Bridge 42 – Grosmont North Yorkshire

Essential Maintenance Work- Bridge 42- Grosmont

Planning Application

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Author

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Section No 1: Introduction:

Proposed repair work to B42 at Grosmont

This Planning Application seeks consent for essential conservation-led repair works to Bridge 42 at Grosmont, a mid-19th-century railway bridge forming part of the operational North York Moors Heritage Railway.

Bridge 42 was constructed circa 1845 and carries two railway lines over the Murk–Esk watercourse. The bridge is a designated heritage asset of significant local historic and engineering value, contributing positively to the character and setting of the Grosmont Conservation Area and the wider National Park landscape.

The structure comprises:

- Two outer stone masonry arch rings, each formed from approximately 50 masonry blocks with a uniform ring thickness of 1400 mm; and
- A central single-span, segmental brick masonry arch, spanning 18.5 m with a mid-span rise of approximately 4.2 m. The brick arch has a ring thickness of 900 mm, constructed in seven layers and comprising approximately 30,000 bricks.

The effective overall bridge width is approximately 9000 mm.

A periodic structural inspection undertaken in December 2025 identified advanced deterioration to the central brick arch. As a result, the bridge was closed to rail traffic on safety grounds.

The proposed works are therefore necessary, proportionate and time-critical to prevent further deterioration, secure the historic fabric, and enable the continued use of the bridge for heritage railway operations.

The works have been specifically developed to follow the principles of minimum intervention, material compatibility and reversibility, ensuring that the historic character and significance of Bridge 42 are fully preserved.

Section No 2: Duration of the work:

The proposed works are anticipated to take approximately five months to complete and will be undertaken in two distinct stages:

Stage 1 – Underside Works

- Erection of temporary access scaffolding.
- Repair of the central brick arch from beneath the bridge.

Stage 2 – Topside Works

- Masonry repairs to the upper arch.
- Waterproofing of the arch barrel.
- Installation of effective drainage.
- Replacement of the two longitudinal tie rods on a like -for-like basis using nonferrous metals
- Resetting of displaced stone masonry

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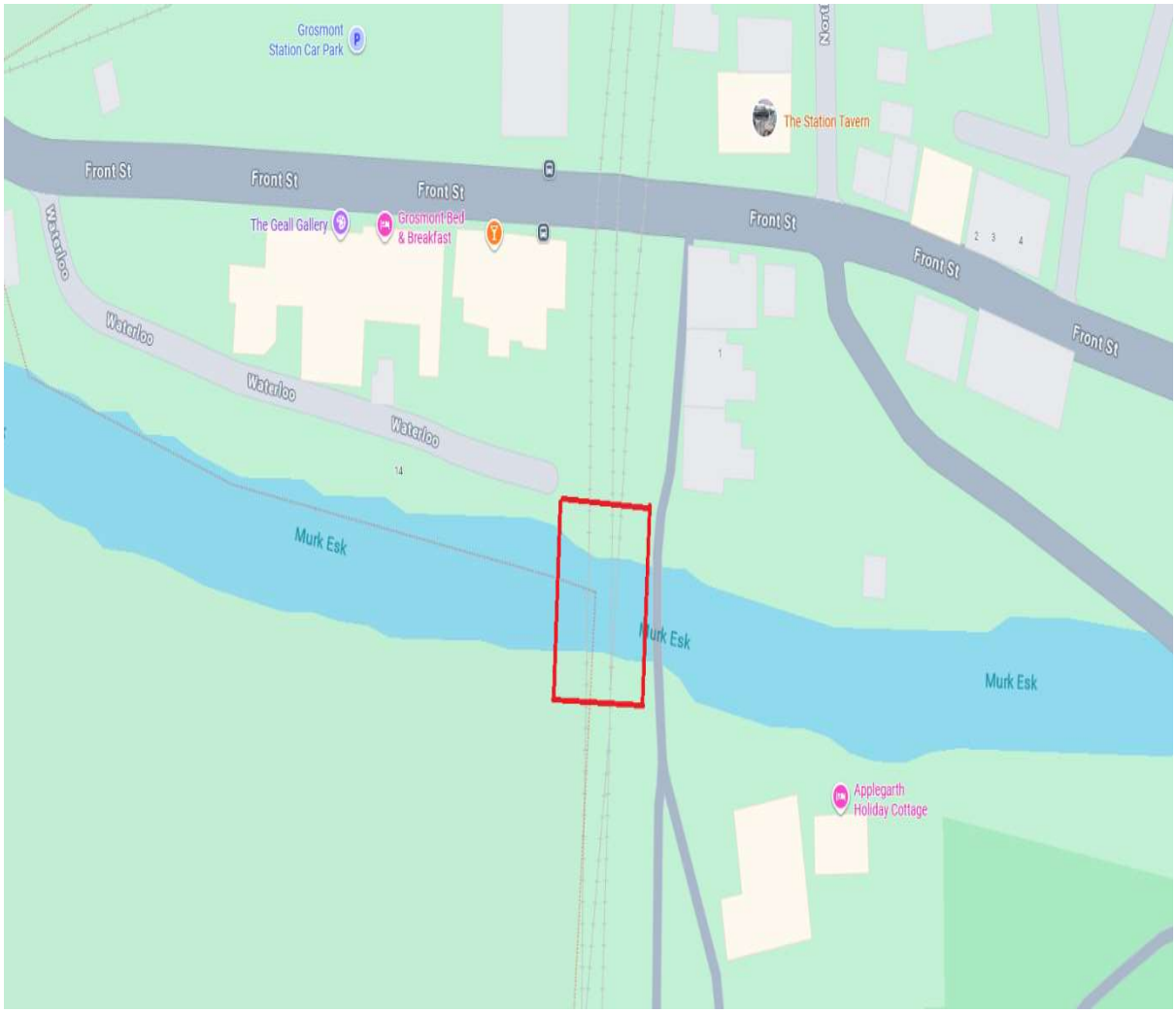
Section No 3: Location of the works:

Front Street - Grosmont – Whitby YO22 5QE

Specifically located at grid reference coordinates:
NZ 82805 05194
54°26′08″N , 000°43′30″W



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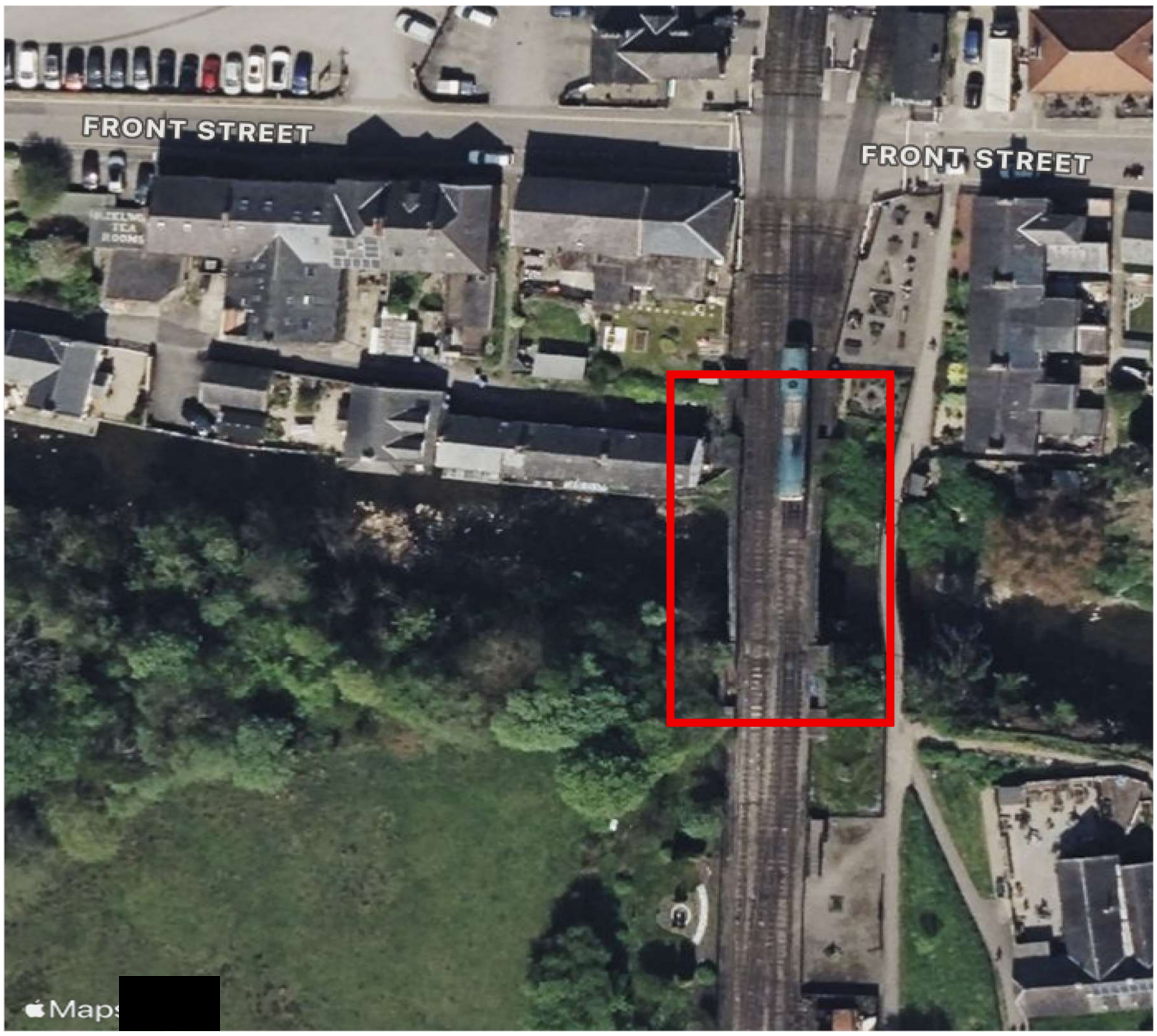

Section No 4: Project directory:

Organisation	Contract Details
North York Moors Railway Pickering Station, 28 Park St, Pickering YO18 7AJ	Luara Strangeway CEO 07780 115346 Phillip Sash Civil Engineer 07483 990436/07919 093914
GGP Consult Hull Head Office 2 Hallam Road Priory Park East Hull Hu4 7DY	Rob Galloway 01482 627963 robgalloway@ggpconsult.co.uk
North York Moors National Parks Authority The Old Vicarage Bondgate Helmsley York Y062 5BP	Annabel Longfield-Reeve Senior Heritage & Conservation Officer 01439- 772700 a.longfield-reeve@northyorkmoors.org.uk

Section No 5: The objective of the proposed work:

The proposed works have been developed with a clear focus on heritage conservation and public benefit. The key objectives are to:

- Conserve and safeguard the historic fabric and appearance of Bridge 42;
- Retain the bridge's original structural form and construction philosophy, with no alteration to its fundamental design;
- Address identified structural defects using proven, conservation-appropriate repair techniques;
- Prevent further deterioration by managing water ingress and groundwater saturation;
- Ensure the long-term structural integrity and safe operation of the bridge;
- Improve the appearance of the structure through sensitive vegetation removal
- Remove contaminated materials in a controlled and environmentally responsible manner;
- Secure the future use of the bridge as part of the North York Moors Heritage Railway, delivering ongoing cultural, educational and tourism benefits.

The scope of works is considered the minimum necessary to achieve these objectives and has been carefully designed to avoid harm to the significance of this heritage asset

Section No 6: Sequence of the proposed work

Stage 1

- Erection of temporary access scaffolding.
- Intrusive investigations to confirm the full extent of required repairs (GGP Consult).
- Finalisation of repair design and selection of appropriate standard details.
- Sequential implementation of repairs to avoid any risk of structural instability.
- Removal of vegetation and repointing where required
- Removal of all scaffolding on completion of underside works.

Stage 2

- Survey and capture of the existing Permanent Way (P-Way) and Signalling & Telecommunications (S&T) equipment.
- Removal of the Permanent Way and S&T equipment.
- Removal of contaminated ash ballast.
- Exposure, repair and waterproofing of the upper face of the brick arch.
- Resetting of displaced Stone Masonry
- Installation of an effective drainage system.
- Replacement of the two longitudinal tie rods on a like-for-like basis.
- Reinstatement of ballast using 35–60 mm grey granite ballast.
- Reinstatement of the P-Way and S&T equipment to their original line and level.

Section No 7: Temporary access scaffolding:

The works will require the erection of a substantial independent access scaffold. The scaffold will comprise a series of beams spanning longitudinally across the bridge above parapet level.

At each bearing point, the structure will be protected using foam and soft timber pattresses to prevent damage to the masonry. No drilling or fixings into the masonry arches will be required; the scaffold will be entirely free-standing.

All scaffold loading will be carefully assessed to ensure compatibility with the bridge's load-bearing capacity. Pedestrian access to the scaffold will be from within the bridge deck cross-section and will be isolated during and after each working shift.

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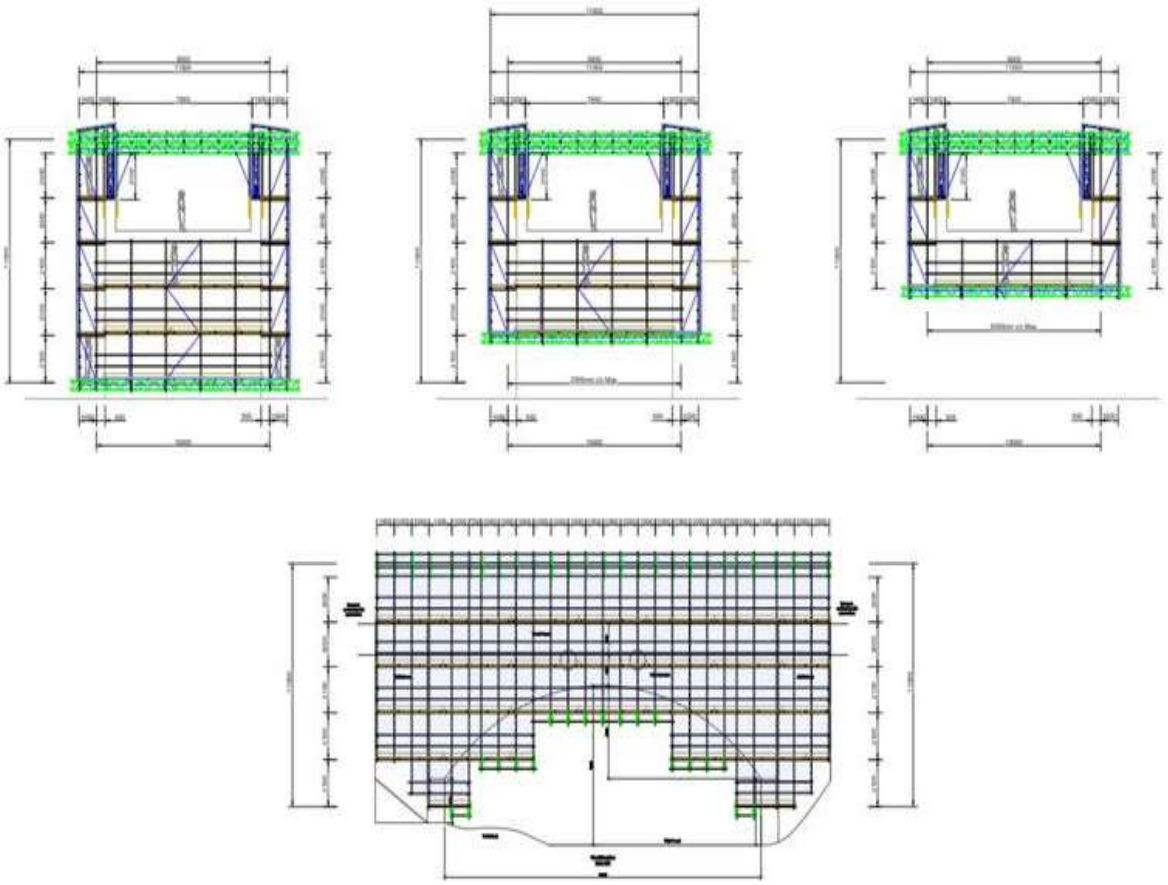
Fig 1 – Scaffold Elevation – Preliminary Design



Section No 9: Stage 1 masonry repairs

Each arch and every brick archway constructed are unique and therefore this arch will be carefully examined by a surveyor in stages to determine the best solution for any one area of this Brick Masonry Archway, the inspection being undertaken to recommend the best repair solution for that specific area being examined.

Please note the repair solutions chosen at one location may not be adopted uniformly across the entire arch and just be limited to a specific area based on the finding of the examination.

The 3 most common defects in a brick archway of this type are:

1. Hollow brickwork where an area of a ring separates from the other rings
2. Transverse fractures
3. Longitudinal fractures

As these defects are common and brick arches like this one exist in abundance all over the Uk Rail Network. Therefore, Network Rail have developed a series of standard details designed to resolve these 3 common defects listed.

Design Proposals are detailed on Drawings Ref:

- R11205-GGP-UBR-RLG-DR-C-101 A1 P01
- R11205-GGP-UBR-RLG-DR-C-102 A1 P01
- R11205-GGP-UBR-RLG-DR-C-103 A1 P01
- R11205-GGP-UBR-RLG-DR-C-104 A1 P02
- R11205-GGP-UBR-RLG-DR-C-105 A1 P01
- R11205-GGP-UBR-RLG-DR-C-106 A1 P02
- R11205-GGP-UBR-RLG-DR-C-107 A1 P02
- R11205-GGP-UBR-RLG-DR-C-108 A1 P02

- NR/CIV/SD/520, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

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Following a LIDAR Scan of the archway we have determined that the central brick Archway at B42 still retains its original profile and that no significant flattening of the archway has taken place.

Findings from the survey:

We have conducted a full review of the inspection report, and our advice remains to keep the bridge closed until repairs can be carried out.

The major defects are:

- Large areas of missing masonry (voids) across the barrel.
- Displaced masonry and a noted ~100 mm drop on the east elevation.
- Longitudinal cracking with widths 5–20 mm, including near the crown/arch ring.
- Widespread vegetation growth and water ingress throughout the arch

In essence the focus of the repair will be to resolve the above defects. The full extent of the defects and the work necessary to correct them will only be truly known once the access scaffold is erected and a throughout touch survey can be undertaken.

Underside of B42- Photo 1

This photograph shows that the outer layer of the archway has separated from the next inner layer and that areas of the outer skin are now missing.

Underside of B42- Photo 2

This photo shows that the original shape of the archway has been retained and that the archway needs re casting to reinstate the overall integrity of the archway.

Underside of B42- Photo 3

This photo shows the localised delamination of the archway layers at this location both layer 2 and 3 of the 6-layer masonry brick ring are exposed.

The proposed work to remedy each of the above defects has been widely used on similar Grade 2 Listed Bridges on the Birmingham Ship Canal and is also extensively across the entire Uk Rail Network including other Heritage Railways.

Hollow brickwork methodology:

- Temporary works in the form of sprung steel irons are placed following the profile of the Arch fixed in place using 12mm steel threaded stud anchored using injected resin and pull tested.
- The brickwork is broken out by mechanical means using battery operated breakers ensuring that no more than 1M2 is removed at any time.
- The area has all loose material removed and is then damped down to ensure good adhesion of the sand/cement/lime mortar (to allow movement) and new to old brickwork.
- The bricks are laid with each course held in place by a 50 x 50 timber lagging and forced back to the profile of the Arch with timber wedges.
- The process is then carried out on the next 1M2 patch until the affected area is repaired.
- The temporary works (irons & laggings) remain in place for 7 days until the repair strengthens and then these are removed.

Transverse fracture repair methodology:

- A transverse fracture is one that runs parallel from front to back and can be as little as 1 L/M or can stretch for the whole Arch. These are the more critical fractures as they can collapse as the integrity of the Arch is compromised.
- The fracture is repaired by cross stitching the fracture approximately 400mm centres at a 30-degree angle, not in a joint and as near to the centre of a brick as possible.
- The holes are blown out to remove any debris and the hole is filled with resin, this this ensures that any crevices, lack of muck or fissures are filled.
- When the resin has partially set (while still green), the hole is re-drilled and filled again. A twisted Heli-fix bar is wound into the hole and any excess resin is wiped clean.
- The final holes should overlap the end of the fracture by 2-300mm to deter further cracking.

Longitudinal fracture repair methodology:

- A Longitudinal fracture is one that simply runs from floor to floor or part thereof across the Arch and is not considered too critical to the integrity of the Arch as all it is doing is forming a construction joint and the Arch is still doing its job.
- The repair consists of removing any debris, damping down the joint, sand/cement/lime mortar filling the joint and introduce a date tab to show if the gap has widened when it is next examined.

Section No 10: Materials sympathetic to the structure:

All materials and methods will be selected to minimise environmental impact and ensure compatibility with the historic fabric of the bridge.

- Existing mortar will be sampled and analysed to replicate its composition and flexibility.
- Replacement bricks will closely match the original in appearance, size, compressive strength and frost resistance. Proposed the use of 3inch reclaimed engineering bricks as photo: Final physical sample to be provided.
- Stainless-steel helical reinforcement systems (Heli fix or equivalent) will be used only where necessary and will remain completely concealed.

The use of reinforcement will be minimised and omitted entirely where safe and appropriate alternative repair solutions can be implemented.

Repairs and strengthening are achieved by producing a composite action between the masonry and the system materials, ensuring the structural character of the bridge is completely maintained. Nothing of the Heli fix system will be visible.

The use of Heli fix will be reduced to the absolute minimum or deleted completely if a repair can be undertaken safely that allows for the omissions of this reinforcement method.

Section No 11: Hazardous materials

The existing track ballast comprises boiler ash contaminated with oil and human effluent. Waste Acceptance Criteria (WAC) testing will be undertaken by NYMR to determine appropriate disposal routes.

All contaminated material will be removed and disposed of at a licensed facility in accordance with the Hazardous Waste Regulations 2005. The Environment Agency will be notified and Waste Consignment Notes completed for each removal.

Section No 12: Stage2 upper arch work and ballast replacement

- Existing P-Way and S&T equipment will be photographed, labelled, surveyed using GNSS and recorded on CAD drawings.
- Equipment will be carefully removed and stored within the NYMR car park adjacent to the site.
- Existing cables will be supported and split-ducted as required, with troughing reinstated on completion.
- The arch crown will be exposed in stages to maintain stability, using small excavators or vacuum excavation techniques.
- Brickwork will be jet-washed and repointed, with all wastewaters collected and disposed of at a licensed facility.
- A waterproofing membrane (MDPE) will be installed over the arch barrel.
- Contaminated ash ballast will be replaced with clean granite ballast.
- Displaced stone segments will be reset

A longitudinal French drain will be installed on the south (tunnel) side of the bridge to intercept surface water and discharge into the river below not before passing through an inline interceptor.

The two existing steel tie rods will be replicated and replaced on a like-for-like basis.

Section No 13: Site welfare arrangements

This will consist of but not limited to:

Site Offices

Canteen

Toilets – both Male and Female

Drying Area

Steel Container Store

Electrical Generation Unit – Noise Supressed

Fenced Materials & Plant Holding area

Section No 14: Testing.

Samples of the mortar being used will be periodically tested

Calculations will be performed using limit ring or similar software to establish the arches load bearing capacity using Rail Specific loading models to confirm its adequacy against the loading level anticipated.

Section No 15: As built modification schedule

A comprehensive record of the all the work undertaken will be captured as the work progresses and will to be placed in the NYMR archive.

- As built drawings
- Photographic Records

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Bridge 42- Photo 4