

the local community to the same standard as Massachusetts, and they are not solely used by the local community. Much of the traffic originates in Massachusetts, and that is why Massachusetts is willing to contribute to the building and maintenance of these roads through the federal fund.

The United States government through its recent appropriation, and including the balance from previous appropriation, has \$275,000,000 which will be available in the fiscal year 1920-21 for federal aid for road building in the United States. After July 1st, 1920, any state can take up as much as this money as it wishes to use, but the state must spend a dollar for every dollar that the federal government gives it.

Big Expenditures Proposed in U.S.A.

Delaware has applied for \$474,000; Rhode Island, \$641,000; Massachusetts, \$4,000,000; Texas, \$16,000,000; Pennsylvania, \$12,000,000; New York, \$13,600,000, etc. New York and Pennsylvania have each spent considerably over \$100,000,000 in recent years. Pennsylvania has \$27,000,000 to spend this year.

One result of federal aid is the organization of a highway department in every state, whereas formerly only twenty of the states had such organized departments. Texas, which, until recently had no highways department and had done no road work whatever, will now spend \$16,000,000 of the government's money. The total appropriation for road work in the United States at present amounts to not less than \$982,000,000, including \$60,000,000 in Illinois, \$50,000,000 in Pennsylvania, etc. Some states have appropriated nearly four times as much money as they will get from the government, which shows how state governments are regarding highway improvements.

Col. Sohier said that from a blue book which he had recently picked up, he noted that the total income of the provincial governments of Canada in 1918 was \$17,000,000, and of the Dominion government, \$232,000,000. This shows, he said, who has the money and who is able to raise the money, and the people who have the money must be the ones to spend the money on road work. The federal government should give at least 10% of its revenue each year to help the provinces to build roads.

J. Duchastel then read a paper on highway maintenance, which is published in full on page 497 of this issue.

The president appointed Messrs. Duchastel, Wheelock, Michaud and Regan as members of the nominating committee, and Hon. Frank Carrel, Mr. Kelly and Dr. Desaulniers as members of the committee on resolutions. The members of the executive were named as the legislative committee.

Improvement of Gravel Roads

Mr. Talbot then read his paper on gravel roads, which is published on page 499 of this issue.

B. M. Hill, of New Brunswick, said that 80% of the roads in that province are built and maintained as gravel roads. Two years ago they had no permanent road department. However, they have some large, fine, permanent bridges, including an arch of 650 ft. span across the St. John River. In two years the department had done at least some work on 900 miles of road, 600 miles of which were gravel roads.

He thought that a 30-ft. road, from shoulder to shoulder, is too wide and that a road built with 18-ft. gravel and 3 ft. shoulders, properly built, would be ample to carry any traffic.

In 1917 some of the roads in New Brunswick were carrying from 150 to 200 motor cars a day, and 6 ins. of gravel, well rolled in, was ample to take good care of this traffic; but to-day these roads are carrying 600 to 700 motor cars a day and in wet weather they are being rutted, although they stand up in dry weather. He believes that if oiled, gravel roads can be maintained cheaper than in any other way. He told of the trouble the province had with the corduroy roads. He stated that they are now removing all the logs from the corduroy roads, and in swamps, where they cannot drain the

water away, they are laying a thick brush mattress and piling the gravel on top of that. Where necessary they lay a mattress 18 ins. deep, of heavy spruce boughs, covered with brush. In one road they had taken up, in which brush had been laid forty years ago, it was found that the brush had turned a dark brown but had not rotted; it had been protected from the air by from 6 to 8 ins. of material.

P. P. Sharples, of the Barrett Co., New York, said that the road problem in Canada was the same as in the northern states. Gravel roads would stand up under a certain amount of automobile traffic—say 200 a day. Up to that point, an untreated gravel road is a good proposition, and every engineer should study his local supply of gravels. Methods of building these roads should be parallel to the building of higher types of roads. Money spent on drainage is money well spent, especially when it comes to replace the road with a higher type of road, as there is no better foundation for a higher type than a good old gravel road well drained. By patrolling and dragging, gravel roads can be well maintained. The main trouble is the dust nuisance, which can be gotten over by oiling. A gravel road can stand from 2,000 to 3,000 vehicles a day in the summer after cold tar treatment, said Mr. Sharples.

Traffic Increased Thirty Times

Mr. Veniot, of New Brunswick, said that the main question of the day is how to make gravel roads meet the heavier traffic. He had seen the traffic on some roads increase thirty and forty times what it was some years ago, and these roads have held up merely under constant patrol. He had also seen the cost of transportation lowered from 50c. to 25c. per ton-mile by the improvement of these roads. If the gravel roads can be treated to meet existing conditions, it will save the province a great deal of money, as permanent roads cannot be built where the traffic does not warrant them. Mr. Veniot said that he does not always believe everything that the engineers tell him, as many engineers, he declared, are experimentally inclined and have their own theories.

President Squire said that of the 58,000 miles of road in the older part of Ontario, 20% will be permanent roads and 80% will be earth or gravel roads, and of the 2,500 miles of trunk roads, probably not more than 500 miles will be first-class or standard roads. In road discussions, perhaps, everyone had been emphasizing the 5% of the roads too much and neglecting the 95%.

Mr. Veniot said that he was in Ottawa recently and from arguments which he had heard between members of parliament as to how the federal aid should be spent, he was afraid that it was the intention of the government that it should be spent mainly on trunk roads and permanent types of construction, whereas he thought the provinces should be allowed to use the money for the improvement of their gravel roads.

Mr. Talbot called attention to the fact that he had not dealt with the treatment of gravel roads in his paper, because, when treated, a gravel road ceases to be a gravel road, and he had considered his subject to be roads built merely of gravel.

Bituminous Treatment in Massachusetts

Col. Sohier said that the roads in Massachusetts which average 300 motors a day must carry 700 or 800 on a nice Saturday or Sunday, and that then they become rutted on the hills and must be dragged on Monday. He had found that treatment with bituminous material, either asphaltic oil or tar is very good if applied in small quantities. He had tried heavy blankets of bituminous materials, but they had rolled and bunched. Many of their roads are being given four treatments of one-fifth gallon per square yard.

Constant care in maintenance is the secret of successful roads, said Col. Sohier. In Massachusetts some roads are maintained at an expenditure of \$1,000 per mile a year, and are little better than roads in Vermont maintained at \$125 a mile per year. On these Vermont roads they have not used much bitumen, and only in short sections where the