large air chamber for each plunger. Moreover, the check-valve is placed between the air chamber and the water main. It was therefore concluded that the greater part of the joint leaks were caused by some derangement of the action of this pump, which transmitted pulsations to the mains, possibly assisted by temperature changes and soil movements.

PROPOSED STANDARD SPECIFICATIONS FOR ONE-COURSE CONCRETE HIGHWAY.

THE following specifications have been submitted to the members of the American Concrete Institute to be given their consideration prior to the coming Convention of the Institute to be held in Chicago in February. Many interesting and useful points are contained therein, as indicated below:

Materials.—1. The cement shall meet the requirements of the Standard Specifications for Portland Cement, adopted by the American Society for Testing Materials, August 16, 1909, with all subsequent amendments and additions thereto adopted by said Society, and adopted by this Institute (Standard No. 1).

When the cement is not inspected at the place of manufacture it shall be stored a sufficient length of time to permit of inspecting and testing. The engineer shall be notified of the receipt of each shipment of cement.

2. Fine aggregate shall consist of sand or screenings from clean, hard, durable, crushed rock or gravel consisting of quartzite grains or other equally hard material graded from fine to coarse, with the coarse particles predominating and passing, when dry, a screen having ¼-inch openings. It shall be clean, hard, free from dust, loam, vegetable, or other deleterious matter. Not more than twenty (20) per cent. shall pass a sieve having fifty (50) meshes per linear inch, and not more than five (5) per cent. shall pass a sieve having one hundred (100) meshes per linear inch.

Fine aggregate containing more than three (3) per cent. of clay or loam shall be washed before using.

Fine aggregate shall be of such quality that the mortar composed of one (1) part Portland cement and three (3) parts fine aggregate by weight, when made into briquettes, shall show a tensile strength at least equal to the strength of 1 to 3 mortar of the same consistency made with the same cement and Standard Ottawa sand.

In no case shall fine aggregate containing frost or lumps of frozen material be used.

3. Coarse aggregate shall consist of clean, hard, durable, crushed rock or gravel, graded in size, free from dust, loam, vegetable, or other deleterious matter, and shall contain no soft, flat or elongated particles. The size of the coarse aggregate shall be such as to pass a one and one-half (1½- inch round opening and be retained on a screen having one-quarter (¼) inch openings. In no case shall coarse aggregate containing frost or lumps of frozen material be used.

4. Natural mixed aggregate shall not be used as it comes from deposits, but shall be screened and used as specified.

5. Water shall be clean, free from oil, acid, alkali, or vegetable matter.

6. Reinforcement.—Concrete pavements twenty (20) feet or more in width shall be reinforced with metal fabric. All reinforcement shall be free from excessive rust, scale, paint, or coatings of any character which will tend to destroy the bond. All reinforcement shall develop an ultimate tensile strength of not less than 70,000 pounds per square inch and bend 180 deg. around one diameter and straighten without fracture.

7. Joint filler shall consist of prepared felt or similar material of approved quality having a thickness of not less than ⅛ nor more than ¼ in.

8. Joint Protection Plates.—Soft steel plates for the protection of the edges of the concrete at transverse joints shall be not less than 2½ in. in depth and not less than ⅛ in. at any point nor more than ¼ in. in average thickness. The plates shall be of such form as to provide for rigid anchorage to the concrete. The type and method of installation of joint protection plates shall be approved by the engineer.

9. Shoulders.—Materials for the construction of shoulders shall be approved by the engineer.

Grading.—10. The term "grading" shall include all cuts, fills, ditches, borrow pits, approaches and all earth moving for whatever purpose, where such work is an essential part of or necessary to the prosecution of the contract. When to bring the surface to grade, a fill of one (1) foot or less is required, the area shall be thoroughly grubbed. All soft, spongy or yielding spots and

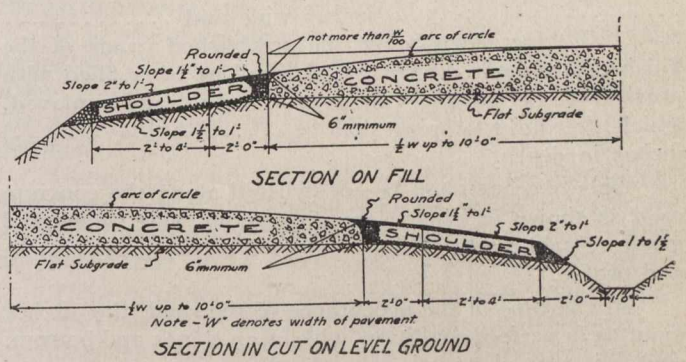

Fig. 1.—One-course Concrete Highway—Sections on Fill and in Cut.

all vegetable or other objectionable matter shall be removed and the space refilled with suitable material.

11. Stakes will be set by the engineer for centre line, side of slopes, finished grade and other necessary points properly marked for the cut or fill.

12. Excess material shall be disposed of as directed by the engineer, the free haul not to exceed.....feet.

13. Over-haul.—Materials hauled a greater distance than the free haul from the place of excavation shall be paid for at the rate of.....cents per cubic yard for each additional.....feet.

14. Fills.—Embankments shall be formed of earth or other approved materials and shall be constructed in successive layers, the first of which shall extend entirely across from the toe of the slope on one side to the toe of the slope on the other side, and successive layers shall extend entirely across the embankments from slope to slope. Each layer, which shall not exceed one (1) foot in depth, shall be thoroughly rolled with a roller weighing not less than five (5) tons nor more than ten (10) tons before the succeeding layer is placed. The roller shall pass over the entire area of the fill at least twice.

The sides of the embankment shall be kept lower than the centre during all stages of the work, and the surface maintained in condition for adequate drainage. The use of muck, quicksand, soft clay or spongy material which will not consolidate under the roller, is prohibited.

When the material excavated from cuts is not sufficient to make the fills shown on the plans, the con-