Additional economies due to electrification.

28. Apart from the various matters referred to above, there are other incidental advantages of railway electrification which cannot easily be brought into a balance-sheet of operating-costs or revenue. The removal of the steam locomotive must necessarily have a favourable effect on the comfort of travel. Coal-handling plant, water-columns, and pumping plant are reduced in number if not altogether eliminated; and, due to the absence of smoke, savings can be effected in the painting of stations, overbridges, and rolling-stock.

Some Factors affecting New Zealand as a Whole.

29. Before examining in detail the application of electric working to the four cities of Auckland, Wellington, Christchurch, and Dunedin it may be advantageous to draw attention to one or two factors which affect all centres equally, and, indeed, the New Zealand railways as a whole. These are the questions of power-supply, of regrading, and of the choice of the system of electrification which would be most suitable for the conditions.

Power-supply.

The use of natural resources.

30. The water-power resources of New Zealand are considerable, and are being developed on national lines. It is obviously desirable, not only from the point of view of the railways but on general economic grounds, to utilize a natural source of power which would otherwise be running to waste, rather than to import locomotive coal at high prices. This has been one of the principal factors in the electrification of the railways in France, Switzerland, Italy, Sweden, and elsewhere.

The effect of load-factor.

31. A large proportion of the cost of power from any supply undertaking, and particularly an hydro-electric undertaking, is made up of the charges on capital and certain charges such as salaries and wages. It is therefore desirable to use the plant to the greatest possible extent in order that these so-called "fixed" charges may be spread over a greater number of units, and the price per unit be thereby reduced. From the point of view of both the consumer and the supplier it is desirable, therefore, within the capacity of the generating plant, that the maximum possible load should be obtained, and, in general, that the average load throughout the twenty-four hours should be well maintained.

Improvement in load-factor by combination of load.

32. The ordinary domestic load and the ordinary industrial load are both characterized by peaks at certain hours of the day—that is, their load-factor is low, although a combination of the two tends to an improvement on the total load-factor of the station, since their maxima do not occur simultaneously. The railway load combined with the other two tends to a still further improvement, and thus to a better utilization of the capital already invested in hydro-electric schemes, with consequent advantages not only to the railway and other consumers but to the country as a whole.

Railway load-factor inherently high.

33. From the Railways point of view, since the whole of the charges are based on maximum demand, it is obviously advantageous to take as uniform a supply as possible throughout the day. The maximum demand may be expected to occur during the suburban-passenger rush-hour periods. The charge for current will be fixed by this demand, and will not be increased by running a steady service of goods and passenger trains throughout the day, provided that no new limit of maximum demand is thereby set up. This principle is of particular advantage since from the very nature of the case it is necessary that railway traffic should be spread as far as possible over the whole twenty-four hours of the day in order to make the best use of tracks and rolling-stock. It is possible, therefore, to bring the costs of power per train-mile to an attractively low figure by extending electrification over as wide a range of traffic as possible.

Cost of power.

34. The figures for power-supply rates have been supplied to us by the Public Works Department, which makes two alternative offers: (1) to supply the central point in each area, after which the responsibility for transmission would rest with the Railway Department, and (2) to supply to each substation as required. Our estimate of the cost of power is based on the second proposal. We assume that such supplies would be given in duplicate, and that satisfactory arrangements can be come to with the Public Works Department to run these lines in a manner which would be satisfactory to the Railway Department. The cost of current is shown separately under the various sections of the report.

Electrification as an Alternative to Regrading or Increasing the Number of Tracks.

Regrading and track alterations.

35. The growth of traffic on the railways has made it necessary to consider what means can be adopted to provide increased facilities, and a number of schemes for regrading and doubling tracks are now under consideration not only in the four towns which are the immediate object of this report, but in other places in the Islands. In all parts of the world electrification has proved itself capable of increasing the capacity of existing tracks, and it is now usual to consider electrification as an alternative in all such cases. On the other hand, we are aware that the provision of additional