MODERN EXAMPLES OF ROAD AND RAILWAY BRIDGES.

having been removed, a frame formed of cast-iron girders was laid between the masonry of each pair of cylinders, and between the pier of the old bridge and the cylinder nearest to it. These frames, some of which are shown in Fig. 9, are employed to carry the face-work so that it is continuous throughout the whole length of each pier. The main body of the pier is also made continuous by means of connecting arches between each pair of cylinders and between them and the old piers. The arches between the cylinders, which are shown in Fig. 9, are struck with a radius of 5 ft. 2 in., their span being 8 ft., and their thickness 3 ft. 3 in., whilst the arches between the old piers and the adjacent cylinders are of 17 ft. 6 in. span, 4 ft. 3 in. rise, and are 3 ft. 9 in. thick.

The cylinders supporting each pier are 23 ft. 7 in. apart from centre to centre, and there is a distance of rather over 32 ft. 6 in. between the centres of the face ribs of the old bridge and the centres of the cylinders nearest to them, part of this space being occupied by the old cutwaters. At the level of the top of the cylinders the width of the piers is 15 ft. 9 in., this width decreasing to 12 ft. 4 in. at the springing. The length of the new piers at the latter level is 101 ft. 9 in., and to this length must be added that of the cutwaters, which project 10 ft. at the base and 8 ft. 9 in. at the summit. From the top of the cylinders to the springing, the piers are solid, and are faced with ashlar masonry of Roof and Portland stone; above the springing their width is decreased to 9 ft. 6 in., and they are built hollow as shown in Figs. 9 and 11, on the previous page, both the longitudinal and transverse walls being 1 ft. 2 in. thick. This upper part is faced partly with Bramley Fall and partly with picked bricks.

On the tops of the piers are built in cast-iron skewbacks for the arched ribs, these skewbacks resting upon two courses of masonry, each 1 ft. 7 in. thick, the lower one being 6 ft. and the upper one 4 ft. 6 in. wide. The top and bottom flanges of the skewbacks as well as the web are 2 in. thick, the top flange being 1 ft. 6 in. and the bottom flange 2 ft. 6 in. wide. They are strengthened by feathers, as will be seen from Fig. 3, Plate XLIV., where a part of one of the skewbacks is shown attached to the arched rib. The depth of the skewbacks is 3 ft. 5 in., and on the top of them are bolted cast-iron standards, as also shown in Fig. 3. These standards are 9 ft. 7 in. wide, and 14 ft. 9 in. high, and to the tops of them are bolted the horizontal girders, which run the whole length of the bridge, as will be described presently. Each standard is divided vertically into two parts, which are united by bolts and flanges, the latter being 1 ft. 6 in. wide by 1 1/4 in. thick on the edges. The flanges at the top, bottom, and sides of the standards are also of the same dimensions, and the web is 1 1/4 in. thick, the openings in it being surrounded by flanges 6 in. by 1 in.

The abutments, which are about 103 ft. long, and extend back for a distance of 40 ft. from the river face, were built within double coffer-clans of timber, the foundations averaging 35 ft. below high-water mark. They are founded on a thick layer of concrete, upon which is placed 3 ft. of brickwork, and from this the face and partition walls of the abutments are raised. The thickness of the face wall is 5 ft. 11 in. at the springing of the arches, increasing to nearly 10 ft. at the footings. The inner wall of the abutments is 4 ft. 6 in. thick, for the greater part of its height, this thickness increasing to 6 ft. 4 1/4 in. at the footings. The end and division walls, of which latter there are eight running at right angles to the river, are of the same dimensions as the inner wall, and the longitudinal division which is carried along the whole length of the abutment 9 ft. 9 in. behind the face wall is 3 ft. 9 in. thick, except at the footings. Above the springing, the face wall decreases in thickness to 4 ft. 6 in., and then to 3 ft. 9 in., this latter thickness being maintained up to the level of the roadway. The spaces between the division walls are filled in with concrete. The abutments are made with the same batter on the face as those of the old bridge, and are faced with stone in a similar manner. That part of the face wall of each abutment which forms the junction between the new and old work is carried upon cast-iron girders in the same manner as the face walls of the piers. The inner ends of the straight girders forming the land spans are supported upon piers of the same length as the abutments, and 9 ft. wide. These piers are built hollow, the walls being 3 ft. thick, and are surrounded by stone slabs on which the girders rest. The brickwork of the piers is carried down 9 ft. 6 in. below the ground level, and is bedded upon a mass of concrete reaching to the firm gravel.

As we have already stated, the bridge consists of four river spans of 175 ft. opening in the clear, and two land spans of 65 ft. and 70 ft. respectively. The superstructure consists of wrought-iron arched ribs for the river spans, and wrought-iron plate girders for the land openings, the general appearance of the former being given by Fig. 1, Plate XLIV., which is a side elevation of the whole of the bridge. There are eight arched ribs to each river span, these being placed at the following distances apart, transversely: From the outer rib of old to the nearest or first rib of the new bridge, 2 ft. 2 1/2 in.; between first and second ribs, 11 ft. 2 in.; between second and third ribs, 22 ft. 4 in.; between third and fourth ribs, 13 ft. 6 in.; between fourth and fifth ribs, 13 ft. 6 in.; between fifth and sixth ribs, 13 ft. 6 in.; between sixth and seventh, 11 ft. 2 in.; and between seventh and eighth ribs, 12 ft. 10 in.; these distances being all measured from centre to centre of ribs. The space thus supported affords accommodation for three narrow gauge and two mixed gauge lines, together with up and down platforms, the arrangement