METHODS OF BRIDGE DESIGNING. 23

"stood the wear and tear of traffic" even for years has in many cases
caused such a secure feeling that sad accidents have resulted therefrom—
witness the Ashtabula horror and another incident in Scotland, of which I
shall have occasion to speak farther on.

The fact of having stood for years is no proof whatsoever of sufficient
strength: it merely shows that the necessary combination of favourable
circumstances for the destruction of the bridges has not yet occurred. The
now nearly obsolete term "factor of safety" or as it has been aptly termed
"factor of ignorance" is responsible for weak structures withstanding for
years all the stresses to which they are subjected, then suddenly collapsing.

Mr. Pownall very coolly omits the Karasugawa bridge, when he refers
to the durability of the Japanese bridges; merely because it was recently
constructed. He says that I am misinformed about the cause of the
failure, but does not state what the cause was. I can state it in a few
words. The damming up of the water by the close piers and the embank-
ment caused an eddy which undermined one side of the foundations of one
of the piers. Had the waterway not been so obstructed, the accident
would not have occurred.

Mr. Pownall's remarks concerning the Japanese bridges having "stood
ten or a dozen typhoon seasons," instead of proving that they are strong
enough to resist the proper allowance of wind pressure, merely show that
the requisite wind pressure for destruction has not yet struck the bridges.

It is a well known meteorological fact that the maximum wind pressure
in any great storm acts at one time over a very limited area, so the chances
of any bridge escaping destruction by any one storm are very good.

Concerning Sir George Airy, my statement, although amusing to Mr.
Pownall, was nevertheless correct; for I have been informed by an eminent
English engineer that he (Sir George) many years ago was referred to
concerning most of the important bridges then being built in England, in
order that he might check the calculated stresses and pass judgment upon
the designs.

Finally, Mr. Pownall advises me to attend to my own work and let his
alone. It is true that if I had done so all the discussions of the last six
weeks would have been avoided. But it happens that my specialty is
bridge, designing, and seeing before me specimens of very inferior designing
of bridges on the Japanese roads, have I not a right to express a profes-
sional opinion thereon? When an engineer erects any structure, he
places himself in the same position in respect to criticism as does an author
in writing a book, so he need not feel offended or insulted, if someone takes
advantage of the opportunity to express an opinion adverse to the work.

Now as the foreign engineers who have hitherto taken part in the dis-
cussion refuse to criticize my work on rational and technical grounds, pre-
ferring to indulge in vague reference to the great mental capacity requisite
to a comprehension of the subject, and in personal attacks, it behoves
me to state as clearly and as simply as possible the faults that I find in
the Japanese railroad bridges. I have done so already in the "Memoir;" but,
as very few of your readers have seen the work, a repetition will not be
out of place.

But first a word in respect to the great mental capacity referred to a few