TESTS OF EFFECT OF METHOD OF BENDING UPON THE SUPPORTING STRENGTH OF DRAIN TILE AND SEWER PIPE.*

By N. J. Schlick,
Drainage Engineer, Engineering Experiment Station,
Iowa State College.

TESTS were made on 24-in. pipe, with the types of bedding indicated by the accompanying diagram. The general method of procedure was to bed the pipe in the various ways and then to ascertain their actual supporting strength by applying load through standard upper sand bearing. A hydraulic jack suspended from a beam anchored to two large concrete blocks was used for the loading, the amount of the jack load being indicated on a gauge attached to the pump which operated the jack.

The test pipe was laid in a trench dug in made soil. The top soil was a rather close black loam and the subsoil a firm yellow clay. The location chosen for the tests of pipe in earth beddings was such that only the lower portion of each pipe was in clay. In all cases of earth bedding the filling material was loose top soil.

The work was done with labor unskilled in pipe laying. For this reason, and also to insure uniformity in the manner of bedding, the specified dimensions of the trenches and concrete cradles were adhered to somewhat more closely than they probably would be in a drainage practice. Aside from the care taken to insure uniformity the quality of the work was much the same as might reasonably be obtained in any drainage district.

The pipe used were selected at the factory primarily for uniformity. They were evenly burned and were free from structural defects. The concrete used in the concrete beddings was made with gravel from the pit on the campus. This gravel is not an exceptionally high grade and is probably no better than the average which would be used for this purpose over the State. It was screened and then remixed so that 50 per cent. would pass a ¼-in. screen. Two grades of concrete were used, grade A, a 1 : 5, and grade B, a 1 : 8 mixture of Portland cement and the remixed gravel.

The tests were made when the concrete beddings were approximately one month old. Classes 4-A, 4-B and 8 were the last put in, so that, because of a slightly shorter time of setting and considerably cooler weather, the concrete did not obtain as great strength as that in the other types of concrete cradles.

The concrete cradles, except those of class 7, were all constructed with the concrete at the sides carried up to a height equal to one-fourth the inside diameter of the pipe above the mid height. In the earth beddings the side filling was carried up to a little above the mid height of the pipe. In each case this allowed the use of the standard upper sand bearing over 90° of the pipe circumference.

The types of bedding tested might be divided into three general classes, namely, earth beddings, concrete beddings for firm soils and concrete beddings for yielding soils. This division can not be adhered to rigidly as some types of bedding might be used in any soil stable enough to prevent the pipe from settling. This is particularly true of class 7, which was patterned after a concrete bedding tested and by the Philadelphia Board of Public Works.

*Extract from a paper read at the meeting of the Iowa Drainage Association.

The first of the earth beddings, class 1, was made in accordance with the "Ordinary" method described in the "Standard Specifications for Drain Tile" of the American Society for Testing Materials except that the pipe were only bedded to a little above the mid height. The trench was shaped in the bottom to approximately fit the lower 90° of the pipe and the ditch filling shovelled in without tamping. There was quite a wide range in the supporting strength of these pipe, but the average agreed quite closely with the average strength as shown by standard strength tests with sand bearings. Because of this close agreement the average supporting strength of class 1 is taken as a basis for comparing the strengths developed by the other types of bedding.

The second class of bedding was the "First Class" method described in the standard specifications mentioned above. The trench bottom was sloped more accurately and was covered with 1 in. to 2 ins. of loose top soil before the pipe were laid. The filling was carefully tamped in, especially at the lower ⅛ points, up to a little above the mid height. The average strength of this class was 28% greater than that of class 1 and there was considerably less variation in the results from the individual specimens.

In the other type of earth bedding, class 9, the pipe were laid in a flat-bottomed trench and the spaces between

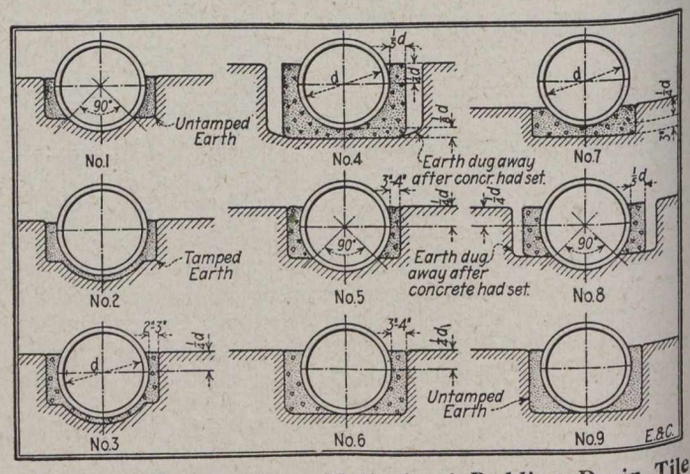

Diagram Showing Nine Methods of Bedding Drain Tile in Testing Supporting Power.

the pipe and the sides of the trench shovelled full of loose earth. No especial care was taken to see that the spaces between the bottom of the trench and the pipe were filled, and examination after the test showed that the filling there was so loose as to give the pipe no support. The average strength of these pipe was 26 per cent. greater than those of class 1. This increase in strength is thought to be due to the frozen condition of the ditch filling material at the sides of the pipe at the time the tests were made. There is reason to believe that this type of bedding will usually give lower strengths than class 1.

The results of these tests of pipe in earth beddings bring out two especially interesting facts. First: The strength of the pipe laid in the "Ordinary" method agreed very closely with that shown by standard strength tests of similar pipe, and second, that an increase in strength of 25 per cent. can be obtained by more careful bedding, as is specified for "First Class" pipe laying. This latter fact is especially noteworthy as in many cases the value of the 25 per cent. increase in supporting strength will be much greater than the extra cost of construction, including the salary of an inspector.

None of the pipe in earth beddings would support a larger load than that at which they cracked. All of the