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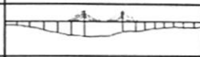
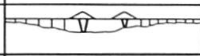
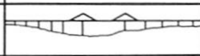
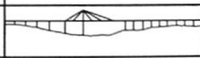
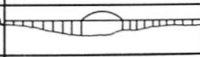
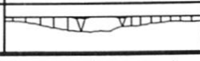
2. Kessock Bridge, Inverness (Scotland)

Owner: Scottish Development Department, Edinburgh
Designers:
Superstructure: Dr Ing Helmet Homberg, Fed. Rep. of Germany
Substructure: Trafalgar House Engineering Services, Croydon
Joint Engineers: Crouch and Hogg, Glasgow
Ove Arup and Partners, London
Contractor: Cleveland RDL Kessock Consortium, Darlington
Works Duration: 40 months
Structural Steel 8800 t
Service Date: Late 1981

TENDERER	SKETCH	*COST
Cleveland Bridge/R D L (Dr. Homberg & T.H.E.S.)		17255
Laing (Maunsel)		18312
McAlpine/Dyckerhoff & Widman		19140
Monk/M.A.N/McGregor/Clarke Chapman (Atkins)		19527
Wimpey/Clarke Chapman/Highland Fab. (Babtie & Leonhardt)		20812
Taylor Woodrow/Campenon Bernard		24850

*Cost in units of £1000

Fig. 1 Analysis of tenders – March 1977

Introduction

The Kessock Bridge is being built as part of the reconstruction of the A9 route north from Perth to Inverness and Ardullie. The dual carriageway bridge, which has an overall length of 1052 m, is required to span the navigation channel leading to Inverness Harbour and the Caledonian Canal. The navigation span is 240 m with a clear headroom of 29 m. There are 7 spans of 64-80 m on the south side and 5 spans of 60-80 m on the north side.

Tendering

In 1976 the Department decided to invite combined tenders for designing and building a bridge on this site. This decision was taken, in the complex circumstances prevailing, to prove by competitive tendering with both steel and concrete designs that the most economical bridge was built. This type of contract is very unusual in the UK and special procedures had to be devised to ensure adequate competition while specifying the design criteria and contractual conditions which had to be met.

After careful consideration six design and construction groups were selected and issued with the detailed contract documents and formally invited to prepare preliminary designs and tenders. A period of 6 months was allowed for the preparation of outline designs and tenders. The tenders had to be submitted with approximate quantities and the bills had to be divided into prescribed sections to facilitate assessment. As the successful tenderer completed his detailed design, he would be required to adjust the quantities, but would not be permitted to adjust the sub-bill cash totals for any changes found to be necessary to comply with the original design criteria. Design calculations, sufficient to justify the structural adequacy of the main elements, together with perspective and other drawings, had to be submitted with the tenders.

The six tenders received included three designs for wholly prestressed concrete bridges and three designs mainly in steel. From a detailed study of the tenders it was clear that an economical and satisfactory bridge could be designed and built in either material. The inset analysis of tenders illustrates the wide range of solutions proposed by the different groups.

The contract to design and build the bridge was formally let to the Cleveland RDL Kessock Consortium on 21 June, 1977. No premiums were paid to the unsuccessful tenderers.

Design

A period of 11 months was allowed for the completion of the detailed design and work started on site in April 1978.

The steel superstructure has been designed in accordance with the Merrison Rules. The bridge has been designed to resist seismic loading. The deck is longitudinally anchored for temperature movement at the southern main pier, but longitudinal seismic forces are also transmitted to the foundations via two large hydraulic buffers at the north abutment.

Foundations

Most of the piers are supported on spread footings bearing on varying layers of sands and gravels, but the deeper water piers are supported by steel H piles driven up to 60 m depth into variable deposits. The main piers were built within two pairs of 21 m dia circular cofferdams in depths of water up to 14 m. The other piers were built within pairs of rectangular cofferdams. The walings for the main piers were erected on temporary tubular piles and then lowered into position above the sea bed. All the pier shafts are being cast continuously using the slipform method. Access to the piers for construction is by temporary

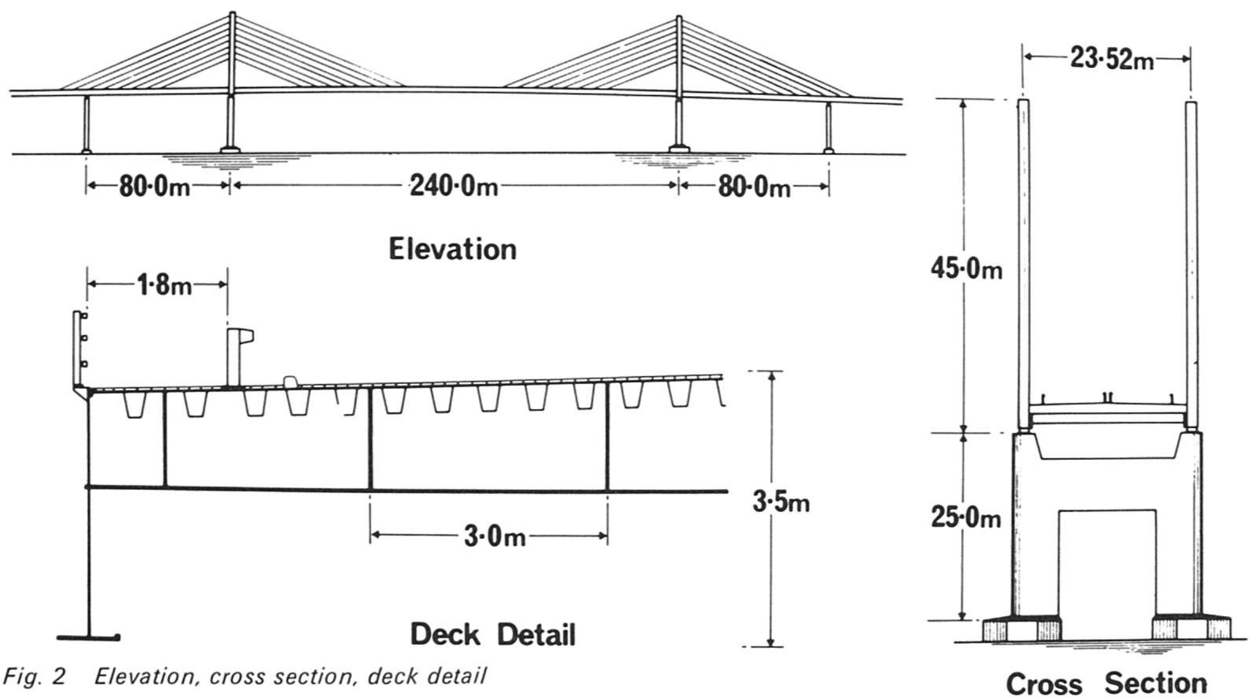


Fig. 2 Elevation, cross section, deck detail

bunds and structural steel jetties. Tidal currents exceeding 6 knots are experienced around the main piers.

Steelwork

The deck cross section, which is similar throughout the bridge, has two 3.3 m deep plate girders at the outer edges, with cross girders at 4 m centres. The deck surface consists of a steel plate with longitudinal trapezoidal stiffeners. Deck panels are delivered to site in 16 m lengths and up to 3 m wide, each with four part cross girders attached.

The steelwork is all being fabricated in the Darlington works of the Cleveland Bridge and Engineering Co. Ltd., and is transported to site by road in lengths not exceeding 16 m. The design is such that the maximum amount of welding is carried out in the factory. All site joints, except edge joints between deck panels are by friction grip bolting. These measures were adopted to facilitate erection. The main 240 m span will be cable stayed with 8 harp-type sets of cables located outside the main longitudinal girders. The uplift from the back anchorages will be taken to piers 6 and 9 by pendle bearings. The completed deck will be surfaced with mastic asphalt.

Construction contract

The construction contract is being managed as a normal contract under standard UK Civil Engineering Conditions of Contract; interim and final payments being based on measured quantities, with the original 1977 rates adjusted for inflation in accordance with the UK Baxter Indices.

(L. Clements)

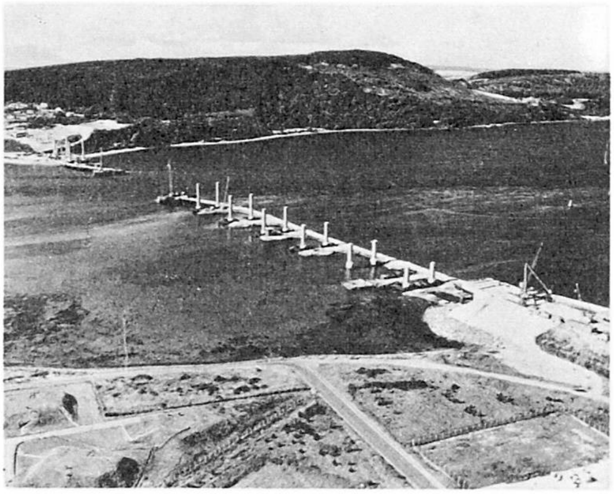


Fig. 3 Aerial view of bridge under construction

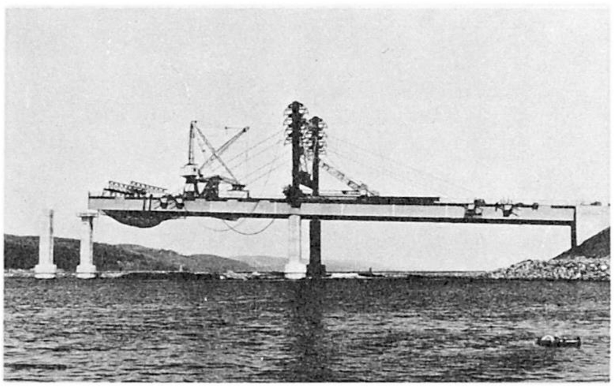


Fig. 4 Cantilevered erection of approach spans showing temporary towers and cables, and other erection equipment