

Repairs of Roads.

Roads should be repaired, not once a year, not twice, but as soon as signs of wear appear. Ruts should not be allowed to form in a gravel or stone road when once properly constructed, but material should be kept in place by a constant use of the rake. This is especially necessary if gravel or stone is placed loosely on the road and left for traffic to consolidate. Settlements and hollows should not be allowed to hold water and to create pitchholes for want of a load of metal. Drains should not be allowed to become obstructed, thereby saturating and softening the whole road-bed. Culverts should not stand full of water to be burst by the expanding ice because of a neglected outlet. An almost inexhaustible list of these everyday occurrences could be mentioned which, in themselves apparently trifling, become in the aggregate of very great importance. Road-making is made up of details none of which can be overlooked, except at a loss.

The overseer should give immediate attention to all emergency work rendered necessary by washouts, etc., either by personal or hired labor. He should be able to send a man over the roads as often as necessary to repair the effect of ordinary wear. Better still, a man should be employed to devote his whole time to a certain mileage of roads, to make repairs as they become necessary. Every farmer, too, should appreciate the value of good roads sufficiently to voluntarily devote time to the roads passing his property, rather than permit them to become bad or impassable because of neglect.

It is one of the great advantages of the new systems of road management being adopted by townships and counties, that men can be employed to work on the roads whenever and wherever needed. Neglect to keep the surface of a road smooth and in repair permits it to break up badly in spring and fall, and the gravel or stone is largely wasted, being mixed with the mud from beneath. When this occurs a comparatively great expenditure is needed to make the road as good as before.

Foundation for Brick Pavements.

The best foundation for a brick pavement is always the concrete foundation, with as thin a "sand pad," as possible, not more than one inch, if the upper surface of the concrete is as smooth as it should be. The best foundation may sometimes be a waste of money, however, for the lightness of traffic, the excellence of the soil, the completeness of drainage and the perfection of the construction may be such that the brick surface will practically retain its uniformity upon a much less expensive foundation. Just what this foundation should be will depend upon the quality of the construction and materials in the items just mentioned.

There are excellent streets on rolled gravel foundations, and there are poor streets laid with foundations of broken stone or bricks laid flat, the difference being mainly in the quality of the sub-grade and the perfection of the drainage. It would not be safe to choose between the two methods of construction without intimate knowledge of the materials and power to fix the method of drainage. The principles on which the choice should be made, may, however, be stated.

The loads which may be concentrated upon wheels rolling over the pavement are a prominent factor. On a busy city street they demand a concrete foundation. On a residence street in a village, heavy loads are so infrequent that they need not be considered, and the choice of foundation may be made on other grounds. On streets intermediate in this respect the question must be considered and a broken stone foundation may be required for the loads on a business street in one town, while another would require concrete and another would be well served by a gravel foundation.

A common cause of the failure of brick streets on other than concrete foundations is the lack of effective drainage. If water can collect in the foundation or in the soil beneath in sufficient quantity, it will expand in freezing sufficiently to heave the pavement, or it will, at least temporarily, make the soil unequal in compactness, and thus permit uneven settlement, and finally cause the destruction of the smoothness of the pavement if not of the pavement itself. It is not necessary for this effect that the foundation be full of water. If it is retentive enough so that the particles of water in freezing will expand more than enough to fill the voids adjacent to them, the same effect, possibly in less degree, will be produced. The broken stone or gravel foundation gives the necessary size of voids to prevent this heaving effect. If the water fills the voids in any portion of the foundation these materials will be heaved by the frost in the same manner as less porous materials, or those with smaller voids, but it is seldom that the drainage of a brick pavement is so greatly neglected as this occurrence would indicate. And, in fact, the porosity of the gravel and broken stone foundations is such as to lead the water to the outer limits of the pavement and thus under most of its area there is none to freeze and heave. Even with a sand filler the amount of water getting through the joints to the foundation is very slight, except that defects in surface or in drainage cause the water to stand, in which case small amounts may find their way to the soil beneath. This will happen even with asphalt or tar filler, because this filler will soften and run out of the joints in hot weather, and thus escape its duty, except fortunately in the gutters, where an impervious filler is most to be desired.

If these principles are applied to the packed sand and gravel foundation their

effect can be estimated. If the foundation is rolled in place it is very difficult to pick out all the soft spots and to get the foundation uniformly compact, so that a heavy concentrated load could easily make injurious depressed spots in passing over the pavement. The smaller size of voids might give opportunity for the freezing of water and heaving of pavement as described, and then for the depressions from concentrated loads on account of unequal solidity. Perfect drainage would remove this danger. Water tight joints would add to the security, if they can be obtained.

If the sub-soil is excavated and thoroughly rolled, and the sand and gravel are filled in and compacted as they are put in place, greater uniformity in solidity can be secured. If the proportion of fine gravel and sand is not too great, the retention of water with slightly imperfect sub-soil drainage will be less, and the durability of the pavement will probably be greater. As stated in the beginning, the probabilities of success in the cases under consideration can be judged only with intimate knowledge of the materials and conditions.

With either gravel or broken stone foundation the voids must be filled to such an extent that the sand cushion will keep its place on top. Otherwise its leakage into the voids below it, will cause inequalities in the brick surface. The surface of the stone or gravel should be rolled until it is smooth, so that the sand cushion can be made as thin as possible. This is especially so if any of it is likely to leak into the foundation, for the less thickness of cushion the less unevenness in brick surface from its disappearance.—

Municipal Engineering.

Dirt Roads.

For six months of the year a dirt road is often as good a driveway as could be desired for light travel. In order to extend its usefulness the greatest care must be taken to see that drains and culverts are placed wherever needed, and that they are always in good working order. It should be well-crowned, or rounded up, so as to shed the water freely to the side ditches; but in making this crown, sod and vegetable mold should be carefully excluded. A great deal of injury is done to this kind of road by running a grading machine along the edges, bringing loose sod and stones to the centre. This material should be thrown outwards and across the open drain. Under-drains should be used judiciously; while a complete system may not be used, tile drains should at least be placed where the water does not leave the side of the road early in the spring, or wherever the ground appears to be continually damp. If open drains are kept in good working order, and if the road is kept properly crowned, its condition in fall and spring will indicate the points at which tile drainage is most needed.