FORTH ROAD BRIDGE

Location PP. 54 North East Main Span. .
Bolt change report.

Personnel Present at Operation:

Wednesday. 21/03/12.

Works carried out.

Prior to fitting the temporary cable band at PP. 54 N/E, an area on the lower half of the main cable approx 1 metre below the cable band required to stripped of the protective membrane. This procedure was carried out between approx 11.00 AM – 13.00 PM by bridge inspectors At approx 15.00 PM top half of temporary cable band was transported to location by cradle and positioned on the main cable by Alps. This was secured in position by the use of ratchet straps and chain pulls until lower half was positioned.
At approx 15.50 PM lower half of temporary cable band was transported to location by cradle, and again This was secured in position by the use of ratchet straps and chain pulls until lower half was positioned. All 8 M36 bolts located in position and secured . All plates and washers positioned as per (Aecom drawings) and tightened by spanner. **(All M36 bolts were give as specified thread extensions on the tensioned end of a minimum of 1.5 times thread diameter. ie M36 = 55mm . Dead end to have minimum of 2 in No threads showing below nut. (As per method statement.)**

This concludes all works carried out on the above date.

FORTH ROAD BRIDGE

Thursday. 22/03/12.

08.30 AM. Prior to commencement of bolt change operations a briefing was held in the training room to go through the sequence of events with staff , this was followed by a question and answer session. This was to ensure that all staff understood the method statement and procedures.

09.00 – 10.00. AM All required tensioning and hydraulic equipment transported to working platform.

10.15. AM. All temporary cable band M36 bolts rechecked to ensure required extensions as per method statement and as checks carried out on the previous day.

10.30 AM. PS. 2 tensioners fitted and hydraulic circuit completed.

10.35 AM. Circuit pressurised and taken up in increments as requested with continual monitoring observations being carried out on clamp and PS 2 tensioners until required pressure of 16610 psi @ 350 kn (1130 bar) was achieved.

Pressure reached 16969

This procedure was carried out as specified in method statement a further three times under tensioning of temporary cable band bolt.

Pressures recorded between 11.00 and 11.10 AM. were -

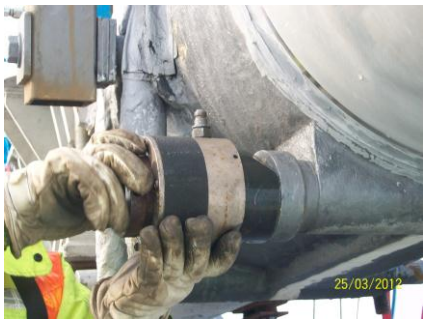
Pressure 1. - 16781 psi.

Pressure 2. - 16832 psi.

Pressure 3. - 16869 psi.

12.00- 13.00 PM. break from work operations was taken.

13.40 PM. Operations to remove defective bolt “D” began. PS 4 tensioner applied to dead side , required pressure in old bolt could not be achieved to release nut. Alternative method applied . The RSL torque wrench would be used . This required a reaction point for the foot of the tool to be able to apply enough torque for the nut to release. Defective nut would still not release.



13.45 pm. RSL 6 offered up to defective nut to see what method could be used to achieve a suitable reaction point. (attention was taken to ensure that no damage would occur to the main cable wrapping when pressure was applied.)

13.50 PM. Method adopted, two hardwood wedges applied to main cable for protection of wrapping . 20 mm steel plate attached and held in position by ratchet strap to give suitable reaction point for RSL 6. This method was un successful , nut would not release.

14.00 PM. Following no success in the use of this method, further discussions were held to offer an alternative method. Method adopted would require an extension sleeve to be fabricated and attached to the foot of the RSL 6 torque wrench. Engineer I. Alexander returned to workshop to complete proposed fabrication.

14.30 PM. Engineer returned with fabricated extension sleeve.

14.35 PM. Fabricated extension sleeve designed to be used horizontally with required purchase to be gained against the underside of the main cable. Reaction point to be gained from metal plate . No success using this method.

Prior to leaving platform photographs & dimensions were taken on the gaps between the nut size against the cassette contained in the RSL 6 as it was found that the required movement was to much before a reaction point was reached to allow the tool to bite. Discussions between Maintenance manager took place that evening to design and fabricate this insert which would be used to counteract excess movement .

Point to point.
Dimension – nut – 65mm.
Dimension – RSL 6 cassette. – 70mm.

Flat to flat
Dimension – nut – 55mm.
Dimension – RSL 6 cassette. – 60mm.

No further work carried out that day on platform.

FORTH ROAD BRIDGE

Friday 25/03/12.

06.30 Am.

Following an early morning telephone between Maintenance inspector & Bridge inspector, several ideas were discussed to try and overcome the problems encountered. One of the issues which concerned us was if the regulator valve on the hydraulic pump had been opened fully to achieve maximum output .

09.00.- 10.00 Am. Bridge inspector & Engineer attended location to test hydraulic pump output. Previous output gained on unit was approx 5000 psi. Adjustment to pump valve gave an extra 1000 psi. Therefore 6000 psi was achieved. PS 2 Tensioners located on the underside of the temporary cable band were also removed for health and safety reasons. .

It was decided that no further work would be carried out that day to try and release Bolt “D”.

At approx 11.30 AM. A briefing meeting was held to decide and plan work to be carried out on Sunday 27/03/12. This meeting was attended by ,

Engineering services manager –
Maintenance manager –
Maintenance supervisor
Bridge inspector .

Sunday 27/03/12.

09.00 AM. Work began to try and release Bolt “D”. With the increase in pressure achieved in the hydraulic pump and the repositioning of the RSL. 6. extension sleeve attached vertically with the reaction point being against two steel packer plates attached and secured by means of a ratchet to the north face of the west hand-strand. This adopted method prove to be a success .The nut was released methodically , using turns of ¼ at a time which allowed the stroke of the hydraulic pump and RSL. 6 to carry out its function efficiently.

09.15 AM. Bolt “ D” released . Slight coating of moisture was observed on bolt sleeve.

09.25 AM. Replacement bolt " D" inserted . No problems encountered. Care taken to ensure positioning of washers and cleanliness of mating face on cable band prior to re- tensioning of new bolt.

10.00 AM. Ps 4 applied to re-tension new bolt, pressure increments applied up to 16500 psi using air pump located on the footpath, this pressure was not enough to raise the tensioner to the acceptable required load as specified.

10.05 am. Reverted to hand pump to reached the specified pressure of between 700 kn @ 18 488 psi and 750 kn @ 19 578 psi.

Pressure taken to 19667 psi. this operation was completed three times to ensure that required load had been reached. All readings taken were over 19000 Psi.

ESM. present and happy with load pressures applied.

12.30. PM. . Work began to try and release Bolt “B”. Method applied to release Bolt “D” was found not applicable to Bolt ”B” for release. Engineer I. Alexander returned to the workshop to remove the extension sleeve which had been added to the RSL. 6.

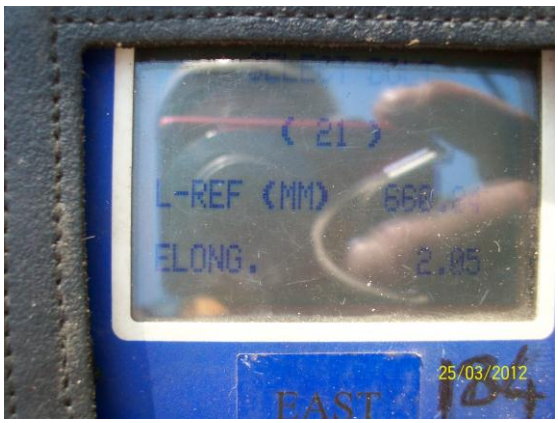
13.40. PM. Sleeve removed and RSL 6. returned.

13.50. PM. Began to release Bolt “B” ¼ of a turn at a time.

14.00. PM. Defective bolt removed . No problems were encountered.

14.10 pm. New bolt entered.

14.30. PM. Bolt torqued up using the RSL. 6. New bolt readings were taken and recorded on Bolt scan EMS., machine 184 group 1 under bolt No 21. New bolt " L "referenced AT 660.084.



14.30. pm. Temperature recorded at 13 C.
Elongation recorded at 1.22.
Load recorded at 418 Kn. .

14.40. pm. Temperature recorded at 13 C.
Elongation recorded at 1.48.
Load recorded at 508 Kn. .

14.50. pm. Temperature recorded at 13 C.
Elongation recorded at 1.94.
Load recorded at 666 Kn. .

15.00. pm. Temperature recorded at 13 C.
Elongation recorded at 2.05.
Load recorded at 704 Kn. .

ESM . contacted by phone . Satisfied with load.

Monday 26/03/12.

Bridge inspector G. Elliott. Visited location with engineer I. Alexander to refit caps to Bolt “B” and to inspect and photograph replacement bolts and nuts.

Tuesday 27/03/12.

Bridge inspector G. Elliott. Visited location with painter C. Marshall to inspect for damaged paintwork which may have occurred during working platform movement at bolt replacement location at PP. 54 N/E. The east face of the east suspender cables were recoated as a precaution to ensure that no bare wires would be exposed to the elements and prevent possible corrosion infesting the cables.

This concludes all relevant information recorded on the above bolt changes. Please be aware that whilst trying to ensure as much information was recorded that participation by myself in all operations related to this task the work procedure sequence may have not been as detailed as I would have liked.

Bridge Inspector