WINDSOR'S HERITAGE

Windsor, the most prominent of the five Macquarie towns located on the Hawkesbury River, some 55km north west of Sydney, has many claims to heritage values, including Aboriginal (Darug) and more recent European heritage. Examples of European heritage include Thompson Square, named by Macquarie after a former convict who Macquarie had appointed local magistrate and who died after being involved in a flood rescue, St Matthews Anglican Church and many other public and private buildings. Another "heritage" issue is currently being played out locally now. The following comments are about this issue.

****

There is a bridge in central Spain near the Portuguese border, known as "Puente de Alcantara". It is constructed of granite stone blocks and comprises six adjacent arches, totalling 200 metres in length. The largest arch is of 30 metres span and the height of the deck above the bed of the Tagus River is 40 metres. This bridge, although magnificent in its setting, is no world beater in terms of size.

However, there are three reasons this bridge is famous – famous to bridge lovers, bridge historians and the broader Spanish and world community. It carries current day traffic, even though it was constructed during the reign of the Roman Emperor Trajan, in the year 104. Subsequently, the bridge was damaged during several wars and required significant repairs. Otherwise the bridge has been in constant use for almost 2,000 years, Its builder was Caius Julius Lacer. He erected a small shrine at the northern the bridge with an inscription in Latin above the doorway that translates simply into English as ***"I have built a bridge which will last forever"***

Fig 1 Puente de Alcantara

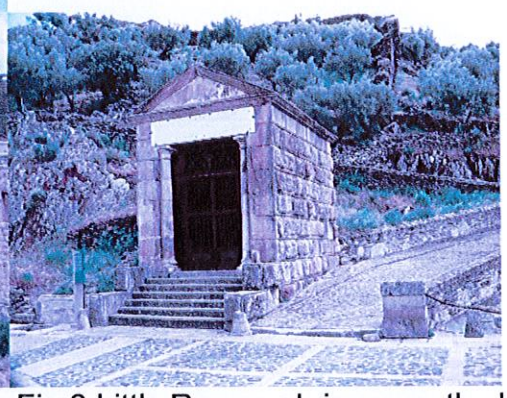

Fig 2 Little Roman shrine near the bridge

****

In 1920, the Public Works Department great bridge designer, Percy Allan (Pyrmont and Glebe Island swing bridges, Tom Uglys steel truss bridge, some 105 timber truss bridges, including many of the type named after him (the Allan Truss), and

mentor of JJC Bradfield of Sydney Harbour Bridge fame), designed the first precast reinforced concrete beams for a bridge in NSW and probably Australia. These beams were manufactured on the bank of the Hawkesbury River and were installed to replace the existing timber deck of the Windsor Bridge, thus enabling the re-use of the existing cast iron piers. The new reinforced concrete superstructure, consisting of the precast beams and a cast-in-place deck, installed in 1922, replaced the original 1874 timber deck.

The original crossing of the Hawkesbury was a punt, which was replaced by a low level timber deck on cast iron piers in 1874. The piers were raised by 8ft ((2.4m) in about 1900, to minimise the effect of floods, before the 1922 works described above. It is roughly estimated that the flood frequency for the original timber bridge would have been less than once in a year, and for the raised timber bridge and subsequently, the concrete deck, once in 2.5 years.

One of the interesting features of the Hawkesbury River flood plain here is that at about RL 12 AHD, the river flow breaks out from Freemans Reach (upstream of Windsor) across to Pitt Town (downstream). As a result, only about 10% of the flood river flow remains in the river channel going past any bridge near Windsor, with 90% of the flow going through the "Breakaway". Therefore velocities and stream forces are substantially reduced. As far as is known, neither the timber deck nor the concrete deck has been washed away.

Percy's design was original in many respects. For instance, in his design he split the central beam so that the new superstructure could be constructed in half widths, thus allowing a single lane of traffic to operate while construction activities proceeded alongside (see Figs 3, 4 & 5 below).

Percy's beams were of great strength and rigidity. They contained so much reinforcement (see Fig 4 below) that today they carry B-Double trucks of at least 65 tonnes mass without a load restriction and without noticeable deflection. His concrete was twice the strength required by the specifications of the day. Thus, with respect to the stone blocks of the Alcantara Bridge, Allan's concrete would nave been three times as strong under compression loading.

At the time of Allan's Windsor Bridge design, the design load was a 16 tonne steam-powered farm tractor, as this was the heaviest vehicle known to travel public roads to the turn of the 20th century. It was not until the late 1920's that this bridge design load was increased. Allan appears to have designed this bridge to be much stronger in anticipation of such a change.

If Alcantara has survived almost 2,000 years – and there are other similar examples of Roman bridges still carrying traffic – it would be expected that the life of the

Windsor Bridge could be more than 100years.

After the relatively minor rehabilitation of the superstructure for superficial corrosion of the steel reinforcement and the strengthening of the cast iron cylinders in the piers, as proposed by us, together with routine inspections and maintenance, and control of traffic loadings, the existing bridge's life would be indefinite.

Traffic loads are controlled with respect to gross mass. The vehicles that should be allowed to use the Windsor Bridge include ambulance and fire brigade services, school and tourist buses, essential providers of small goods and services and cars. We have suggested for discussion purposes that a limit of between 16 and 20 tonnes be applicable in the future.

In conjunction with this rehabilitation, it is proposed to add a new cantilever footway on the upstream side of the existing bridge to make access to Macquarie Park's beaches more convenient and safe.

Perhaps, like Caius Julius Lacer, our Percy Allan could have inscribed his work with the words "***I have strengthened this bridge to last forever".***

To achieve the above noted result, Windsor Bridge requires a by-pass structure for the conveyance of traffic that exceeds the size of those vehicles necessary for the daily operational requirements of the community and tourists.

It is logical that this by-pass, which would incorporate a second bridge crossing of the Hawkesbury River, should be linked into the Hawkesbury Flood Evacuation Route to provide ready and convenient access for the local community and motorists during flooding. Because this bridge will be inundated during floods, the deck would require pressure relief openings to control uplift buoyancy forces.

****

People of Windsor – if you allow the RMS to replace your present historic bridge, you are committing to a structure that will direct all traffic through Windsor. This traffic, with its predicted growth rate, would eventually strangle your beautiful Macquarie town and historic Thompson Square, dedicated by Macquarie.

Don't let this occur – keep fighting for the alternative solution as outlined above.

Brian Pearson*
Former Chief Engineer (Bridges)
DMR

Ray Wedgwood*
Former Chief Bridge Engineer
RTA (successor to DMR)

*with a combined 80 years experience in bridge design, location, construction and maintenance and management.

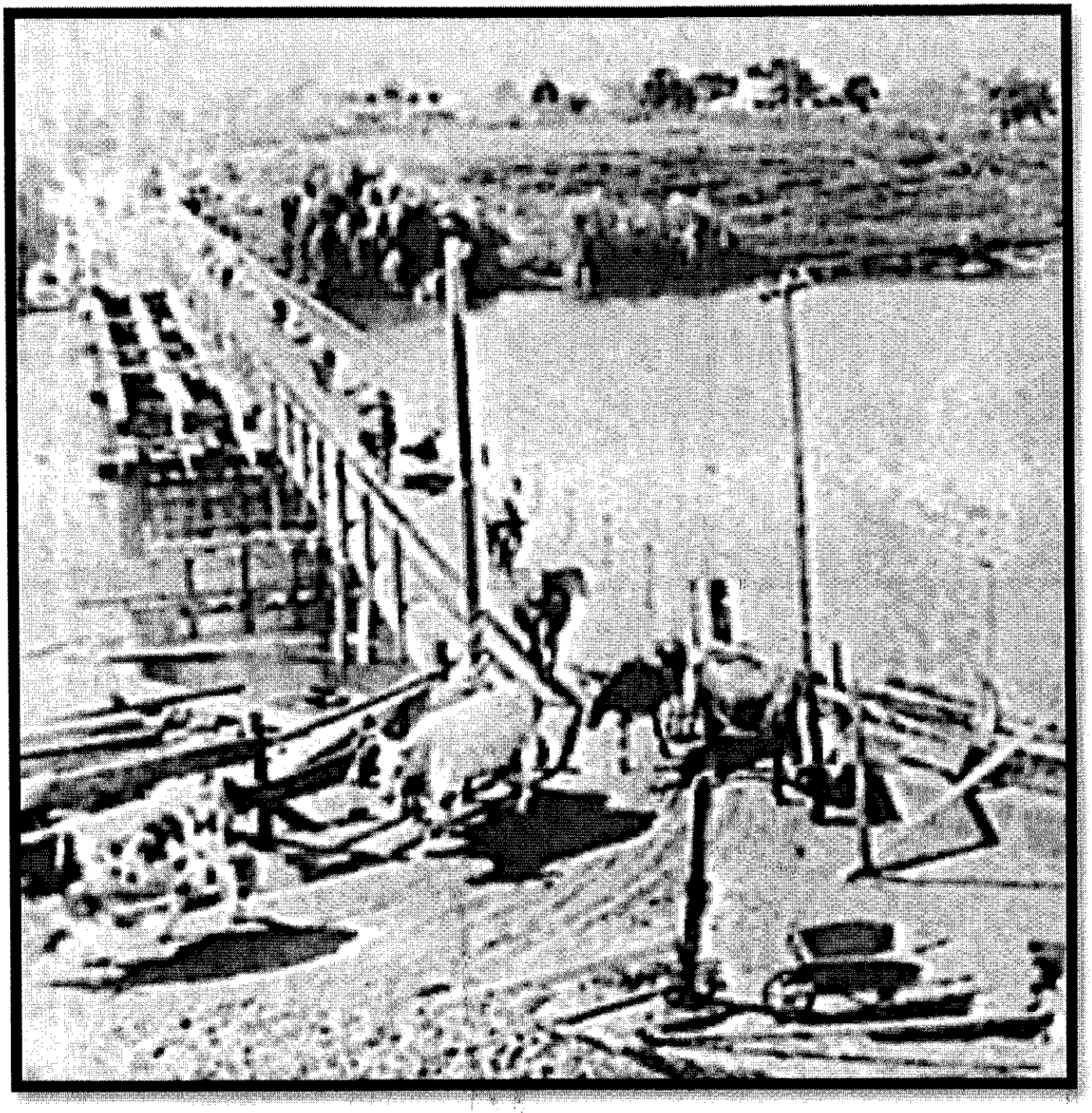

Fig 3 Bridge over Hawkesbury River at Windsor – 1922/3 - replacement of timber deck by reinforced concrete deck in half widths – note reinforced concrete beams in midground, reinforced concrete deck on beams in background

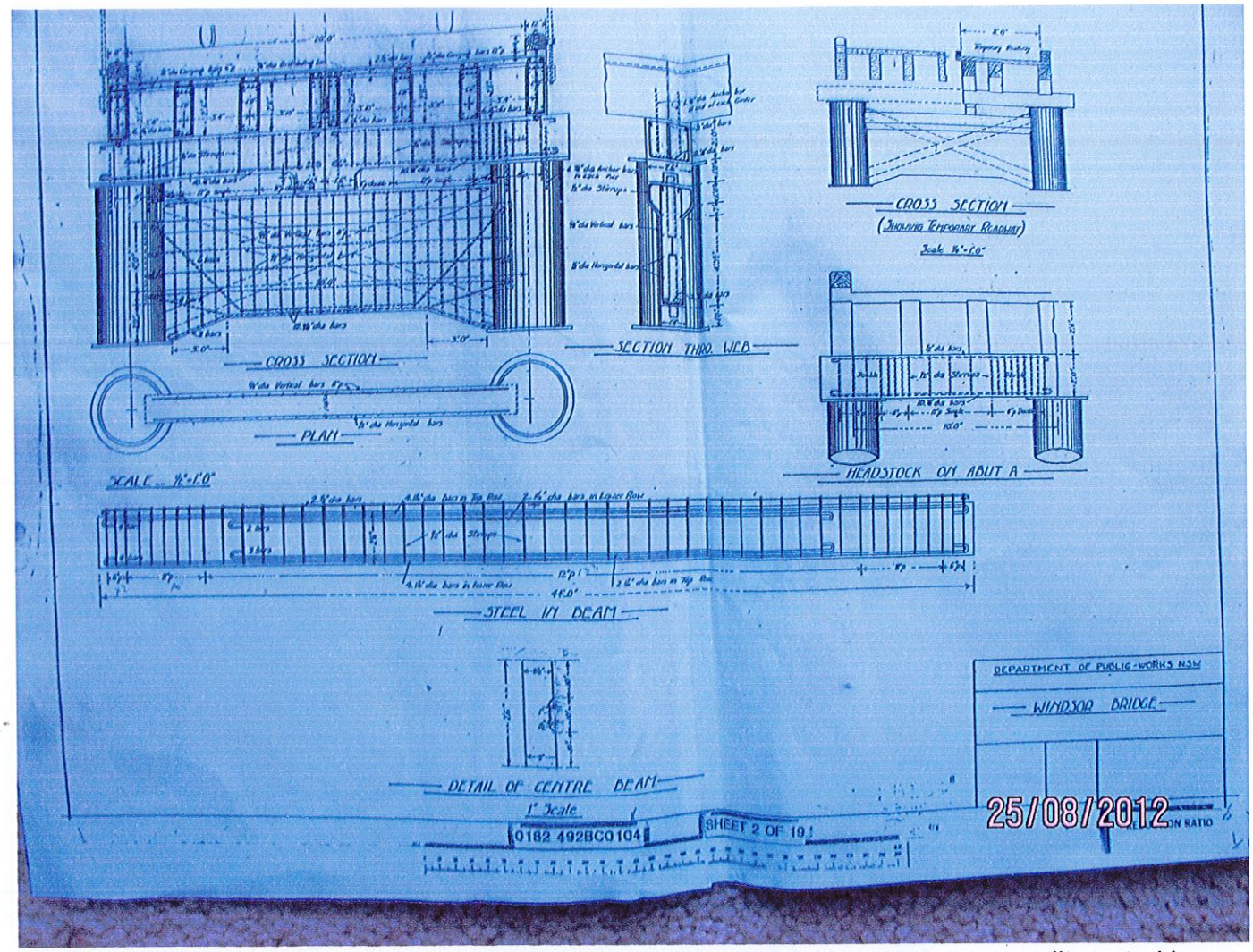

Fig 4 Public Works Plan for Windsor Bridge Superstructure Replacement – note split central beam for half width construction

Fig 5 Windsor Bridge – note central split beam on headstock