

unpardonable waste of material in the girders which the by-law requires to be used in buildings.

Some indication of the unreasonable exactions of the by-law in this particular may be had from the following estimates made by the writer. A girder built in accordance with the by-law to carry a load of 100 tons would, according to the specifications of the great railways, the Dominion and Ontario Governments, the Canadian Society of Civil Engineers and the Works Department of the City of Toronto, be entirely safe for a load of $122\frac{1}{2}$ tons. A girder designed for 200 tons according to the by-law would be safe for a load of $238\frac{1}{2}$ tons. To put the matter generally, girders designed in conformity with the Toronto building by-law will carry with the factor of safety demanded by the railways, for example, from 17 to 35 per cent. more than they are at present permitted to carry.

The waste of material involved in following such an antiquated plate girder specification varies with the capacity and span of the girder but lies normally between 8 and 10 per cent. Plate girders as used in the buildings of Toronto thus cost from 8 to 10 per cent. more than they should. In the new Dominion Bank Building at the corner of King and Yonge Streets, \$1,200 was absolutely wasted on this one item alone. In the new Royal Bank Building the corresponding loss will be \$1,400, in the Toronto Technical School it will be \$2,100, and in the new Methodist Book Room it will be about \$2,200. From these, and other facts it is apparent that not less than \$25,000 is expended every year in putting excess material into plate girders, which, as far as use is concerned, might quite as well be thrown into the sea.

SAFE LOADS ON TIMBER COLUMNS.

Section 18, page 80.—The safe loads on timber columns are much lower than are sanctioned by almost any good specification that might be named, and do not correspond at all to the results of actual tests. For example, a long-leaf yellow pine column 12 x 12 ins. and 15 ft. long and which would not be allowed to carry more than 52 tons by the Toronto by-law would be considered entirely safe for a load of 61 tons in Boston, Buffalo or Minneapolis or a load of 64 tons in Chicago, or a load of 70 tons in Baltimore or in a structure built by the Works Department of the City of Toronto 65 tons, or in any structure built in accordance with the requirements of either the Dominion or Ontario Governments a load of 68 tons. It is not remarkable that a column which a Toronto contractor must put into a building to carry a certain load, would, if put into a civic bridge in the same city, be allowed to carry a load of 24 per cent. greater, or if put into any bridge sanctioned by either the Dominion or Ontario Governments a load 31 per cent. greater? And this is not by any means the worst case, for with columns of greater slenderness the exactions of the by-law are still greater.

The practical result of this is that the cost of the columns of mill construction buildings, is on an average 25 per cent. greater than it should be.

FLOOR LOADS.

Section 23, page 86.—The specified live loads for which floors are required to be designed are in a number of cases greater than are at all likely to occur in the life of the buildings concerned, and in the interests of economical construction some reduction in such loadings should be made. A careful comparison of the prescribed loads set forth in the by-law with the results of actual investigations, with recent authoritative specifications

and with such building codes as have been revised recently, indicates excessive requirements in the Toronto by-law. Two instances will suffice to show the need of careful consideration of the present specified loadings.

Paragraph d, page 87.—It has been clearly shown by careful determinations of the maximum loads on the floors of office buildings, that the loads in the offices themselves, above the ground floor, will ordinarily never exceed 40 to 50 pounds per square foot. A thorough investigation of this kind was made by Messrs. C. H. Blackall and A. G. Everett in three large office buildings in Boston. For each room the weights of the furniture and contents and of the greatest number of people known to have been in it at any one time were taken, and the greatest load thus found in any one office was 40.2 pounds per square foot. In only 12.4 per cent. of the offices was the maximum known floor load in excess of 25 pounds per square foot and in only 26 per cent. was it over 20 pounds per square foot.

In the light of these and other observations which might be cited, a floor load in offices of 75 pounds per square foot as is required in Toronto appears to be extravagant and should be reduced to 50 pounds per square foot. Partitions should be considered as an additional load.

As an instance of the adoption of rational floor loads for office buildings, the recently revised building code of the City of Chicago places the loads at 50 pounds per square foot for all floors and corridors with partitions extra.

Paragraph f, page 87.—A consideration of the character of the loading on school room floors and of the conditions existing in such buildings leads to the conclusion that 75 pounds in rooms and 100 pounds in corridors and lobbies are excessive live loads. A mixed throng of children averaging, perhaps, 75 pounds each in weight cannot impose upon a floor any such load as a throng of adults averaging 150 pounds each. Investigations will show that while children weigh on an average half as much as adults they occupy two-thirds as much space, and therefore the intensity of loading due to a throng of children should not be over three-quarters of that due to a throng of adults. If, then, a load of 75 pounds per square foot represents, as the by-law assumes, the probable weight of a mixed crowd in the main entrance halls of hotels, apartment houses, tenements and boarding schools and in the corridors and halls of office buildings, surely it should be an adequate allowance for the live load in the corridors and lobbies of schools where the typical crowd will weigh 25 per cent. less. Nevertheless, the by-law requires the latter to be figured for 100 pounds. In the school rooms, where the seats are generally fixed, a load of three-quarters of that specified for the corridors and lobbies, or, say, 60 pounds per square foot should be entirely adequate.

The propriety of these loads for schools is evidenced by the fact that the framers of the new Chicago code fixed the maximum loads for the assembly halls, corridors and stairs of schools at 75 pounds per square foot and for all other parts 40 pounds per square foot.

REDUCTION OF LIVE LOADS ON GIRDERS.

Since a girder can receive its maximum load only when the beams which it supports are fully loaded, it follows that a much larger area must be covered for the maximum load on a girder to arise than it is necessary to cover for the production of the maximum load on a floor beam. In an average case these areas are as three