

A recent careful investigation in the United States is said to have proved that with *proper methods of maintenance* 16 ft. gravel roads without bituminous surfacing can economically carry an average daily traffic of 350 vehicles. As no main highway in New Zealand has at present an average traffic of over five hundred motor-vehicles per day, and as most of the mileage is subjected to not more than a hundred motor-vehicles per day, it can again be deduced that the cheaper types of bituminous surfacing should economically satisfy the traffic conditions on practically all our highways for at least ten years to come. England's highway system on the whole is unrivalled, and it is the adoption of the cheaper forms of bituminous construction for by far the greater portion of her main country roads that has put her in this position.

CONCLUSION.

New Zealand is a young vigorous country anxious to have the best of everything. Visitors from abroad, to our disadvantage, compare our transportation facilities with those afforded the inhabitants of older and more populous countries.

The *per capita* wealth of New Zealand is claimed to be as great, if not greater, than that of any other country, and when Government assistance is forthcoming the tendency is for the local "good roads" enthusiast to demand the most expensive forms of paving for the roads in which he is particularly interested. The enormous activity of the United States in the construction of high-class pavements is held up as an example of what we should strive for.

Already the position of New Zealand as regards proportion of surfaced mileage has been pointed out, and before concluding I would like to draw attention to the peculiar position this country holds when total road mileage is compared with population. There is one mile of road—in England, to every 253 persons; in Scotland, to every 192 persons; in Ireland, to every 80 persons; in United States of America, to every 40 persons; in Canada, to every 32 persons; in New Zealand, to every 20 persons.

New Zealand, having double the mileage of the United States per unit of population, can therefore only afford to spend half as much per mile as is spent in the United States, if her people are to be equally taxed.

Where the traffic warrants it, by all means build expensive high-class pavements, but we must never allow our desire for a smooth luxurious road to outweigh rational economics. We all like Rolls-Royce cars, but most of us ride in Fords.

Permanent improvements, such as better alignments, better grades, better drainage, and better foundations must also universally precede high-class surfacings.

ENCLOSURE A.—SPECIFICATION FOR SUBGRADE.

(a.) *Description.*—The subgrade will be considered as that portion of the highway upon which surfacing or paving is to be placed. Before surfacing or paving is placed a subgrade shall be constructed, conforming to the grades and cross-sections shown on the plans and in accordance with these specifications. The finished subgrade shall be true to cross-section, hard, uniform, smooth, and must support without perceptible indentation the wheels of heavily loaded trucks, except where the soil is too sandy.

(b.) *Rolling and Watering.*—Thorough rolling and watering of the earth grade shall be done prior to the operations of making subgrade. If the shaping of the subgrade does not follow closely the watering and rolling the grade shall, if damaged by traffic and when ordered by the engineer, be reshaped and again watered and rolled. If the shaping of the subgrade follows closely the watering and rolling specified in paragraph (w) of the Grading Specifications, so that the moisture then applied can be utilized, reshaping and rewatering will not be required.

(c.) When the grade has been finished to a flat cross-section, and the side forms set to the line and grade given by the engineer, the subgrade shall be prepared by cultivating, shaping, pulverizing, watering, and rolling to a true cross-section as specified below.

(d.) With rooter, scarifier, or plough, thoroughly loosen the earth between the side forms to the full depth of the implement—12 in. is not too much. Break up clods with cultivator and disk to full depth of loose material. Run diagonally across road to see that all ribs are broken.

(e.) Use Fresno to lower high places, and raise low places. Continue the deep cultivating. When roughly shaped to cross-section, thoroughly dry-roll with a power roller of approved type weighing not less than 350 lb. per lineal inch of tire-width. Fill spots which roll below uniform grade when using shaper.

(f.) When clods are broken, earth pulverized, and dry rolling done, by means of the subgrader or any shaper riding on the headers, grade the loose earth uniformly to the desired height above finished grade. Cultivate when shaped to make shallow lengthwise furrows.

(g.) In the afternoon, preferably around 3 o'clock, begin watering on a section—say, 500 ft. to 600 ft. High water-pressure and large hose necessary. Proceed by directing the stream into the earth in straight lines crosswise of the subgrade, advancing 4 in. to 6 in. each time across. Plenty of water to be used; speed at which man walks governs amount of water applied. Watering of the section should be finished in a continuous operation.

(h.) The next morning, cultivate deeply to mix excess of wet earth with dry earth beneath. Cultivation to be continued until the loose earth for full depth is at the proper consistency for rolling. If dry spots are uncovered, showing that insufficient water was applied, they should be rewatered carefully before proceeding any further with the subgrade.