

Technical Methodology

Project Title: Chepstow Underbridge
Client: Network Rail Infrastructure Ltd
Site: SWM2 141m 5ch
OS Grid Ref: ST 53953 94079



Scope of Work

Chepstow underbridge is a Grade II listed bridge originally designed by Brunel.

It comprises four simply supported spans carrying 2No. tracks of the South Wales Main lines between Newport and Gloucester over the River Wye at Chepstow

The structure has undergone extensive alterations in two stages with the steel construction seen today

- ▶ 1948: Land spans (2-4) re-constructed each comprise of a pair of parallel riveted steel half through decks (6 in total) with steel cross girders, rail bearers and deck plate.
- ▶ 1962: River Span (span 1) replaced with an inverted steel “Warren” truss pairs per track. Truss members are fully welded steel box-section girders, spliced to ease construction connected to one another using HSFG bolts.



The west substructure comprises masonry abutments and wing walls. The east end of the deck is supported on a reinforced concrete bearing shelf which is cast directly on the exposed rock face of the Wye Valley.

The project is steelwork repair and refurbishment driven by asset condition and the proposed works consist of:

- ▶ Steelwork repairs to maintain the allowed speeds on the railway RA8 (at 80mph) and heavy axle rating RA10 (at 40mph)
- ▶ Steelwork repairs to handrails, parapets and walkway panels on Span 1
- ▶ Mechanically preparation and paint of Spans 1 – 4
- ▶ Localised Waterproof injection of land spans (Spans 2-4)
- ▶ Masonry repairs to west abutment and wing walls (landward)
- ▶ Strengthening of west abutment (landward)
- ▶ Reconstruction of the east abutment ballast wall (landward)
- ▶ Replace downpipes/gutters on land spans (landward)
- ▶ Vegetation clearance within 3m of the structure

Construction Sequence & Methodology

Access Strategy and Enabling works

Access Establishment & Site Compound.

Access to the site is particularly constrained, the site is access via an existing access track to the south of the structure that is currently being used as access to a housing development adjacent to the bridge

The diagram below shows the proposed arrangement for the site establishment, we have visited site and have assessed that there will be insufficient room to safely set up welfare, blasting facilities, parking and safe access routes below the structure to ensure a safe and reliable area in which we can accommodate all facilities whilst still maintaining safe walking routes and segregation of people from plant.

We have therefore identified a separate area for the welfare and parking on land adjacent to the structure, there is some flexibility on which side of the structure this can be location but it is clear that, once all the scaffolding is in place, there will not be enough room below the bridge. Furthermore an exclusion zone will be established around the historic boat adjacent to the works.



Access through the compound area

During normal working hours, site accommodation shall be delivered, offloaded and commissioned. Use of HIAB equipped vehicle(s) shall be subject to a Lifting Plan & ALO plan and supervised by a competent person. It is proposed to locate the site welfare facilities and compound

The existing road access to the Network Rail compound will be improved with additional stone if required and Herras fencing will be erected to separate the compound to provide a segregated route to the adjacent signal box.

Welfare facilities shall comply with NR/L2/RSE/015 – The Provision of Welfare Facilities and will be established in accordance with the diagram below.

The scaffolding will also be erected to enable a space below to be used by vehicles, creating a clear 15mx10m opening as per the drawings.

For the works at Chepstow Underbridge our intention is to provide a static welfare facility that is suitable for up to 10 operatives. The office and associated welfare facilities will be arranged neatly within the site compound to utilise the space available.

Our site set up will comprise of the following:

- ▶ 32ft Office
- ▶ Satellite Decontamination unit
- ▶ Meeting Room
- ▶ 3 + 1 WC Block
- ▶ Mess and Drying Room
- ▶ Silenced generator (using HVO fuel and battery back-up) and Stores

All AmcoGiffen sites aim to set up with minimal environmental impact in accordance with necessary licenses, consents and approvals.

Establish site compounds and fencing to areas

Land access will be agreed by NR in advance of us going to site.

The cabins will be delivered to site and will be sited as per the previous plan. The proposed compound areas will be fenced off with suitable fencing. The cabins will be separate cabins and welfare facilities with remote generator and septic tanks. The electrical installation will be tested and certified. The welfare will consist of branded vandal proof cabins, including drying room, mess and WC. Secure stores will also be places at site.

Remote CCTV security systems will be installed to ensure the security of the site during the works.

Confirm service locations

Prior to the works a visual check will be undertake to verify all serviced information against the physical conditions on site. The site team will use Cable Detectors with signal generators to find any buried services once vegetation has been removed. The information will be checked against the design to ensure that firstly, the works can be carried out without a clash and secondly that the work can be done safely with room around the services for adequate trench support

De-veg and survey structure

Operatives using strimmer's will remove any vegetation local to the piers and will provide a cleared area 3m around the existing supports.

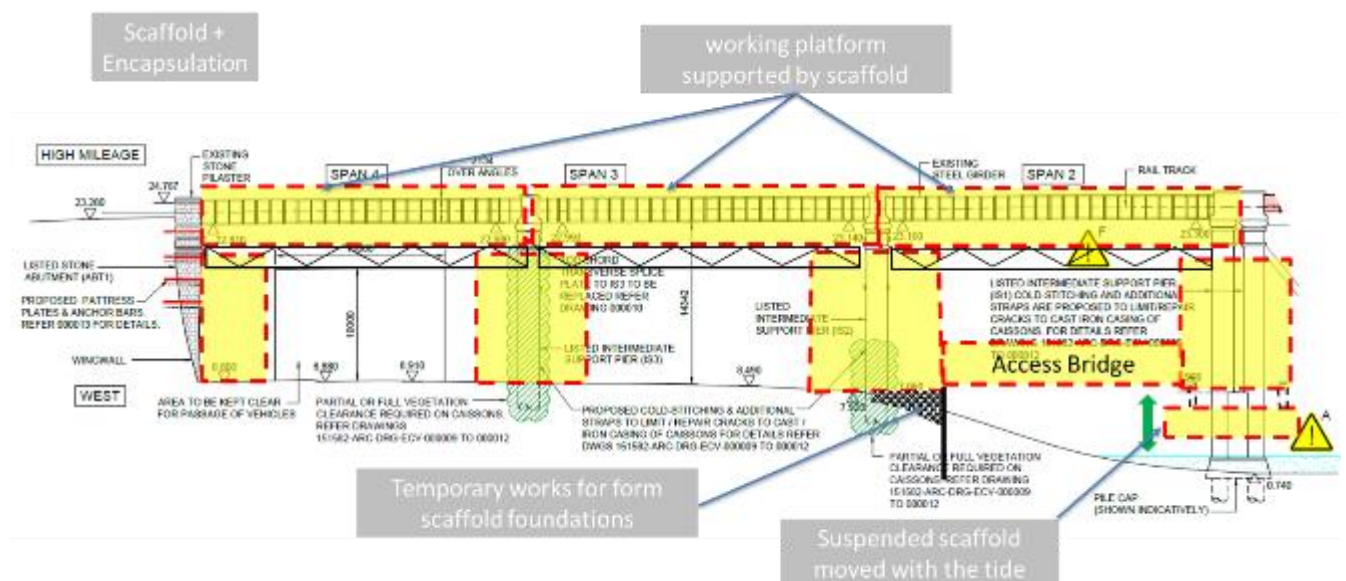
Establish temporary boundary within 3rd party land and install haul road and compound

From the existing stone track to the bridge we will require a temporary haul road, this will be stone of matting and removed on completion of the works

Erect scaffold to land spans

Following completion of the temporary works design we will install suitable foundation for the scaffold, this will comprise of compacted stone with bog mats to distribute the load from the scaffold Furthermore we will install some temporary works adjacent to IS2 along the river bank. This will comprise some temporary screw piles and compacted stone infill to provide a formation for the scaffold adjacent to the river.

The diagram below demonstrates the configuration of the scaffolding to spans 2, 3 & 4:



Spans 3 & 4 are above MHW

Access and Encapsulation to Piers

The scaffold will comprise tubular materials and scaffold boards to form an access scaffold, for light steel repairs, mechanical prep and painting purposes only. The scaffold will be built in 1 No 0.30m lifts, with 2.00m high lifts thereafter.

Every lift boarded to allow access to all metal surfaces. The base lift single layer of boards, a flame retardant polythene inlay and a flame retardant CORREX overlay.

The proposal includes shrink wrap encapsulation sheet to the sides, lean to roof and ends installed to 5 phases as works progress East to West

Ladder access built within the scaffold in one position, from the ground, to the full height, with pole ladders fixed at the rake.

The specified scaffold(s) will be constructed on a nominal 1.80m x 1.75m grid and will support one number working (decked) lift with a load of 2.00 kN per metre square. A further working (decked) lift will support a load of 1.0 kN per metre square. The working decking on the inside line of the scaffold will support a load of 0.75 kN per metre square. These loads to be uniformly distributed and must not be exceeded.

Access and Encapsulation to Soffit of 2, 3 & 4

The scaffold will comprise tubular materials and scaffold boards to form a suspended access scaffold, for light steel repairs, mechanical prep and painting purposes only. Built in 1 No 0.30m lifts, with 2.00m high lifts thereafter, as follows :-

Suspended Scaffold Measuring:- 1 @ 31.50m x 12.20m on plan, attached to the bottom of the girders then hung down approximately 1800mm below the soffit deck.

With one working lift of boards, consisting a single layer of boards, a flame retardant polythene inlay and a flame retardant CORREX overlay

Includes shrink wrap sheet to the sides, lean to roof and ends. Track Side Screen - Erected and dismantled during railway possessions. Includes a timber sheeted screen to the inner faces of the frames above the track. The screen, sheeting and timber screen requires 4 possessions to install and 2 possessions to remove.

Ladder access built within the scaffold in one position, from the ground, to the full height, with pole ladders fixed at the rake.

The specified scaffold(s) will be constructed on a nominal 1.80m x 1.74m grid and will support one number working (decked) lift with a load of 2.00 kN per metre square. A further working (decked) lift will support a load of 1.0 kN per metre square. The working decking on the inside line of the scaffold will support a load of 0.75 kN per metre square. These loads to be uniformly distributed and must not be exceeded.

The scaffold will be erected by trained and competent scaffolders, a typical layout is noted below:

Erect scaffold to river span 1

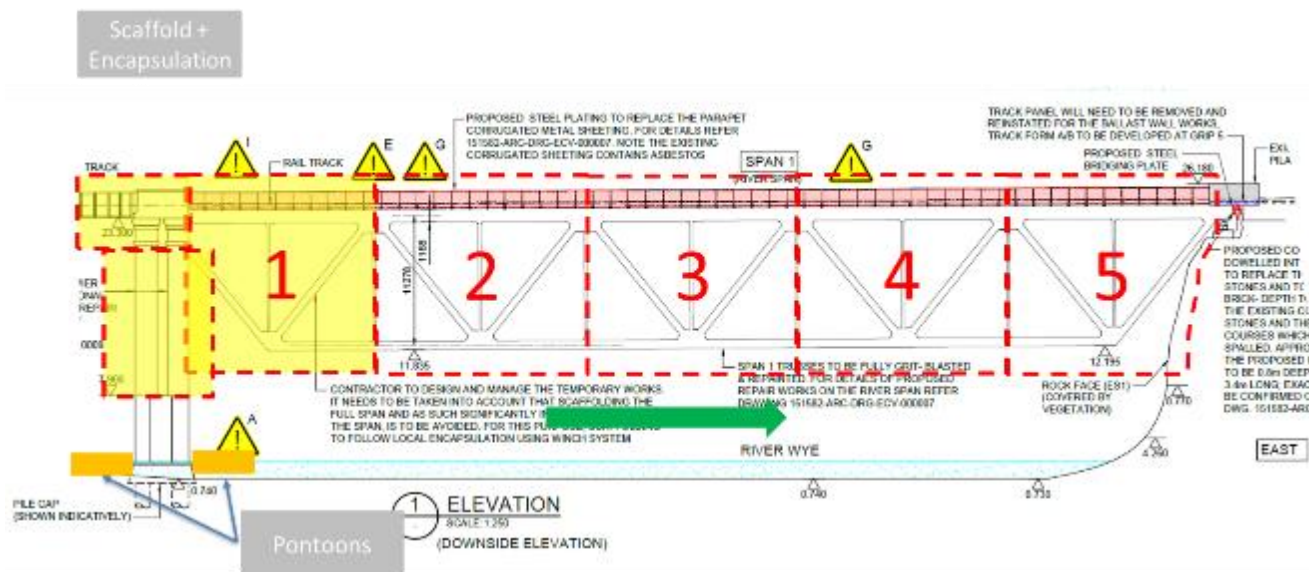
The scaffold will comprise tubular materials and scaffold boards to form a suspended access scaffold, for light steel repairs, mechanical prep and painting purposes only. Built in 1 No 0.30m lifts, with 2.00m high lifts thereafter, as follows :-

Suspended Scaffold Measuring:-

- ▶ 1 @ 91.50m x 12.20m on plan, attached to the bottom of the trusses and built up to the soffit, top level 1800mm below the soffit deck.
- ▶ 2 @ 91.00m x 1.00m on plan, access to the elevations of the main girders and parapets, includes an up and over frame to allow works to the parapet and grated walkway.
- ▶ 1 @ 91.00m x 2.00m on plan, access between the up & down lines, includes an up and over frame to allow works to the parapet and grated walkway.

Includes an access walkway built from IS1 pier to the East [low Mileage End] 91.00m x 1.20m x 1 level to access materials, to remain in place for carrying hoses and cables and other personnel.

Erected in 5 Phases Starting East Low Mileage End



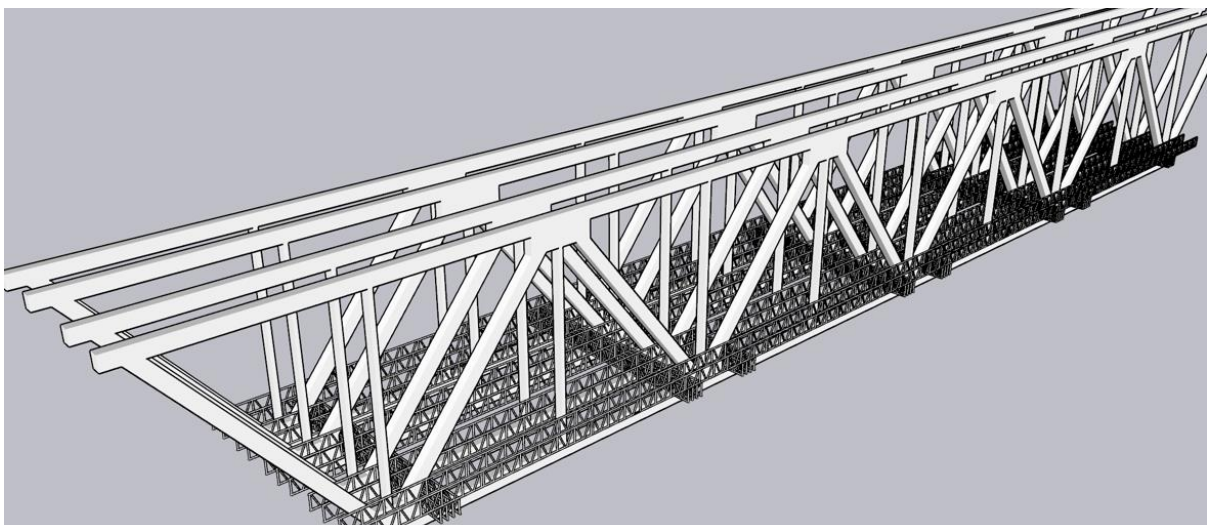
With every lift boarded to allow access to all metal surfaces. The base lift single layer of boards, a flame retardant polythene inlay and a flame retardant CORREX overlay.

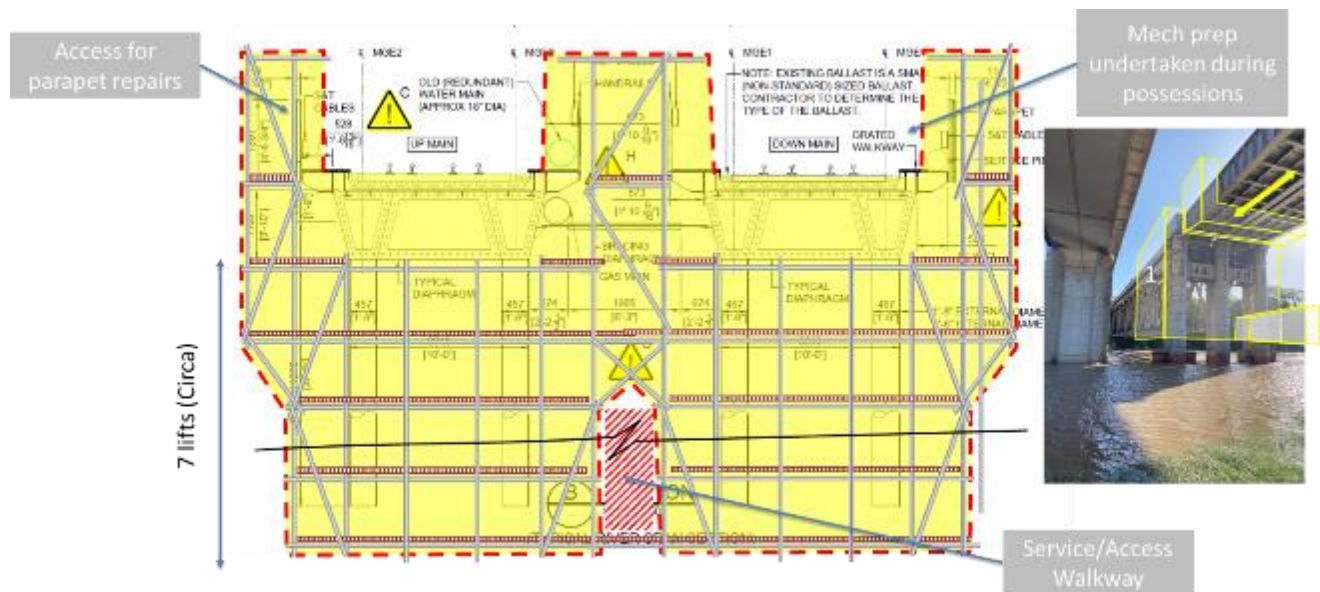
Includes shrink wrap sheet to the sides, lean to roof and ends. Installed to 5 phases as works progress East to West.

Track Side Screen - Erected And Dismantled during Possessions, Includes a timber sheeted screen to the inner faces of the frames above the track. The screen, sheeting and timber screen requires 4 possessions per phase to install and 2 possessions to remove.

Ladder access built within the scaffold in one position, from the ground, to the full height, with pole ladders fixed at the rake giving access to all boarded levels.

The specified scaffold(s) will be constructed on a nominal 1.80m x 1.74m grid and will support one number working (decked) lift with a load of 2.00 kN per metre square. A further working (decked) lift will support a load of 1.0 kN per metre square. The working decking on the inside line of the scaffold will support a load of 0.75 kN per metre square. These loads to be uniformly distributed and must not be exceeded.





Undertake steelwork repairs to Span 2, 3 & 4 decks

Following erection of the access the specialist steelwork contractor will gain access to the deck soffit and will undertake steelwork repairs. Using hand tools the area will be prepared and any repairs will be offered up for templating. The proposed repair detail will then be fabricated and fixed in-situ, where rivets are required to be removed this will be on a one by one basis.

All rust and loose scale will be removed and any knife edging will be removed back to sound metal. The area will then be primed ready for painting.

The steelworks can be summarised below:

- ▶ Spans 2, 3 & 4 – Cut & dress corroded web stiffener sections - D5 - Cutting and dressing of bottom 'sloping' outstand legs of angle and tee stiffeners; 76nr total per elevation over 3 spans = 152nr stiffeners x 2nr legs = 312nr locations total. All carried out during Normal midweek working.
- ▶ Pier IS3 – Replace splice plate - D25 - 1nr plate, 600 x 400 x 25mm thk, 24nf TCB's, All installed during midweek Rules of The Route (RoTR) working – Mon – Thursdays – 6hrs working minimum per shift.

At the same time operatives will access the scaffold to undertake the injection waterproofing using proprietary method as recommended by the manufacturer.

On completion of the repair and waterproofing works an area local to the repair will be repainted.

Undertake steelwork repairs to Span 1

The access scaffold will be erected to enable access to the parapets and hand railing to undertake the following works.

- ▶ Span 1 only - Supply & Install new parapet plates to Outer parapets - Details as per Drg 000007/A01 – allowing for 20nr self-drill, self-tap anti vandal fixings into existing parapet steelwork per panel, based on 124nr panels, approx.. 1495 x 1400 x 5mm thick. All installed during midweek RoTR working – Mon – Thursdays – 6hrs working minimum per shift. The existing corrugated sheeting, which contains asbestos will be removed in advance of these installation works by a specialist contractor.
- ▶ Span 1 only - Supply & Install new Inner parapet hand railing - Supply of CHS sections, rails and posts, approx. 188m overall length; 48.3mm O/D x 5mm thick complete with proprietary galvanised 'tube clamp' style hand railing fittings galvanised. All installed during midweek

RoTR working – Mon – Thursdays – 6hrs working minimum per shift. Includes removal of existing hand railing

- ▶ Span 1 only - Supply & Install new Galvanised Open grid flooring - Replacement allowance of 20% of existing walkway grating area, based on 52nr panels, 1495mm long. All installed during midweek RoTR working – Mon – Thursdays – 6hrs working minimum per shift

Repairs to collars at head of the caissons and install down pipes

There are no works proposed to the caissons. Any downpipe work from scaffold

Grit blast and painting

Prior to works commencing, the AmcoGiffen Site Manager shall issue a grit blasting permit which will take into account items to ensure that operative's blood levels are acceptable, sufficient extraction is maintained, a decontamination unit is available. A decontamination unit will be placed near to the rear of IS2 and will be available behind a segregated fence and it is the Painting's supervisor's responsibility to ensure all staff sign the register after passing through the decontamination unit

Prior to any grit blasting the encapsulation is to be inspected by AMCO Rail site / EP manager for any potential leakage areas. This inspection must continue through the grit blasting and painting operations and works must stop if any leaks develop within the encapsulation.

The blasting kit will be situated on land at the rear of IS2 and will be elevated such that it will not be affected by flood waters. All blast lines and extraction hoses will be housed in the temporary footbridge crossing between the piers IS2 and IS1, the footbridge will comprise a service route below a walkway and will enable all operatives and equipment to reach the main span.

Blasters will wear fresh air fed blast helmets and ensure communications rigs are working prior to each shift start.

An air extraction unit will be used and ducting routed to the working area and secured into the encapsulated area. This will be sealed into the encapsulation and will maintain a negative pressure within the encapsulated area.

All steelwork to the bridge and columns shall be grit blasted to SA 2½ prior to painting and ensure that the primer coat is applied within four hours of blasting. Isolated repairs on decks 2, 3 & 4 will be ST3 mechanical preparation and hand painted.

All spent grit will be removed by vacuum aided by brooms and shovels prior to the encapsulation being removed. The levels of grit on the scaffolding shall be monitored on a daily basis. Max levels of grit will be determined as part of the temporary works. The mobile vacuum unit shall be positioned within adjacent to IS2 and vacuumed grit shall be collected within the unit using the hoses provided. In support of this, any small amounts remaining will be cleaned up manually and placed into rubble bags which will be sealed. All clean up operatives shall use the decontamination unit before exiting the site boundaries.

Once blasting has commenced, a sample of grit will be sent for analysis to clarify the process required for its removal. All waste will have waste transfer documentation which will be kept in the site records.

Upon completion of the grit blasting the cleanliness shall be inspected by paint inspector, AmcoGiffen Site Manager and an invitation for inspection shall be given to Network Rail. Surface profile and salt tests shall also be carried out by the painting specialist and witnessed by AmcoGiffen.

Prior to any spent grit leaving the site a copy of the waste classification analysis shall be available on site to determine if it should be disposed of as hazardous waste or non-hazardous waste. Waste carriers license and tip license shall be made available for inspection by AmcoGiffen Site Manager. All waste transfer notes will be completed and kept in the site records.

All operatives will be checked for ICATTS, blood test results and face fit tests, all these will also be contained within the Site File. Task lighting will be provided to illuminate the structure.

Paint will be applied to the structure to the required DFT, this will be applied by spray or brush only. Once correct curing times have passed a further coat will be applied to the require DFT again this will applied by spray or brush only.

Inspections will be undertaken by an ICORRS Inspector to determine the correct WFT/DFT, this will also be witnessed by the AmcoGiffen Site Manager. Ambient conditions to be monitored by ICORRS Inspector and AMCO Site Manager. All sprayers will wear specific PPE to the task they are undertaking.

Brickwork repairs (above MHW)

All brickwork repairs will be undertake to the western abutment in accordance with the NR standard drawings. An access scaffold will be erected to facilitate access to the repairs.

Replacement of Ballast Wall (above MHW)

The replacement of the ballast wall will be undertake during one of the 51hr OROR possessions. Once the possession has been take the existing track will be removed by NR and the ballast wall, will be exposed. The brickwork will be demolished using an RRV mounted breaker, and edge protection will be installed to suit.

On removal of the brickwork the surface will be prepared and dowel sockets will be drilled to suite the location on the recast unit. The pre cast units will then be placed using the RRV on a sand cement screed. Once the precast concrete has been installed to the correct line and level the area behind will be backfilled with a suitable material.

Ballast will then be replaced and compacted and the track reinstated.

Site de-mobilisation

On completion of works the site setups will be removed and areas inspected with the NwR land agent. Any snagging works will be recorded and completed before the areas are handed back to the land owners.