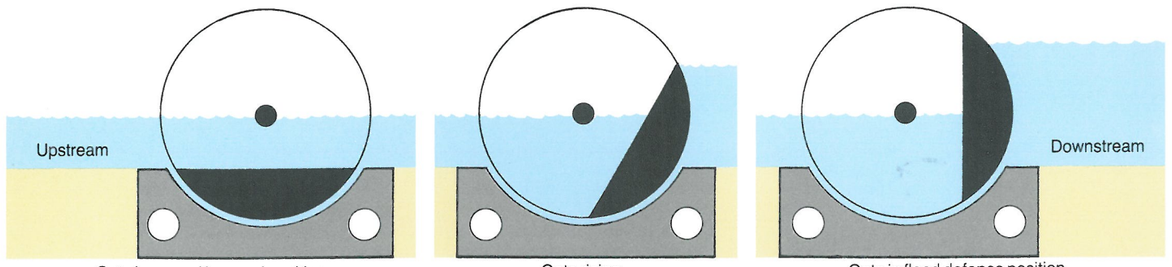

Gate in normal lowered position | Gate rising | Gate in flood defence position

AWARD

Thames Barrier Rising Sector Gates

For The Greater London Council

The basic requirements for the Thames Barrier scheme were to prevent surge tides passing upstream of its location, for it to be completely reliable in operation, to enable shipping to pass safely and to cause minimum interference with all other aspects of the River Thames.

The complete Barrier consists of four main navigation openings of 61 metres clear span each containing a Rising Sector Gate to give a channel depth of 9.15 metres below O.D.N., two smaller openings of 31.5 metres clear span containing smaller Rising Sector Gates to give a channel depth of 4.6 metres below O.D.N. and four side openings of 31.5 metres each containing a conventional Falling Radial Gate with sill level at O.D.N.

The Rising Sector Gates are steel box girders whose cross section is a segment of a circle. They are supported at both ends by thin double skin steel discs which are centrally pivoted about stub shafts projecting from the piers. The gates normally lie in the bed of the river in the scallop of a concrete sill. In operation, the steel discs, or gate arms rotate through approximately 90°, to take the gates to their flood prevention position. The discs can also be rotated through a further 90° to move the gates to their maintenance position above the river or positioned to allow water to undershoot the barrier to reduce reflected surge. The housing for the operating machinery is roofed with stainless steel.

The gate arms are of cellular construction and permit the free flow of water, drawn in from the cleaner upper levels of the river through the inlet ports in the skin plates. Water passages are provided between the gate arms and gate span. Flap valves, at the trailing edge of the gate enable water to drain out as the gate rotates out of the river.

When the gate crest is above water level, the water within the gates will be approximately at the same level as that upriver and the curved skin of the gates will separate the upstream and downstream water levels. In this way, the resulting hydrostatic forces, acting in either direction, will pass through the centre of curvature of the gate skin and the centre of rotation of the gates' structure, thus avoiding an out-of-balance moment to be resisted by the machinery. The dead weight of the gate span about the centre of rotation is balanced by cast iron blocks in the gate arms.

Longitudinally stiffened skin plates form the segmental shape of each gate, stiffened web plates and transverse braced diaphragms creating an integrated box girder structure. The stiffened curved skin plates withstand the local water pressures in an efficient manner, and make the gate insensitive to accidental local damage.

Each gate is connected to one gate arm by a rigid connection and to the other by a continuous hinge. In the case of the 61m openings, the design specification results in hydrostatic loads of approximately 8,000 tonnes being carried by each gate in either direction. The design approach adopted for the gates and gate arms were verified from model behaviour.

The gates were fabricated on the basis of a sub-assembly system as plate girder units in workshops and then transported to a Teesside site where the units were joined together and the structural form of the segmental gate completed. On completion, the 1400 tonne gates were loaded out on to North Sea module barges which were then towed down the North Sea to the Thames. On site, erection was achieved by the use of very heavy lift floating cranes, used in tandem for the major heavy elements of gate spans and arms.

The steel generally used to fabricate the gates and gate arms was Grade 43D to BS 4360 in order to minimise the possibility of brittle fracture when the gates were exposed to freezing air conditions but certain areas of the skin plates of the gates employ Grade 50C.

The innovation of the Rising Sector Gate provides a new means of dealing with the limitations that exist with other forms of gates. Its most suitable applications are expected to be those where large differential heads of water have to be resisted over large spans. It is probably also the most suitable structure when gate closure is required against a strong flow of water.

The gate can be housed in a relatively shallow recess in the bed of the passage and can be raised clear of the water for maintenance without being removed from an operational position. Further, it requires no overhead structure across the opening and, except when in the maintenance position, it provides unlimited headroom.

Structural Engineers: Rendel Palmer & Tritton
Steelwork Contractors: Davy Cleveland Barrier Consortium*

*Davy Loewy Ltd & The Cleveland Bridge & Engineering Company Ltd.

Judges' Comments

The design concept, structural analysis and attention to detail of these gates are worthy of the highest praise. The formidable task of fabricating and erecting the steelwork, undertaken to extremely accurate tolerances, played no small part in the success of this unique project.