HEAVY TRAFFIC ROADS.

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IN selecting a type of surfacing for any particular road, the engineer not only has to study the amount and kind of traffic that daily passes over the road, but has to make a very comprehensive study of the amount and kind of traffic that will probably pass over the road in the future, by virtue of the development of the surrounding territory on account of the improved road.

The writer has made studies of roads where the traffic, before improvement, consisted of light vehicles and nothing heavier than 2-horse loads, but as soon as the road was reconstructed, the amount of traffic increased from 50 to 300%, and the loads from light 2-ton loads to 10 to 12-ton motor trucks, and 14 to 18-ton tractors. He also recalls constructing a section of road through a very sparsely settled section, and estimating that it would be quite a long time before the adjacent territory would be more thickly populated, and accordingly selected a soft local limestone for the metal surfacing, but which had sufficient strength and hardness to carry the traffic that was passing over the road at that time. Scarcely had the road been completed when several large tracts of woodland, not a great distance from the road, were cut down, and the lumber was transported on wagons, drawn by large traction engines with cleats, over the road to the railroad station. The effect of this heavy traffic on the soft limestone surface can be easily surmised.

Drainage.—Drainage of a road-bed that is required to carry heavy traffic, should be well taken care of by tile or other sub-surface drains, so as to render the sub-foundation as dry and firm as possible. The maximum grade should not exceed a 6 per cent., and the alignment should be as straight as possible, with all sharp curves and bends eliminated. The width of the roadway and the width and thickness of the metal surfacing should be designed to meet the requirements of the present as well as the future traffic which it will have to accommodate, but the minimum width should not be less than 30 feet, nor the metal surfacing less than 18 feet. Broken stone or gravel make a fair foundation, but concrete is almost as cheap and is more preferable.

The thickness of macadam and gravel should not be less than 5 inches after rolling, nor more than 10 inches, while concrete should not be less than 4 inches, nor more than 8 inches, depending primarily upon the character of the soil of the sub-base, and the intensity and character of traffic it will have to sustain. In some cases where the loads are very heavy, but the number of loads small, it has been found economical to lay a strip of high-class and durable pavement in the middle of the road for a width of 9 to 14 feet, with a cheaper and less durable material on each side.

Before selecting the type of pavement to be used, a close and accurate census of the different kinds of traffic should be taken, a very thorough study made of the surrounding section, and an estimate made as to the possible increase of the different kinds of traffic, or the decrease of one kind and the large increase of the other. It is the opinion of the writer that in no other line of engineering should there be a larger factor of safety used than in estimating the amount, intensity, and kind of motor and self-propelled traffic that will pass over our improved roads in the near future. The great change in the character of traffic developed in the past five years, is but a small index to what can be expected in the next five years to come.

The types of pavements used on heavy traffic roads should be selected as to their fitness to stand the kind and intensity of the traffic that will travel them. Roads in the outlying districts, where horse-drawn traffic comprises the larger percentage, should be constructed of macadam with a light surface treatment. Concrete will also be found serviceable and desirable. Where motor traffic is in the majority, bituminous macadam or concrete will give good results. Near the centres of population, where the traffic is mixed and heavy, concrete, bituminous concrete, asphalt or vitrified brick will prove the most economical. Where the heavy traffic is concentrated, brick, asphalt or stone block are the most suitable.

There can be given no hard and set rule for selecting the type of construction that should be used on a given section of road to carry a known traffic. For local conditions, the availability of materials, etc., play such an important part in the selection of the type of surfacing in any locality, that each individual case must be worked out on its own merits.

The following method of selecting a type of surfacing to carry an estimated traffic, however, will prove fairly accurate where a study can be made and the maintenance cost can be had of roads constructed and maintained under similar conditions:

Where the annual cost of maintenance of a less durable type of road surfacing will exceed the annual cost of maintenance of a more durable type of surfacing, plus 4 per cent. on the excess cost of the more durable type over the less durable type, the more durable type should be used, and vice versa.

The maintenance on heavy traffic roads should be continuous and thorough—never allowing the surface to remain broken any length of time, but as soon as the slightest defect or indication of failure appears, it should be speedily repaired.

LARGE PROJECTED HYDRO-ELECTRIC STATION IN NORWAY.

The proposed exploitation of the water-power in the Take Falls, with the co-operation of the Norwegian State, is one of the largest undertakings in the country. The first stage is the building of a power-station with a capacity of 125,000 h.p., which can be obtained simply by the regulation of the Totak, by retaining the water of the Totak during the high-water season and using the power of the Vinje waters without any regulation. The plan is based upon an English Company contracting for about 100,000 h.p. for a period of 30 years, with the option of a further 20 years at $7.25 per h.p. per annum, the energy to be supplied as alternate current of some 10,000 volts, the factories in question to be erected within a distance of 100 kilometres from the power-station. The Take waters represent one of Norway's largest and best water-power streams. By regulating the Totak and the Vinje waters a capacity of 250,000 h.p. is confidently reckoned upon, and of this 140,000 h.p. will come from the Totak after regulation. Of this the Hyllands Fall represents 15,000 h.p. The exploitation of either the Totak and the Vinje is not expected to offer any difficulties whatever from a technical point of view, and the cost can, it is confidently asserted, be kept at a comparatively low figure, the existing roads for transport, for one thing, being adequate. The cost of the finished power-station for the first 125,000 h.p. is calculated at $26.80 per electric h.p., and the next 125,000 h.p. will naturally come out somewhat cheaper.