the working lines of chords, posts and diagonals should meet at a point. Also care should be taken in spacing an equal number of rivets on each side of the centre of a member for the connections. Extreme care should be taken to avoid eccentricities at connections as far as possible.

For lateral or wind bracing connections it is a common error to connect the lateral plates to resist the stresses along the line of one component only. The connections should be made to resist both components. A difficult connection to make is at the point where the bottom laterals connect at the abutment. For the best design the transverse component should be carried direct by the end floor beam and the longitudinal connection by the bottom chord. As noted before, the end bottom chord should be a stiff member.

The bottom laterals are generally connected to the bottom of the posts and to the bottom flanges of the floor beams. The longitudinal component of the wind stress must go from the bottom of the post up to the pin to be carried by the eye-bars. As this eccentricity is unavoidable in our present designs, the posts must be designed to resist this bending. This is accomplished by a plate on each side of the post running to the bottom of the post and above the pin to be utilized also as a pin plate. For the large wind stresses it is advisable to design these reinforcing plates wider than the post to add greater resistance to the bending of the posts.

As the posts cannot be laced from the floor beam to the pin, this part of the post should be amply strong, by cutting the outstanding legs of the angles as little as possible, by extending the pin plates up to reinforce the weak section and by using as few countersunk rivets as possible. Countersunk rivets are not as good as full-head rivets in bearing and, besides, remove more of the section of the plates they connect by the counterboring. The chipping of the countersunk rivet also weakens the rivets by loosening them.

Eye-bars should be designed to conform to the dies of the manufacturers. It will be found that ins. is the maximum thickness for eye-bars, for tests have demonstrated that the thicker bars are not as efficient in tension per square inch as the narrower bars. It is recommended that only two or three sizes of pins be used on a span. If the pin is too large for the bending stresses the pin plates may be correspondingly reduced. Besides, the eye-bars will be more uniform and a less number of pilot and driving nuts are used. Pinplates for transmitting bearing to the pins should be designed with the idea that the web plate is transmitting its own bearing, therefore the bearing from the chord angles to the cover plates should be transmitted through the chord angles to the pinplates direct.

As truss spans are riveted up in the field after the span is "swung" clear of the blocking, the ends of the top chords at the splices come to a bearing for dead load only, consequently the splice plates should be designed heavy enough to carry at least the live load stresses.

In good designing splices should be avoided on the principle that a splice, even if excessively strong, is never as certain of action as a full member. It is important in a splice to secure a proper distribution of material and rivets. The reinforcing material should be adjacent to the material spliced, with the correct number of rivets to each part of the splice. For instance, it would be manifestly wrong to splice a 6 x 4 in. angle by putting all of the splice material on the 6-in. leg.

On through truss spans the tendency is for the stringers to elongate as the bottom chord stretches. It is therefore advisable to design the stringer connections with a wide gauge for the rivet lines to permit the connection angles to "spring" under deflection.

On deck truss spans, having the stringers riveted between the floor beams, the top chord compresses and becomes shorter, tending to throw compression into the floor system, but in reality bowing the stringers outward. To offset this condition the stringers are built a trifle short for short spans, or one expansion pocket is provided at the centre of the span for spans over 300 ft. in length.

On deck trusses where the stringers rest on top of the floor beams the difference in movement between the top chord and the bottom flanges of the stringers is the shortening of one panel of top chord plus the elongation of the bottom flange of the stringers. This movement is taken care of by slotting the holes of one end of each stringer. In such a case the top laterals should not be rigidly connected to the stringers. The only connection necessary is such that will support the weight of the laterals to prevent sagging.

Bottom laterals should always intersect at the centre line of the truss where eye-bars occur in order to prevent the twisting of the post. This is not so essential when the bottom chord is a built member, as the stiff member carries the stress from one side to the other. The objection to having central connections where stiff members occur is that the lateral plates become very long and ungainly. However, when eccentric lateral connections are used, the two sides of the member should be rigidly connected.

Top chord sections are usually shipped in two panel lengths. The engineers should remember this and design these sections of the same material to avoid the shop splice. The weight is practically the same and the member is stiffer without the splice.

The wide lacing bar having two rivets at each end is advocated instead of the narrow bars with one rivet at each end. In addition to its greater efficiency the wider bar is more easily riveted.

For truss spans the reaction of the end floor beams should be carried on the end pin and not on the shoe. This will enable the end beam to take up deflection with the trusses and also place the loading more central on the main shoe. The pin shoes, as noted elsewhere in this paper, should be of cast steel, while the main bolsters should be of cast steel or cast iron, depending on the amount of reaction.

The tractive force of the engine exerted when the brakes are set has a tendency to bend the floor beams in the direction of the moving load. This force, which is usually taken at one-fifth of the vertical moving load, is resisted by the stiffness of the floor beams for small spans. For long spans, say over 250 ft. long, it is best to provide a truss frame to carry the tractive forces over the trusses. For a solid floor, such as a trough section floor, I-beam floor, or where four lines of stringers are used for single track, the provisions for bracing against tractive force may be neglected.

Trestle Work.—The design of the viaduct will depend upon economic conditions and on the equipment for erection—that is, the length of span is determined from the length of boom on the traveller or derrick car. We are not concerned with the erection in this paper, but this point was brought out to show that all phases of construction should be considered.

After deciding on the lengths of the main girder and tower spans, the elevation of the trestle should be determined by making the tower spans of one length, and as many as possible of the main spans of one length. The elevation at the top of the piers should be fixed with the object of making all of the tower posts alike if possible. If the contour of the ground will not permit this, the tower lights should vary only where necessary.