having sixteen cells on the inner side to receive them, and deep flanges on the upper side forming channels for the reception of the saddles and rollers which carry the cables and stays. The timbers break joint with each other, and are firmly bolted together, and wrought-iron plates \( \frac{1}{4} \) in. thick, and central dowels, are inserted in every butt joint. The posts are so firmly built and braced as to warrant them being considered, in detail, as short square struts or pillars, having a breadth of base equal to one-fifth their height, and therefore not liable to bending under a heavy load. The mode of framing also cuts so lightly into the wood, that every single piece of timber, 12 in. \( \times \) 12 in., may be taken as having an effective sectional area of 12 in. \( \times \) 11 in. = 132 square inches.

The crushing force of white pine being about 3000 lbs. to the square inch, or 2\( \frac{1}{2} \) net tons (American tons of 2000 lbs. each), the weight required to crush down one of the towers will be 132 \( \times \) 32 \( \times \) \( \frac{2}{3} \) = 10,560 tons, or forty times the weight of the permanent load it has to carry.

The effective strength of pine is estimated at \( \frac{1}{2} \) of its crushing force, and hence the towers should be able to bear safely a load of \( \frac{10,560}{10} \) = 1056 tons. This is still four times as much as the permanent load, and three times as much as both the permanent and transitory loads. Should occasion require it, it will be perfectly safe to take out any one of the four timbers of the eight corner posts, and replace it by another, and the mode of framing adopted admitting it, the change can at any time be made without difficulty.

The Roadway.—At the centre the curve of the roadway rises 4 ft. above its chord in summer, and 7 ft. in winter, there being a rise and fall of 3 ft. due to the changes of temperature alone. The chord line is not a horizontal plane. The end resting on the right bank is 5 ft. higher than the other, but in so great a span the difference of level is imperceptible.

The two ends of the roadway are fixed to the rock on either side, but in the middle must necessarily rise and fall the 3 ft. just stated. The framing had to be adapted to this variation. It is sufficiently rigid to resist the influence of a moving load, and distribute it over 100 ft. of the platform, but is not too rigid to yield fairly to the necessary changes in the position of its centre.

The platform is greatly stiffened by a light, yet strong, reticulated truss on either side, 6\( \frac{1}{2} \) ft. deep, going down 2 ft. below the road, and rising 4\( \frac{1}{2} \) ft. above it, forming at the same time a strong parapet for the protection of foot-passengers (FIG. 3, Plate LX.).

The floor beams are of pine, 13\( \frac{1}{2} \) ft. long, and \( \frac{1}{4} \) in. \( \times \) 10 in. in the middle, bolted together in pairs, and suspended 5 ft. apart between centres, the tension bolts passing down between them (FIGS. 2, 3, and 4, Plate LX.). They are notched upon the lower chord of the truss which passes under them, and are fastened to it by screw bolts. The floor is made of two courses of Norway pine \( 1\frac{1}{2} \) in. thick. Between it and the floor beams is a series of horizontal braces, which act with the floor to keep the bridge in line.

The upper chord of the truss is 6 in. \( \times \) 7 in., made of two pieces of pine 3 in. \( \times \) 6 in., and covered with an oak cap 7 in. \( \times \) \( 1\frac{1}{2} \) in., breaking joints, and bolted together. Tension braces, from the floor beams to this chord, serve to keep the truss in a vertical position (FIGS. 3 and 4).

The lower chord is 6 in. \( \times \) 8 in., and is made of pine, in two pieces of 3 in. \( \times \) 6 in., breaking joints, and bolted together, and under these is a wrought-iron channel bar (FIG. 2), 6 in. \( \times \) \( \frac{1}{4} \) in., with flanges turned downwards 2 in. deep. These channel bars weigh 30 lbs. per yard, and extend the whole way from shore to shore. The joints are fitted with covering plates, 15 in. \( \times \) 5 in. \( \times \) \( \frac{2}{3} \) in., and eight screw bolts at every joint, the holes being slotted to allow for the contraction and expansion of the material. This continuous connexion of wrought iron under the truss, gives it a great additional stiffness and tensile strength, and prevents the stays from pulling the lower chord asunder.

To counteract the horizontal thrust of the stays, the lower chord is gradually enlarged from the point where the longest stay is attached towards both towers. From being 6 in. \( \times \) 8 in. at centre at this point, it is increased to 8 in. \( \times \) 8 in., and 1 in. is added to its width at every 60 ft. until it is enlarged to 8 in. \( \times \) 12 in. at the landings. Abutting blocks and transverse beams of oak are bolted to this chord for the attachment of the stays and guys, and form, so to speak, a kind of stirrup, in which the roadway rests.

Between the top and bottom chords of the truss is a series of diagonal braces and vertical tie bolts, binding the two members firmly together through the oak cap and channel bar at top and bottom (FIG. 3). The cross braces are 6 in. \( \times \) \( 2\frac{1}{2} \) in., with rounded ends where they abut against the oak prisms, which are hollowed out for their reception, and thus the truss accommodates itself to the rise and fall of the bridge without racking the framework.

At the middle of the bridge the weight of the cables, which here descend to the level of the roadway, is brought to bear directly upon the latter, and act as an insistent weight to prevent it being lifted by the wind. At the point of osculation (FIG. 3) of the two reverse curves, formed by the cables and roadway, the floor beams are screw-bolted close up to the cables, and at every 50 ft. of the 200 ft. each side of the centre, a stud or pillar formed of a 2 in. gas pipe enclosing the suspender, is placed between the cable and roadway. These studs serve to spread the inertia of the cables over 400 ft. of the