

brick or stone. It differs from the frame construction in that the joists are spaced from 3 to 6 ft. apart and are timbers of considerable size. The floors are matched planking. All stair and elevator hatchways must be enclosed, with doors at each floor opening. This construction is, of course, somewhat more expensive than the frame construction. Its principal advantage is that it takes an insurance rate about 20% less than frame construction.

Any timber construction has several advantages over more permanent types such as concrete or steel. Alterations in the buildings, due to changes in processes of manufacture and the installation of new machinery, are much more cheaply and rapidly made. The expense of attaching shafting and machinery to the finished structure is considerably less. Wooden buildings are more rapidly constructed than either reinforced concrete or structural steel buildings.

The columns in buildings with wood beams should be spaced from 12 to 18 ft. on centres. If a greater column spacing than this is required it is usually more economical to make the beams spanning in the longer direction of steel. These beams may rest on cast iron or steel columns, the remainder of the construction being of wood.

A better construction consists of steel columns and beams throughout. The floors may then be made of reinforced concrete or tile. If the columns and beams are then covered with fireproof material such as tile or concrete the building may be regarded as the best type of building which modern civilization has produced. In such a building the steel columns do not occupy so large a percentage of the floor area as do concrete columns. Exact stresses in a steel frame building are more easily computed. The chance for variation in the strength of the material due to faulty workmanship or design is not nearly so great. Alterations of the building are more economically made in a steel than in a concrete building.

The most popular type of factory building in many localities is reinforced concrete. A properly designed concrete building is the very best building which can be put up for many industries. It is entirely fireproof and takes the same rate of insurance as a fireproof steel building. Such buildings are probably the most rigid type which can be constructed. The material will stand a large amount of abuse in the way of faulty workmanship and design. Other types of buildings deteriorate with age, but a concrete building increases in strength. So far as we are able to determine at this time, our concrete building will be as good in the structural parts fifty years from to-day as they were when built.

The floor spans of a concrete building may economically be made from 16 ft. to 24 ft. in length. The exact span for minimum cost, of course, depends upon the expense of the foundations. The more expensive the foundation piers the longer may be the economical span. We find that the flat plate type of column pier is considerably less expensive than the old-fashioned masonry piers of the pyramid type.

The statements made concerning the exterior walls of one-story buildings are, of course, true in regard to buildings with a greater number of stories. It is usually economical to build self-supporting exterior walls for buildings up to three stories in height. For buildings higher than three stories the walls are often made twelve inches thick and carried upon the steel or concrete frame of the building.

The details of the work which have been described in the foregoing paragraphs are interesting in illustrating the method by which we try to arrive at the final economical design. A factory is made up of such a large number of details that only a few can be touched upon at this time. The arrangement of electric lighting and the ventilating systems, so as to give each worker sufficient air and light, are other interesting problems.

Finally, it may be said that in the last analysis the most economical factory building is the one where each worker is given the best conditions for doing his work, for the least cost.

### UNION STATION, TORONTO.

The contract for the construction of the new Union Station for the city of Toronto was awarded last week to the P. Lyall Construction Company, of Montreal and Toronto, the amount of the contract being approximately \$4,000,000. The station is being built by the Toronto Terminals Railway Company, Mr. J. R. W. Ambrose, chief engineer. Messrs. J. M. R. Fairbairn, assistant chief engineer, C.P.R., and H. R. Safford, chief engineer, G.T.R., are consulting engineers to the organization formed for the purpose of handling the enterprise.

The new station will be constructed on a site east of the present building and will be bounded on the north, east and west by Front, Bay and York Streets respectively. The site forms a portion of the fire-swept region which has remained for the most part unoccupied and desolate since the conflagration of 1904.

Messrs. Ross, Macdonald and Jones are the architects with whom is associated Mr. J. M. Lyle, Toronto. The erection of the new Union Station will form a part of a \$15,000,000 development project which includes a large amount of grade separation to be affected along the water front.

### REINFORCED CONCRETE SEWER AT VICTORIA, B.C.

A reinforced concrete sewer is under construction in Victoria, B.C., that will drain a section of the city 425 acres in extent; also, 800 acres in Saanich and 1,000 acres in Esquimalt. It will be two miles in length when completed, and will empty into an outfall near Macaulay Point, where it will discharge through several hundred feet of steel pipe at a point below water level where the tides admit of unusually favorable disposal. The trunk sewer is 27 in. in diameter at its beginning, increasing to 36 in. at the outfall, and the sections of reinforced concrete pipe are cast in 5-ft. lengths.

The excavation for the sewer consisted of about 7,250 ft. of rock tunnelling and 3,100 ft. of open work. The tunnel work attains a depth of 65 ft. below the surface, and consists essentially of three separate tunnels, the first of which is now being driven and in connection with which two shafts have been sunk. The tunnel is being constructed 5 ft. in width and 7 ft. in height. The excavated material is for the most part solid rock, and admits of an average progress of 5 ft. per day. The work is in charge of Mr. A. E. Forman, assistant to City Engineer Rust.

Another notable reinforced concrete pipe line in Victoria is that in connection with its water supply. It is a 28-mile conduit, 42 in. in diameter, and is being constructed by the Pacific Lock-Joint Pipe Co., of Tacoma.