

The best season for repairing broken stone roads is in the spring or early summer, when the weather is neither very wet or dry, for either of these extremes prevents the material from consolidating and therefore produces either a heavy or dusty road. If made at this season the roads are left in a good state for the summer and become consolidated and hard so as to be in a condition to resist the work of the ensuing winter.

If several depressions are found very near each other, cover the worst and attend to the next after the first has become solid. The ruts which are formed should not be filled with loose stones for this would make longitudinal ridges of harder material, but the laborer should work the rake backward and forward on each side of the rut and across it; and if he does it with his eyes shut he will do more good than by taking pains to gather all the stones he can find to place in it.

The number of men required by this system of constant watchfulness may at first seem an objection, but the expenses will be amply repaid by the advantages obtained. Each laborer should have a certain length of road assigned to his special care and the most intelligent and trustworthy among them should be made inspectors over the others for a certain distance. At times unfavorable for on the road they should be employed in breaking stone.

With a reversible road machine, properly managed, five miles of well graded and well drained earth road can be repaired. This operation should be repeated once a month for eight months in the year, and in the case of a properly made and properly drained gravel road ten miles can be repaired in one day. With a stone road, however, the repairs should be made by manual labor, one man being able to rake, and keep in proper repair twenty miles of road by working six months in the year. The cost of repairs for the different kinds of roads would then be fairly estimated as follows:

Earth Roads (five-mile sections.)

Two teams on machine at \$3 per day for eight days	\$48 00
One man to operate at \$1.50 per day	12 00
One man cleaning drains, etc., for sixteen days at \$1.25	20 00
	\$80 00

or \$16.00 per mile.

Gravel Roads (ten mile sections.)

Two teams on Machine for eight days at \$3.00	\$48 00
One man to operate at \$1.50 per day	12 00
One man cleaning drains, etc., for thirty-two days at \$1.25	40 00
New material for repairs	200 00
	\$300 00

or \$30.00 per mile.

Stone Roads (twenty mile sections.)

Service of one man for 8 months at \$25.00	\$200 00
Material for repairs	100 00
One man cleaning drains, etc., for	80 00
	\$380 00

or \$19.00 per mile.

Broad Tires.

It will be some years before all or even a majority of our country roads will be improved by gravelling or macadamizing, but in the meantime it is necessary to urge the adoption of some means to keep the ordinary earth roads from becoming impassable for a few months during the wet season of the year. One important move in this direction would be the use of broad tires on all vehicles used for hauling heavy loads. The only difficulty in the way of this is to get farmers and teamsters to make the change. Michigan law-makers realized this and have made a law which provides, that a man using on his wagon, tires of a certain width shall have a rebate of one-half of his road tax. In buying a new wagon the difference in cost is slight as the wider tires may be thinner and the added strength in the wider rim makes a stronger wheel. To take from a wagon already in use, the narrow rims and tires and replace them with wider ones only costs about \$15. Farmers who have had experience in broad tires assert that in a corn field where thirty bushels was considered a good load on narrow tires, they can haul fifty bushels with greater ease on broad tires. When hauling stuff to market, the load with wide tires can be increased from twenty-five to fifty per cent. In localities where a considerable portion of the inhabitants use broad tires, the road is kept in better condition than when narrow tires prevail. The advice of men who are in a position to know is that when broad tires are universally used on highways of all kind, from city pavement to the poorest earth roads, they may be kept in better repair than at present at one-fourth the cost. The greatest improvement for the least outlay is what the present generation is most likely to consider.

Legislation looking forward to the general adoption of wheel tires proportioned in width to the maximum load to be carried is something that should be taken hold of at once. Such a law made universal would greatly improve our roads, and as fast as they are made better, would tend to keep them so. The great objection to the adoption of broad tires, by degrees and the use of them as at present, is that wagons fitted with them run hard over a road where the narrow tires are mostly used, but when all wheels are what they should be, ruts will not be found cut deep in our roads as with a sharp instrument. Team-

sters say that they would be glad to use broad tires and would willingly go to the expense of making the change if every one was compelled to do so. Make wrong doing in this direction illegal and at the same time show to the wagon owner, who is not already convinced in this matter, that it is directly profitable to him to comply with the law. A man willingly becomes a law abiding citizen when he can make money out of it. The money now expended for roads would be twice as effectual if it were not for the constant abuse inflicted by narrow tires, and this will continue until the question is settled by the legislature. Upon a hard and well-made road, such as broken stone, there is not so much difference in the effect of broad and narrow tires, but on a common road, narrow wheels supporting heavy weights exercise a very destructive cutting and plowing action. This diminishes as the width of the felloe increases which in many cases is done to such an extent that the wheels act as a roller in improving instead of injuring the surface. For this reason the New York turnpike laws enact that carriages having wheels of which the tire or track is six inches wide will pay only half the usual tolls; those with wheels nine inches wide only one-quarter; and those with wheels twelve inches wide shall pay none at all.

The imperfect surface of an earth road makes it doubly important to take every precaution to lessen the friction of vehicles upon it. The resistance decreases as the breadth of the tire increases on compressible roads as earth, sand, gravel, etc., while on paved and broken stone roads the resistance is nearly independent of the breadth of the tire. Cylindrical wheels also cause less friction than conical ones. The larger the wheel the less friction they have, and the greater loss of leverage in overcoming obstacles. The fore wheels should be as large as the hind ones, were it not for the inconvenience of turning. The axles should be straight and not bent downward at the end which increases the friction though it has the advantage of throwing the mud away from the carriage. The load should be placed on the hind wheels rather than the fore ones.

The felloe should have a flat bearing surface and not a rounded one. The benefits of broad wheels are sometimes destroyed by overloading them. Narrow wheels are particularly injurious when in rapid motion for having less resistance and greater velocity than others. They revolve less perfectly and drag more, thus producing the worst effect. Conical wheels of which the inner is greater than the outer in circumference tend to move in a curve and being forced to proceed in a right line exert a peculiarly destructive grinding action on the roads. If a law of this kind were adopted to take effect, say two years after its passage, the people would at once agreeable commence to make the change and by that time no hardship would be felt.