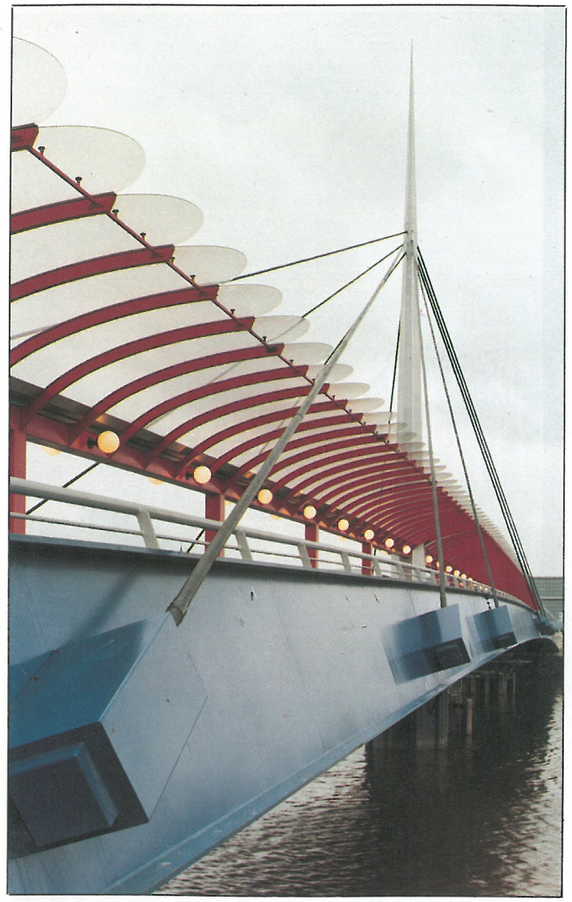

AWARD

River Clyde Garden Festival Bridge

For Scottish Development Agency

The bridge provides eight metre width covered pedestrian access across the River Clyde from the Scottish Exhibition and Conference Centre on the north side to the Garden Festival on the south side with an 88 metre swing span providing 35 metre navigational clearance for shipping.

In December 1985 the Scottish Development Agency initiated an open competition for a pedestrian crossing of the River Clyde stating that "The structure should reflect the excitement and character of the Festival event". A challenge indeed which was taken up by some 50 competitors including some of the leading UK bridge consultants and contractors. Designs were to be submitted by 6th February, 1986 with a ceiling cost of £1,225,000. The competition was in two stages, the first of which narrowed the field down to a short list of three. This bridge was awarded first prize in May 1986.

The rules stated that the river crossing had to provide a clear footway width of six metres and 20 metre clear height over mean high water spring for a navigational clearance of 35 metres to provide passage for 16000 tonne vessels. A full or part cover was to be provided to protect pedestrians from the worst of the weather. Both street and display lighting were to be included. At the site the river is 124 metres wide between quay walls with an extreme tidal range of 6.25 metres.

Provision had to be made for dismantling the bridge with a view to its being erected elsewhere after the five month period for the Garden Festival.

The bridge soffit had to be above existing quay level and ramps were to be provided at each end with 1 in 20 maximum slopes. Provision was to be made for a small train consisting of a locomotive and three trailer wagons with rubber tyred wheels so rails were not required. Pedestrian loading over the full area of the bridge was to be 5kN/m^2 and the bridge was to be designed in accordance with BS5400. The second stage of the competition took the form of a priced tender submission to Bovis, the managing contractor for the Glasgow Garden Festival 1988 Limited.

Many alternative designs were considered for the crossing including aluminium and timber structures and glass tubes suspended from steel masts. The opening portion could be made to swing, lift, retract by rolling or float and be tugged out of the channel to allow shipping to pass. With an extremely limited budget construction had to be relatively simple, straightforward and material content tightly controlled. Steel provided the best answer for nearly all elements of the bridge including the piled foundations and piers.

The simplest solution for providing a 35 metre navigational clearance appeared to be two steel 'trays' with edge girders tied up to central masts which would deliver the load directly to supporting piers on which the 'trays' or swing spans would rotate. Each span would be symmetric about its mast to equate wind loads and avoid kentledge and each would be equipped with simple machinery to provide a means of rotation. Ideally the two swing spans should occupy the full crossing width.

This would have been a good solution especially in view of each complete swing span being within the capacity of the Finnieston hammer head crane close to the site and on the river quay where it could have lifted them on to a barge for tidal placement.

However, the twin span lacked drama and excitement for the Festival and lacked a single focal point. Also the twin span arrangement would have required two sets of machinery and greater mechanical complication than a single unit. The dowelling of each free end would have presented greater difficulty and the cost of the operation would definitely have been greater than that for the single moving span.

To gain height and drama to suit the Festival circumstances a single steel swing span was adopted with unusual sloping web edge girders which minimised the lower cable attachment eccentricity. The swing span is tied with steel cables fanning out from an octagon steel spire with a base of 1.5 metres and an overall height of 25 metres. The base of the pylon accommodates the electric/hydraulic power unit and the top is taken to a fine point some 7 metres above the cable attachment point. The fineness of detail in the steel mast was seen to be vitally important and special consideration was given particularly to the anchorage portion.

The chosen shape for the pylon resulted in there being very little room for rope end anchorages. After considerable design effort in examining alternative solutions for the anchorage area, a twin casting arrangement was developed which was recessed in the inside face to receive the cylindrical anchorage blocks retaining twelve BBRV parallel strand cables, each having 24 wires 7mm dia. By adopting this arrangement the cables are seen to exit the pylon without interruption to the octagon spire. The two steel castings are prestressed together against spacer blocks and have two studded closure plates. The 7 metre top to the spire is folded from thin steel plate with a conical machined top made sharp to prevent birds perching on it. The overall requirements for the mast including the base housing for machinery, the anchorages and the slenderness could only be met by use of the steel.

Possibly the largest pedestrian swing bridge of its kind, the 88 metre cable stayed portion is mounted on a roller ball slewing ring and to rotate it 90° an electric hydraulic power unit energises two hydraulic cylinders fixed below deck level.

With the aid of wire ropes and sliding sheaves one cylinder pulls the bridge round while the other restrains it. The operation is controlled from a small consol mounted in the side of the pylon and from the start of releasing the locking dowels the time for opening is less than five minutes. The required overall response time for the bridge to be open for navigation is 15 minutes. To close the bridge the sequence is reversed.

The bridge is seen as a ship's promenade deck with open viewing to the water. Intentionally the idea of a complete canopy enclosure was discarded to avoid the inevitable tunnel effect. The chosen canopy, in steel hollow section, is mounted on central columns from the cross girders and radiused cantilever arms carry polycarbonate sheeting which is scalloped for interest on the outer edge. Rain water is gathered in a spine gutter and is directed to the river via the columns. The shape of the canopy is very unusual but the long slender curved cantilever arms were readily achieved by the use of rectangular hollow section steel tubes which are mounted on a torsionally stiff square hollow section spine beam.

Bridge lighting consists of globes at 4 metre centres on each side of the spine which at night appear as a string of pearls. Two floods are mounted above the canopy to highlight the pylon. The colour scheme chosen for the bridge is dark blue for the steel deck, silver for the pylon and tubular handrail and dull red for the canopy steelwork. The deck surface is grey/brown calcined beauxite with a trace of white.

Already the bridge has been operating frequently to allow shipping to pass and during installation it was interesting to see that two men on the end of a single rope could rotate the bridge without difficulty. Although allowance has been made in the design and construction for dismantling and removal it has been decided that the bridge will be retained on its present site providing a pedestrian link with the north bank for the planned housing, business and leiusure park which will develop on the south bank following the end of this year's Garden Festival

JUDGES' COMMENTS:

Originally intended and designed for a limited life, this structure is of great technical competence, yet achieves a light and lively appearance which is wholly appropriate to its function and Festival environment.

STRUCTURAL ENGINEERS
Crouch and Hogg

ARCHITECTS
Boswell Mitchell and Johnston

STEELWORK CONTRACTOR
Sir William Arrol/ NEI Thompson Limited

MAIN CONTRACTOR
Lilley Construction Limited