I-inch surface coating of cement-sand mortar. Particular care should be given in laying such a walk to provide the best Portland cement, thoroughly mix the concrete, and to completely divide the walk into blocks so that there will be a clear space at each joint. Even on clay soils, if properly drained, such a construction should be safe; or, in any event, a four-inch gravel or stone foundation should be sufficient. A great deal of the failure of concrete walks, commonly attributed to a weak foundation, is really due to poor workmanship, carelessness in mixing the concrete, inferior cement, and other causes. Crushed granite in the wearing surface is needlessly expensive, except for certain walks in the larger cities, subjected to exceptionally heavy traffic.

These walks are variously called "artificial stone," "granolithic," "cement," "concrete," "cement-concrete." The term "granolithic" is properly applied to the walks of this class in which granite chips are mixed with sand and cement in forming the wearing surface. Although of similar appearance, concrete walks are not the same material as is used for asphalt roadways, with which they are very commonly confused, the asphalt pavement being a mixture of sand and mineral pitch. Asphalt is occasionally, as in the City of Kingston, used for sidewalks. Vitrified paving brick are also used to some extent for sidewalks, costing about the same as concrete, while they are commonly used for crossings, being laid on a concrete base, and taking the place of the concrete wearing surface.

The usual requirements of a concrete walk are :

(1) A foundation layer of stone, gravel, cinders, or other suitable material, consolidated to a depth of from four to twelve inches in thickness, according to the nature of the sub-soil.

(2) A concrete base from three to four inches in thickness.

(3) A surface coating of cement-mortar one inch in thickness, mixed in proportion of one of cement and two of sand.

The foundation layer is intended to provide a certain amount of drainage, as well as strength, and should be greater on a clay soil, retentive of moisture and subject to upheaval by frost, than it need be on a loose gravel or sand.

A concrete base three inches in thickness is ordinarily required on a favorable soil, and four inches where the sub-soil is of clay, or where, for other reasons, the drainage is not thought sufficient.

Where broken stone is used in the concrete base, safe proportions would be one part of Portland cement, two and one-half or three of sand, and five of broken stone. This quantity of sand and cement will make a strong mortar, and there will be sufficient to surround each stone and fill the voids.

Where gravel is used to form the concrete base, the usual proportions are one part of cement to six or seven of gravel. The gravel used in mixing concrete should be free from clay, loam, or earthy material, and should contain about thirty per cent. sand. As there is apt to be some uncertainty as to the quality of the gravel and the uniformity with which sand is intermixed with it, a greater proportion of cement is required than with a carefully adjusted mixture of cement, sand and broken stone.

The sand used in mixing broken stone concrete should be clean, sharp, and of varying sized grain. One of the objects to be aimed at in mixing concrete is to have fine and coarse materials in such proportion to one another that the percentage of voids in the consolidated mass will be reduced to a minimum. For the surface coat the proportion of one of cement to two of sand is customary, except at street crossings, where one part of cement to one and one-half of sand is commonly employed.

As previously pointed out, special care should be taken to thoroughly mix the concrete, and to divide the blocks completely at each joint—this division providing for contraction and expansion. A four-inch slab of wellmade cement-concrete is exceedingly strong, and should not crack or disintegrate when laid on the surface of any soil; but if the soil is wet, the walk would have a tendency to become uneven.

Quite apart from conditions to be expected in frosty weather, concrete sidewalks exhibit at times a tendency to become dangerously slippery; the entire surface in some cases, and in others, merely in spots. The condition is frequently serious, and is one to be avoided as far as possible. The tendency to be slippery may arise from several causes. Granite chips, or broken stone of almost any kind, used in the surface coating, will wear smoother than an ordinary sand finish. A surface rich in cement generally wears smoother than one in which the proportion of sand is greater. The dusting of the surface on completion with neat cement, instead of a mixture of sand and cement, tends to smoothness. A trowel finish is smoother than a surface finished with a wooden float. Towns in which hills are numerous, and slippery walks therefore more necessarily avoided, find most serviceable a plain, sand-cement surface, finished with a wooden float, indented with a toothed roller, or other means of roughening.

Then walking on concrete sidewalks, a hollow sound is frequently noticed. This hollow sound indicates a separation of the concrete base and surface coating. The remedy is that ordinarily prescribed in specifications for sidewalks, requiring the surface coating to be put on the base before the latter has set and while still adhesive. That is, the concrete base should be covered with the wearing surface as the work progresses, the former being spread in short sections and immediately surfaced. In this way the two layers of concrete unite to form a solid stone.

The "hollow sound" is the forerunner of the time when the surface will crack and shale away from the concrete base. When, for this reason, it becomes necessary to re-surface a concrete walk, the entire surface as far as it can be loosened, should be taken off. The concrete base should be thoroughly flushed to free it from all loose particles, and made as wet as possible. Dry cement should then be sifted over it and the new surface coating of cement mortar at once applied. This is the usual process for re-commencing interrupted concrete work, the surface being always well flushed, dusted with dry cement, then the new concrete put on.

Engineer K. L. AITKEN, of Toronto, the electrolysis expert, finished making his tests here yesterday, and his report will be in the hands of Mr. BARROW, the city engineer, within a week. He has found many places where there is a large flow of current in the pipes, but in the excavations so far made no material damage has been discovered. Advice will be given Mr. BARROW as to what precautions are to be taken in connection with the matter.—Hamilton Spectator, June 28, 1907.

JNO. MACDONALD, clerk of the Village of Bolton : "I feel as though I can't do without THE WORLD. It is the right thing for all municipal officers."

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