Background Information

Dunardry Bridge
Date 15/09/2025

The information below was requested by attendees at the online meeting held 28th July 2025, which related to the refurbishment of Dunardry Bridge.

Details of relevant funding streams

Association for Industrial Archeaology Restoration Grant
Grants of up to £30,000, which have to form a significant part of the total project cost (>20% of total spend).
https://industrial-archaeology.org/aia-awards/restoration-grants/

Historic Environment Scotland Historic Environment Grants Programme
Grant support not-for-profit organisations, grants available between £1,000 and £500,000.
https://www.historicenvironment.scot/grants-and-funding/our-grants/historic-environment-grants-programme/

National Lottery Heritage Grants
Funding for projects that connect people and communities to the national, regional and local heritage of the UK.
https://www.heritagefund.org.uk/funding

Guidance on how community-led groups can partner with Scottish Canals

A third party wishing to undertake work on our ground or within the canal environment is required to contact us at the beginning of their planning process. Scottish Canals have produced a code of practice which outlines our guidance on how we manage third party works.

Information relating to the code of practice and how to contact Third Party Works is available here: https://www.scottishcanals.co.uk/business-governance/business-opportunities-and-how-to-work-with-us/third-party-works

Background project documentation and records

The project page on the Scottish Canals website can be found here:
https://www.scottishcanals.co.uk/about-us/maintaining-and-developing-the-canals/our-projects/dunardrybridge

On this page, the Aecom Inspection and Refurbishment Options Report (November 2015) can be found. The report is appended to this document. Much has changed since the AECOM report was produced in 2015, particularly the costings contained in the document are now 10 years old and should be revisited to be brought up to date to inform project cost and potential grant applications.

Historical and contextual information

The bridge is located in Dunardy on the Crinan Canal. To the south of the bridge is the B841 road which runs between Cairnbaan and Crinan and a forested hillside. To the north is the tarred towpath, farm land and a nature reserve.

The canal is a Scheduled Ancient Monument, is classified as a Conservation Area and lies within the Knapdale National Scenic Area.

Dunardry Rolling Bridge (Bridge 8) is a rare example of a launching bridge on the canal network. The current bridge reputedly dates from 1900. It has overall dimensions 14.8m long x 3.8m wide; the internal deck width available is 2.7m.

The bridge carries a track over the Crinan Canal, crossing Lock 11.

The bridge comprises timber main beams and a timber decking system, which cantilevers beyond pairs of wheeled axles. Lattice tower and twin stay rod arrangements, rising some 2.5m above main beam level, relieve the timber beams.

The bridge is driven by the operator who stands on an attached platform, using a windlass on a gearing system fixed to the bridge.

Structural problems associated with the bridge's closure stem from the main timber beams showing numerous and extensive signs of wet rot allowing the steel rods to start to pull through the timber. The eastern main beam (MB3) was replaced in 1985 with a beam of incorrect section.

Works to temporarily strengthen this beam took place in 2008 and 2009, however longer term strengthen work is now required on the bridge. Any bridge repairs should match the existing aesthetics of the bridge, preserve as much of the existing ironmongery as possible and records kept during any repair work of the bridge construction.

A study produced by Scottish canals 'Dunardry Bridge Historical Background (2013)', is appended to this document.

Draft agenda for *Dunardry Day*

09:00–10:00: On-site meeting at Dunardry Bridge to assess condition and constraints.

10:30–13:00: Discussion session at the Egg Shed:

- Review of strategic options.
- Formation of a community-led working group.
- Assignment of roles and responsibilities.

13:00–13:30: Informal networking and meeting close.

Dunardry Rolling Bridge,

The Crinan Canal

Inspection and Refurbishment Options Report

November 2015

60270317

Prepared for: Scottish Canals

Prepared by: AECOM

REVISION SCHEDULE					
Rev	**Date**	**Details**	**Prepared by**	**Reviewed by**	**Approved by**
0	07 October 2015	Issued For Approval	Zoran Levi Senior Engineer	Graham McFarland Principal Engineer	Graham McFarland Principal Engineer
A	06 November 2015	Revised following comments from Client.	Zoran Levi Senior Engineer	Graham McFarland Principal Engineer	Graham McFarland Principal Engineer

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

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Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

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EXECUTIVE SUMMARY

Structural Assessment Of The Bridge In Its Current Condition

The bridge is not currently fit for pedestrian loads due to the poor condition of certain vital elements of the timber superstructure. The condition of these elements appears to be in such state that their replacement rather than repair should be more economically viable solution. Every time the bridge is currently opened or closed, damage is caused to the substructure elements that are built into the canal side. As these would be time consuming, expensive and difficult to replace, the bridge should not be used until remedial work is carried out on the superstructure. Should appropriate repairs be carried out, with damaged timbers replaced on a like-for-like basis, the current structure would be fit to carry pedestrian and cyclist loading.

(Refer Sections 3 & 4 for details)

Work Required To The Operating Mechanism

As a full examination would only be possible with significant elements of the superstructure removed for access, our examination was limited to the visible elements of the operating mechanism whilst the bridge was in-situ. We observed the lock-keeper operating the mechanism and noted deficiencies in the operation, and have suggested likely causes and solutions, which directly relate to repair works noted above.

As the structure is a Scheduled Monument, we highlight that any remedial work to the bridge, including the mechanism, will require agreement with the relevant authorities. Such discussions were outwith our scope.

(Refer Sections 2 & 3 for details)

Strength Of A Refurbished Bridge

Assuming that the bridge was refurbished for pedestrian and cyclist use only, and that damaged materials were replaced on a like-for-like basis, the repaired bridge would have a minimum safe load capacity of 1.5 tonnes.

(Refer Sub-Sections 3.6 & 4.2 for details)

1. INTRODUCTION

1.1 Project Description

Dunardry Rolling Bridge crosses the Crinan Canal in Argyll & Bute and is a rare example of a launching bridge on the canal network. The bridge reputedly dates from 1900 and is registered as a Scheduled Ancient Monument. The bridge crosses the Crinan Canal at Lock 11 and connects the B841 road with canal side properties and a local farm.

The bridge is overall 14.8m long and 3.8m wide. It carries a single track over the canal with an internal deck width of 2.6m. The bridge comprises timber main beams with a timber decking system which cantilevers beyond pairs of wheeled axles. A 2.5m high lattice tower supports each main beam using 22mm rod arrangements.

The bridge is currently closed to all traffic following an asset inspection undertaken in 2014 by Scottish Canals.

1.2 Scope of Work

AECOM Bridges have been asked to carry out an inspection for assessment of Dunardry Rolling Bridge and compile a report summarising the findings, along with consideration of the following requirements and criteria:

1. The remedial options including refurbishment and replacement of existing elements.
2. Refurbished elements to achieve a design life of 25 years. Any part of the structure unable to achieve this to be replaced.
3. For options of major like for like reconstruction the design life to be in excess of 60 years.
4. Minimum loading requirement to be considered is to allow the bridge to carry pedestrian and cycle traffic.
5. It is to be highlighted where current bridge design standards cannot be achieved or are likely to have a significant impact on the overall cost of the option.
6. It is a requirement that any bridge repairs match the existing aesthetics of the bridge, preserve as much of the existing ironmongery as possible and records kept during any repair work of the bridge construction.
7. Scheduled Monument Consent will be required for any works to the bridge.
8. Any repairs must blend into the existing fabric. This is a high profile project and will generate media interest both during refurbishment and at completion.
9. During repair work, it will be possible to remove the bridge from its position, lift and crane the bridge to a ‘workshop’ area for work to be carried out. The duration of bridge removal must not exceed 4 to 6 weeks.
10. Assessment AIP to be submitted for the bridge structure to the relevant Technical Approval Authority (assumed to be Scottish Canals).

This report presents a reduced scope of work. Due to the poor condition of the structure, no quantitative assessment is currently proposed, which is discussed further in this report.

1.3 Record Information

Record information was supplied by the Client, including the following documents:

- Inspection reports dated 1984 and 1989
- Principal Inspection reports dated 1999, 2005 and 2008
- Heritage Engineering Report dated 2004
- Mechanical Inspection Report dated 2014
- Temporary repair details dated 2008 and 2009
- Historic Inspection and works summary including various historic photographs

1.4 Inspections for Assessment of Dunardry Bridge

The inspection of the bridge was carried out on 8 September 2015. The weather was dry and cloudy with temperature of approximately 15°C. The inspection included a visual and dimensional survey of all accessible components of the bridge. In addition, accessible timber elements were tapped by hammer and where suspected probed for soft areas. The driving mechanism was visually inspected and monitored while driven by the canal operator.

2. INSPECTION OF STRUCTURAL COMPONENTS

2.1 Abutments and Substructure

The bridge is supported on the walls of the lock which are constructed in masonry and appear to be in good condition.

The bridge is launched from the south abutment end, where it is supported by a set of metal rails on timber sleepers which are built into the abutment. The rails appear to be in a fair condition showing signs of corrosion throughout although this appears to be mainly superficial. The timber sleepers appear to be in fair condition although a split was noted at the west end corner.

The north abutment is only loaded when the bridge is in its fully extended position. When extended, the bridge's end transverse beam sits on timber support wedges, which in turn are supported by large timber logs built in to the masonry lock wall at coping level.

The timber logs are in a poor condition. The western support is well seated within the masonry but has large cracks evident across its section. At the east support, the log is worn and undermined so that a large gap is visible between the bottom of the timber and the masonry. The top of the section has been worn or cut flat. The timber wedge supports are unevenly worn with the eastern timber wedge significantly more worn than the western one.

2.2 Superstructure

2.2.1 *Main Beams*

The bridge has 4 No main beams which (as in the previous reports) will be referred to as MB1 to MB4 looking from west to east. They are all 180mm wide by 350mm deep sections except MB3 which is 225mm deep with additional 75mm and 50mm thick timber sections on top, connected with a series of tie rods. The inspection history provided indicates that MB3 was previously replaced with these sections incorrectly, where a like for like replacement was intended.

In addition, a 260x90x35 PFC with 260x60mm infill timber was attached to the inside face of MB3 during the last bridge repair. Beams MB2 and MB3 run the full length of the bridge while beams MB1 and MB4 extend just beyond the lattice tower support providing stiffening and counterweight effect about the forward axle, which is located below the centres of the lattice tower.

The main beams are in poor condition exhibiting varying degree of timber decay. Beam MB3 appeared to be in a very poor condition and the outer face showed negligible resistance when probed. The inner face was not accessible due to the location of the PFC section.

Soft timber sections were found on MB4 and to a lesser extent on Beams MB1 and MB2. It was also noted that the decayed areas of timber were saturated with water. A tapping survey was carried out along the main beams and sections of possible hollow sound were observed particularly to the north ends of beams MB2 and MB1.

Beam MB4 appears to have a longitudinal crack in line with the connecting bolts. This crack was covered by a thick layer of paint making it difficult to determine the extent of the crack.

There were a number of areas where a significant loss of section and/or structural integrity was evident. These areas correspond to the locations of deterioration already identified by the last inspection report in 2008. Furthermore these areas are close or adjacent to decayed sections described above. This suggests that the degree of deterioration has increased since the last inspection.

All main beams are painted throughout which although serving as a protection may be also accelerating wet rot decay due to moisture retention.

2.2.2 *Transverse Beams*

There are 11 No transverse timber beams 150mm wide by 250mm deep (except the first one which is 250mm wide) suspended from the main beams by a system of cast iron bearing plates and tie rods. The end faces of the beams are painted including the top of the tie rods. The transverse beams appear to be in good condition however the access underneath the bridge was limited and only the end sections were accessible for inspection. Water marks including rust and algae stains were visible on the transverse beams. The front transverse beam which serves as a support when the bridge is fully extracted is showing signs of wear and tear with some delamination of the paint.

2.2.3 *Deck Planks*

The deck is made of 9 No 63mm thick timber planks with the width ranging from 260 – 300mm. The original planks were spanning the full length of the bridge deck while some later replacements were installed in sections. There is a bituminous strip covering the centre of the deck serving as a non-slip path for pedestrians and cyclists.

The planks are in fair condition for the age apart from the central ones covered with the strip which are showing signs of timber deterioration at various locations. The extent of deterioration appears to be higher under the strip as it prevents planks from drying. The planks are not jointed leaving gaps up to 10mm between them.

The deck planks are stiffened by 2.5 x 3/8" equal angles half way between the transverse timber beams. Similar to the transverse beams their inspection was limited due to restricted access. Localised corrosion of various degrees was noted throughout. It was evident that the majority of the connecting bolts were corroded due to lack of deck waterproofing and therefore allowing unrestricted water seepage between the deck planks.

2.2.4 *Bridge Ramp*

The ramp is hinge fixed to the main deck and operated with assistance of counterweights and pulleys. It is generally in poor condition. The locking system for retracted position appears to be surface corroded throughout. The ramp has deformed into a concave shape. This prevents the timber from meeting the concrete front end nosing to allow a smooth vehicle passage. The underside of the ramp was not accessible for inspection.

2.2.5 *Tower Truss and Tie Rods*

The twin lattice towers are made of metal equal angle sections with flat diagonal bracings. They are painted throughout and appear to be in good condition.

Tie rods are 22 – 24mm diameter round sections connecting the top of the lattice tower to the front end and the mid front span of the bridge with a twin rod arrangement to the back end of the bridge for each lattice tower. The front tie rods connect to the ends of transverse beams while the back tie rods are connected to steel brackets attached to the end of the main beams.

Tie rods are in good condition although it was noticed that the tightness and tension carried by them varies. The front tie rod at the east side connecting to beam MB3 is bent at the end, possibly from a boat impact.

The twin rods connecting to the back end bracket pass through the gap between the main beams. This is a dirt trap and in turn causes deterioration of the beams' inside faces at this location.

The paint protective system is generally in fair condition with some flaky areas at the top of the tower and some supporting members at the base.

2.2.6 *Bridge Parapets*

The parapets consist of steel equal angle posts attached to the deck at main beam - cross beam intersection with a top rail made of the same angle section. The remaining horizontal sections are two rows of infill wire. The parapets at both side of the deck appear to be in good condition.

2.2.7 *Bridge Operating Mechanism*

The gear wheels consist of a simple mechanism which drives railway type wheels by turning a windlass. The wheels and the gear mechanism appear to be in a fairly good order for its age although there is surface corrosion throughout.

During the inspection the bridge was fully extended, reaching the bearing position at the other side of the canal. It was noted that the bearing of the structure is concentrated on the east side of the bridge, where the bearing pad is visibly worn compared to the pad at the west side. At the time of the inspection the bridge operator highlighted that the gear wheel is rubbing against the slipper underneath the rail at the east side, adding additional friction and making it difficult to operate. A visible mark is present on the east face of the timber supporting the rail. The possible causes of this and potential remedial works are discussed in Section 3.

3. DISCUSSION

Based on the findings of this inspection, it is recommended that the bridge should remain out of service until repair or replacement works are undertaken. In order to re-commission the bridge for use by the general public the bridge will require extensive work. This will require the bridge to be temporarily removed from site.

3.1 Bridge substructure

The timber support sections are in fair to poor condition, particularly the supporting wedge at the east end. In order to achieve a minimum 25 service life these timber elements should be replaced.

3.2 Timber Components

For the majority of the deck timber components, replacement will make more economically viable solution than repair. A number of sections may superficially appear suitable for reuse however this should be confirmed by intrusive investigation followed by timber testing. Timber testing is generally expensive and even positive outcome would only provide limited lifetime which may still not satisfy a minimum 25 year service life requirement.

The main beams are in poor condition due to widespread timber deterioration. The level of deterioration varies from beam to beam. It is highlighted that the current paint system is broken at numerous locations, contributing to further deterioration and wet rot by trapping the moisture within the sections. Similarly, the existing antislip sheets attached to the deck planks act as a water trap and prevent the timbers from drying out, expediting deterioration.

The deterioration of beams MB3 and MB4 has advanced to the extent that any repair to the existing timber section would not be economically viable.

Once the deck is dismantled further close investigation will be required in order to determine whether beams MB1, MB2, deck planks and transverse beams are suitable for reuse.

3.3 Metal components

Most of the metal components should be viable for reuse with a paint system repaired or reinstated as applicable.

The tie rods supporting the deck are generally in good condition with some signs of broken paint system at isolated locations. The front tie rod connecting the front east corner is bent at the bottom, most likely from boat impact. The tie rods should be viable for reuse providing that repair of the assumed impact damage is carried out and the protective paint system reinstated.

It was noted that the tension between tie rods varies which could be caused by different factors. One reason for the difference in rods tension may be the partial loss of connections strength in the timber deck due to timber deterioration. Another contributing factor could be unequal load distribution due to the additional PFC section installed at the inside face of beam MB3. This steel PFC section is actually heavier than beam MB3 itself.

Transverse deck stiffener angle sections are showing various level of corrosion which suggests that a number of these may be available for reuse. A large number of connecting bolts were found to be corroded suggesting that most of these should be replaced.

Parapets on both sides of the bridge appear to be in good condition with some isolated areas of paint system showing signs of deterioration. The steel angle post and rail system does not provide adequate edge protection in accordance with current standards. It should be noted that the substandard parapet represents a risk and therefore a liability for the bridge authority. An alternative system could be investigated, but is unlikely that a new compliant parapet would meet the aesthetic requirements of Historic Scotland and may introduce structural problems as discussed further in Section 4.

3.4 Bridge Operation Mechanism

The rolling mechanism is generally in good condition although its paint protective system appears to have long gone and is showing corrosion throughout including the rails and wheels.

It has been reported by the bridge operator that the mechanism is difficult to operate and particularly at the final stage before it reaches the north support. Although the mechanism could not be inspected from underneath to eliminate other possible causes, the most likely cause of additional friction is the additional weight contributed by the PFC section installed along beam MB3. A clear mark of this friction is visible on the east face of the rail timber support. Furthermore, observing the moment when the bridge reaches the end of travel at the east corner, it is apparent that the bridge hits the supporting wedge low before stepping on and sliding into the final position. At the same time the wedge at the west side hardly supports the other corner of the bridge.

The above observations suggest that the whole superstructure is twisted and leaning to the east. This distortion is causing a series of problems such as difficulties in driving due to additional friction, uneven tension in the tie rods and excessive wear of the eastern bearing pad and even possible lift-off at the western bearing pad.

In order to restore balance to the bridge the steel PFC including the infilling plank along beam MB3 should be permanently removed. This should remove the existing problems associated with the use of the mechanism, twisting of the deck and uneven bearing on the northern supports. The bridge operating mechanism should also be closely inspected during the bridge repair. Due to simplicity of its mechanism it is unlikely that the foregoing problems should persist once the PFC section is removed and the weight of the bridge restored to its original alignment

Corrosion of the rolling mechanism appears to be superficial. A new paint protection system should be applied. Prior to this being applied, the mechanism should be checked for signs of superficial damage, such as broken cog teeth, with local repairs carried out as required.

The counterweight system which operates the ramp onto the bridge appears to be in a fair working order and could be reused with a repaired ramp as part of the bridge refurbishment.

3.5 Historic Repair Works

The inspection and maintenance history provided by Scottish Canals indicates that a number of repair works to the bridge have been previously undertaken. It would appear that these have potentially exacerbated the deterioration of the bridge.

The replacement of beam MB3 in 1985 was intended to be a like for like replacement, but instead, smaller sections were used and connected with a steel tie. The provision of three different sections instead of one solid section has potentially allowed more water ingress and can possibly account for the propogation of the particularly extensive wet rot in this beam. The installation of tie rods in order to try and ensure the composite action of these three sections has again provided a path for water to enter but not effectively dry out. Similarly the addition of a new PFC Steel section alongside beam MB3 involved drilling new holes in the beam, exposing the timber to more potential water ingress. The application of the paint system is also likely to have contributed to this. Although the application of paint to the timbers may be in part protective, when it is applied to timbers which are already wet it prevents the timbers from properly drying out and can therefore cause further wet rot.

3.6 Existing Capacity

Existing signage on the approaches to the bridge state that the safe load capacity is 1.5 tonnes. Records show that a quantitative assessment of the structure was undertaken in 2008. The principal inspection and assessment report indicates that this capacity was based on conservative timber strength (as the species and grade of the timbers in unknown) and including a condition factor for the poor condition of the bridge.

It is our opinion that it would not be appropriate to undertake another assessment of the existing structure in its current condition without further information about the strength of the materials and under the assumption that the members are restored to a more serviceable

condition. The circumstances under which the bridge could be assessed are included in Section 4.

4. OPTIONS FOR REFURBISHMENT

4.1 Option 1 – Do Nothing

- Bridge remains out of service and is not safe for use by the general public for vehicular access or access by pedestrians and cyclists, and is removed from site.
- Temporary bollards should be installed in front of the structure in order to prevent vehicular access.
- The alternate vehicle crossing, currently in use, is at Cairnbaan Bridge, while pedestrians are able to cross the canal at any of the waterway's lock gates.
- As a part of the Crinan Canal, the structure is designated as a scheduled monument. Historic Scotland should be consulted to clarify any consequences for permanent closure or removal of the bridge.
- If the bridge is removed from site, there will be no future maintenance requirements.
- If the bridge were to remain on site, measures should be put in place to ensure that it cannot be used and that its continued presence would not represent a health and safety risk.

4.2 Option 2 – Refurbish for Pedestrians and Cyclists

- The bridge should be temporarily removed from site and taken away for repairs.
- Replace the timber support components at the abutments
- The PFC Channel installed along beam MB3 and timber boarding should be removed.
- Main timber beams MB3 and MB4 should be replaced. Economic viability of timber repairs for beams MB1 and MB2 may be considered but would be unlikely to be cost effective and meet durability requirements. Like for like replacement of these members is recommended.
- Transverse beams should be closely inspected once the deck planks are removed and individually assessed for their reuse potential.
- Deck planks should be individually inspected and replaced where required. Economic viability of timber repairs for some deck planks may be considered but would be unlikely to be cost effective and meet durability requirements.
- All metalwork associated with the deck including lattice tower and tie rods should be inspected and reused unless extensive corrosion and loss of section are present. Metalwork should be repainted.
- Bridge driving mechanism should be reused after closer inspection confirms its viability. A new paint protection system will be required.
- The timber ramp deck planks and associated steelwork should be replaced. The counterweight system can be reused.
- Replace the timber log and wedge supports at the north abutment.
- Proposals for like for like replacement of required elements should be submitted for review by Historic Scotland.
- No structural analysis will be undertaken.

- Following refurbishment, the bridge can be reopened for pedestrian and cyclist use. Bollards should be installed in front of the structure to prevent use by vehicles.

- Service life will depend on the specification and treatment of the replacement timbers and paint system but is likely to exceed 25 years.

- Existing parapet system does not provide adequate edge protection to current standard BS EN 1317. The substandard parapet would remain as part of this option. Although this parapet is does not provide adequate edge protection for vehicles or pedestrians, the risks are lower for pedestrian use alone.

- New paint/timber treatment should be applied to new timbers and regularly maintained.

- A new antislip coating will be required to the timber deck planks.

- A programme of regular inspections for general maintenance should be implemented to ensure the continued functionality of the structure. A general inspection every 2 years followed by a more detailed inspection every 6 years is the current standard for highway bridges and would be recommended here.

4.3 Option 3 – Assess and Refurbish for Limited Vehicles

- The bridge should be temporarily removed from site and taken away for repairs.

- Inspection and replacement of structural members should be undertaken as per Option 2.

- Materials testing of the metalwork and timber (TRADA) if required should be undertaken to enable a structural assessment of the bridge to be carried out. Timber testing would not be required to the replaced bridge deck elements as the properties of any new material can be obtained from the supplier. The type and strength of ironmongery should also be determined.

- A structural assessment of the bridge to be undertaken to determine the capacity of the bridge for vehicles. This would be based on the existing arrangement and sections, but assuming that they are all in good condition. The assessment would be undertaken in accordance with current standards in accordance with the Department of Transport's Design Manual for Roads and Bridges. The assessment will result in an allowable load in terms of Gross Vehicle and Axle weight to be determined. A separate report would include details of the specific components which limit the bridge capacity.

- Proposals for like for like replacement of required elements should be submitted for review by Historic Scotland.

- The bridge can be reopened for limited vehicle use. The exact limitations and requirements would be established following the conclusion of the assessment.

- Service life will depend on the specification and treatment of the specified replacement timbers and paint system but is likely to exceed 25 years. It may be possible to achieve a 60 year service life with this option.

- A new antislip coating will be required to the timber deck planks.

- New signage would be required in order to ensure that any weight limit was adequately observed.

- Existing parapet system does not provide adequate edge protection to current standard BS EN 1317. The substandard parapet would remain as part of this option and therefore a liability for the bridge authority if any vehicle impact occurred.

- A programme of regular inspections for general maintenance should be implemented to ensure the continued functionality of the structure. A general inspection every 2 years followed by a more detailed inspection every 6 years is the current standard for highway bridges and would be recommended here.

4.4 Option 4 – Assess and Refurbish for Full Highway Loading

- The bridge should be restricted from use until a permanent design solution is agreed.
- Materials testing of the metalwork and timber if required should be undertaken to enable a structural assessment of the bridge to be carried out. Timber testing would not be required to the replaced bridge deck elements as the properties of the material can be obtained from the supplier.
- A structural assessment of the bridge to be undertaken to determine the capacity of the bridge for vehicles. The assessment would be undertaken in accordance with current standards in accordance with the Department of Transport's Design Manual for Roads and Bridges. The assessment will result in an allowable load in terms of Gross Vehicle and Axle weight to be determined. A separate report would include details of the specific components which limit the bridge capacity.
- Strengthening options which could be achieved without changing the appearance of the bridge would be investigated and presented in a report with a recommended solution.
- Refurbished bridge would be designed for current design standards which includes the Eurocode suite of design documentation.
- Reuse of the existing historical rolling mechanism would be the preferred option, but the limitations of this and potential strengthening options of this would be investigated and presented in the report.
- Detailed proposals for strengthening of required elements should be submitted for review and approval by Historic Scotland.
- The bridge is temporarily removed from site and taken away for repairs/strengthening.
- The bridge would be reopened with no traffic restrictions to achieve a design life of 60+ years.
- New compliant parapet system to BS EN 1317 would be proposed. This may prove difficult to achieve as the failure hierarchy requirements for the parapet design may require the parapet support elements of the structure (i.e. timber section) to be strengthened. Subsequently this may lead to problems with maintaining the existing appearance as well as increasing the weight of the bridge which in turn may affect the rolling mechanism.
- A programme of regular inspections for general maintenance should be implemented to ensure the continued functionality of the structure. A general inspection every 2 years followed by a more detailed inspection every 6 years is the current standard for highway bridges and would be recommended here.

4.5 Option 5 – Replace with new structure

- Detailed proposals for a new structure should be submitted for review and approval by Historic Scotland.
- New bridge would be designed for current design standards which includes the Eurocode suite of design documentation. New compliant parapet system to BS EN 1317 would be included.

- New opening mechanism would be proposed to allow passage for canal users.
- The bridge would be reopened with no traffic restrictions to achieve a design life of 120 years.
- A programme of regular inspections for general maintenance should be implemented to ensure the continued functionality of the structure. A general inspection every 2 years followed by a more detailed inspection every 6 years is the current standard for highway bridges and would be recommended here.

5. RECOMMENDATIONS

Option 5 would require early consultations with Historic Scotland to discover whether they would, in principle, accept a full replacement of the bridge with a different structural form. These consultations may exclude this option from further consideration.

Option 1 would result in the permanent removal of the bridge. This decision would require careful consultation with local residents and Historic Scotland, and is likely to depend of the local politics and stakeholder concerns. Although permanent decommissioning would remove all future costs associated with the bridge, it is considered that the cost of a like for like refurbishment as discussed in Options 2 and 3 would provide a good value solution for the medium term.

In order to facilitate the reopening of Dunardry Bridge, and from the stated Client requirements and criteria, it is therefore recommended that Option 3 be progressed. This will allow some vehicle access across the bridge for local residents whilst providing an extended service life and minimising changes to the aesthetics of the structure.

A programme of regular inspections and maintenance are recommended for any option in which the bridge continues to be in service.

All proposals for refurbishment should be submitted to Historic Scotland to obtain Scheduled Monument Consent.

ANNEX A

PHOTOGRAPHS

General view from east side


Decay timber of beam MB3 near back wheel

Decayed timber section in beam MB3

Deformed ramp section in raised position

Decayed deck section underneath non slip central strip

Front transverse beam showing distress. Timber sleeper split below the rail at the east end

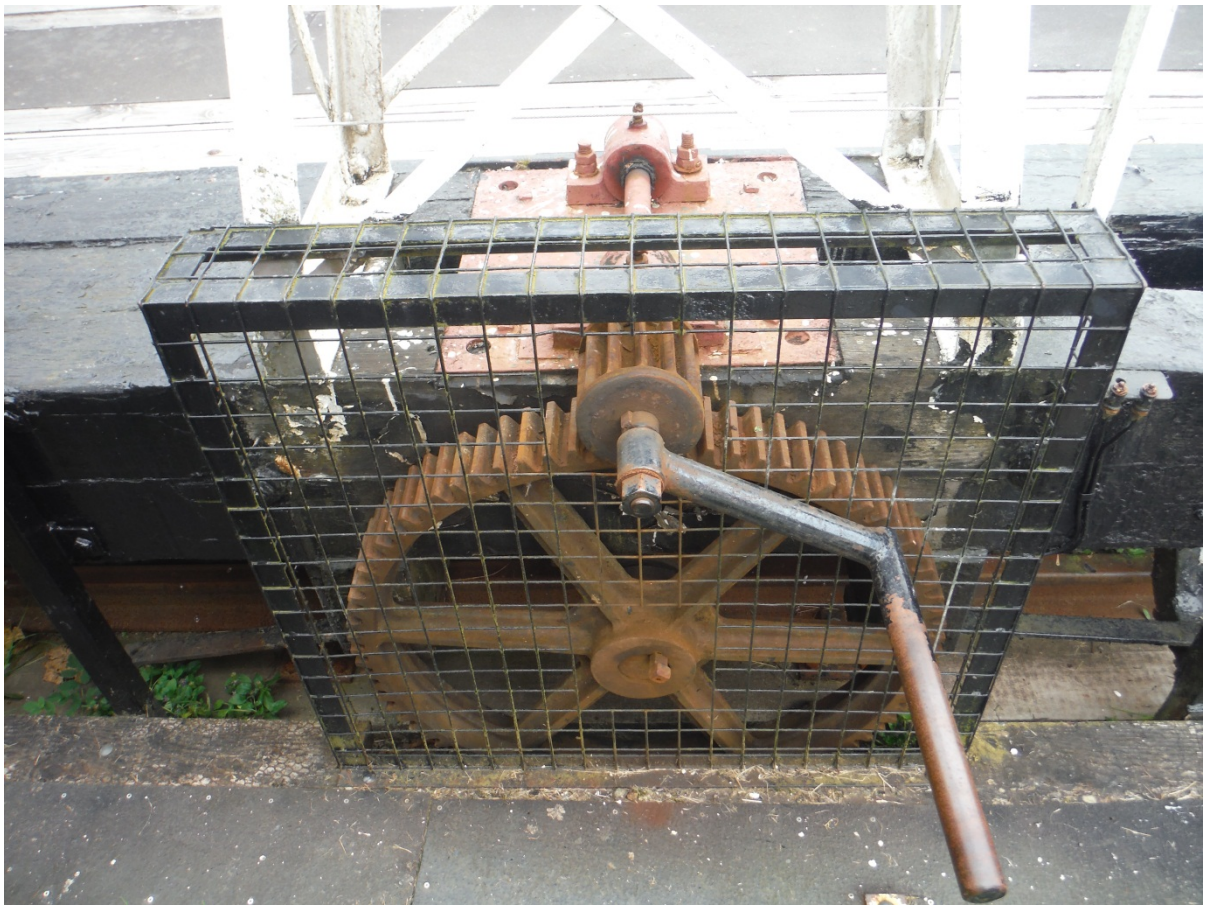
Decayed end of beam MB4

Loss of section at angle deck stiffener and corroded bolts

Transverse beam staining

Friction marks caused by driving mechanism along the timber sleeper east face

Uneven wear of timber supports and deteriorated timber ‘log’ supports at the north abutments



Rolling mechanism

Metal lattice tower

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DUNARDRY BRIDGE, LOCK 11, CRINAN CANAL Project ref: A00380

HISTORICAL BACKGROUND

27th June 2013

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1. INTRODUCTION

Dunardry Bridge spans the lock chamber of lock 11 of the Crinan Canal, approximately 2 km west of Cairnbann (NGR: 181995, 691206) and is a rare example of a cantilevered launching bridge, retracting from one side of the canal to the other to allow ships to pass through the lock chamber and vehicles to access the northern bank and Barnakill Farm from the main road to the south. It is the only known bridge of this type on any of the Scottish canals and few comparable structures are known anywhere else in the UK.

The following document has been prepared to inform the proposed program of works to refurbish the bridge, which is part of the scheduled monument 6500, Crinan Canal, Crinan to Cairnbann. The bridge is suffering from significant structural deterioration to several of its components and a major refurbishment is now required to prevent further deterioration and ensure the structures long term survival.

A basic description of the bridge has been included based upon an inspection carried out on the 28th of March 2013 along with a desk based historical assessment compiled from available cartographic, documentary and photographic evidence sources.

2. DESCRIPTION

The structure comprises eleven transverse timbers supporting two main longitudinal timber beams on each side which run from the north bank to the south along the full length of the bridge. A second pair of longitudinal beams set outside the line of the first, extend from the southern bank of the bridge to a point a little over halfway across.

Near the centre of the bridge pyramidal steel latticed towers rises from the tops of the main beams on each side. From the top of both towers two steel rods project diagonally downwards, north to the nose of the bridge and to one of the transverse timbers midway between the nose and the tower. Further steel rods arranged in pairs extend south from each tower to the rear of the bridge with an attachment to the underside of the main beams.

The bridge is decked with timber planks and at the southern end there is a hinged tail gate attached to a counter weight system which regulates the height of the tailgate while the bridge is extended and retracted. Along each edge a waist height safety rail formed in angle section steel runs from the nose for 5/6ths the length of the structure.

The bridge is operated by turning a small toothed gear attached midway along the exterior of the eastern side with a cranked handle from a wooden platform. Through a larger gear this turns two steel wheels on each side beneath the underside of the main beams moving the bridge either backwards or forwards along steel rails attached to sleepers on the southern bank. When fully extended the nose of the bridge rests upon the northern bank, where the approach is flanked by two curving masonry wing walls.

The timbers are coated in a thick black paint which has probably prevented evaporation of moisture and resulted in rot to the main beams. The steel components are predominantly painted white in line with the traditional two tone colour scheme of British Waterways.

3. HISTORICAL BACKGROUND

Throughout the 1890s the poor condition of the "old opening bridge" (1897, 9) at lock 11 is a repeated entry in the commissioners reports from the Crinan Canal, the bridges condition being apparently due to problems with the foundations upon which the lock was constructed (Cameron, 1978, 9). However lack of available money seems to have prevented the bridges repair or replacement for a decade.

In 1898 the intention to temporarily replace the swing bridge at Ardrishaig sea lock while repairs were carried out is reported in the annual summary (1898, 9) and it is believed that this temporary bridge was then moved to Dunardry in 1900. If this is the case then it might help to explain the unusual design of the bridge in comparison to the others on the canal, which are otherwise of swing design.

A photograph of the bridge taken in 1969 shows that its design is the same as that seen today, although before 1978 the main beams are painted white rather than black (Cameron, 1978, 9).

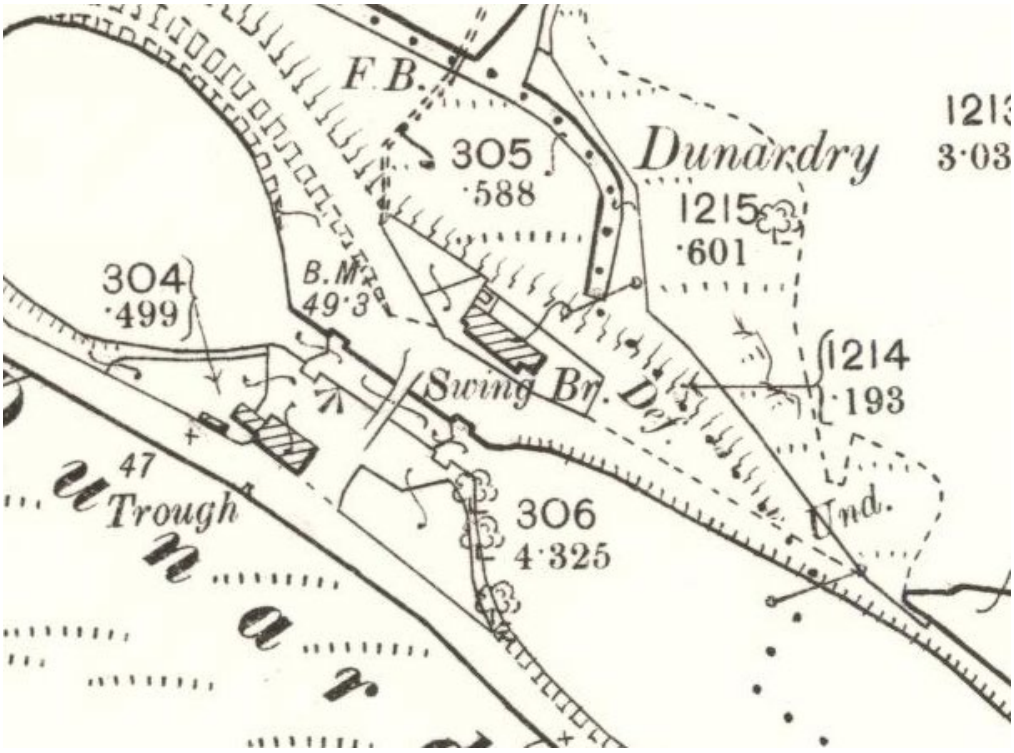
Our archives show that the bridge has seen piecemeal repair and replacement of its component parts since at least the late 1970s and although the basic design may remain largely unaltered it seems likely that this pattern of repair extends back throughout the 20th century.

4. RECOMMENDATIONS

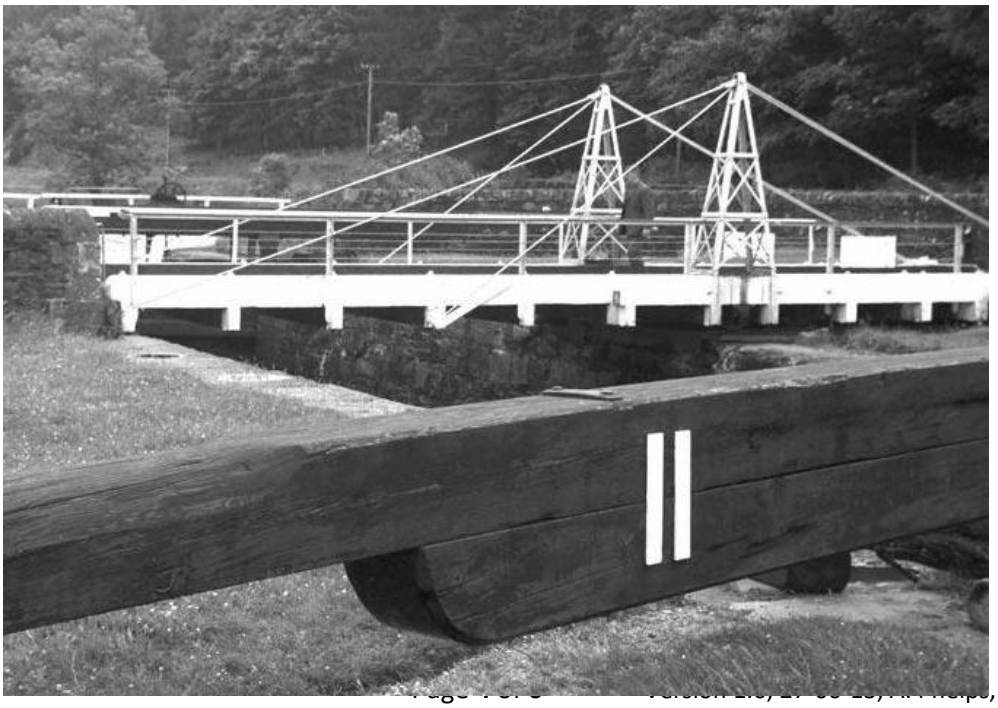
The Scottish Canals project manager should complete a Scoping Environmental Appraisal at this stage of the project development.

Dunardry Bridge from the north bank, facing south west, Scottish Canals, 28-3-13

Approaching Dunardry Bridge from the north, Scottish Canals, 28-3-13



Ordnance Survey 2nd edition 1899, (National Library of Scotland)



Dunardry Bridge, looking southeast, circa 1969, ©British Waterways, Licensor www.scran.ac.uk.

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