Volume 26. Toronto, April 16, 1914

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The Canadian Engineer

A weekly paper for engineers and engineering-contractors

COMMERCIAL DESIGNING OF STRUCTURES

MONEY CONSIDERATION NEXT IN IMPORTANCE TO THE GOVERNING FACTOR OF STRENGTH—SOME INSTANCES OF EXPENSIVE DESIGNING—A CRITICAL ANALYSIS OF COSTS.

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THE highest function of an engineer is that of designing. A man with limited ability and education may be able to carry out the plans and designs of another, but the broader and higher the education of an engineer, together with a well-balanced experience, the greater should be his ability in designing.

The world knows much of the structures and appliance of such greater designers and inventors as Sir Christopher Wren, Watt, Stevenson, Bartboldi, Eiffel, Roebling and Westinghouse, although it knows little of the men who carried out their designs. The names of the greater designers of engineering structures and machines live in the history of the world, but to few of those who carry out designs, i.e., the builders, does this apply. Goethals, of Panama, is an illustrious exception.

In all designing there is need for care and accuracy. The lives and welfare of many people are dependent upon the work of designers. There should be two standards of designing in every country. One should be for work done by the general government, in which the standard for excellence should be of the highest, represented by strength and artistic lines and finish.

Cost and service should not be the governing factors. Representative structures of this kind abound in the old world, in the many cathedrals, palaces, memorial arches, parks and boulevards, and in America the number of similar magnificent structures is increasing.

The second standard should be for commercial structures, for which the first consideration should be strength, the second cost and service or utility, and the last, art. However, art should not be sacrificed for a few cents, or when an artistic finish can be had for the same money for which an unsightly structure can be reared. In all commercial designing, all governing factors should give way to cost, except that of strength. This cost is not only that of construction, but also of service and operation, for it is manifestly wrong to design a structure for cheapness of construction that will not serve its purpose, or will cause a high cost for operation.

It is to be regretted that there are many instances occurring annually of engineers sacrificing strength for money considerations. Only a few years ago the sad spectacle was recalled in a paper before a technical society, of an engineer acknowledging that owing to money considerations, he had designed an important structure with such a low factor of safety that it had failed, wrecking very valuable property and causing heavy loss of life.

Buildings under construction fail, dams are washed out and many other engineering structures go down owing to faulty designs, insufficient strength being given to the designs through errors of judgment, lack of knowledge of designing, and sometimes to incomplete surface and sub-surface surveys, and data upon which to base the designs.

Such things are either directly or indirectly the fault of engineers. Directly, when they can control their work, or they undertake designing for which they are not fitted, and indirectly, when they cannot control their work, by not being furnished ample funds and time for surveys or are interfered with by governing boards and bodies, and they do not protest against such restrictions. Engineers under such circumstances should put their protests in writing and if conditions are not then remedied, they should refuse to go on with the work. Engineers should remember that in continuing under these circumstances, they are no longer living up to the high standards of their profession, but are injuring both their profession and themselves, for they suffer in reputation, while others escape all odium.

Beyond these considerations, money and service should be the guide of all commercial designing. Many designs will serve the same purpose, but some are much more expensive from either a construction or operation standpoint than others.

Some years ago, in designing some pile bridges for a railroad the plan called for a tenon on top of the piles to be mortised into the caps. This added to the cost of construction and of renewals, while it did not add to the strength. Drift bolts and lag screws formed the ordinary method and proved satisfactory for this purpose. Mortise and tenon work is used in frame structures, but owing to the extra cost the tendency is to substitute cheaper joints that will give the same strength and longer service, as a mortise is a hole to catch rain water and start decay.

A revolving drawbridge of the bob-tail type, i.e., with but a single span, was designed by an engineer, and to counterbalance the weight of the span, he designed heavy steel members on the end opposite to the span, as in the space provided for concrete he could not get enough of that material to serve as a counterbalance. A more experienced engineer cut out of his design several