

# Two unusual features of the Merivale Rail Bridge

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## IV

### **Two unusual Features of the Merivale Rail Bridge**

Deux propriétés extraordinaires du pont de chemin de fer „Merivale“

Zwei ausserordentliche Eigenschaften der „Merivale“ Eisenbahnbrücke

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#### **SUMMARY**

Two unusual features of the Merivale Rail Bridge across the Brisbane River in Australia are described; the cable pattern in the tied arch and its effect, and the foundations of the piers.

#### **RESUME**

Deux propriétés remarquables du pont de chemin de fer „Merivale“ traversant le fleuve „Brisbane“ en Australie sont décrites: le tracé des câbles dans l'arc et son effet, et les fondations des piles immergées.

#### **ZUSAMMENFASSUNG**

Zwei beachtenswerte Eigenschaften der „Merivale“ Eisenbahnbrücke werden hier beschrieben: der Kabelverlauf der Bogenbrücke und seine Wirkung sowie die Fundierung der Flusspfeiler.



## 1. INTRODUCTION

The Merivale Bridge across the Brisbane River, Australia carries a double track rail connection between the north and south side suburban rail systems in the City of Brisbane. The bridge has a number of unusual features, certainly unique in Australia, two of which are described herein.

## 2. MAIN SPAN

The main river navigation span is a 132m steel tied arch with sloping arches. Cross bracing between the arches has been eliminated after detailed buckling analysis. This system was chosen because

1. Good appearance in the city environment was of the utmost importance.
2. Erection of the structure permitted minimum interruption to shipping.
3. Railway grading requirements and river navigation clearances were satisfied.
4. Stiffness under railway operations could be assured.
5. The structure could be relatively easily maintained.
6. Cost was acceptable.

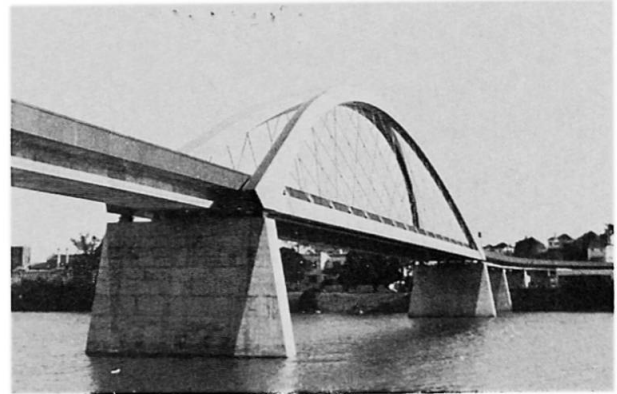


Fig.1. Merivale Bridge

With respect to item 4, an innovation in this bridge was the development of a cable arrangement in which the slope of the cables varies symmetrically about the centre of the arch. The effect is to inhibit distortions of the arches and ties, particularly in the outer quarter, under asymmetric live loadings. The benefit can be illustrated by comparing the distortions under a partial load of similar structures with vertical, uniformly sloping and varying sloping cables. This is illustrated in Figure 2 where the deflection of arch and tie are shown much distorted. It can be seen that the uniformly sloping hanger pattern reduces the deflections by  $4\frac{1}{2}$  times compared with the vertical pattern. The varying slope pattern reduces them by half again to be one ninth of the deflections of the span with vertical hangers. The theory has been verified in practice and the vibration characteristics of the span are remarkably good. Other beneficial effects are an estimated reduction of approximately 250 tonnes in the quantity of steel necessary for this bridge compared with one with constant slope hangers, and a reduction in the quantity of bolts needed for the splices in the arches. Moving locomotive tests have confirmed favourable vibration and stiffness characteristics.

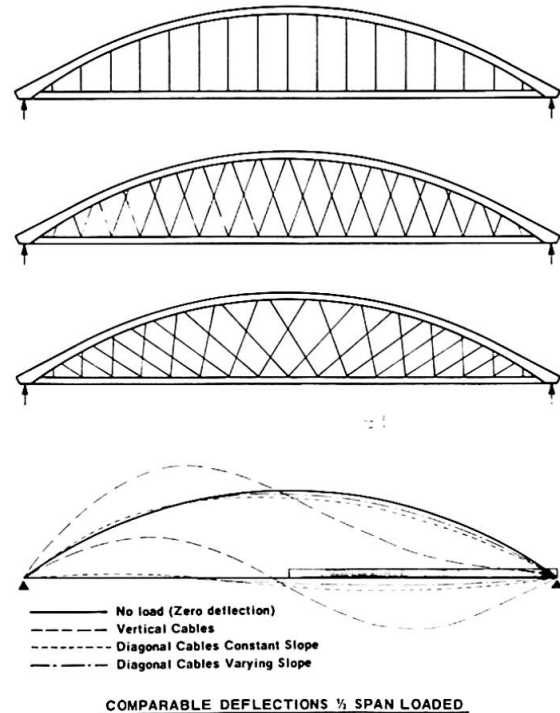


Fig.2

### 3. RIVER FOUNDATIONS

The river piers are founded on multiple 1220mm diameter steel cased cast insitu piles socketted into rock. To avoid the expense of cofferdams which have been troublesome elsewhere in this river, and precast concrete base skirting panels which would be vulnerable to damage by shipping at this location, and to minimise underwater work, a system was devised for the construction of the river piers whereby the bottom of the pier was formed as a pre-cast concrete boat, floated into position and sunk onto falsework. (Fig.3)

Holes had been formed in the bottoms of the boats for the piles to pass through

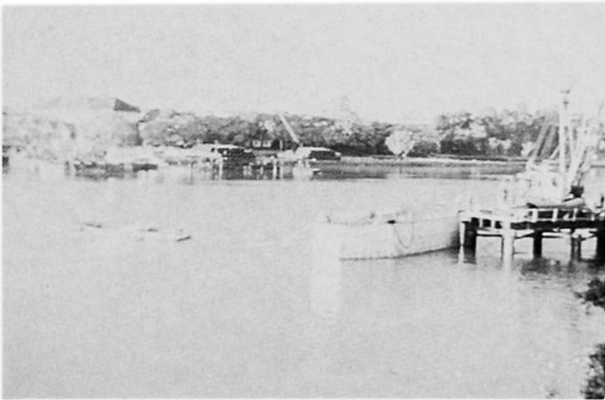


Fig.4

Pier base manoeuvring onto Falsework

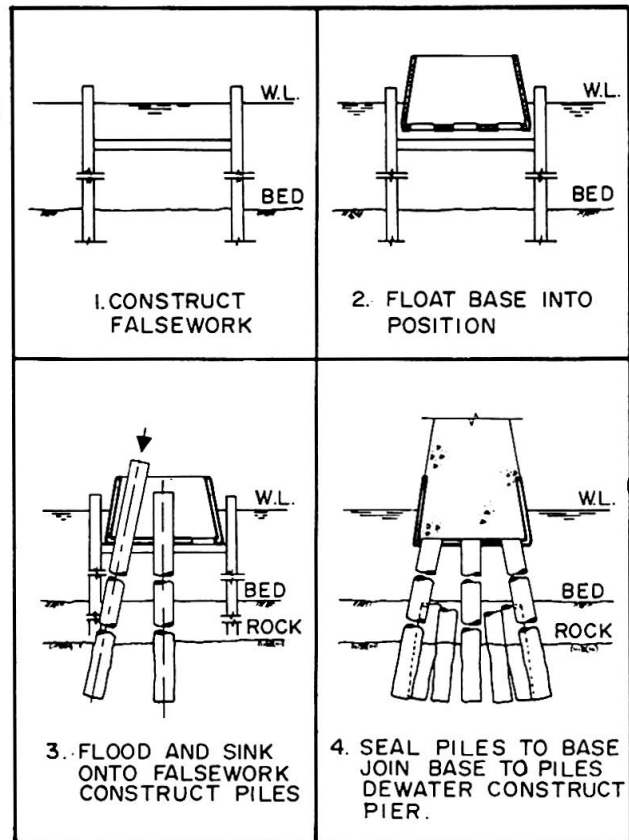


Fig.3

Construction Sequence

and temporary templates at the tops of boats fixed the directions of the piles which were driven to bedrock with diesel hammers.

On completion of the piling, the pile liners were fixed to the pier base by metal straps and the annular space between the pile liners and the base was sealed by a diver working in a metre of water - the only underwater work involved.

Once the seal was made, the base was dewatered and cleaned, and permanent brackets were welded between the pile liners and the base. Excess liners were cut off, the reinforcing steel placed, and the pier base cast.

The remainder of each pier was then completed conventionally.

Underwater work was avoided, the piles were accurately positioned and the system worked well with completely satisfactory results.

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