Bonar Bridge

on A9 Trunk road, Kyle of Sutherland, for the Scottish Development Department

Structural Engineers

CROUCH AND HOGG

Steelwork Contractors

REDPATH DORMAN LONG (CONTRACTING) LTD

Judges Comments

An elegant major structure which although visible from a distance does not overwhelm its immediate environment. Clean lines and careful detailing ensure easy maintenance and the formed steel fascia plates give a satisfactory horizontal feature and a tidy appearance. Its structural efficiency is apparent from wherever the bridge is viewed.

This new bridge is the third to cross the Kyle of Sutherland. The first was built in 1812 but was swept away by floods in 1891; the second was opened in 1892 but increased loads combined with the effects of corrosion and scour led to the decision to build a new bridge. The specification called for a 7.3m carriageway with a 2m footpath each side, full HB loading and resistance to winds up to 140mph.

Many alternatives were considered both in concrete and steel, including multi-span arrangements. However, the overriding factors were the fast flowing tidal waterway subject to severe flooding and the restricted deck depth. The best solution to these problems was a steel bowstring arch which left the waterway clear and required only a small increase in deck depth.

The east abutment is founded directly on rock while the west abutment is piled. Anchorage is provided with fixed rockers at the east end and stainless steel rollers at the west.

The arch ribs are 600mm wide and 700mm deep and are made from 30mm steel grade 50B. They were fabricated in 14m sections and the ends were milled. Site joints are dowelled and friction grip bolted. The rib bracing is made from square hollow sections and was assembled on site, erected in cruciform portions and friction grip bolted to the ribs. The stiffening girders are automatically welded plate girders in 50c steel and each 12m portion is straight and square ended with camber introduced by means of shaped cover plates. The suspenders are single 64mm diameter locked coil steel ropes each with an ultimate capacity of 350 tonnes. Studs were welded to the cross girders for composite action with the reinforced concrete deck slab.

The tied arch solution to the problem of crossing this difficult waterway has a number of advantages. The deadweight of the simply supported structure is kept to a minimum compatible with acceptable live load deflections and vibration.

As the site is remote the sections of the bridge structure were kept below 8 tonnes in weight and by using a temporary piled trestle in the river the erection was effected with one 35 tonne wheeled mobile crane.

Road lighting is of the high-pressure sodium type and since the fittings are attached to the arch ribs the structural form is emphasized.