NOTES ON THE CONDITION OF SOME UNDER-GROUND CONCRETE WORK IN WINNIPEG*

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I N presenting this subject for discussion, under the general title given above, it is proposed to eliminate theory as much as possible, and to cite (literally) concrete examples of deterioration under various conditions. Examples which will be given are taken from experience in the Province of Manitoba, and mainly in the city of Winnipeg. These have all come under the observation of the writer, or have been reported to him from reliable sources.

As this subject deals with underground conditions, the examples naturally divide themselves into two main classes :----

(a) Foundations for buildings or bridges.

(b) Pipes for sewers, drains or water supply.

These will be discussed in the above order and a few typical examples given.

Foundations

(1) The first case which came under the writer's observation occurred in the footings for the columns of a seven-story building in Winnipeg. The footings consisted of the usual square stepped design. Owing to proposed increase in the loading it was considered necessary to put caissons to rock under the existing footings, and in the course of excavation for this work some rather extraordinary conditions were revealed. The first discovery was made by one of the workmen who was engaged in placing a strut between two adjacent footings. To his astonishment the concrete of one of the footings appeared to be practically a slime. The mass was so



Fig. No. 1—Caisson Under Ten-story Building Had Appearance of Pile of Broken Stone

soft, indeed, that he could without difficulty plunge his hand into same and squeeze the material through his fingers. The matter was reported to the writer, who was associated on the work, and an examination of the material was made. The concrete had the appearance of lime mortar, being quite white and of a slimy consistency. There was quite a strong smell of sewage, and the inference, at first, was that there had been a chemical action by sewage from a broken drain in the vicinity, but this was not confirmed by further investigation.

Other examples were soon discovered in other footings as the work proceeded, and conditions were of such a nature that the architect in charge of the work decided to remove the old footings altogether and to build the caissons up to the base plates of the columns. In one extreme case a mass of concrete fell away from the corner



Fig. No. 2-A Sheath of Hard Clay Adhered to Rough Parts of Caisson

of a footing, and was so soft that it was possible to swing the head of a sledge hammer sideways through the mass. The disintegrated concrete, on being allowed to dry, becomes fairly hard with a white powdery surface. In the course of removing the old footings it was found that patches of this soft concrete occurred in what appeared to be otherwise quite sound masonry, thus indicating that a gradual rotting process was going on, which now appears to be most probably due to some chemical action by the ground water which had gained access to the footings. Wherever the condition was found it was observed that the concrete was very damp and porous, and the latter condition may explain the action to a certain extent.

In Clay for Fourteen Years

(2) The second example was discovered when exposing the surface of caissons which had been lying in the clay for over 14 years. These were under one of the 10story office buildings in Winnipeg. It was found necessary, on account of settlement in the building, to excavate under these old caissons and continue same to rock. They were generally lying at a depth of about 35 ft. below ground level, and in practically every case (21 in number) water in considerable volume was found lying around the caisson and concentrated at the bottom. This water had come from under the basement floor and seeped down along the surface of the caisson. The first caisson exposed had an unusually rough surface, having the appearance of a pile of broken stone. (See Fig. No. 1.) There was a certain bond between the stones but the concrete was full of large voids.

If any mortar had ever existed in these spaces, it had entirely disappeared. It was noted that in the spaces mentioned above, a deposit of a brown jelly was often found. It was thought at first that this might be gelatinous silica, left as a residue from some chemical action, but this was not confirmed by analysis. Wherever this rough surface appeared there was discovered a curious sheath of hard clay about $1\frac{1}{2}$ ins. in thickness, which showed quite a marked cleavage from the mass of sur-

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