any gravel in which the stones are rounded and smooth, never binds well. In such gravel one-half the stones should be broken and mixed with the other half, one-eighth in bulk, not more, of clay or loam being added as a binding material. Sand, except in very small quantity, is detrimental, as it prevents packing. Pit gravel is apt to contain too much earth. It is well worth while to screen gravel that is to be used for road surfacing. Screens with meshes of one-half and one and one-half inches respectively should be used. Any stone under or over these sizes should be rejected.

A 4-inch layer of the prepared gravel is spread uniformly on the road-bed, then compacted with a roller of at least 2 tons weight, and not under 30 inches in width. Before rolling, the surface is moistened. It is then rolled until no pebble rises or creeps before the roller. With two such layers on a proper road-bed a good road for ordinary traffic should be obtained. Like sized gravel, uniformly mixed, must be used in both layers, otherwise frost and rain, acting with the vibration due to the traffic, will cause the larger pebbles to rise while the smaller ones sink between them, and the road rapidly disintegrates. Gravel roads are at their best during moderately damp, or dry weather. In continued wet weather, the binding material becomes soaked and more or less muddy, while in drouths it is apt to crack, and the pebbles in the gravel thus to become loose.

Broken stone surfacing varies in durability with the quality of the stone used. Hardness, toughness, and qualities enabling it to resist the disintegration caused by the weather, are the desired qualities. These are seldom all found together in the same stone. Trap rock, basalt and syenite are very good. Granite should not be used when containing too much mica. Gneiss slates, mica schists, and any easily crumbling stone are entirely unsuitable. Limestone, though not very hard, binds well and makes a good road covering. One of the prime requisites of a good road covering is that it shall be impervious to water. Limestone fills this requisite as well as any stone. But in limestone, too, there is much difference in quality, and therefore in fitness as a material for road surfacing. Quartzose or siliceous grits, uniformly mixed with about one quarter in bulk of limestone, make a good aggregate. When hard stone only is used a small proportion of binding material, such as road-sweepings, clay, or loam, must be used with it as a binding material.

In breaking stone for road covering, the nearer cubical the pieces can be obtained, the better. Hard stone, such as trap or granite, should not exceed 1½ in. in greatest dimension; limestone should not exceed 2 in. It is not desirable that all the stone should be broken to uniform size; smaller pieces are required to fill the interstices between the larger ones. Hand-broken stone is somewhat better than machine broken, but the latter is cheaper and is now almost universally used where broken stone is required in any larger quantities. Broken stone should not be screened. The smaller stone and detritus are needed for interstices and binding, as already indicated. Great care should be taken to have the mass homogeneously mixed throughout. This must particularly be looked to when it is spread on the road-bed.

A layer of stone 4 or at most 6 in. thick when compacted, resting on a well made road-bed, can be counted on to give a good durable road. Nearly 50 miles of broken stone road in Bridgeport, Conn., have a covering only 4 in. thick. They are subjected to a large traffic of loads averaging 3 tons, and give entire satisfaction. The failure of roads of such comparatively thin covering is nearly always attributable to deficient foundations. Broken stone surfacing should never rest directly on the soil. A layer of gravel or sand at least, if no other foundation course is used, should always first be rolled into the road-bed.

The stone is hauled on the roadway in broad tired carts, and dumped in heaps, which are then spread with rakes to a uniformly thick layer. The depth of the layer will be reduced by rolling one quarter or more, depending on the kind of stone used. Rolling should be done slowly, commencing at the sides of the road and gradually working to the centre. The stone should be wetted, care being taken not to wet to excess, before rolling. This prevents undue crushing and facilitates binding.

(*Concluded in next issue.*)

MGR. J. C. K. LAFLAMME, whose lucid and interesting description of the disastrous landslide at St. Alban, Que., appears in this issue, was born in September, 1849, at St. Anselme, in Dorchester county, Que. His mother was a great grand-daughter of a soldier of Montcalm. He entered the Seminary of Quebec in September, 1862; was graduated an A.B. in 1868, and

PROF. LAFLAMME.

ordained priest in 1872. He became a doctor of theology in 1873. He has occupied the chair of natural history at Laval University since 1870, and had charge of the course of Physics from September, 1876, to 1893. He studied in Harvard in 1878, and in Paris in 1881, and in 1888-9. Mgr. Laflamme is a foundation member of the Royal Society of Canada, Section 4, and is also a member of the following learned societies: Geological Society of France (elected 1881); Geological Society of America (1891); French Society of Physics (1892). He became Rector of Laval University in 1893, and Apostolic Prothonotary during the present year. The Quebec Government appointed him delegate to the International Congress of Geology at Washington in 1891. Mgr. Laflamme has worked for many years for the Geological Commission of Canada, and has written several scientific works, amongst which may be mentioned the "Manual of Mineralogy, Geology and Botany," of which two editions were exhausted in a few years; and "Notes on a Course of Electricity for the use of Students" (1893), besides a large number of memoirs in the Transactions of the Royal Society and in various scientific reviews in Canada and France.