

unless extraordinary pains are taken to ensure the earth settling. But as part of the filling on clays exposed to water and frost let it be repeated that coarse pit sand or fine loose dry gravel are better than broken stone to lay the best stone road upon, because they pack easier and hold as well. Herein so many mistakes have been made that we need line upon line, and precept upon precept.

Let us beware, however, of trusting to gravel that is part clay, or that will grind the clay inside of a road. Clay mingled with water is a very insidious and slippery thing. Chemists have difficulty in separating some forms of clay from water. We want no manner of it mingled with the bottom or top stone of a road, that we design to be frost proof, because of its great water holding capacity, and because it acts as a lubricant in preventing the fractured surfaces of broken stone from clinging together. The relay acute road maker will be as shy of having clay in the interstices of his stone work as the vigilant mason of having clay in a brick or stone wall. Wherever unburnt clay goes, there water will stay if it gathers, and then frost may expand it with irresistible power.

* * *

If we bed large stones on clay alone, without the utmost faithfulness of fine grit packing (for which sharp sand may be cheaper and better than crushed rock) up will come the dilute clay whenever the road is used in a rainy, freezing and thawing winter. Even with the ideal vigilance on the part of authority, there will be the insidious clay unless every man engaged upon the work knows wherein the danger consists.

Cover that clay with a thick blanket of course sand or fine gravel, free from earth and clay mixtures—though in some places fine crushed rock may be cheaper; and the best road making may go on above in perfect security.

Earth roads go to ruin everywhere for lack of surface drainage, and ready appliances for securing that are not at all commensurate with the need, or the ingenuity and mechanical contrivances fitted to a hundred concerns of far less importance.

Another great feature in a properly constructed road is its elasticity. Uniform traffic upon the surface tends to distribute the wear and tear of its component parts so that they offer equal resistance, and enable the road to keep its solidity, cohesiveness and elasticity. Roads retaining these properties cause less friction and shaking to both vehicles and pedestrians. Such qualities are only to be obtained by exercising proper precaution in construction, compactness and cohesiveness being thus assured. This may be illustrated by noting the different effects in driving or walking upon an asphalt road compared with those constructed of hard stone and like material.

Economy is as applicable to highways as to public or private expenditure, and the golden rule of "The maximum of benefit at the minimum of cost" should be the leading idea in road construction. The progressiveness of the age demands the better education of the people to the necessity of a high standard of roads and the immense advantages of good over imperfectly constructed ones. The economic benefit of a good road can be readily seen by its cheaper maintenance, greater and easier facilities for travelling, less cost for repairs to vehicles, corresponding relaxation of strain upon animals drawing same, and consequent saving of time, ease and comfort to those driving over them. It is well known that a horse will draw a much heavier burden over a good road than over an indifferent one. From the experience gained in recent years, the advantages just stated are so apparent that it would excite no misapprehension of the fact that the time has arrived when the people are inclined to appreciate them, and are determined to have them, on the ground of economy. The most important factor of maintenance is the question of cost. The charges are reduced by the fact that a properly constructed road requires less maintenance. The charges for material are also lessened, and when from any cause reconstruction is necessary, the economy is demonstrated by the reduced expenditure required.

Increase in the value of property adjoining first-class roads follows their construction as is proved by the rise in price of land having the advantage of proximity to macadamized or turnpike roads. The necessity of presenting a tabular statement of the cost of county roads may be saved by quoting an adage well known to those versed in highway principles viz: "It is cheaper and easier to maintain a good road than an indifferently constructed one". The economy of maintenance depends entirely upon the system employed. The present system under which the greater number of townships roads are maintained is not of an economical nature and it is absolutely necessary for the sake of greater economy to place their control under more skillful and liberal management.

The measures necessary to be taken for affording the means of travelling from place to place, easily and rapidly, and for transporting farm product and other merchandise in quantities at an economical rate at all seasons of the year, form an essential part of the domestic economy of every people, and as the making of roads is fundamentally essential in bringing about the first change, that every county must undergo in its development, it becomes one of the important duties of every government to enact the necessary laws, required for such purpose to the end that a well-constructed highway be made the means for intercommunication between all populated places.

Road Making.

With all the new inventions and appliances for excavating and handling material for road construction, which we believe has reduced the cost of road-making at least fifty per cent within the last ten years, we are satisfied that the next ten years will see a revolution in the system of making and maintaining a wonderful change in the condition of our country roads. The earnest determination of the people to no longer endure the inconveniences and enormous costs which have arisen from the impassible condition of our roads, and the necessity for better ones throughout the country has never before been more intelligently placed before the public than at the present time. The paramount importance of the subject is manifested by the wide-spread interest taken in it by municipal councils, governments, and technical schools and by private energy and enterprise, in all parts of the country. The measures necessary to be taken for affording the means of travelling from place to place easily and rapidly, and for transporting farm product and other merchandise in quantities at an economical rate at all seasons of the year, form an essential part of the domestic economy of every people, and as the making of roads is fundamentally essential in bringing about the first change that every country must undergo in its development, it becomes one of the important duties of every government to enact the necessary laws required for such purpose to the end, that well constructed highways be made the means of intercommunication between all populated places.

Earth roads should be kept smooth, hard, up to grade and cross-sections by the addition of suitable materials at frequent intervals and in small quantities at a time, on all places out of grade, securing a surface such as shall quickly convey the water to side ditches. The latter should be kept open, of uniform and sufficient slope, free from rocks, ridges, depressions, and continuous to some natural or artificial outlet. Sprinkling and rolling are valuable adjuncts of repair especially in dry weather, and a thorough rolling in spring after ground has settled, is a market benefit.

Sarnia township council have decided to favor a scheme for deepening the Perche drain at a cost of \$17,800. Mr. Pike, of Chatham has the contract for dredging.

Guelph, Ont. council has given the contract for laying 155,000 square yards of composite stone sidewalk to the Ingersoll Silica, Barytic Company. The price is 15 cents per square yard for sidewalk and 18½ cents for crossings.

The township of Gray has awarded the contract for improving government drain No. 2 for \$14,000, under plans prepared by Jas. A. Bell, Engineer.