TASMAN DISTRICT COUNCIL
CONTRACT NO 682 - PROFESSIONAL SERVICES

REPORT FOR ROADING ASSET MANAGER

Date: 27 January 2009
To: Peter Thomson
Copy to:
Reference: Z1448907
Subject: SALISBURY SUSPENSION FOOTBRIDGE, AORERE – BRIDGE NO. 112302

Status: Final

ASSESMENT AFTER BRIDGE TEMPORARY CLOSURE

INTRODUCTION

The Salisbury Suspension bridge was inspected by Tasman District Councils' contractor Nelmac on the 22nd December 2008. Nelmac identified visual defects in one of the main suspension cables and also areas of rotting in one of the existing timber bridge towers. Nelmac subsequently sent photos of the cable defects to John Foulds from the wire rope specialist 'Ropetech'. Ropetech recommended that the structure should be closed until a detailed assessment could be made of the cable and timber structure.

The Salisbury Suspension footbridge has been the subject of inspection, analysis and reporting by MWH structural engineers since August 2001. An initial report stated that the bridge tower structures should be replaced and the entire bridge structure be programmed for replacement in 5-10 years.

A further report in April 2002 identified the fact that the structure has a Historic Places trust listing of Category II as Heritage Building and Structure – Registration Number 5123, 15th February 1990. This status resulted in the requirement by the Historic Places Trust, of a remedial solution that is sensitive to the historic nature of the structure. The bridge was closed to the public in December 2003, pending load testing and subsequent remedial work. During 2004, load testing of the bridge was carried out and approximately $40,000 was spent to improve the bridge for public use.

BRIDGE DESCRIPTION

The description of the bridge included in the MWH 2001 report is described again for completeness.

'The Salisbury suspension bridge is a footbridge crossing the Aorere River approximately 30 to 40m downstream of the Quartz Range road bridge in Golden Bay.
The bridge has a span of around 36 metres. The deck consists of 3/150 x 30 boards overlaid with 2/260x25 boards spanning longitudinally over 100x80 timber transoms at around 900mm to 1.0m centres supported by 10 or 12mm rod hangers. The main cable is 18mm diameter (subsequently measured at 19mm) anchored to

concrete blocks. The towers are 250mm x 250mm hardwood posts with 200mm x100mm hardwood struts. The handrail/barrier consists of a wire rope fixed to the hangers with mesh (chicken wire) infill.

There is a short "link" span of timber construction at the true left side. This consists of 160x25 decking supported on 105x80 joists.

The bridge is currently sign posted for a 2 person limit".

The main use of the bridge is as a tourist attraction. Tourists are regularly directed there by locals to view the bridge. During the 3 hours that MWH spent on site on the 22nd January 2009, in excess of 20 vehicles stopped to walk down to a nearby swimming hole and also to look at the footbridge.

LOAD TESTING CARRIED OUT IN 2004

A load test was carried out on 2 April 2004.

The test involved the use of the DOC load bag placed on the centre of the bridge, which was incrementally filled with water (measured by a flowmeter on a water truck).

- As the bag was filled over a period of an hour, the bridge was loaded and the deflections at a number of key points were measured.
- When a test load of 18kN was reached, the abutment on the true right bank experienced 3mm of deflection. The midspan deflection was around 400mm at this load. The sway cable connection to the transom also failed at this point.
- Because of the movement in the abutment and due to the unknown abutment configuration (size, depth and strength) the test was stopped at 18kN loading.
- The bag was unloaded and measurements were taken of the relaxation at the end. Two-millimetre recovery was observed at the true right abutment.
- The bag was left empty for a period of 20 minutes.
- The load was then reapplied incrementally (second load cycle) over about an hour, held for 10 minutes and then released again, and deflection measurements were taken with similar deflection results to the first load cycle.

With normal Factors of Safety for Live Load and Dynamic effects 18kN equates to a 5 person load, but due to the age of the structure and the condition of the tower posts we suggested a three-person load limit on the bridge.

It is noted that the signs on site currently state that the loading on the bridge is to be limited to 2 persons at a time.

REMEDIAL WORK CARRIED OUT IN 2004

Inspections of the bridge structure identified the poor condition of the tower posts. Parts of the posts were showing signs of extensive rot and decay particularly in the upper and lower sections. Ground line rot on the true right bank downstream post and diagonal strut necessitated strengthening of these areas prior to the load testing.

At the time of the load test, a number of items identified during prior inspections were given further scrutiny and a schedule of remedial work items was created. In particular, cable support brackets were fabricated and placed at the top of each downstream tower post. Preservative was injected/applied to the towers to aid

preservation of the timber. A new handrail cable and chain mesh in-fill was placed. The timber run-on structure and barrier on the true left bank was strengthened.

The northern approach to the bridge site from the Quartz Range Road was improved with drainage work and gravel. This work was included in the contract to improve the aesthetics and amenity of the site.

INSPECTION CARRIED OUT IN JANUARY 2009

The footbridge was closed to the public on the 16th of January 2009. On the 22nd of January Nigel Beatson (Structural Engineer) from MWH and John Foulds (wire rope specialist) from Ropetek carried out an inspection of the Salisbury suspension footbridge. This visit focused on the items identified by Nelmac, but also a general inspection of the whole structure was carried out.

Wire rope defects

The wire rope defects identified by Nelmac were on the TLB downstream end between the top of the tower and the cable anchorage. On site these defects looked like the cable had been kinked at two locations and gave the appearance of being slightly squashed.

John Foulds comments on the wire rope are as follows:

- The main cables are 19mm diameter – made up of 6 groups of 7 wires wound around a hemp or manila core. He thought the wires were aluminised steel which was commonly used in the electricity industry and has been used on various bridges in the district.
- The core seems to have rotted out. This was confirmed by exposing the end of the cable at one of the anchorages.
- The damage does not look recent – he did not remember seeing this damage on the cables 4 years ago when he last worked on this bridge, but it probably had been there from before this time.
- There are no signs of the steel yielding.
- After visually seeing these cables on site and the defects highlighted by Nelmac, John was happy to withdraw his recommendation that the bridge be closed to the public.
- Because the core has collapsed this will cause wear to the internal strands. He recommended that to minimise the accelerated wear the cables should be liberally lubricated on a routine basis.

Timber defects

Nelmac identified that the vertical timber post on the downstream side of the southern end of the bridge was badly rotten near the top.

- This defect was identified previously by MWH, but due to the historic nature of the bridge an alternative to the original recommendation to replace these towers was implemented. Preservative was applied to the rotten areas of the tower, and plates were installed to transfer the vertical loads on the post lower to where the timber was in better condition. From the inspection on the 22nd January it appears that this decay has continued and it is recommended that further remedial work be carried out on this post to maintain the load carrying capacity and to slow down the continual decay of the post.

Other Defects observed during the inspection

The base of two of the bracing posts on the TRB downstream post are decayed at ground level. It is recommended that the base of these two posts be encased in concrete using the same detail that was used on other braces in 2004. (Sketch attached).

One bolt on the TLB downstream side of the bridge is missing its nut - which has rusted off. This bolt should be replaced with a new galvanised bolt, washers and nut.

RECOMMENDATIONS

Bridge Closure
It is recommended that the bridge be reopened, however one load limit sign has been vandalised and the people limit had been removed. This sign should be reinstated prior to reopening the bridge.

Improved signage
Signs should be added to the crossarms of the towers above head height, these should repeat the message that the bridge is only safe to be used by 2 people at a time. Hopefully by putting these signs higher on the bridge they will be less likely to be vandalised. Other signage could be added to note the aged and fragile nature of the structure – to explain the importance of the load limit.

Decayed timber
It is recommended that the decayed section of timber at the top of the downstream TRB tower be repaired. In a normal situation MWH would recommend that this tower should be replaced, but due to the historic classification of the bridge and the requirement to maintain its historic appearance the existing member could be repaired. We would recommend that the rotted wood be cleaned out and the cavity filled with a foamed boron preservative. Over a period of a few hours this foam collapses against the sides of the cavity transferring the boron to the adjacent wood. The cavity should then be filled by a rigid filler with compressive strength. Then disguised to maintain the 'old' appearance.

The base of the two braces that have decayed on the same tower should be encased in concrete as per the attached sketch.

This work should be carried out in the next 6 months

Missing nut at northern tower
The bolt with the missing nut on the TLB tower should be replaced with a new galvanised bolt, washers and nut.

Additional Sway Cables
Currently there are only sway cables running from the midspan of the bridge to the TLB. It is recommended to install a second set of sway cables running from the midspan to the TRB. This should remove some of the swing in the suspension bridge and hopefully reduce the amount that people can deliberately swing the bridge side to side.

Load testing of the bridge
It is recommended that the bridge be load tested again within the next 6 months to confirm the structural integrity of the main cables. The load testing should be carried out from then on every 5 years.

Specialist Rope Inspections
It is recommended that a wire rope expert is contracted to inspect the wire ropes every two years. Ropetek is one contractor that would have the skills to carry out this inspection.

RISK

The obvious risk with this bridge is that even though there is signage stating a limited number of people can use the bridge, there is nothing stopping many more people being on the bridge at one time. It has been documented by Nelmac that on one occasion when they turned up to inspect the bridge there were 6 people on the bridge swinging it from side to side. The location of the bridge is well signposted on the Aorere Valley Road and seems to be used by many sightseers who are visiting the area. The 2 person limit on the bridge does have a factor of safety but there is still a risk that this can be exceeded. The signage on site needs to be checked on a regular basis.

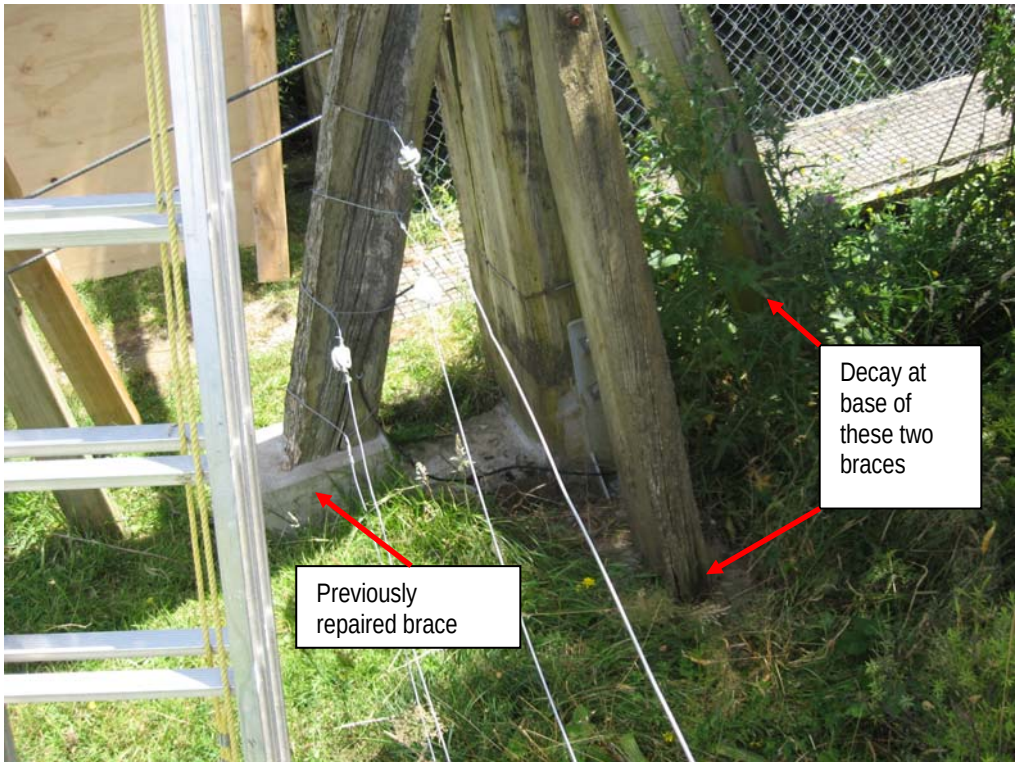
Photo1 : Salisbury Suspension Footbridge


Main Area of
deformation in cable


Black Material is
decayed core of cable


Area of decay in timber post


Severe decay at top of tower post


Decay at base of these two braces
Previously repaired brace


Decay at base of brace


Nut rusted off end of bolt

MWH

MWH

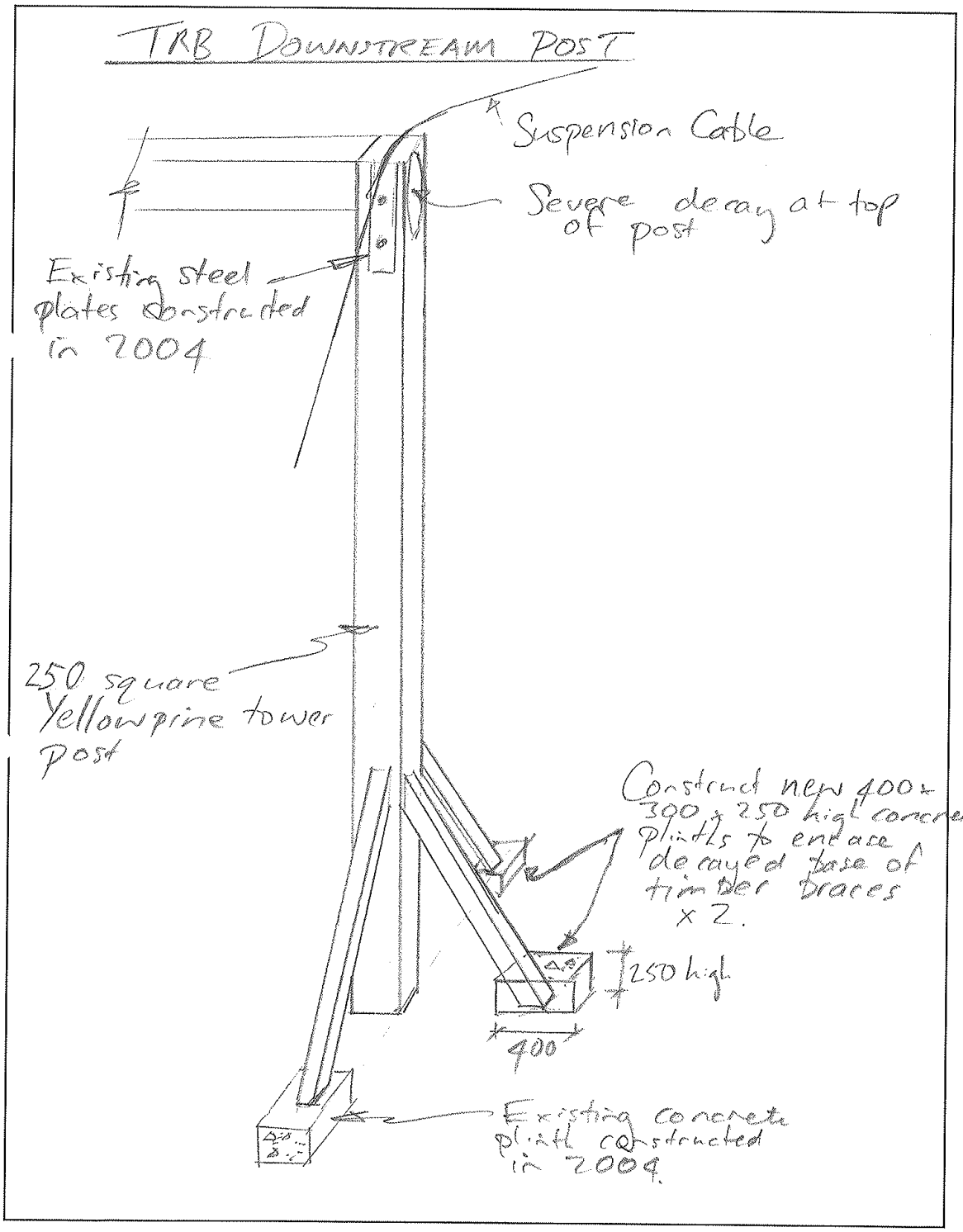
PROJECT Salisbury Suspension Bridge PROJECT No.

DESCRIPTION TRB Downstream Post.

COMPUTED/PREPARED BY DATE 20

REVIEWED/CHECKED BY DATE 20

REF/DWGS SHEET OF



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Prepared by: Date:	Reviewed by: Date:

Yours faithfully

MWH NEW ZEALAND LTD

Geoff Ward

GROUP MANAGER TRANSPORTATION