HERITAGE COUNCIL OF WESTERN AUSTRALIA

REGISTER OF HERITAGE PLACES - ASSESSMENT DOCUMENTATION

11. ASSESSMENT OF CULTURAL HERITAGE SIGNIFICANCE

The criteria adopted by the Heritage Council in November 1996 have been used to determine the cultural heritage significance of the place.

11. 1 AESTHETIC VALUE*

Causeway Bridges has aesthetic value in the balanced proportions and sizes of the elements of the piers, steel beams, concrete deck, concrete abutments, balustrading, pilasters and original lighting standards. (Criterion 1.2)

Causeway Bridges over the Swan River is a landmark providing an entry statement to the City of Perth from the eastern approaches. (Criterion 1.3)

11. 2. HISTORIC VALUE

Causeway Bridges is of historical significance as the bridges assisted in the evolution of road transportation and personal mobility in the State; allowed residential settlement south of the Swan River to move away from the river; and, connected the City of Perth with the Albany, Great Eastern, Great Northern, South Western and Canning Highways. (Criterion 2.1)

Completion of construction of the *Causeway Bridges* in 1952 concluded over 120 years of continuous endeavour to successfully bridge the river with a permanent structure. (Criterion 2.2)

Causeway Bridges has associations with E W C Godfrey, who designed and supervised its construction, and with the Department of Public Works and the Main Roads Department. The place also has historical associations with Surveyor General J S Roe, Superintendent of Works Henry Trigg and Major F C Irwin, who designed and modified the first Causeway opened in 1843, and with Richard Roach Jewell, who designed the second Causeway that was built by convicts and opened in 1865. (Criterion 2.3)

The concrete and steel structural design was innovative. The 1952 *Causeway Bridges* were the first in Western Australia to be lit with vertically mounted fluorescent tube street lighting and the first to employ PVC underground cables for street lighting. (Criterion 2.4)

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* For consistency, all references to architectural style are taken from Apperly, Richard; Irving, Robert and Reynolds, Peter *A Pictorial Guide to Identifying Australian Architecture: Styles and Terms from 1788 to the Present* , Angus & Robertson, North Ryde, 1989.

11. 3. SCIENTIFIC VALUE

The geotechnical assessment of the bridge foundations to establish the bridge pier design parameters was significant research. (Criterion 3.1)

The composite steel beam and concrete deck design of *Causeway Bridges* is technically innovative and is the first example of a concrete deck being cast in situ over the steel beams, a process pioneered and developed by Alan W Knight. (Criterion 3.3)

11. 4. SOCIAL VALUE

Causeway Bridges is highly valued by the community in providing a link over the river for pedestrians, cyclists and vehicle transport and access to the adjacent landscaped recreational areas. (Criterion 4.1)

Causeway Bridges provides a sense of place of cultural significance as the eastern access to and from the City of Perth. It forms an eastern entry statement to the City of Perth. (Criterion 4.2)

12. DEGREE OF SIGNIFICANCE

12. 1. RARITY

Causeway Bridges is the first example of structural design based on composite steel beams and concrete decking used in Western Australia. The technique was developed by Alan Knight, who later became Commissioner of the Tasmanian Hydro-Electric Commission. It is distinctive in its design, including the river piers and concrete balustrading. (Criterion 5.2)

12. 2 REPRESENTATIVENESS

The balustrading is representative of the type used on other bridges in Perth, Melbourne and Brisbane. (Criterion 6.1)

12. 3 CONDITION

Causeway Bridges is well maintained and is in very good condition. The balustrading is in good condition. There is visible surface cracking in the concrete abutments at the end of each bridge. This is possibly due to alkali reaction in the concrete, with the reaction estimated to be almost complete.

Causeway Bridges is structurally sound and will remain so into the foreseeable future.

12. 4 INTEGRITY

Causeway Bridges has high integrity. *Causeway Bridges* is compatible with its current use and has sufficient traffic capacity to match that of the connecting road system, and will continue to remain viable well into the future.

12. 5 AUTHENTICITY

Causeway Bridges has a high degree of authenticity with the fabric of the place in its original state. The removal of the original lighting standards has detracted from the authenticity of the place; however, the modified standards are still supported from the balustrading pilasters.

13. SUPPORTING EVIDENCE

The documentary and physical evidence has been compiled by J. L. Paton Consulting Engineer subsequent to the preparation of a Conservation Plan also by J. L. Paton. Additional information has been prepared by HCWA staff.

13. 1 DOCUMENTARY EVIDENCE

Causeway Bridges consists of two bridges spanning the channels of the Swan River to the east and west of Heirisson Island. These bridges, completed in 1952, are the third set of bridges on the site of a traditional crossing over the Swan River.

Prior to the arrival of Europeans in Western Australia, the relatively shallow waters and mud banks between what is now East Perth and Victoria Park provided a natural crossing for the Aboriginal groups that frequented the area. When William Vlamingh arrived in 1696, at which time he named the Swan River, the river flats presented an obstacle that prevented his progress upriver. Members of the French Scientific Expedition, which included Midshipman Francois Heirisson, in 1801, and Captain James Stirling in 1827, also encountered difficulties at this place during their explorations of the Swan River.

After settlement of the Swan River Colony in 1829, the shallow flats in the vicinity of Heirisson Island continued to impeded progress upriver and it was not long before a bridge was urged. Only flat-bottomed boats could make the transition to deeper water upstream and cargo had to be man-handled across the shallow and muddy flats.[1]. In an effort to facilitate transport on the Swan River, the *Burswood Canal* was constructed in 1831.[2] The canal helped alleviate the navigation problems, but as the colony matured, the need for a road link between Perth and the southern districts and Guildford became increasingly pressing. Bridging the Flats with a causeway was discussed, but lack of funds prohibited its construction for several years.

At a meeting of the Roads Board Trust on 28 February 1839, a motion was passed allowing for 'the erection of a Bridge and Causeway across the Flats at Perth, [which] is a very real utility, and would materially benefit the Settlers throughout the Colony.'[3] The first tenders were called on 12 February the following year and the work was spread over about three years and several contracts.[4] The design was prepared by J S Roe, Surveyor General, and modified by Henry Trigg, Superintendent of Works, together with Major F C Irwin. Consisting of two timber spans and associated roadway over the Heirisson Islands, the Causeway was officially opened on 24 May 1843. A toll was charged for almost all who crossed the Causeway, including pedestrians, each head of stock and vehicle. However, all officers and soldiers 'in

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1 J S Le Page, *Building a State: The Story of the Public Works Department of Western Australia 1829-1985*, Water Authority of Western Australia, Leederville, 1986, p. 38.

2 Fragments of the *Burswood Canal* are extant.

3 As quoted in Le Page, ibid.

4 Perth Gazette, 12 September 1840, p. 3; Le Page, op. cit., p. 39. A bridge across the Narrows had been considered, but the Causeway provided better access to the agricultural areas being opened up south of the river.

proper...uniform...and their horses...and all mail carriers...[were] exempted from any charge or toll whatsoever.'[5] *The Perth Gazette and Western Australian Journal* reported that 'this communication with the interior...presents one of the best public works constructed throughout the Colony.'[6]

Flooding in June 1862 overtopped the Causeway and necessitated rebuilding. The new bridge was designed and supervised by Richard Roach Jewell and the 'whole of the work [was] executed by convict labour, together with quarrying and boating the stone, and the manufacture of all the necessary ironwork.'[7] The new Causeway, built on the same alignment as the old, was raised by one metre in height and a third span was added. The bridges were connected by 'a raised causeway of earthwork, protected on the upper side with sheet piling and on the lower side with a stone wall, and approaches at either side by means of a railed embankment of similar construction'.[8]

The bridges were constructed of jarrah timber and material from the original was reused where possible. When the piles of the old bridge were drawn, they proved to be in extremely good condition, showing no signs of decay. Jewell reported that they 'were as sound as when first used, upwards of 25 to 30 years; showing the superiority of the Swan Jarrah for engineering purposes of this kind over other known timber.'[9] Some of the removed piles were shipped, on orders of Governor Hampton, to Sir William Denison, Governor of Madras, as an example of 'our invaluable jarrah timber, and its indestructibility'.[10] The new bridge opened for traffic in August 1865 and was officially opened by Governor Hampton on 12 November 1867:

> It is a work of general rather than local interest; for it [the Causeway] forms a main line of communication which connects the metropolis and the principal seaport with all the old established districts of the colony; and taken in conjunction with the noble Bridge which now spans the River at Fremantle, and with the viaduct recently erected at Guildford, renders complete the means of ready transport over an extent of country of which older settlements might feel proud.[11]

The gold discoveries of the 1890s and the associated increase in population led to the development of suburbs which radiated out from Perth. To accommodate the increased pedestrian and vehicular traffic passing over the Causeway between the city and Victoria Park, the Causeway was widened to provide a footpath in 1899. By 1902, it had became necessary to further increase the capacity of the Causeway to 'afford accommodation for proposed tramway communication with Victoria Park'.[12] This work, completed in 1904, involved strengthening and widening the Causeway for an average width of

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5 *Government Gazette*, 19 May 1843.

6 *Perth Gazette and Western Australian Journal*, 27 May 1843, p. 2.

7 Report by R R Jewell as quoted in Le Page, op. cit., p. 96.

8 Le Page, op. cit., p. 94.

9 Le Page, op. cit., p. 96.

10 *Perth Gazette and Western Australian Times*, 28 August 1865, p. 1.

11 The Chairman of the City Council of Perth's Address at the opening of the Causeway Bridge, as quoted in Le Page, op. cit., p. 96. The Helena Bridge at Guildford and the North Fremantle Bridge were under construction at the same time; the Helena Bridge was also opened by the Governor on 12 November 1867. North Fremantle Bridge was informally opened by Captain Manning on 28 November 1866.

12 Annual Report of the Public Works Department, Roads and Bridges Branch, for the year 1902.

2.85 metres (9' 6").[13] Service pipelines were installed on support structures adjacent to the bridge.[14]

The Main Roads Board was established in February 1926, with Edward Tindale as Chairman. The Board took over responsibility for the Perth-Fremantle Road and the Causeway and Fremantle Road bridges, as well as other metropolitan roads, from the Roads and Bridges Branch of the PWD. One of seven engineering appointments made the following March was E W Godfrey, Bridge Engineer, who became responsible for the design, construction and maintenance supervision of all road bridges in Western Australia.[15].

The Swan River Improvements Bill was passed in 1925 to 'authorise the reclamation of land along the shores of the Swan River' between South Perth and Maylands. The Act aimed in part to address problems in the vicinity of the Causeway:

> ...that part of the Swan River is anything but a beauty spot and algae is growing there to such an extent that instead of being...a natural feature...it is fast developing a nuisance..[and] gives off a most offensive odour...It is intended to reclaim both sides of the river and make an island in the centre near the Causeway...[16]

The *Stirling*, a suction dredging plant, was assembled in Fremantle and soon began work on the perimeter of Perth Water and around the Causeway. At the same time, construction of a new causeway was under consideration to meet the ever increasing demands of traffic. This did not eventuate and instead new piles were added downstream to widen the Causeway a further 11.3 metres (37 feet).[17]

Nevertheless, the Causeway continued to deteriorate. In June 1940, Godfrey reported that the existing structure was nearing the end of its life and that the provision of a new structure was becoming imperative. Godfrey recommended that the new Causeway be built immediately upstream of the existing timber bridge and forwarded a proposal to the Minister for Works in August of that year.[18] Three years later, Godfrey was instructed to prepare

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13 Annual Report of the Public Works Department, Roads and Bridges Branch, for the year 1904.

14 G B Hill, Consulting Engineers, 'Causeway Bridges Conservation Plan', July 1997, p. 6. Derived from photographic evidence.

15 Godfrey held this appointment until c. 1957. Aside from Causeway Bridges, Godfrey was also in charge of construction of the Stirling Highway (c. 1933) and the Eyre Highway, a major defence project (1941). The Main Roads Board was replaced by the Commissioner of Main Roads in 1930. Edward Tindale was appointed Commissioner and held that position until 1941, when he was replaced by Jim Young. The concept design of *Causeway Bridges* was formulated during Tindale's term and executed during Young's term

16 The Minister for Works, 1925, as quoted in Le Page, op. cit., p. 415.

17 As reported in *The West Australian*, 28 May 1945, p. 6.

18 W C Godfrey, Minute to the Secretary, Main Roads, 26 June 1940. MRD File 438/32 Now File 373/43 Folio 5. Godfrey had considered alternate river crossings, including a bridge over Perth Water from Hill Street to Berwick Street in South Perth and another to Mends Street. However, the site upstream and adjacent to the existing Causeway was chosen because of the existing roads - Great Eastern, Canning and Albany highways, Adelaide Terrace and Riverside Drive.

design specifications which were forwarded to the Commissioner of Main Roads and the Minister for Works in September 1944.[19]

The new Causeway was to be a broad roadway of six lanes, with tramtracks in the two central lanes to remove any risk of traffic congestion. The two new bridges were to be reinforced concrete structures, utilising composite steel beams and concrete decking on timber piles. The technique was relatively new and had been developed by Alan Knight, who later became Commissioner of the Tasmanian Hydro-Electric Commission.[20] Geotechnic assessment of the bridge foundations was undertaken to establish the pier design perimeters.[21] All services were to be carried in the footway and under the decking.

However, no immediate action was taken and, it being war time, work on the Causeway was restricted to repairs to ensure safety. In April 1945, the Minister for Works, A G R Hawke, released a press statement outlining the Government's lack of positive action:

> the proposed new Causeway could not be regarded as sufficiently urgent to justify construction during the war when men and material were required so desperately for the building of houses, the making of additions to hospitals and schools, and for water supply undertakings in drought stricken areas. [22]

Hawke released another press statement on 5 September 1946, announcing that land reclamation had commenced in preparation for the new Causeway to be built to the specifications forwarded in 1944.[23] Negotiations regarding land reclamation, land acquisition, cost sharing, landscaping and the maintenance of public reserves at either end were soon underway between the PWD, Perth City Council, the Police Department and the Western Australian Railways and Tramways Department.[24] Building the new bridge involved resumption of land at the Victoria Park end, widening and deepening other sections of the river and the reclamation of Heirisson Island.[25] It was expected that the Causeway would be completed in under three and a half years and the existing road surface and timber bridges were to be maintained until the new Causeway was completed.[26]

There was much comment in *The West Australian* during 1947 on the need to improve the aesthetics of the Causeway vicinity, as well as to improve worsening post-war traffic conditions. In June, the paper reported:

> In 1947...it is imperative not only to meet the traffic requirements of the day and some part of the future, but also to give the Causeway the qualities it deserves as a

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19 E C Godfrey, Report to the Commissioner on the Condition of the Existing Bridge Structures and Proposals for the New Causeway, 27 September 1944. MRD File 373/43 Folio 53-60.

20 In a paper presented to the Australian Institution of Engineers in Perth 1949, Godfrey acknowledged the work of the Public Works Department of Tasmania and the Victorian Roads Board in the design for the Causeway Bridges.

21 ibid.

22 MRD File 373/43 Folio 77-78.

23 A G R Hawke, Press Statement, 5 September 1946. MRD File 373/43 Folio 139.

24 *The West Australian*, 5 September 1946, p. 6; G B Hill, op. cit., p. 11.

25 *The West Australian*, 28 May 1947, p. 6.

26 A G R Hawke, Press Statement, 5 September 1946.

> vital link in the communications of a modern city. Just as important too, is the need to give it full value as a key piece in a plan of river architecture.[27]

A letter to the Editor two days later supported this view:

> No spot in Perth lends itself better to artistic treatment than the adjuncts of the Causeway and it is hoped that the responsible authorities will seriously consider the advisability [of merging] the present unsightly conditions [dumping grounds for rubbish, dangerous neon signs, garages and minor shipbuilding yards] into what could be one of the most beautiful spots in Australia.[28]

One major concession to the new Causeway's aesthetics was Cabinet's decision not to allow trams to run over the new Causeway. While it was agreed that not having overhead wires would improve the look of the Causeway bridges, this decision was based on economic and planning concerns. Not only would no trams save the Government a considerable amount of money (about £30 - 40,000), the removal of the tramlines would ease traffic congestion along Albany Highway. The double decker buses which were to replace the trams could pull up to kerbs and allow other traffic to pass.[29] However, the provision for trams was retained in the structural design.[30]

Construction of the new Causeway was carried out by staff and employees of the Main Roads Department, under the supervision of Godfrey. The steel girders were fabricated in Perth by Forwood Down Ltd, using the new submerged welding process that was much speedier than hand welding.[31] Work proceeded slowly, hampered by a shortage of men and materials - the legacy of the 1930s Depression and World War Two. However, by November 1949, the new Causeway was beginning to take shape with fifty percent of the pier system of the longer bridge (225 metres / 738 feet - Victoria Park end) and the driving piles of the shorter span (115 metres / 382 feet) completed.[32] Long-awaited girders and steel rods for the eastern bridge arrived from Japan and the Eastern States in February 1950 and in May of that year, 30 newly arrived immigrants joined the labour force of 82 to provide much needed unskilled labour.[33]

By September 1952, the decision had been made to install fluorescent lighting on the new bridges, 'an innovation in Australia'.[34] Leading up to this, the Main Roads Department had conducted a series of practical tests using temporary standards to assess the capabilities of the new technology. The architectural division of the Public Works Department was called in to satisfy the aesthetic requirements of the design of the standards, which were then fabricated by the State Engineering Works.[35] The lighting standards were

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27 *The West Australian*, 4 June 1947, 6.

28 *The West Australian*, 6 June 1947, p. 12.

29 *The West Australian*, 19.11.1947, p. 11.

30 Archival drawings held by the Department of Main Roads.

31 *The West Australian*, 18 May 1950, p. 2.

32 *The West Australian*, 23 November 1949, p. 12.

33 *The West Australian*, 15 February 1950, p. 1; 18 May 1950, p. 2. The paper described the immigrants as 'Balts'.

34 *The West Australian*, 19 September 1952, p. 2.

35 Florescent lights were not yet common in Australia. Despite low running costs, the cost of fitting and installation was high. *The West Australian*, 19 September 1952, p. 2.

mounted on the bridge balustrading; the balustrading was designed to the Concrete Bridge Details of the United States Portland Cement Association.[36]

The Causeway was completed with circus or roundabout interchanges at each end to cope with the merging traffic. The new Causeway opened for traffic on 19 September 1952, although the western bridge was not yet completed. Traffic was diverted from the existing bridge at the western end over the new eastern bridge, while work at the Perth end continued. The old timber bridges were demolished. The construction of the new Causeway was regarded as 'the consummation of one of the State's major post-war public works...a monument to Western Australia's progress'.[37]

From the outset of planning, it was intended that the Causeway fulfil the traffic requirements of the connecting road system, and that any necessity for future bridge capacity over the Swan River would be met with the construction of bridges at other locations. The bridging of the Narrows in the late 1950s and the commencement of the Northern City Bypass (Polly Farmer Freeway) and a new bridge over the Swan River, upstream of the Causeway, in 1997, are evidence that this requirement has been fulfilled.

In 1998, the Causeway remains essentially as constructed with little change to the structures. The most significant changes have been the modification of the traffic interchanges, landscaping including cycle paths on the public areas of each end of the Causeway and on Heirisson Island, and modification of the type of street lighting. The decorative standards and florescent light fixtures have been replaced with electric lamps fitted to steel standards. The use of the inside traffic lands for a combination of cycle and vehicle use has not been continued, and cyclists and pedestrians now both utilise the bridge footway.

13. 2 PHYSICAL EVIDENCE

Causeway Bridges over the Swan River and Heirisson Island forms an eastern entry statement to the City of Perth.

The central features of the place are the two bridges, the eastern bridge (Bridge 932) being 224.72 metres in length and consisting of 11 separate spans between the river piers, and the western bridge (Bridge 914) consisting of 5 spans and being 114.6 metres in length. Although of dissimilar length, the two bridges are of similar construction.

The river piers are supported on deep piled foundations. and each of the structural spans supporting the roadway consists of reinforced concrete decking. Integrated steel beams act on end bearings at each of the river piers.

A feature of the two bridges is the balustrading and the large abutment piers at the end of each bridge. The balustrading is in panels, each supported on pilasters 4.7 metres apart connecting to the concrete deck. The top of the balustrading is 1.07 metres above the top of the kerb with each panel consisting of 10 openings of 0.9 metres (7.5 inches) wide between solid pieces

36 Hill, op. cit., p. 17.

37 *The West Australian*, 19 September 1952, p. 2.

0.13 metres (5 inches) in width. Street lighting standards are erected on every fourth balustrading pilaster.

The balustrading, although less ornate, reflects the type used for the Horseshoe Bridge and Barrack Street bridges and in Perth and for the Spencer Street and Princes Street bridges over the Yarra River in Melbourne. The William Jolly Bridge in Brisbane also displays similar handrailing.

On the downstream side of the bridges between the balustrading and kerb is a 2.44 metre wide foot and cycleway. Cable services run under the kerb and balustrading on the upstream side of the bridges. Steel water and sewer service pipes are supported between the steel beams beneath the concrete decking.

Causeway Bridges blends with the low level of the land at each end and on Heirisson Island and forms a low profile over the river. The balustrading and abutment piers define the bridges from both the roadway and river aspects.

The structures and surrounding areas are well maintained with the river piers, steel beams and reinforced concrete decking in good condition.

The exposed aggregate balustrading and pilasters is in good condition. The abutment piers requiring recoating once the alkali reaction, which has caused surface cracking, has been stabilised.

13. 3 REFERENCES

G. B. Hill Consulting Engineers, 'Causeway Bridges Conservative Plan' July 1997.

Microfilm of archival drawings, held by Main Roads of Western Australia.

Papers on early bridge development:

Paper by Alan W Knight and Prof. A Burn, 'Transactions of the Institution of Engineers', Australia, vol. 15, January 1934.

Paper by Prof. A Burn, *Journal of the Institution of Engineers,* Australia, vol. 7 no. 3, March 1935.

E W C Godfrey, 'The Causeway Bridges of Perth', presented to the National Engineering Conference of the Institution of Engineers, Perth, 1949.

13.4 FURTHER RESEARCH

Aboriginal associations.

Geotechnic studies.

The Department of Main Roads' Bridge Branch is able to provide further information on the condition of the bridges.