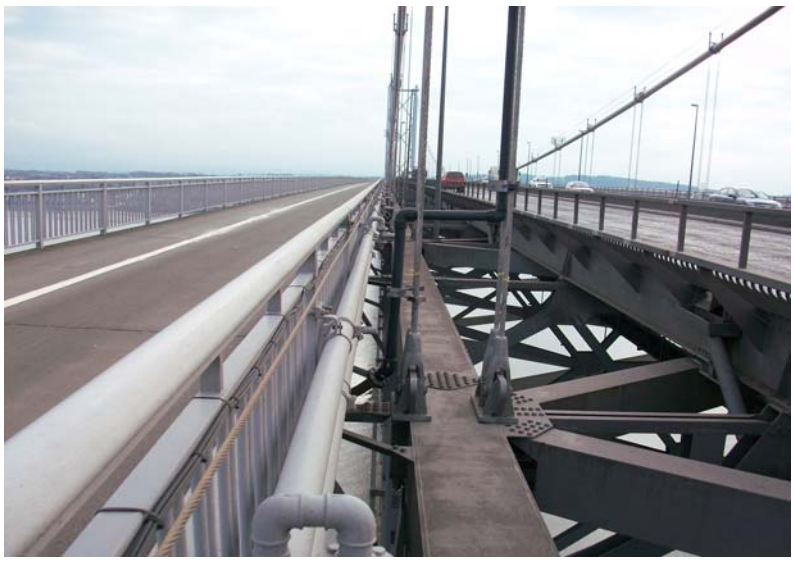
Forth Road Bridge

Hanger Replacement with main cable temporary access

Method of how to replace a Hanger



Rev	Status	Date	By	Check	Approve
0	Draft	14/06/2010	FD	CT	

Please see other Doc's:

- PE005 FRB Hanger Failure Emergency Procedures
- Replacement Hanger Programme
- Document S0912395 MS Spencer Cable band/Bolt replacement
- BD 2/05
- VOLUME 13 - REPLACEMENT PROCEDURES FOR LONG HANGERS - WAF

Introduction

On the Forth Road Bridge if a hanger fails a set of procedures is in place to replace the cable. These procedures are referred to as PE005 “Suspender Failure”. This accounts for the failure of a single rope or a complete hanger failure as a result of connection failings at the connection of the stiffening truss or at the wire ropes forming the hanger. PE005 is included in Appendix A. The Programme for the replacement of a hanger can be seen in Appendix B. The following text sets out to explain the procedure. It will mirror the programme tasks.

Stage 1 – Access to the Hanger

1. *Project Management*

The structure will be inspected to examine areas where a hanger has failed or is about to fail. Following these plans will be made to set about changing the hanger in a way which is safe for all bridge users and the maintenance staff. If possible at low levels around the mid span and where the side span meets the viaducts scaffold can be erected to change the hanger and install the temporary hangers required. Weather precautions will be taken. All material and equipment must be safely transported to the walkways, which will be closed to pedestrians and cyclists.

2. *Widen Handstand*

TM will need to be established to erect birdcage scaffolding at this low level. Hardstands can then be widened to carry out the work.

3. *Provide access to the cable with a working platform*

The contractor will be required to design, supply and install a suitable access platform to allow removal of this latest damaged bolt/nut. This access platform must be pre assembled by operatives who will be carrying out the work. Framework unit AK and AL are to be constructed.

To erect the working platform which travels along the main cable TM must be established. Temporary cable bands are to be erected and prestressed. A friction test must then be completed. Next the transport unit is erected and once this is completed the removal of hardstand spreader units. Final erection of Erect hydraulic Cylinders (VSL). The framework unit AK and AL and other small parts are then installed.

On completion of the installation and prior to use the contractor will be required to provide a construction compliance certificate.

The platform is required to provide suitable access to allow positioning of the temporary cable band by the contractor's personnel. FRB personnel will then utilise the platform to carry out de-tensioning/ tensioning work required to replace the damaged bolt/nut. Loading requirements for the platform are as detailed in the AIP.

The platform is expected to be in use for approximately xxx days; however it may be required for further work on cable band bolts in future. The contractor will be responsible for the operation of the platform for the duration of the works.

On completion of the works the platform and all associated equipment will be removed from site by the contractor.

4. *Moving Working Platform*

To move the platform hardstands must be dismantled and tirfors are to be erected. Timber wedges are then installed and the platform can then be moved in a slow and safe manner.

5. *Close off walkways*

6. *Test at low level replacement*

7. *Position safely up at greater height on cable*

8. *Check and sign off*

Stage 2 – Changing of the Hanger Rope

1. *Erect Anchor Beam*

2. *Selection and procurement of appropriate hanger rope*

3. *Safe transportation of hanger rope to walkways*

4. *Temporary Hangers*

5. The hangers must be preassembled before erection on site. A tirach winch and wire must be installed on site. A guide and safety wire and line must be established. Next the temporary VSL hanger is erected and attached. An access cradle is also installed.

6. *Set up downstream and upstream temporary hangers*

7. The hanger spacing units are dismantled and a temporary jacking system is installed. The load is transferred from the hanger to the temporary VSL. The jack system is dismantled. The existing hanger is dismantled and cut down. It is safely lifted in section to the walkways below were is is wrapped around a steel coil storage bund.

   Comment [f1]: Assumption here

8. The cable band is cleaned and any repairs which need to be undertaken *Install new hanger rope* are completed. Protection is applied to the cable bands. Any bolts which have cracked or failed are replaced.

9. *Remove bolts*
   The contractor will also be required to lift and secure a temporary cable band which has been designed to protect the cable band against slippage during bolt removal. Details of this temporary cable band will be provided. Final tensioning of both the temporary and permanent cable band bolts will be carried out by FRB personnel.

   Design, certification and approval of the platform will be as per the criteria laid out in The DMRB, Volume 1, Section1, Part 1 BD2 05. This will include all lifting and containment arrangements.

   The contractor will be required to provide a design certificate for the platform.

   The design will be subject to a fully independent design check, details of the organisation responsible for the check will be forwarded in due course.

   The contractor will be required to install the platform at Panel Point 32 NE on the North Side Span of the Forth Road Bridge, at an exact date to be

determined, ideally sometime during April/May 2010. A drawings register is included in Appendix C.

10. *Install new hanger rope*

    New hangers are erected and the jack system is re-erected on new hangers. Protection is given to the new hangers. Loading is re-applied to the new hangers. New hanger bushings are installed and the spacer units are re-installed. Dismantle jack systems and protect new hangers again.

11. *Take down access*

    Dismantle access cradle and disconnect VSL at top chord. Detach and remove VSL hangers. Disconnect wire/safety lines. Move working platform and re-install handstand support frame.

12. *Test certification and sign off*

13. *Removal of access gantry*

    Dismantle working platform, tirak winch and tirfors. Transport back to a fenced compound.

Appendix A

Procedures Manual – Forth Estuary Transport Authority

Reference: **PE 005** **Title:** **Suspender Failure**

Issued by: Operations Manager

Approved by: General Manager

Issued: January 2005 Page: 1 of 1

Introduction

This procedure details the action to be taken in the event of a failure of any component of a hanger assembly occurring which could be either :

1. the failure of a single rope,

or,

2. a complete hanger failure which could be the result of a failure either of the connection to the stiffening truss or the loss of both wire ropes forming the hanger.

Procedure

1.1 **Immediately close the bridge in both directions**.
1.2 Advise the Operations rooms of Fife Constabulary and Lothian & Borders Police of the closure.
1.3 Advise General Manager or Depute who will in turn instruct the call-out of the Standby Team.
1.4 Update Nadics, FETA Web-site, & Information Line.
1.5 Install appropriate Traffic Management to restrict the left lane (Lane 1) adjacent to the failure for **200 metres on each side of the failure**.
1.5.1 This will involve the Lead taper for the Guide Island being started a minimum of 700 metres in advance of the failure. The total restricted length is minimum 900 metres.
1.6 Upon completion of all signs and cones being in place and authority obtained from the General Manager or Depute, the Police Forces can be advised that **traffic up to 3.5 tonnes GVW (Gross Vehicle Weight)** will be allowed to cross.
1.6.1 Advise the Police Forces that **Single-Deck Buses with a GVW of 10 tonnes** can be permitted to cross the bridge although they will require to be controlled to prevent bunching and **must** be spaced out.
1.7 Allow traffic to flow when the police have confirmed that they have introduced the weight restriction on approach roads.

1.8 The police forces are responsible for co-ordinating the restriction on traffic on the approaches to the bridge.

1.9 Update Nadics, FETA Web-site, & Information Line as required.

Notes : **Weight Restrictions apply for both directions of traffic regardless of which carriageway is restricted.**
Single-deck Buses (gvw 10 tonnes) must be spaced out.

Reference : W.A.Fairhurst Report - Hanger Failure Contingency Plan July 2004
(File ref : K73/)

Appendix B

Appendix C

Drawings from Fauber Maunsell Aecom			
Mark Bulmer (MJB)			
Drawing No.	**Rev**	**Title**	**By**
47484/W/924	A	NE Side Span PP 18 NE, 22,26,32,43 Stage 2 Hole Reaming Jig	MJB
47484/W/925	A	Additional Works, Cabel Band Replacement NE Side Spam - PP 18 NE Stage 2	MJB
47484/W/926 (i)	A	NE Side Spaj - PP 22NE Stage 2 Sheet 1	MJB
47484/W/926 (ii)	A	Additional Works "Details" Stage 2 NE Side Span PP 18NE, 22NE, 26NE, 32NE, 42NE	MJB
47484/W/927	A	Additional Works, Cabel Band Replacement NE Side Span - PP 26 NE Stage 2	MJB
47484/W/928	A	Additional Works NE Side Span - PP 32 NE Stage 2	MJB
47484/W/929	A	Additional Works NE Side Span - PP 42 NE Stage 2	MJB