

BRUNEL, ISAMBARD, *Duke Street, Westminster*.—Models of Saltash and Chepstow bridges, designed by late Mr. Brunel.

MODEL OF BRIDGE ON THE SOUTH WALES RAILWAY  
OVER THE WYE AT CHEPSTOW.

This bridge was designed by the late Isambard Kingdom Brunel, Esq., D.C.L., F.R.S., Engineer of the Railway. It is constructed for a double line, and consists of three side spans of 100 feet each, and one principal span over the river of 300 feet. Each roadway over the land openings is carried between a pair of wrought-iron girders. The intermediate piers each consist of three hollow cylinders of cast-iron, six feet in diameter, filled with concrete. Each roadway over the main opening is carried between a pair of girders of similar construction, 300 feet long, which are supported at the extremities by the piers, and at four intermediate points—two at twelve feet, and two at sixty-two feet—from the centre, where they are attached to two sets of suspension chains, which form the tensional parts of a pair of rigid trusses. In these trusses, the tension delivered by the suspension chains is received by a straight tube of plate-iron, of circular section, nine feet in diameter; which is supported at its extremities on the superstructure of the piers, with its centre fifty feet above the line of rails, and at two intermediate points by vertical struts raised from the suspension chains at the points sixty-two feet from the centre of the span where the girders are attached to them. Rigidity is given to the structure by diagonal chains extending from the top of each strut, to the foot of the other. Each tube where it rests on the eastern pier is carried by a system of rollers, to allow of the expansion and contraction caused by changes of temperature. The weight of iron in each truss is 460 tons. The pier supporting the western end of these trusses consists, up to the level of the roadways, of six cast-iron cylinders similar to those which carry the land spans, and which here penetrate the rocky gravel of the river bed to the rock at eighty feet below high water spring tides. Above the roadway the pier is also of cast-iron, forming two archways, one for each roadway, over which the tubes of the respective trusses rest. The eastern pier is of masonry resting on the rock a few feet below the level of the line of rails. The form of this pier above the roadway is similar to that of the cast-iron pier at the western end. The bridge was commenced in April, 1850, and was completed in three years. On the successive completion of each tube, it was temporarily rendered rigid with chains, and being placed at right angles to the river, one end was supported on pontoons, and the other on a rolling truck. The pontoons were then drawn across the river by warps from the opposite shore. The tube was next lifted into its place on the top of the piers by chain purchases, and the rest of the truss was then completed. The operation of floating was rendered difficult by the great rise and fall of the tide, which is forty-two feet at spring tides. The contractors for the iron work were Messrs. Finch and Willey, of the Windsor Foundry, Liverpool. The total cost of the bridge was £77,000.

MODEL OF THE ROYAL ALBERT BRIDGE ON THE  
CORNWALL RAILWAY OVER THE TAMAR AT SALTASH.

This bridge was also designed by the late Mr. Brunel. It is for a single line, and consists of two spans of 455 feet each over the river, and seventeen land openings of spans varying from ninety to seventy feet. The land openings—of which there are ten on the Cornwall, and seven on the Devonshire side—form curved viaducts

leading to the main spans. Throughout the structure, at a level of one hundred feet above high water, the rails are laid on a ballasted platform of planks carried on cross girders between pairs of plate-iron girders. In the viaducts, the ends of the girders rest on piers of limestone masonry, each pier consisting of two square pillars which spring from a common base, and are united at the top. In the main spans the girders are supported by trusses, in principle analogous to those at Chepstow; but here the tubes which resist the tension of the suspension chains are in section elliptical instead of circular, and in general profile, curved instead of straight, the rise of the curve, being equal to the drop of that of the chains; thus the weight of the girders and roadway rests half on the tube, half on the chains, the girders being carried by vertical struts, placed at intervals of forty feet, diagonally braced so as to give rigidity, and by intermediate attachments to the suspension chains. The weight of iron in each truss is 1,070 tons. The substructure of the piers at the shore ends of the main spans is of granite masonry and brickwork. That of the centre pier consists at the base of a granite pillar thirty-five feet in diameter, resting on a rock foundation eighty-six feet below high water mark, and built to a height of ten feet above it, from which rise four hollow octagonal columns of cast-iron, built up in segments bolted together internally, and which carry the girders on an entablature above their capitals. The superstructure of each pier consists of an archway through which the trains pass, and over which the ends of the tube are carried. The superstructure of the centre pier is of cast-iron, and of the shore piers of masonry with a casing of cast-iron. The shore ends of the tubes are carried on rollers, to allow of expansion and contraction. The centres of the ends of the tube are thirty-six feet above the roadway, and the extreme depth of the truss is sixty-two feet. The lower part of the centre pier, which was the chief difficulty in the construction of the work, was built in a cofferdam or cylinder of plate-iron, thirty-seven feet in diameter and ninety feet in length, closed at the top, strongly stayed throughout, and having its bottom divided into compartments, which were kept clear of water partly by a supply of compressed air, partly by pumping. This cylinder was correctly placed on the rock through the mud which was there, thirteen feet in depth, and which being loaded with shingle ballast, assisted to keep out the water. Each truss was put together on the Devonshire shore of the river. Docks were formed, and pontoons prepared with wooden framings to carry the truss. Warps were led from these pontoons to various points on shore, and to vessels moored in the stream. The operation of floating in each case was performed without delay or accident, and the ends of the tube placed on the piers which had been built up to receive them. The truss was then lifted by hydraulic presses, the piers being built up underneath. The total cost of the whole work was £225,000. It was commenced in the beginning of 1853, and was opened on May 3rd, 1859, by H. R. H. the late Prince Consort, Warden of the Stanneries, by whose gracious permission it was called the Royal Albert Bridge.

These models were made for the late Mr. Brunel by Mr. Salter, of Hammersmith, and are both to the scale of ten feet to one inch.