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Form 34, B.

Report on Tests of Earthen-ware Pipe.

DEPARTMENT OF HEALTH,

BROOKLYN, N. Y., NOV. 12th, 1884.

J. H. RAYMOND, M. D.,

Commissioner of Health:

SIR:—In compliance with your instructions, I have been engaged, at various times within the past twelve months, in the examination and testing of earthen-ware sewer-pipes.

You are aware that, as soon as possible after the passage of the Plumbing Law of 1881, this department adopted rules and regulations for the construction of plumbing in new houses; these rules were, to some extent, modeled after the rules adopted by the New York Department of Health. One of these rules required that soil pipes laid within the house-walls should be of iron. This rule was adopted for several reasons: first, because it was held by prominent sanitarians that iron pipe as compared with those of earthen-ware would be less liable to fracture and could be put together with metal joints; second, a more perfect alignment could be obtained with iron pipe, since the earthen variety was decidedly unsymmetrical. The public health demanded that we should use some material which we knew was tight, and we had not the time to institute the necessary tests to determine the relative values of iron and of earthen pipes. No information could be obtained from any available literature, as I was unable to find any reports on comparative tests or statistics showing the average duration of iron pipes used for sewerage. Iron soil pipes are a comparatively modern production, and no necessity had hitherto arisen for an investigation into their merits when laid in the ground; the practical results of such use were only apparent to the men who had been called on to repair them. The only way to obtain this information was by inquiry, personally addressed to the plumbing trade. To meet this end the following circular was prepared and mailed to all the plumbers of New York and Brooklyn:

"DEPARTMENT OF HEALTH.

BROOKLYN, Sept. 18th, 1884.

DEAR SIR:—I am desirous of accumulating facts in regard to the average duration of iron pipe when placed in the ground.

Will you have the kindness to communicate to this Department any experiences you may have had in the removal of iron sewers which have been rusted out, giving, as near as possible, the length of time they have been in use, their size and thickness, and, if possible, a sample of the pipe removed? Please state the character of the soil in which the sewers were laid, and whether they were used for chemical or for stable refuse, with such other facts as may bear upon the cause of the decay.

Respectfully, J. H. RAYMOND, M. D., *Commissioner.*"

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The results of this inquiry go to prove that the average duration of the standard iron pipe, when placed in the ground, is not more than twenty years and that when, from the effects of corrosion, they leak, the area of such leaks is very much greater than any possible leak that could occur in earthen pipes, either from age or use.

Common sense dictates that we now take advantage of the information and experience which has been obtained by our inquiries and experiments.

The tests have been made with gas and water pressure under variable conditions; no efforts being spared to make the tests thoroughly practical.

In the preliminary tests, pipe of ordinary standard manufacture was used, four inches internal diameter, five-eighths of an inch thick, and two feet long; various compounds were employed to make the joints, some being made with sulphur, some with Rosendale cement and sand, and others with Portland cement and sand. In the two last tests, the pipe used was one and a quarter inches thick, two feet long, six inches internal bore, and having an annular socket at the base of the hub to receive the end of the connecting pipe and support it while the joint was setting. It is claimed for this pipe, that the thickness makes it insusceptible to fracture, and less liable to defects in manufacture, and that the additional socket in the hub facilitates perfect laying and jointing.

My experience with joints has shown me that sulphur is useless for this purpose; and Rosendale cement undesirable, unless a long time can elapse before the joints are called on to retain fluids.

While the joints made of Portland cement and sand have, in some cases, given evidence of porosity, at the final test, iron filings and sal ammoniac were added to the cement with the best results, producing a joint which was tight and easily made.

The manufacturers of earthen pipe have shown a desire to improve the quality of their pipes, and they also favor increasing the strength. As to the durability of earthenware pipes, there can be no question; the material will outlast any other at present used for the conduction of sewage. It is the proper use and methods of laying and jointing that we have to consider.

It is an accepted rule in engineering that earthen-ware pipes should not be laid in filled-in ground, except on a previously constructed foundation bed of pile work or cement, as the surroundings may necessitate. In virgin soil, I can see no necessity for the requirement of a foundation other than the proper ramming of the soil, as it is reasonable to infer that all perceptible settlement has ceased.

The principal source of leakage in earthen pipes is from the joints, and there can be no question that a large percentage of these leaks is due to carelessness in the making of the joint, and the miserable quality of the ingredients used to form the cement mixture; but even with great care, both in the selection of the materials and of the workmen who have made the joints, there seems to be a tendency to different results in the same line of pipe at different joints. Whether this is due to a lack of homogenousness in the cement mixture or imperfect packing, I am unable to say.

That a perfectly tight joint can be made on earthen-ware pipe has been demonstrated to my entire satisfaction; but

that this desirable result can in all cases be obtained, I seriously doubt; it can be expected only as the result of competent and rigid inspection. But as inspection is necessary, no matter what the character of the pipe used may be, I cannot see that this is a good argument against the use of earthen pipes.

There is no doubt that a well-made earthen-ware pipe, if placed in the ground and carefully jointed, will outlast the iron pipe now in use for sewerage purposes; and indeed it seems to me, after careful investigation, that iron pipes of the ordinary thickness should not, under any circumstances, be permitted to be laid beneath the ground.

If, however, iron pipes are used, they should be of at least one-half inch in thickness, as the samples sent in response to our inquiries would indicate that we cannot expect tightness nor immunity from sewage vapors when iron pipes of the present standard have been buried beneath our cellars for more than twenty years.

All earthen-ware pipes for the conduction of sewage are alike in the rough or unfinished state; but in the subsequent treatment or glazing, there exists considerable difference.

Pipe clay is a compound of alumina clay, with sand or fire clay added to obtain the necessary self-supporting strength during firing. Made to the requisite size and shape in hand or steam presses, the collars or hubs are in some cases formed in the press at the same time as the body of the pipe. In other cases the hub is separately formed and attached to the body while yet in a plastic state, and some hubs are formed from the material of the body of the pipe by hand, on kick-wheels. The pipes are then allowed to dry until the material is stiff enough to be stacked up in the kiln. It is then taken and dipped into a fluid mixture of clay and water, known in the trade as Albany slip; then transferred to the kiln, and fired until the slip clay fuses, when the vitrifaction is considered complete. This mode of manufacture is known in the trade as "slip-glazed" pipe, and has the merit of being thoroughly covered with the fusible clay, while the parts to which cement is to adhere can be wiped off after being taken from the bath, so that a porous condition can be preserved at the jointing part. This is of great value in the laying of the pipe, as it very much increases the possibilities of obtaining tight joints.

The other process is known as "salt-glazing," and is accomplished as follows: the pipes, when dry enough to support their weight, are placed in the kiln, and fired to the desired temperature; then a large quantity of common salt is thrown into the kiln, where it vaporizes, and the product combines with the clay, forming the pipe body, making a very hard pipe, which, if well burnt, is impervious to moisture. I am unable to find that there exists any reason for preference in the mode of glazing, as both processes produce an article equally adapted to the needs of the public and trade, while the imperfectly burned pipes of either process can be readily recognized by their appearance, viz.: a brownish or red sandy exterior; the well-burnt

pipe being distinguished by the glassy surface, which shows that the heat was great enough to fuse the slip.

It is an accepted fact that earthen-ware pipes are a necessity in sewering buildings, where waste chemicals form a portion of the flow; also in stables, etc., where large quantities of ammoniacal liquid pass into the sewer, for the reason that iron pipes will not last for a reasonable length of time under these conditions; and there are also some buildings which have not these corrosive discharges, but in which it is a necessity to lay the sewer pipes in the ground. Common sense dictates to us in these cases the necessity of providing some material which will last at least twenty-five years and remain tight, because it will be an injustice to the owners of property to compel them to uncover their sewers every few years for inspection, while it would be unjust to the occupants for their health conservators to assume a tightness which practical experience and our own tests have shown to be fallacious. For these reasons I would favor the requirement of a greater strength in sewer pipes.

Another prolific source of injury to house sewers, and consequent danger to health, arises from the plumber's habit of cutting into the sewers to remove stoppages, and then covering the opening so made with cement, putty or metal, insecurely fastened. This could be remedied in a great measure by the requirement of hand-hole openings on the main sewer at the front and rear of cellars, and also on each branch, where lodgment is apt to occur. These openings will suffice for clearing a sewer when stopped, and they can be tightly closed with screw caps.

As the result of my investigation and experiments, I respectfully recommend—

First.—That where sewer pipes are to be placed in the ground, cast-iron pipes one-half inch in thickness, or glazed earthen-ware pipes one and a quarter inches in thickness, and with hubs three inches deep, be required; that joints on earthen pipes be made with Portland cement, sand and iron filings, thoroughly mixed before wetting with a weak sal ammoniac solution; that all pipes laid beneath the ground, whether iron or earthen, be filled with water, and shown so filled to the inspector.

Second.—That hand-hole openings, four inches in diameter, be required on all pipes laid beneath the ground; said openings to be closed with brass ferrule and screw cap, and one such opening be required at each branch, and one at each end of the cellar in the main line—said screw caps to project above the level of the cellar-floor; or, if they do not project above the cellar-floor, man-holes must be provided in order to give access to them.

Third.—That an opening be provided in the cellar walls of all buildings for the entrance of the sewer pipe; said opening to be two inches clear of the pipe on the top and both sides, to avoid injury by settlement.

Respectfully,

JAMES J. POWERS,

Inspector.