GARRANE GREEN ENERGY LIMITED

Garrane Wind Farm,
Garrane, Charleville, Co. Limerick

Bridge Inspection Report

May 2024

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DOCUMENT APPROVAL

PROJECT	Carrane Wind Farm	
CLIENT / JOB NO	Garrane Green Energy Limited	6839
DOCUMENT TITLE/No.	Bridge Inspection Report	6839-JOD-00-XX-RP-S-001-P1

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Date 3rd May 2024	Signature	Signature	Signature

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1. Introduction

1.1. Terms of Reference

Jennings O'Donovan and Partners Ltd. (JOD) have been appointed by Garrane Green Energy Limited to undertake an inspection of an existing bridges along the L1537 local road which will form part of the haul route to the proposed Garrane Wind Farm in Co. Limerick. The location of the haul route bridge is indicated in Figure 3.1.

The JOD scope of works includes an inspection and structural assessment on the existing bridge in the L1537. This report contains information and comments relating to the structural condition and defects present at the time of an inspection carried out by JOD.

The reporting on the bridge follows the same format as set out in the document entitled 'Bridge Asset Management System for Regional and Local Roads', September 2019, developed by the Department of Transport, Tourism and Sport, that sets out Guidelines for;

- Identifying the location of the structure and recording its dimensions – The Bridge Inventory Survey (BIS);
- Assigning an initial rating to the structure – Maintenance Inspections (MI);
- Assigning Component Condition Ratings to individual structure elements (cCR's) and an overall Condition Rating to the Structure – Engineering Inspections (EI).

All naming conventions are as per the above guidelines.

The hydrology industry standard for river bank and abutment description has been adopted, i.e. the left-hand river bank (LHB) is always when the observer is facing downstream as indicated in Figure 1.2 below.

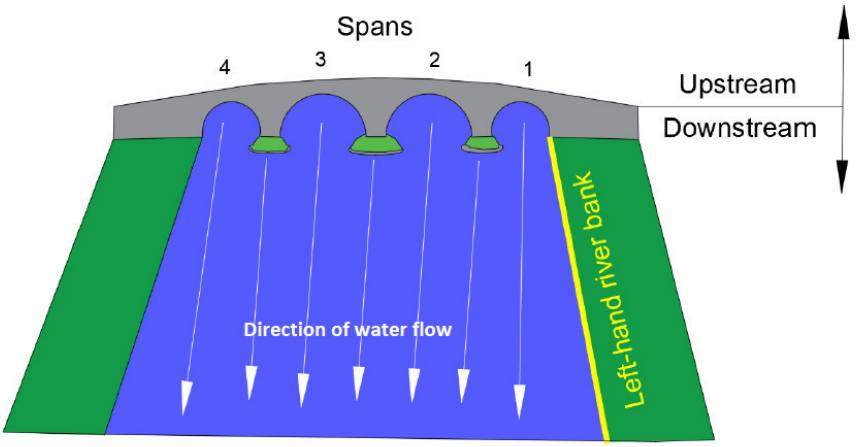

Figure 1.2 – River Bank and Abutment Description

Figures 1.3, 1.4, 1.5 and 1.6 below, are taken from the Guidelines noted above and to indicate the various dimensions referenced in this report.

Figure 1.3 – Total Span

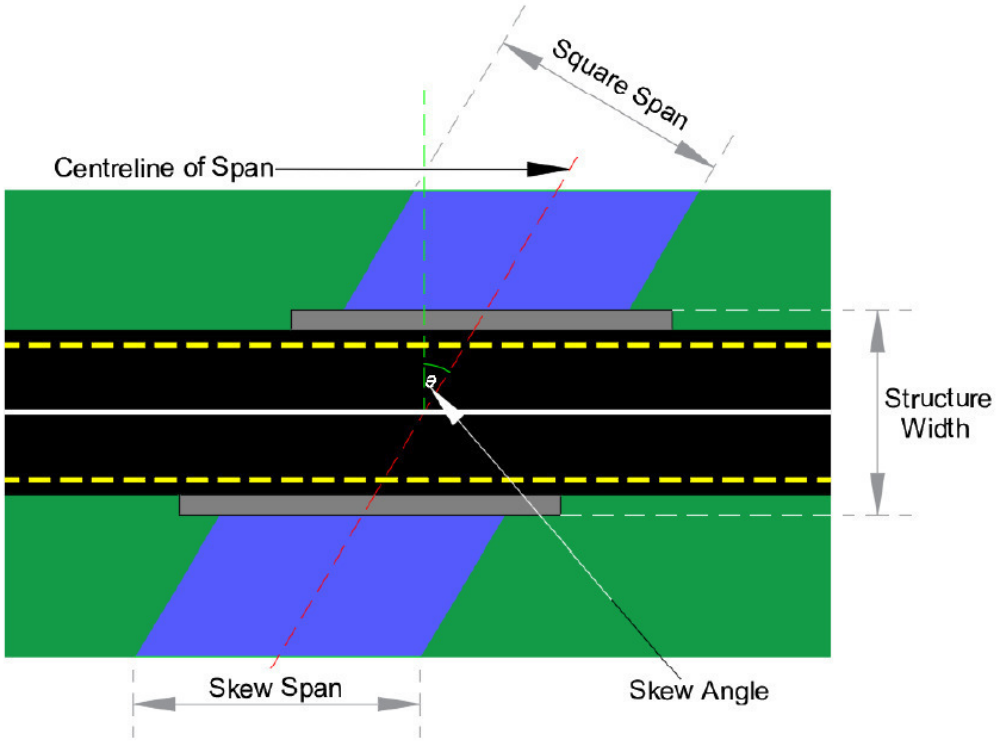

Figure 1.4 – Span, Width and Skew Angle

Figure 1.5 – Maximum and Minimum Span

Figure 1.6 – Overall Bridge Length

2. Structural Capacity Assessment

An assessment of the masonry arches has been carried out in accordance with BA 16/97: The Assessment of Highway Bridges and Structures. The assessment uses the modified MEXE method, detailed in Chapter 3 of BA 16/97, and uses the measurements taken on site.

The modified MEXE method determines the carrying capacity of masonry arches in terms of allowable axle weights. This method takes account of the materials, various defects and geometric proportions which affect the strength of the arch.

3. Bridge Inspection Procedures

John McElvaney and Alex White of JOD carried out a visual inspection of the bridge on the 17th of April 2024. Insofar as was practicable, the inspection included measurement of key dimensions and a record of the condition of the various elements of the structure. Full access was not available to carry out a close inspection of the abutments and arch of the main span. Safe access was not available to carry out a detailed inspection of the left hand side arch. It is assumed that its condition is similar to that of the right hand side arch.

A layout map showing the location of the bridge is provided in figure 3.1 below.

Figure 3.1 – Bridge Location

4. Crossing No. 1

4.1. Inspection Record

4.1.1. Stage 1 – Bridge Inventory Survey

Access Hazard	Steep banks, Deep water, fast moving water, vegetation	
Culvert	No	
Structure Type	Arch	
Location	Latitude: 52.397271	Longitude: -8.661568
Road Number	L1537	
Structure Number	Not available	
Structure Name (Alias)	Not available	
Structure Material	Masonry	
Number of Spans	3	
Total Span	17.7 m	
Maximum Span	7.2 m	
Minimum Span	3.0 m	
Structure Length	29.5 m	
Structure Width	6.0 m	
Principle Function	Public Road	
Structure Over	Watercourse (River Loobagh)	
Height of Opening	4.3 m	
Slew Angle	0°	
Height Restriction	No	
Weight Restriction	No	
Services Present	No	
Comments	2 no. dry arches an 1 no. main central arch. Upstream parapet wall 440 mm wide x 840 mm high. Downstream parapet wall 480 mm wide x 940 mm high. Main arch thickness = 470 mm. Secondary arch thickness = 430 mm. Road surface in good condition.	

4.1.2. Stage 2 – Maintenance Inspection

Maintenance Inspection Rating					
Main Element	**Red**	**Amber**	**Green**	**Not Applicable**	
Parapets		✓			**Non-Structural**
Access and Egress		✓			
Vegetation		✓			
External Walls		✓			**Structural**
Abutments and Piers		✓			
Deck or Arch		✓			
See Appendix 1 for explanation of rating system					

Maintenance Inspection Notes	
Parapets	Relatively good condition with some overgrowth.
Access and Egress	A steep narrow path provided access to the underside of the left hand side arch. This also gave close but not direct access to the main arch. Vegetation prevent access to the right hand side arch.
Vegetation	Left hand side of upstream parapet is overgrown. Tree growing in very close proximity to upstream side of right hand side arch. Minor vegetation on side walls and spandrel walls should be removed.
External Walls	Some open joints and vegetation were observed but otherwise in relatively good condition.
Abutments and Piers	Good condition. An in-situ concrete wall has been poured against the lower portions of all abutments and piers.
Deck or Arch	Some open joints and cracking in right hand side arch. Main arch is in good condition and appears to have received a shotcrete coating. Limited water ingress through the arch was noted.

4.1.3. Stage 3 – Engineering Inspection

	Component Condition Rating (cCR)				
	1	**2**	**3**	**4**	**5**
Component	**Insignificant Damage (VL)**	**Some Damage (L)** Repair when convenient	**Significant Damage (M)** Repair needed very soon	**Critical Damage (H)** Repair needed immediately. Consider load restriction/propping	**Ultimate Damage (U)** Bridge closure/lane restriction needed
Bridge Surface	✓				
Footpath, Verges, Rubbing Strips, Medians	✓				
Parapets and safety Rails	✓				
Embankment and Revetments	✓				
Wing Walls and Retaining Walls		✓			
Abutments (also see riverbed)		✓			
Piers (also see riverbed)		✓			
Spandrels		✓			
Arch Barrels and External Voussoirs		✓			
Beams / Girders	**N/A**				
Slab / Deck	**N/A**				
Riverbed		✓			
Bearings and Expansion Joints	**N/A**				
OVERALL BRIDGE CONDITION RATING	**1**	**2**	**3**	**4**	**5**
See Appendix 2 for explanation of rating system					

Engineering Inspection Notes		
1	Right Hand Side Arch	Circumferential joint at approx. 3 m from downstream end. This may be a result of an historic widening of the bridge. Recommend that the joint is repointed when appropriate.
2	Right Hand Side Arch	Some open joints and cracking observed. Recommend that these are repointed when appropriate. It is expected that the left hand side arch has similar issues.
3	Left Hand Side Arch Parapet	The upstream parapet is fully obscured by vegetation and could not be inspected.
4	Spandrel Walls	Some open joints and minor vegetation were observed.
5	Low Level Concrete Wall	Damage to lower level concrete wall was observed.

4.1.4. Photographic Record

Photo No. 4.1

General view of bridge facing south.

Photo No. 4.2

General view of main arch from upstream side.

Photo No. 4.3

Main arch from upstream side.

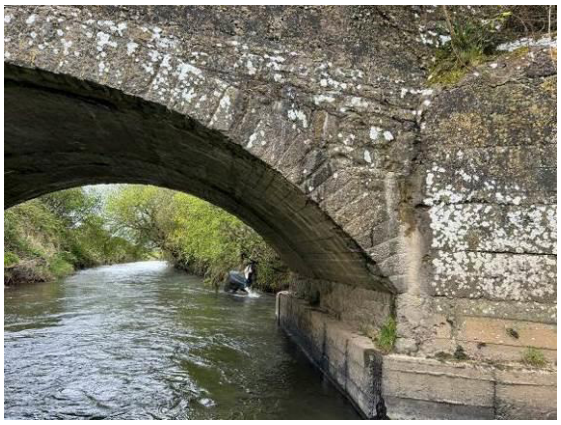

Photo No. 4.4

Main arch from upstream side

Photo No. 4.5

General view of main arch from downstream side.

Photo No. 4.6

Main arch soffit.

Note concrete surface to arch soffit.

Photo No. 4.7

Main arch soffit and voussoirs.

Photo No. 4.8

Downstream spandrel wall.

Photo No. 4.9

General view of upstream side of right hand side arch.

Photo No. 4.10

Upstream side of right hand side arch.

Photo No. 4.11

Upstream side of right hand side arch.

Photo No. 4.12

Downstream side of right hand side arch.

Photo No. 4.13

Downstream spandrel wall.

Photo No. 4.14

Joint in right hand side arch.

Photo No. 4.15

Joint in right hand side arch.

Photo No. 4.16

Open joints in right hand side arch.

Photo No. 4.17

Open joints in right hand side arch.

Photo No. 4.18

Pointed joints in right hand side arch.

Photo No. 4.19

Open joints in right hand side arch.

Photo No. 4.20

Crack in right hand side arch.

Photo No. 4.21

Abutment between main arch and right hand side arch.

Photo No. 4.22

Open joints in abutment.

Photo No. 4.23

Crack in concrete low level wall.

Photo No. 4.24

Vegetation on upstream side wall.

Photo No. 4.25

Vegetation on upstream side wall.

Note tree in close proximity to side wall.

Photo No. 4.26

View of left hand side arch from above.

Photo No. 4.27

General view of downstream parapet wall.

Photo No. 4.28

General view of downstream parapet wall

Photo No. 4.29

General view of downstream parapet wall.

Photo No. 4.30

General view of upstream parapet wall.

Note heavy vegetation.

4.2. Assessment by the MEXE Method

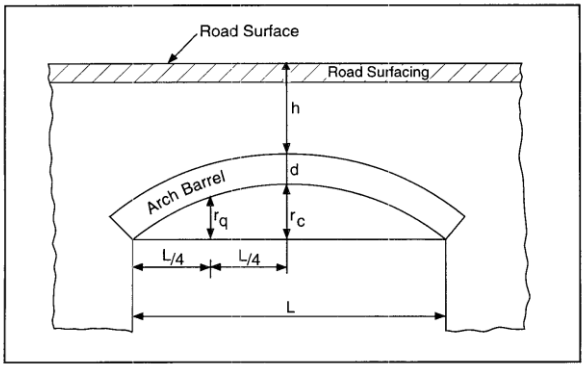

Figure 4.1 – Bridge dimensions for MEXE method

4.2.1. Central Arch

Arch dimensions used:

- Span L = 7.2 m
- Rise r_c = 1.8 m
- Rise at quarter points r_q = 1.45 m
- Thickness of arch barrel d = 0.47m
- Average depth of fill, h = 0.2 m

Provisional Axle Loading (PAL) (BA 3.10)

PAL = $[740 \times (d+h)^2] / L^{1.3}$ or 70 (whichever is less)

= $[740 \times (0.47+0.2)^2] / 7.2^{1.3}$ or 70 (whichever is less)

= 25.5 or 70 (whichever is less)

PAL = 25.5 tonnes

Modifying factors (NRA Design for Roads and Bridges – Assessment of Masonry Arch Bridges by the Modified MEXE Method):

- Span/rise = 7.2 / 1.8 = 4.0
- Span/Rise Factor (F_{sr}) = 1.0 (as actual span / rise is not greater than 4 – figure 3.3)
- Profile Factor (F_p) = $2.3[(r_c-r_q)/r_c]^{0.6}$
  = $2.3[(1.8-1.45)/1.8]^{0.6}$
  = 0.86

- Material Factor (F_m) = $[(F_b \times d) + (F_f \times h)]/(d + h)$

  Where:

- Barrel Factor (F_b) = 1.0 (Table 3.1)
- Fill Factor (F_f) = 0.7 (Table 3.2)

  Therefore:

- Material Factor (F_m) = $[(1.0 \times 0.47) + (0.7 \times 0.2)] / (0.47 + 0.2)$
  = 0.91

- Joint Factor (F_j) = $F_w \times F_d \times F_{mo}$

  Where:

- Width Factor (F_w) = 0.9 (Table 3.3)
- Mortar Factor (F_{mo}) = 0.9 (Table 3.4)
- Depth Factor (F_d) = 0.9 (Table 3.5)

  Therefore:

- Joint Factor (F_j) = 0.9 x 0.9 x 0.9
  = 0.73

- Condition factor (F_{cM}) = 0.9 (based on proven capacity and good condition)

- Axle Factors (A_f) = 0.95 (Figure 3.5a) (no axle lift off)

Modified Axle Loading = $F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times PAL \times A_f$

= 1.0 x 0.86 x 0.91 x 0.73 x 0.9 x 25.5 x 0.95

= **12.5 tonnes**

It should be noted that this carrying capacity is for this arch alone, and that the capacity of the full bridge is a combination of several other elements including fill materials buttresses and foundations. It should also be noted that this method can return quite variable results as the modifying factors are subjective. In particular the Condition Factor of 0.9 was taken in this instance due to the overall good condition and proven existing traffic capacity.

Due to the span and generally good condition of the arch, it is within the parameters of the MEXE calculation method. Accordingly, it is concluded that currently this arch can support the maximum axial load applied by movement of standard roadworthy vehicles.

4.2.2. Side Arches

Arch dimensions used:

- Span L = 3.0 m
- Rise r_c = 1.0 m
- Rise at quarter points r_q = 0.75 m
- Thickness of arch barrel d = 0.43m
- Average depth of fill, h = 0.1 m

Provisional Axle Loading (PAL) (BA 3.10)

PAL = $[740 \times (d+h)^2] / L^{1.3}$ or 70 (whichever is less)

= $[740 \times (0.43+0.1)^2] / 3.0^{1.3}$ or 70 (whichever is less)

= 49.8 or 70 (whichever is less)

PAL = 49.8 tonnes

Modifying factors (NRA Design for Roads and Bridges – Assessment of Masonry Arch Bridges by the Modified MEXE Method):

- Span/rise = 3.0 / 1.0 = 3.0
- Span/Rise Factor (F_{sr}) = 1.0 (as actual span / rise is not greater than 4 – figure 3.3)
- Profile Factor (F_p) = $2.3[(r_c-r_q)/r_c]^{0.6}$

  = $2.3[(1.0-0.75)/1.0]^{0.6}$

  = 1.0

- Material Factor (F_m) = $[(F_b \times d) + (F_f \times h)]/(d + h)$

  Where:

- Barrel Factor (F_b) = 1.0 (Table 3.1)
- Fill Factor (F_f) = 0.7 (Table 3.2)

Therefore:

- Material Factor (F_m) = [(1.0 x 0.43) + (0.7 x 0.1)] / (0.43 + 0.1)
  = 0.94

- Joint Factor (F_j) = F_w x F_d x F_{mo}

Where:

- Width Factor (F_w) = 0.8 (Table 3.3)
- Mortar Factor (F_{mo}) = 0.9 (Table 3.4)
- Depth Factor (F_d) = 0.8 (Table 3.5)

Therefore:

- Joint Factor (F_j) = 0.8 x 0.9 x 0.8
  = 0.58

- Condition factor (F_{cM}) = 0.5 (based on proven capacity and good condition)

- Axle Factors (A_f) = 1.0 (Figure 3.5a) (no axle lift off)

Modified Axle Loading = F_{sr} x F_p x F_m x F_j x F_{cM} x PAL x A_f

= 1.0 x 1.0 x 0.94 x 0.58 x 0.5 x 49.8 x 1.0

= **13.6 tonnes**

It should be noted that this carrying capacity is for this arch alone, and that the capacity of the full bridge is a combination of several other elements including fill materials buttresses and foundations. It should also be noted that this method can return quite variable results as the modifying factors are subjective. In particular the Condition Factor of 0.5 was taken in this instance due to the cracking observed in the arch and proven existing traffic capacity.

Due to the span and generally good condition of the arch, it is within the parameters of the MEXE calculation method. Accordingly, it is concluded that currently this arch can support the maximum axial load applied by movement of standard roadworthy vehicles.

4.3. Conclusions & Recommendations

In general, the triple arch bridge is currently in a relatively good structural condition. Our assessment indicates that the bridge is capable carrying the loads exerted on it by standard roadworthy vehicles.

The arch has not lost its shape and the joints appeared to be even. The underside of the main arch appears to be lined with concrete.

It was not possible to ascertain the condition or nature of the foundations or formation soils during the inspection. These however, appear to be performing adequately.

The Modified MEXE Method concludes an axle load capacity of 12.5 tonnes for the bridge in its current state. This assumes that there is no axle lift off.

Appendix 1

Maintenance Inspection Rating System

Main Element	RED	AMBER	GREEN	NOT APPLICABLE	
Parapets	Part or all of parapet or safety rail missing, collapsed or significantly displaced.	Some damage - nuts missing, corrosion, deformation, cracking, vegetation causing disturbance, tilting, sliding, missing masonry.	Minor defects or vegetation growth only.	**Select this if it is obvious the Structure never had a parapet.** If unsure, please select **RED**	Non-structural
Access and Egress	Dangerous high risk ***DO NOT ENTER***	Some hazards and risk. Risk assessment required.	Easy and safe.		
Vegetation	Heavy growth and/or Invasive species.	Appreciable growth clearance required, includes some Ivy, small saplings, brambles.	None or minor growth only.		
External walls	Significant cracks, bulging, leaning, rotation, missing masonry, or a collapse. Significant exposed reinforcement and/or corrosion.	Some cracks, bulging, leaning, rotation, minor missing masonry, exposed reinforcement, corrosion.	No evidence of or minor defects present.	Structure doesn't have external walls Or Couldn't access.	Structural
Abutments and Piers	Severe scour holes below walls, Significant areas of missing masonry or failure. Significant rusting of steel members, buckling or steel missing.	Some scour in bed, pier or abutment. cracks, leaning, bulging, missing stones, exposed reinforcement, or rusting of steel members.	Minor or no evidence of scour in bed. Minor or no evidence of defects in pier or abutment.	Couldn't access.	
Deck or Arch	Large cracks, severe sagging, spalling, deformation, missing elements, arch separation. Severely exposed reinforcement, corroded or missing steel on struts, ties, beams or failure. Holes.	Some: cracks, sagging, spalling, missing elements, exposed rebar or rusting of steel, struts, ties, beams or corrugated or other jack arch elements.	None or minor cracks, sagging, spalling, or any other minor defect.	Couldn't access.	
Overall Rating determined by worst rating of the three structural components					

Table 4.2 – Maintenance Inspection Rating Guide

Appendix 2

Component Condition Rating System

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Bridge Surface	No damage.	Minor surface issues, drainage issues, broken expansion joints.	Rutting, potholes, slight cracking, crazing, loss of skid resistance.	Large potholes, deep ruts, ravelling, depressions, severe loss of skid resistance. Structural deck/arch exposed.	Surface unsafe, structural deck/arch exposed with component breakdown, holes through superstructure. Road should be closed.
Footpath Verges rubbing strips Medians	No damage.	Small potholes, ruts, hairline cracks, porous verges, vegetation growth.	Potholes, cracking of surfacing, shrub growth, services exposed.	Large potholes, major depressions, paving bricks displaced or lifting and broken paving slabs, shrub and tree growth lifting elements.	Large pothole, hole through superstructure, footpath should be closed.
Parapets and Safety Rails	Minor loss of mortar in masonry. Some painting of railing required.	Minor stone issues, loss of mortar. Light vegetation growth. Painting of metal railing required.	Loose stones, loose mortar, slight leaning, tilting, bulging or impact damage. Bolts corroded, isolated vertical rail missing, safety barriers slightly damaged, visibility reduced due the vegetation growth.	Parts of masonry parapet missing, part of parapet collapsing. Heavy vegetation or shrub/tree growth - roots displacing walls. Missing railing, badly damaged safety rails, substantially reduced iron or steel cross-section through rusting.	Missing railing or parapet, danger of accident.

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Embankment and Revetments	Minor stone loss, light vegetation.	Some stone loss, vegetation growth at joints, significant mortar loss. Slight scour to base or at drainage outlets.	Embankment material starting to break down, isolated base displacements, shrubs growing, Scour evident. Minor flanking erosion. Masonry walling isolated stone loss.	Localised failure of slope and construction, masonry collapsing, Tree growth deforming structure, Major erosion at base or flanking. clear settlement/movement self-arching and breaches, rock armour moving away from base, base rotation, severe scour Road pavement failing.	Undermining of approach road, partial collapse of structure, road pavement collapsing.
Wingwalls and Retaining walls	Very minor bulging, leaning, cracking.	Minor: bulging, cracking, mortar loss, vegetation. Slight spalling of concrete. Slight rotting in crib walls.	Cracking, bulging, leaning, tilting, mortar loss, some stone loss. Shrubs and roots slightly moving stones. Spalling of concrete, exposure of reinforcement. Isolated timber member's failure, infill escaping.	Significant: leaning, bulging, cracking, impact damage (some parts broken off), sliding, heaving, undermining. Isolated stone work areas collapsing or falling off bulges and leaning walls. Isolated areas of crib walling, reinforced earth failing.	Extreme bulging, leaning, tilting, cracking, sliding. Partial collapse of any type of wall.

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Abutments (also see riverbed)	No cracks, loss of mortar. No concrete issues.	Minor cracking, loss of mortar, Small cracks in concrete, exposure of reinforcement.	Cracking, loss of mortar, isolated stones, displaced or missing stones. Very minor cracks in masonry. Exposed steel reinforcement, significant spalling and staining.	Large cracks, possibly separated into sections, substantial mortar loss, missing stonework, piping water, isolated stone areas failing, deformation and bulging, wash out of core. Corroded steel reinforcement, spalling, structural cracking.	Large Cracks separating sections, collapsed portions, missing concrete and totally corroded steel reinforcement.
Piers (also see riverbed)	No cracks, loss of mortar. No concrete issues.	Minor Cracking, loss of mortar, small exposed steel reinforcement slight cracking.	Cracking, significant loss of mortar, abrasion, missing isolated stones, movement, exposed steel reinforcement, significant spalling.	Large cracks, washed out joints, stone slippage, voids evident and water flowing through pier. Exposed partially corroded steel reinforcement, missing or failed areas of stone.	Large cracks causing separation of element, collapsed portions, self-spanning sections, missing concrete and totally corroded steel reinforcement exposed, deformation of section.
Spandrels	No cracks bulges, mortar loss.	Minor cracking, tilting, bulging, water egress, minor vegetation.	Cracking, bulging, leaning, sliding, mortar loss, substantial vegetation/shrub growth.	Extensive cracking, stone loss, rotation, substantial bulging, tilting, leaning with stones falling, sliding. Shrub and tree growth moving masonry.	Portions collapsing, extreme leaning bulging, compression failure, separation and articulation.

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Arch Barrels and External Voussoirs	No cracks, no loss of mortar, no distortion, no sagging.	Minor Cracking, loss of mortar. Small amount of exposed steel reinforcement (concrete arch).	Arch distortion, cracking (longitudinal, transverse, diagonal), loss of mortar, evident, slight slippage. Porous concrete, exposed reinforcement, staining.	Large cracks, multiple cracks, deformed arch including flattening and bulging, open joints little to no mortar present), stones displaced, slipping and or missing from intrados and or springings Large exposed areas of steel reinforcement(concrete) structural cracking.	Extreme cracking, and structure breaking into sections, sections of arch missing, heavily deformed/flattened arch, open transverse cracking. Heavily corroded main steel reinforcement (concrete arch) severe cracking.
Beams/ Girders	Very minor cracks in concrete. Paint rusting on steel girders and beams.	Minor cracks in concrete soffit and beam webs or reinforcement visible, metal beams showing rust and paint heavily flaking.	Cracks in concrete, minor concrete spalling, staining, some rebar exposed. Leaching. Extensive areas of beams without paint (protective coating), rusting steel work.	Concrete heavily spalling, structural main reinforcement rusting, evidence of structural distress at supports or midspan. Structural steel members losing cross-section due to extent of rust, distortion of members, rivets or welds breaking down.	Deflection of beams discernible, steel reinforcement heavily rusted and reduced in cross-section. Substantial structural cracking. Steel beams extensive corrosion and reducing load carrying capacity. Flanges and webs only partially existing.

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Slab/Deck	None or very minor cracks, no spalling in concrete. No rust.	Minor crack and slight evidence of concrete surface breakdown or carbonisation of concrete soffit walls. Paint missing on steel trough units Minor light rusting of steel or iron.	Cracks in concrete, porous concrete, minor concrete spalling some rebar exposed. Extensive areas of soffit without paint (protective coating), rusting steel work.	Concrete heavily spalling, structural main reinforcement rusting, evidence of structural distress, Structural steel work corroding through significant thickness of member, rivets or welds breaking down Composite decks: materials separating, some components in-effective.	Deflection of slab discernible, fracture in concrete, sagging, steel reinforcement heavily rusted and reduced in cross-section, substantial areas of spalling. Steel soffits suffering from extensive corrosion and reducing load carrying capacity. Failure of some components in composite decks.
Riverbed	No Erosion or scour evident.	Minor bed or bank erosion, minor scour evident. River bed below structure base. Bed protection showing minor issues.	Evidence of minor undermining of abutments, piers, cutwaters or training Bed protection showing isolated areas of failure: pitching stones missing, concrete portions missing.	Serious erosion and scour. Bed protection failed over a substantial area. Abutments, piers, cutwater etc. undermined and scour holes at piers visible, foundations exposed Masonry blocks missing and water seeping through the structure between spans.	Major erosion & scour. Substantial bed erosion, foundations exposed or partially missing. Piers deforming, tilting, suspended, partially missing Abutments only partially founded, structure redistributing load, cantilevering, failure imminent.

COMPONENT	RATING (cCR)				
	1	2	3	4	5
	Coarse Damage and Repair equivalence				
	Insignificant Damage (VL)	Some Damage (L) *Repair when convenient*	Significant Damage (M) *Repair needed very soon*	Critical Damage (H) *Repair needed immediately. Consider Load restriction/propping*	Ultimate Damage (U) *Bridge closure/lane restriction needed*
Bearings and Expansion Joint	No damage or insignificant. Clear any blocked associated drainage systems, if necessary.	Minor cracks in rubber. Steel components starting to rust. Water ponding evident on bearing shelf-etc. Surface cracks in joint in road.	Loose, cracked rubber pads. Steel components rusting. Surfacing starting to break up at expansion joints.	Rubber bearing pads delaminating or starting to break down. Steel bearings heavily rusted into steel components and bearing plinths. Damaged expansion joint, twisting, lifting, jammed, carriageway has large pot holes at joint, foot path broken up.	Bearing components excessively reduced in cross-section due to rust, bending, buckling of elements, nuts shearing. Road surface depressed or disintegrating: unsafe. Road should be closed.
Other Elements and Special features. Other elements may occasionally be present-the user can input descriptions of the component and its condition in the appropriate column. E.g. channel blockages.					
OVERALL BRIDGE CONDITION RATING (CR)	**1**	**2**	**3**	**4**	**5**

Table 5.3 – The Ratings Assistance Table