

solid material is situated. Fortunately, it is generally found that quicksand is placed on the upper layer of a bed or strata of good, hard sand, and the excavator having obtained this will have no difficulty in testing and treating his base, but he should endeavor, as far as he possibly can, to locate the area of the sand bed to guard against any possibility of its slipping. A sectional profile map of the land, should such a thing be within his reach, will help to guide him in this query, especially in the cities where other buildings have been previously in existence, and have been pulled down to make room for the new structure; but in open land he can easily learn from the oldest inhabitant, any of the neighbors, or perhaps from his own personal observation of the topography of the land as to the natures of the bottom.

The foregoing remarks apply to liquid or soft mud, loose clay, mixtures of sand and gravel, shale or any ground which conveys an idea of uncertainty or unfitness, and it is here that we recognize the true and important value of a practical knowledge of the geological constituents of the earth's crust and the infinite variations with which the constructor must cope. If mother earth had only laid down some fixed rule for her compositions, if we were assured that there would always be the same ingredients all over one site, all would be well, and the task would be simple; but, unfortunately, she is erratic in her formation, and it has been the experience of the writer to have to provide against rock clay, sand and mud all within an area of 200 square feet. The most serious problem the foundation constructor has to solve is the matter of filled-in ground, or dumping ground, which is, as a rule, generally swamp, along the banks of rivers, valleys or flat land adjacent to the sea; though there are in the cities plots and lots whose original filling in to bring the cellars up to the depth from the curb line required by law. This, then, is a matter needing consideration, and can only be regulated by the size and weight of the building to be erected on the site, in addition to the nature of the ingredients the fill is composed of. This, then, can

only be settled by a close study of the existing conditions and what weights the filled-in ground will be obliged to sustain. For example, it would be manifestly unwise to erect a five or six storey apartment house or flat on a filled-in bottom, the thickness of the filling being from three to four feet, dumped on top of a clay crust, resting on a substratum of mud or marsh land, for the reason that the constituent materials are incapable of resisting the downward pressure, and the result would be that the building would settle dangerously or perhaps collapse; so in this consideration there is nothing for it but to drive piles to solidify the mud and make the same a coherent mass by using concrete.

Nothing is more deceptive than "filled-in" or "made" ground, for the reason that the fill may sometimes consist of very good material, excavated from another site not far away, and having laid on the filled-in lot for some years, assumed an appearance so natural as to deceive even the most experienced observer; and it may perhaps happen that the intended building is not so heavy as to demand the excavation of the fill down to natural bottom, and that its sustaining power approximating 100 pounds to the square foot will be enough for the purpose; but the load to be supported should be determined by the plans and specifications, as set forth by the architect. A good, hard clay dump which has rested on a rock or natural clay crust may be relied upon, provided it has had a long time to solidify, as the weather serves to force together its particles, but ashes and other incongruous and miscellaneous materials are never trustworthy, even for the smallest class of buildings, not alone for the possibility of their changing their formation, but also on account of their unhealthfulness.

In the Supreme Court of the State of New York, recently, the question was asked a witness as to "what he considered safe ground to build on." The question being hypothetical, it was obviously impossible for the witness to give an exact answer, so he answered that "he didn't know, as it would all depend upon the class of building which was to be erected and the nature of the underlying

ground." The result was that counsel was compelled to state specifically, in detail, the class of building which had been or was to be placed on the site, and then assume a clay bottom as the earth's crust. From this it will be inferred that the greatest judgment is requisite on the part of the builder in setting the foundation footings, and there is not now, and never has been, any golden rule laid down by which any human being could foretell what is beneath the topographical appearance of the earth's surface, and it is only by boring or excavating that its formation can be determined, and even then it may deceive. To illustrate this, a case may be mentioned where, in excavating for a twelve storey building on Broadway, New York, the bottom was found after excavating to a depth below the curb level of twenty feet, the soil was found to be ostensibly good, sharp, compact sand, evidently sufficient, when treated with concrete and grillage, to fully support the superstructure. This work was completed; the steel frame set, and together with the brickwork carried up to the third tier of beams; when the walls commenced to crack the beams and girders settled out of level, and the whole job became unsightly. The architect ordered it down, and it was removed and another excavation of the bottom made. On the level of twenty-five feet below the curb the old brick cesspools built by the English and Dutch settlers were uncovered and removed, proving that the present level of Broadway was much above the original topographical contour of the island at that point, and that the site was being built on the third time. Much difference of opinion prevailed among the experts on this operation, but the result was the same; when the bottom subsided the whole mass of the building followed the footings to their levels.

In consideration of the foregoing it would be well if more attention was paid to this feature of building by those engaged in its practice, not leaving the treatment of the soil or rock to those who do not know, but by practical observation and a study of the geological properties of the crust of the earth to provide that every structure may maintain its equilibrium and statical permanency. — Architects' and Builders' Magazine.