

long time before we can make many of the proprietors, foremen, and workmen in our bridge and girder yards understand that *something more of the nature of an instrument of precision than a sledge hammer and drift* may be used without great expenditure either of time or money in girder constructing; and that with suitable designs the drilling and boring machine may have to take the place of a blunt shearing machine, and punching machine with blunt punch and blunt edged die.

The rule to which we have been referring was useful in its day, and was adopted by the Board of Trade upon the recommendation of civil engineers. The Board is therefore not to be blamed for it, and steps ought at once to be taken by the Board to obtain the opinion of civil engineers *who are amongst the leaders in modern practice; not of those who, though eminent as engineers, are beyond that age which admits alteration to be necessary in any rules they have long been accustomed to work with.*

* * * * *

"IN ALL CASES OF BRIDGE DESIGN DIFFERENTIAL FACTORS SHOULD BE USED INSTEAD OF A SLAP-DASH ALL-ROUND FACTOR, WHICH IN SOME PARTS OF A BRIDGE IS TOO HIGH, AND IN OTHERS AS MUCH TOO LOW."

The foregoing evidence, coming as it does from the highest English authority, is so conclusive that I will rest my case thereon, and will trouble you after to-day with no more letters on "Iron Railroad Bridges for Japan."

Will you kindly add one more to the many favours that you have done me by inserting the appended letter to the Japanese engineers? It was promised some time ago.

And now, Mr. Editor, allow me to most sincerely thank you for all the courtesy that you have shown me during this discussion, and for the large amount of valuable space which you have given it in your columns. Although it has undoubtedly been somewhat uninteresting to many of your readers, it will eventually prove of value to the Japanese engineers and other gentlemen connected with the Railway Department.

Yours very respectfully,

J. A. L. WADDELL.

Tôkyô, February 24th, 1886.

TO THE CIVIL AND MECHANICAL ENGINEERS OF JAPAN.

GENTLEMEN.—Having promised during the course of the bridge controversy to explain, if requested to do so, how to correct the principal faults in the Japanese railway bridges, and having been so requested by one of your number, I now proceed to comply.

In my letter of September 13th I stated that the three great dangers to which the railroad bridges of this country are subject, are washout, destruction by wind, and derailment. To prevent the first nothing can be done unless the embankment has been carried too close to the stream, in which case a portion of it should be removed and replaced by trestle work or short spans.

The second danger can be averted by attaching at right angles to the planes of the trusses several pairs of 4" x 5" angle-irons to the underside