is well adapted to situations where the bottom is very soft, as for instance the bay of a shallow lake, or the channel of a slough, where the water level is subject to sudden fluctuations.

Solid Timber Open Culverts.

The construction of these culverts, Figs. 8 and 9, is somewhat similar to those already described—that is solid timber side walls drift-bolted together, and braced with 8-inch by 8-inch cleats on the outside. These structures seldom exceed 5 feet in height, and serve also as cattle passes. Where greater height is required a framed culvert, Figs. 10 and 11 is, as a rule, adopted. A planked floor and sheet piling are sometimes necessary.

Framed Culvert.

Figs. 10 and 11 represent what is termed a framed culvert. The framework is constructed of 12-inch by 12-inch squared timber, tenoned at sills and caps, and drift-bolted. The sheathing and flooring consists of 3-inch planking. This structure is adapted to situations where the water-course has a well-defined deep channel with gravelly bottom.

Pile Culvert.

Where the situation is unfavorable for the class of structure shown in Figs. 8 and 9, a pile culvert of the class, Figs. 12 and 13, is substituted. The piles are driven to a solid bearing, and capped as shown, and sheathed behind with 3-inch planks.

The superstructure shown in Fig. 14 is common to each class of open timber culvert.

Pile Trestle Bridges.

The pile trestle bridge, Figs. 20, 21, and 22, already referred to on account of its adaptability to difficult or uncertain situations, consists of a series of 4 pile bents with their centres placed 15 feet apart. The inner piles are driven to a batter of 1 in 12, and where the height above ground will permit, the outer piles are driven to the same batter, and "sprung" to 1 in 6 at the top. The transverse bracing and longitudinal walings are of 3-inch by 10-inch timber, bolted to caps and sills and spiked to piles. The superstructure is similar to Fig. 18 prescribed for framed trestles.

Framed Trestles.

The design for framed trestles, Figs. 15, 16, and 17, was selected after a careful study of the various designs from which structures were built from time to time over the entire system. One feature of this design, which is, no doubt, a commendable one, is the absence of the usual elaborate system of longitudinal bracing, and the additional stiffness obtained from the arrangement of the horizontal longitudinal girts. There is nothing remarkable about the transverse bracing or arrangement of posts, except, perhaps, that the same system can be applied to any desired height by simply inserting an additional post between the two inner pairs, those with batters 1 in 5 and 1 in 24, when the space between becomes too great, as would occur had Fig. 17 been carried down another storey. Fig. 19 shows the minimum height for framed bents.

The floor system, Fig. 18, deserves mention on account of the fact, that by arranging the stringers in this manner, the load is distributed over a larger area at the point of application. It was found necessary to provide for the load due to increased weight of engines in this way without materially increasing the weight of trestle floor. It will be observed that the outside or jack stringers usually placed directly under the ends of ties, can be omitted by this arrangement and brought into action to better advantage nearer the point of application of the load. The stringers, ties, and guard rail are usually made from clear white or red pine, or Douglas

Fig. 16.

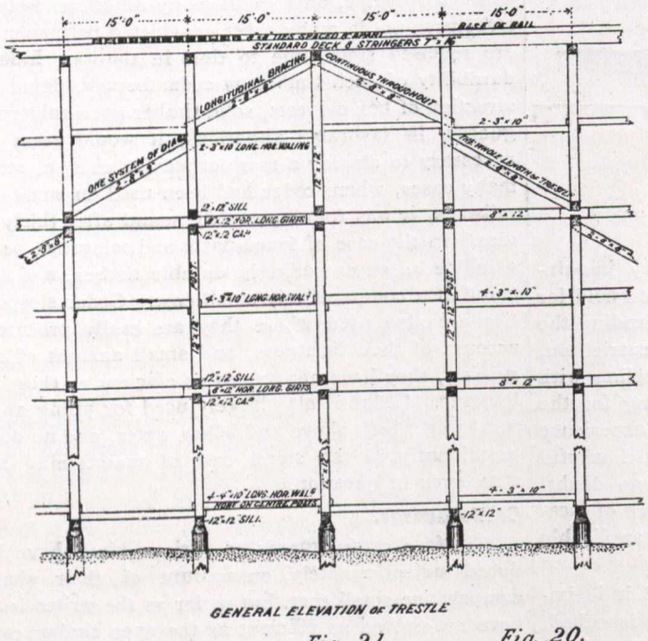


Fig. 17

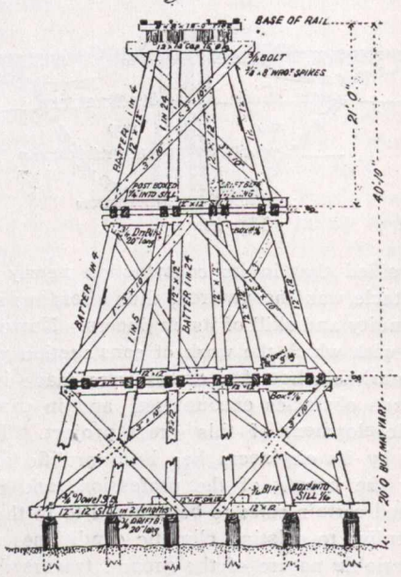


Fig. 22.

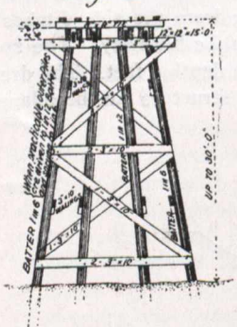


Fig. 21.

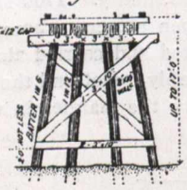
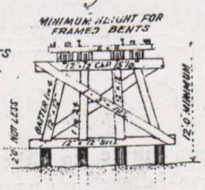


Fig. 20.

Fig. 19.



FIGS. 20, 21 & 22
ELEVATIONS OF PILE TRESTLE BENTS
SHEWING BRACING FOR VARIOUS HEIGHTS.

SCALE FOR FIGS 15 TO 17 & 19 TO 22

Fig. 18.