

## THE NECESSITY FOR ADEQUATE METHODS OF WATERPROOFING IN ROAD CONSTRUCTION.\*

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**A** WHEEL and a road may be considered as two elements of a machine and the ideal requisites for each determined to be: (1) Perfectly hard and perfectly round wheel; (2) perfectly hard and level road.

The ideal road cannot be maintained but can be approached by constructing a moderately hard road which resists wear and disintegration.

In order to fulfil their requirements, roads must be waterproof, so as to protect them from the flowing, undermining, and penetration of water. Principles of waterproofing are simple, but are neglected.

Roads are constructed under five general conditions: (1) On level ground; (2) on inclined ground; (3) in cuts; (4) on embankments; (5) on side of slopes.

Each condition requires a different method of waterproofing and waterproofing is dependent upon: (1) Location of drains; (2) construction of road; (3) treatment of surface.

Comparative costs of construction and maintenance show that at the end of five years the total cost of a non-waterproof road and a semi-waterproof road are about

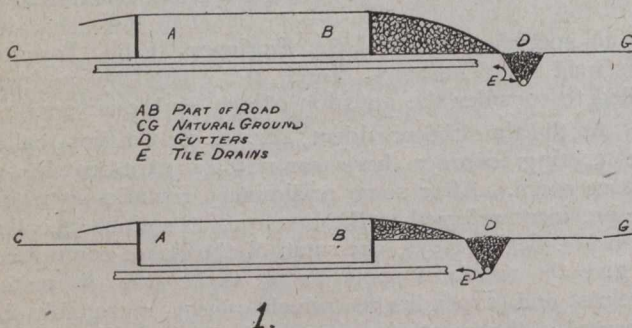


Fig. 1.—Construction on Level Ground.

equal, but that the former is practically useless while the latter shows little deterioration. Similar comparisons for waterproof roads are not yet available.

The ideal condition of things is obviously that in which a perfectly hard and perfectly circular wheel runs on a perfectly hard and level road. It might be said, therefore, that a steel wheel and a steel road would be suitable as in the case of railway practice. As a matter of fact, quite apart from the practical question of the cost of such a road, there are questions of adhesion, in the matter of gradients as well as storing, that a really hard road cannot be obtained. It may be at once said that if a moderately hard road could be kept level and entirely free from all unevenness of surface there could be nothing better than a truly circular metal wheel, and such a wheel being cheap and durable would doubtless be universally employed.

**Ideal Road Impossible.**—However, a thing so desirable as a truly level surface is exactly what it is impossible to maintain, and it is in order to mitigate the shocks caused by the tendency to deflect a vehicle from its movement in a straight course that yielding material such as solid rubber or pneumatic tires are employed on the periphery of a wheel. This soft material cannot be used without paying the penalty, not merely of wearing the wheel, but of wearing the road itself, and as a matter of

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fact, inasmuch as the contact between the wheel and the road departs from a point in the side elevation, or a line looked at in plan, by so much is wear between the surfaces in contact introduced.



Fig. 2.—Plainfield Road.

**Conditions Beneath Surface.**—In the next place, consider what goes on beneath the surface. If the road is not hard, then a certain amount of deformation must take place.

The injury done by this deformation will depend on two things: (1) The depth to which it extends; (2) the extent of permanent disintegration of the internal substance of the road.

**Practical Requirements.**—It is therefore obvious that, both as far as the surface is concerned and also the body of the road, what is required is a hard, strong substance which presents great resistance to wear, deformation and disintegration. If it is impossible, on account of expense, to make the whole of a road of such material, then the surface of the road should be of such material, and the



Fig. 3.—Break in Plainfield Road.

body of the road should be bound or cemented together with such material.

**Necessity for Waterproofing.**—In any case, as the road is exposed to the action of the weather, one of the very first conditions of its efficiency is that it must be waterproof, and that the surface must be sufficiently hard to prevent the formation of mud in wet weather and dust in dry weather.