations of BA16/97 Annex D, the following condition factors were used in the arch assessment are summarised in Table 5.1.

Condition Factors used in Arch Assessment		
Barrel Factor, F_b	1.0	Limestone
Fill Factor, F_f	0.8	Well compacted Material
Joint Width Factor, F_w	1.0	Joints widths up to 6mm
Mortar Factor, F_{mo}	1.0	Mortar in good condition
Joint Depth factor, F_d	0.9	Mortar loss was <12.5mm
Condition Factor, F_{cm}	1.0	Arch in good condition

Table 5.1: Condition Factors used in Arch Assessment

The live load capacity of the masonry arch structure using MEXE was determined to be 40/44 tonnes Gross Vehicle Weight (GVW). The road is flat therefore axle lift-off was not considered.

Assessed Capacity Using Mexe Method
40/44 tonnes

Table 5.2: Assessed Load Capacity using MEXE

BR286—Blackwater Bridge										Upperbound
					Span 1					
MEXE Analysis to BA 16/97										MMConsult Consulting Engineers
L =	12.22	r_c =	2.44	r_q =	1.64	d =	0.8	h+d =	0.81	
						Adjustment to limit h+d to 2*d not required			1	
						Calculations are based on an h+d value of			0.81	
F_b =	1.0	F_f =	0.8	F_w =	1.0	F_{mo} =	1.0	F_d =	0.9	F_{CM} = 1
Clause No:										
3.10)		Provisional Axle Load = $740(d+h)^2/L^{1.3}$ =					18.75	tonnes		
3.11)		Span/Rise Factor L/r_c =			5.01		Hence F_{sr} =		0.86	(Fig 3/3)
3.12)		Profile Factor $F_p = 2.3((r_c - r_q)/ r_c)^{0.6}$ =					1.00			
3.13)		Material Factor $F_m = ((F_b * d)+(F_f * h)) / (d+h)$ =						1.00		
3.16)		Joint Factor $F_j = F_w * F_d * F_{mo}$ =				0.90				
ICE		Modification Factor, Fmod =				1				
3.24)		Modified Axle Load = Fsr * Fp * Fm * Fj * FCM *Fmod* PAL =							14.4	tonnes
3.27)		Axle Lift-Off								
		(Fig 3/5a & 3/5b)						Af for 2 axle bogie =		1.00
	a)	Single Axle	A_f =		1.68		Allowable Axle =		24.0	tonnes
	b)	2 Axle bogie	A_f =		1.00		Allowable Axle =		14.0	tonnes
	c)	3 Axle bogie	Af =		0.75		Allowable Axle =		10.5	tonnes
	From Table 3/6 Max Gross Vehicle Weight =						40	tonnes		

Table 5.3: MEXE Analysis Output

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