



**TAMAR ROAD BRIDGE**  
**Suspension System Remedial Work 2017/18**  
**Rev 04**  
**PRELIMINARY CONTRACTOR BRIEFING DOCUMENT**  
**Issued January 2017**



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# Tamar Road Bridge Suspension System Remedial Works

## 1. Purpose

This document provides preliminary contractor briefing information for proposed remedial works to the cable suspension system primarily including cable band bolts and hanger bolt connections on the Tamar Bridge.

This information is available to upload in specific relation to this tender opportunity as advertised via OJEU and the Contracts Finder website, and shall not be disclosed to others (except necessary subcontractors or consultants), or used for any other purpose, beyond those reasonably required for this procurement, without the express permission of the Contracting Authority.

This document is made available in accordance with the requirements of The Public Contracts Regulations 2015.

## 2. Background

The cable band and hanger bolts are critical structural elements of the suspension bridge. Inspection of a small sample of these hidden critical elements in 2014 and associated laboratory testing in 2015 revealed some anomalies in bolt hardness values. As a result some additional sample hardness testing was instructed and undertaken in Summer 2016 and this was further extended to full coverage hardness testing in Autumn 2016. The preliminary results of the full testing exercise have indicated that there is a technical requirement for selective bolt replacements. Test result analysis is not yet finally complete but it is considered reasonably likely that the widespread selective replacement will be upgraded to a full replacement scheme as part of the risk mitigation requirements. However there will still be a prioritisation schedule for the order in which works are to be completed.

## 3. Intended Procurement Route

The contracting body will be:- the Joint Authorities of Cornwall Council and Plymouth City Council with the lead Authority overseeing the Procurement exercise being Cornwall Council (Commercial Services Team). Tamar Bridge and Torpoint Ferries Joint Committee will be the client for these works (hereafter referred to as Tamar Bridge).

Please note this Procurement Exercise was initially advertised to the market, as an upcoming opportunity, to alert and stimulate initial market interest via the Contracts Finder website and OJEU, PIN reference 2016/S 237-432224 from early December 2016 through to early January 2017.

The nature of the proposed replacement works is of a relatively specialist nature and will involve works at height adjacent to and above live traffic and a waterway. The works are likely to be instructed for priority completion. In view of the likely mobilisation period and winter working restrictions this is expected to mean a start on site in late Spring 2017. Tamar Bridge are seeking initial comments and proposals from suitably experienced contractors to assist in an efficient procurement and implementation for these works.

It should be noted that testing works and interpretation are still ongoing at the date of production of this document and therefore the final scope of the works cannot yet be defined. It is therefore not possible to determine the entire procurement route for the whole of the potentially necessary works at this stage. This document is limited to the scope of the highest priority work which will be undertaken under using the “competitive dialogue” procurement route as set out in the Public Contracts Regulations 2015.

Under this procurement approach Tamar Bridge intends to:-

1. Issue an OJEU contract notice, and corresponding advert via the Contracts Finder website, in the middle of January 2017, with a minimum 30 day response request advising interested providers to formally express their interest and respond via the [supplyingthesouthwest.org.uk](http://supplyingthesouthwest.org.uk) electronic portal and requesting their attendance at a Provider Information Event , scheduled to take place at the Bridge Offices from 10 am on Wednesday 25<sup>th</sup> January , 2017
2. Select the three most suitable respondents (as determined by the stated assessment criteria in this document) and enter into a staged period of competitive dialogue anticipated to end March 2017, which is likely to include further opportunities to visit the Bridge site.
3. Consider feedback from the contractor teams throughout the dialogue period. Subject to the feedback received, Tamar Bridge may issue further information to direct the dialogue to only consider more specific solutions.
4. Issue formal tender documents to a maximum of three contractors in April 2017.
5. The tender documents will contain a fully specified design for the items of permanent works but only an outline concept for the replacement scheme which will form the baseline for quality assessment and quantities measurement. Contractors will be required to entirely adopt and develop the replacement scheme concept to suit their intended methods. Alternative replacement scheme concepts are also likely to be permitted provided they achieve equivalent or better safety and efficiency of the works. Quality and price will both be assessed. The weighting will be 70% quality 30% price subject to final confirmation in the tender documents. The contract will be NEC form.
6. Proceed with a fairly short tender process designed to establish a preferred bidder status notification by the end of April 2017 and a target appointment of a contractor by early May 2017.

#### 4. Contract terms - intention

The following describes the general intentions for the contract terms that will be incorporated in the final tender. The form of contract will be an NEC3 standard form. The exact option cannot yet be determined and there may be a requirement for phasing. If phasing is used the following principles will apply.

- a) Contract terms for the initial priority work phase including mobilisation and supply of access and equipment will be weighted significantly towards Employer risk responsibility.
- b) Contract terms for the residual part of the (currently) 221 bolt replacement recommendation (and using access, equipment and method documentation all as

supplied above) will also be weighted with an appropriately balanced level of Employer and Contractor risk responsibility.

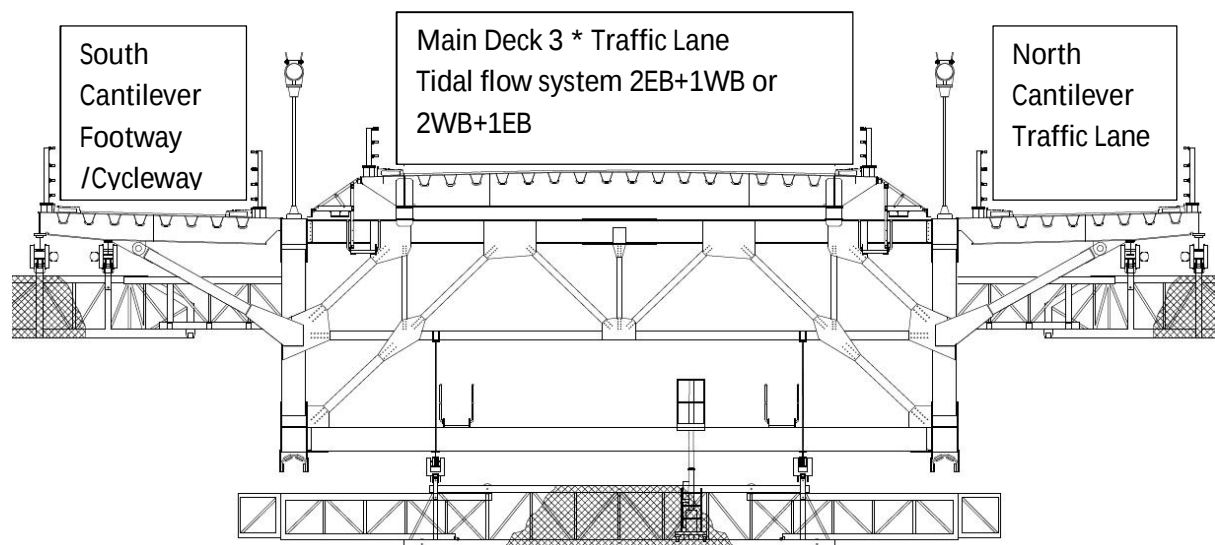
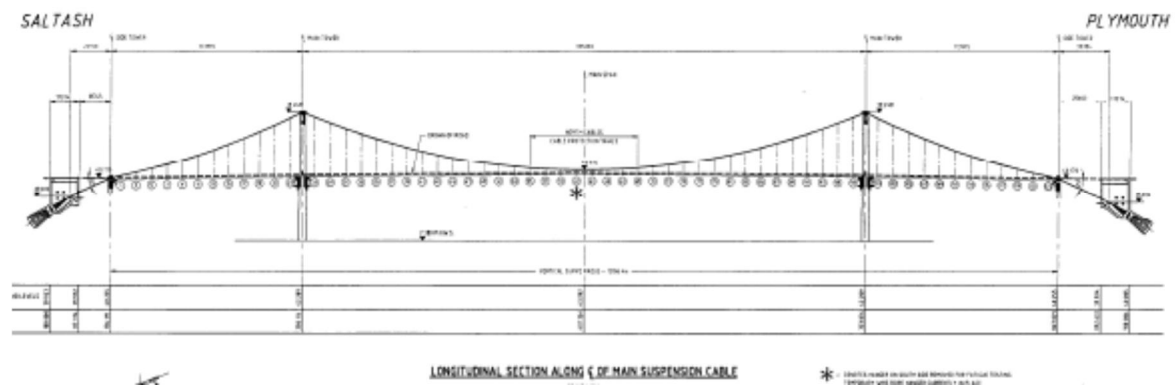
- c) Subject to the findings of further investigations by Tamar Bridge and their consultant, and taking account of all relevant mandatory procurement restrictions then there may also be a follow-on phase of work with a more standard risk share approach between Employer and Contractor.

The extent of these phases and the exact NEC contract form to be applied will be confirmed at the earliest opportunity during the dialogue process.

## 5. General arrangement of the structure

(A3 copies attached)

There are two main cables each with a Saltash Sidespan, Mainspan, and Plymouth Sidespan. All six of these zones will require works to be undertaken.



**TYPICAL CROSS SECTION 'B-B' AT SUSPENDED SPAN**

## 6. Traffic Arrangements – Normal operation

- A. The main deck operates with three traffic lanes an eastbound lane, a westbound lane and a centre lane that is operated in a “tidal” fashion. This is usually:-
- 2 lanes Eastbound into Plymouth in the morning
  - 2 lanes Westbound to Cornwall in the afternoon

Variation occurs depending on prevailing traffic conditions on particular days and arising from local events. Lane control is effected with overhead gantry signals and illuminated lane markings by Tamar Bridge Operations staff.

- B. The South Cantilever lane is shared (by demarcation) as footway and cycleway carrying pedestrian and cycle traffic in both directions. The South Cantilever lane is capable of full traffic loading and has been used periodically for diversion of the main deck traffic westbound lane. If used as a vehicular trafficked carriageway, pedestrians and cyclists have to be transported safely across the bridge by use of a dedicated bus service(covering the full 24hr period) , which has been used in past projects.
- C. The North Cantilever lane is a single traffic lane always operating in the Eastbound direction.

## 7. Traffic Arrangements – Anticipated periodic changes during the progress of the Works

Tamar Bridge and the Highways Authorities will be seeking to minimise any disruption to the traffic flow over Tamar Bridge and all of the surrounding local network as a result of these works.

It is however acknowledged that there is high likelihood of requirements for temporary traffic management. The following are anticipated:-

- Absolutely minimised requirements for total bridge closure. Probably restricted to 6hrs (12am to 6am). For example to initially install and remove equipment at tower locations.
- Minimised requirements for two main deck lane closures and one associated cantilever closure. Probably restricted to 6 hrs (12am to 6am) or two hours during the day but outside of peak time and probably requiring use of mobile TM for speed of installation and removal.
- Single lane closure of main deck available most days between 9.30 am and 3pm also between 8pm and 6am. In some peak period conditions this availability will be restricted and may be suspended.
- Friday afternoon working restrictions are likely to apply and the working window is likely to be reduced to 9.30am to 12.30pm.

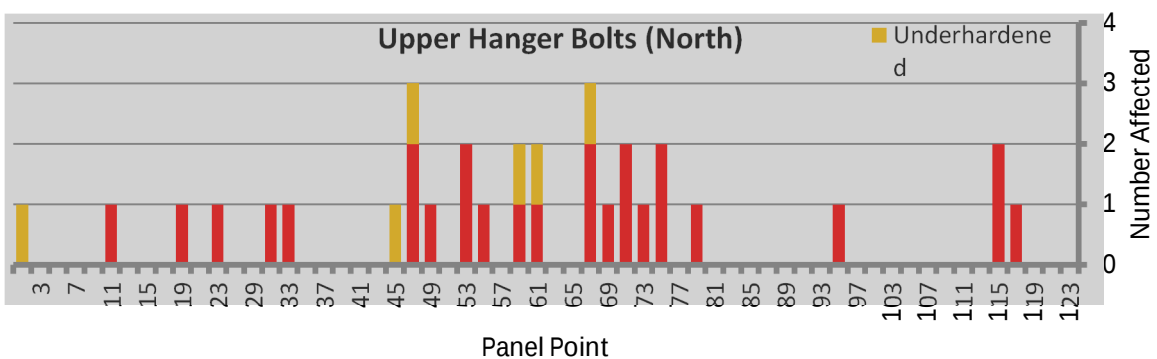
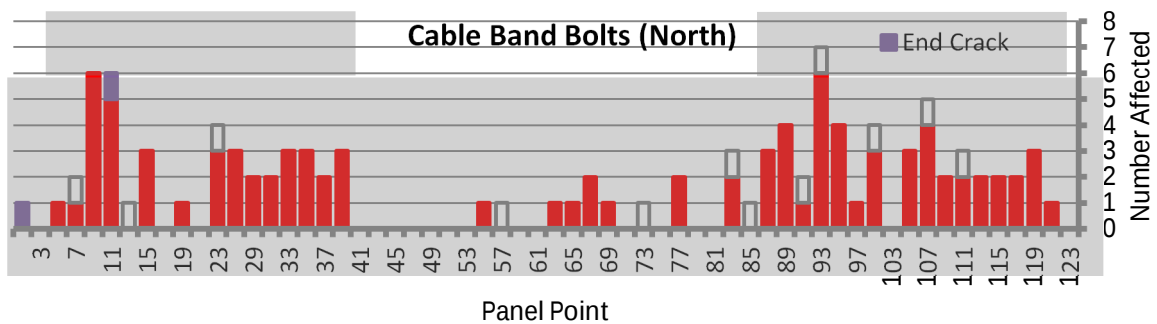
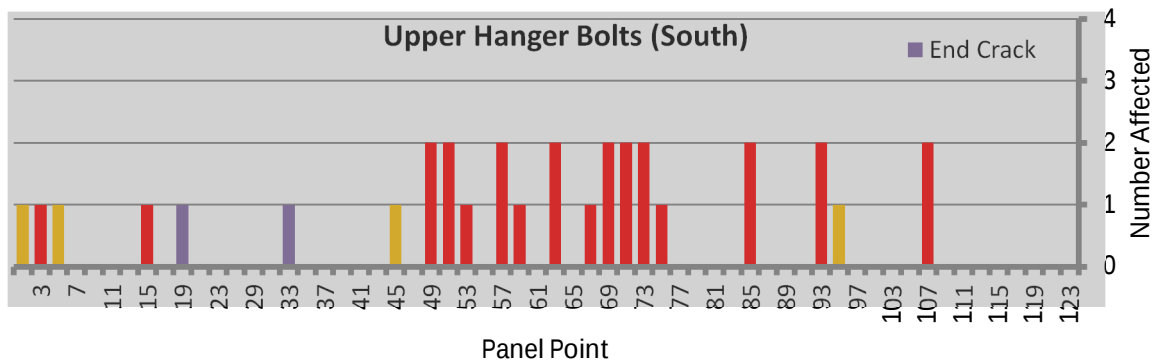
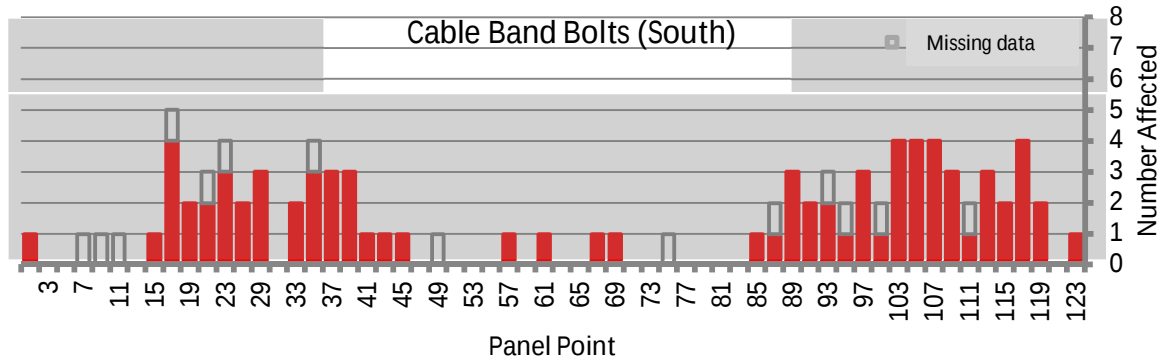
Tamar Bridge will consider other suggested traffic management arrangements if these are considered to be key to a particular contractor proposal. Proposals which assist in truly minimising the traffic management implications and associated disruption will be considered very beneficial.

## 8. Distribution and phasing of the works

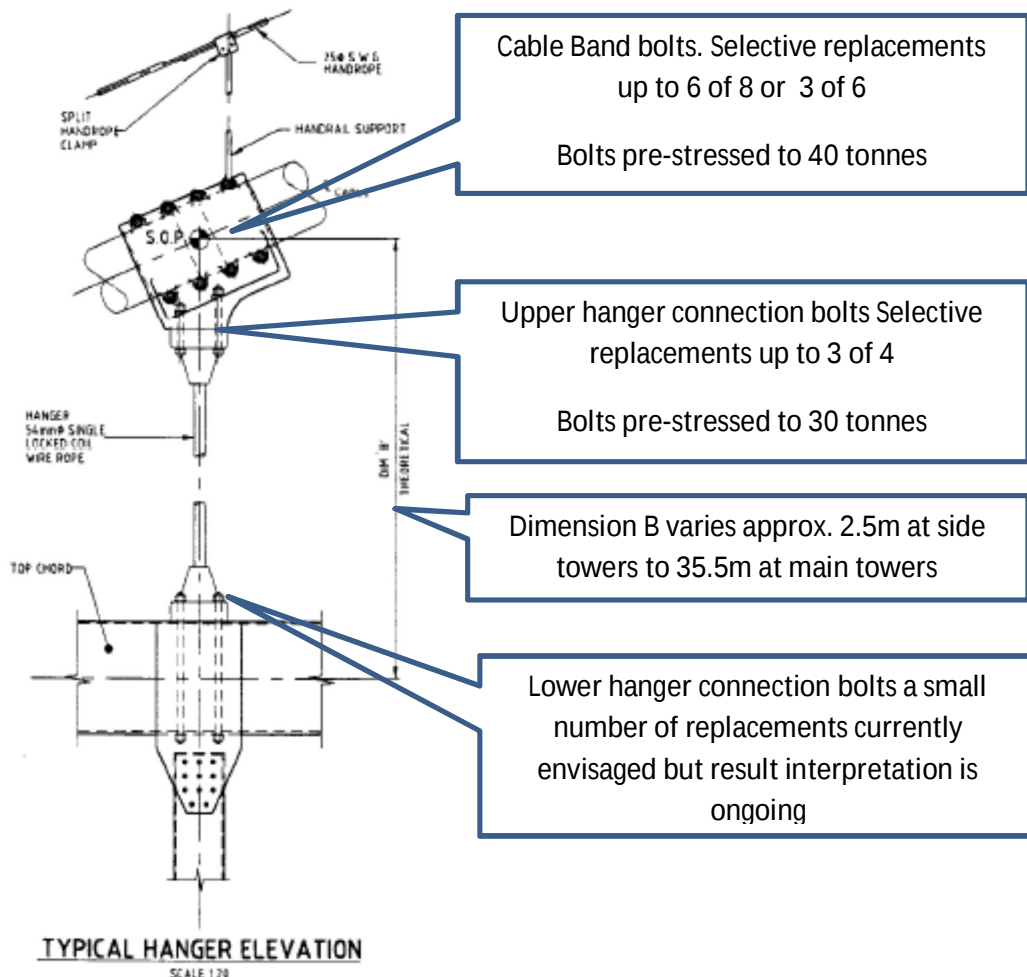
The following graphs indicate the potential coverage of the current technically required works. This is provided to give an indication of the fairly widespread distribution of the replacement works. The actual replacement requirements will depend upon further ongoing investigations, testing, and result interpretation. It is possible that a point could be reached where total replacement becomes the most efficient option. However that point has not yet been reached. Furthermore there will be a

sequence requirement to prioritise some zones for the earliest replacement. Consequently the development of a specific access approach remains the key priority.

Current estimate of hanger and cable band bolts technically identified for replacement is around 20% of a total of 1310. The “point in time” distribution shown in the graphs below is indicative only. Total number and distribution are likely to increase with further refinement of the test results and interpretation.



## 9. Arrangement of the components for replacement

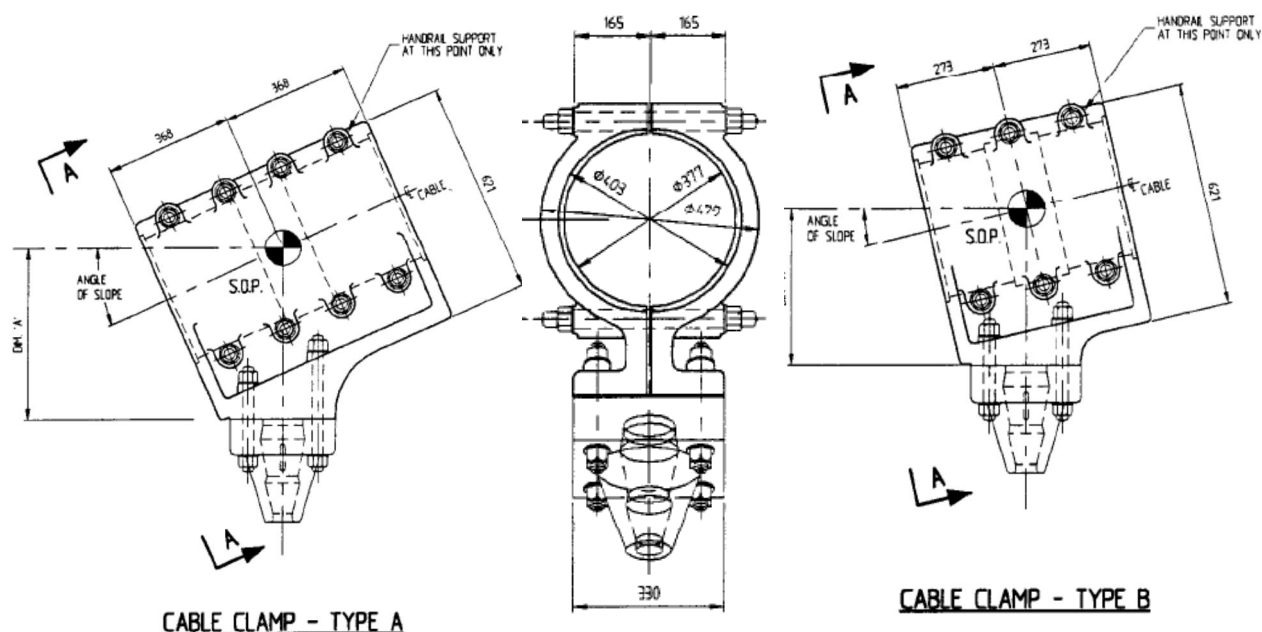


The cable band clamp and upper hanger socket assemblies occur at 60 positions on each of the 2 main cables. Based on the distribution of bolts requiring replacement given in the graphs above, it will be necessary to visit most (and probably all) of these 120 locations to replace one or more cable band or hanger bolt. Confirmatory hardness testing will need to be undertaken by the contractor at every location where access provision is instructed (probably all).

Additional miscellaneous items for replacement (provisional).

- There may be a requirement to remove and locally re-position up to 16 short hangers (including top and bottom cast sockets) around mid mainspan
- There may be an additional requirement to replace cable band bolts at 4 cable band type C (4 standard bolts) and 4 cable band type D (6 long bolts) at the anchorage locations. i.e. up to 40 bolts in total.
- There may be a requirement to remove and replace up to 24 similar bolts (vertical orientation) located at 4 side tower saddles. (Restricted access).

## 10. Details of components for selective bolt replacements



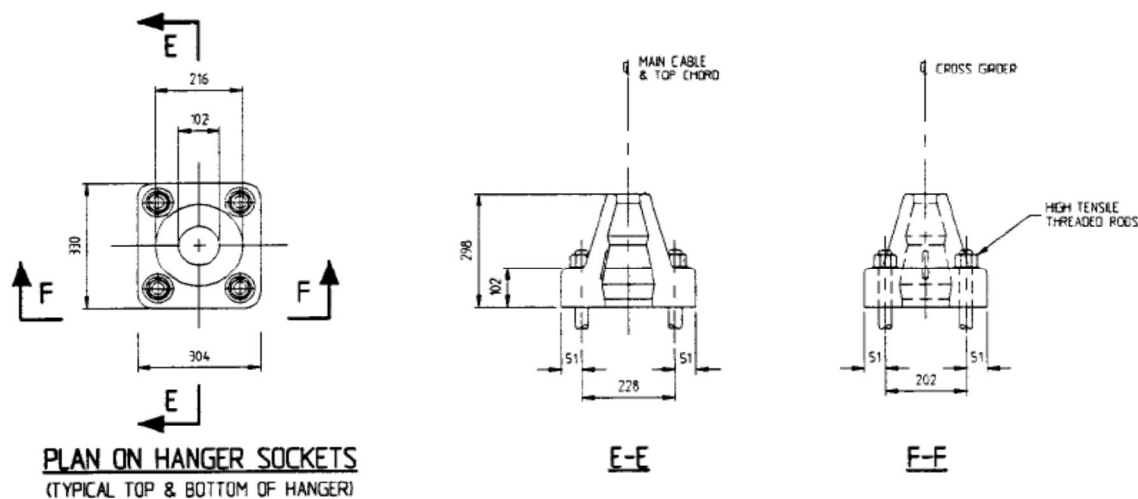
There are  $2 \times 34 = 68$  type A Cable Bands with 8 bolts

There are  $2 \times 26 = 52$  type B Cable Bands with 6 bolts

All cable band bolts were preloaded at installation to a load of 40 tonnes force.

Cable band casting halves weigh between 250kg and 360kg

Some potential misalignment of cable band holes should be anticipated (although it has not so far been demonstrated to exist based on 3 replacements in 2014).



There are  $2 \times 120 = 240$  Upper hanger socket connections with 4 bolts each.

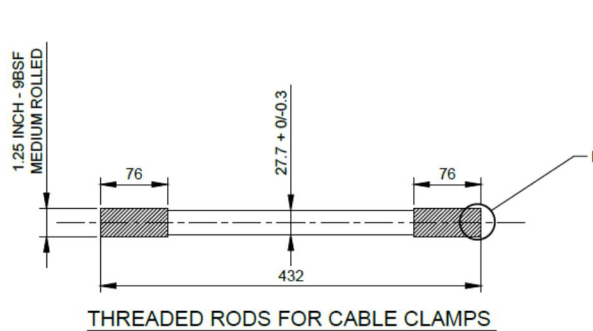
All hanger rods were preloaded at installation to a load of 30 tonnes force.

Hanger assemblies (upper and lower socket plus hanger rope) weigh between 240kg and 840kg.

Hanger socket connection to cable band has known tolerance / hole alignment problems which mean that replacement by "one out / one in" is very unlikely to be workable and a requirements for full unloading together with all necessary temporary support should be anticipated.

## 11. Replacement bolts

The Contractor will supply all of the necessary replacement cable band bolts and hanger bolts complete with all associated nuts and special washers plus spares. All components will need to be supplied with full traceability, test samples, test results and certification. These are relatively specialist items and contractor attention is drawn to this and to the detailed QA procedures to be followed. Indicative details (based on the original design) are shown:-

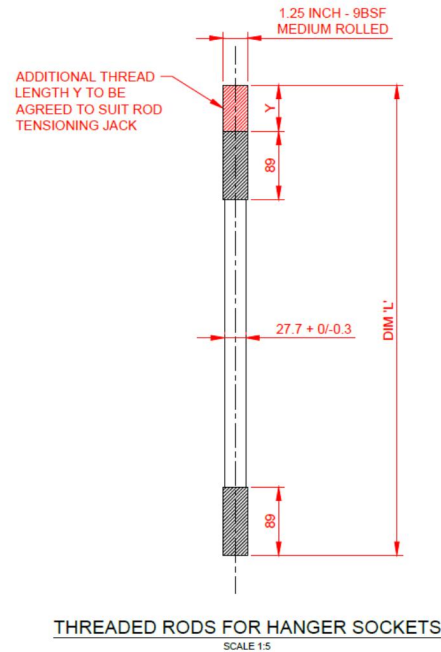


### MATERIAL GRADE SPECIFICATION

MATERIAL GRADE 817 M40V (EN24V) TO BS PD970-2005. SUPPLY CONDITION SELF COLOUR + CORROSION RETARDANT. RODS TO BE SUPPLIED WITH MACHINED MEASURING POINTS FOR LENGTH. SUPPLY RODS EACH COMPLETE WITH TWO NUTS AND TWO WASHERS. SUPPLY CONDITION FOR NUTS AND WASHERS - SELF COLOUR.

### INSTALLATION NOTE

CABLE BAND ROD REPLACEMENTS WILL BE REQUIRED TO BE INSTALLED UNDER TENSIONING TO A PREDETERMINED EXTENSION LENGTH.



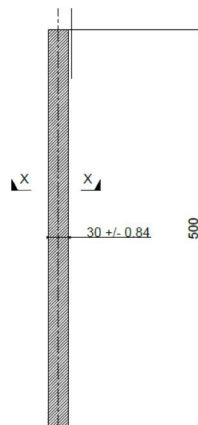
### MATERIAL GRADE SPECIFICATION

MATERIAL GRADE 817M40V (EN24V) TO BS PD970-2005. SUPPLY CONDITION SELF COLOUR +CORROSION RETARDANT. SUPPLY RODS EACH COMPLETE WITH TWO NUTS, TWO WASHERS AND ONE END CAP. MATERIAL GRADE 605M36R(EN16R) SUPPLY CONDITION FOR NUTS, WASHERS AND END CAPS.

### INSTALLATION NOTE

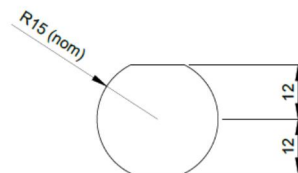
HANGER SOCKET REPLACEMENTS WILL BE INSTALLED UNDER DIRECT TENSION EQUIVALENT TO THE ORIGINAL SPECIFICATION OF 30TONS - TO BE CONFIRMED.

Temporary rods (A small number as a contingency)



M30 THREADED HANGER RODS WITH MACHINED FLATS GRADE 8.8

### OPTION A



X-X VIEW  
THREADED HANGER RODS WITH MACHINED FLATS  
SCALE 1:1

Final permanent works replacement item drawings and specification will be updated to account for current material designations and thread specifications. Tamar Bridge's Consultant will be responsible for the permanent works design.

## 12. Component photos

These are typical shots of the permanent works components associated with these works. For further general photos refer to Appendix D.



Typical 6 bolt cable band and upper hanger socket connection with 4 bolts.



Typical lower hanger socket connection with 4 bolts (a few replacements possible).



Lower hanger socket connection anchorage of bolts below truss top chord.



Typical view at location where bolts were removed for intrusive inspection in 2014. Bolt extensions were for use of rod tensioner

### 13. Access Provisions

- Access will be required at most (possibly all) of the 120 locations at main cable height
- Access provision will almost certainly need to be prioritised to meet the replacement sequence that will be specified. It is likely that this will require at least some “out of sequence” working until any initial priority replacements have been completed. There will probably be a subsequent period where all remaining routine replacements can be carried out in the most efficient manner to suit the access availability.
- Access detail will be determined by the contractor but it is expected that schemes will need to be developed for three primary types in order to give the necessary flexibility and efficiency. Additional indicative details are provided in Appendix A to assist with understanding the likely scope of works. Contractors may develop alternative access types if improvements in safety, efficiency for working and reduction of traffic disruption can be demonstrated.

### 14. Unloading Provisions

- The findings of the 2014 bolt extractions resulted in a recommendation that any subsequent extractions required the hanger to be unloaded. As a general principle this will remain as a requirement for these proposed works and unloading equipment must be designed for all locations and must be immediately available at site.
- In specific situations it may be acceptable to undertake some replacements on a one-out and one-in basis. However this will be restricted by the caveat that many locations are expected to exhibit the hole misalignment issue encountered in 2014 and this will require a reversion to the unloading approach.
- In some situations the number of affected bolts at a location is high and at these locations the risk of one-out one –in is likely to be unacceptable.
- As a general principle the only acceptable reason not to use the unloading approach will be in situations where it is possible to demonstrate a reduction in the risk of work at height by doing so.
- Where unloading is a requirement (expected to be most locations) then the following indicative equipment capacities will be required.

|                                                        |           |                                                                                                                                                                          |
|--------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rated SWL total min jack capacity (at 70%)             | 85 tonnes | This is based on the operational limit value and higher utilisation will occur if the peak event occurs.                                                                 |
| Required stroke not exceeding 70% of supplied capacity | 90 mm     | Max – on the longest hangers. Note that all proposed imposed strokes will need to be checked for implications to the permanent structure and some may not be permissible |

## 15. Replacement and re-tensioning

Contractor attention is drawn to the requirement for accurate re tensioning of the replacement items. This is a specialist activity requiring use of calibrated tensioning equipment and a strain measurement system using specialist micrometer for cable ban bolt tensioning.

## 16. Risk Assessment and CDM2015

The extent and full scope of the scheme for replacements is yet to be determined but it has been determined that some replacements will be required. Consequently a significant programme of maintenance works will be required and therefore CDM2015 requirements will apply. The risk assessment included in Appendix C has been developed during preliminary scheme development to date and contractors will be required to have taken it into account when developing their own schemes.

Contractor's detailed mitigation measures will need to provide equivalent or better risk reduction and equivalent or lower residual risks levels compared to the preliminary versions shown in Appendix C.

The Contractor will be required to undertake the role of Principal Contractor in accordance with the CDM 2015 Regulations. There are already other contractors operating on this site.

A Principal Designer will be formally appointed shortly and contact details will be provided.

## 17. Scheme Development – Engineering

The requirements of DMRB document BD02/12 Technical Approval of Highway Structures will apply.

These works require the use of temporary works equipment and access equipment constituting type P temporary works which have the capacity to affect the safety of highway users. The development of the scheme and eventual design and detailing must therefore be undertaken under the direction of a suitably experienced chartered engineer. All such works must additionally be independently checked by a chartered engineer.

In the event that contractor's erection scheme and temporary works design are intended to be wholly subcontracted then the same requirement applies but in addition the Contractor must engage a chartered engineer to supervise the conversion of the temporary works designer's requirements and assumptions into the necessary method statement and risk assessment inputs that will be needed for the approval submissions for the works.

The appointed Contractor's temporary works designer must take full consideration of the available pre construction information and will need to provide a designer's risk assessment documenting how risks have been identified and wherever reasonably practicable a design provision taken to remove the risk. The Contractor's temporary works designer must also clearly highlight any residual risk that cannot be reasonably removed and which will require operational risk assessment and associated mitigation measures at site.

The Contractor's Temporary Works designer will be required to sign-off key commissioning stages for access and unloading equipment, to be available on call throughout the duration of the works and to review periodic maintenance reports / compliance with the O&M documents for the equipment designed.

## 18. Scheme Approval and Documentation – Operational staff

These are potentially high risk works and there will therefore be a correspondingly high Employer expectation for thorough documentation, method statements, risk assessments, programme provisions, contingency measures, availability of additional support staff and supplementary equipment etc to ensure that all risks are mitigated and controlled.

This competency level will be required across all aspects of planning, design, off site works, supplier assessment, off site quality control, installation works, operations, traffic management and completion activities including records for the project safety file.

Only contractors who can demonstrate engineering and operational staff experience and capability of the type described above will be suitable for selection to the tender list (max 3 contractors).

## 19. Competitive Dialogue Participants Request from Tamar Bridge

The Tamar Bridge Project Team will require the following information from interested contractors with the considered capability to undertake the works as currently outlined within this document :-

Phase A (To be completed, by all recipients wishing to proceed, via an electronic submission via the [Supplyingthesouthwest.org.uk](http://Supplyingthesouthwest.org.uk) portal by the deadline specified in the OJEU Contract Notice/ Contracts Finder Opportunity Advertisement) will be based around the principals of demonstrable capability, confirmed availability, and compliance with pre-contractual preliminaries.

*(The following are a close representation of the key questions to assist with completeness of this document. Note that the format, order, and numbering on the portal version may be slightly different. The version provided on the portal shall be considered as the final version for responses.)*

1. A registered expression of interest to participate in this Competitive Dialogue process;
2. Confirmation of suitability of experience to undertake such works and possession of a recognised and appropriate Health and Safety Accreditation;
3. Confirmation of availability of adequate resources to undertake the works commencing with design and planning in May 2017.
4. Confirmation of adequate levels of Insurance and demonstrable Financial Stability.

Items 1-4 are to be assessed as either pass or fail and any failures are likely to result in exclusion from the process.

The following quality based assessment items 5-8, which will be set out within Section 11 of the Electronic ITT, as questions 11.1, 11.2 and so on, presume no specific knowledge of Tamar Bridge, other than that which can be determined from this document or from other public access sources. Responses should demonstrate general understanding based on previous experience.

5. Contractor's initial views on the proposed form of contract, tender period, risks and liabilities to assist with the achievement of a short but productive dialogue, tender, and tender assessment periods, prior to contract award. (Up to 1000 words maximum) – Up to 5 marks available.
6. Contractor's explanation of understanding of the most relevant issues of safety, quality and productivity when working at height adjacent to live highway and over a working river environment and partially live railway branch line ( Up to 1000 words maximum) – Up to 5 marks available.
7. Contractor's explanation of understanding of typical issues of using traffic management in a manner to minimise disruption and optimise productivity. (Up to 1000 words maximum) –Up to 5 marks available.
8. Contractor's explanation of understanding of the most relevant issues of traceability records, quality control and inspection of pre-tensioned bolts using hydraulic and other devices. ( Up to 1000 words maximum) – Up to 5 marks available.

Items 5-8 will be marked in accordance with the Council's standard 0 to 5 scoring system, as will be included within the ITT guidance online, with each of the 4 individual questions carrying an equal weighting of 25%.

The Employer will select up to three of the contractors that clearly demonstrate to be the most suitable, on the basis of their initial submission, to warrant their inclusion on the subsequent Competitive Dialogue phase.

The selection criteria are intended to be:-

- Qs 1-4 inclusive must achieve pass
- Qs 5-8 the highest three total weighted scores out of 100% will be selected to proceed to the next stage of the process.

Phase B (By subsequent invitation only)

(Intended to involve a maximum of 3 potential contractors). The number of dialogues required is variable but it is considered to be unlikely to exceed 3 attendance sessions. The Client and their consultant will issue agendas and direct the dialogues. A schedule of proposed dialogue dates will be issued at or immediately after the mandatory site attendance visit. The following description indicates the general dialogue procedure.

Technical dialogues

1. Contractor to provide open review comments on the Employers draft outline drawings and specification for access requirements, traffic management and bolt replacement activities. (These responses will be used collectively by the Employer to adjust the documents to be issued for tender).
2. (Part a) Contractor to present their own outline intentions for the above in greater detail. (This will generally be treated as commercially sensitive information between each contractor and the Employer and the outcome of discussions will not necessarily result in any change to the Employer's documents to be issued for tender. This stage to include a presentation by the contractor and site visit. (3 separate appointments one per contractor).

Commercial dialogue

2. (Part b) Contractor to raise any commercial issues that they wish to be considered. (This will generally be treated as commercially sensitive information between each contractor and the Employer and the outcome of discussions will not necessarily result in any change to the Employer's documents to be issued for tender.) Attendance at Tamar Bridge offices may be required.

Repeat the above process, as many times as may be deemed necessary, with attention to any specific refinements raised by the client in the agenda for the next dialogue.

#### Phase C (Employer's discretion)

The Employer may briefly request clarification on any issue prior to issue of formal tender documents. This will occur (if necessary) after the last formal dialogue meeting. On completion of such request the dialogue process will be formally closed.

## 20. Issue of subsequent tender documents

These will be issued to the competitive dialogue participants (only) as soon as reasonably practicable following the end of dialogue and for reasons of consistency and for audit purposes via the [Supplyingthesouthwest.org.uk](http://Supplyingthesouthwest.org.uk) procurement portal.

Contractors should note that the Employer's final budgetary approvals process may result in a short delay but this should not exceed 1 month.



## 21. Indicative Programme

The following programme is indicative only and may be changed to suit updated findings from current testing or otherwise at the discretion of Tamar Bridge / Cornwall Council and in accordance with relevant procurement regulations. The notional period for dialogue is shown as 6 weeks but this is variable. Attendances will be required within this period. All dates , durations and activity descriptions are subject to updating on the contracting authority's electronic procurement portal.

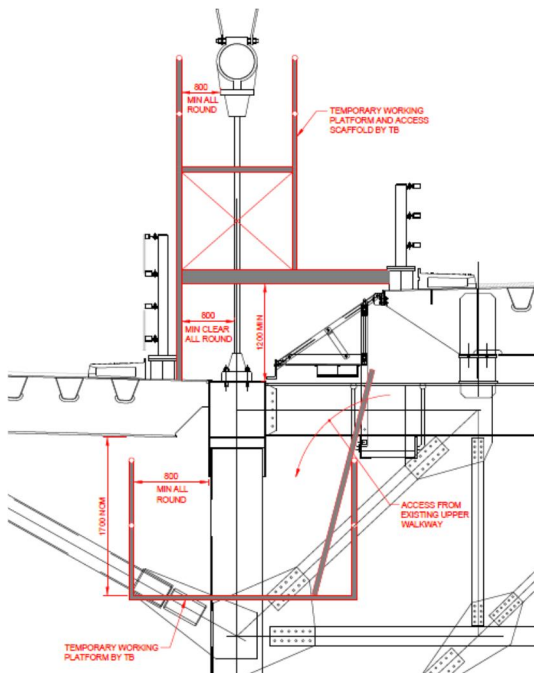
| Indicative Competitive Dialogue / Tender Programme      | 16-Jan | 23-Jan | 30-Jan | 06-Feb | 13-Feb | 20-Feb | 27-Feb | 06-Mar | 13-Mar | 20-Mar | 27-Mar | 03-Apr | 10-Apr | 17-Apr | 24-Apr | 01-May |
|---------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Issue contract notice / CD invitation                   | Blue   |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Contractors consider and respond                        |        | Red    | Red    | Red    | Red    | Red    |        |        |        |        |        |        |        |        |        |        |
| Tamar Bridge prelim visit - 25th Jan                    |        | Red    | Red    |        |        |        |        |        |        |        |        |        |        |        |        |        |
| TB Choose target of 3 contractors to proceed            |        |        |        |        |        | Blue   |        |        |        |        |        |        |        |        |        |        |
| Issue draft contract docs to contractors                |        |        |        |        |        | Red    |        |        |        |        |        |        |        |        |        |        |
| TD1/CD1 - Review of outline documents                   |        |        |        |        |        | Red    |        |        |        |        |        |        |        |        |        |        |
| TD2/CD2 - Contractor specific dialogue and visit(s) TBC |        |        |        |        |        | Red    | Red    | Red    |        |        |        |        |        |        |        |        |
| TD3/CD3 - Contractor final dialogue                     |        |        |        |        |        |        |        |        |        | Red    | Red    |        |        |        |        |        |
| End of dialogue - issue of tender docs                  |        |        |        |        |        |        |        |        |        | Blue   | Blue   |        |        |        |        |        |
| Tender period                                           |        |        |        |        |        |        |        |        |        | Red    | Red    | Red    | Red    | Red    | Red    | Red    |
| Tender assessment                                       |        |        |        |        |        |        |        |        |        |        |        |        |        |        | Blue   | Blue   |
| Contract award                                          |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        | Green  |

TD1/CD1 – Technical Dialogue session 1 followed by Commercial Dialogue session 1. Similarly for sessions 2, 3 and further if necessary (unlikely). Some sessions particularly commercial dialogue sessions may be by teleconference call.

## APPENDIX A

### Low level access

It is expected that low level zones (central mainspan and up to 2 positions in the lower end of sidespan) will be most suited to deck mounted scaffold or proprietary platform systems mounted in the work zone between the traffic parapets. The representation shown was as used for the selective removals undertaken in 2014 and includes access to the lower hanger rods. (It has not been determined if any works will be required to the lower hanger rods). Containment and weather protection may be required for these works. The structural form is tolerant of local loads from this type of access system and most reasonable arrangements should be possible. Where sheeting or mesh panels are provided there is likely to be a limitation of around 4 panel bays per span in order to prevent excessive wind loading. Note in particular; the proximity of lighting columns to main cable midway between certain hanger positions, the proximity of safety barriers and pedestrian parapet throughout the length of the bridge, the proximity of pedestrians and live traffic and the associated requirement for robust and effective prevention measures for unauthorised access.

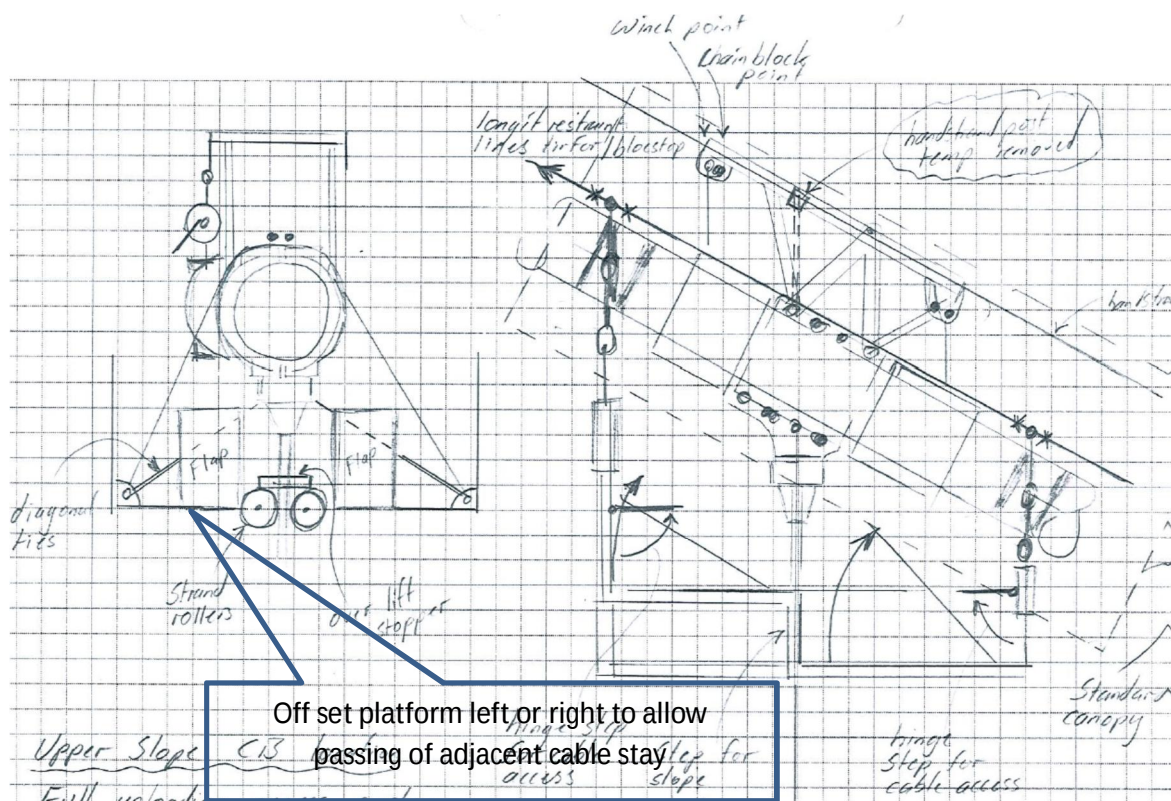


## High Level Access (specific location)

There will very likely be a requirement for initial specific locations to have prioritised bolt replacements. This is likely to require a purpose designed suspended access platform with a capability for incorporation of a man riding hoist function (to reach the access). The system should be capable of installation at any location in the medium to high range of hangers that are not accessible from low level scaffold. The following operational requirements would be likely to be required:-

- Incorporates proprietary hoisting equipment to minimise lead time
- Capable of efficient relocation to another location with minimal use of loader crane or other equipment which requires traffic management.
- Capable of operation with minimised TM requirements (except during the hanger unloading operation when TM is anticipated).
- Capable of accommodating the hanger unloading equipment
- Capable of accommodating cable band restraint equipment (in situations where multiple bolt replacements are required).
- Capable of accommodating the inclined cable stays which pass alongside most of the longer hangers. This may be particularly problematic close to the towers where stays pass on both sides close to the same level.
- The system would constitute type P temporary works and would require and AIP and TAA acceptance including permanent works checks for all applied loading

A highly indicative sketch shown below indicates the general form that could be suitable but it is acknowledged that there are many potential options.



## High Level Access (general)

It is feasible that a full programme of replacements may be required but this is not yet the confirmed expectation. It is expected that access will be required to most locations for at least 1 bolt replacement. Therefore there may be a point at which a more general access scheme ie cable catwalk could become the most efficient option. There are a number of considerations:-

- The access system would need to be sufficiently rigid and of sufficient load capacity to allow the replacement works to proceed safely and efficiently.
- There would be a need to minimise potentially high end anchorage loads at the side towers and main towers. This should be feasible since intermediate support will be available along the length of main cable.
- The system would constitute type P temporary works and would require a BD02 AIP and TAA acceptance including permanent works checks for all applied loading.
- Security against unauthorised access would require very significant attention and there would need to be careful consideration of any interface with the low level scaffold access system described above.

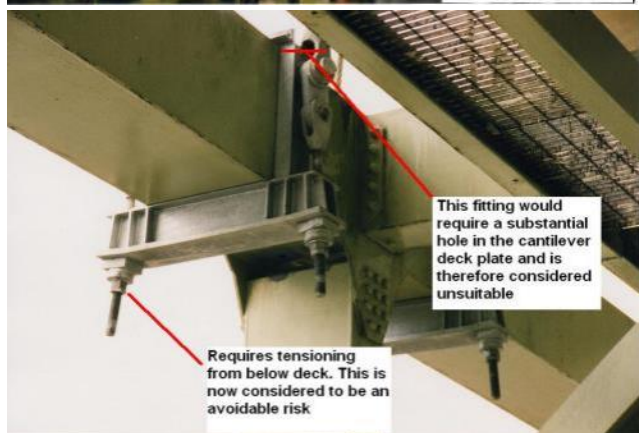
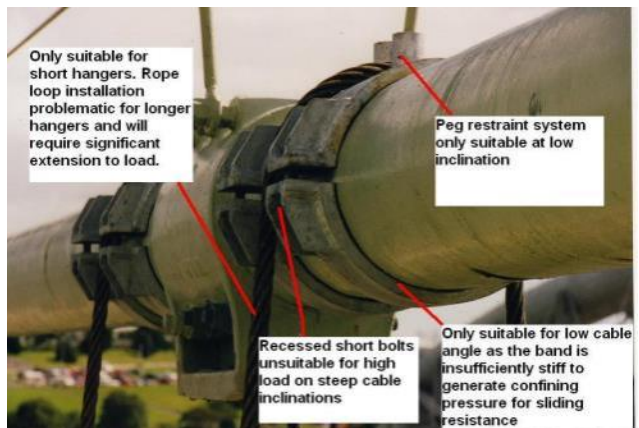
Another UK suspension bridge has previously undertaken cable band bolt replacement using a mobile cable crawling gantry to progressively access all required locations. It is considered unlikely that such an approach is likely to be effective at Tamar due to the generally smaller size lower height and varying proximity of the cable stays

## APPENDIX B

### Unloading and Removal Works

#### Previous history - unloading

There has been a previous scheme to remove hanger bolts and a cable band bolt in the 1980s. This was undertaken at a single midspan location and was undertaken prior to the incorporation of the strengthening and widening work s cantilever deck plate so it is no longer directly applicable but demonstrates typical equipment used for these type of activities.



## Previous history – removal

Bolt removal at number of cable band and hanger locations was undertaken in 2014 as part of a programme of intrusive examination. The method employed did not involve unloading the hangers and individual bolts were replaced using a simple one out an one in approach which had been verified for temporary loading implication on the permanent works. This exercise was completed safely but there was significant inefficiency and difficulty arising from the difficulty experienced in extracting and replacing the bolts. This was due to original construction (casting) mis-alignment which had been locked in place when the bolts were originally pre-stressed. Consequently the bridge safety file information contains a recommendation that this method should not be reused and that an unloading method will generally be necessary.



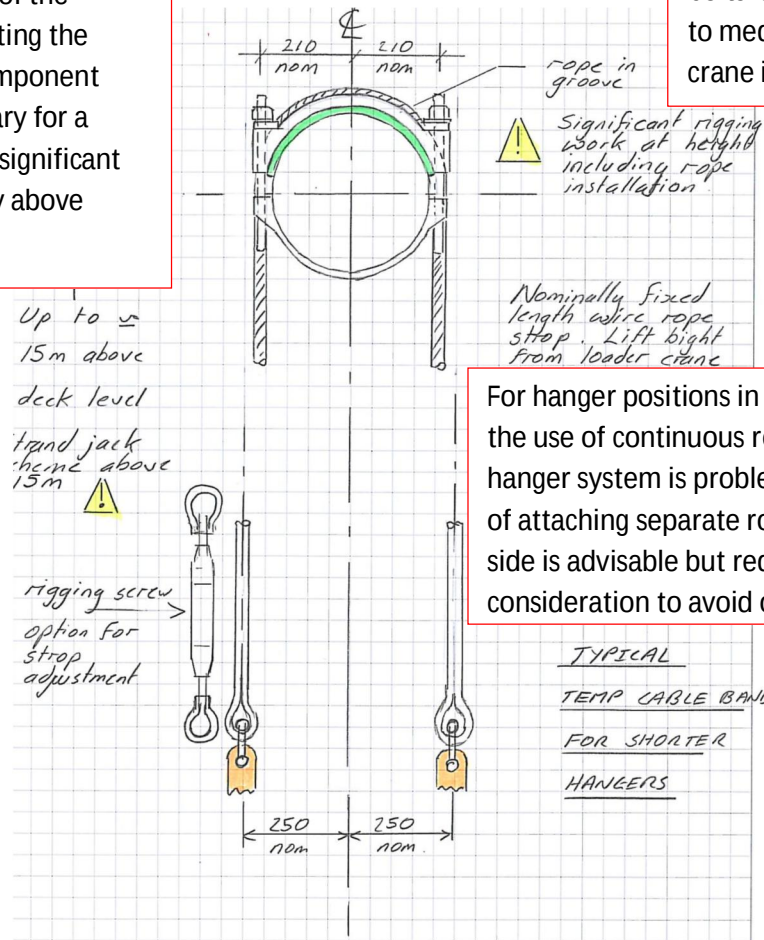
Typical photos from the 2014 selective inspection bolt removals. All undertaken from low level scaffold access and using hydraulic bolt tensioner equipment for measured tension re installation of hanger bolts.

### Indicative unloading equipment concept

For these works it is anticipated that most locations will require full unloading for some of the replacements. An indicative concept is shown. Contractors may develop alternatives to suit their proposed methods.

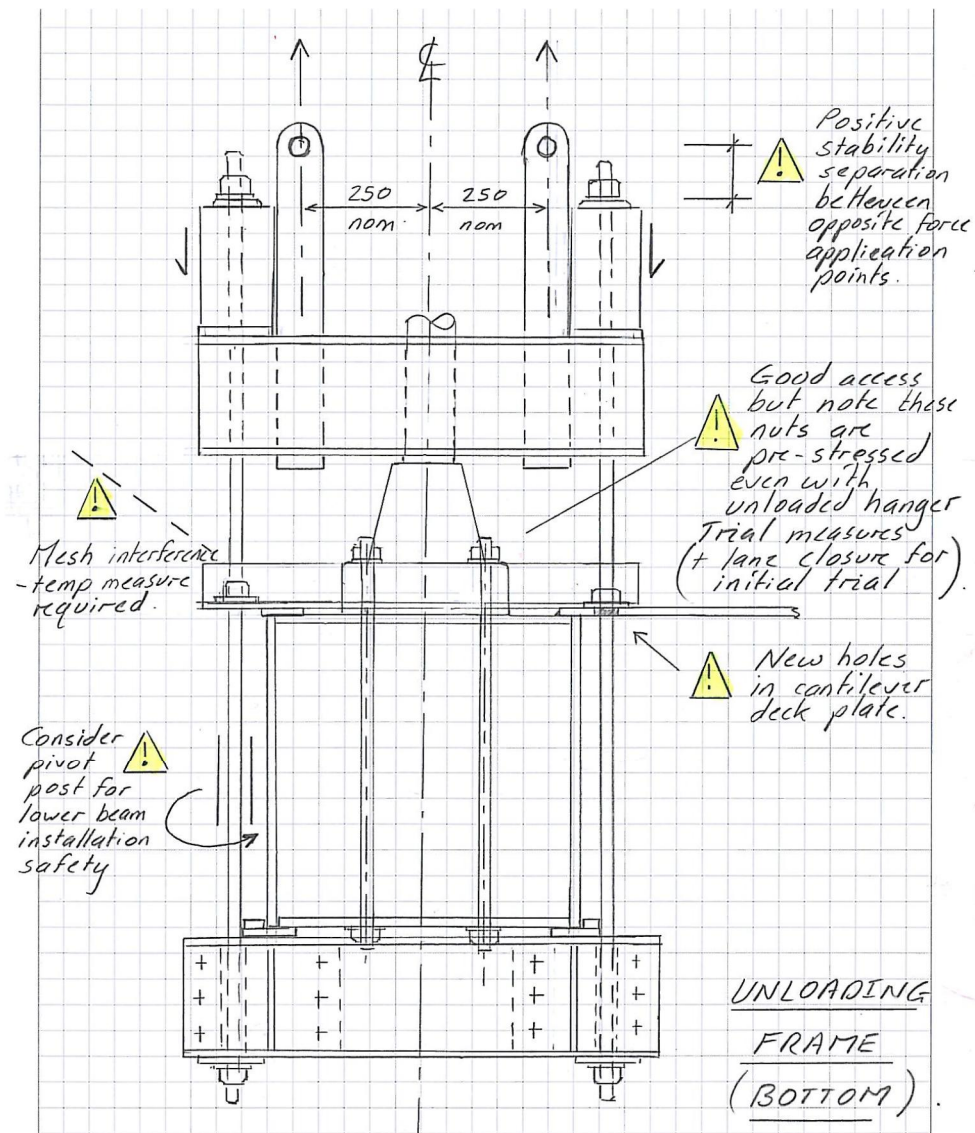
Consideration of the means of resisting the downslope component will be necessary for a locations with significant inclination (say above 5deg)

Temp cable band with horiz bolts is most suitable at low to med locations with loader crane installation



For hanger positions in the mid to high zone the use of continuous rope temporary hanger system is problematic and a means of attaching separate rope lengths to either side is advisable but requires careful consideration to avoid out of balance loads.

Upper section view showing temporary cable band and temporary wire rope hanger.



Lower cross section view showing bearing beam below the truss top chord and jacking crosshead with hollow ram jacks above the top chord (and safely accessible to the operator).

## APPENDIX C

### Risk Assessment (preliminary)

| Ref | Hazard description                                                                                                            | Mitigation measure                                                                                                                                                                                                                                                                                                                                                                                                 | Residual risk level |
|-----|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1   | Unnecessary work at height                                                                                                    | Only locations where there is a proven risk of defective materials will be specified for maintenance works. Work at height is unavoidable.<br><br>Set a high quality threshold for experience of access and cable works contractor including design capability.                                                                                                                                                    | Med                 |
| 2   | Work at height general                                                                                                        | Consider inclusion of any other relevant and necessary maintenance at the locations where access will be provided as this can reduce overall risk for the whole bridge maintenance.<br>Consider:- <ul style="list-style-type: none"> <li>· sample hanger removal and testing</li> <li>· improvements to the main cable sealing and drainage</li> <li>· improvements to the inclination of short hangers</li> </ul> | Med                 |
| 3   | Method of removal fails to allow full replacement resulting in reduced capacity and associated restrictions                   | Only permit methods which involve full unloading and complete freedom to realign components prior to re tightening.                                                                                                                                                                                                                                                                                                | Low                 |
| 3a  | Method of removal unsuitable for use at the long hanger locations because imposed stroke cannot be achieved without overload. | Ensure that suitable methods are considered for all locations. This may require the use of a number of methods and could possibly involve some long hanger replacement or temporary removal of the rocker link to soften the vertical stiffness.                                                                                                                                                                   | Med                 |
| 4   | Failure to correctly determine capacity of the temp works resulting in overload or abortive works at height                   | Use existing bridge model and conservative assumption and provide suitable margin on load and stroke range predictions with allowances for tolerances and component strains                                                                                                                                                                                                                                        | Low                 |
| 5   | Failure to correctly determine and balance the requirements of load restriction and traffic management                        | Consideration must be balanced between the benefits of using TM to control and reduce loads and control of risks associated with TM. Scenarios should be considered and relative risks assessed. This should be undertaken before any detailed scheme or equipment design.                                                                                                                                         | Med                 |

|    |                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |
|----|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 6  | Traffic Management scheme hazards                                                                        | The TM scheme duration should be reasonably minimised subject to the risk mitigation in the item above. The period(s) chosen should be appropriate and should consider traffic congestion, driver distraction, weather effects and suitability for the conduct of the maintenance works.                                                                                                                                                                                                     | Med        |
| 7  | Equipment erection to main cable (low to mid level cable range) – dropped object hazard.                 | Use MEWP access to raise equipment wherever possible (within SWL). Provide a secondary restraint system at the main cable level to prevent dropped object during transfer. Tether all equipment. Use TM and exclusion zones as necessary.                                                                                                                                                                                                                                                    | Low        |
| 7a |                                                                                                          | For heavier equipment eg temporary cable bands (vertical bolt type) use loader crane operating in lane closure                                                                                                                                                                                                                                                                                                                                                                               | Med        |
| 8  | Equipment erection – access (low to mid level cable range) – fall from height.                           | Use direct MEWP access to the work location wherever possible. Provide lightweight access platform to improve comfort and efficiency of working (maintain as a harness zone)                                                                                                                                                                                                                                                                                                                 | Low        |
| 9  | Equipment erection to main cable (mid to high level cable range) – dropped object hazard.                | Consider the use of suspended access cradle system for personnel. Subject to SWL limit it may be necessary to use separate winch system for equipment. Provide a secondary restraint system at the main cable level to prevent dropped object during transfer. Tether all equipment. Use TM and exclusion zones as necessary. Consider the use of separate rope hanger system to reduce the difficulty of introducing a long loop over the cable. Carefully consider out of balance loading. | Med        |
| 9a |                                                                                                          | For heavier equip eg temporary cable bands (horiz bolt type) use winch system with tackle to suspend cable band half at correct inclination.                                                                                                                                                                                                                                                                                                                                                 | Med / high |
| 10 | Equipment erection – access (mid to high level cable range) – fall from height.                          | Consider the use of suspended access cradle system for personnel. Provide lightweight access platform to improve comfort and efficiency of working (maintain as a harness zone)                                                                                                                                                                                                                                                                                                              | Med        |
| 11 | Equipment installation to top chord deck level – trapping hazard, falls from height, public distractions | Unload with loader crane operating from TM. Land on purpose designed stillages and secure against dislodgement. Where necessary provide localised hop-up scaffold to                                                                                                                                                                                                                                                                                                                         | Low        |

|    |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |
|----|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|    |                                                                                                   | reach jack level. Modify and make safe access through inclined mesh. Install screens to walkway and carriageway to prevent distraction.                                                                                                                                                                                                                                                                                                                                                                |     |
| 12 | Equipment installation to top chord soffit – trapping hazard, dropped object , falls from height. | Design the bearing beam so that it can be rotated into place (suspended C clamp lifting beam or similar). Provide a tethering system for transfer protection. Provide localised scaffold access of securing connections.                                                                                                                                                                                                                                                                               | Low |
| 13 | Hydraulic equipment failure                                                                       | Use conservative loading assumptions. Restrict loading to 70% of manufacturer SWL rating for all reusable equipment where reasonably possible. Special conditions by separate RA.                                                                                                                                                                                                                                                                                                                      | Low |
| 14 | Unloaded permanent hanger components – dropped object risk.                                       | Method statement control. Routine measure at top chord level should be sufficient because hanger rods / nuts are effectively captive below. Restrain the hanger to prevent free pendulum effect when disconnected.<br>At the cable level consider installation of a longer temporary rod (or pair) so that the socket can be lowered away from the connection but the hanger weight is still supported. Chain block tackle can be used to raise and lower on this system so there is always a back-up. | Low |
| 15 | Unloaded permanent cable band components – slippage hazard.                                       | In the event that full loosening of the cable band bolts is necessary then an alternative anchorage for the downslope force component is necessary and must be in place before loosening commences (beyond 1 bolt)                                                                                                                                                                                                                                                                                     | Med |
| 16 | Failure to restore correct load distribution in the permanent works                               | The system of length control and reinstallation to marks will be used unless there is good reason to make a correction to local distribution using variable packs to the hanger. Assess with engineering review once the process has been commenced.                                                                                                                                                                                                                                                   | Low |
| 17 | Unforeseen hazards                                                                                | Unlikely but the potential consequences could be high for this type of structural work at this location. Engage staff with suitable experience in all parties to these works.                                                                                                                                                                                                                                                                                                                          | Low |

## APPENDIX D

### Tamar Bridge - Selected photographs of main cable, cable bands and hangers



Tamar Bridge (from east in poor weather)



Tamar Bridge (from west in good weather)



Traffic arrangement east (Plymouth end) – typ. 3 lanes of traffic main deck, 1 lane traffic north cantilever, FW/CT south cantilever.



General photo of main span from Saltash main tower



General photo of main span from Plymouth main tower



Traffic arrangement west (Saltash end) taken from Saltash main tower



Walking the main cable



Walking the main cable



Walking the main cable. Cable gates in place at ends side spans and mid main span.



Cable gates in place at ends side spans and mid main span.

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |
| <p>Typical 8 bolt cable band</p>                                                    | <p>Typical 8 bolt cable band</p>                                                     |
|   |   |
| <p>Typical 6 bolt cable band (lower levels)</p>                                     | <p>Typical 6 bolt cable band (lower levels)</p>                                      |
|  |  |
| <p>Upper hanger bolt arrangement</p>                                                | <p>Upper hanger bolt arrangement</p>                                                 |



Typical lower hanger arrangement – 4 bolts through top chord of truss



Typical lower hanger arrangement (underside of truss top chord)



General view of top chord and cantilever



Top chord and cantilever at one of the cable stay anchorages (inner stay)



Photo of typical tower top showing inclined cable stays (inner and outer) either side of main cable



Photo of tower top showing cable stays either side of main cable (side span and main span)



Main cable handstrands at top of main tower (typ)



Main cable handstrands at top of main tower (typ)



Upper post connection to handstrand



Upper post connection to handstrand



Typ main cable arrangement at ends of side spans



Main cable handstrand terminations ends of side spans