TECHNICAL NOTE

TO	Martin Whitchurch	**FROM**	Brendon Pell
DATE	**28 March 2018**	**CONFIDENTIALITY**	**Confidential**
SUBJECT	Poole Park Sluice Bridge Abutment Assessment		

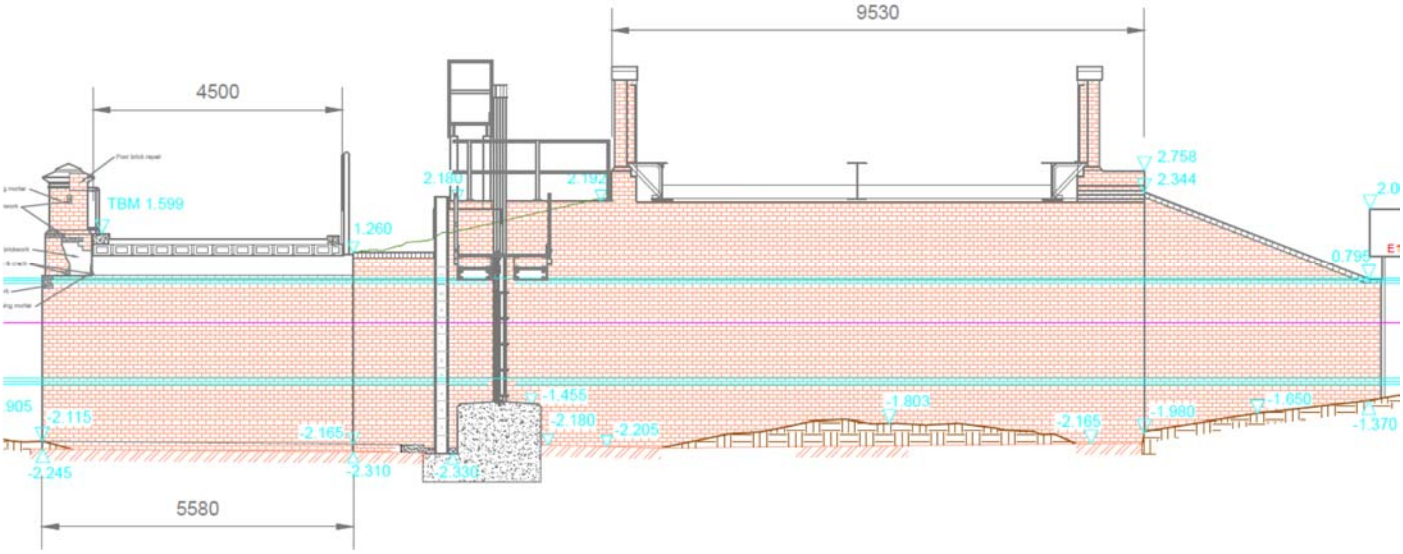
Background

Poole Park was laid out in 1886 at the time the London and South Western Railway was constructed across Parkstone Bay. The construction of the railway and supporting embankment allowed the creation of a salt water lake. At the approximate mid-point of the embankment a sluice and bridge was provided to allow for exchange of water between the lake and Poole Harbour, as shown in this map from 1888:

The sluice and bridge structures are located at OS grid reference 402448, 090691.

Introduction

The current Poole Park Sluice Bridge comprises a deck of 210mm deep hollow floor beams (more usually used for internal flooring within steel framed buildings) with a 75mm thick in-situ topping and with a surface of bituminous surfacing. This deck dates from circa 1950 and replaces an earlier deck, making use of steel I section that was constructed contemporaneously with the railway structure. The two structures, and the boating pond sluice between, all share the same brick abutments dating from 1886. The long section prior to the recent Network Rail renewal of the railway structure is as in the drawing extract below:



Due to on-going deterioration, in 2008 Borough of Poole (BoP) implemented measures to prevent the bridge from being used by vehicles. Later, in 2012, BoP opted to provide a temporary scaffold footbridge above the structure with independent support to ensure the safety of park users. This was due to be in place until 2014, but is still in situ; some parts of this structure are now reaching the end of their useful lives.

The stubs of the ‘I’ section beams from the previous deck are expansively corroding leading to the instability that can be seen in the left hand, eastern pilaster. The brick pilasters at each end of the bridge are listed and will be taken down, conserved and reconstructed.

It is therefore proposed to remove the scaffold footbridge, demolish the existing concrete bridge deck, and replace it with a Fibre Reinforced Plastic (FRP) deck, along with associated finishing works. The method for removing the existing structures and installing the new deck will be covered separately. This document will consider the sufficiency of the existing brick abutments for re-use.

Abutment Condition

The structure has been regularly inspected by BoP adopting the defect identification system in accordance with Inspection Manual for Highway Structures 2007 Vol 1: Reference Manual, ISBN 978 011 55297 5 and Inspection Manual for Highway Structures 2007 Vol 2: Inspectors Handbook, IBSN 978 011 552798 2.

The most recent inspection was carried out on the 6th March 2016. The section on the abutments is extracted below:

Load-Bearing Substructure	04	Foundations	1	A	B	NP	No evidence of structural movement in the substructure below water level to indicate any foundation defect.
	05	Abutments Bearings	4	E	NW	NP	Mass insitu concrete bearing beams on top of the original brick abutments. Poor quality concrete with weathering honeycombed surface and some vertical cracks. Wet patches and staining on surface indicate water seepage through the concrete.
	06	Abutments Brick	3	C	R	H	All exposed brick surfaces are sound with little or no spalling or mortar loss. Pointing is good except locally around ends of abutments and below up stream parapet piers. Where there is significant mortar loss weathering/scour. Majority of the element is below water level and is in very good condition with little or no spalling or mortar loss evident.

Photos to illustrate these areas are below:

In this image the original blue engineering brick abutment can be seen below the concrete bearing beam and the “I” section beam from the previous deck indicating the previous soffit level of the structure.

In this image, a view of the localised mortar loss under the east pilasterdeck elevation, east abutment, and scaffold bridge above

In this image the straight even coursing and filled mortar joints of the engineering brick abutment can be seen

As can be seen above, other than the mortar loss below the pilasters, which will be repaired during the works, the abutments are in excellent condition. Diving inspections have also been undertaken confirm that there is no cracking, tilting, bulging or other deformation of the abutments that would indicate that they are not suitable to carry the loads to which they have been and are subjected to.

Abutment Loading

As stated above the pilasters will be taken down and reinstated as part of these works. As such the load they exert on the abutments will be unchanged.

The unfactored load the existing deck exerts on each of the abutments has been calculated as follows:

Existing deck weight	(dimensions in m)					(kN/m3)	
	thickness	width	length 1	length 2	Void %	Density	Mass kN
Bison floor beams	0.21	4.50	6.50	5.50	0.43	24.00	77.76
topping	0.08	3.90	6.50	5.50	0.00	23.00	40.37
edge upstands	0.15	0.60	6.50	5.50	0.00	23.00	12.42
Surfacing	0.03	3.90	6.50	5.50	0.00	23.00	16.15

Existing parapets	length of rails	length of posts	weight per m (N)	
Tubes	13.00	1.80	44.15	0.65
Mesh	ignore			

Pilasters will be re-built like for like; consider deck weight only	134.92	kN
	13.75	t

This is split between the two abutments; per abutment =	**67.46**	**kN**
	6.88	t

It can be seen above that the existing total per abutment is 67.5kN or 6.9t.

The new FRP deck is lighter and thinner. The existing concrete bearing beams will be removed and new versions cast to suit the details of the new deck. It is assumed that the finished foot/cycleway level will remain the same, so the bearing beams will need to be thicker to accommodate the difference in deck depth.

This project is at an early stage, as such detailed calculations for the new FRP deck have not been carried out. However an early conservative estimate has been provided by one FRP bridge supplier. In their proposal the new deck will weigh approximately 3.8t.

New deck; from FRP firm proposal = 3.8t (add say 20 %)			44.7336	kN
Parapet; BoP specified, 40kg/m (both sides this time), (dimensions in m)				
length 1	length 2	mass/m		
6.5	5.5	0.4	4.8	kN
Total split between two abutments; per abutment =			**24.77**	**kN**

As above, even if 20% is added to this to accommodate any design changes, and 5kN for the new parapets, this comes to 25kN / per abutment. The existing deck totals 0.315m deep, the proposed deck is expected to be 0.13m deep, with a resin bound surfacing of minimal depth. The difference of 0.185m, as above, is therefore to be taken up in the cill/bearing beams. Trial holes have confirmed the width of the abutments as 0.45m, the deeper cill beams therefore result in an additional load of 9kN per abutment bringing the total to 34kN, or 33.7kN less than existing.

Live Loading

The structure was previously used by parks maintenance vehicles. However since closure to vehicles took place in 2008 no undue difficulty has been encountered by parks maintenance staff. The new bridge will therefore not be required to carry any loading above that required for a footbridge in BS EN 1992-2; namely pedestrian loading and a notional service vehicle. Both are will within the vehicular loading to which the structure was previously subject.

Conclusion

It is therefore determined that the existing abutments are adequate to carry the new deck and the changes will therefore not cause any distress to them or result in disturbance to the adjoining sluice and railway bridge structures.