The modern bridge builder, if he has been properly educated for his business, having arranged the outline of his truss, makes his computations, and marks upon each line of his diagram, so many thousand pounds of tension upon this, so many tons of compression upon that, and so much shear strain, or lateral strain upon each rivet, connecting pin, or beam, and assigns to each place a member containing such an amount, and such a kind of material, as experience has proved to be sufficient to sustain the given stress with safety.

Thus far, his course is scientific and sensible. But in arranging his system for securing lateral stability and steadiness, science can lend him but little assistance.

He knows the wind will blow against the side of his structure; but whether with a maximum force of one hundred pounds, or as many thousands, he has no means of knowing with any considerable degree of certainty, or probability.

He knows, furthermore, that every deviation from a straight line by a body passing over and upon a bridge, even to changing the weight of a pedestrian from one foot to the other (unless his steps be directly in front of one another, and this could hardly form an exception), is attended by more or less tendency to lateral swaying of the structure.

Every inequality in the line of a rail road track, laterally or vertically, unless both rails have precisely the same vertical deviation, produces a transverse motion in the centre of gravity of the load, and consequently a lateral sway in the structure. The passage of a carriage wheel over a stick or a pebble, raising one wheel above the opposite one, changes the centre of gravity of the load to the right or left, and impels the structure in the opposite direction.