

be so improved as to do away with the very objectionable torsional effect that I have pointed out; it will necessitate, however, either a slight raising of the grade or the lowering of the trusses a few inches. If under each end of each floor beam there be placed a small pin, say  $2\frac{1}{4}$ " or  $2\frac{3}{4}$ " in diameter, having its axis horizontal and lying in the central plane of the truss, and if proper bearings both on the under side of the floor beam and above the chord be provided, the object will be accomplished. Each bearing could be made of two pieces of angle-iron rivetted to a plate bent into channel shape, so as to form a double T. The head of this T would be rivetted to the upper side of the bottom chord, and the pin would pass through holes bored in the two stems. Another plate bent into channel form should be rivetted to the under side of the floor beam at the end, and a hole should be bored through the vertical flanges thereof. In order to reduce the thickness of the bent plate, the circumference of the hole might cut into its web about an eighth of an inch. By this means the load on each beam will be applied in the central planes of the trusses, and the objectionable torsional effect will be avoided. The pins will hold down the floor beams in case of an upward wind pressure.

These improvements have been merely sketched out, but the description will be sufficient to enable you to make the changes should you ever find them necessary. It is not likely that such troublesome and expensive improvements will be attempted until the bridges show signs of failure; and then it might be better to replace them by entirely new structures. I would, however, advise the immediate use of the lateral system and side bracing described and the adoption of my arrangement of ties and guard rails.

The bridges should be watched carefully to detect signs of failure according to the system described in the Memoir. When the rivets begin to work loose, and when any members show the slightest evidence of bending, then look out for disaster.

It would be a very wise precaution if the Railway Department would so alter the time schedule on the Tôkyô-Yokohama Railway as to avoid having trains meet on the Kawasaki bridge. Two benefits would result therefrom: first, the structure would last longer, and second, if an accident should occur, it would involve the loss of one train only.

These few remarks will, I hope, close the bridge discussion.

That both it and the Memoir may in the years to come prove of real, practical benefit to our profession in this country is, Gentlemen, the earnest wish of

Yours faithfully,

J. A. L. WADDELL.

Tôkyô, February 24th, 1886.

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