PROPOSED TENTATIVE RECOMMENDED PRAC= TICE FOR LAYING OF SEWER PIPE.*

From Report of Committee C-4 of the American Society for Testing Materials. Criticism of this recommended practice is solicited and should be directed, preferably, before January 1st, 1917, to Mr. Rudolph Hering, Chairman of Committee C-4, 170 Broadway, New York City.

I. Preparing Trenches and Foundations for Pipe Laying.

THE foundations in the trench should be formed to prevent any subsequent settlement and thereby possibly an excessive pressure and consequent rupture of the pipes. If the natural foundation is rock it is recommended that an equalizing sand bed be placed upon the rock and well compacted by watering or otherwise so as to obviate irregular settlement. If the natural foundation is good firm earth, the earth should be pared or molded to give a full support to the lower third of the pipe. Otherwise the bed should be made firm, either by sand well watered or rammed, or by a layer of cement mortar. The same means of securing a firm foundation should be adopted in case the excavation has been made slightly deeper than necessary.

If there is no good natural foundation, a firm and sufficiently broad bed should be artificially made either with sand, with gravel or broken stone, with concrete, reinforced concrete or other means to secure a solid and firm foundation.

If the soil is porous and ground water rises above the sewer pipe, a plank foundation with or without piles may be advisable.

When the sewer is to be laid in a concrete cradle, the concrete for the full width of the cradle should be continuously deposited to the height of the outside bottom of the pipe. Before the concrete has set the pipe should be evenly bedded therein and the remainder of the concrete immediately placed on each side of the pipe and carefully tamped in such a manner as to avoid disturbing its position. Or, the pipe may be supported and held in position by wedges or templates and the concrete mixed wet, and Poured under and around it in such a manner as to complete the cradle in one operation.

When the sewer is to be laid in a gravel or brokenstone cradle, the material should consist of clean gravel or sound broken stone, all of which should preferably pass through a screen of I-in. mesh and be retained on one of ½-in. mesh. The gravel or broken stone should be deposited and consolidated for the full width of the trench to the height of the outside bottom of the pipe. The pipe should then be bedded therein and the remainder of the gravel or broken stone deposited and carefully consolidated in such a manner as to avoid disturbing the position of the pipe. The cradles should in all cases be so constructed that an excessive proportion of the load shall not be borne by the hubs.

If the trench is situated in ground water, it is recommended to lay the pipe in a concrete cradle up to the ^{springing} line to maintain firm joints.

When a sewer is to be laid without a cradle the earth forming the bed should be carefully freed from stones and organic material. The pipe should then be evenly bedded therein, the joints properly made and the backfilling placed and firmly tamped in such a manner as to avoid disturbing the position of the pipe.

When pipe is laid in soil which is not sufficiently firm to carry it, the earth or soil should be removed, and sufficiently broad foundations and retaining supports substituted.

When pipe is to be laid in new embankment the fill up to a point over the springing line of the pipe should be deposited in layers not exceeding 6 in. and thoroughly consolidated by rolling, ramming, teaming, watering or a combination of these, depending upon the nature of the filling material, whether it is clay, sand, gravel or a mixture of these.

If a pipe line is situated on one side of an embankment where the soil is liable to lateral movements, and is thus subjected to a one-sided load or pressure, care must be taken to secure a stable foundation, so that the pipe line will not be moved on its bed and broken. A retaining support should be placed at the side having the less pressure. It should be made with suitable material of proper height, width and weight, to transfer to the foundation the excessive lateral earth pressure, without danger to the stability of the pipe line.

Trenches should be kept free from water until the material in the pipe joints has hardened sufficiently so that the pipe line will be continuous and strong.

The stresses produced in pipe by the backfilling will differ according to the conditions of the soil. In selfsustaining soil it is possible to lay pipe at a considerable depth without producing excessive stresses. In soil which permits of lateral movement or which is water-carrying, special precautions are necessary to prevent undue pressure upon the pipes.

To protect pipe lines from unusual stresses all work should be done in open trenches. Tunnelling should be prohibited except with the special consent of the engineer.

Pipe lines should be placed at such a depth below the surface of the street that dangerous pressure or impact cannot occur. If it is not possible to do this, special reinforcement is required.

Rock excavation should be made to a depth of at least 4 in. below the outside bottom of the pipe, or as shown on the plan.

Width of trenches in earth should be sufficient to provide a free working space of from 6 to 12 in., exclusive of spurs and hubs, according to the size of the pipe and the character of the ground.

The width of trenches in rock should be sufficient to provide a free working space of 12 in. on each side of the pipe, exclusive of spurs and hubs.

In every case there should be sufficient space between the pipe and the sides of the trench to make it possible to thoroughly ram the backfilling around the pipe and to secure tight joints.

If soil conditions and ground water require the use of sheeting, sheet piling and bracing, the trenches should be made correspondingly wider. The sheeting should be closely driven and to such depths as the soil conditions may indicate to be necessary for the stability of the pipes.

Steel sheeting may be used with advantage where the flow of ground water into the trenches is excessive and the stability of the foundation soil and of the sewer is affected thereby.

Where a trench for a proposed sewer or extension of a sewer terminates in rock, it should be excavated for a distance of not less than 5 ft. beyond the end of the sewer and in the direction of the proposed extension. The pipes

^{*}These recommendations are limited to conditions which will affect the strength of pipes in their resistance to the external stresses, and are not intended to cover the art or practice in other respects. It is the intention of the committee that the acceptance of sewer pipes, to be furnished in compliance with the specifications for sewer pipes as finally presented to and adopted by the Society, shall be generally conditioned upon the substantial observance of the precautions formulated in the Recommended Practice for Laying of Sewer Pipe, as finally adopted by the Society.