

# MUNICIPAL DEPARTMENT

## CRUSHED STONE FOR ROADWAYS.

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It is impossible to discuss the wearing qualities of different kinds of stone for macadam roads from the standpoint of names. Granite, limestone, sandstone, are names of different rocks common in this province, but to say that granite is better than limestone, or that limestone is better than sandstone, while true perhaps of the best qualities of each, may be totally incorrect; since a sandstone may be infinitely preferable to a poor limestone or granite. The best stone for macadam is hard and tough, not easily affected by the atmosphere, moisture, and the varying conditions of climate. The choice will generally lie between a cheaper and less durable stone near at hand, and a more costly but better stone from a distance. The city of Cleveland, Ohio, is for example importing trap rock from Poole Island near Bruce Mines on the north shore of Lake Superior. This rock is very hard, tough, and for qualities of endurance can scarcely be surpassed on the continent.

By far the greater portion of macadam roads in Ontario, however, will be constructed of limestone, since this rock is the most common, quarries being within easy access of almost any part of the province. In quality it ranges from that which is useless to that which is almost equal to trap. Limestone which is tough and close grained is excellent material for roads on which the weight of traffic is not excessive. Some dolomitic limestones, while hard, appear to lack in toughness. Other limestones of a slaty texture have few wearing qualities, are rapidly disintegrated on exposure to the atmosphere, and should be avoided. Some limestones of open, porous nature yield readily in this climate to the effects of moisture and frost. But the excellent binding qualities of limestone make up largely for a lack of hardness, a sort of cement being formed by the dust, which adds very much to its solidity.

Some qualities of granite rank high, but much of it will crumble readily, and wear into sand. It is to be had in many parts of Northern Ontario, and is easily reached by boat or rail. Except when the traffic is unusually heavy on the road to be paved, and the best granite is obtained, the cost of transportation will debar it from use in the greater portion of Ontario.

Sandstone is seldom of service except when used for very light traffic on country roads, since it also readily crumbles and wears to sand. It is quarried chiefly at the Forks of the Credit.

Limestone is quarried very largely at Queenston, along the Grand River, at Kingston, and in the counties east; granite

is obtainable in the more northern part of the province. Trap rock occurs in dikes and is quarried in considerable quantities near Kingston and Gananoque. While elaborate trials may be made, a practical man can judge of the qualities of a stone by applying some simple tests; by breaking the stone with a hammer; wearing it on a grindstone; crushing it in a blacksmith's vice; scratching with an iron nail; breaking small pieces with the fingers. By such simple means a general idea of the stone can readily be formed, but no test is conclusive except actual wear, climates and other conditions lead to varying results.

There is considerable objection to the use of boulder as road metal. Exposure to the weather softens many varieties of stone, while their rounded sides do not consolidate readily. In many parts of the country, however, they are by all means to be recommended, care being taken to discard soft and disintegrated sandstone, limestone, gneiss and granite.

The town of Ingersoll has recently contracted for a crusher with screen attachment, and, their beds of gravel containing much cobble stone, it is intended to put all material through the crushing and screening process. This should make an excellent metal for residential streets on which the traffic is light, and is a method which will probably commend itself to other localities in the province.

## STREET CONSTRUCTION FOR MEDIUM TRAFFIC.\*

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In the great majority of provincial towns the provision of such high-class and of necessity expensive pavements as those required and constructed in Liverpool, parts of London, and other large towns, would cause unnecessary and extravagant expenditure; on the other hand, gravel, flint, or macadam are not found to be adapted to the requirements of many streets in such provincial towns, and the engineer has to adopt methods of construction which, whilst not so expensive in first cost as the high-class pavements, shall have most of their advantages and shall avoid the mud, dust, and heavy charges for cleaning, watering and maintenance always accompanying the use of gravel, flints, or ordinary macadam in the streets of towns.

The three intermediate classes of carriageway paving of which the author has had more or less experience are the following: (1) sett paving, with and without concrete foundation; (2) wood paving, with and without concrete foundations; (3) the red macadam on pre-existing macadamised road foundations.

It is probably universally admitted that a syenitic granite-sett pavement forms the most durable street surface known; when its joints are made in such a manner as to remain watertight, it is a good paving from the sanitary point of view. It is, however, so noisy that, in the opinion of the author, it should never be laid in

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streets having good residential property, offices, or shops abutting upon it. For streets through manufacturing districts, and in similar situations, it is difficult to find sufficient reasons against its use to outweigh its undoubted advantages. The author has laid such pavements with both cement and pitch grouted joints, and is of opinion that, with equal care, one method is as good as the other as regards stability and imperviousness; each method has its own advantages and disadvantages. Cement grouting can be done at any time, excepting during frosty weather, but the pavement must not be subjected to traffic for at least a week after it is grouted. Pitch grouting cannot be done to be sure of good results in cold or wet weather. The pavement may be opened for traffic immediately it is completed, and it is not so noisy as where cement grouting is used. The success or failure of pitch grouting depends on the efficiency of the person in charge of the pitch boiler. If the mixture be too hard, it pulverizes in very cold weather; if it be too soft, it runs and becomes sticky in very hot weather. When it is intended to use pitch grouting, the joints of the pavement must be filled with clean dry shingle or stone chippings, and after thorough ramming and regulating the joints must be again so filled; the pavement is then ready for grouting, which is best done with a lipped iron can. The pitch should be poured into the joints, leaving as little on the tops of the setts as possible.

For the average class of traffic found in provincial towns, and where granite paving is substituted for a macadam surface over a well consolidated bed, an impervious granite-sett paving will last for many years before depressions make it necessary to relay it; if, however, water is permitted to penetrate the surface the paving soon becomes uneven. To avoid this, a thin layer of cement concrete has been found efficacious, the principal office of which, in the author's opinion, has been to increase the imperviousness of the construction, thus preventing churning and local yieldings of wet material below the setts. The author sometimes lays down such thin layers of concrete in the following manner: a layer—say, 3 in. thick—of gravel having been laid, watered and rolled, it is thoroughly sluiced with water, so as to wash down all loamy matter, and cement grout is swept into the interstices. The granite paving is laid upon this in the usual manner, after an inch layer of sand has been spread on the concrete. Time is allowed for the cement to set before any running or other operation likely to disturb it is commenced. Where granite paving is used in a town where macadam is prevalent there are, the author thinks, more accidents to horses in proportion to traffic than where granite is more general. This is due to the fact that horses in the former case are not so well accustomed to the sort of foothold. Further, horses in such towns are not usually shod in a suitable manner to enable them to travel with safety on granite paving.

(To be Continued.)