

Definition of Waterproofing.—The term "water-proof" is used here in the broad sense, meaning both the protection of the road from water, and the rendering of the road itself impervious to water.

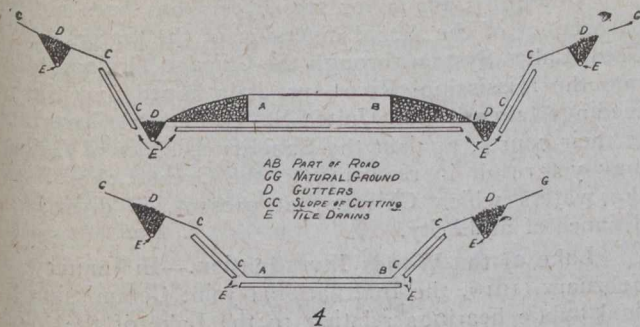


Fig. 4.—Construction in Cut.

Neglect of Waterproofing.—Roads must be waterproofed so as to prevent damage from abrasion, from undermining, from foreign substances being washed onto them, and from water penetrating the mass of the road. Although water is one of the worst enemies of the roads, the fact seems to have been given little attention and as a result, the cost of maintenance has increased enormously. Possibly the condition is due chiefly to the deplorable fact that road building has been largely in the hands of politicians and contractors instead of engineers.

Last winter hundreds of miles of roads were ruined because they were not waterproof. Water penetrated the body of the roads and froze. The result was upheavals and disintegration. Even the most elementary principles of waterproofing have been neglected, as will be illustrated later by photographs of various points on recently constructed highways.

Conditions Met in Construction.—As the elementary principles of waterproofing have been so completely neglected, it may not be amiss to describe them. Roads

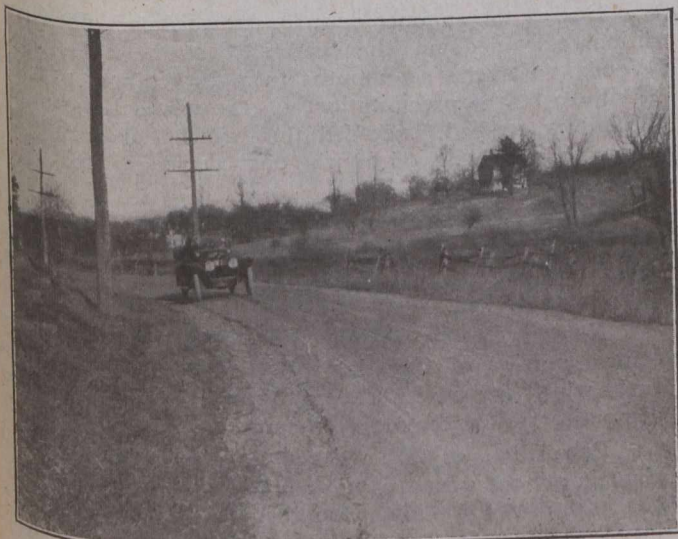


Fig. 5.—Road in Cut Near Englewood, N.J.

are built under five general conditions and combinations of these conditions. The general conditions are: (1) On level ground; (2) on inclined ground; (3) in cuts; (4) on embankments; (5) on the side of slopes.

Roads on Level Ground.—A road built on level ground can be very easily waterproofed by building it slightly above the general elevation, by giving it a crown sufficient to cause any water to flow, by providing ample

gutters on each side, by laying sufficient underdrains, and by applying a surface which is impervious to water. This method of construction is shown in Fig. 1. At frequent intervals, trenches or drains should be provided to carry off the water from the gutters.

Although it is so simple and inexpensive to properly waterproof a road built on level ground, the precaution is often neglected.

Sections of a new concrete road near Plainfield, N.J., are shown in Figs. 2 and 3. The body of this road is concrete and the surface is a soft asphalt. A far better road would have been secured by using a topping of integral waterproofed concrete instead of the asphalt. Although there has been no hot weather since this road was opened, the surface is already badly marked by horse-shoes and wheels. These indentations will eventually go through to the concrete, water will collect in the depressions and percolate through the non-waterproofed concrete. Moreover, the road is neither properly protected from flowing water, nor adequately drained. We predict that it will not survive the second winter.

The shoulders on the sides of the road are a soft clay and the edges of the concrete have no protection. Already sections are being broken off, as can readily be seen in Fig. 6.

Roads in Cuts.—Roads built in cuts are probably the hardest to protect from flowing water, and there is therefore all the more necessity for a hard surface and integral waterproofing. Fig. 4 shows the general method of protecting a road in a cut and is so elementary that no comment seems necessary. Although so elementary, the

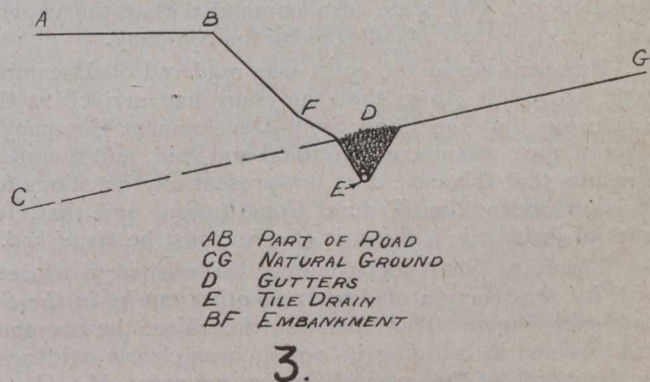


Fig. 6.—Construction on Embankment.

methods are quite generally neglected. A road in a cut at Great Notch, N.J., may be taken as an example. There is no waterproofing whatever and the net result is that the road has been rebuilt three times in three years. It will probably be rebuilt again next spring.

Fig. 5 shows a road in a slight cut near Englewood, N.J. Practically the same conditions prevail as at Great Notch. The picture shows ridges due to upheavals last February which had not yet been repaired on December 7th, when the photograph was taken. The present winter will probably about finish this road.

Roads on Embankments.—Roads on embankments seldom cause trouble if the most elementary principles are observed. These principles are shown in Fig. 6. The two salient features are to build the road so that it is integrally waterproof and so that the embankment is protected from flowing water.

Roads on Sides of Slopes.—Roads on the sides of slopes should be waterproofed in the same manner as roads in cuts with the exception that protection from flowing water is necessary only on one side.