1930.

NEW ZEALAND.

PUBLIC WORKS STATEMENT

(BY THE HON. W. B. TAVERNER, MINISTER OF PUBLIC WORKS).

MR. SPEAKER,—

Having taken over the portfolio of Public Works only a few weeks before the opening of the session it was not possible for me to make visits of inspection covering the extensive activities of the Department. The session has emphasized features in our public finance and in the social condition of a large section of our people, which must be taken into consideration in framing a statement for presentation to the House. Perhaps the most important from the point of view of a programme of expenditure on public works are:—

(1) The fact that a Select Committee has been appointed to inquire into and consider the position respecting railways under construction; and

(2) The fact that unemployment as revealed by the statistics of registration has increased rather than decreased.

The first factor is important in that it introduces an element of suspense in detailing items relating to expenditure on railway-construction. This Statement is necessarily prepared in regard to the position as I view it and the finance made available by the Minister of Finance for the year's programme of works. The second factor, however, it may otherwise be regarded, must weigh with all honourable members in balancing the pros and cons of one of the most difficult situations that has confronted Parliament since the end of the war. It is for the moment our most embarrassing problem, as it is reported to be in most civilized countries, and one that vitally concerns the Public Works Department, the largest employer of manual labour in the Dominion. I shall have occasion to revert to one or other of these factors in subsequent paragraphs.

The general position and certain aspects of policy dictated by our present circumstances may be briefly reviewed. Honourable members will perceive from a perusal of tabulations embodied in other parts of this document that public-works expenditure has steadily increased. During the last financial year the total

expenditure reached £7,781,000. Included in this Statement is a most interesting diagram showing, in the form of a graph, the annual expenditure on public works since 1872 up to the end of last financial year, and also the annual expenditure per head of population for that period. It will be seen from this that, apart from the period of unusual activity during Sir Julius Vogel's railway-building policy when there was a very small population in New Zealand, the expenditure from 1882 to 1920—a period of thirty-eight years—has varied round about £2 per head of population. Since that date it has increased, and in the two years immediately following 1920 it reached £5 10s., and since then has averaged nearly £5. I suggest that a study of the particulars set forth in the graph under mention should be a valuable aid in assisting honourable members to consider the economics of the present position in regard to public-works expenditure. The necessity of paying due regard to the economic aspect of the various works proposed is most necessary, and the ability of those works to produce an adequate return or to assist in increasing production must be carefully reviewed.

A continued programme of expenditure of borrowed money on services that are not likely to prove productive will probably in the end result in a serious condition in the public finances of the Dominion. It is not desirable that the additions to our national debt should become entirely the burden of the taxpayer for annual charges of interest and sinking fund, but insofar as public works are unproductive such annual charges will have that effect. In respect to external debt, where the interest goes out of the country, it is essential that for the expenditure of moneys borrowed abroad, the Dominion should show such increased development and productive capacity for the creation of additional taxable wealth that the interest payments will not be found burdensome, although they may require to be met partly out of taxation. It is for this reason that the economic aspect of prospective railway extension must be seriously considered.

The statement tabled by the Hon. the Prime Minister, which, on the motion of the Hon. the Acting Prime Minister, has been referred to the special Committee, gives the estimated cost of railways under construction, including cost to the end of June last, and the estimated total annual loss thereon, as follows:—

	£
Estimated total expenditure when completed ..	13,631,000
Estimated total annual loss	737,553

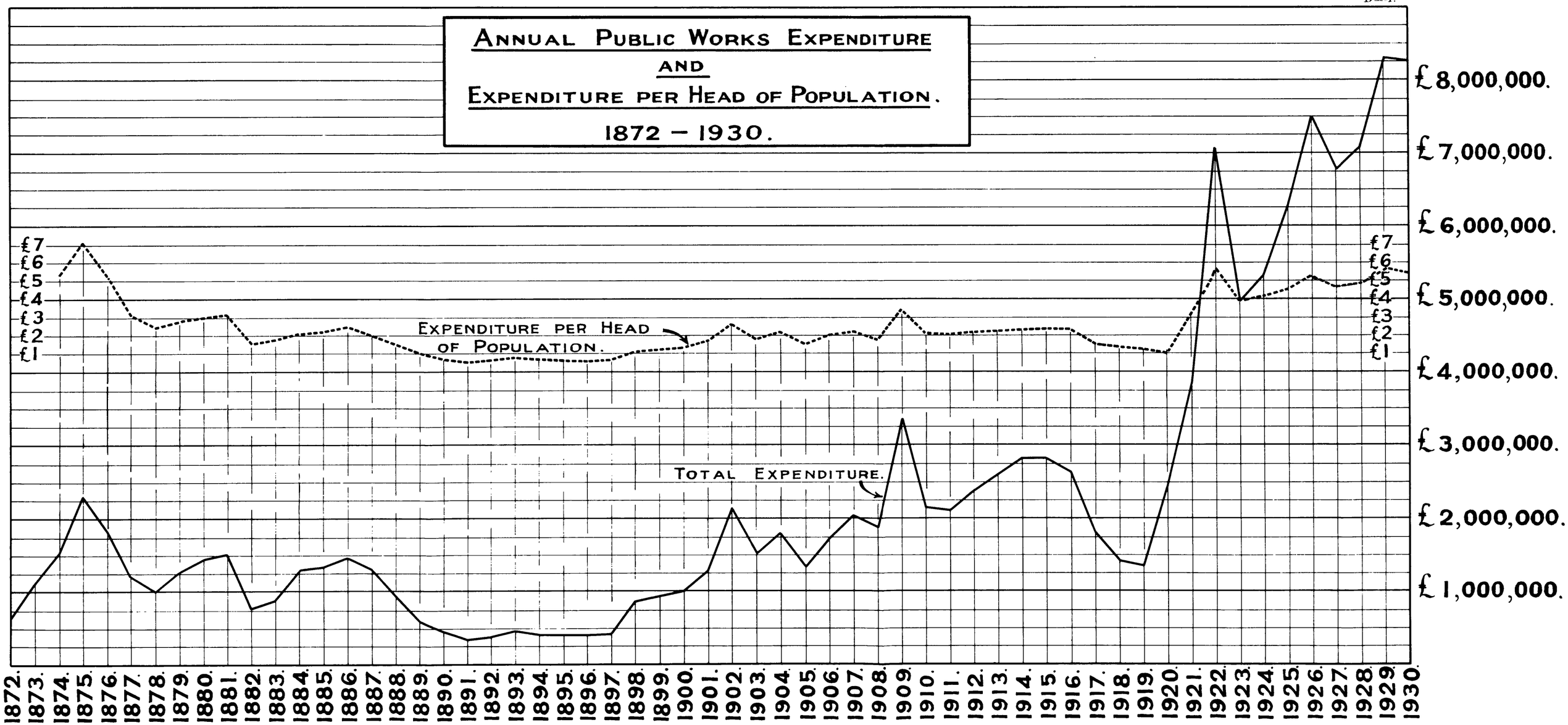
I leave out of consideration individual lines referred to in that Statement, but must draw attention to the fact that heavy standing charges, represented principally by interest, will be borne by the Consolidated Fund until such time as the various sections of line are handed over to the Working Railways Department.

It is not necessary to stress the fact that the Working Railways are finding it increasingly difficult to carry additional burdens. I desire to state the urgent necessity that exists for a complete evaluation of the lines under construction in regard, *inter alia*, to community value for increased settlement, increased production, and those services to the public which are not easy to assess in terms of money. It must be admitted that while certain factors in the problem are definitely assessable there are others of a tangible character that may be grouped under the heading of services and public conveniences which in prosperous times do not impress the public mind, but are serious items in the balance-sheet during periods of depression. I am convinced that such an investigation should be our first duty, and that upon the conclusions reached a programme of railway-construction must be largely controlled.

In regard to the high cost of many of the lines at present under construction it should be remembered that, as in the case of roads, the lines that presented no great engineering difficulties were built years ago, while those remaining are for the most part through difficult country and have to be constructed at an enormously increased cost, and the modern standard is much higher. As illustrative of this point, it can be mentioned that the main line across the Canterbury Plains, and also other lines in similar country, were constructed years ago at as low a figure as £3,800 per mile. The lowest estimated cost of lines under construction is £26,000

Annual Public Works Expenditure and Expenditure per Head of Population.

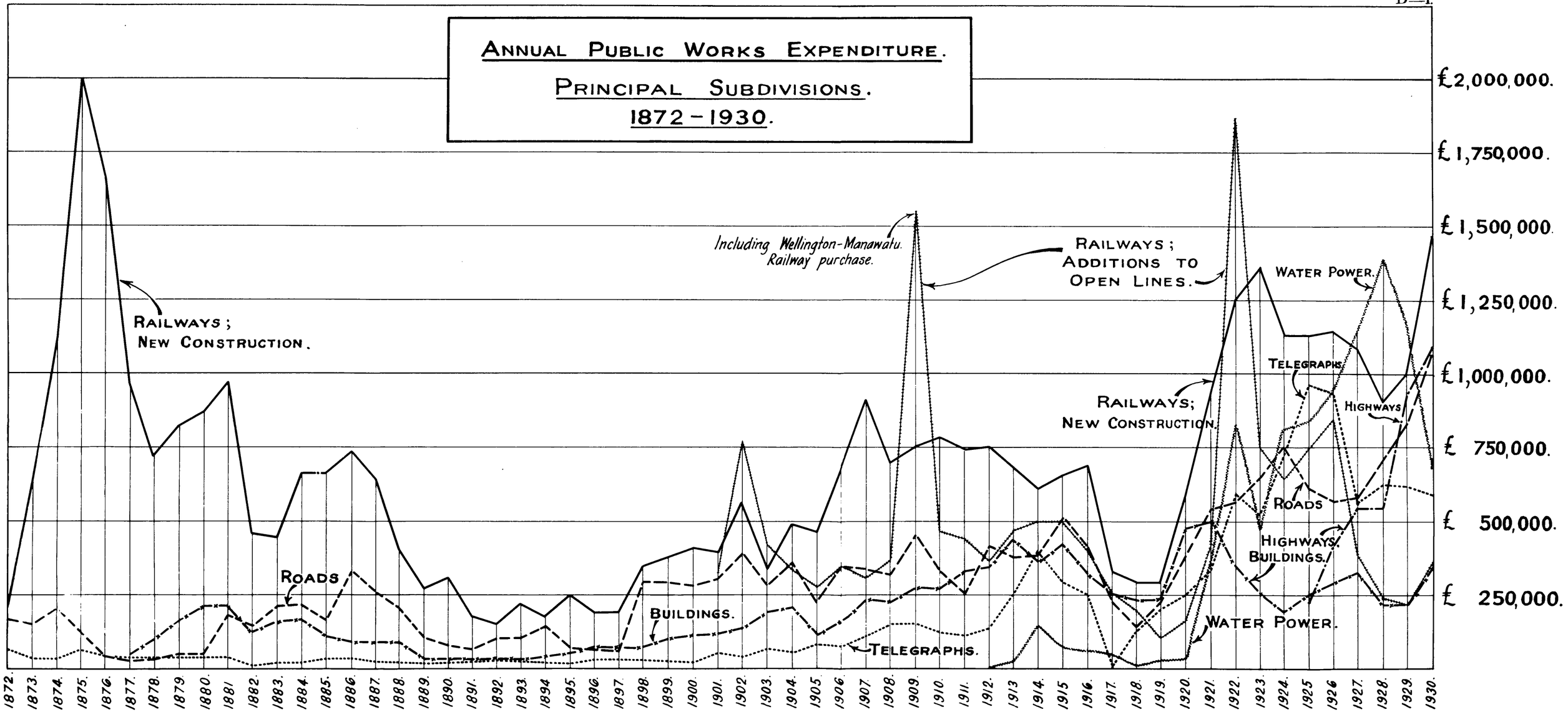
1872 – 1930.



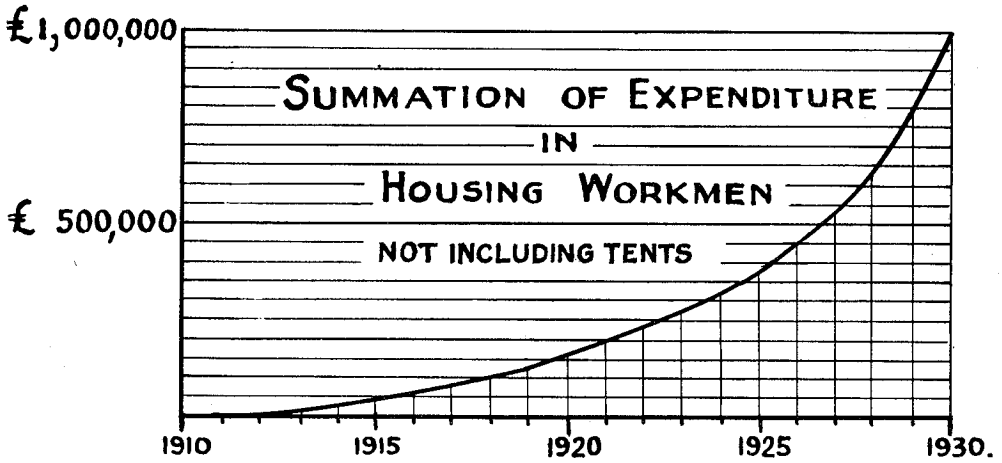
ANNUAL PUBLIC WORKS EXPENDITURE.

PRINCIPAL SUBDIVISIONS.

1872 – 1930.



per mile, and on some of these lines it is costing up to £3,000 per mile to provide housing accommodation for the workmen. The graph reproduced below shows the rising cost in this connection. Temporary accommodation, such as tents on works of short duration, is not included.



While no one would desire to return to the standard of accommodation and conditions which prevailed in those days, it will be seen that when the Department is faced with an annual expenditure exceeding £200,000 for the purpose of housing its workmen, it has an item of increased cost which materially adds to the financial burden. This aspect of the problem could with benefit receive the attention of the Select Committee of the House recently set up.

In making the above statement I am not unmindful of the important part played by the Department's railway activities in regard to employment, and I wish to state that at the present moment there are 3,848 men so occupied, and that the amount disbursed in wages during the financial year ended 31st March, 1930, was £750,000, to which, of course, must be added the cost of materials, the overhead charges, consisting of supervision, interest, cost and depreciation of plant, and other items, which increased the total annual disbursement by a further £700,000.

I remarked above the value, from the employment standpoint, of the works under consideration. Taken in conjunction with road-construction and relief works, the second factor emphasized in my opening remarks may be developed more fully. The statistical position is as follows:—

NUMBER OF MEN EMPLOYED ON PUBLIC WORKS ON 20TH SEPTEMBER, 1930.

Railways-construction (charged to Railway Construction Vote under control of Minister of Public Works) ..	3,848
Railways-construction (Railways Improvement Authorization Account)	435
Roads:—	
Settlement Roads	1,534
Main Highways	2,714
Hydro-electric works	1,447
Irrigation	109
Waihou and Ohinemuri Rivers improvement	67
Buildings	638
General	229
Relief workers	4,939
Public Works Department total	15,960
State Forest Service total	1,089
Total	17,049

It is obvious that any curtailment that Parliament may find it necessary to impose under any one of these items will throw men out of work and add to the already considerable number of the unemployed.

RELIEF WORKS.

The position regarding unemployment has received close attention, and every effort has been made to offer employment to the greatest number of men that it has been possible for the Department with available moneys to employ. At the

present time the number of men engaged both on relief works and on ordinary standard works is in the vicinity of 17,000.

As a result of the necessity to provide employment for large numbers of men and the desire to do so with as little delay as possible, the suitability of certain roadworks for unskilled labour has perhaps in several cases been the deciding factor in favour of their commencement. Several of the large roadworks at present in hand could with advantage be held over until such time as transport requirements warrant their construction. This aspect of the present relief works is receiving attention. Most of the relief work in hand, apart from the operations of the Forestry Department, is road-construction, and although it is generally recognized by the local bodies in whose areas work is progressing that excellent work is being done and good value received for the money expended, I feel that in many cases the question of the subsequent maintenance of those roads, particularly if they are allowed to remain unmetalled, will present a difficulty to the local bodies, unless, of course, increased settlement in the districts served by these new roads can be brought about. It is hoped that, as a result of the improved access facilities now being provided to many more or less isolated localities by these relief-works roads, increased settlement will automatically follow. Nevertheless, I am strongly of opinion that more reproductive work can be found for the purpose of relieving unemployment than the building of roads, which work is, as honourable members will realize, not a permanent solution of the problem.

At the moment of writing there are 4,939 men employed by the Department on relief works which for the most part are situated in the out-back areas. Realizing the unfortunate predicament in which a regrettably large section of the community finds itself, and having regard to the fact that relief works in some form or another are likely to be required for some time to come, it is only right that a reasonable standard of comfort should be provided. In order that I may review the position and make any adjustments that may be deemed necessary, a special Inspecting Officer has been detailed to report in regard to all relief workers' camps. It is intended that accommodation, as far as it is possible, should be to a uniform standard and reasonably comfortable, at the same time having regard to the temporary nature of the works.

ROAD-CONSTRUCTION.

My remarks on railway-construction are in some ways applicable to road-construction, in so far as, under the extreme necessity of providing employment, roads have been made that in some cases are beyond the financial capacity of the local authorities to maintain, and are certainly years ahead of the demand of progressive settlement. In this connection attention is drawn to the graph on page xxii. A road, no less than a railway-line, is a liability on the community if it is not receiving its full share of use and assisting by the added facility which it provides to increase the production of the country and to lessen the cost of transportation. I propose during the coming recess to thoroughly investigate this position.

PROVISION FOR RAILWAY-CONSTRUCTION.

The sum available under this head is £1,570,000. I have necessarily framed the estimates for the year according to the requirements of the works now in progress, and honourable members must bear in mind that half the financial year is past, and that approximately one-half of the financial provision now being submitted for the approval of the House has been used. I cannot anticipate the adjustments that may be found necessary as the result of the investigations of the special Committee and the ultimate findings of Parliament and the Government based thereon, but I am convinced of the importance of considering other avenues of employment which may be imposed as the result of curtailments found necessary in the railway construction programme.

ALTERNATIVE MEASURES.

It must be patent to honourable members that alternative measures aiming to keep men in employment or to absorb a number of men now out of employment must take time to mature and to be put into operation, whether these take the form of the Unemployment Bill or concerted efforts in regard to land-development, increasing the area of State forest plantations, providing additional public buildings, irrigation, and grade-easements on open railway-lines.

Pokeno–Paeroa Railway and extension of the East Coast Railway beyond Taneatua: In view of the investigation to which reference has just been made, I have not deemed it advisable to place any sum on the estimates in respect to these two projects. I wish to state, however, that it is my intention to submit these two proposals, which have been represented to the Department by honourable members representing the respective districts, to the Committee for its consideration. Surveys have been made in connection with the Pokeno–Paeroa project in accordance with the undertaking to that effect given last year. This information will also be available to the Select Committee.

The growing expenditure as far as arterial roads are concerned, the ever-increasing mileage of permanent construction laid down, has to some extent operated disadvantageously in regard to the backblocks settler. A moment's thought will show that the full use of the main roads is not reached until a reasonably adequate measure of assistance is given to those who are developing the out-lying areas and who in many cases have had to put up with little more than bullock-tracks as their means of communication.

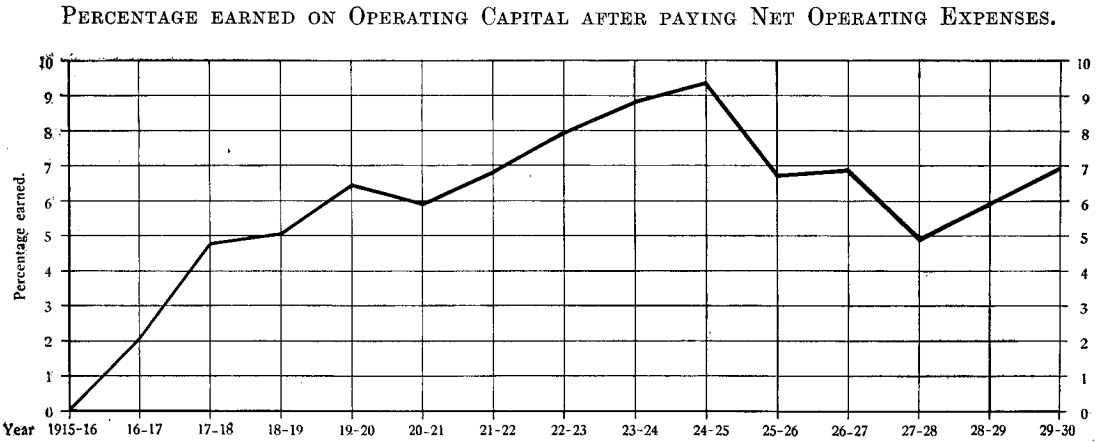
The question of assistance to the backblocks settlers in the way of improved road access which was the subject of special mention by my predecessor in his Public Works Statement of last year, has had my sympathetic support, and arrangements have been made this year for the vote providing for access to outlying districts to be materially increased.

The large expenditure on the development of hydro-electric-power works which was being incurred by the Department caused me to carefully review the position under that heading, and the result of my investigations is that I consider the Government in endeavouring to keep up with the demand for bulk supply of electrical energy is adopting a sound policy. The investigations I have made into the financial aspect of the main systems of supply at present operating give gratifying results, as the following statement of the position and the accompanying graph will show.

HYDRO-ELECTRIC OPERATIONS, 1929–30.

——	Average Operating Capital.	Gross Revenue.	Working-expenses.	Net Profits.	Percentage of Net Profit to Operating Capital.
	£	£	£	£	
Horahora-Arapuni	2,649,085	225,683	62,571	163,112	6·15
Mangahao-Waikaremoana ..	3,351,711	259,461	59,235	200,226	5·97
Lake Coleridge	1,517,803	196,648	36,808	159,840	10·53
Total	7,518,599	681,792	158,614	523,178	6·96

PERCENTAGE EARNED ON OPERATING CAPITAL AFTER PAYING NET OPERATING EXPENSES.



From the above graph it will be seen that the complete system indicates a general improving position until 1924–25. This is, in the main, due to the fact that the two schemes then operating, Horahora and Lake Coleridge, were largely

built at pre-war costs, and were operating practically at full-load conditions. Supply was short in some areas, whilst capital was being spent building other plants. From then on the percentage drops for a few years whilst larger plants, such as Mangahao, came into operation. These were built at very high cost during and following the war period, and for a year or so they had spare capacity, particularly on the transmission and substation side. The year 1928 was one of exceptional drought which adversely affected the revenue at Mangahao through having to purchase power from outside sources. The demand for electrical energy for all purposes is continually on the increase, and there is no doubt that the Government schemes will show a satisfactory return to the Electric Supply Account.

Arapuni Hydro-electric Works.

As honourable members are aware, certain earth-movements took place at the Arapuni Hydro-electric Station on the morning of the 7th June of this year, resulting in the closing-down of the station until such time as the position could be fully investigated. Full details of what occurred are contained in the report I presented to the House on the 28th June, 1930, copy of which is appended to this Statement. The Government made arrangements for the engagement of an eminent Swedish engineer, Professor P. G. Hornell, to fully investigate the position of Arapuni and to report on remedial measures. Professor Hornell arrived on the 25th August. He has visited Arapuni and is now engaged in preparing his report. On his arrival I handed to him a copy of the above-mentioned detailed statement to the House concerning the earth-movement and the immediate steps taken to safeguard the position, a copy of the geological report obtained from the Department of Scientific and Industrial Research, a detailed statement on the financial and economic aspect of the Waikato supply system, and the proposals of the Public Works Department indicating from an engineering point of view the steps which the Government's engineers considered should be taken to repair the works. For the purpose of ensuring that the Investigating Engineer should comment and advise on certain particular points which had been prominently before the Government, I deemed it desirable to submit to Professor Hornell an order of reference covering these points. I wish to assure honourable members, however, that, in submitting this order of reference, I did not restrict the scope of the Professor's investigation, nor limit in any way the breadth of his report. The order of reference calls for comments on various specific points. Apart from those, Professor Hornell has an entirely free hand in the matter, and he has been requested to report fully and as his investigations and wide engineering experience indicate. Copies of all the above-mentioned papers will be found appended to this Statement. For the information of honourable members I may say that Professor Hornell's report on the Arapuni scheme will be tabled in the House as soon as it is received and has been considered by Cabinet. I would particularly refer honourable members to the financial report on the Waikato supply system above referred to, a perusal of which indicates that, although the cost of rehabilitating Arapuni may prove to be heavy, the scheme could from a financial point of view carry a considerable additional expenditure, and still show a good return on costs of generation. That calculation, I may say, is based on an installed capacity of four generating sets. When it is realized that the completed Arapuni scheme provides for an installed capacity of eight generators, totalling 120,000 kw., it will be seen that, even though the cost of repairing the present trouble may be considerable, the scheme would not necessarily be rendered unfinancial by such expenditure. This financial report also indicates what charge would be represented to the Consolidated Fund if Arapuni had to be abandoned. It is not anticipated that such a drastic step will be necessary, and it is confidently anticipated that as a result of Professor Hornell's investigations and report remedial measures will be practical.

The closing-down of the Arapuni Station resulted in only very slight disorganization in the power-supply to the Waikato and Auckland districts, for it was possible before Arapuni closed down to make arrangements for the country load to be taken over by Horahora Station and various smaller plants throughout the district, and

the Auckland City load to be carried by the Auckland Power Board's steam plant at King's Wharf, Auckland. In order that all supply authorities concerned might be made fully acquainted with what had transpired and with the arrangements proposed, I convened a conference in Wellington on the 30th June of all interested Boards and members of Parliament. All information was placed before that conference, and the position fully discussed. The Auckland Power Board decided to increase its capacity at King's Wharf by the installation of an additional 15,000-kilowatt machine, and in order that available Government supply might keep pace with the continually increasing demand for power, the Government decided to install a steam generating-plant of 15,000-kilowatt capacity in the vicinity of the Huntly coalfields. Various offers to supply suitable machines have been received, and these are at present receiving consideration. It may here be stated that the necessity of proceeding with the erection of the Huntly steam plant is not of such extreme urgency as was at first thought, and it is therefore possible to give full consideration to the question of type of plant, &c., to be installed.

The Auckland Power Board has not asked for any financial assistance of a capital nature; but the fact that additional expenditure is being made by the Board in its endeavour to assist the general position is recognized by the Government, and is receiving consideration in relation to the overhead charges on the augmented steam stand-by plant and the increased costs of generation rendered necessary by the unforeseen circumstances.

I desire to take this opportunity of thanking the Power Boards, and particularly the Auckland Board, for the reasonable and helpful manner in which they have met the Department in all negotiations relating to the Arapuni breakdown, and thus very greatly assisted the Department in its endeavours to so arrange matters as to cause the least inconvenience to all concerned. Throughout the negotiations the Boards have in every instance taken the broader view of the interests of the Waikato supply district as a whole rather than the parochial view of how their own particular areas would be affected. This has been very gratifying and it has helped materially in placing the whole position on a footing which I feel can be regarded as satisfactory.

Electric-supply Accounts.

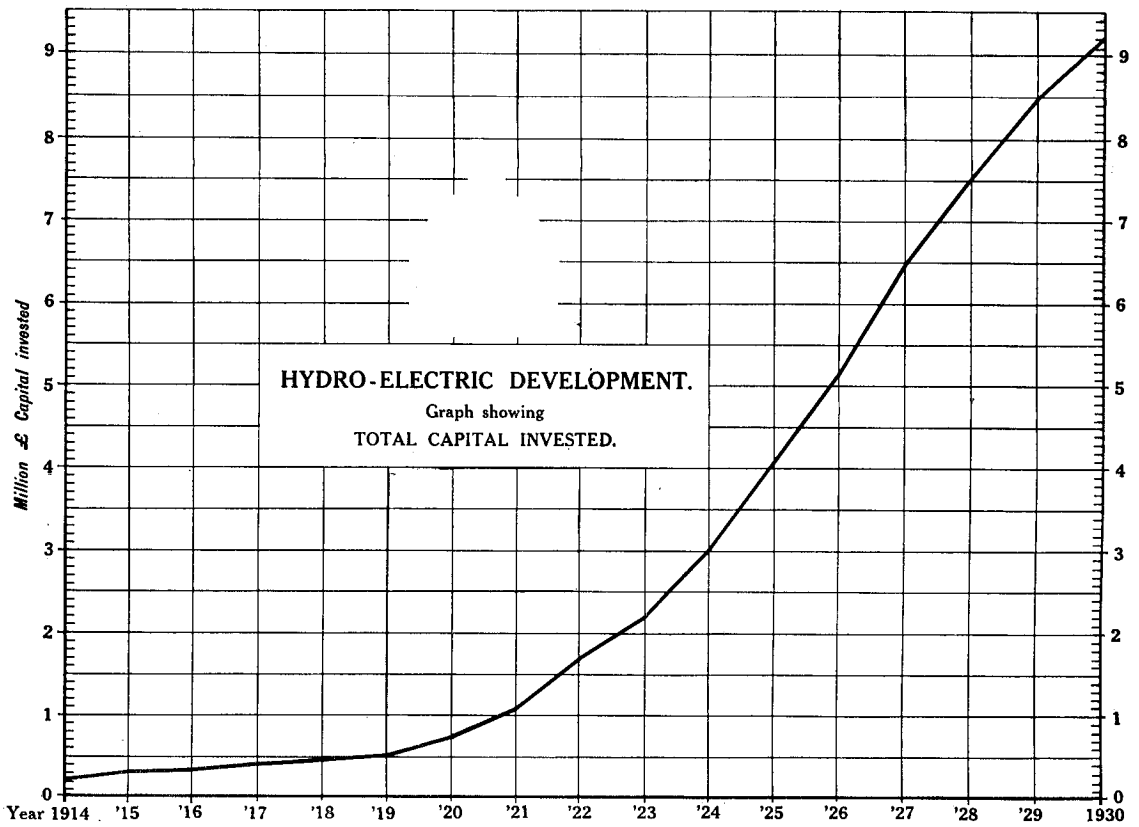
A gratifying feature of the financial position of the Electric Supply Account is indicated in the following graphs and the figures published above, which show the net revenue earned at the various stations. The amount at present invested in this branch is £9,205,885, which is received as a credit from the Public Works Fund annually as required. As the works are brought into commercial operation the Electric Supply Account is called upon to carry all the charges on the amount advanced, provision for renewals and depreciation, with the result as shown.

It is considered that the time has not yet arrived for a complete review of the prices charged for bulk supply, as this could be more profitably undertaken when the annual capital expenditure is reduced, as it should be after the Arapuni situation has been cleared up, the Waitaki Station completed, and probably an extension of the Waikaremoana plant undertaken. For the successful development of industry cheap and abundant power is essential, but due regard should be paid to the quantity which the community can absorb as a set-off against the amount of capital invested.

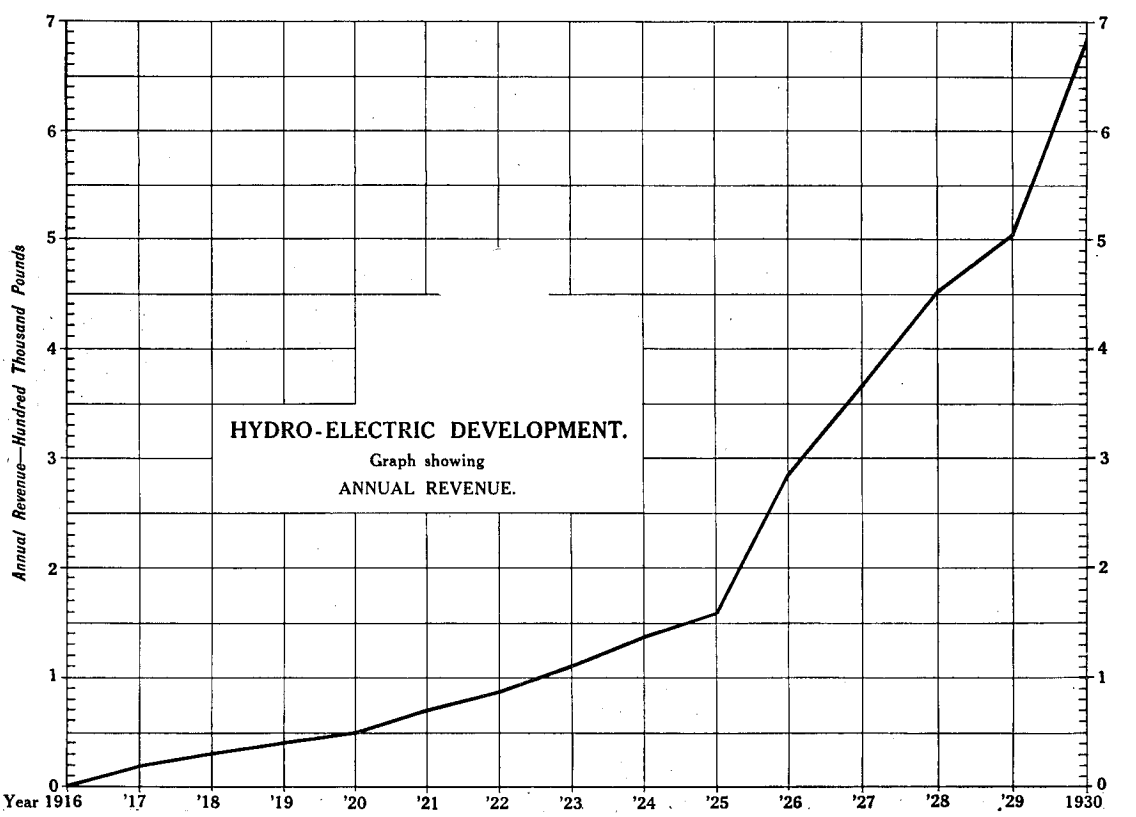
The past year has been one of very considerable importance to the hydro-electric-supply policy of the Government. In the first place, it is the first year in which the Waikaremoana and Mangahao Stations have been operated as a combined system, and, in the second place, it is the year in which commercial operations of the Arapuni Station were commenced.

The latter event was, unfortunately, followed by the recent stoppage of all supply from Arapuni, which has introduced complications which are discussed elsewhere in this report.

Capital expenditure on all schemes has been somewhat lower than in the previous year, the total being £738,150. The reduction does not mean any great slackening-off in development, as the reduction has been caused by the late delivery of materials which were due towards the close of the year, but which have actually come to hand early in the present year.



The total revenue for the year was £681,792, as against £516,127 for the previous year, an increase of 32 per cent. As power became available at Arapuni the amount of power that had to be purchased from outside sources or generated in more expensive auxiliary plants was reduced, and in consequence a better return obtained on the capital in operation. On the whole of such capital a percentage of 6·96 was earned, as against 5·62 last year.



Considering the various schemes individually, the position may be summarized as follows:—

Horahora–Arapuni.

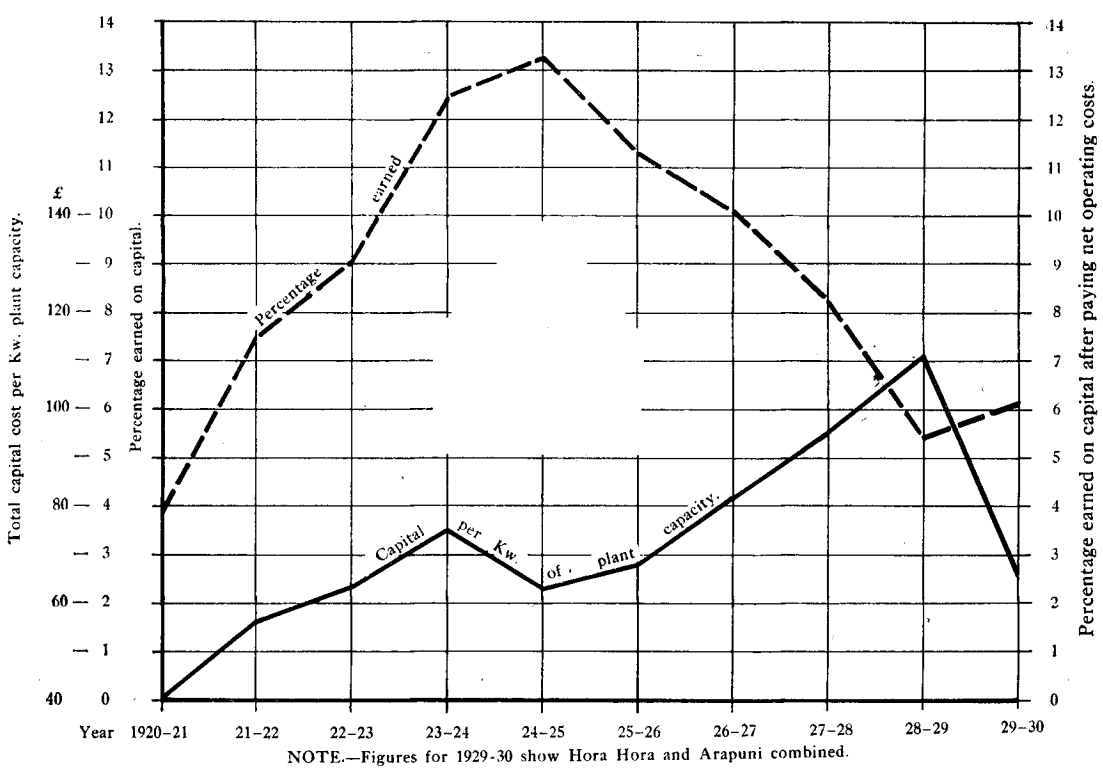
Consequent on the bringing into operation of the first unit at Arapuni, these two plants and the various transmission-lines connected thereto have been considered as one during the year. Notwithstanding the fact that the scheme is loaded with

the whole cost of headworks capable of supplying a much larger plant than is at present installed, the financial position has been very satisfactory. It may be summarized as under:—

	£
Capital investment at end of year..	3,660,427
Revenue	225,683
Operating expenses	62,571
Balance	£163,112

The balance has been used in paying interest charges and has allowed a sum of £60,259 to the depreciation fund. This is not sufficient to provide the statutory amount for depreciation, and means a gross loss of £32,768 on the year's operation. The scheme now has a depreciation reserve amounting to £165,758 and a sinking fund of £54,445.

Erection work in the power-house was continued during the year and the three units of the first installation completed. Two of these operated quite successfully but some trouble was experienced with the third machine. This was being investigated when the earth-movement occurred necessitating the closing-down of the station.



NOTE.—Figures for 1929-30 show Hora Hora and Arapuni combined.

The above graph deals with Horahora and Arapuni, and shows how, on pre-war costs and a fully loaded station, high percentages were earned. From 1925 onwards portions of transmission-lines and substations built to provide for the Arapuni load and to meet insistent demands for power, came into operation, and being designed as part of a much larger system than the original Horahora one, necessitated capital charges which were unduly high for the size of Horahora, and so reduced its earning-capacity. The earning-capacity in these years was still further reduced by the operation of auxiliary plants, steam and Diesel, where the operating costs per kilowatt were much above that of water-power.

For the year 1929–30 it is noted that 6·15 per cent. was earned, although a large amount of extra capital at Arapuni was brought into operation during the year. This figure is higher than the percentage earned in the first year on any of our other systems. It should also be particularly noted that, after taking in the whole of the capital cost of Arapuni with its attached lines and substations, the capital cost per kilowatt is only about £63.

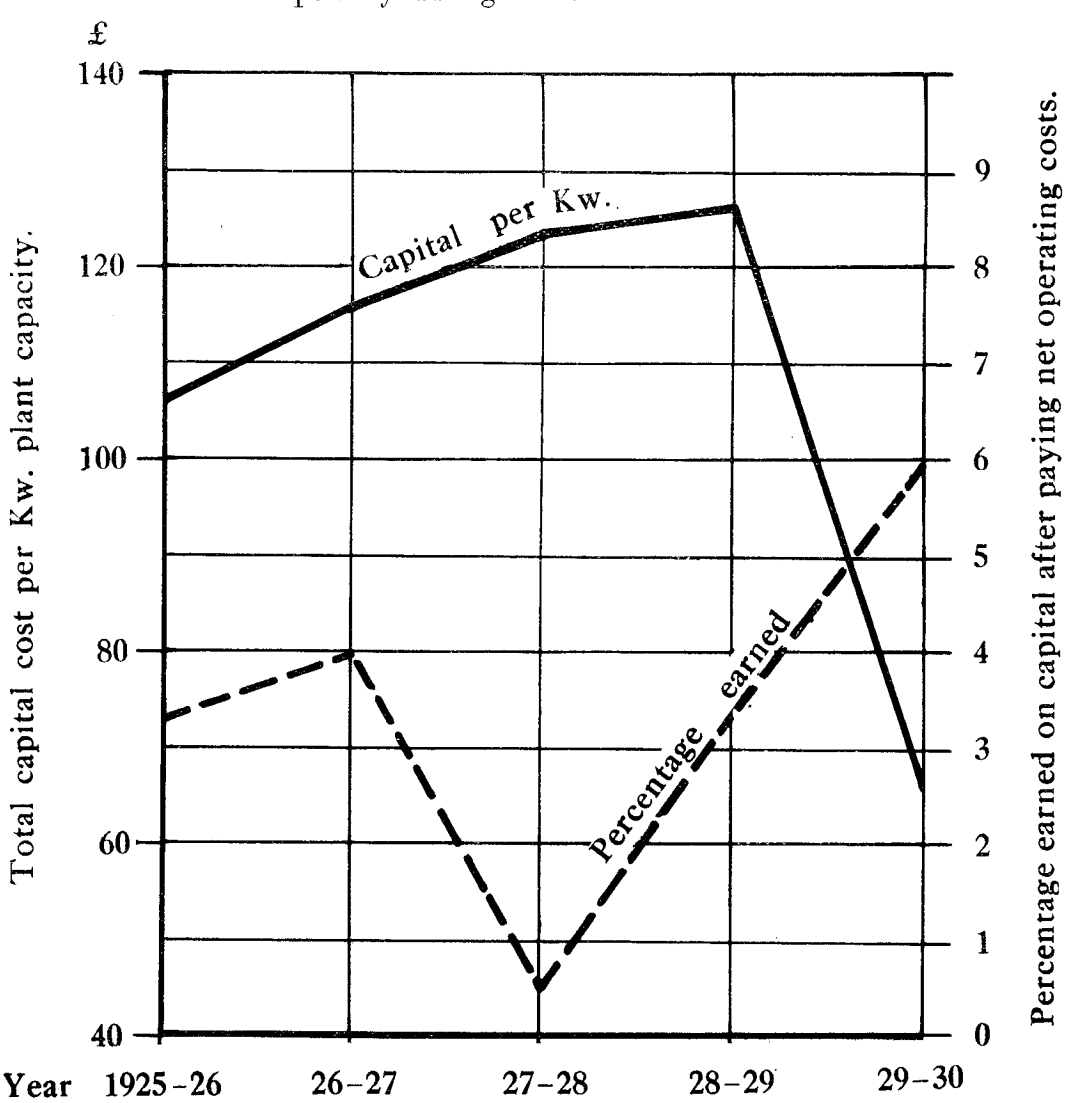
Waikaremoana-Mangahao.

As during the year these two stations have been supplying power into a common transmission system, they are treated as one in the system of accounts. Although

the putting into operation of the Waikaremoana plant has made a big addition to the capital on which charges have had to be paid, the financial position of the scheme shows an improvement on the position of the two schemes acting independently in the previous year. It may be summarized as follows :—

	£
Capital investment at end of year	3,426,901
Revenue	259,461
Operating expenses	59,235
Balance	£200,226

The balance has been used in paying interest, and has, in addition, allowed a payment of £62,205 to the depreciation fund. Now that the stations are interconnected the method of operation has been considerably altered, Waikaremoana, where at present little storage is available, being run almost to the capacity of the water, while Mangahao is run to a considerably lesser degree than previously, so as to conserve water in the reservoirs to meet special demands. The improvement in the financial position is mainly due to the fact that it has been unnecessary to purchase power to any extent from fuel plants in the area, the only occasions in which these plants have been called upon being when machines at Waikaremoana were out of action temporarily during tests.



NOTE.—Figures for 1930 show Mangahao and Waikaremoana combined.

The above graph deals with the Waikaremoana-Mangahao system. It indicates the high cost per kilowatt of that system. This is due partly to the very high construction costs at the time Mangahao, in particular, was built, and also to the extent in which transmission-lines and substations were built in advance as part of a general

system and to be available to absorb power from Waikaremoana. The percentage earned is lower than in the other schemes mainly on account of the higher capital cost, and in 1927–28, in particular, on account of the need of purchasing steam-generated power to supply the demand during a period of exceptional drought.

The decided drop in capital cost per kilowatt in 1929–30 is due to the fact that Waikaremoana power-station came into operation. The cost here was less than at Mangahao, but the main reason for the drop in the curve is that now the power-station capacity has been increased without any appreciable addition to the transmission and substation costs.

Growth on the system will show an improving position, mainly on account of the growth of load possible without very expensive additions to the substation and transmission costs. Power-house extensions will be cheaper than the original, but much less markedly than would apply at Arapuni.

Professor P. G. Hornell has been requested to make a separate report on possible methods of developing the further stages at Waikaremoana, which presents some peculiar geological features.

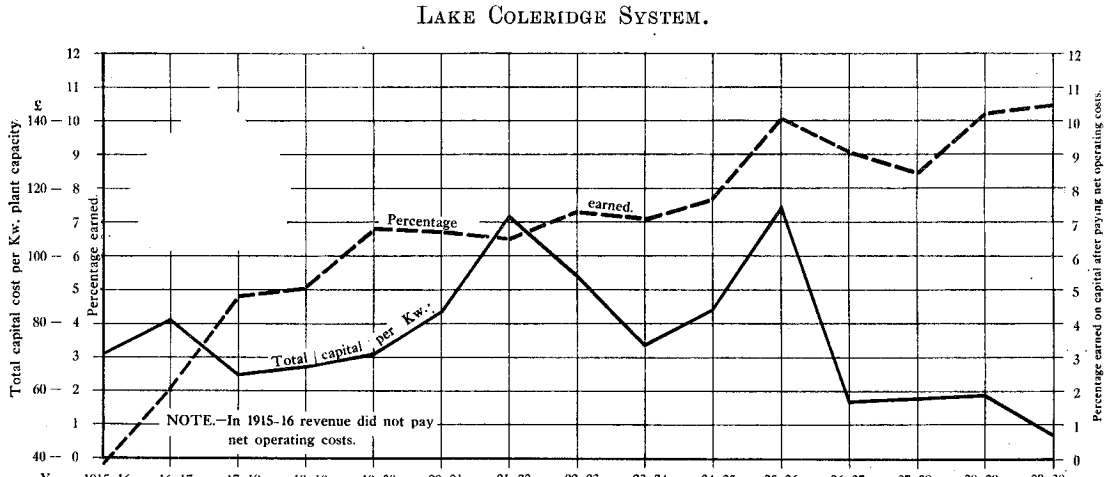
Lake Coleridge.

	£
Capital investment at end of year	1,622,199
Revenue	196,648
Operating-expenses	36,808
Balance	£159,840

The balance has been used in payment of interest, £15,315 to the depreciation fund, £23,783 to the sinking fund, and £44,388 to general reserve. This scheme has now paid off all arrears of depreciation and sinking fund, and for the first time established a general reserve fund. It now has a credit of £188,294 in depreciation funds, £144,557 in sinking fund, and £44,388 in general reserve accounts.

There has not been a great deal of construction work on this scheme, the main items being on lines and substation extensions in anticipation of interconnection with the Waitaki power plant.

Lake Coleridge System.



This graph has no particular points of interest, except that it shows the very low percentage earned in the earlier years, and also that, although there have been very considerable increases in total capital in recent years, these increases have only tended to reduce the percentage earned for a brief period.

It is regretted, however, that owing to the phenomenally low rainfall experienced in the watershed supplying the Lake Coleridge station, there is at the moment of writing a shortage of power in the area served. The Department is doing everything possible to minimize the inconvenience caused thereby. The scheme relies on heavy rains and melting snow in the spring months to replenish the storage used up during the summer and winter months. These rains, which in the main come from

the west, have not been available this year. Rainfall records are taken in the Lake Coleridge catchment area at the power-station, the Lake Coleridge Homestead, Simois Creek, Harper River diversion, and Glenthorne Homestead, and for the six months March to August inclusive the average fall at these points has been: 1929, 24·74 in.; 1930, 7·73 in.

For the same periods records of the Harper River show this year an average of 166 cusecs has been taken from the river and none allowed to go to waste, whereas last year an average of 399 cusecs was taken from the river over the same period and an average of 69 cusecs allowed to go to waste.

Consequent on the low level reached, it has been necessary to ask consumers in the area of supply to economize in the use of power as far as possible. The work of diverting water from the Acheron River into the lake has also been undertaken to augment the supply available.

It is recognized that a critical period will be reached next winter in the area supplied from this station owing to the growth of the load becoming more than can be carried under conditions of low river flow. Investigations are now being made with a view of providing additional power until the Waitaki Station is able to supply, which it should be able to do in 1932.

Generally, the Department's aim is to earn just over 8 per cent. on the capital. This provides for interest, depreciation at the rate of 2 per cent., and sinking fund at the rate of 1 per cent.

The graphs, I think, indicate that in considering the operation of a business of this magnitude, we must not be influenced too much by temporary or local considerations, the effect of which soon becomes absorbed in the general average result.

The Government hydro-electric developments for the past few years have been costing large sums in an attempt to catch up with the ever-increasing demand. The development has been planned in a comprehensive way, so that future developments (and this includes transmission and substations) should not be more expensive, and will almost certainly be less expensive per kilowatt than what has been done. Even with the limited loads of the past, reasonable percentages have been paid on the investment, and, even with prospective temporary increases in cost such as at Arapuni, there is little doubt that the developments will soon be in a position to earn at least 8 per cent. on the average.

The recent failure of supply from Arapuni and the shortage from Lake Coleridge stations have drawn pointed attention to the necessity that exists for adequate standby plants being available.

The complete reliance upon generation by hydro operation, even if supported by expensive interconnection, is unwarranted, and must, in fairness to the supply authorities, be supplemented by suitably located steam plants. This important matter is receiving detailed attention.

Waitaki.

Work on this new scheme to augment the supply to Canterbury and North Otago has been pushed on energetically throughout the year. All the main items of plant for the power-station have been delivered shortly after the end of the financial year, and a commencement has been made with their installation in the power-station. A section of the main dam to above water-level has been completed in the centre of the river, and concrete is being placed in the main coffer-dam on the Canterbury side. The erection of the main transmission-line to connect with the main lines between Coleridge and Oamaru is well in hand.

Interconnection with Waipori.

During the year negotiations were continued between the Department and the Dunedin City Council with a view to the purchase by the Department of the city power plant at Waipori. It was not possible, however, for the two parties to come to a settlement, particularly as to the price that was to be paid by the city for its power after the works were taken over by the Government.

Meanwhile work has been proceeding on the big dam which the city is building on the Waipori River, and as a large expenditure has now been incurred on this work, some of the advantages of control by the Department have ceased to exist. Negotiations are proceeding with a view to the city purchasing part of its power from the Department in lieu of proceeding with two smaller developments lower down the Waipori River.

Electrical Supply Authorities Activities.

The Department, being a wholesale supplier of electricity, depends on Power Boards and other electric-supply authorities to undertake the retail distribution side of the business. All electric-supply authorities operate under licenses issued pursuant to the provisions of the Public Works Act and subject to regulations made under that Act. This enables the Department to exercise a measure of control over them, which, however, is more in the nature of co-operation and assistance than of restriction.

The capital invested in the Government supply schemes is £9,205,885 (of which £8,856,387 was in operation at 31st March, 1930), and the capital invested by the associated electric-supply authorities buying electricity from the Department is £12,337,647. In addition to the above amounts, there is a sum of £6,467,111 invested by electric-supply authorities possessing their own generating-stations and electric lines isolated from Government supplies. The total sum invested in the electric-supply business at the end of the present financial year was £28,010,643, and the total revenue received for the year £4,214,987. After paying working-costs (£1,871,670) and capital charges (£1,578,823), the net profit for the whole Dominion was £764,494, which indicates that the electric-supply business as a whole is in a healthy condition.

At the present time there are ninety-eight electric-supply authorities in the Dominion, and, of these, seventy-seven showed net profits aggregating £841,410, whilst twenty-one showed losses aggregating £76,916 for the year under review.

There are forty Electric-power Boards actively engaged in the electric-supply business, and twenty-six of these are bulk supply customers of the Government. Rates totalling £6,964 were collected in the case of three Boards taking Government supply, whereas a sum of £89,393 was collected in the case of five Boards in the other category.

The statistical data relative to each electric-supply authority will be found in the series of tables accompanying the report of the Chief Electrical Engineer.

Irrigation and Water-supply.

The policy of irrigating semi-arid lands in Central Otago, which was commenced over twenty years ago, has made progress as indicated in the diagram on page xxi.

The benefits of irrigation to the community at large are undoubted, though it is difficult to obtain from individual irrigators the exact alteration of their finance that it has caused, there being so many other causes which affect the earnings of people engaged in farming pursuits, but the increased output of wool, fat sheep, dairy produce, &c., which has taken place from the district in the last few years is very gratifying, and must have reflected both directly and indirectly not only on the actual farms producing, but also on the towns of Central Otago, the City of Dunedin, and the Dominion as a whole.

I intend to have surveys and investigations pushed on more vigorously than has been the case in the past, in order that greater areas may be served and further subdivision of existing holdings brought about.

It is realized that irrigation farming is a special branch, and that men successful in wet districts would not necessarily succeed in irrigated lands. Therefore, it has been the policy in the past to develop irrigated lands at about the rate at which they can be profitably brought into intensive production by settlers accustomed to Central Otago conditions. I am of the opinion, however, that the time is approaching when it will be necessary to proceed more vigorously, and to draft into

this district persons skilled in farming and anxious for an opportunity to get on to land of their own. I am confident that with due care in the selection of these men the percentage of failures will be small and possibly complete success may be achieved.

EXPENDITURE.

The total net expenditure under all votes and accounts appearing on the public-works estimates for the financial year ended 31st March, 1930, was £8,258,686. Of this sum £4,704,673 was expended out of General Purposes Account, and the balance, £3,554,013, out of special accounts.

A brief summary of this expenditure, as well as the total expenditure since the inception of the public-works policy to the 31st March last, follows in tabular form :—

Class of Work.	Expenditure for Year ended 31st March, 1930.	Total Expenditure to 31st March, 1930.
	£	£
Railways—		
New construction	1,452,860	37,618,009
Additions to open lines	359,661	16,363,301
Payment to Midland Railway bondholders	..	150,000
Roads	1,060,908	18,859,767*
Public buildings	347,636	10,696,215
Immigration	41,756	3,276,305
Purchase of Native lands	..	2,061,147
Lighthouses, harbour-works, and harbour defences	15,196	1,280,972
Tourist and health resorts	20,547	518,914
Telegraph extension	594,383	10,510,744
Development of mining	..	881,325
Defence works (general)	46,766	1,393,361
Departmental	132,783	2,625,431
Irrigation and water-supply	69,657	906,129
Lands-improvement	79,454	591,722
Minor works and services	..	312,607
Plant, material, and stores	*Cr.* 31,813	319,621
Quarries (acquisition and operating)	329	5,418
Timber-supply and sawmills for Public Works Department	*Cr.* 3,608	*Cr.* 3,218
Motor-transport services	..	33,635
Cost and discount, raising loans, &c.	518,158	3,549,209
Total General Purposes Account	4,704,673†	111,950,614†
Aid to Water-power Works and Electric Supply Account	689,810‡	9,085,720‖
Waihou and Ohinemuri Rivers Improvement Account	27,361‡	687,660‡
Total Public Works Fund	5,421,844	121,723,994
Wellington–Hutt Railway, &c.—		
Railway	..	228,374
Road	..	101,658
Railways Improvement Account	..	641,275
Railways Improvement Authorization Act 1914 Account	1,227,019§	7,709,304§
Loans to Local Bodies Account—Roads to open up Crown lands	..	697,408
Opening up Crown Lands for Settlement Account—Roads to open up Crown lands	..	206,626
Lands for Settlement Account—Roads to open up Crown lands	..	590,025
National Endowment Account	..	53,401
Education Loans Account	428,764§	4,186,990
Main Highways Account—Construction Fund	1,097,148	3,779,072
Hauraki Plains Settlement Account	25,770	486,035
Rangitaiki Land Drainage Account	5,171	768,256
Swamp Land Drainage Account	52,970	492,305
	8,258,686	141,664,723

* Includes £4,500 expended under section 16, subsection (1), Native Land Amendment and Native Land Claims Adjustment Act, 1923. † Does not include expenditure under the Ellesmere Land Drainage Act, 1905. ‡ Excludes interest during construction and loan charges. § Includes proportionate cost of loan raised under these accounts. ‖ Includes total expenditure under votes only for construction and maintenance—for commercial accounts see Table 6 *infra*.

WAYS AND MEANS.

	£
On the 1st April, 1929, the available ways and means for public-works purposes were	3,889,083
Additional funds were received as follows :—	
(*a*) Under Finance Act, 1927, section 2 (public works)	729,036
(*b*) Under Finance Act, 1928, section 2 (public works)	583,229
(*c*) Recoveries on account of expenditure of previous years ..	62,859
(*d*) Ellesmere and Forsyth Reclamation and Akaroa Railway Trust Account receipts	1,612
	£5,265,819

	£
The net expenditure on works and services against the General Purposes Account for the year was—	
(*a*) Under appropriations	4,386,515
(*b*) Under Lake Ellesmere Land Drainage Act, 1905	439
(*c*) Under Lake Ellesmere and Akaroa Railway Trust Account ..	82
(*d*) Charges and expenses of raising loans	518,158
(*e*) Under Finance Act, 1929, section 32	12,500
Making a total of	£4,917,694

	£
This left a credit balance in the account for general purposes at 31st March, 1930, of	£348,125

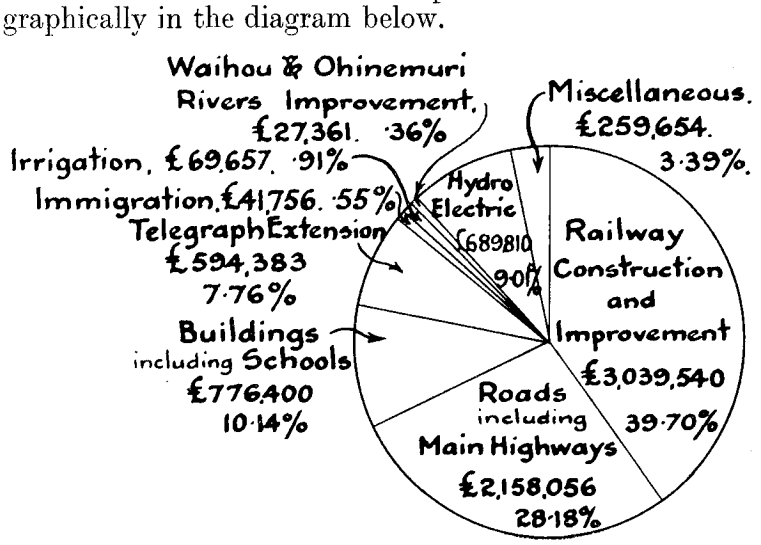
The estimated expenditure under the account for the current financial year is £5,242,815, and arrangements are being made with the Minister of Finance to provide the necessary funds.

The gross cash expenditure on works and services under the direct supervision or control of the Public Works Department itself was £7,781,734. This includes expenditure from the Public Works Fund, Consolidated Fund, Main Highways Account, Electric Supply Account, Railways Improvement Account, and various other accounts.

The Department also collected in cash a total of £628,951 as revenue from electric-supply and irrigation undertakings. The total, therefore, of gross cash expenditure and revenue for the year was £8,410,685. This figure is exclusive of interest and loan charges, credits-in-aid for works of various kinds, and sundry relatively petty items of revenue, and gives some indication of the volume of work handled by the Departments' staff.

RATIO OF EXPENDITURE, 1929–30.

The ratio which the various classes of expenditure on works bear to the whole are indicated graphically in the diagram below.



Establishment.

It will, of course, be apparent that ordinary commercial standards are scarcely applicable to a Department that apart from its commercial branches, Hydro-Electric Supply and Irrigation, has only one side to its ledger—that is, which spends a large annual sum, but does not have revenue. The first and greatest consideration is the community value of the work performed, and the second is the standard of efficiency that is maintained by those responsible to the Government. In this connection I desire to draw the attention of honourable members to the table given below, which sets out a comparison of the strength of the establishment in 1920 and in 1930. A perusal of these figures will show that, while the number of men employed has been increased from 4,691 in 1920 to 12,978 in 1930 and the amount expended from £1,928,000 to £7,781,000, the staff has, in regard to the engineering and clerical branches, increased by only 100 per cent., and in other branches by a lesser figure. In some respects I am convinced that the staff is inadequate when it is remembered that to the 12,978 men employed on standard works there has to be added about 5,000 relief workers. The employment of all this extra labour has undoubtedly placed a strain upon the officers concerned, and one which cannot be maintained indefinitely if it is found necessary to keep the number of workmen up to the figure indicated.

Schedule showing Strength of Establishment, etc., in 1920 and 1930.

Classified Staff.	1920. Number employed.	1920. Number of Men per Officer.	1920. Amount spent per Officer.	1930. Number employed.	1930. Number of Men per Officer.	1930. Amount spent per Officer.	Percentage Increase in Staff.
			£			£	
Engineers and Engineering Cadets	111	42	15,949	221	59	33,081	100
Clerical Staff	132	35	13,411	267	49	27,380	102
Stores Staff	53	88	33,403	104	125	70,297	96
Overseers and Inspectors	118	40	15,003	176	74	41,538	49
Draughtsmen ..	72	65	24,588	139	93	52,596	93
Workmen	4,691	..	..	12,978	..	..	..
	Expenditure, £1,928,000			Expenditure, £7,781,000			

(Workers nearly trebled; money spent, quadrupled.)

Note.—Numbers of men only include the *direct* employees.

It is with sincere regret that I have to record that the following officers of the Department died during the year. Mr. J. B. Robertson, Senior Draughtsman, Head Office, after a fortnight's absence from duty, and Mr. J. C. Buchanan, Water-race Manager, Otago Central, after an illness of one week.

The only officer retired on superannuation was Mr. G. Halliday, Land Purchase Officer, after forty years' service with the Government.

As appendices to this Statement honourable members will find full details of the principal works carried out by the Department in the reports of the Engineer-in-Chief, Government Architect, Chief Electrical Engineer, and Main Highways Board respectively.

The following are the details of the works in progress:—

RAILWAY-CONSTRUCTION.

The net expenditure as shown on graph was £3,039,540, being £184,354 less than that of the previous year, and is the second highest on record. The total length of all lines under construction over which goods and passenger traffic has been run during the year is 83½ miles, and these services have been well maintained.

The work for the year on the several lines in course of construction is fully set out in the Engineer-in-Chief's report, and may be summarized as follows :—

North Auckland Main Trunk Railway.—The construction of this line was confined to the Rangiahua Section between 24½ and 38½ mile pegs. During the year great difficulty has been experienced in consolidating this length. The country has proved to be extremely unstable, and in eight places the line had to be moved to more solid ground, the total length of these deviations being 3¾ miles. The buildings at Waihou Station-yard have been completed, and those at Rangiahua Station-yard are nearing completion. Platelaying has been completed on the deviations above referred to, and also to the 34½ mile peg. The line is now being ballasted.

The ballast has been obtained from the quarry at Okaihau, the output for the year being 19,279 cubic yards of metal and 2,083 cubic yards of spalls.

It is anticipated that all formation should be done by summer and the rails laid to the railhead at Rangiahua. The ballasting will then be pushed ahead as quickly as possible.

Dargaville Branch Railway.—During the year construction work on this line has progressed steadily. The earthworks have been generally of an easy nature, except between 13 and 14 mile pegs, where a flat terrace with an average cut of 13 ft. has given trouble. The country at this point is blue pug, and the steam-shovel has made slow progress. With the exception of this cutting and the bridge approaches, formation has been completed to 15 mile peg. Three steam-shovels have been working continuously during the year.

Four bridges totalling 540 lineal feet have been completed and two others are in hand. Difficulty was experienced in reaching firm foundations for the piles at 7 mile, the piles ranging from 90 ft. to 120 ft. in length. The platelaying of permanent track has been extended for a further 5½ miles during the year.

The station-yard at Tangowahine has been completed. A start has been made on the Tangowahine Bridge, and when this is erected platelaying can proceed uninterruptedly into Dargaville. It is expected that by the end of summer the first lift of ballast will be right through and the whole line should be completed in about fifteen months' time.

Auckland–Westfield Deviation.—This double-track deviation, a distance of 8 miles 70 chains, has been completed, and is now under the direct supervision and maintenance of the Railways Department. This line was opened for goods traffic on the 1st September, 1929, and the Railways Department has operated on schedule time-table.

Gisborne–Napier Railway.—Wharerata Section: This section is near the Gisborne or northern end, and is 9 miles 18 chains in length. The work done during the year has been of a preliminary nature, and consisted of placing culverts, formation of access roads, water-drives, and erection of workers' accommodation. Huts have been erected to house ninety-three married men and 294 single men. The earthworks at this end are unusually heavy, and access is difficult. It is anticipated that the ensuing year will see formation work nearing completion, and an extensive tunnelling programme in operation.

The Kopuawhara Section commences at Waikokopu and runs northwards, and is 10 miles 72 chains long. The Opoutama–Gisborne Road has been re-formed and metalled to enable railway material to be carted. The formation on this section is in hand, co-operative contracts having been let in sections over the whole length. Borings at three bridge-sites have been taken, and 181 chains of permanent fencing has been erected. Workmen's accommodation has also been erected.

Putorino Section: The section between Tatara and Putorino has been completed, and goods and stock traffic has been carried daily between Eskdale and Putorino, a distance of 26 miles 59 chains, for practically the whole of the year and has been of great benefit to the district. This section will be handed over to the Railways Department at an early date.

On the Wairoa Section the work has been pushed ahead vigorously. Several steam-shovels have been working, all formation is nearing completion, and a considerable length is ready for platelaying. This will enable the transport of steelwork for the several bridges to be railed to the various sites, and thus save heavy road-transport charges.

The Wairoa River Bridge has been erected after encountering numerous difficulties and losses by floods. The bridge is a very fine structure, consisting of four 105 ft. steel spans supported on cylinder piers.

Test piles have been driven at the Mohaka Viaduct site and a start has been made on the temporary staging-work for the concrete caissons for the four river-piers. Material and plant are being carted to the site.

A large party has been working three shifts on the north end of the Kotemaori Tunnel, and good progress has been made. The heading has advanced 11 chains and 10 chains lined.

At the south end, working three shifts, 14 chains of heading has been driven.

A start will shortly be made to lay the permanent rails from Waikare Viaduct to the south end of Kotemaori Tunnel, approximately 4 miles.

The Waikare Viaduct has been completed. It consists of five 50 ft., one 65 ft., and three 100 ft. spans on steel trestles with concrete abutments, a total length of 615 ft., and the rail-level is 250 ft. above the river-bed.

The Maungaturanga Viaduct is now in hand. With the present rate of progress Kotemaori Tunnel should be almost complete, the Maungaturanga Viaduct steelwork well in hand, and the northern railhead extended to this point, a distance of 14 miles, in about twelve months' time. It is anticipated that the whole line to Wairoa, including the Mohaka Viaduct, will be completed in about two and a half years' time.

Stratford–Main Trunk Railway.—On the eastern end the daily goods and passenger service has been operated between Ohura and Okahukura, a distance of 19 miles. On the Tokirima Section four tunnels have been proceeding. Tunnel No. 3 has practically been completed, and is 466 yards in length. Tunnel No. 4 is 61 yards long. The bottom heading is through and enlarging is in hand. Tunnel No. 5 is 727 yards long, and is proceeding satisfactorily, the two headings being about 2 chains apart. Tunnel No. 6 is 585 yards long, and activities on this work are steadily increasing. The bottom heading is being driven from both ends, being 9 chains apart. The earthworks and bridges are well in hand. On the Heao Section the work is very heavy. There are three tunnels in hand and work is progressing satisfactorily.

On the western end of the line the permanent-way was laid to Tangarakau to enable coal traffic to be carried and a tri-weekly service has been operated to Tahora. The bridge over Tangarakau River, consisting of 25 ft., 30 ft., 60 ft., 80 ft., and 60 ft. girder spans is in hand. On the Heao Section there are three tunnels in progress, but work is hampered through difficulties in transporting material.

Wellington–Tawa Flat Deviation.—Work has been continued on the sea-wall and 8 chains has been completed. The embankment at Kaiwarra was completed for a distance of 13 chains. In No. 1 Tunnel 100 ft. of heading was driven, thus completing the heading right through. On the southern end 21 chains and on the northern end 19 chains of concreting has been completed, leaving 21 chains to be done to complete the tunnel. The heading of No. 2 Tunnel has been driven 47 chains at the south end and 1 mile 17 chains at the north end, leaving 69 chains to complete. Wet conditions have caused much delay with this tunnel.

Midland Railway.—The formation of this railway is in hand from Gowan Station towards Murchison, and the earthworks are proceeding satisfactorily over a distance of 9 miles. There are several very heavy cuttings in hand. One is being worked with a steam-shovel (double shifts), and night shifts are being worked on two other heavy jobs. Workers' accommodation, consisting of seventeen single men's huts and twelve married men's huts, have been erected. A large

housing scheme is proceeding to provide additional 170 single men's huts and thirty-nine married men's quarters. The permanent-line survey has been completed, and plans have been prepared for the whole of the section.

Westport–Inangahua Railway.—The formation is progressing satisfactorily, but work has been retarded owing to heavy rainfall experienced during the year, and the transfer of men to repair the earthquake damage to the main highway. On the Hawk's Crag Section numerous culverts and bridges are under construction. The approaches to No. 1 Tunnel are nearly completed and a co-operative contract has been let for driving the heading in No. 2 Tunnel. On the Orikaka Section (9 miles 34 chains in length) the permanent-line survey has been completed, and the final plans are approved. Bushfelling and clearing has been carried out over 6 miles 31 chains, and about 100 men are on formation work.

South Island Main Trunk Railway.—The formation on Kekerangu Section at the northern end has been continued during the year, and parties are at work installing culverts, forming road-deviations, and erecting temporary bridges. Platelaying has been extended from Kekerangu for a distance of 4 miles 37 chains. Parties are also at work on the Shades and Clarence River sections. The work is progressing satisfactorily.

At the southern end formation has been completed for a total length of 68·36 chains, and culverts placed. Several side drains, water-drives and creek-diversions have been completed. Workers' accommodation has received attention, and huts, &c., have been erected.

RAILWAYS.

Additions to Open Lines.

The net expenditure out of the Public Works Fund for the year ended 31st March, 1930, amounted to £388,739 7s. 6d. This sum represents the provision of new rolling-stock and motor-vehicles, improvements and additions to station buildings, extension of sidings, grade easements, and other facilities.

Railways Improvement Authorization Act, 1914.

The expenditure under the Railways Improvement Authorization Act, 1914, amounted to £1,227,019, including the sum of £91,039, proportion of cost of raising loan. The works included in this expenditure were new stations and improved approach lines at Auckland and Wellington; duplication of lines Horotiu–Frankton and Penrose–Papakura; grade-easement, Mercer–Frankton; provision of signalling, interlocking, and safety appliances, electric lighting, and bridge-strengthening. In addition to these works, the Public Works Department has proceeded with the Wellington – Tawa Flat Deviation.

RIVER-IMPROVEMENTS AND LAND-PROTECTION WORKS.

Waihou and Ohinemuri Rivers.—The work carried out during the year comprised the strengthening of the stop-banks on the Upper Waihou River, and raising the stop-bank in the Lower Waihou River for a distance of 13 chains to final level. The small drag-line excavator has been used on improving internal drains. The main drains in the Kaimanawa Drainage District have been reconditioned, and the drains in the Rotokohu Drainage District are receiving attention.

Taieri River.—The main canal from the new pumping-station was completed, and this scheme of protection-works is now complete, and ready to be handed over to the Taieri River Trust for maintenance.

HARBOURS.

During the year Westport, in common with other ports on the Coast, has experienced considerable shoaling on the bar, partly caused by the long spell of dry weather in the latter portion of the year and partly by the gradual seaward advance of the foreshore.

A vigorous policy of dredging has been maintained, and, in addition, the training-walls are being extended into deeper water, the dredging of the berthages and swinging-area is being continued, and the dredge "Maui," which was found after extensive trial to be suitable for the port, has been purchased.

The position at Karamea is not as satisfactory as I would wish, the earthquake damaged the training-wall and the wharves very considerably and caused extensive slips in the upper reaches of the river. These slips provided enormous quantities of debris which was carried down the river during the heavy floods at the end of December, and, lodging in the lower four miles of the river, have raised the bed very considerably. This fact, combined with the sinking of the land immediately surrounding Karamea, has created a situation in which it is somewhat difficult to forecast the effect of a heavy flood. Suitable precautionary measures have been taken in this connection.

The repair and renewal in stone of the training-wall is now proceeding satisfactorily, but the re-erection of the wharf has been held over pending the result of the spring floods and the effect on the navigable channel.

The contractor for the Waikokopu Breakwater has made fair progress with his work, but has had difficulties to contend with which have considerably delayed the work; the portion already completed shows excellent results, and there is no doubt that the completion of the work will render the port much more attractive to coastal shipping.

Various other works in the form of wharves and other harbour-improvements have been carried out, and have assisted to improve transport conditions in many of the smaller communities.

LIGHTHOUSES.

The policy of gradually increasing and improving the aids to navigation round the New Zealand coasts, both with regard to efficiency and economy, has been steadily pursued.

The principal feature has been the installation during the year of a new high-powered automatic revolving light at Cape Egmont in place of the existing fixed light. The fixed light has in these days of electric light and motor headlights become obsolete, as it is somewhat difficult for a shipmaster approaching populous localities to be sure that he is not confusing the beam from the lighthouse with some other bright light in the near locality. By adopting a revolving lens, with its consequent flashing character, this difficulty is overcome.

The entrance to Tory Channel has been well marked by the provision of an automatic light on the West Head and the old oil-burning leading lights themselves have been replaced by automatic acetylene lights with a flashing characteristic.

At Jack's Point a new flashing acetylene light and lens have been provided in place of the original occulting light.

The Kahurangi Lighthouse was considerably damaged by the earthquake in June last, and a new lens has been ordered and additional cast-iron segments for the repair of the tower have been delivered. In the meantime a temporary light has been maintained.

IRRIGATION AND WATER-SUPPLY.

During the year the existing irrigation schemes were maintained in good order.

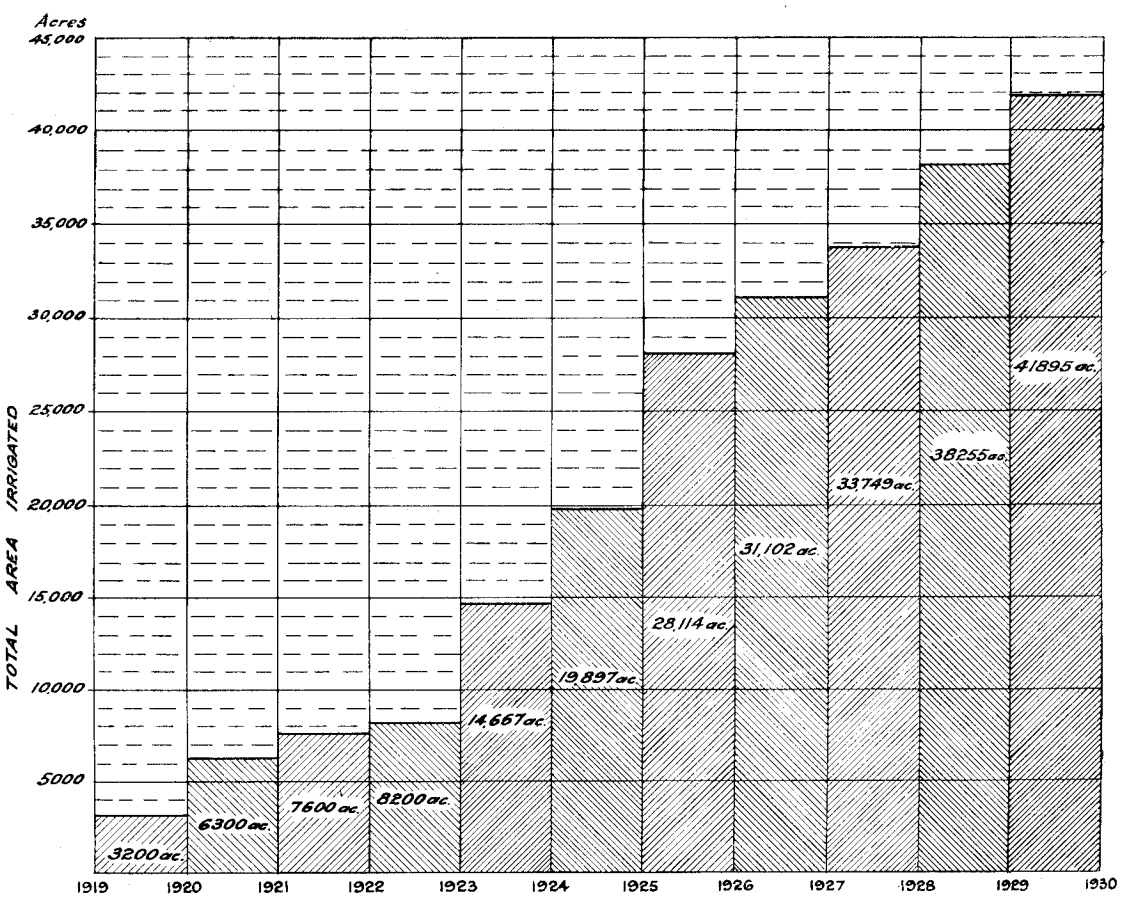
The following schemes are now on a trading basis: Ardgour, Bengerburn, Earnscleugh, Galloway, Ida Valley, Last Chance, Manuherikia, Tarras, and Teviot. The profit for the year was £3,828, an increase of £1,201 on the previous year.

The total area irrigated under all Government schemes was 41,895 acres, the number of irrigators being 395.

The Arrow River scheme is nearing completion, and will be ready for operation next season.

The Poolburn Dam is being erected to supplement the water-supply to the Ida Valley scheme where it was necessary to temporarily reduce the settlers' supplies last season.

A small extension has been put in to serve the Teviot settlers.



The above graph shows the growth of irrigation under Government schemes for the last ten years.

ROAD-CONSTRUCTION.

The past financial year saw a very extensive roading programme undertaken, with the result that the expenditure on the various types of roadwork was particularly heavy, a total sum of £2,158,056 having been expended on the construction of roads and main highways, as against £1,770,073 for the preceding year. Roads other than main highways accounted for £1,060,908 of this sum, and main highways £1,097,148, compared with £833,577 and £936,496 for 1928–29.

It will be seen that a very considerable increase took place in the expenditure, and, in explanation of this, I wish to point out that it was accounted for largely by the provision that had to be made to meet the unemployed situation. A large number of men were engaged throughout the year on relief works on roads in various parts of the Dominion.

In addition to the construction of new roads the services of unemployed were utilized in widening and improving alignments and grades on many of the more important roads, and a great deal of very satisfactory work of this nature was completed.

Many of the poorer-class roads were improved to such an extent that they are now in a condition to receive metal, and metalling may be proceeded with immediately the necessary funds can be made available. It will be essential, of course, for the local bodies to finance a portion of the cost of metalling.

When the estimates were in course of preparation last year it was decided to amend the system of automatically allocating the funds under the "Roads" vote. The proposed amendments were explained in detail in my predecessor's last statement, and the amended system proved very satisfactory, having met the requirements of the districts generally in a better manner than had been the case previously.

It was anticipated that some of those districts, whose quotas had been reduced as a result of the alterations which were made, would experience a certain amount of difficulty for the first year, and this was the case. In most instances, however, the position has righted itself, and there should not be any further difficulty in this respect.

The experience gained from the year's operation has been sufficiently satisfactory to entirely warrant a continuation with the amended system.

Last year the vote for "Roads to give access to outlying districts" was increased by £20,000, and this enabled many more of the backblock settlers to be given road access to their properties. It was well known that many of these settlers had been handicapped with their improvements for the want of reasonable access, and the allocation of a substantial sum for this purpose has undoubtedly met a long-felt want.

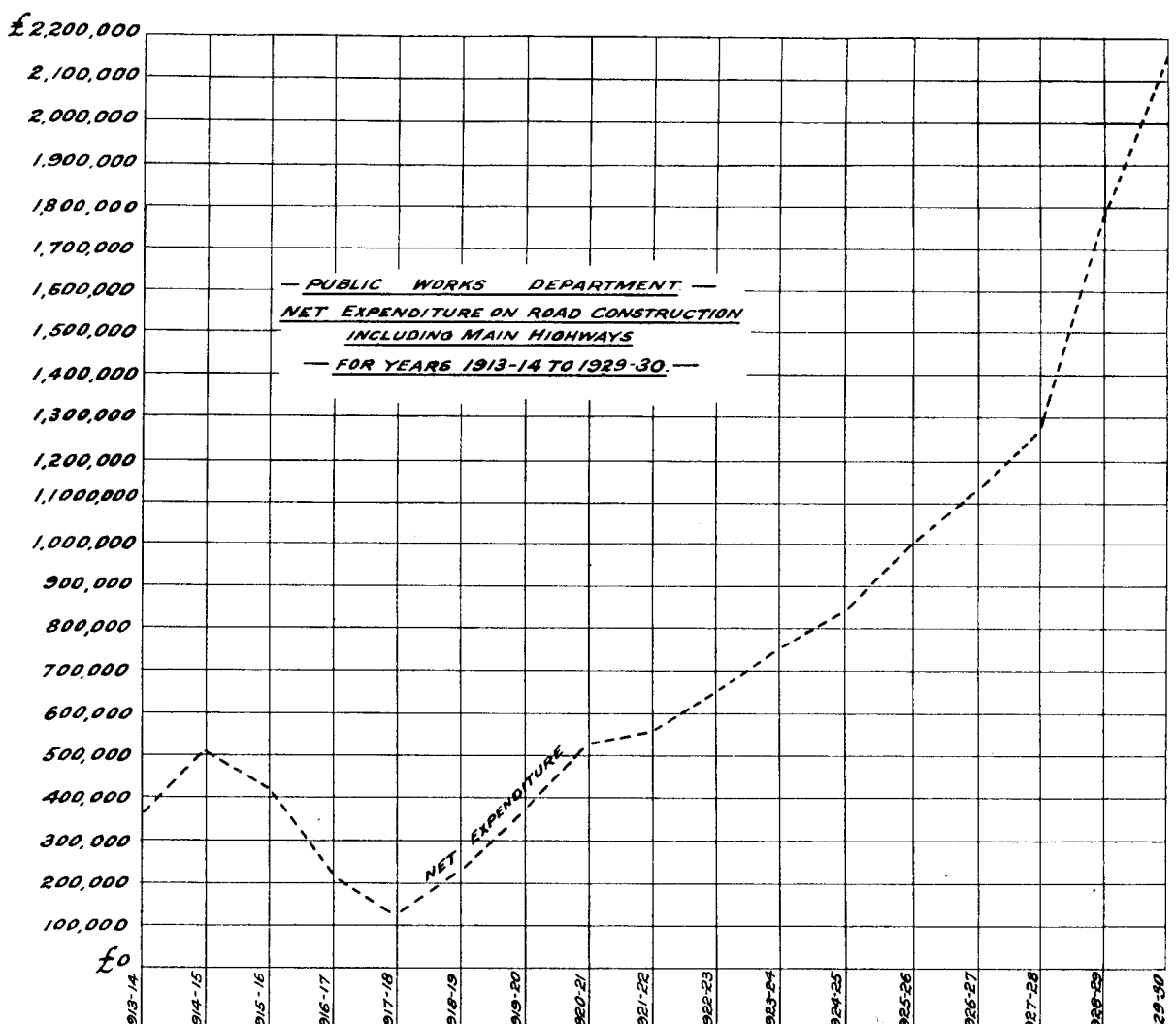
This year I propose asking Parliament to again increase this particular vote, with a view to continuing with the work to an even greater extent.

The disastrous earthquake which occurred in Marlborough, Nelson, and West Coast districts in June last year caused very extensive damage to roads and bridges throughout those districts. Temporary measures were adopted immediately to permit of those people who were isolated being relieved, and, as soon as possible, allowing in the first instance for the opening-up of track access in cases where the roads were blocked or destroyed, a commencement was made on the restoration of the most important roads and bridges. Large gangs of men were engaged, and the work was pushed ahead as expeditiously as possible. Public satisfaction resulted from work being completed more quickly than had been anticipated. As the important roads were finished, attention was directed to the side roads.

A great deal of the restoration work, as was to be expected, was expensive, as not only were the roads in many cases completely destroyed, but the country was so badly shaken and shattered that it was extremely difficult to carry out reconstruction.

With regard to maintenance work, although the expenditure on the renewal of bridges was slightly less than the previous year, a considerable amount of assistance was granted to local bodies towards replacing worn-out and obsolete structures.

The expenditure on the restoration of flood damage also showed a decline on the previous year, no very disastrous floods having occurred during the year.



PUBLIC BUILDINGS.

Dunedin New Post-office Building.

Reference is made later in this report to various public buildings under construction. Of special interest and importance among these is the new post-office building proposed for Dunedin, the need for which has been felt for many years, and is now urgent. Extensive work has already been carried out on the foundations, which, owing to the size of the proposed structure and the softness of the ground, is a very heavy and expensive work. It has involved the driving of 1,800 piles, the placing of 255 tons of steel work and 3,350 cubic yards of concrete. The foundations are now well advanced, and expedition is being extended by the Department to the preparation of working plans and specifications, which I anticipate will be in readiness before the end of the present year, when it is proposed to recommend that tenders be called forthwith for the construction of the building. The structure will be a nine-storied reinforced-concrete one, and when completed will be the largest and most up-to-date post-office building in the Dominion. Its erection will occupy three years, and during that time will employ a considerable number of tradesmen and others.

General Departmental Buildings.

The Department in co-operation with the Wellington City Council has taken land at the corner of Bowen Street and Lambton Quay for the site and grounds for the War Memorial which is now being erected, and for a road deviation which will greatly improve the traffic facilities in this locality and the appearance of the approach to Parliament Buildings.

At Wellington a shelter shed has been erected to accommodate two cars for the District Office, Public Works Department, and accommodation for storage provided for the Scientific and Industrial Research Department.

At Hamilton a double garage was erected at Public Works Office for departmental cars.

At Rotorua an additional room was erected in the departmental buildings for an office for the Assistant Instructor in Tobacco-culture.

At Christchurch a new septic tank and necessary drains have been installed at the Magnetic Observatory.

A strong-room was erected for the Valuation Department in the Invercargill departmental buildings.

The total net expenditure under the vote is £28,748, which includes compensation for land taken.

Courthouses.

New Courthouses have been erected at Maungaturoto, Papakura, Patea, and Upper Hutt. A substantial building is in course of erection at Hamilton to accommodate Supreme Court and Magistrate's Court, Library and offices, and will be ready for occupation at an early date. Repairs and renovations have been carried out to a number of Courthouses in the Dominion. The capital expenditure last year on Courthouses was £15,765.

Prison Buildings and Works.

The actual net cash expenditure from the Public Works Fund on prison buildings and works for the year ended 31st March, 1930, was £18,814, as compared with £12,572 for the previous year. Included in last year's expenditure was an adjustment with the Lands for Settlement Account of £10,625, representing payment for farming areas acquired for prison purposes at Paparua (Templeton) in previous years. The actual expenditure for comparative purposes was thus £8,189, which is the lowest capital expenditure on prison buildings and works for many years past. This is in conformity with the indication given last year that a halt would be made in respect of the construction of additional large buildings for prison accommodation. Except for certain extensions, and the construction of workshops for vocational training and industrial purposes at the Invercargill Borstal Institution, it is

anticipated that requirements, at any rate for some few years to come, will be confined to the construction of huts and smaller movable buildings as may be required for the establishment of farm colonies and camps.

Summarized hereunder is a statement of the classes of work on which expenditure was made last year :—

	£
Erection and extensions of prison buildings	1,791
Water-supply and sanitary drainage	612
Erection of cottages and officers' quarters	2,460
Formation of access road	747
Purchase of farm lands and erection of farm buildings	894
Estuary farm reclamation	1,399
Additions to quarry and laundry plants	302
	8,205
Transfer to Lands for Settlement Account for farming areas acquired in previous years	10,625
Total gross expenditure	£18,830

Estimated expenditure for the year ending 31st March, 1931, will, on account of the need for economy, be limited to the total sum of £13,500.

The following is a summary of the principal works involving expenditure from Public Works Fund that were carried out during the past year.

Expenditure at Auckland Prison was limited to a minor alteration to the quarry crusher plant towards the close of the year, the whole involving an expenditure of £145.

At the Waikeria Borstal Institution the installation of a sanitary drainage system was commenced, and nearly completed at the 31st March. This meets a long-felt requirement from a hygienic point of view.

At the Rangipo Prison Camp a building was erected to provide an association room for inmates and drying facilities for prisoners' clothing.

Work at the Wi Tako Prison was confined to the erection of a wool-shed from a dismantled building from the recently demolished Terrace Prison. Progress has also been made in connection with the installation of a high-pressure water-supply for the institution.

In Wellington the end of the year saw the erection of seven officers' cottages at Mount Crawford nearly completed, one of these cottages being secured from the Wellington Education Board, and re-erected at a total cost of £200. Other work at Mount Crawford included the completion of the formation of the road access to the prison. This road, being of an easy gradient and a more direct route, will result in a considerable economy in transport costs.

The new Wellington Prison is now almost finished, and besides embodying up-to-date ideas for lighting, sanitation, and arrangements for the general welfare of the inmates, as a trial and remand prison it has special facilities for the classification of prisoners on modern lines.

Work at the Paparua Prison was confined to certain additions to the quarry plant, the completion of the exercise yards, and to the renovation of farm buildings recently acquired with an additional area of land purchased for farming purposes.

At the Invercargill Borstal Institution the only major work was the estuary land reclamation. The dredging-work is now practically completed, and the reclamation will involve a minimum of cash expenditure in future, the work being confined mainly to inmates' labour after a main access road on to the farm has been metalled, and to the maintenance of the protective works which is likely to be an increasing quantity as the fascine work decays or is displaced by storms.

Police-stations.

The capital expenditure on police-stations for the year amounted to £8,442 out of an allocation of £10,000.

The additions to the Auckland Central Police-station were completed, a new police-station was erected at Eastbourne, additional office accommodation was provided at Stratford, and the purchase of the site and building used as a police-station at Ruatorea was finalized.

Contracts have been let for the erection of police-stations at Culverden, Cromwell, and Palmerston South to replace buildings which are beyond repair.

Post and Telegraph Buildings.

The erection of five post-office buildings was completed during the year, and additions and alterations were made to some eighteen existing buildings. Several large buildings, as well as additions, &c., of a major character, are under construction.

The earthquake of June destroyed the chief post-office building at Westport, a two-story brick structure, and also caused extensive damage to a number of the Department's buildings. The necessary repairs involved the expenditure of approximately £4,000. The greater portion of this amount was expended in the demolition of the ruins of the Westport Chief Post-office building; and the repair and strengthening of the clock-towers on the Greymouth and Nelson Chief Post-office buildings. The preparation of the plans of a new chief post-office building for Westport are sufficiently well advanced to anticipate an early commencement of this work.

At Napier the new chief post-office building has been completed and was opened on 28th July, 1930. The Right Hon. Sir Joseph Ward laid the foundation stone on the 9th May, 1929.

The construction of a new post-office building at Courtenay Place (Wellington) has been commenced. This building is due to be completed about June, 1931.

On the 6th March a fire, which originated in an adjoining building, destroyed the post-office building at Urenui. The matter of erecting a new building is now under action.

During the year buildings were erected as follows:—

Post-office buildings: Colville, Cust, Mercer, New Lynn, Northcote, Shirley.

Garages: Carterton, Cheviot, Hokitika, Martinborough, Woodville, Otahuhu, Otorohanga, Raglan, Waiau.

At Ohakune a garage and store, together with accommodation for "carrier current" telephone equipment, has been provided.

Increased or improved accommodation for departmental purposes has been provided at the following places: Cromwell, Dannevirke (accommodation for line staff), Geraldine (store), Hamilton (automatic telephone exchange), Hastings (store, &c.), Invercargill, Kilbirnie (Wellington), Kopaki, Matakana, Newmarket (Auckland) (workshops), New Plymouth (telephone exchange and money-order branch), Oturehua, Palmerston North (garage, &c.), Rotorua, Roxburgh (garage), Te Kuiti (garage), Tokaanu, Wairoa, Waitomo Caves, Waiuku (garage), Wellesley Street (Auckland) (parcels branch), Wellington (Public Service garage), Wellington South.

The following works are in progress: Blenheim—Garage and store; Christchurch—Alterations; Courtenay Place (Wellington)—New post-office building; Dunedin—Foundations for new chief post-office building; Greymouth—Addition and alterations; Kurow—New post-office building and separate residence for Postmaster; Masterton—Addition and alterations; Napier—New chief post-office building; Nelson—Addition and alterations; Newton—Addition and alterations; Whangarei—Addition and alterations.

The erection of new buildings at the following places has been authorized: Dunedin, Greymouth (garage and store), High Street (Christchurch), Hinds (residence for Postmaster), Mount Albert (Auckland), Palmerston (South), Petone, Taumarunui, Te Anga, Upper Symonds Street (Auckland), Waitara, Walton (garage, &c.), Westport.

An addition to the Kaikohe Post-office building has been authorized.

Land.—Areas of land were purchased for departmental purposes as follow: Birkenhead (central site for post-office building), Dannevirke (site for store and garage), Gisborne (site for store and garage), Hastings (site for store and garage), Rangiora (additional land for storage purposes), Lower Hutt (site for automatic-telephone exchange).

Action is being taken to acquire sites for post-office buildings at Te Anga and Thornbury, and a more suitable site at Ruatoria.

The net capital expenditure for the year amounted to £104,156.

Mental Hospitals.

Avondale: Additions and alterations to the laundry have been completed. Plans and specifications have been prepared for a new residence for the Medical Superintendent.

Puhitahi: The permanent water-supply was brought into service. The dining-room has been extended. The sites of the proposed kitchen block and two new villas have been excavated, and tenders have been called for the erection of the latter in brick and concrete.

Tokanui: Three villas for women patients were completed and a Nurses' Home in brick is being built.

Porirua: Extensive repairs and renovations were carried out during the year, and new fire-escapes were provided at the main building.

Nelson and Stoke: Earthquake-damage repairs were effected at Nelson and Stoke. Three new villas in brick and concrete are being erected at Stoke, and will be ready at an early date. York's farm was purchased. The permanent water-supply is now in hand.

Sunnyside: The new boiler-house was completed, and boilers were installed.

Templeton: Villa No. 3 to accommodate forty-eight patients was completed during the year.

Hokitika: A 40,000-gallon water-tower was completed, and tenders called for the necessary pumping-plant. A large villa in wood on concrete foundations is being erected.

Seacliff: The necessary equipment for the new kitchen and laundry was provided, and the additions to the Nurses' Home were completed.

The net capital expenditure under this heading for the year was £152,096.

Health and Hospital Institutions.

The chief works under this heading were the completion of the new Nurses' Home at Queen Mary Hospital, Hanmer; the new maternity hospital at Paeroa for the Thames Hospital Board; and an ante-natal clinic at Wanganui.

Extensive earthquake damages were repaired at Buller Hospital, Westport, and monetary assistance was granted to Grey River, Inangahua, and Nelson Hospital Boards to effect repairs to earthquake damages at the various Boards' institutions.

Agricultural Buildings.

The amount expended last year on capital works was £2,963. The principal works carried out were additions to the laboratory at Wallaceville, the provision of a water-supply at Mamaku, and the erection of a plant-research station at Palmerston North.

Education.

During the year ended 31st March, 1930, the sum of £443,885 was spent on new school buildings, additions, sites, and teachers' residences, an increase of £68,533 on the expenditure for the previous year. Of the total, £253,636 was expended in connection with primary schools, and £78,438 on secondary schools. During the year new schools were erected at Richardson Road, Auckland; Milson's Line, Palmerston North; St. John's, Wanganui; Randwick Road and Brooklyn (infants), Wellington; and at a large number of schools additional accommodation was provided. As far as possible, the Department undertook the remodelling of out-of-date schools in order to provide better conditions, especially with regard to lighting and ventilation. The larger schools so treated were Terrace End, Palmerston North; Castlecliff, Wanganui; Invercargill Middle and the Dunedin Normal School. Additional class-rooms were erected at the Dannevirke High School and also at the Pukekohe, Hamilton, Palmerston North, and Southland Technical Schools.

A further sum of £45,304 was expended in the erection of the science building and refectory for the Massey Agricultural College, and large works are in progress at a number of primary, secondary, and technical schools.

Many of the old schools are regarded as worn out, and will be replaced by new and up-to-date buildings as funds are available. At present old buildings are being replaced at Wellington Boys' College, and new primary-school buildings at Hunterville, Tapanui, and Nelson Central. A new infant school is replacing the old one at College Street, Palmerston North.

The following table shows the amount expended during the year ended 31st March, 1930, on new buildings, additions, sites, and teachers' residences:—

	£
Primary schools	253,636
Secondary schools	78,438
Technical schools	32,593
Training colleges	10,984
Universities	800
Native schools	1,068
Schools for feeble-minded	2,999
Child-welfare institutions	9,995
Kindergartens	1,107
Massey Agricultural College	45,304
Canterbury Agricultural College	6,961
Total	£443,885

TOURIST AND HEALTH RESORTS.

The net capital expenditure for the year was £20,547, as against £39,254 for the previous year. For this year a vote of £60,000 is proposed.

The principal works undertaken were the rebuilding of Glade House, Te Anau, which was destroyed by fire; the purchase of a new launch for Waikaremoana; track and suspension bridge, Fox Glacier; and the reconstruction of the Pavilion Baths at Rotorua. The former will be completed this year and will be a great improvement on the old building both from the medical and recreational points of view.

TELEGRAPH EXTENSION.

The expenditure for the financial year in extending and improving the telephone, telegraph, and wireless facilities throughout the Dominion amounted to £594,383. Of the works upon which capital expenditure was incurred during the year the following were the more important: The installation of carrier-current telephone systems between Auckland and Hamilton, Auckland and Rotorua, Hamilton and Palmerston North (Auckland–Wellington link), Palmerston North and Napier, Palmerston North and Hawera, Palmerston North and Wellington, Wellington and Seddon, Seddon and Christchurch; the erection of new metallic circuits between Auckland and Waiuku, Palmerston North and Pahiatua, Blenheim and Seddon, Seddon and Ward, Invercargill and Riverton; the laying of submarine telephone cable across Auckland Harbour and across Onahau Bay (Queen Charlotte Sound): the installing of toll dialling-circuits between Palmerston North and Wellington; the opening of new exchanges at Kerikeri and Mossburn; the installation in thirty-eight exchanges of additional switching-equipment for 6,636 exclusive lines and 504 party lines; the establishment of seventy new public call offices (coin-in-the-slot telephones); the laying of 1,242 chains of underground telephone-ducts and 7,884 chains of underground cable; the erection of 2,837 chains of overhead cable; the erection of 830 miles of pole-line and 8,357 miles of open wire; and the connection of 12,781 new subscribers' stations.

The most important matter, so far as the extension and improvement of long-distance-telephone facilities throughout the Dominion is concerned, was the extension of the carrier-current system of telephony. During the year this mode of communication was extended by the installation of carrier equipment as follows: Auckland–Hamilton—One additional single-channel system; Auckland–Rotorua—One single-channel system; Hamilton – Palmerston North—One three-channel system; Palmerston North – Napier, Palmerston North – Hawera, Wellington – Palmerston North, Wellington–Seddon, and Seddon–Christchurch—One single-channel system.

The immediate effect of these installations has been to extend considerably the range of toll communication to relieve the congestion of traffic between certain large centres, and to increase substantially the efficiency of the long-distance toll network. Practically all the principal centres in New Zealand, from Dunedin in the south, to Auckland in the north, are now in telephonic communication at all hours of the day

and night. On Sundays and holidays, and after the usual busy hours on week-days, the range is extended as far south as Invercargill, and includes a number of centres telephonically too remote from the main arterial routes to be given a full intercommunication service during the whole of the twenty-four hours. The availability of long-distance communication will be further increased during the next twelve months, in order that other centres may be brought into the full benefits of a continuous long-distance service.

In addition to the extension of carrier-current telephony, a considerable amount of work has been done in the erection of additional physical circuits and in necessary reconstruction. These capital works have resulted in the augmentation of existing facilities, and in the provision of telephone service in localities not previously catered for.

The local telephone-exchange systems throughout the Dominion showed a marked development, the number of new connections installed being 12,781, as against 12,110 for the previous year; and an average of 12,112 a year during the preceding five years. The total number of telephones connected to departmental exchanges on the 31st March was 157,023, and the number connected with toll stations and non-departmental stations was 4,300, making a total of 161,323.

To provide service for the 157,023 telephone stations connected to departmental exchanges on the 31st March, there were in existence at that date 490 single miles of underground conduit or duct line, 1,051 miles of underground cable, 564 miles of aerial cable, and 14,349 miles of pole-line, a total of 513,096 miles of wire being provided from these sources.

As may be imagined, the steady and well-maintained development of the local exchange systems during the past several years has necessitated a continued demand for capital to provide the plant and equipment required to connect the subscribers offering and to render service after they had been connected. Owing to the fact that continuous development in the past presages similar development in the future, it is necessary when making extensions to plant and equipment to forecast and make due provision for future extension. In many cases this entails the installation of plant and equipment considerably in excess of present-day requirements. As a result, a certain amount of capital is absorbed in plant and equipment which for the time being is non-revenue producing, but which for reasons of economy in installation and developmental considerations it is desirable to provide in advance of immediate requirements. This provision of capital in advance can be regarded as a contribution to the well-being and future progress of the country.

The cut-over of the Christchurch telephone exchange to automatic working was accomplished at midnight on Saturday, the 14th September, 1929. The conversion was accomplished with a minimum of trouble. Since the cut-over the equipment has been giving a highly satisfactory service and is meeting all the demands made upon it. This operation marked a distinct step forward in the development of automatic telephone exchanges in the Dominion, and increased the number of dial telephones in use to approximately 50 per cent. of the total.

The coast and point-to-point radio stations in New Zealand have continued to function efficiently. In November last a 5 kw. short-wave transmitter was installed at Wellington Radio. As a consequence of this installation, the Pacific Islands service has been improved and extended, and it has been possible to close down the high-power long-wave spark apparatus at Awanui Radio.

An order has been placed for a new tower for supporting the aerial system at Wellington Radio.

Improved receiving-apparatus has been provided at Awarua Radio. In consequence of the cessation of high-power working from that station the large aerial associated with the high-power apparatus has been dismantled.

At Auckland Radio a low-power battery-operated transmitter has been installed with a view to guarding against possible interruptions to the service from such causes as the failure of the normal power-supply system.

WORKS FOR DEFENCE DEPARTMENT.

The mobilization base and training-camp at Ngaruawahia, Waikato, has now been completed, and handed over to the Defence Department.

Trentham Camp has been maintained in good order, and a contract was recently let to paint a number of the buildings.

Burnham Camp has been maintained in good order.

The drill-hall at Blenheim—damaged by fire—has been repaired. New offices and storerooms have been built at Invercargill, and additional storeroom accommodation provided at Ponsonby and Narrow Neck.

Improvements to other buildings have been carried out, and the buildings generally maintained.

The development of the New Zealand Air Force Base at Hobsonville, Auckland, has proceeded satisfactorily.

The undermentioned works which were in hand last year have now been completed: Water-supply and drainage system, sea-wall apron, slipway, jetty, runways, and one airman's residence.

The undermentioned new works have been put in hand, some already have been completed, and good progress is being made with the remainder: Seaplane hangar block, fuelling system, one married officer's residence, marine storeroom and aircraft-repair shop, plumbers' and blacksmiths' shop, mooring dolphin, pigeon-loft, oil-store, garage, fire-alarm system, and street-lighting.

There are still a few minor buildings to be provided for, and it is hoped to have these completed and the base in working-order before the end of the present financial year.

The Wigram Aerodrome at Sockburn, Christchurch, has been maintained in good order, and minor improvements effected.

PLANT AND MECHANICAL APPARATUS.

Careful consideration has been given to the economical running of all existing construction plant and mechanical equipment and the maintenance of same in adequate repair to ensure that no expensive delays are caused to construction works due to breakdowns.

Small workshops each equipped with the minimum necessary machine tools and skeleton staffs to handle urgent repair jobs have been constructed at economic points on the major railway-construction works, and these are functioning efficiently.

The present costing system and occasional field inspections serve to keep a close check on inefficiency and waste, and the depreciation rates on plant in service are closely watched to ensure that each of the monetary authorities for works on which the plant is engaged bears an adequate charge and thus that the book values of the plant reach nil when the plant items become obsolete or worn out.

During the year a number of new plant items were purchased, to serve in many cases as replacements, and in others to efficiently cope with the new construction works authorized.

The major items of plant which have in all cases been purchased by competitive selection during the year include: Thirteen concrete-mixers, nine air-compressors, four electric-battery locomotives, seven petrol locomotives, twenty-six power-driven pumps, forty motor-cars, forty-five motor-lorries, three air-operated shovels, one drag-line excavator, one cableway conveyer, one mechanical loader, two pile-driving plants, two cranes, four stone-crushers, one water-tube boiler, one motor grader, fifteen power-driven machine tools, thirteen oil-engines, and fourteen electric motors.

In addition to the new purchases, the original plant, which forms the bulk of the present holding, has been conserved and judiciously distributed among the various construction works in hand, so that none is kept idle; and the question of economy in the matter of repairs, renewals, and transfers receives a prominent place along with despatch in all undertakings.

The inspections of motor-omnibuses still continues to be a function of the Public Works Department, and this work has entailed a considerable amount of work that is most necessary to ensure the safety of the travelling public.

A good deal of mechanical work in active and advisory capacities has also been done for other Departments and for the Samoan Administration.

APPENDICES TO MINISTER'S STATEMENT.

APPENDIX A.—ARAPUNI HYDRO-ELECTRIC-POWER WORKS.

STATEMENT BY THE HON. W. B. TAVERNER, MINISTER OF PUBLIC WORKS.

28th June, 1930.

In accordance with the undertaking I have recently given to the press, I desire to make the following statement to the House regarding Arapuni:—

At about 4 a.m. on the morning of Saturday, the 7th instant, water was noticed on the floor of the battery-room at the back of the power-house, having found its way in through the power-house drainage system. On the officer at the pumphouse end of the penstock structure near the spillway weir being communicated with, he found a crack approximately 2 in. wide between the end of the spillway proper and the structure adjoining same. Other water was found issuing from a number of points on the cliff behind the power-house.

Wellington was immediately advised, and some of the principal officers of the Department left immediately for the scene, arriving the same night.

In the meantime a crack had been traced on the surface of the ground running from the one first observed through the hill between the old gorge of the Waikato River and the present headrace. This crack was not continuous, but was observed in a number of places all trending much in the same way and ending a short distance below the Falls where the water from the headrace drops back on to the Waiteti Flat. Wherever these cracks existed in alluvial ground they disappeared during the first rain which fell afterwards.

After observing the flows through the hill and the movements, it was decided that it was advisable to lower the water so that it would not overflow the spillway, and thus give an opportunity for better examination. Accordingly the gates in the diversion tunnel were opened, and by the following morning the spillway ceased to overflow, and further examination was made.

In the meantime I had departed for Arapuni, and with the engineers made a thorough inspection; and, after carefully going over all the evidences of earth movement, a decision was arrived at that the water should be drawn down until the headrace was dry. This was done, the lowering of the water to this extent being accomplished by Sunday, the 15th instant.

On the water leaving the headrace and forebay it was found that the cracks already observed ran approximately on the lines of the headrace for several hundred feet farther than had been observed on the dry land, and the drainage water was disappearing down these cracks. As the water in the headrace lowered during this week the leaks through the hillside at the back of the power-house and elsewhere had decreased in sympathy, and shortly after the complete emptying of the headrace they fell away very greatly, and by Tuesday, the 17th instant, had entirely ceased. Certain cracks were observed in the back of the power-house on the first morning of the trouble, and a small quantity of water was seeping through these. This, of course, stopped when the other leaks stopped.

As the water in the forebay and headrace was lowered, the cracks tended to close, and when the water pressure was entirely removed it may be said that in a general way the cracks closed up to half the width at which they were at the maximum. The maximum width of the cracks was 2 in. at one point, gradually fading away to a hair crack at each end. This is now 1 in., and fades away to nothing in a shorter distance than previously.

Very careful measurements both by direct measuring from known fixed points and by triangulation from parts of the country remote from the scene of movement all indicated that the movement, small as it was, was definite and in the direction from the penstocks to the tailrace—in other words, towards the gorge in which the Waikato was running prior to the diversion in 1928.

At the time of my visit on 9th June investigations indicated that some movement had taken place in connection with the power-house, the turbines being slightly out of true level. It was also ascertained that the high-level suspension-bridge spanning the gorge had sagged to some extent, presumably on account of movement of one of the supporting towers. Also, the heavy-traffic low-level bridge just below the power-house gave indications that movement had taken place there. All these displacements support the theory that whatever movement took place was inwards towards the old gorge.

It was apparent almost from the first that extensive work would be necessary to make good the position, and that the plant would of necessity have to be shut down for a considerable period. The entire emptying of the lake was therefore decided upon, and the lake was finally drained on the morning of the 24th June. As the water in the lake was lowered certain overhanging material from the cliff wall above the intake to the diversion-tunnel slipped away at intervals during the night of 13–14th June with the result that the gates of the diversion tunnel became blocked on three occasions. The blockage was overcome by raising the gates and thereby increasing the opening, the pressure of water sweeping the slipped material through the diversion-tunnel. Apparently the gates were not affected by these blockages, as they were successfully operated again immediately afterwards.

On Friday, the 20th June, certain cracks, one-fiftieth of an inch in width, were reported as having been discovered in the floor of the power-house round No. 2 unit, and, on telegraphing for further particulars as to the positions and directions of these cracks, the information was received next day that they had become visible round all three machines, and extended from the upper machine-floor down approximately to the top of the turbine scroll cases. These cracks were believed by the staff to have developed in the last few days, as with quite a number of men constantly looking for signs of damage it seems inconceivable they could have been missed previously if there.

As soon as it became evident that it would be necessary for the plant to shut down Auckland was communicated with, and arrangements made with the Power Board for it to take up its own load at its King's Wharf steam plant, and arrangements were also made to get steam on the Department's steam set at Grand Junction, and also to ensure that the Department's Diesel plant at Penrose was ready for immediate service. It was also arranged that all the power available from McLaren's Falls plant, which belongs to the Tauranga Borough Council, from which the Department has in the past taken power over a considerable period, should be drawn upon. Further, the Government's plant at Rotorua, which has been shut down for some time, was also got ready for immediate action. As a result, when the water fell too low for the machines at Arapuni to operate, which occurred on Wednesday, the 11th instant, at 3.40 p.m., the load was taken up by the plants indicated above in addition to the Department's station at Horahora, and has been carried in this way ever since.

Excluding the Auckland load, which is being carried by the Auckland Electric-power Board with its own plant, there is approximately a total load of 18,000 kilowatts to be supplied, and for the supply of this we have the following sources :—

	Kilowatts.
Horahora Government hydro-electric scheme, installed capacity	10,300
Grand Junction steam plant belonging to the Government, capacity ..	3,000
Diesel plant at Penrose belonging to the Government, capacity	3,700
Rotorua hydro-electric plant operated by Tourist Department, capacity ..	350
And whatever surplus may be available from the McLaren's Falls hydro-electric station owned by the Borough of Tauranga, which has been drawn upon largely by the Government in the past prior to the completion of Arapuni, the available surplus being estimated at approximately	1,800
Total estimated amount available	19,150
Amount of present load is	18,000
Thus there is at present an estimated surplus of approximately	1,150

It will be seen that, although the margin is small, there is a definite margin. Furthermore, certain industrial undertakings have their own power plant with which they can supply their own loads and may be able in some cases to feed back a small amount into the general reticulation ; also, as the winter passes away, the Auckland City load will fall, and it will then be possible for the Auckland Electric-power Board to supply power back to the Government lines for distribution should it be required to the districts where large milking loads have to be carried during the summer. Realizing, however, that the demand for electricity grows continually even faster than the population, I, immediately the gravity of the position became manifest, cabled to the High Commissioner to make inquiries as to the possibility of securing for prompt delivery a steam plant which could be installed in the Waikato district handy to the coal-mines. Negotiations concerning this are still in progress, and I expect to be able to report before long that a conclusion has been reached and definite arrangements made for the supply and installation of this plant.

Considerable inconvenience has, of course, unavoidably been caused to the Auckland Power Board and other Boards on account of interruption of supply, and I may here state that although the Department is, under its agreement with its customers (the Boards) relieved from liability as a result of such happenings as have now occurred, every effort will be made and all expedition used to alleviate the position.

The Director of the Geological Survey Branch of the Scientific and Industrial Research Department proceeded to Arapuni immediately after the trouble occurred, and, after closely examining everything then visible, returned to Wellington until such time as the headrace could be laid bare. He then again visited Arapuni and had a further examination, after which he consulted with the head of his Department ; and, at my request, the Minister in charge of that Department agreed that a technical committee, consisting of the head of the Department (Dr. Marsden), Dr. Henderson (Director of the Geological Survey Branch), Dr. Marshall (a member of the staff and at one time Professor of Geology at Otago University), and Professor Bartrum (Professor of Geology to the Auckland University) should further examine the position, and make a joint report. This they have done. The full geological report will be published in due course, but for the purposes of this statement a summary of it is as follows :—

A block of country near the penstock tunnels, between the spillway and the power-house, broke away at 1.30 a.m. on the 7th instant, developing a crack extending along the front of the penstock tunnels and spillway. Water poured into this crack, developing hydrostatic pressure, which bent the block, including the power-house, progressively over towards the river. This bending extended over two days, while the base of the cracks filled up with grit, allowing fuller development of pressure. It is evident that the block moved about a base well below river-level—*i.e.*, some 300 ft. below the penstock-head. This is evident by the tilt of the power-house, which attained about one minute of arc, and the tilt of one support of the suspension-bridge. The crack on the penstock-head attained to an

opening of a little over 2 in. After the diversion-tunnel at the dam was opened, and the level of the water in the penstock-head began to recede, the block moved slowly back by about three-quarters of its original displacement, and the leaks were reduced in greater proportion.

It appears evident that the movement of the crack after its original formation can be accounted for by hydrostatic pressure of water entering the cracks; and the question naturally arises as to the origin of the original crack, and whether or not further disturbances are likely to occur.

Several alternative explanations may be advanced to account for the original rupture—first, the whole block of country may have been in tension from natural causes and the extra excavation for the new power-house, together with the hydrostatic thrusts in the penstock-head, may have just caused the limit of resistance to be overcome. This seems the more likely explanation. Alternatively, it is possible that water leaked into deep vertical joints below the penstock-head, developing sufficient pressure to cause rupture. No evidence, however, can be found for such joints in the absence of deep borings. Several cracks developed in the blocks between the penstock-heads and the gorge, which rapidly filled with water, and would create extra hydrostatic pressure or facilitate transmission of same. A third possible explanation is the stress caused by a possible earthquake wave, which, owing to the fact that the power-house and penstock-head were rigidly tied, might possibly cause such a rupture. Against this is the lack of observation of any such tremor. It is true that the initial movement of the block caused tremors and vibrations of the block, which were observed by a man living in a hut near the penstock-head. These tremors, together with the tremors caused by the progressive probable jerking return of the block on removal of the water which gave rise to the hydrostatic head, caused vibrations and cracks to appear in the power-house. These cracks in the power-house, however, do not necessarily indicate disturbance of the power-house foundations, since they consist of a transverse crack of the whole building at a point where its width changes suddenly and cracks round the supports of the heavy generators and turbines (350 tons).

The rock surfaces visible indicate no movement of rock masses relative to one another.

The whole occurrence might well be unforeseen and due to unexpected weakness of the support of the whole block which has moved. This supporting material is only just strong enough to withstand the weight of the overlying rock without failure. Further buttressing of the whole block would appear necessary to prevent recurrence of movement and leakages of water from the forebay.

The geologists are of the opinion that there was no undue water percolation from the spillway into the block of rock between the spillway and the gorge and power-house previous to the formation of the crack; thus, the initial movement is unlikely to be due to this cause.

There has not been sufficient opportunity to finish a fuller report covering the whole power-development site, but such a report is in process of compilation.

This report will be submitted to the officers of my Department in order that with the information contained therein they might devise remedial measures. Meantime, realizing the magnitude of the issues at stake and also the uneasiness which has arisen in the public mind, the Government decided to obtain the very best engineering advice that could be obtained, and with that object in view has been in communication with the High Commissioner for New Zealand in London, the president of the Institute of Civil Engineers, and organizations elsewhere, in order to select the most suitable man. Until such time as the report to be made by this engineer has been received, I have felt it my duty to advise Cabinet to discontinue any further works at Arapuni. It must be realized that very considerable works were in progress in the direction of installing a fourth unit to increase the capacity of the station in accordance with the growing demand for electric energy, and also work was in hand for securing the position at the point where the water from the headrace falls back to the normal level of the Waikato. At this point considerable erosion occurred last year, and, although for the last ten months no further erosion has occurred, my predecessor did not deem it advisable to take any risks in this direction, and Cabinet on his advice had decided to thoroughly secure the position by the construction of a drop weir. Plant had been assembled and a certain amount of work done on this, but if the position at Arapuni should be found on mature consideration to be beyond repair, which I sincerely trust will not be the case, then it would have been a waste of money to proceed with the securing of the waterfall. Similar remarks apply to the completion of the fourth generating-unit. As any one reporting on the position would naturally require the very best information not only concerning surface indications, but also concerning the lie of the strata below, exploratory tunnels and shafts will be carried on until such time as the fullest information concerning all the surroundings has been obtained.

Further investigations will include a survey of the financial position of the scheme and will deal with the economic aspect.

Meantime, for the general information of honourable members, I wish to make the following observations:—

The amount already invested in the Arapuni scheme, including substations and transmission-lines, and works in progress, is £2,500,000.

In the previous year before Arapuni came into operation, the working-charges for the Waikato system amounted to £76,231, and the standing charges for interest and depreciation and renewals were £74,571, or a total of £150,802. For the year ended 31st March last, the respective figures were £62,702 and £195,752—altogether £258,454—so that the difference amounting to £107,652 represented the additional total operation costs of Arapuni for the year.

The units sold for the year from the whole Waikato system were 191,000,000, and the net revenue, after paying working-expenses of £62,702, was £162,981. The average operating capital for the year was £2,649,000, so that the net revenue over and above working-expenses was 6·15 per cent. on the operating capital, notwithstanding that the plant installed was insufficient to take the whole available load during the earlier months of the year.

The present installed capacity of the Arapuni Station is 45,000 k.w. and consists of three units. The fourth unit is now in process of shipment from England, and, had the course of events not been interrupted, would have been installed on arrival, thus bringing the total capacity of the Arapuni plant to 60,000 k.w.

In a subsequent statement details will be given showing the cost involved in calling into operation standby plants and other stations which were required to take the load when supply ceased from Arapuni, but it may be remarked that the estimate at present for the generating-costs at those stations is at the rate of £85,000 per annum, as against £12,000 for generating-costs had Arapuni continued in commission.

GEOLOGICAL REPORT, TOGETHER WITH STATEMENT BY THE HON. W. B. TAVERNER, MINISTER OF PUBLIC WORKS.

17th July, 1930.

MINISTER'S STATEMENT.

I desire to lay on the table the geological report on the fracture of the rock at the Arapuni Spillway.

I also wish to say that, apart from the suggestions made in this report, an investigation is actively in progress on the water content and elastic content of the various materials in the neighbourhood of the dam and power-house.

Already there has been obtained information which indicates that the material has about one-tenth the elasticity of concrete, and a value which agrees with the conjecture that, after the initial crack in the forebay had been formed, the block between the forebay and the gorge bent over as a result of hydrostatic force. The present investigations are aimed at an estimation of the behaviour of the pumice breccia and rhyolite under different degrees of moisture content. One possibility suggesting itself is that water seeping into the rhyolite and breccia caused volume alterations, which, possibly, resulted in the original crack. This, and other investigations, are being actively pursued with a view to ascertaining more definitely the original cause of the disturbance.

I have submitted the geological report to my departmental Engineers, and I have asked them to now supply me with a report, based on the geological position, indicating what steps they consider should be taken from an engineering point of view to deal with the trouble that has occurred. This engineering report will be submitted by me to Professor Hornell, the expert from overseas who has been appointed by the Government to investigate the Arapuni scheme, in order that he may advise on the steps suggested by the Department.

GEOLOGICAL REPORT.

The Fracture of the Rock at the Arapuni Spillway.

We (Professor Bartrum, and Drs. Marshall and Henderson) arrived at Arapuni on the morning of the 23rd June, and left on the evening of the 25th June. We examined the Arapuni area generally, paying special attention to the area about the spillway and the power-house where cracks had recently formed and tilting occurred. Mr. Rabone, Engineer in Charge, and his staff, gave every facility for examining the works, plans, and records, and we take this opportunity of expressing our thanks and appreciation of the courtesy everywhere extended to us.

Outline of Geology.

There are four geological formations, near the power-house, which in downward order are—

(1) Unconsolidated sands and gravels, often 50 ft. thick;
(2) Much-jointed columnar rhyolite tuff, 50 ft. thick;
(3) Massive pumice breccia, 90 ft. to 100 ft. thick; and
(4) Tuffaceous clays, sands, and breccias, which extend to an unknown depth below the river.

The first group of beds, the unconsolidated sands and gravels, here need no further consideration. The second and third formations are relatively strong rocks. They are porous rocks and when dry readily absorb water, but are not readily permeable, though the joints in them allow the passage of water. Weathering accentuates these joints, which are conspicuous on the faces of the cliffs. In the solid they are tightly appressed and often scarcely perceptible. Between the columnar rhyolitic tuff and the pumice breccia are a few feet of weak beds consisting of a poorly consolidated silty phase of the columnar tuff and thin beds of gravel, sand, and clay, the last mentioned being the soil of the gently undulating old land-surface of the pumice breccia on which the columnar rhyolite tuff was deposited as volcanic ash. These weak beds, especially the old soil, are decidedly impervious. The upper few feet of the fourth and lowest set of beds consists of indurated clays, probably the old soils of a former land-surface carved from weak tuffs and bedded sands. The power-house is built on these beds, of which only a small area is exposed.

Indications of Deformation.

Cracks.—The main crack ruptures the concrete at the corner where the spillway weir joins the penstock block and extends on the floor of the forebay nearly parallel with and close to the penstock block and along the headrace southward to a point 960 ft. from the north-east corner of the spillway. Northward, the small discontinuous fissures that appeared on the surface of the unconsolidated sands and gravels probably mark the extension of the crack in the rock below. These were traced for some distance, and, directly in line on the road from the low-level bridge to the transformer-house, several strong springs appeared at or near the base of the columnar rhyolite tuff. Cracks, more or less parallel with the chief break, cross the northern end of the penstock block. Another series of narrow discontinuous cracks in the covering beds extends at a slight angle from the main fracture, more or less parallel with the lower part of the overflow-channel, as far as the gorge eroded at its end. Strong leaks appeared at or near the base of the columnar tuff in this locality also.

A table of measurements prepared by the engineering staff shows how the fissure in the concrete —the only place where it could be exactly measured—at first widened, and then, as the dam was emptied and the forebay drained, became progressively narrower, until now it is less than half the width it was at the time of the maximum opening. The fissure in the forebay also showed progressive narrowing from the time it could be observed, and the fact that fragments of rock and pumice are pinched in it shows that decided closing occurred.

Leaks.—The first indication that something untoward had happened was the flooding of the battery-room in the power-house. This was afterwards found to be due to the partial blocking of a drain which, on that account, could not carry the discharge from the leaks that appeared in the rock wall at the back of the power-house. Other leaks were discovered during the day. The leaks are in three localities: (*a*) Those near the power-house are from joint-planes in the pumice breccia and were at several points in the cliff some 30 ft. or 40 ft. above the main floor of the power-house; another strong leak was through a joint-plane on the lower part of the No. 4 penstock tunnel. (*b*) Two decided leaks came into existence near the base of the columnar tuff on the road above the power-house and several smaller seepages at the same horizon in the cliff behind the power-house and in No. 4 penstock tunnel. (*c*) Five leaks were noted a little above water-level in the gorge excavated by the fall at the end of the overflow-channel; these are at the same impervious horizon at the base of the columnar tuff. It should be noted that several of the leaks at first discharged milky water, but, in general, this discoloration disappeared within twenty-four hours.

The lowering of the water in the forebay had also a decided effect on the amount of water yielded by all the leaks and seepages, as is well shown by the table prepared by the engineering staff. The leaks ceased altogether shortly after the water had drained from the forebay, though at that time the water still stood high in the dam.

Tilts.—No. 1 generator had been levelled on the day preceding the formation of the crack, and, on relevelling, was found to have a slight tilt toward the river. The other generators, when the turbines stopped, were found to have tilts of similar amount, also toward the river.

The 70 ft. tower at the west end of the suspension-bridge over the gorge was found to be 1½ in. out of plumb, the inclination being toward the river. The ropes forming the handrails were noticeably slack, and, on measuring, the span was found to have been reduced by an inch or two. The tilts in the power-house and of the bridge tower steadily decreased as the forebay was emptied.

Results of Resurvey.

By survey, the power-house has been found to be slightly displaced; but the precise amounts and directions of the movement have not been closely considered.

The cracking and tilting above described could all be readily explained if the block of country between the spillway and power-house had tilted toward the gorge about one minute of arc, and indicate a maximum movement of the top of the block in that direction. If the rocks forming the block were absolutely rigid, the base of the block would be about 200 ft. below river-level.

Possible Causes of the Overturning Movement.

There are several known stresses and other possible causes that would tend to open the cracks and overturn the mass of rock between the headrace and the gorge. These may be divided into the stresses and weaknesses created by the engineering works undertaken, geological factors, and earth-tremors.

Engineering Factors.—The engineering factors require little more than mention. They include the hydrostatic head on the penstock block, the headrace, and the overflow-channel; the weight of water in the penstock tunnels; the kinetic energy of the moving water; the vibration of the generators; and the weight of water in the headrace, and also the weight of the transformer-house. In addition, the blasting of the rock during the driving of the penstock tunnels, and the removal of the rock itself, no doubt weakened the mass. The excavation of over 100,000 yards of rock to provide room for the power-house and its extension is more important, as this mass formed a buttress supporting the moved block.

Geological Factors.—"Any excavation in the earth's crust sets up stresses in the contiguous rocks, becuase of the unbalanced pressures created by the substitution of atmospheric pressure for the greater pressure of the material excavated." The horizontal components of these stresses exert a pressure toward the excavation, in this case, toward the gorge, and would tend to open cracks sub-parallel with the gorge and with maximum deformation near the surface.

The floor of the old river-channel, followed by the headrace and the overflow-channel, has now been largely stripped, by the moving water, of its cover of soil and forest debris that up till now almost entirely concealed the rock. A number of relatively straight cracks, some of them several

chains long, obliquely cross the smooth gently hollowed rock floor of the old channel. The cracks are now sealed and as watertight as the somewhat altered rock they traverse. They are undoubtedly old and may have been formed in the manner suggested after the gorge was cut, a time which, as judged from the size of the trees growing in it, was at least several hundred years ago. One would expect cracks of this kind to gape more widely near the edge of the gorge than those farther back, and the cracks on the east side of the river above the dam may be cited. These are from 6 in. to 12 in. wide at the surface, but disappear at a depth of 40 ft. On the west or headrace side of the river the heavy cover of sands and gravels may conceal widely opened cracks, but there is no evidence of this. The crack that traverses the upper end of the headrace nowhere reaches an inch in width. The fracture that opened in the forebay on the 7th June closely resembles the cracks described above, and may have been produced in the same way.

The well-developed vertical joints of the great bulk of the rocks greatly reduces the tensile strength of the mass, and it is not improbable that the tensional stresses developed when the gorge was cut were not wholly dissipated during the many years it has existed. The residuum of these tensional stresses combined with similar stresses due to the power-house excavations may have been sufficient to rupture the rock.

Shortly after the crack formed, bubbles of gas were observed rising discontinuously at several points in the forebay. Later gas emanations were found on the floor of the forebay and headrace, and at one point gas was feebly rising to the 23rd June. The gas generally escaped from joint-planes near the crack, but some of the points of issue were some distance from it. The Dominion Analyst examined a sample and found it to consist chiefly of nitrogen, no oxygen being present. This gas may be interpreted as air so long imprisoned in the joint-planes, and pores of the rock mass, as to be completely deoxygenated. Its expulsion may be explained as being due to the slight contraction of the rock-mass as soon as the tensional stresses were relieved by the cracking of the rock.

Failure of Basal Rocks.—The tuffaceous indurated clays, banded sandstones, and breccias on which the power-house is built are undoubtedly the weakest rocks of the area, and their position at the toe of a deep excavation places on them the maximum crushing and gravity stresses due to the weight of the moved mass between the headrace and the gorge. The crushing-strength of these weak rocks, as determined by experiment, is not much more than sufficient to sustain the weight of the superincumbent mass. This critical area was carefully examined, but no sign of failure was observed. Possibly failure occurred below the river-level, but against this the block, after its maximum deformation, has moved back within a few days more than half-way to its original position, a fact suggesting that the elasticity of the rock is not destroyed as it would be if failure and crushing had occurred. Had sand and grit not entered the crack in considerable amount the fissure would probably have closed entirely. Again, the available data on the correlation of the strengths of rocks in small blocks, and in mass, indicate clearly that as the area under load is increased the load per unit area may also be much increased without crushing. It must, however, be pointed out that most of the investigations on the strengths and elasticities of rocks have described the properties of rocks much harder and denser than are the tuffs and breccias of Arapuni, and possibly the results of these studies are not altogether applicable. When, however, it is also considered that the weak rocks at the power-house have not failed during the hundreds of years the gorge has existed, it appears unlikely that the deformation is due to rock failure and crushing at this point.

Hydrostatic Head of Water in Rocks.—The rocks of the headrace, forebay, and overflow-channel, though porous, do not readily permit the passage of water. Small pools on their surface remain till the water evaporates, and the penstock tunnels driven as much as two years after the headrace was filled, were dry. There is, of course, some slow percolation and the base of the columnar rhyolite tuff exposed in the cliff above the power-house became slightly damper after the headrace filled. Assuming that the partings in the columnar tuff, though too small to allow the flow of water, were yet large enough efficiently to transmit the pressure due to hydrostatic head, this pressure must have been fully operative for over two years. The same applies to the underlying pumice breccia which floors the whole of the headrace from a point a few chains above the spillway.

The tables prepared by the engineering staff, showing the changes in the width of the crack, the amounts of the tilts, and the discharges from leaks, clearly indicate the effect of the alteration of the depth of water in the forebay. Undoubtedly once the crack was formed the hydrostatic head in it was the main factor in determining the amounts of these. But until this crack formed the small amount of water (if any) that percolated from the headrace into the rock did not, in our opinion, exert an effective hydrostatic pressure.

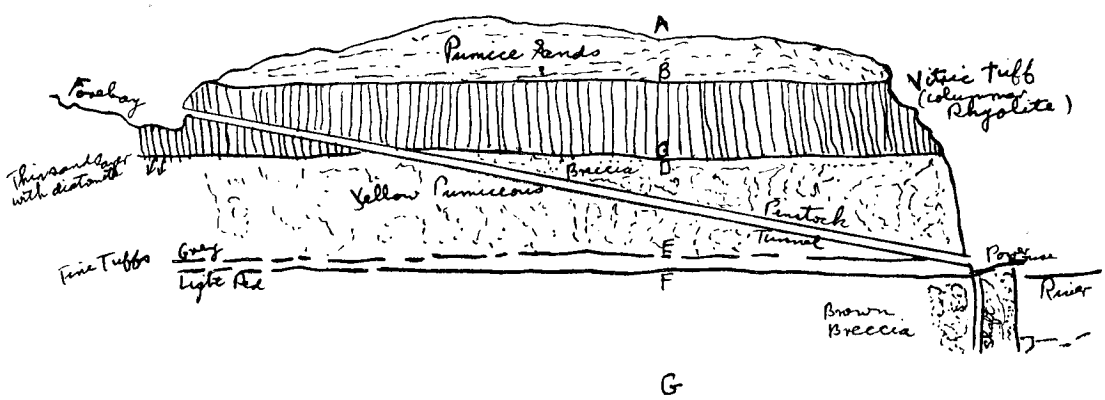
Earthquake Tremors.—Earthquake tremors cause deforming movements in rock-masses, and produce landslides and fractures in solid rocks. Several people at Arapuni now say that they felt an earth-tremor sometime after midnight on the 7th June; but as this slight earthquake was not felt in the surrounding district it is possible that the opening of the crack caused the earthquake, and was not caused by it.

Possibility of Recurrence of Movement.

Once the crack opened the hydrostatic pressure of water in it undoubtedly was the principal cause of the widening of the fracture and the concurrent increase in tilt of the moved block. The evidence does not clearly show that the purely geological factors, as detailed above, were important in causing the crack. Possibly they were sufficient, in combination with the definitely known engineering stresses, to rupture the rock, already weakened by the erosion of the channel forming the headrace and by the engineering excavations. The cause of the fracture must be definitely ascertained so that remedial measures may be taken. We suggest that the strata beneath the power-house be explored to a depth of 100 ft. or more by shafts or by bores of large-enough diameter to yield a continuous core, and that the different rock-layers be geologically examined and tested for their strength and elastic properties.

J. Henderson.
P. Marshall.
J. A. Bartrum.

REPORT ON ROCKS AT ARAPUNI.



The ground surface at Arapuni is covered with unconsolidated pumice breccia and pumice sands to a considerable depth. At the centre of the neck between the penstock intake and the power-station it appears to be about 50 ft. thick. In the channel of the headrace this deposit is absent.

Beneath this surface covering in the upper part of the headrace there is a bed of river-drift which contains thin and irregular beds of gravel. There is no indication of this material between the penstock intake and the power-house. If it is present here, it lies above all the works that have been undertaken in connection with the power-development, and, like the superficial covering of pumice mentioned above, needs no further consideration.

Vitric Tuff.—The highest rock-formation involved in the construction at the power-house penstock-site is a vitric tuff, which has often been called a "columnar rhyolite." This rock-formation has a well-developed system of vertical joints which divide the rock into columns approximating 1 ft. 6 in. to 2 ft. in diameter. This vitric tuff has been formed by an air-borne cloud of minute fragments of volcanic glass. Much of this, when it reached the ground, was still at such a high temperature that the particles could fuse together. The pressure of overlying material that fell towards the end of the shower was sufficient to flatten the fragments that fell earlier, and even to develop a partial flow-structure in the material, for it would remain viscous for a long period beneath the cover of incandescent dust subsequently deposited. The thickness of this formation of vitric tuff is about 50 ft., but neither top nor bottom is a plane surface.

Examination of the vitric tuff shows that, although apparently uniform, it actually varies greatly in physical condition, as evidenced by the tables of specific gravity and water content in a previous report. The upper part is loosely coherent and contains 35 per cent. of water by volume. As depth increases, the coherence of the particles and density of the rock become more pronounced, the maximum being attained near the bottom, as shown in the tables mentioned above. Near the base of the rock it has a glassy lustre, and microscopic examination shows that it has a flow-structure. Samples from higher in the rock show no flow-structure, and glassy fragments are subordinate in quantity to dust. The change in condition is not, however, uniformly progressive, and there appears to be a weak belt near the middle of the formation. Such variations must be expected in view of the nature of deposition.

The base of the vitric tuff is marked by the occurrence of a band of fine sand less than 1 ft. thick. With this there is some diatomite, and fragments of charred wood have been found. This is the first deposit from the fiery volcanic cloud, and the material was possibly of a lower initial temperature, but, at any rate, would be cooled more rapidly by contact with the cold ground.

Beneath the vitric tuff there is a thick formation of yellowish pumiceous breccia which extends from the base of the vitric tuff almost to the level of the floor of the power-house, 90 ft.–100 ft. Fragments of pumice are conspicuous in it. Samples of this rock rarely contain less than 35 per cent. of water by volume, and in one case the amount was 60 per cent. Apart from the fragments of pumice, this rock consists of crystals of feldspar and quartz, and a few crystals of other minerals embedded in a dense felt of irregular and elongated glass-fragments which show marked bogen structure. These glass-fragments have no flow arrangement, and it is clear that they were solid when they reached the ground.

However, there is no stratification that would denote sorting by deposition in water. The conclusion is reached that this pumiceous breccia was, like the overlying vitric tuff, deposited on a land surface. The marked difference in compactness and consolidation was due to the fact that the component particles of the vitric tuff were finer and were deposited in the heated viscous state, while those of the pumiceous breccia were coarser and were deposited in a cooler and a solid state.

Nearly all of the large quantity of water contained in the pumiceous breccia is contained in the capillary spaces between the fine particles of glass.

This rock is almost free from vertical joints, a further indication that its materials were deposited in a far cooler condition than were those of the vitric tuff.

The pumiceous breccia rests on a grey tuff. This is about 4 ft. thick, and consists of a fine-grained water-deposited material. Beneath the grey tuff is a thin bed of pink tuff, which also consists of fine water-worn material, but in a finer state of division than that of the grey tuff.

The lowest rock reached by the works is a brown pumiceous breccia which extends at least 75 ft. below the floor of the power-house. This has similar composition and structure to those of the yellow pumiceous breccia, and, like it, was deposited on a land surface in a relatively cool condition. The pore space and water content are even higher than those of the yellow pumiceous breccia lying between the vitric tuff and the bed of grey tuff.

P. MARSHALL.

1st July, 1930.

ARAPUNI POWER SCHEME: SCHEMES FOR REMEDIAL MEASURES.

THE HON. THE MINISTER OF PUBLIC WORKS,—

In reply to your instructions that I should prepare a report indicating the steps which I consider should be taken to deal with the trouble at Arapuni which occurred on the 7th June last, it will be necessary for me first of all to set out my interpretation of the cause of the crack which appeared on that date. You will recollect that the Geological Committee which dealt with this matter stressed the importance of the finding of this cause before dealing with the question of remedial steps. I have, therefore, spent a great deal of time in considering this matter and endeavouring to obtain data which would enable a reasonable cause to be discovered.

A considerable amount of exploratory work is still in progress, but, as the time is now short before Professor Hornell arrives, I must, in order to comply with your directions, proceed to develop my theory and devise a cure without waiting for all the information.

Between the headrace and the old gorge of the Waikato there is a bar of comparatively undisturbed country. When I say "undisturbed" I mean that no major geological disturbance has taken place since the various layers of volcanic rock were laid down, and prior to the cutting-out of the various channels of the Waikato River which exist to-day at various depths.

The bar of country which exists between the headrace and the gorge at the power-house at Arapuni consists of five main geological formations. The uppermost is simply sand and earth laid down by ordinary alluvial processes in recent geological times. The next layer, about 80 ft., consists of rhyolitic tuff (sometimes referred to as vitric tuff) which is of columnar structure, the columns being of fairly small size and roughly five- or six-sided. The next layer is a less consolidated tuff together with indications of small lenses of diatomaceous earth. The thickness of this varies between 3 ft. and 20 ft., and is approximately horizontal. The next layer is massive breccia in which there are infrequent sub-vertical joints. This formation is about 80 ft. thick. Underlying this there is an irregular old land-surface, the formation below being weakly cemented tuff on which the bearing values range between 8 tons and something over 50 tons, there being few spots where a value less than 20 tons obtained.

Viewed as a whole, the mass between the two channels, considered as a dam, even if merely of random rock without any cohesion, would be ample to act as such.

Experiments made indicate that the modulus of elasticity of these rocks is low, and the vitric tuff, apparently made of nothing but glass spikules matted together like hair in felt, is very springy and capable of considerable deformation without the slightest permanent set.

When water was taken into the headrace first it pressed horizontally upon the upper half of the columns in the vitric tuff, these individual columns being 40 ft. to 90 ft. long and 1 ft., 2 ft., or 3 ft. in diameter. They were bent over in the same way as a laminated spring bends, whereas a solid piece of metal of the same total size would be rigid. When a spring is rusty the bending is restricted, and in the case in question the individual columns of rock were irregular and closely cemented together, and consequently could only act as a very rusty spring. This bending of the upper ends of the columns introduced a tendency in the whole mass to split vertically on a plane adjacent to the point of application of the horizontal force. No split, however, took place for two and a half years after the race was filled.

It is hard to imagine that the very slight vibration which was experienced in the No. 1 machine—the last one brought into service—could affect such a mass of rock, or that the imperceptible vibration caused by the falling of the waters over the waterfall, nearly quarter of a mile below the spillway, even if transmitted to the spillway, could have had any appreciable effect. Still, both of these causes may have had some effect. On the other hand, all that was necessary may have been time, in the same way that when an axe is driven into a log it does not always split it immediately although it opens up the upper fibres to a width equal to the thickness of the blade, and if left for a short time the log may be rent without the application of any further force.

On the 7th June, when, by the way, the No. 1 machine was neither vibrating nor running at all, and when the vibration from the falls was less than usual owing to the low river, the condition previously referred to, due to the bending of the columns, caused a split to occur at right angles to the general direction of the pressure. Immediately the split occurred water filled this split, and increased the intensity of the pressure and the area over which it operated. As a result, progressive splitting proceeded—probably the whole process was only a matter of minutes, and may have been less.

As soon as the water following down the split came to the third layer described above, it began to travel through the weakly cemented tuff, or between it and the "columnar" above or the "massive" below, and in approximately an hour appeared as a series of small streams on the face of the cliff at various points on top of the massive breccia. At one or two places these streams were slightly discoloured. The discoloration was extremely slight, and was similar to that caused by putting perhaps a centimetre of milk into a litre of water.

When the columns subsequent to the split bent, as they would do over practically their whole length, they threw a concentrated stress on the penstock-linings, which were securely anchored to the surrounding rock, and although a great deal of the longitudinal compression which was caused to the pipe at its upper one-third, due to this movement, was taken up by compression within itself, nevertheless a small portion was communicated into the power-house, causing small cracks where the power-house joins the cliff, and bringing about a slight though measurable tilt. When the water was withdrawn, the crack was unable to close owing to the sand and pumice which had in the meantime been washed into it, but the spring of the rock was very decided, and in spite of the obstruction just referred to, closed the crack to less than half the dimension it possessed immediately after the cracking. As the pressure was relieved from the floor of the power-house in the vicinity of the generators the same tended to return to true horizontality, although they did not absolutely do so, and fine cracks, which owing to the compression had previously been unnoticed, opened up sufficiently to be visible.

As will be seen from a perusal of the above the chief cause of the trouble has been the ability of the columnar rock (in what I may call the second principal geological formation) to bend through very considerable limits. One does not usually look upon rock as an elastic substance, but the vitric tuff or columnar rhyolite, by both of which names it has been referred to, is highly elastic.

In addition to this characteristic of the individual rocks, we have the shape of the ground, which would have the effect of placing a certain amount of initial tension in the rocks. Under normal circumstances with rocks of a less elastic character this might have had no effect, but there is evidence, which has been brought to light by the wash of the water in the headrace channel, that a certain amount of cracking in past ages has occurred in rocks of this kind, but these old cracks, where seen, were closed by later deposits and recemented.

Scheme No. 1.

One method of dealing with the matter which strikes any thinking observer, is to buttress the hill which has exhibited weakness, and two schemes in this direction were worked out, but, in view of the elasticity of the rock previously referred to, it appears that without the power-house side of the hill moving at all—that is, assuming it to be buttressed absolutely—nevertheless, sufficient movement could take place on the headrace side to again rupture concrete structures which might have been repaired or rebuilt.

After considering the whole subject from every angle, I come back to the proposal which I made to you a few days after the shut-down—that is, to confine the water in a concrete structure in such a way that it cannot bring horizontal pressure on the country between the present spillway and the power-house, in a direction approximately at right angles to its length—that is, in the direction of its weakest dimension.

Involved with this proposal is the necessity for draining away any water which might escape through the concrete structure, but, more particularly, water which from rain and natural drainage could still accumulate, and in a very short time set up just as much pressure as the whole flow of the Waikato. This draining could best be done by means of small tunnels and galleries draining freely to the power-house side of the hill, and the exploratory drives which are now being driven will be available as part of this drainage system.

The general scheme referred to above is indicated on plan P.W.D. 79659 attached hereto, from an examination of which you will see coloured in blue the line and extent of the concrete channel which I propose. The question of the length of this channel is of importance. At its upper end it must be tied in to the surrounding country in such a way as to prevent the possibility of any considerable quantity of water from the headrace finding its way down towards the spillway by any other path than through the designed channel. In other words, a small dam must be constructed across the headrace and the artificial channel begun from an opening in this dam.

The crack, so far as it was visible in the headrace, did not extend up to the point which I propose as the location of this dam, but the crack gradually decreased so that for the last few hundred feet it was merely a hair crack, the absolute end of which was hard to determine. This factor prompts one to make the artificial channel some distance beyond that point, but there is another point, and that is that the result of probings which have been taken in the last week or two shows that the point indicated on the drawing P.W.D. 79659 previously referred to as the site for the commencement of the channel is the point at which the cheapest dam could be constructed.

The channel should be constructed of reinforced concrete of a sufficient capacity to carry the maximum floods for which the whole works have been designed, and the sides of this channel should be tied together in such a way that it is an entirely self-contained unit, in other words, a flume. As it approaches the present spillway and what is usually known as the spillway extension, its left-hand side should be reduced in height to level 317, and from the left-hand edge where lowered to the crest of the spillway a floor of reinforced concrete should be constructed supported on adequate pillars. This floor should be adequately tied into the existing concrete-work. A wall at level 328 (approximately) would be carried on, on a curved course, to make with the floor referred to, a channel for the flood and surplus waters.

On the penstock side—that is, the right-hand side—the cross-ties of the channel and its floor would be adequately connected to the present penstock-intake structure. This structure is badly cracked in some parts, and was not designed to be connected with a structure of the kind now under contemplation, and therefore very considerable modification of it will be required. In other words, it is now a compression structure designed to rest against the rocks behind it. As modified, it will be a tension structure designed to hold on to the flume now being described.

The result of the construction just outlined will be that the waters of the Waikato River, whether considered as the portion driving the machines or as the surplus and flood waters passing over the spillway, will not be able to bring any horizontal pressure on the block of country which moved on the 7th June.

As in any concrete structure cracks are almost unavoidable, and the larger the structure the greater the tendency to cracking, it cannot be assumed that the reinforced concrete flume will be absolutely watertight (to make it absolutely watertight would involve a heavy and unjustifiable waste of money), and therefore provision must be made to carry away harmlessly any water which may leak, as well as the previously referred to natural drainage and rain-water.

In order to assist in collecting this water into the desired outlet-channels, a layer of broken stone or coarse gravel should be introduced under the flume, inclined in such a way as to lead the water freely towards the sumps down which it would run into the underground galleries, which would lead it away into the main gorge, where it could be discharged into the river without doing any harm.

The lines of the drainage galleries which will have two principal levels are indicated on P.W.D. 79659 by red and yellow lines respectively.

	£
The estimated cost of the works set out above is	230,000

The occurrences which we are now considering, and the disquietude in the minds of the public, indicate that the original idea that the diversion tunnel should be merely a contrivance for facilitating construction, and should thereafter be dispensed with and walled up, should now be modified, and it should be reinforced and fitted with valves suitable for operating for lengthy periods under full head. If this is done it will be possible at stated intervals to by-pass sufficient water to enable the works, particularly those at the waterfall, to be thoroughly inspected, and even to be repaired should such ever become necessary.

This proposal involves an expenditure of	60,000

In considering the whole problem it is as well to take cognizance of all the expenditure which is required, and I therefore propose to add to the cost of the above the amount which has already been authorized to deal with the erosion at the waterfall.

The waterfall work has been previously estimated at £168,000, but I propose to place it in round figures at	175,000
Making a total expenditure of	£465,000

Some works, you will see from the above, are essential and some advisable.

It may be asked why I introduce these other matters into the question of safeguarding the works behind the power-house, but my reason is that some of the further schemes to be considered later on in this memorandum do not involve the expenditure at the waterfall, therefore for the true purposes of comparison I shall show in each case all that has to be done, or which should, in my opinion, be done.

Realizing that possibly the scheme as I have outlined may not meet with the approval of Professer Hornell, the consultant whom the Government has engaged to deal with this matter, I have prepared a number of other solutions of the problem.

Scheme No. 2.

Assuming that the idea of running the flood-waters of the Waikato, and also the surplus not required at the power-generation station, over the present spillway, even when modified as indicated in my No. 1 scheme, is not approved, and that it was desirable that the great weight of this water, and the vibration caused by its passage, should be kept well away from the present works, I have worked out a scheme in which the present headrace is dammed at the same point as is provided for under the No. 1 scheme, and that from just above this point a special overflow-channel should be excavated running on a fairly uniform grade to the head of the falls. The velocity in this channel would be high, and it would require concrete lining throughout. The effect of this will be to increase the stability of the mass of country between high-water level and the tailrace level to two and a half times what it is at present at the weakest point.

The water necessary for the turbines would be taken to each of the existing penstocks by independent pipes, the pipes being laid side by side on the floor of the present headrace, the same being levelled out to allow for this.

The gates of the dam across the headrace will in this scheme take the form of a penstock intake similar to the present penstock-intake, and all the gates, screens, &c., at present existing will be simply transferred to the new position: see P.W.D. 79660.

	£
The cost of these works would be	282,500
To which, for the purpose of comparison, as explained under the No. 1 scheme, must be added for the treatment of the falls	175,000
And for improving the diversion tunnel it is desirable that there be spent	60,000
Making a total of	£517,500

One objection which may be taken to this scheme is that it does not make provision in the headrace for the ultimate possible development, but the other pipes which are necessary can be added from time to time when the scheme has grown beyond the four units which I have allowed for in all the proposals, at an additional cost of approximately £50,000.

Scheme No. 3.

Assuming that it is desired that all the water be removed from the present intake works, and the locality of the crack, and that it is thought the whole of the country which was disturbed by the crack is now unsafe, a scheme has been worked out involving moving the power-house to a point where the size of the hill between the headrace and the tailrace (in other words the old gorge) is twice what it is at the present power-house, and at which point it consequently has a very much greater resisting-power against the stresses brought about by the relative positions of the high and low-water levels, and, in order that the power-house may be in the strongest position possible, I propose that it be a

subterranean structure placed midway under the hill; that the headrace be dammed at the same point as in schemes No. 1 and 2, but with a dam in which there are no openings; that a penstock-intake structure similar to the existing one be erected, in which the fittings now existing can be used as in the No. 2 scheme; that the penstock tunnels between this intake and the power-house should be alternately on different grades in order to minimize the amount of disturbed rock at any section as much as possible. The subterranean power-house would be much smaller than the present one, as all switching and control gear would be on the surface, and only the generators, turbines, and valves, together with the necessary governor gear would be underground. From the power-house the water would be carried away by tunnels which, in order to give greater stability, would be carried out fanwise in plan.

In order to deal with surplus water and floods I propose that the diversion tunnel should be lined with steel from a point above the dam to its outlet, so that it can operate as a pressure tunnel. At its outlet it should be divided into a number of branches, probably three, each branch being fitted with a piston valve similar to the Larner-Johnson valves now controlling the water for each of the penstocks to the present power-house, or other suitable high-velocity dispersion valve and an emergency stop valve. One or more of these valves, as the case might be, would be continually in operation under maximum head, and would be so adjusted from day to day or hour to hour that the level in the lake would be kept nearly constant, and would never be allowed to rise above the predetermined level.

It is realized that a structure such as this diversion tunnel could not be operated indefinitely without attention. This is one of the reasons for having a number of valves at the outlet, so that during periods of low river they could be overhauled alternately. but, even allowing for this, we have still the main gates which now control the tunnel. These could be drawn up and any repairs or renewals necessary could be done to them while the flow was being controlled by the new outlet valves. In this way the operation could be carried on for a great many years, but even with these facilities it must be recognized that the day would come when the lining of the tunnel, and the cast-iron frames of the gates, would require attention if not renewal, and to enable such attention to be given without the shutting-down of the generating-plant, a duplicate diversion tunnel would be required.

In order to avoid the dead capital involved in the construction of this duplicate tunnel at the present day, but at the same time to enable it to be constructed with facility in the future, I propose that its intake and a short length of the tunnel, ending in a shaft structure with grooves in which stop-logs could be installed, be constructed while the present shut-down continues. When I say "stop-logs," something more than baulks of timber are meant. The stresses to be withstood are so great that the stop-logs would probably take the form of very heavy steel girders. These need not be provided until it was desired to proceed with the duplicate tunnel.

In my estimate of this scheme I have provided for improving the present diversion tunnel as in all the other schemes, and spending of £30,000 in the preliminary work of the second diversion tunnel. This scheme avoids the £175,000 required under the other schemes for protection of the waterfall, but, on the other hand, it sacrifices a certain amount of the available head, with the result that at least 15,000 kilowatts less could ultimately be developed at Arapuni. This is a decided handicap on the scheme in question. See P.W.D. 79660.

Placing the matters in the same order as in the other schemes—

	£
The estimated cost would be immediately	495,000
Of which £60,000 is for the improvement of the present diversion tunnel. This item I have shown as a more or less optional item in schemes No. 1 and No. 2, but it cannot be so regarded in scheme No. 3. It is an essential part without which the scheme could not be carried out safely.	
In the future the second diversion tunnel would require to be finished at a cost of ..	150,000
This would not become necessary for forty or fifty years, or perhaps even longer, depending on the effect of the Waikato River water upon metal structures entirely submerged.	
Making a total of	£645,000

SCHEME NO. 4.

No. 4 scheme is the same as No. 3, with this exception, that the water is allowed to proceed by its present course, the present spillway being used. The cracks where they exist under water would require to be staunched either by cement grouting, bitumen grouting, or by blanketing with a bituminous cement substance, or by covering with a telescopic concrete joint. If this were done it would not be necessary to build a weir across the headrace, nor would it be necessary to provide for the commencement of a second diversion tunnel, and the £60,000 for the improvement of the present diversion tunnel would be moved from the category of essential to the category of advisable but not imperative.

An objection which might be taken to this scheme is, however, the fact that it does not remove the pressure, which in my opening remarks I assume to have caused the bending of the columns in the vitric tuff and eventually the splitting of the rock on the lines of the columnar jointing. It is conceivable that the amount of splitting which took place might considerably increase, so that the steps taken for staunching the existing crack would be inadequate, and a certain amount of leakage might begin again, and in the course of time might, if no steps were taken to check it, erode the material lying between the vitric tuff and the massive breccia, and bring about collapse to some extent of the upper stratum. Naturally, steps would be taken to prevent any such happening, but these steps would involve the shutting-down of the power-house again while the matter was dealt with, and we might be forced to eventually do all the works indicated under the No. 3 scheme. See P.W.D. 79660.

The £150,000 mentioned under No. 3 scheme as necessary for the eventual driving of the second diversion tunnel would also be avoided, but the £175,000 for the repairs to the falls would have to be provided for.

Placing the costs in the same order as in the previous schemes,—

	£
We have .. .. for new works	375,000
Plus advisable .. .. for improving diversion tunnel	60,000
Plus .. .. also approved for falls treatment	175,000
Making a total of	£610,000

SCHEME No. 5.

Scheme No. 5 involves a subterranean power-house, &c., as for No. 3, but instead of disposing of surplus and flood waters by diversion tunnels or over the existing spillway, I propose to carry the surplus water by the lined channel described in scheme No. 2. This is the scheme which probably gives the highest factor of safety, in that the power-house occupies what appears to be the strongest part of the hill, and the water standing at high level is kept away from the gorge as far as practicable, while no use is made of any of the ground which shows evidence of having been disturbed by the recent crack. P.W.D. 79661.

Putting the figures as previously—

	£
This scheme is estimated to cost	604,500
To which must be added .. .. desirable improvement to the diversion tunnel	60,000
And .. .. for the treatment of the falls already authorized and in progress	175,000
Making a total of	£839,500

SCHEME No. 6.

Scheme No. 6 involves the damming of the headrace as in the previous schemes, constructing therefrom a flume somewhat similar to that of No. 1, but dimensioned for the bare requirements of the ultimate development—in other words, for about 12,000 cusecs, but making no provision in this way for floods or surplus. Modification of the penstock-intake structure as in No. 1 would be necessary. The surplus water and floods would be dealt with by an artificial spillway as in No. 2 (see P.W.D. 79661), and placing finance in the same order as above—

	£
Estimated cost	337,000
Plus .. .. for improvements to diversion tunnel	60,000
Plus .. .. for treatment to falls	175,000
Making a total of	£572,000

SCHEME No. 7.

If the power-house were retained in its present position, and any one of the several possible methods of dealing with the surplus water between the power-house and the dam were adopted, we would be faced with a tail water-level during floods so high as to prevent the operation of the power-house, or at any rate to prevent the successful operation of the present machines. Modification could be introduced in future machines, but this would not be important.

The occasions when a flood of 30,000 cusecs would occur are extremely rare, in fact we have only knowledge of one such occurrence since recorded history began. If the possibility of the power-house being shut down when floods exceed, say, 25,000 cusecs, which would be extremely seldom, is recognized and allowed for, the cost of the works could be very much reduced. Assuming also that the ground between the present forebay and the power-house is not dangerously shaken, then a scheme considerably cheaper than any of those so far mentioned could be devised, and would be as follows: A new weir across the headrace as in almost all the other schemes; a minimum-sized flume as mentioned under No. 6, with the necessary modification to the penstock structure; surplus and flood waters would be dealt with as in scheme No. 3. This scheme avoids any work at the falls, but requires the immediate strengthening and refitting of the present diversion tunnel, and the providing of a start on the second, and also involves in forty or fifty years the completion of the No. 2 diversion tunnel. Thus we have—

	£
Estimated cost	238,000
Plus in the future	150,000
Making a total of	£388,000

No. 8 Scheme.

No. 8 scheme involves the same assumptions as are made in No. 7, but instead of the minimum dimension flume with alteration to the penstock intake, which are provided in No. 7, it involves the fitting of screens and other penstock-intake accessories to the small weir across the headrace, and the carrying from four openings therein of four separate pipes to connect with the present penstocks. The cost of these works would be £183,000, but when the station was extended beyond four machines it would be necessary to bring further pipe-lines, involving a cost of £50,000, to the new machines, and it would also involve the future spending of £150,000 to complete the No. 2 diversion tunnel. Thus we have, to bring the scheme comparable with those previously mentioned,—

	£
Estimated cost	183,000
Plus .. .. for additional pipes	50,000
Plus .. .. for future No. 2 tunnel	150,000
Making a total of	£383,000

In addition to the eight schemes set out above, quite a number of other combinations could be put forward, and some of these have been to a greater or lesser extent elaborated.

Coming back to my memorandum to yourself of 21st July, 1930, and the suggestion in the third paragraph: It was found when the details were worked out that the space between the cliffs behind the dam was so small that a power-house of the size necessary could not be installed without weakening the cliffs by excavation. Further, this scheme involves a great loss of available power, and was consequently not further proceeded with.

The proposal in the fourth paragraph turned out to be undesirable for the reason mentioned in connection with schemes 7 and 8, but more particularly on account of expense, and my disinclination to throw upon the dam, even when modified, stresses for which it was not originally designed.

The proposal in the fifth paragraph also is open to the objection that it brings flood-waters past the present power-house, and, further, the cost of the artificial channel would be very considerable, and the ground over which it must pass is not of a character suitable for the service, although, of course, at sufficient expense it could be made so.

The buttressing system referred to in the sixth paragraph has already been dealt with.

A suggestion that the power-house be transferred to the opposite side of the gorge and the penstocks simply brought across the river on piers, assumes that the site of the power-house is faulty, which is not correct, and still leaves the penstocks intake, &c., in the disturbed ground, and does not remove the cause of the trouble.

Should the consultant be of the opinion that none of the schemes put forward are satisfactory, then others can be devised.

My reason for preferring No. 1 scheme to any of the others described are:—

(1) It removes what I consider to have been the cause which brought about the crack which developed on the 7th June.
(2) It in no way reduces the ultimate capacity of the scheme.
(3) It provides immediately headrace facilities for the ultimate development with very little extra cost.
(4) It retains the original works in their entirety, interferes to a minimum degree with any part of the rock-structure, and preserves the whole layout from the point of diversion above the dam to the return of the waters to their old bed.
(5) It enables use to be made of the work done on Nos. 4, 7, and 8 penstocks and the power-house extension excavation.

In connection with this report certain estimates have been given for each of the schemes, and an endeavour has been made to make these fairly comparable, but I would point out that if any one of these schemes were to be put up for public tender it would be reasonable, and in fact imperative, to allow intending contractors several months to take off the quantities and make their estimates of any one of the schemes, whereas I have only had a matter of days in which to attend to the whole matter. Nevertheless, I consider that the figures given could be considered a basis for comparing one scheme with another, and they will be within the ordinary limits of tolerance allowed in connection with estimates made in this way.

F. W. Furkert,
Engineer-in-Chief and Under-Secretary.

22nd August, 1930.

ARAPUNI POWER SCHEME: FINANCIAL POSITION.

THE HON. THE MINISTER OF PUBLIC WORKS,—

The water-power schemes erected by the Government for generation of electricity are operated under the provisions of the State Supply of Electrical Energy Act, 1917, which provided that the revenue, after paying working-expenses, is to be disposed of in the following order:—

(1) In payment of the interest charges on the operating capital invested in the undertaking:
(2) In providing for a Depreciation (Renewal) Fund of not less than 2 per cent. of the value of the assets in operation, exclusive of the sums appearing for interest during construction and for loose stocks of material:
(3) In providing, when sufficient profits are available, a sinking fund of 1 per cent. per annum on the capital invested in the undertaking:
(4) Any surplus after meeting the charges already enumerated is to be carried to a general reserve.

The present average rate for interest borrowed for hydro-electric development is 5·18 per cent. It is urged by some authorities that a renewal provision of 2 per cent. and a sinking fund of 1 per cent. particularly where, as at Arapuni, the heavier portion of the expenditure is in permanent works such as dams with long expectation of life, is too severe. Nevertheless, in the computations that follow, those rates have been adopted.

The output from Arapuni commenced in May, 1929, from which time electricity was supplied to the system from both the Arapuni and Horahora Stations, so that for the year ending 31st March last the accounts for those stations had necessarily to be amalgamated. After deducting £23,712 for the cost of electricity supplied from steam and oil generating sets, the revenue earned was £201,971, and the maximum station output was 41,520 kw. The net result was that, after paying all working-expenses and £135,622 for interest at 5·18 per cent. per annum on the operating capital, there remained £27,490 for the Renewal Fund, or only £32,768 short of actual requirements. Although these results were so eminently satisfactory, they could not be taken as any true indication of the very favourable financial prospects of the system before the mishap occurred, because, as already stated, the machines at Arapuni were on load for a portion of the year only, and, in any case, even at the end of the year only three machines, representing a capacity of 45,000 kw. had been installed. Moreover, the very heavy expenditure involved in the dams and waterworks, sufficient to provide for eight machines with a total capacity of 120,000 kw., had already been incurred, and it was merely necessary to extend the power-house and machinery to reach that capacity at Arapuni. The power-house capacity of the Horahora Station is 10,300 kw. (nominal full load).

At the time the trouble at Arapuni occurred, in June this year, the total capital expenditure for the whole system, including Horahora and all the distribution and transmission works, but excluding £56,739 for the value of movable stocks and similar items, was £3,670,107. After making an apportionment of the charges for supervision, interest during construction, loan charges, and similar overhead expenses, this capital sum can be allocated as below:—

——	Horahora.	Arapuni.	Total.
	£	£	£
Dams, power-house, and other headworks	315,094	1,658,804	1,973,898
Interest during construction	19,014	257,121	276,135
Engineering expenses, loan charges, &c.	32,624	164,136	196,760
	366,732	2,080,061	2,446,793
Distribution and transmission system	214,189	827,938	1,042,127
Interest during construction	13,000	64,164	77,164
Engineering charges, loan charges, &c.	22,103	81,920	104,025
	249,292	974,022	1,223,314
Totals	616,024	3,054,083	3,670,107

Various contracts and other commitments, principally in connection with the supply of the fourth unit, have been entered into, and it is estimated that these will amount to £200,000, which, added to the sum of £2,080,061 above, brings the total investment in the headworks at Arapuni to £2,280,000. Other charges incidental to the actual erection of the fourth unit, bringing the capacity of Arapuni alone to 60,000 kw., would make the then total cost of the headworks £2,380,000, and the total cost of both Arapuni and Horahora, with all distribution and transmission, £3,970,000. It will thus be seen that the total capital involved in any investigation of the future of Arapuni alone is approximately £2,280,000, and that the installation of 60,000 kw. there would cost for headworks £2,380,000, or nearly £40 per kilowatt. The installation of a further 60,000 kw., for which the dam and other waterworks have been designed and constructed, would cost approximately £600,000, bringing the capacity at Arapuni to 120,000 kw., at a capital cost of about £25 per kilowatt. In order

to dispose of this output the transmission and distribution system would have to be extended at a cost of probably another £600,000. The total cost of the whole system for 120,000 kw. at Arapuni and 10,300 kw. at Horahora would then be £5,170,000, including £410,000 for interest during construction. The annual cost would then be—

	£
Working-expenses	50,000
Interest on £5,170,000 at 5·2 per cent.	269,000
Renewals and depreciation on £4,760,000 at 2 per cent. ..	95,000
Sinking fund on £5,170,000 at 1 per cent.	52,000
	£466,000

All this, of course, relates to the position prior to the discovery of the crack that caused the plant to be closed down.

It was anticipated that without making any concessions to consumers, the whole of the 130,000 kw. would have been taken up by 1940 and sold at an average cost of £6 10s. per kilowatt year, giving a total annual income of £845,000, as against £466,000 actually required to cover all costs at that time, leaving a margin of £379,000 per annum to pay for contingencies and to make good any losses or sinking-fund arrears that might possibly have accrued in the earlier years of operation, or, alternatively, to enable reductions in charges to consumers.

Taking the whole system for the purposes of the present discussion as being confined to 70,000 kw. at a cost of £3,970,000, including £360,000 for interest during construction, the annual charges for interest at 5·2 per cent. and depreciation at 2 per cent. would be £279,000, and working-expenses £45,000—a total of £324,000 per annum. There is very little doubt that within a very short time after resumption of operation, without any great increase in the transmission capital costs, the whole output of 70,000 kw. could be sold at an average rate of £6 10s. per kilowatt a year, which would give an income of £455,000. This, after paying a sinking fund of 1 per cent., equal to £40,000, and the £324,000 above referred to, would leave £91,000 per annum, or sufficient to meet any small losses during the period the station would be gathering full load, and the interest and other charges on a further capital expenditure of £1,100,000 without increasing the plant capacity. On the assumption that repairs could be completed at Arapuni by 1st April, 1932, and allowing £210,000 for interest on Arapuni headworks during the intervening period to be capitalized, and other capital charges deferred until operating is resumed, it appears that the Government could spend up to £890,000 on repair work and still look for financial success, even with only four units installed instead of eight. Even if the full £890,000 had to be spent, which is unlikely, the position about 1936 would be—

Total capacity of Horahora and Arapuni, 70,000 kw.

Capital cost—	£
Ordinary expenditure to 4-unit stage at Arapuni	3,970,000
Deferred interest charges during repair period	210,000
Loss between 1932 and 1936 until full load is reached	100,000
Cost of extraordinary repairs	890,000
	£5,170,000

Capital charges on above—	£
Interest at 5·2 per cent. on whole amount	268,600
Sinking fund at 1 per cent. on whole amount	51,700
Renewal provision on £4,500,000 at 2 per cent.	90,000
	410,300
Working-expenses	45,000
Total annual costs	£455,300

Annual income (70,000 kw. at £6 10s.), £455,000.

As any further machines could safely be installed at a capital cost for power-station and distribution of about £20 a kilowatt, the annual return from their operation would be something like 25 per cent. per annum on cost when fully loaded, and there is no need to further pursue that aspect of the case.

These conclusions have taken no account of the cost of installing or operating steam or other similar plants to carry the load in the meantime, as whatever is done at Arapuni will not affect the necessity for their erection.

Should the whole of the Arapuni headworks, costing to date, as set out above, the sum of £2,280,000, be abandoned, the annual interest charges at 5·2 per cent. and sinking fund 1 per cent. would amount to £141,000 per annum for thirty-seven years, which annual amount would require to be found either from the general Consolidated Fund or an extra charge to the users of electricity from other works. In addition, there would, of course, be the unassessable loss to the country, and to the Auckland Province in particular, through the impossibility of supplying cheaper electricity for the several years that must elapse before some other water-power scheme could be completed to replace Arapuni.

F. W. Furkert,
Engineer-in-Chief and Under-Secretary.

22nd August, 1930.

LETTER TO PROFESSOR P. G. HORNELL.

DEAR SIR,— 23rd August, 1930.

Re *Arapuni Inspection.*

1. In connection with your forthcoming inspection and subsequent report on the Arapuni Hydro-electric Station and surroundings I desire to say that facilities have been provided by the Engineer-in-Chief, Public Works Department, for you to make an examination of the records, plans, and specifications, and other matters in connection with the scheme.

2. It is presumed that you will require a few days to carry out this investigation, and Mr. F. W. Furkert, Engineer-in-Chief, will then, at your convenience, accompany you to Arapuni, where residential quarters have been arranged.

3. In order to further facilitate your examination and report, I hand you herewith the following :—

(*a*) Statement presented by me to the House of Representatives on the 28th June, 1930.

(*b*) Report (in two sections) by the Officer in Charge of the Scientific and Industrial Research Department on the geological formation of the area.

(*c*) The proposals of the Engineer-in-Chief, Public Works Department, in regard to the station.

(*d*) A report covering the financial and economic aspects of the Waikato hydro-electric system, which includes Arapuni Station and Horahora Station.

(*e*) The order of reference, which sets out the points upon which the Government desires information.

I desire to assure you that I shall be pleased to do everything in my power to facilitate your investigation of the position, and to that end I ask you to please consider all the resources of my Department as being at your disposal.

Yours faithfully,
W. B. TAVERNER, Minister of Public Works.

Professor P. G. Hornell, Wellington.

ARAPUNI HYDRO-ELECTRIC SCHEME: ORDER OF REFERENCE FOR PROFESSOR P. G. HORNELL.

The Government desires a full report, set out in your own way, covering your impressions of the scheme generally, the trouble which occurred on the 7th June, 1930, and the possibilities, methods and probable costs of rehabilitation, and, in addition, the Government desires replies to the following questions :—

(1) Are the general surroundings, the class of country, and the power-development possibilities such that the locality was suitable for the economic generation of hydraulic power ? Also under this heading replies to the following :—

(*a*) Whether it is likely that the country supporting the lake is capable of continuing to retain the weight of water, having special reference to the part known as Acacia Gully ; if it is not capable of continuing to retain the weight of water, what steps, if any, are recommended to create adequate strength ; and an estimate of the cost of carrying out such strengthening-work.

(*b*) Whether the main dam is correct in its location, design, and construction, having regard to the nature of the country, the weight of water the dam is required to support under full head, the ultimate proposed power output, and the public safety.

(*c*) If, in any particular under (*b*) the answer is in the negative, how and at what cost do you consider such shortcoming(s) may be rectified ?

(2) Assuming the reply to (1) to be in the affirmative, do you consider that the best use was made of the topography existing ?

(3) Were the works sited in such a way as to ensure the development of the maximum power available consistent with reasonable expenditure, and have the works as executed been designed in accordance with the accepted principles of engineering ?

(4) Are there any points in connection with the scheme on which you have reason for adverse criticism ? If so, give particulars. Also reply to the following question :—

Whether, in view of the geological formation between the gorge and the headrace and spillway the locations of the spillway-weir, the penstock-tunnels, the out-door station and the power-house are situated in the best relation to each other from the viewpoints of (*a*) electrical engineering practice and (*b*) civil-engineering practice.

(5) Has the constructional work been well carried out ?

(6) Was the cracking which took place on the 7th June a phenomenon which should have been foreseen by those responsible for the installation ?

(7) If your reply to No. (6) is in the affirmative, what steps do you consider should have been taken to prevent this cracking ?

(8) What, in your opinion, was the cause of the cracking ? Also reply to the following points :—
To what extent, if any, the following factors contributed towards the fracture in the hill between the gorge and the headrace and spillway :—
(i) Geological weaknesses in the headrace ;
(ii) The driving and operation of penstock-tunnels ;
(iii) The weight of the outdoor-transformer station ;
(iv) The moment exerted by the weight of water in the headrace and spillway as a force applied against the hill in the direction of the gorge ;
(v) The weakening of the hill by water-absorption.

(9) Does the fact that the crack occurred render the continued operation of the power-generating station impossible, presuming remedial measures to be carried out ?

(10) Could the present power-house be safely operated without any major remedial measures being taken, and could the displacement of the generators be remedied ? Would it be possible or advisable to run the plant in the present condition of the machines and concrete emplacements ? If not, what should be done to remedy this position ?

(11) Having in mind the condition of fracture which exists, do you consider it advisable to construct any additional penstock-tunnels on lines of present existing tunnels ; and, if so, what would be the effect of the increased strain or pressure which would thus be placed on the hill between the headrace and the gorge ?

(12) Prior to the present trouble occurring, and owing to the rapid erosion taking place below the spillway-dam, authority was given to concrete the "falls." After examining the plans and specifications for this work, do you consider the proposal a proper one, possessing reasonable prospects of success, and what is your opinion of the estimated cost ?

(13) If you do not consider above proposal for concreting the "falls" a proper one, what is your alternative suggestion for dealing with this portion of the scheme and preventing further erosion ?

(14) Is the scheme put forward by the Department's engineers for remedial measures the best, in your opinion, and could it be carried out at the price estimated ?

(15) If your answer to No. (14) is in the negative, which other of the possible schemes put forward by the Department's engineers should be adopted ?

(16) If, in your opinion, none of the schemes put forward by the Department's engineers indicates the best solution, what do you consider should be done, and what is your estimate of the cost of your proposals ?

(17) Assuming you are of the opinion that the position is or can be made quite secure without moving the present power-house, do you consider that there will be any risk in proceeding to extend the power-house on the lines which were being followed prior to the trouble of the 7th June ?

(18) If your answer to No. (17) is in the negative, what additional safeguards do you consider should be provided ?

(19) If your answer to No. (17) is in the affirmative, would it be practicable and safe to run the power-house up to its present installed capacity, or, alternatively, would a modification of the present installed capacity enable the present power-house to be operated with a requisite amount of safety ?

(20) If, even with additional safeguards, you are of the opinion that the present power-house should not be extended, what do you consider the best method to adopt for the generation of the remaining half of the possible power at this location ?

(21) Having examined the geological evidence and the formation as disclosed by the test holes, do you consider that it was reasonable to erect the dam and the power-house on the sites selected ?

(22) If your answer to No. (21) is in the negative, what conclusions do you derive therefrom ?

(23) Having given full consideration to the conditions of the headrace, and in the event of your opinion precluding its further use, what alternative method would you recommend for the delivery of water to the penstocks ?

APPENDIX B.—OTHER HYDRO-ELECTRIC WORKS.

LETTER TO PROFESSOR P. G. HORNELL.

Office of Minister of Public Works, Wellington, 23rd August, 1930.

Professor P. G. Hornell, Wellington.

DEAR SIR,—

As you are probably aware, the State owns and operates other hydro-electric works in various parts of New Zealand, and the Government has decided to ask you to be good enough to extend your examination to these stations, which are Waikaremoana and Mangahao in the North Island, and Coleridge and Waitaki in the South Island.

I have accordingly arranged for the Engineer-in-Chief to personally conduct you round our principal works.

The topographical and geological conditions which exist at the Waikaremoana site are in some respects peculiar, and, as it is desired to extend the installed capacity of this station, specific replies to certain questions germane thereto are desired.

The following brief comments on Waikaremoana will, no doubt, make the position clear to you :—

Waikaremoana is a lake formed by the damming of a canyon by landslide, the occurrence dating from several hundred years ago. Water issues from the lake principally through a large number of subterranean passages in the slip material. Where the most of these channels run into one course they have been gathered by a weir and a short headrace into a small lake, which by artificial mea was raised 10 ft., and from there carried to the present power-house.

Further power can be obtained at Waikaremoana—

(*a*) By stopping the underground flows, and thereby obtaining more complete regulation of the waters flowing into the lake :

(*b*) By drawing water from the lake by a tunnel or other method at a level some distance below the surface, and developing power from the fall between the lake-surface and the present intake at the small lake previously referred to :

(*c*) By taking tail-water from the present power-house, leading it by tunnel conduits for a considerable distance down the valley, and then dropping to a power-house at river-level.

It will be seen from the foregoing that the regulation of the lake would improve the value of the present power-station and both the other possible developments.

Following on this description, which no doubt will be clearer after you see the place, I would be glad to have your opinion on the following questions :—

(1) Is the present installation at Tuai safe and satisfactory, viewing all the surroundings of the case ?

(2) For the purpose of increasing the supply of hydro-electricity energy, should the Government proceed with a scheme of development above the present intake or below the present tailrace ?

(3) Would any risk be involved in stopping or attempting to stop the underground passages through which water now escapes from the lake ?

(4) If there is any risk, is this risk so great as to make the attempt unwise ?

(5) In proceeding with upper power-development, would it be safe to make any excavations in the nature of tunnels or open cuttings, or to undertake the installation of pumping machinery or syphons on a large scale on the narrowest part of the slip material which separates the waters of the lake from the valley below ?

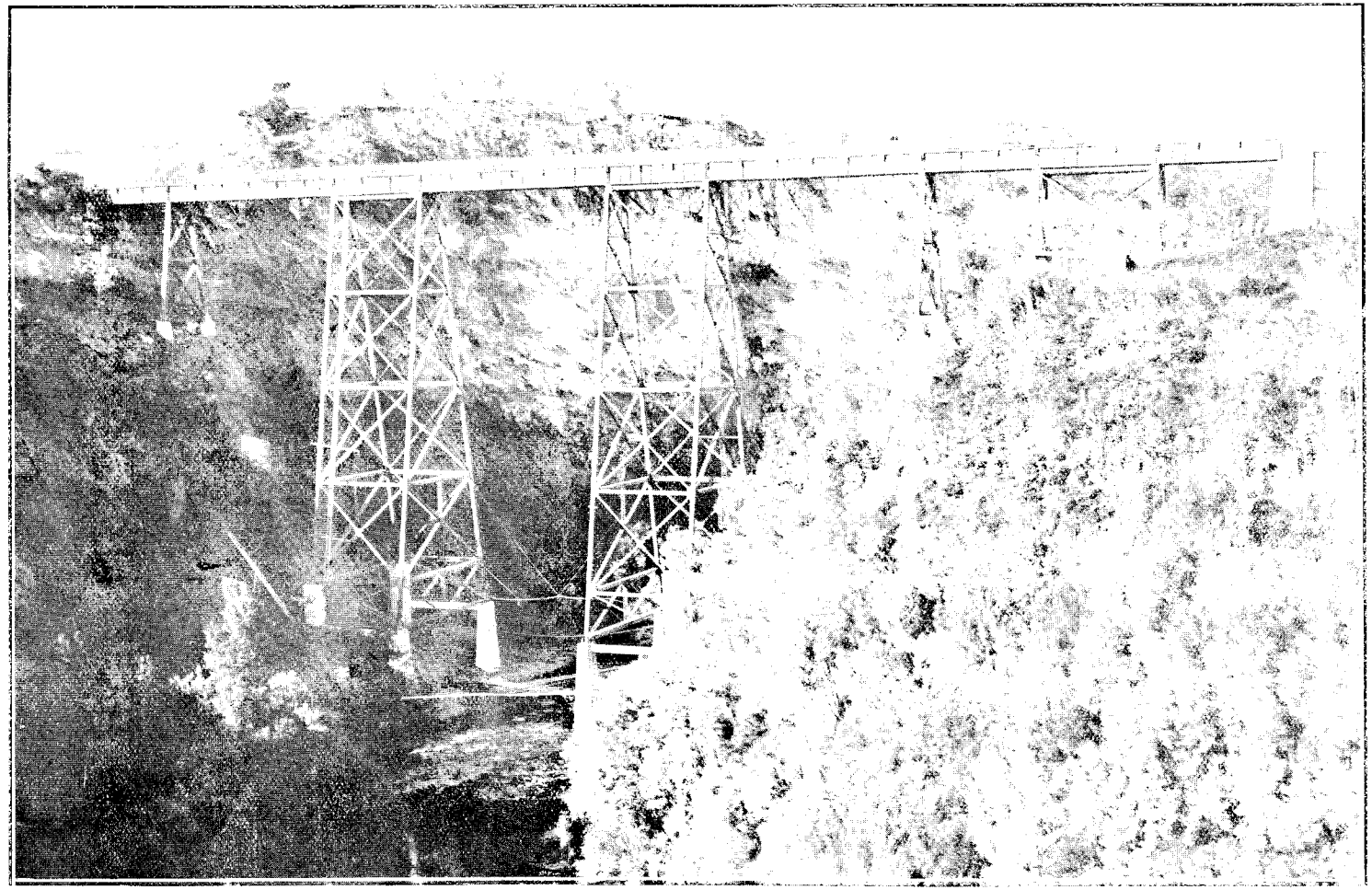
(6) Alternatively, should any further engineering-works be executed in the slip material, or should the point at which the water is drawn off from the lake and the conduits for carrying same be located entirely outside the slip area ?

(7) Generally, are the conditions at Waikaremoana such as render it a more suitable place for maximum development than the Waikato River at Arapuni or elsewhere on its course ?

Although I have put these definite questions, I do not wish you to limit your answers necessarily to direct affirmatives or negatives, but would be glad if you would, in addition, view the matter in a broad light, and comment upon the position, both present and future, to any extent which you consider necessary in order that the Government may be fully aware of your opinions and recommendations.

In regard to the other stations, the Government would be obliged if you would render a general report. I shall be pleased to discuss with you in due course the question of additional remuneration for this work. I wish to make it clear, however, that the Government regards the situation at Arapuni as being of paramount importance in relation to the other schemes.

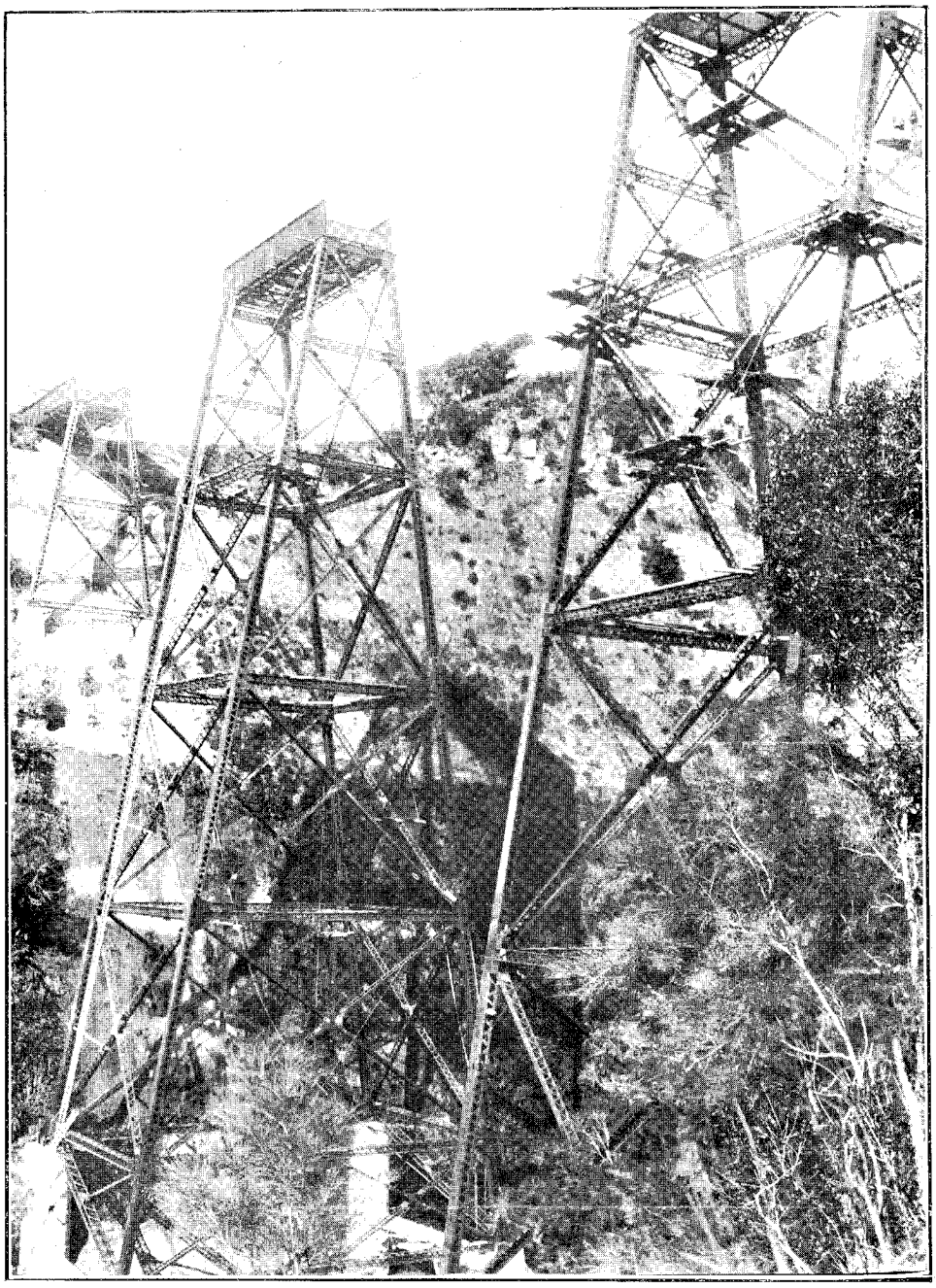
Yours faithfully,
W. B. TAVERNER, Minister of Public Works.



WAIROA CANYON—GENERAL VIEW.

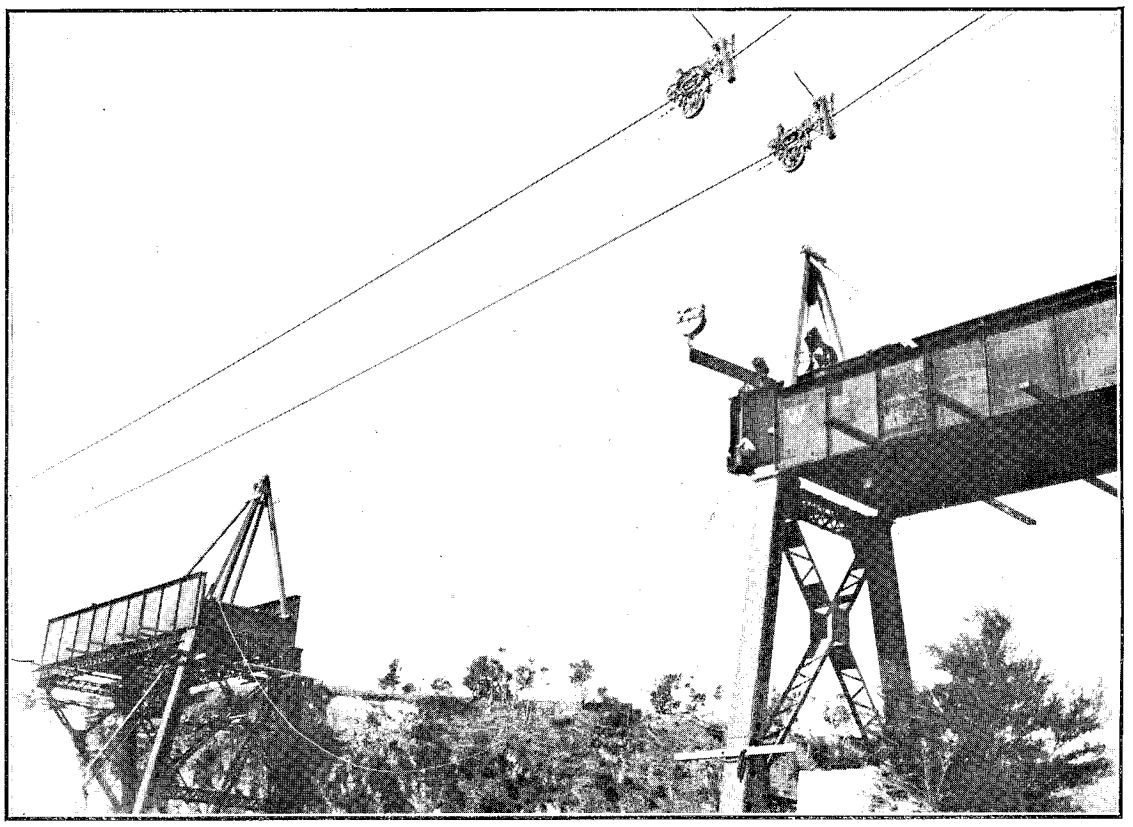
Three 90ft. (lat. 30ft.), and one 65ft. Gwynn steel plate girder spans on steel towers and concrete foundations—height from [illegible] to rail level, 250ft.—[illegible] viaduct.

GISBORNE-WAIROA RAILWAY—WAIROA SECTION.

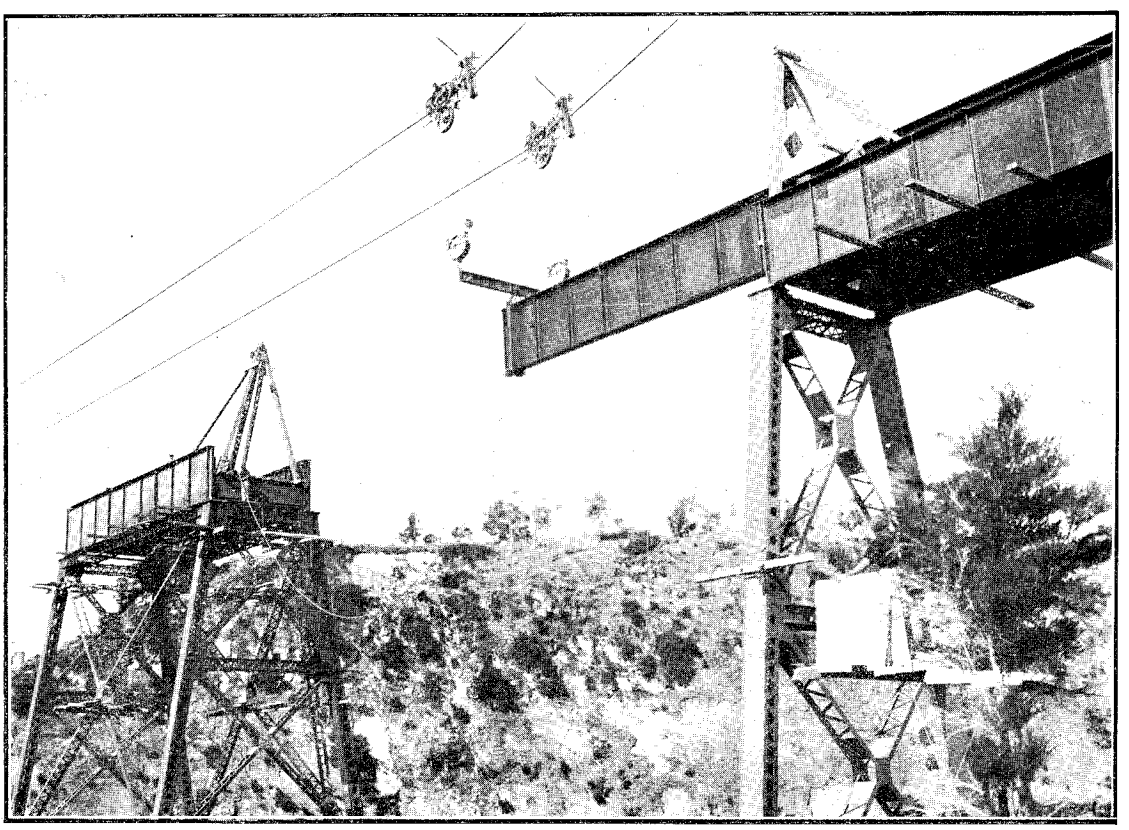


WAIKARE VIADUCT.—GENERAL ELEVATION OF MAIN TOWERS.

Note man at rivet-forge in top right-hand corner.



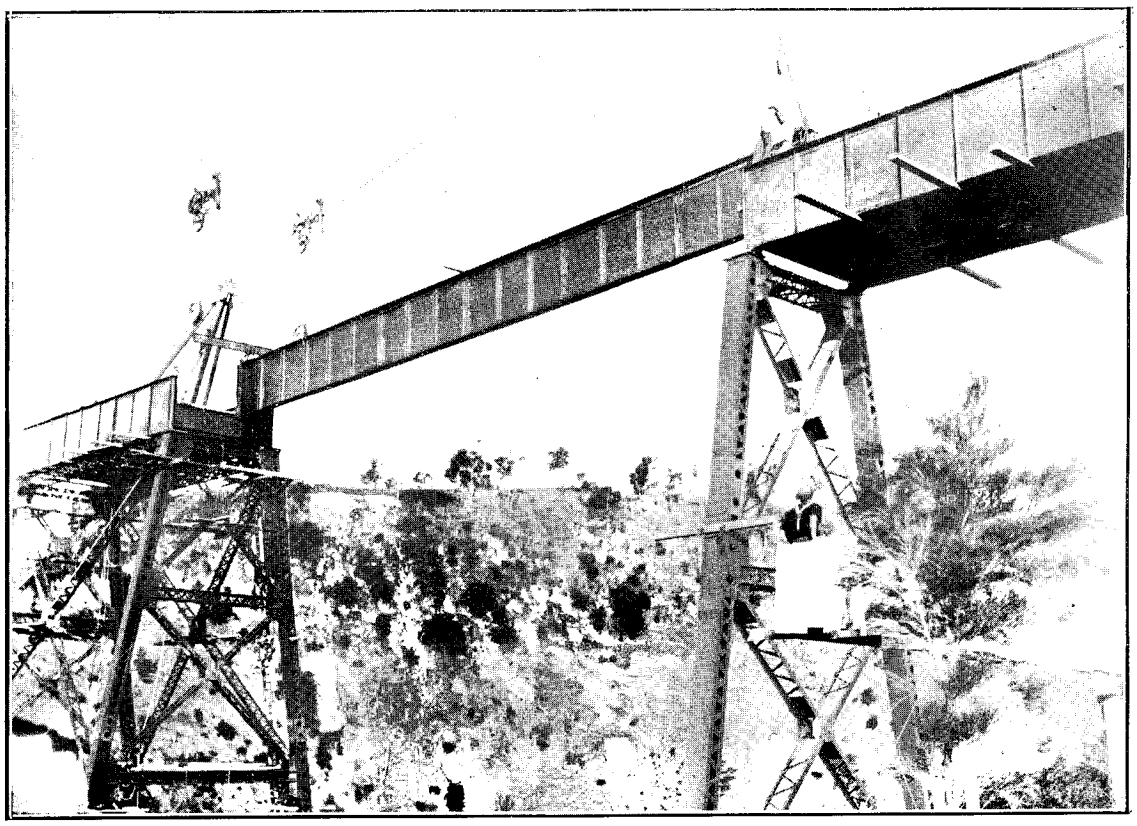
READY TO LAUNCH.



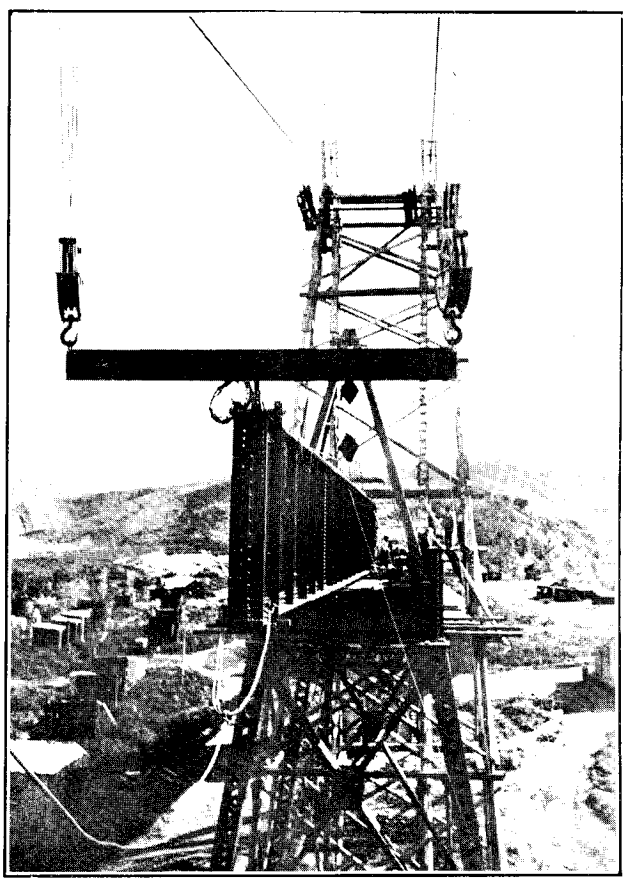
HALF-WAY ACROSS.

VIEWS SHOWING LAUNCHING OF 100 FT. SPAN.

GISBORNE–NAPIER RAILWAY.—WAIROA SECTION.



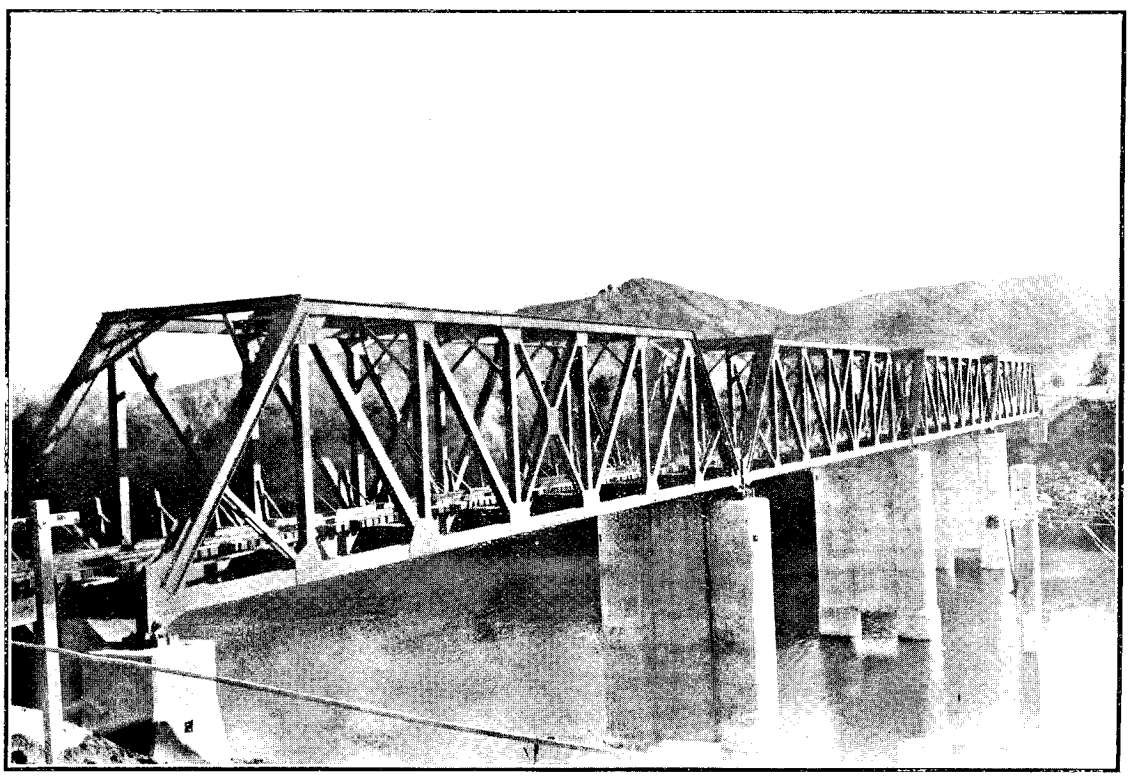
Span almost in Position.



Details of Launching-gear.

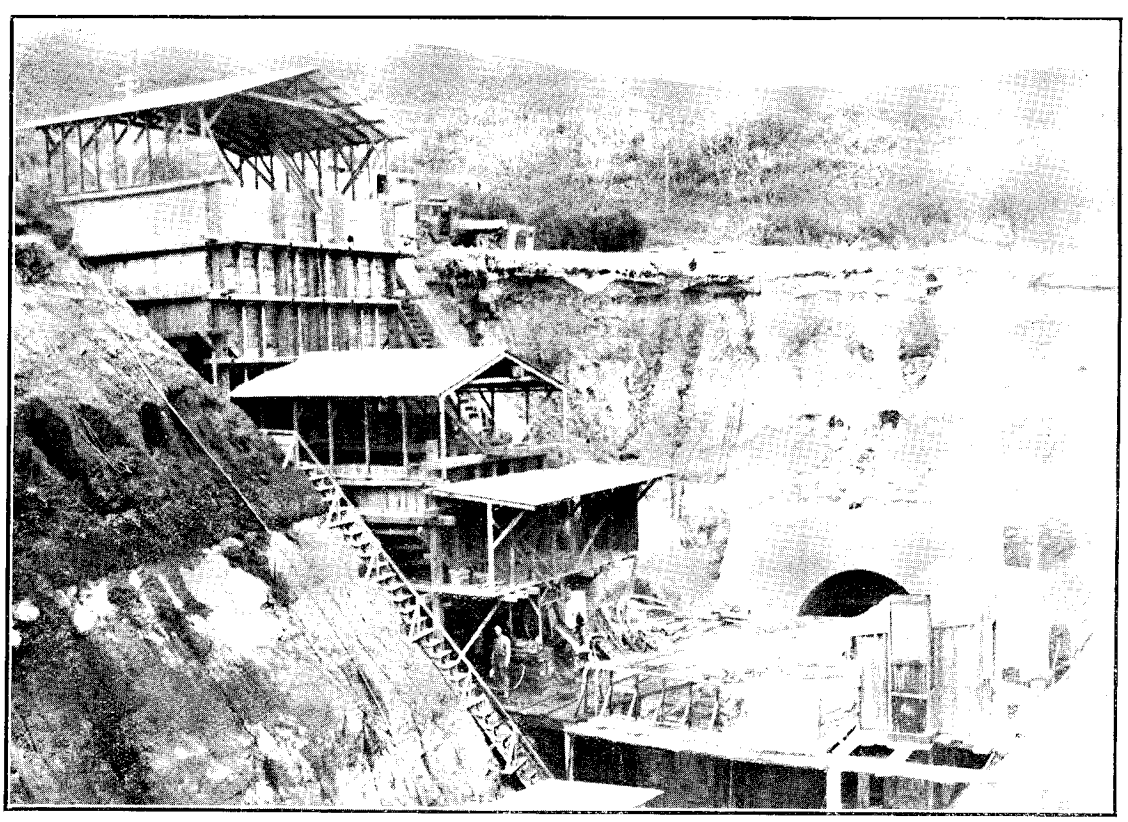
Views showing launching of 100 ft. Span.

GISBORNE-NAPIER RAILWAY.—WAIROA SECTION.

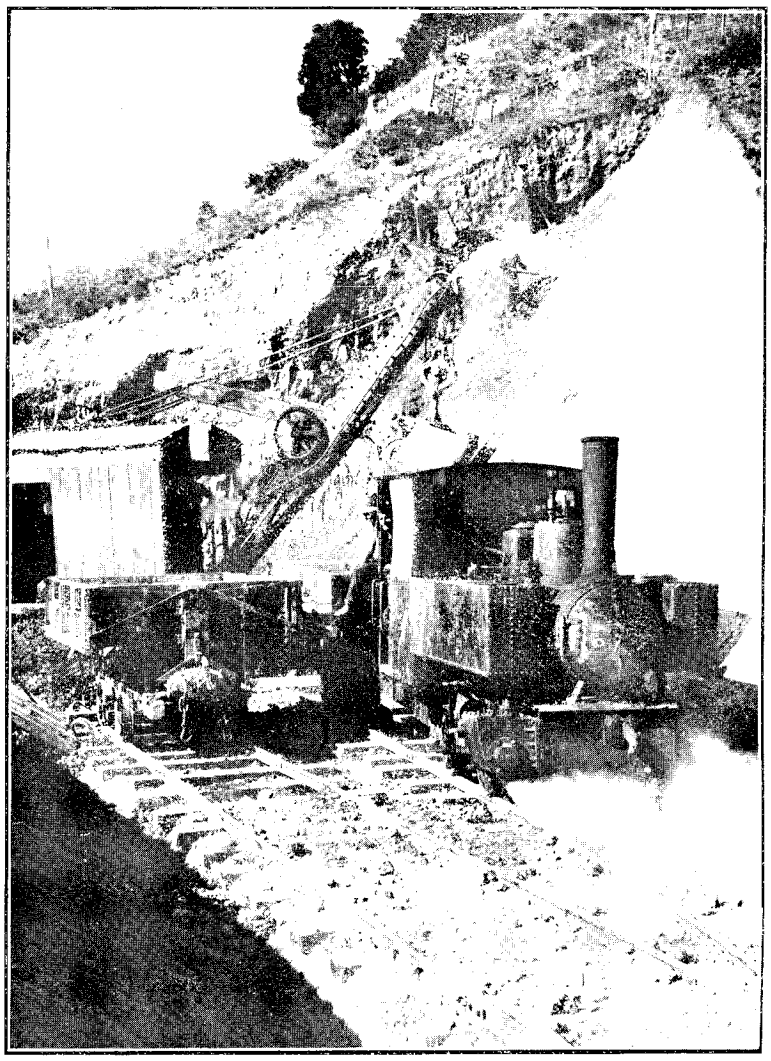


Wairoa River Bridge.

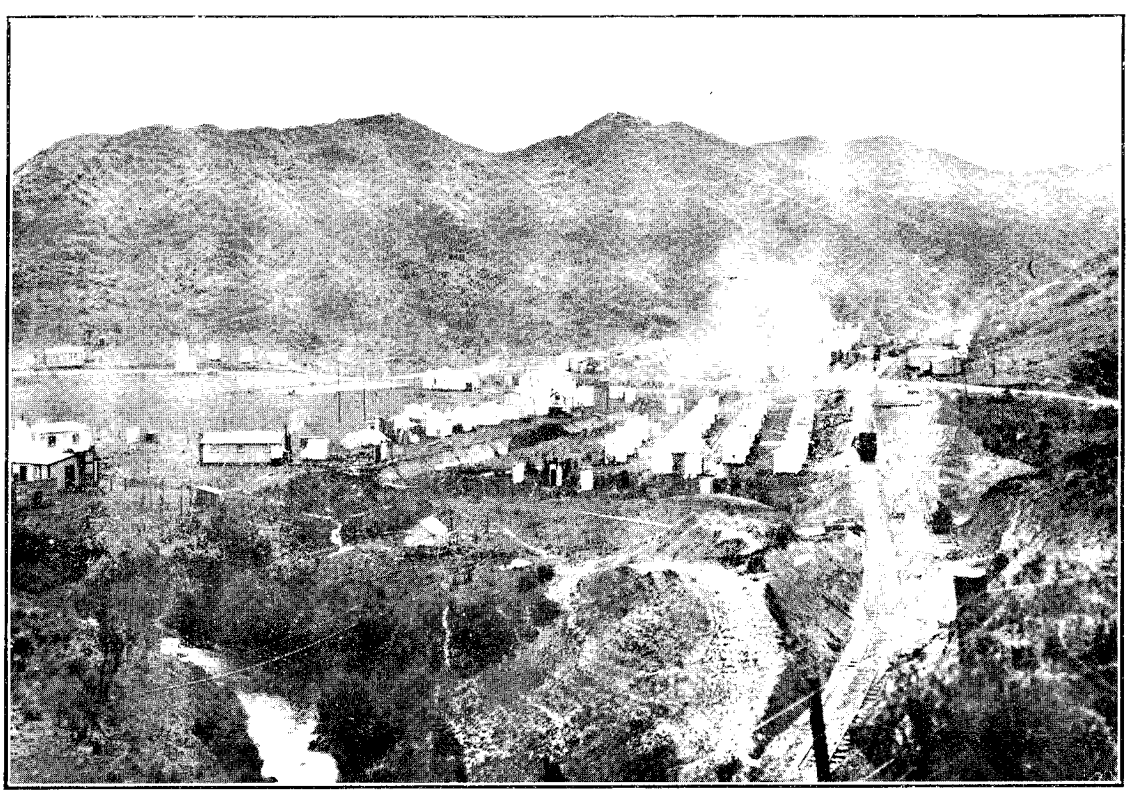
Four 105 ft. through steel-truss spans and two 15 ft. rolled-steel-joist landing-spans: reinforced-concrete cylinder piers, and piled abutments.



Kotemaori Tunnel, North End.—View showing Concrete-aggregate Bins, Screening-plant, and Concrete-mixer.

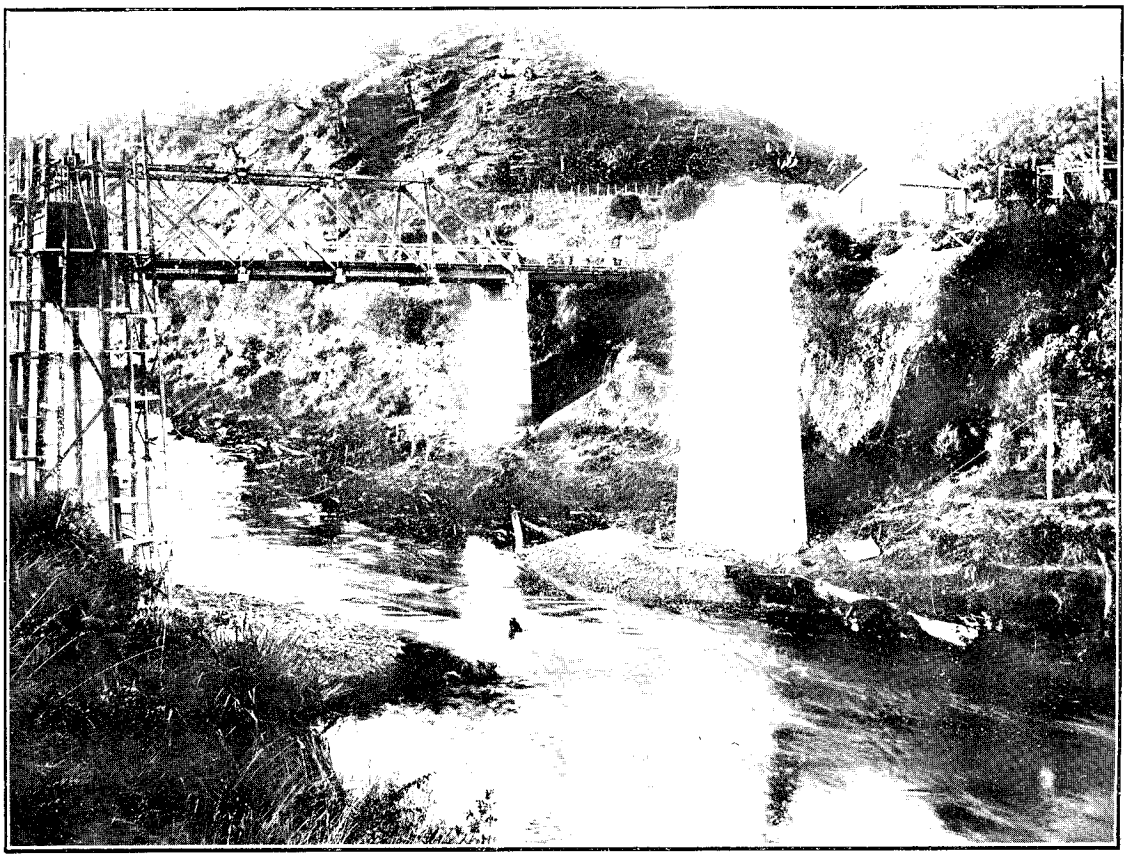


View showing Steam-shovel and Service Locomotive in Cutting at 33 m. 10 ch.

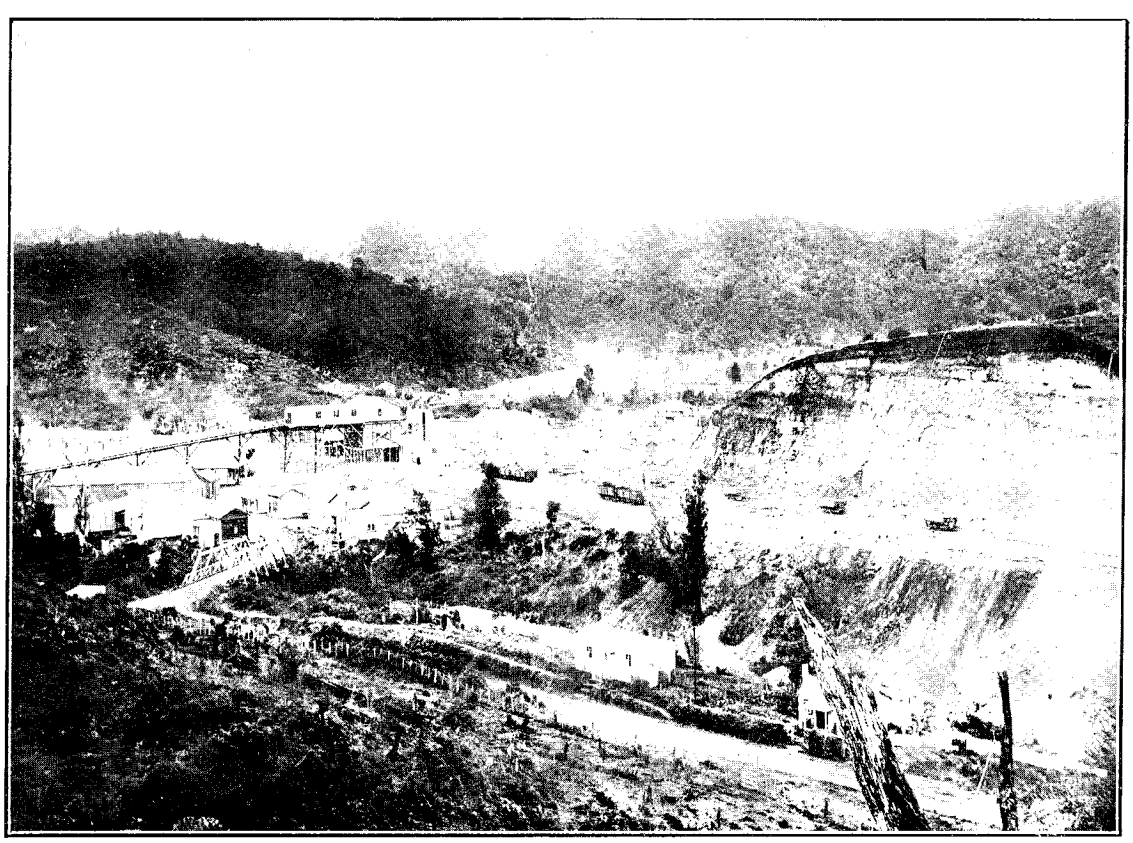


View showing Heao Station-yard Camp.

STRATFORD MAIN TRUNK RAILWAY.—EASTERN END: HEAO SECTION.

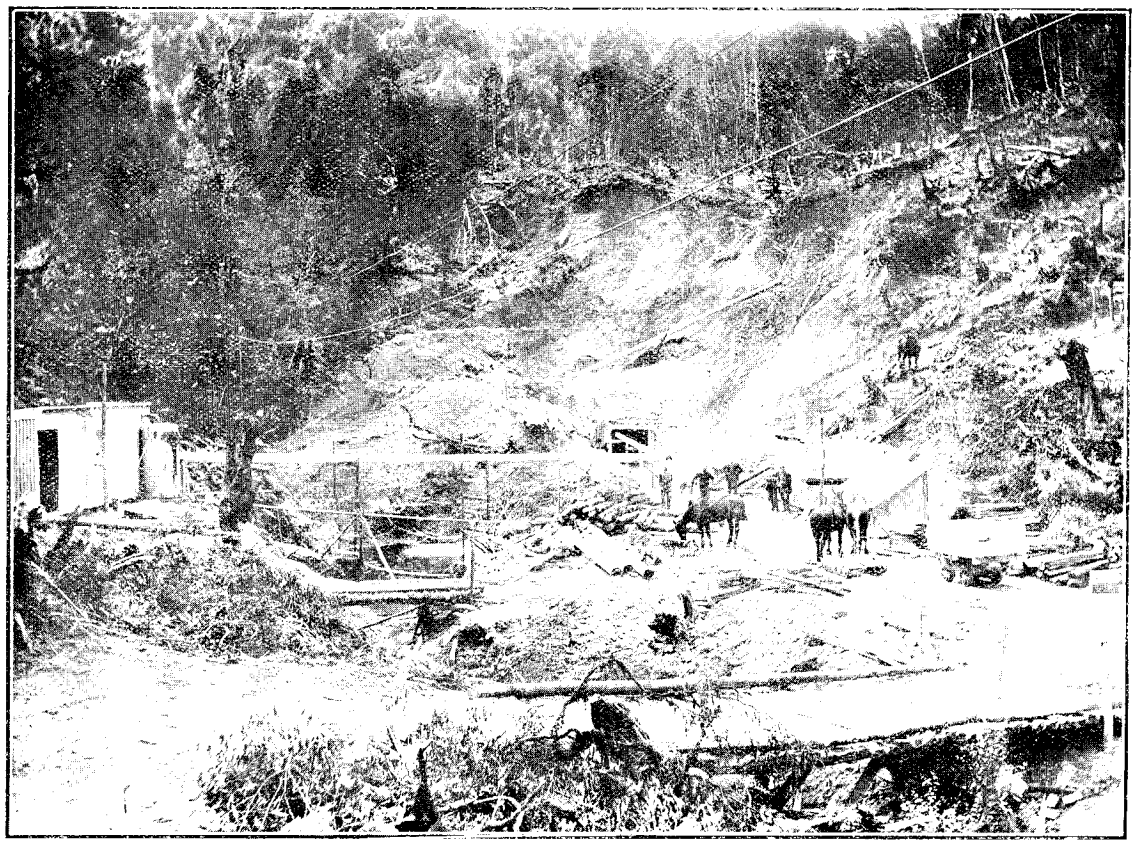


Bridge over Tangarakau River: Piers under Construction.
Road-bridge in background.

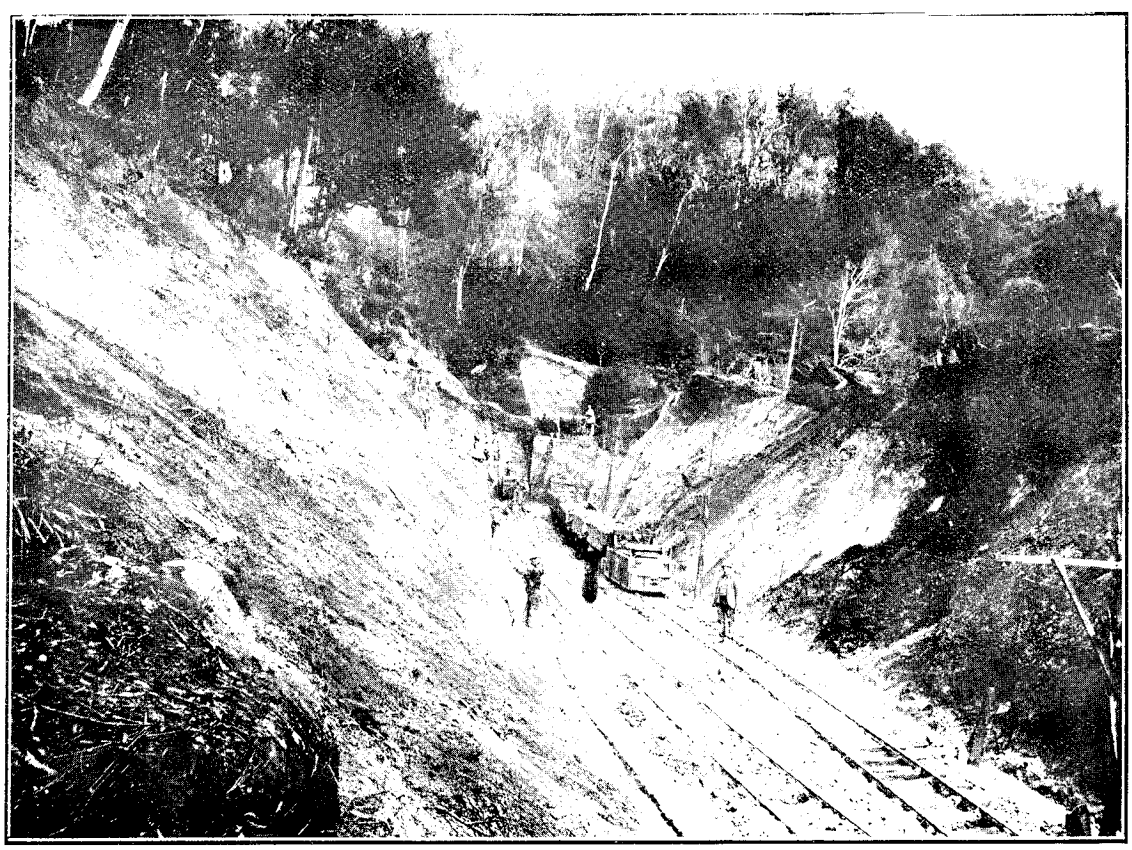


Tangarakau Station-yard. View showing Egmont Coal Co.'s Plant.

STRATFORD—MAIN TRUNK RAILWAY.—WESTERN END.

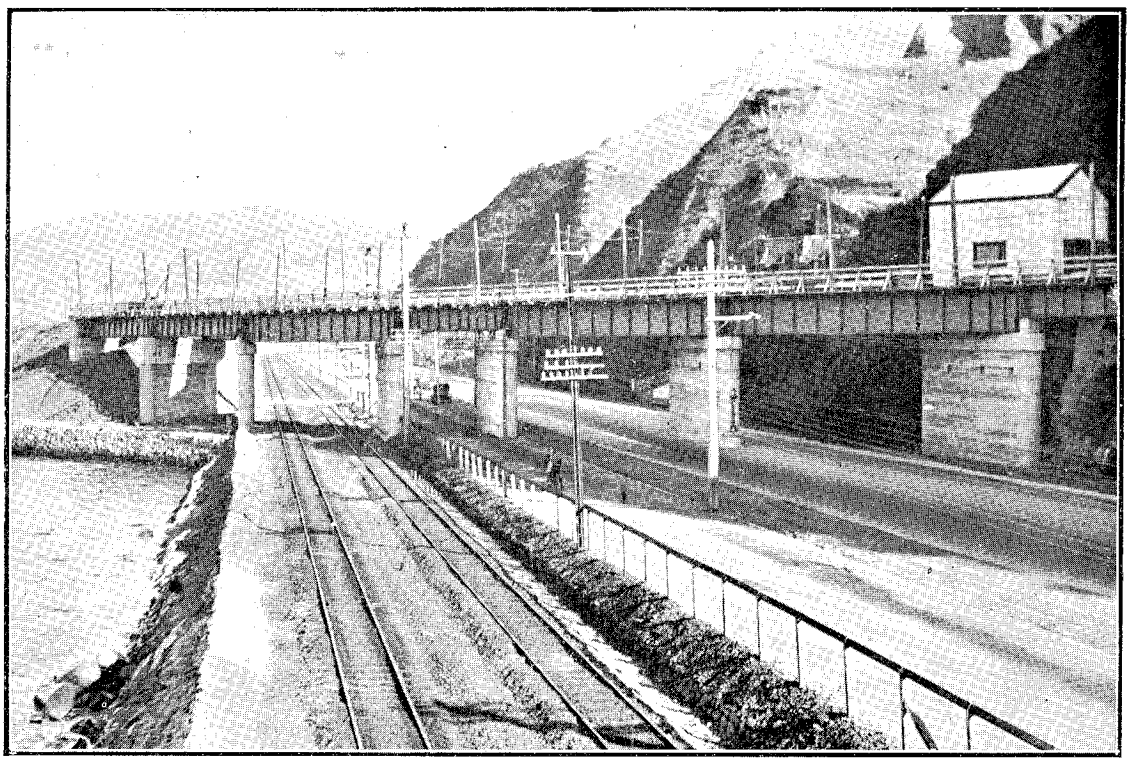


Beginning of No. 4 Tunnel at 55 m. 16 ch.

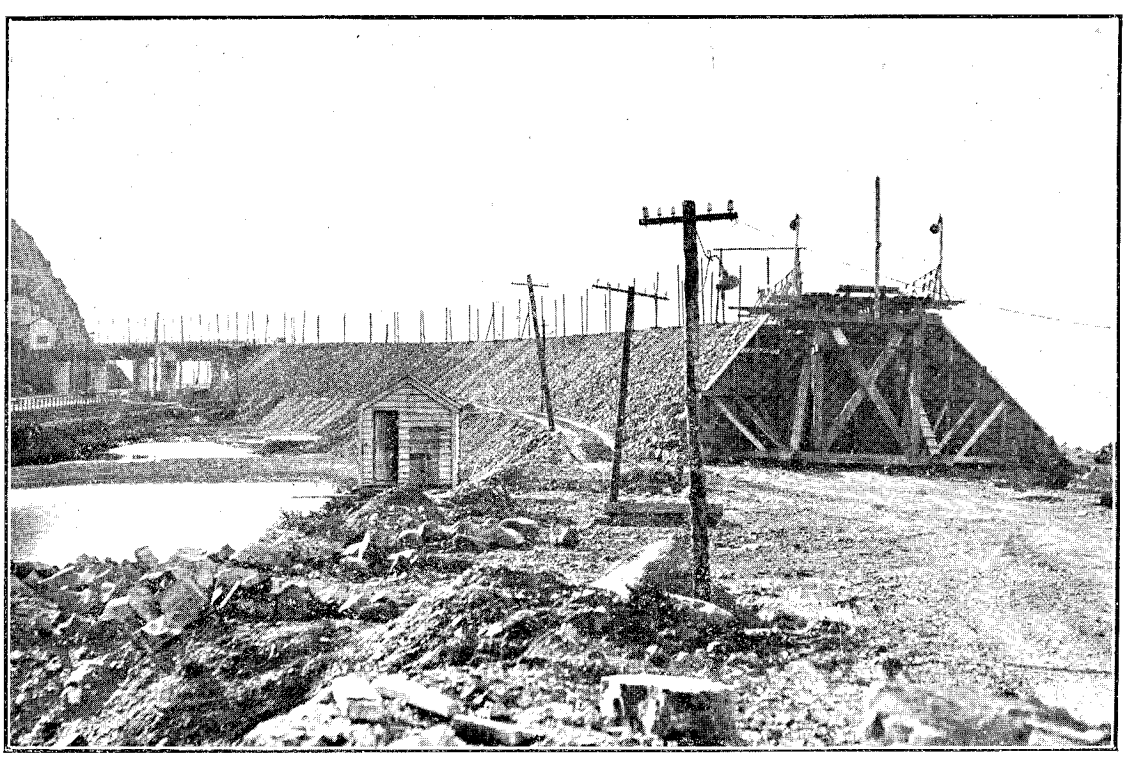


Large Cutting at 52 m. 70 ch.

STRATFORD MAIN TRUNK RAILWAY. WESTERN END.

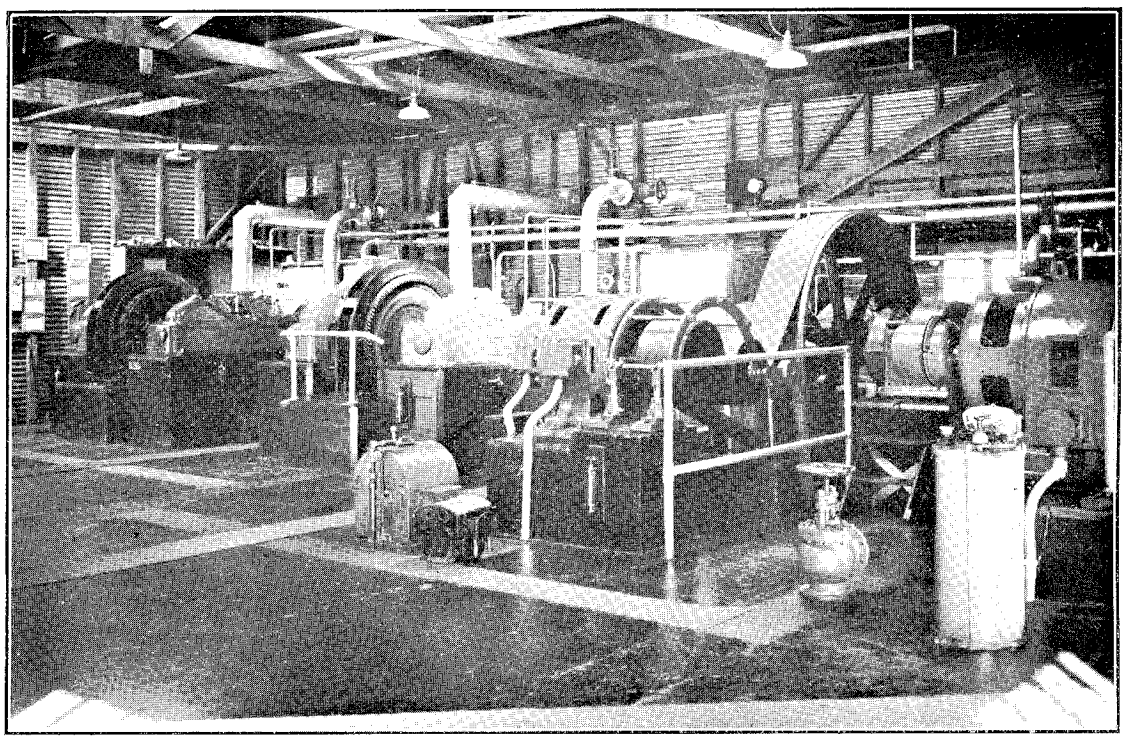


Bridge over Hutt Road and Railway.

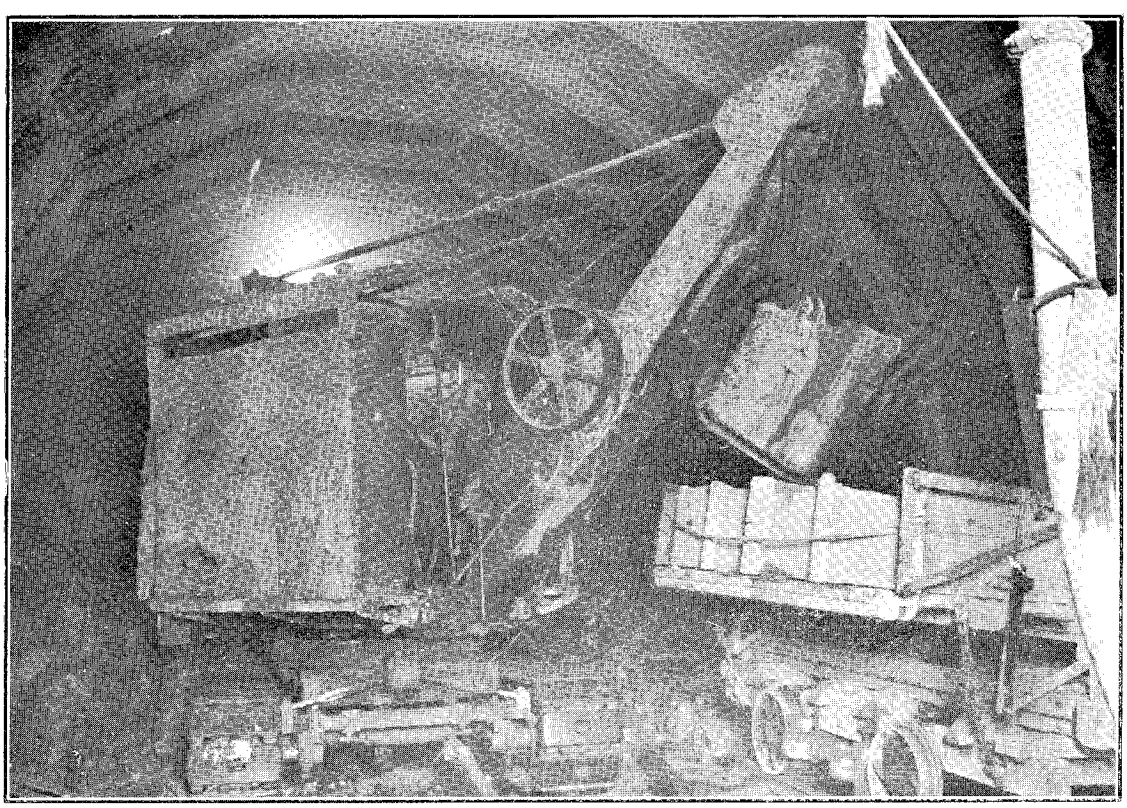


Approach Bank to No. 1 Tunnel.—Movable Trestle in Foreground.

TAWA FLAT DEVIATION.

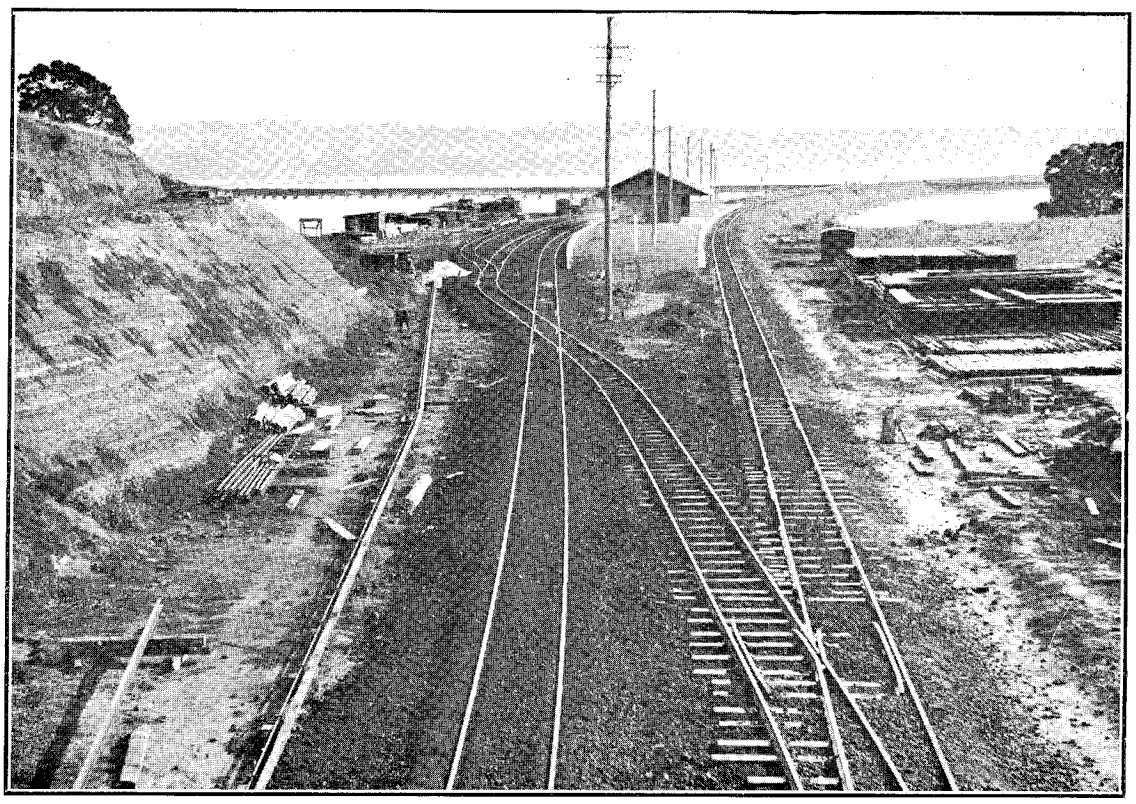


Air-compressors at Ngahauranga.

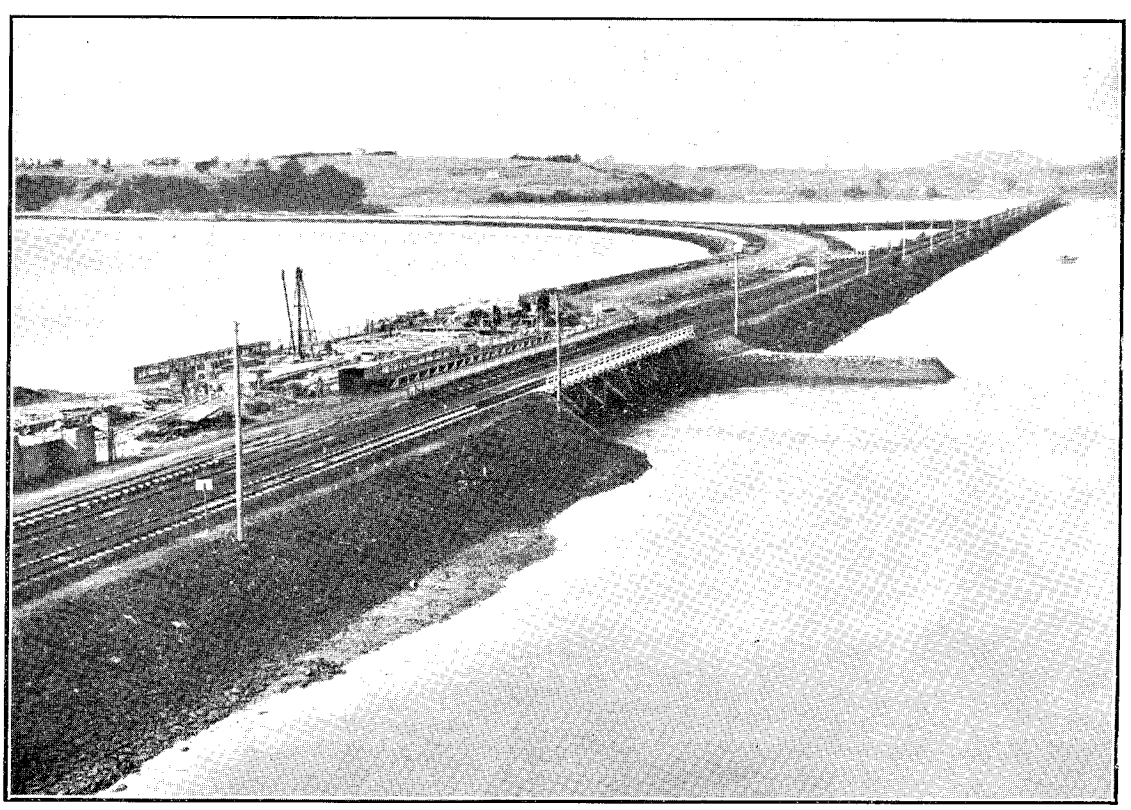


Large Compressed-air Shovel in No. 2 Tunnel.

TAWA FLAT DEVIATION.

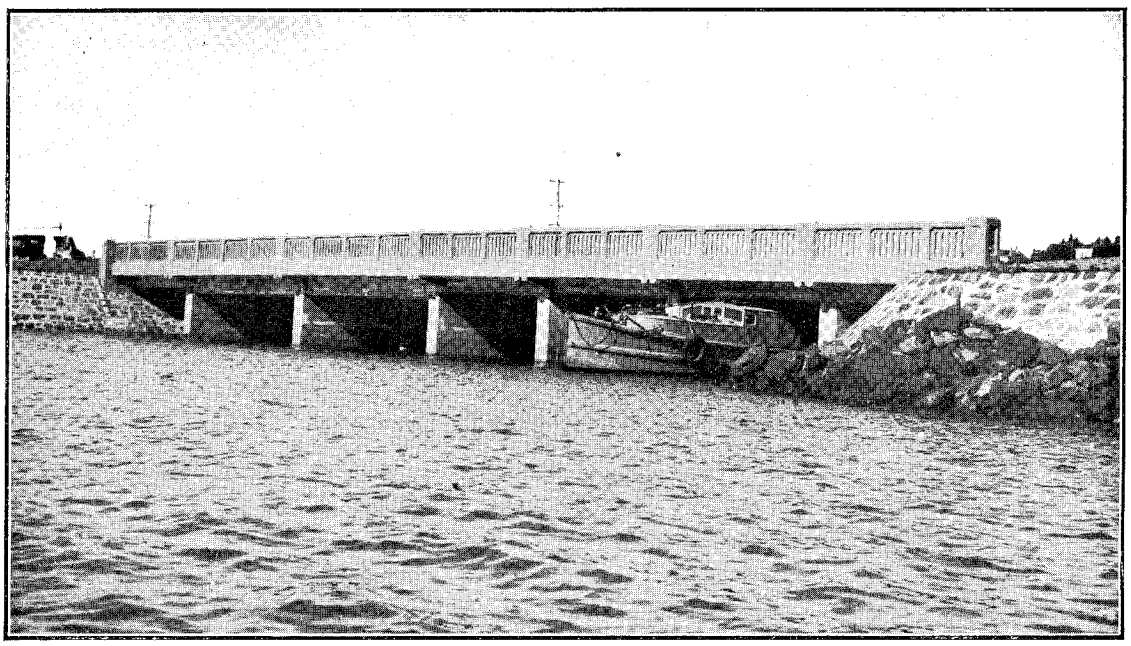


Orakei Station.—View looking towards Auckland.



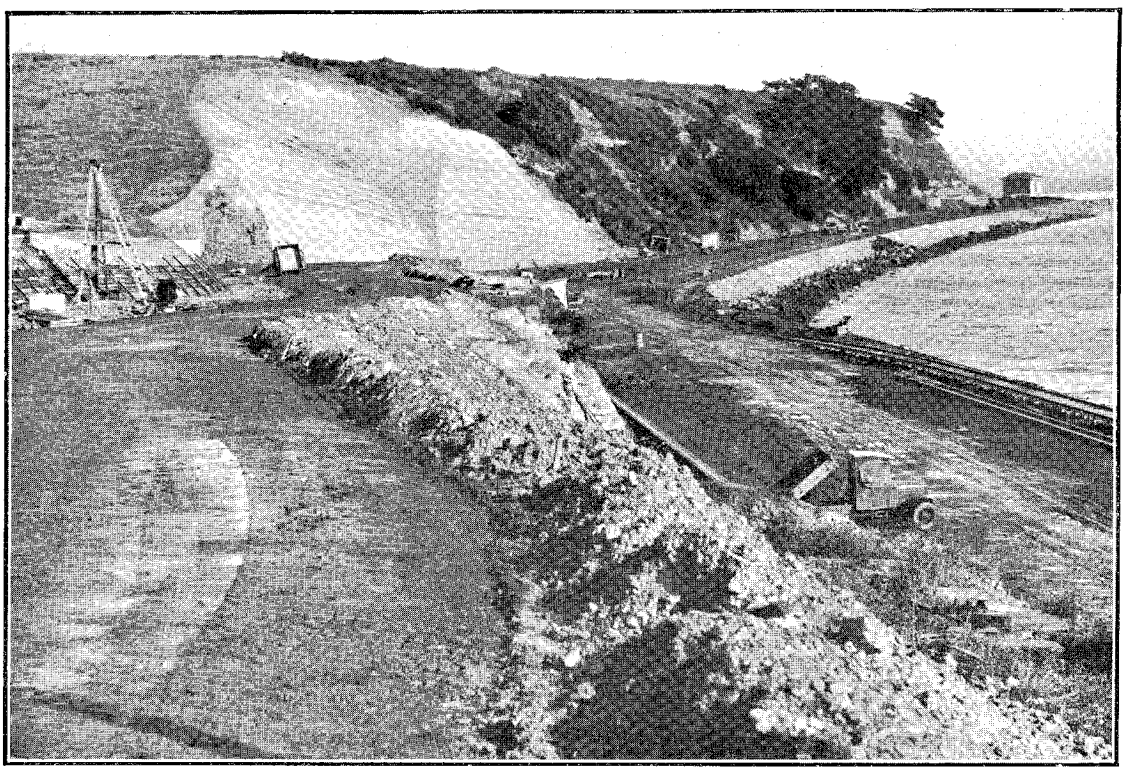
View showing No. 1 Road-bridge and Railway-bridge.
Auckland Waterfront Road on left.

AUCKLAND–WESTFIELD DEVIATION.



Auckland Waterfront Road. Orakei Bridge No. 1.

Two 30 ft. and five 20 ft. spans, reinforced concrete. 40 ft. roadway and two 10 ft. footways.

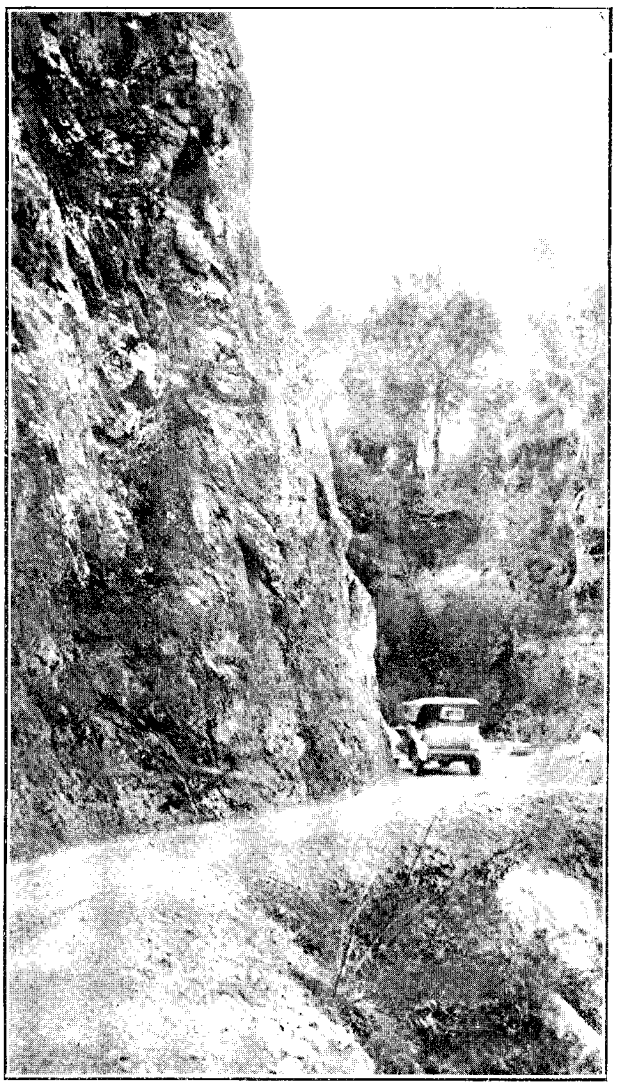


Mission Bay Extension, Section of Orakei Waterfront Road.

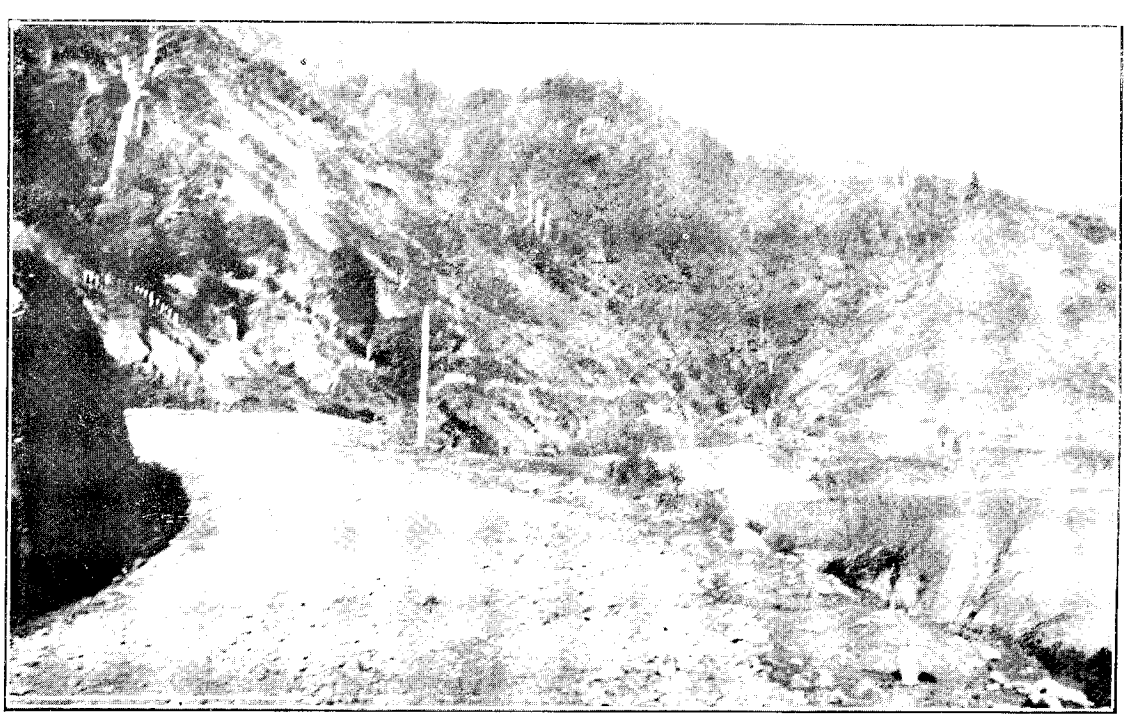
View from high-level road, looking towards city.



Newly widened Formation, 13¾ Miles from Opotiki.

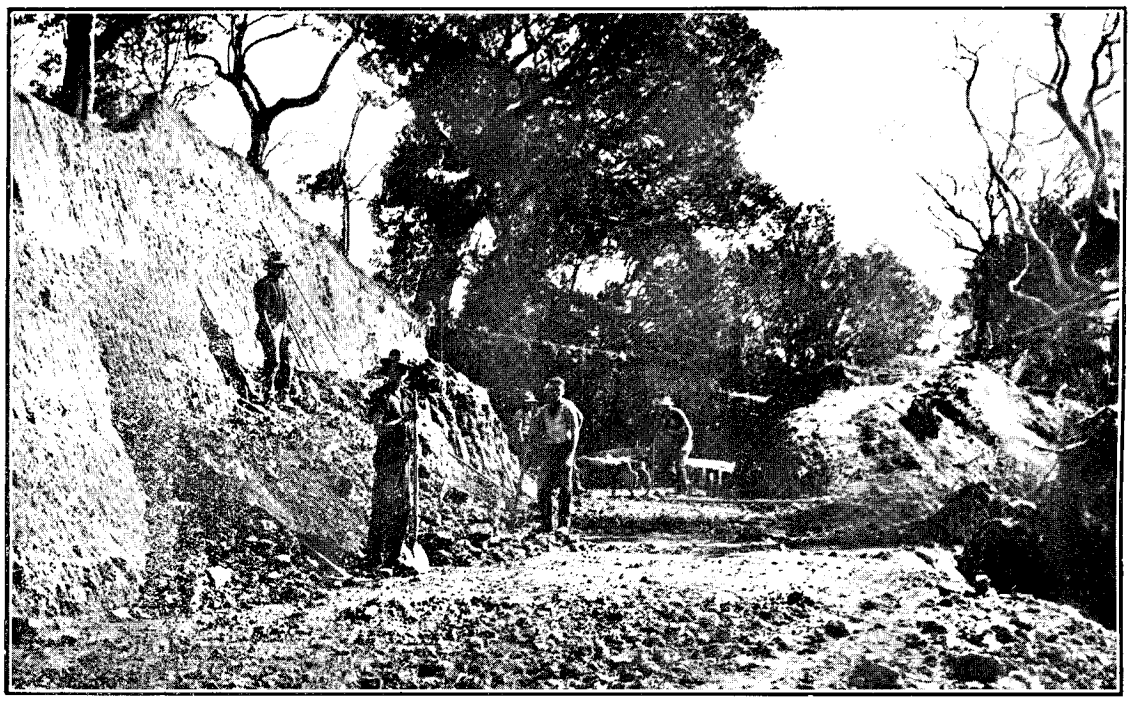


Bluff near Opato Junction, 28 Miles from Opotiki.
Old formation.

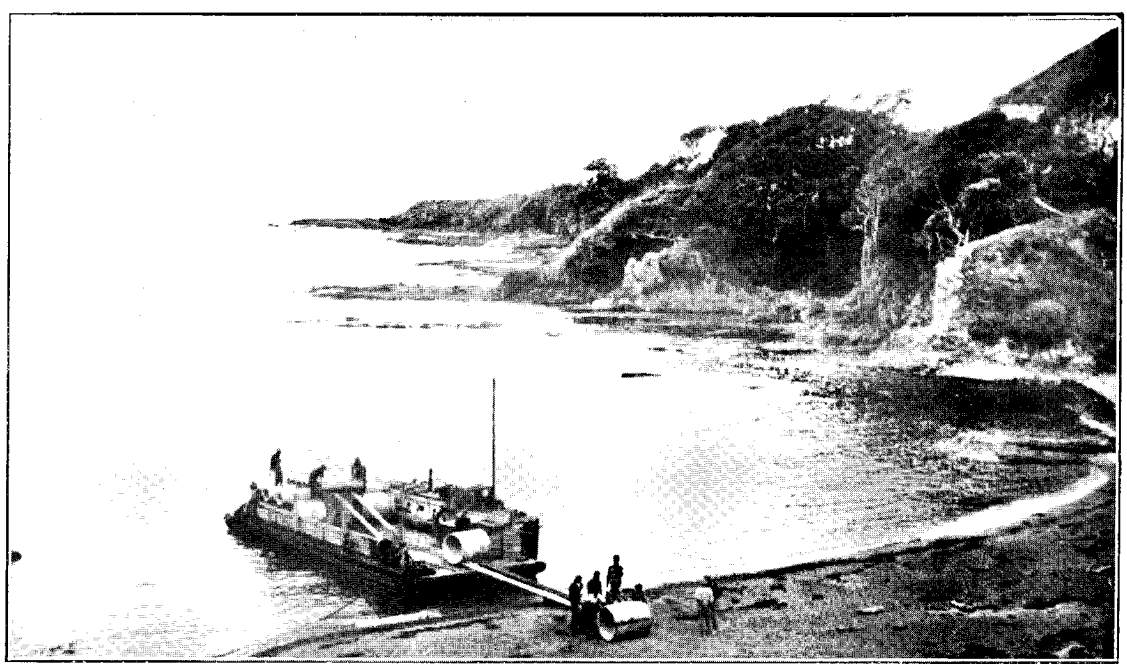


View 9 Miles from Opotiki.
Newly widened formation.

OPOTIKI MATAWAI VIA WAIOEKA ROAD.

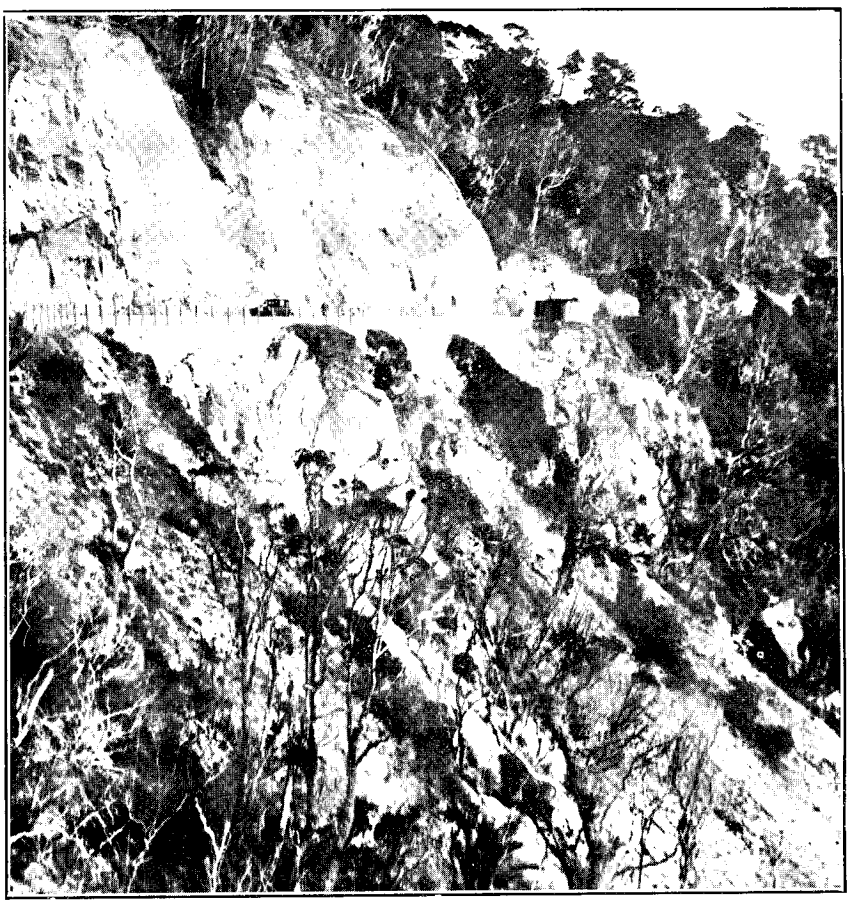


Cutting at 5 m. 70 ch.

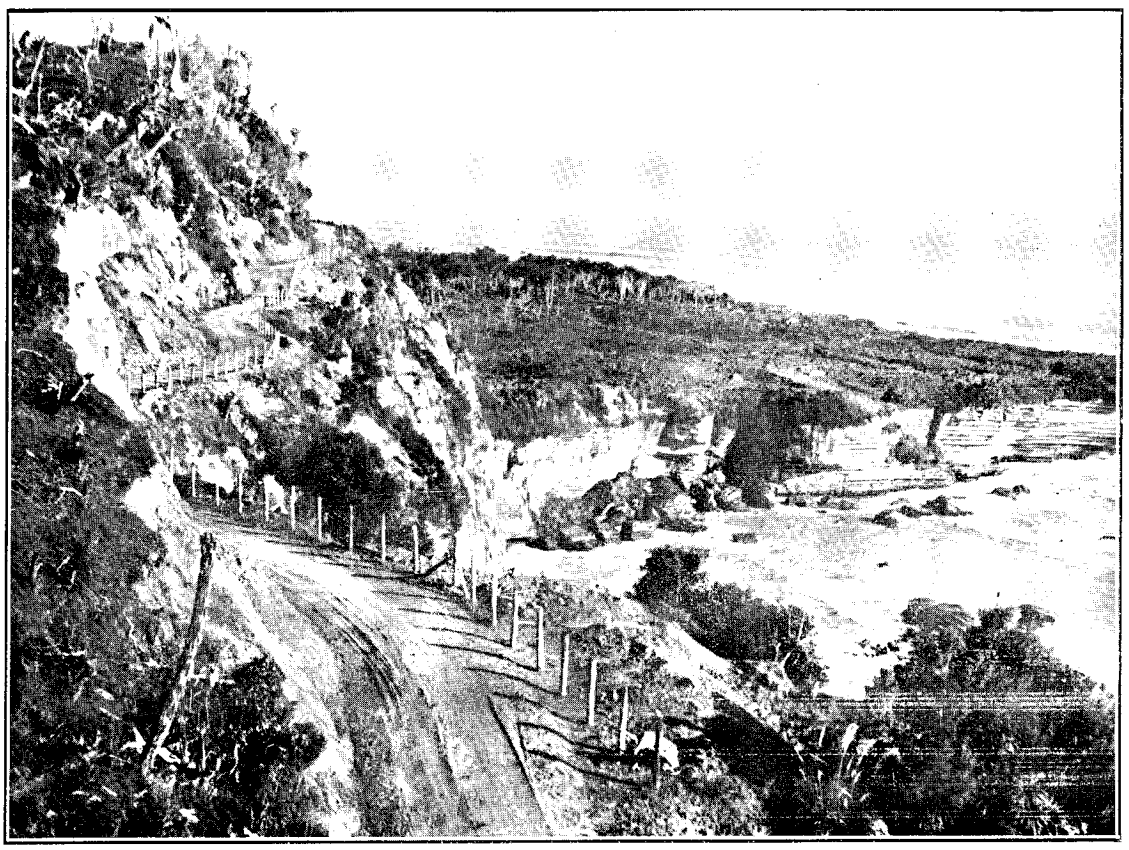


Unloading Concrete Pipes at 3¼ Miles, Waikawa Point.

OPOTIKI–EAST CAPE ROAD: TE KAHA TO ORETE.

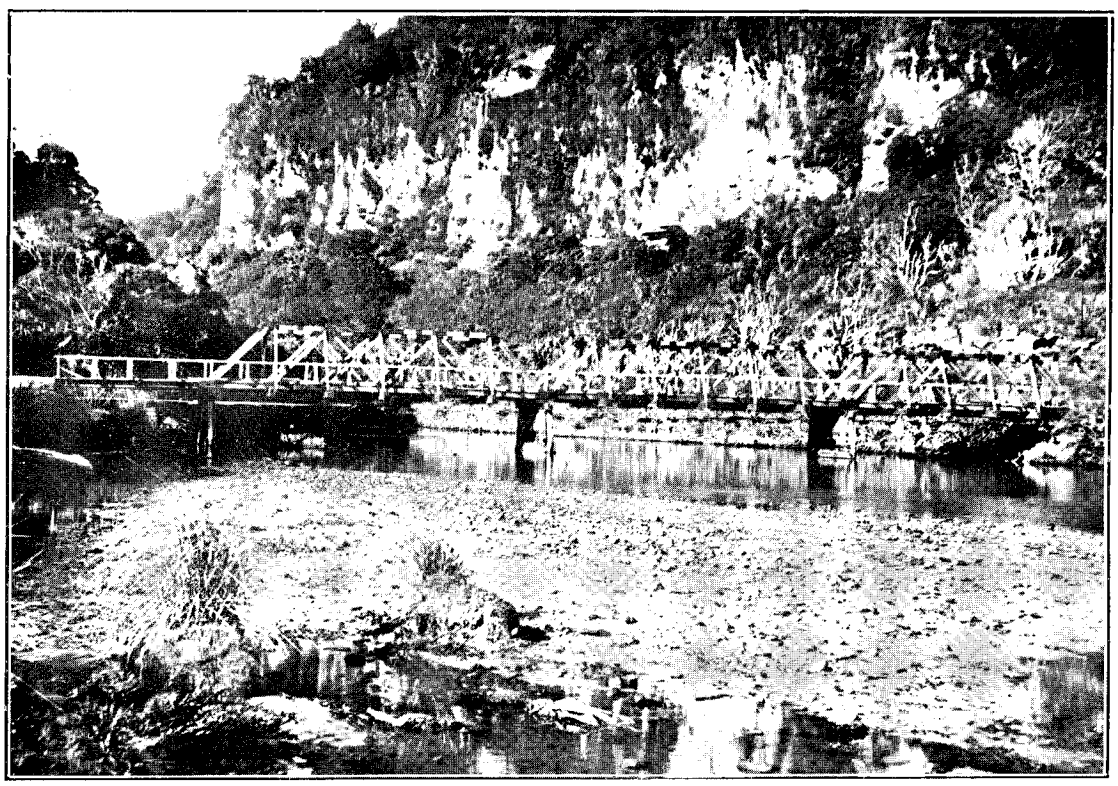


Road and Concrete Retaining-wall at Mabel Bay.



Gentle Annie Bluff, about 400 ft. above Sea-level.

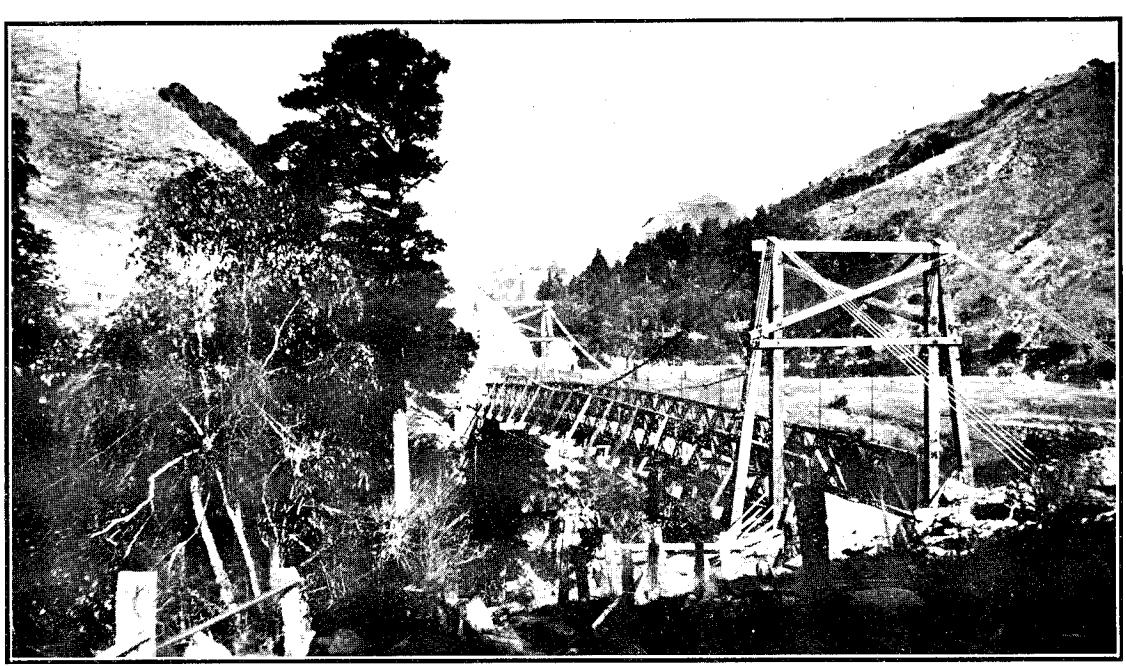
WESTPORT-GREYMOUTH (COAST ROAD): CHARLESTON TO COUNTY BOUNDARY.



Pōrārari River Bridge.

Three 60 ft. timber-truss spans and one 25 ft. stringer span: 10 ft. 6 in. roadway.

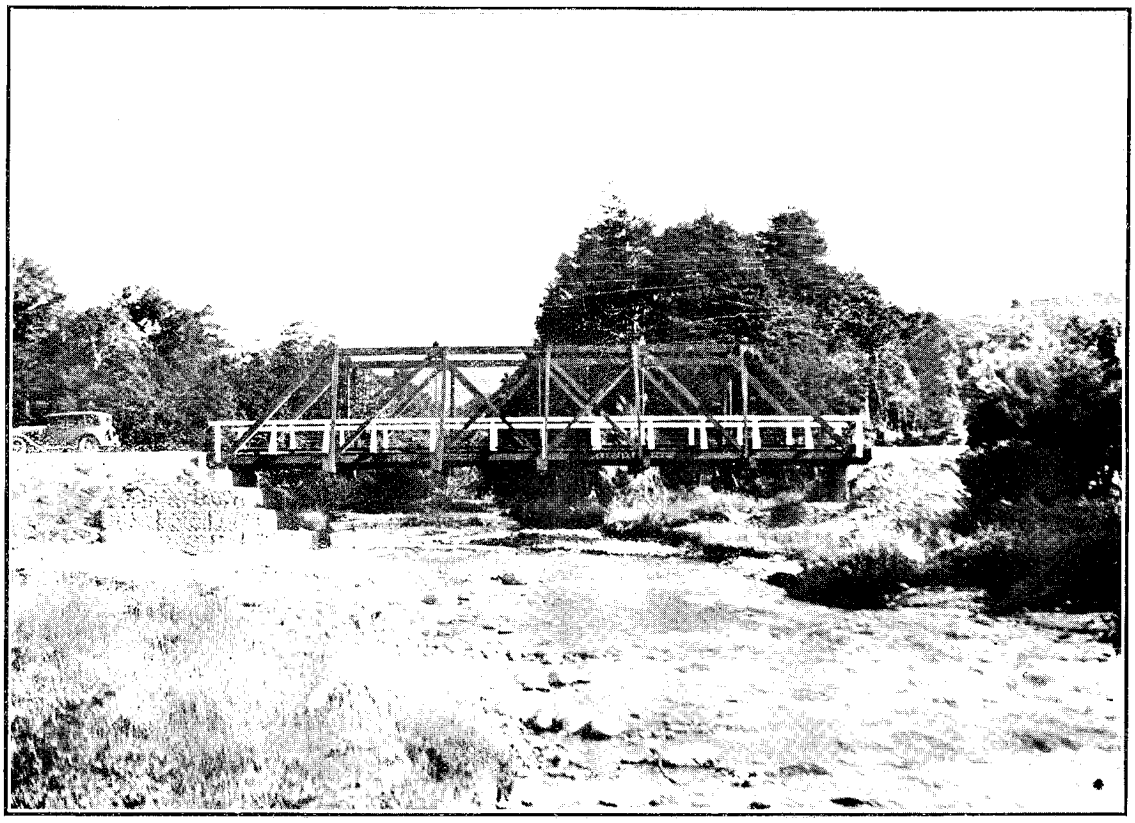
WESTPORT–GREYMOUTH (COAST ROAD): CHARLESTON TO COUNTY BOUNDARY.



Wangaehu Suspension Bridge.

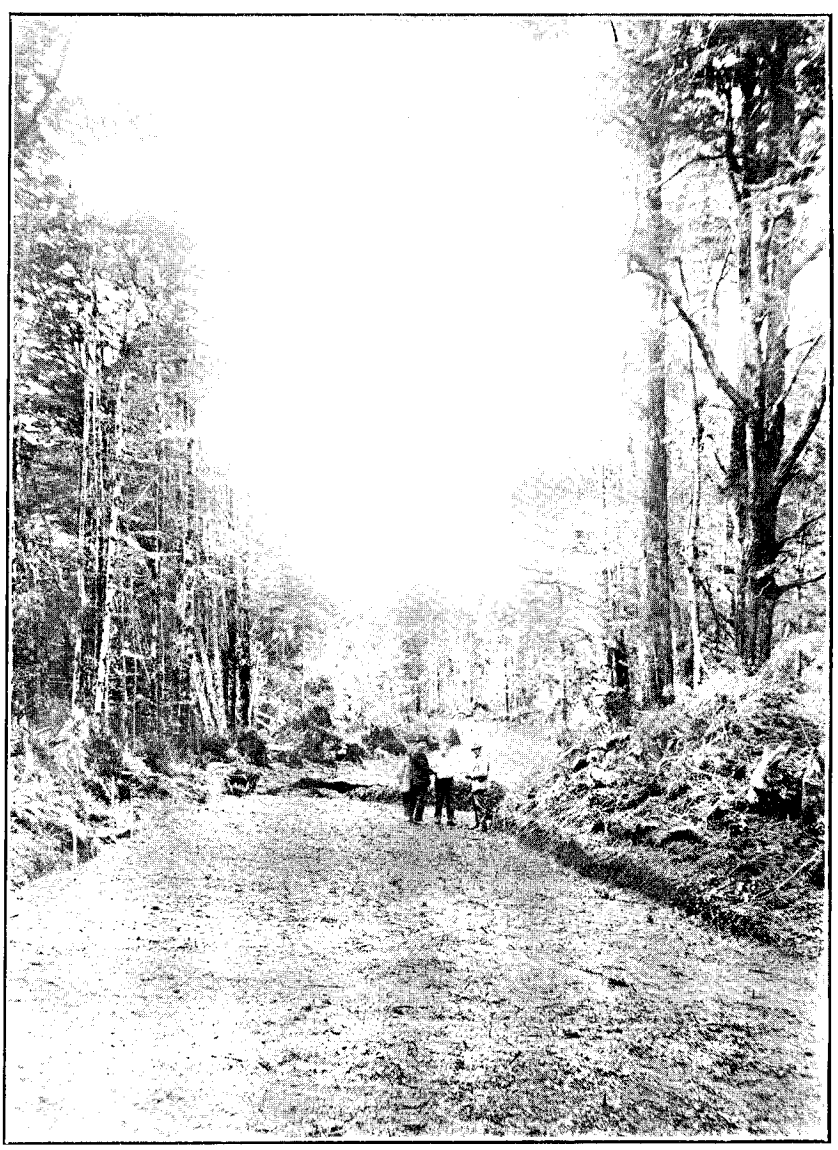
Length, 175 ft.

FIELDS TRACK TO RANGIWAEA ROAD.

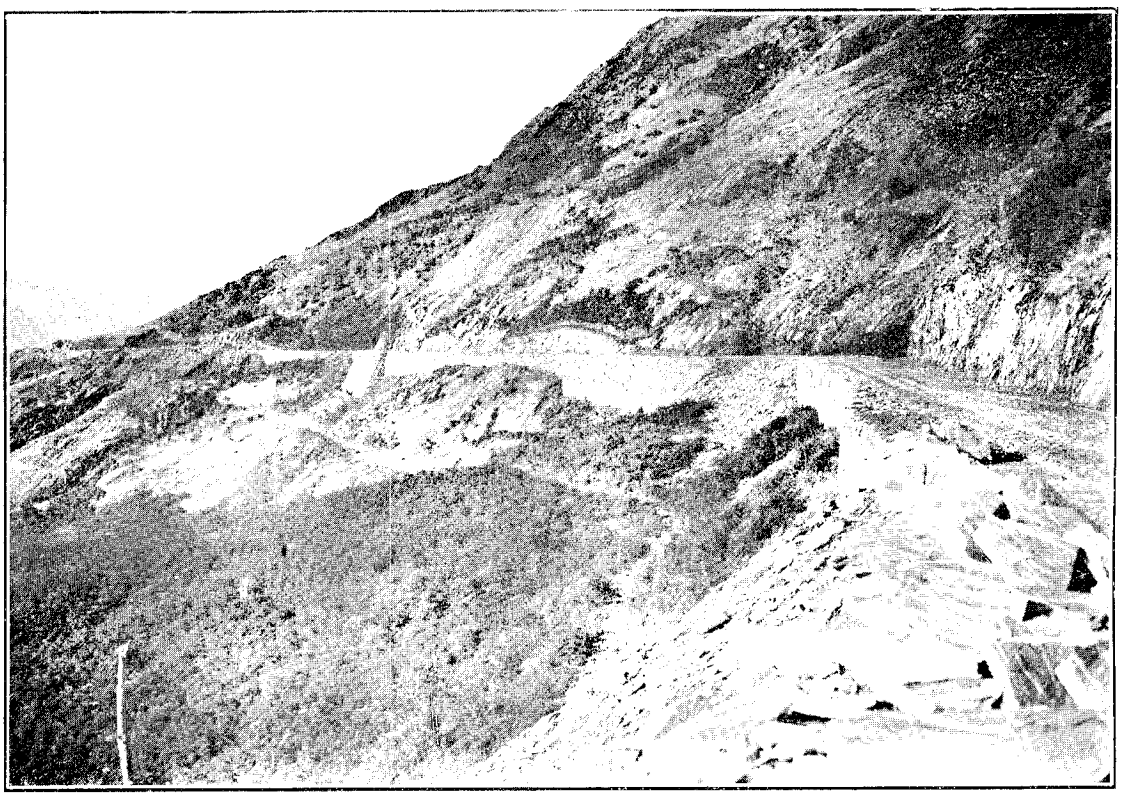


Speargrass Creek Bridge.
One 80 ft. timber-truss span.

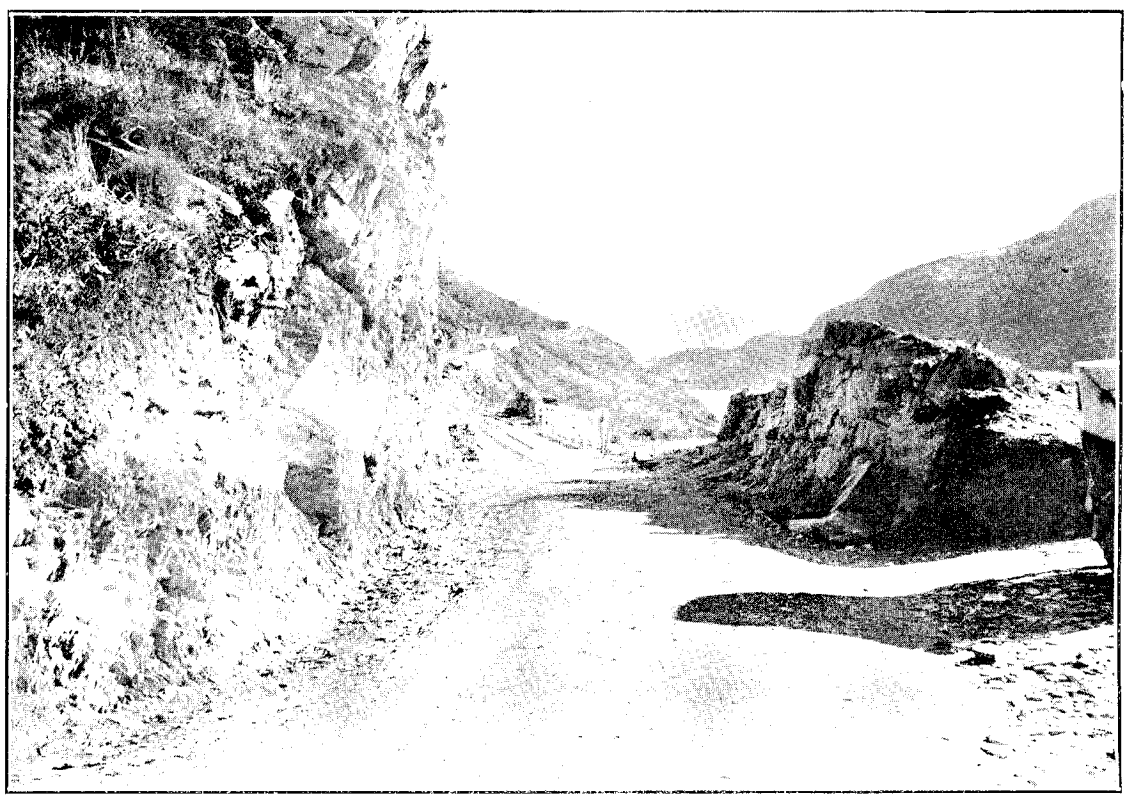
BLENHEIM - HOPE JUNCTION ROAD.



TE ANAU - TE ANAU DOWNS ROAD.

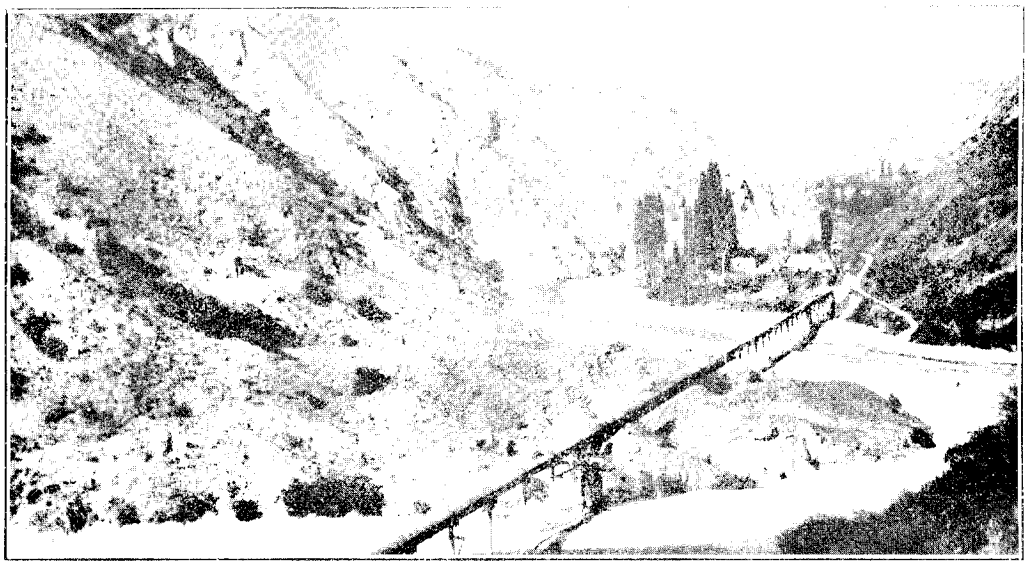


HAWEA MAKAROPA ROAD.

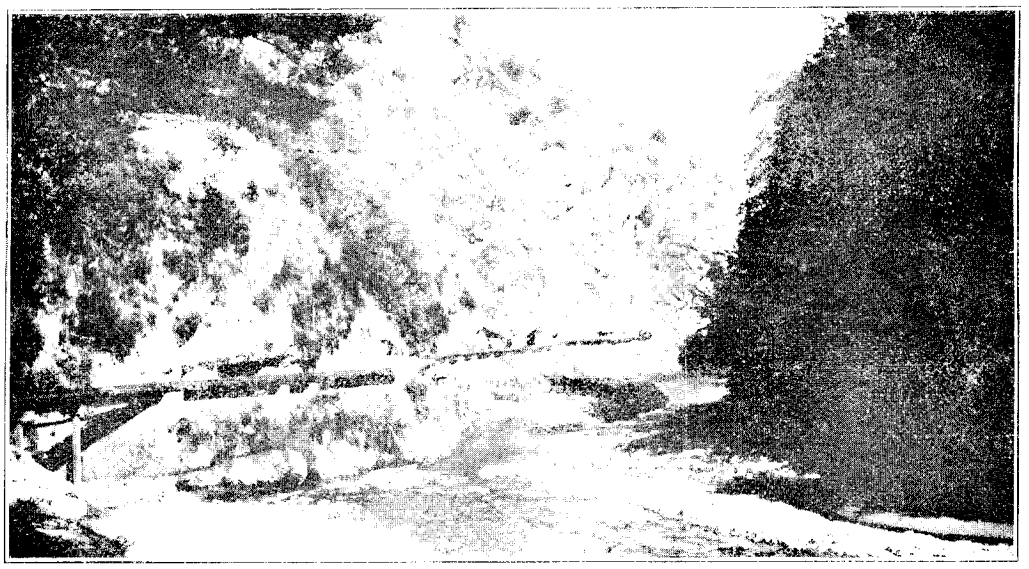


Looking towards the Neck from Hall's Creek.

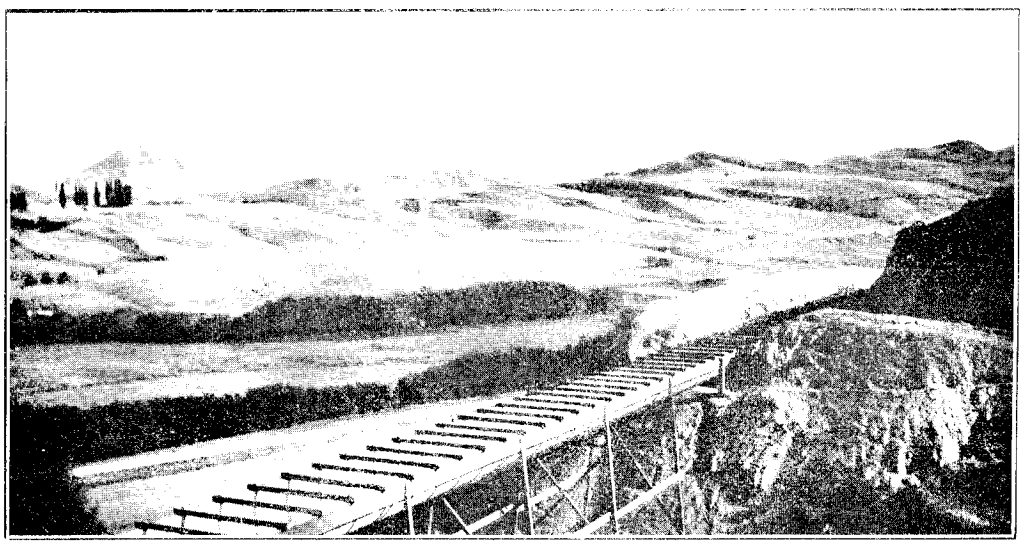
HAWEA MAKAROPA ROAD.



Main Pipe line—River Crossings 6 and 7.

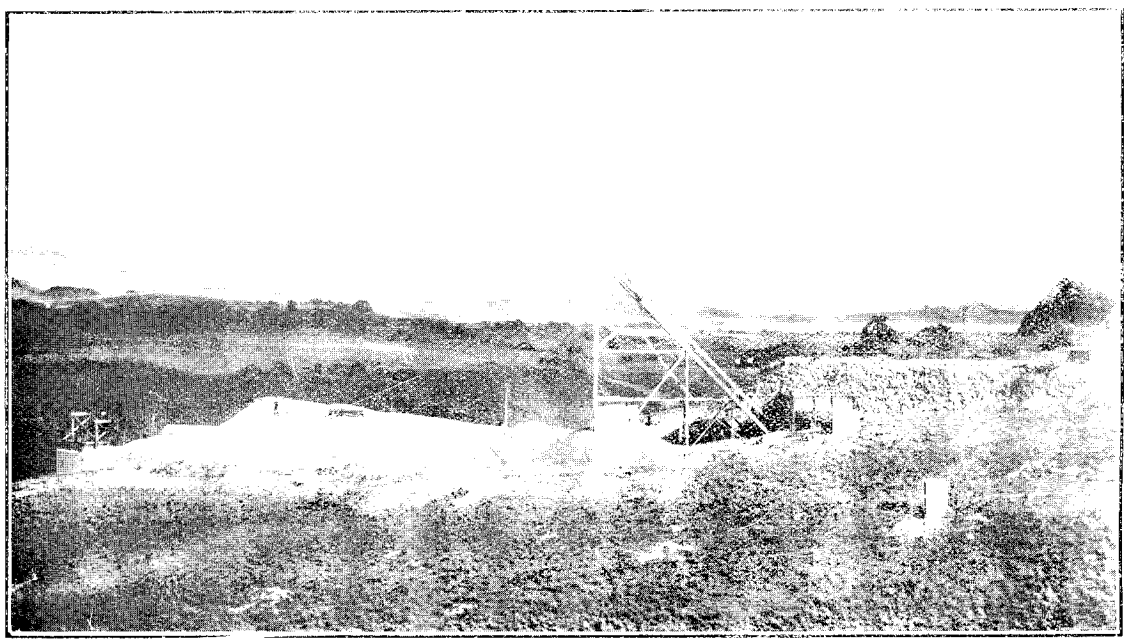


Main Pipe line—Section in Yellow Gorge showing Bench and Tunnel.

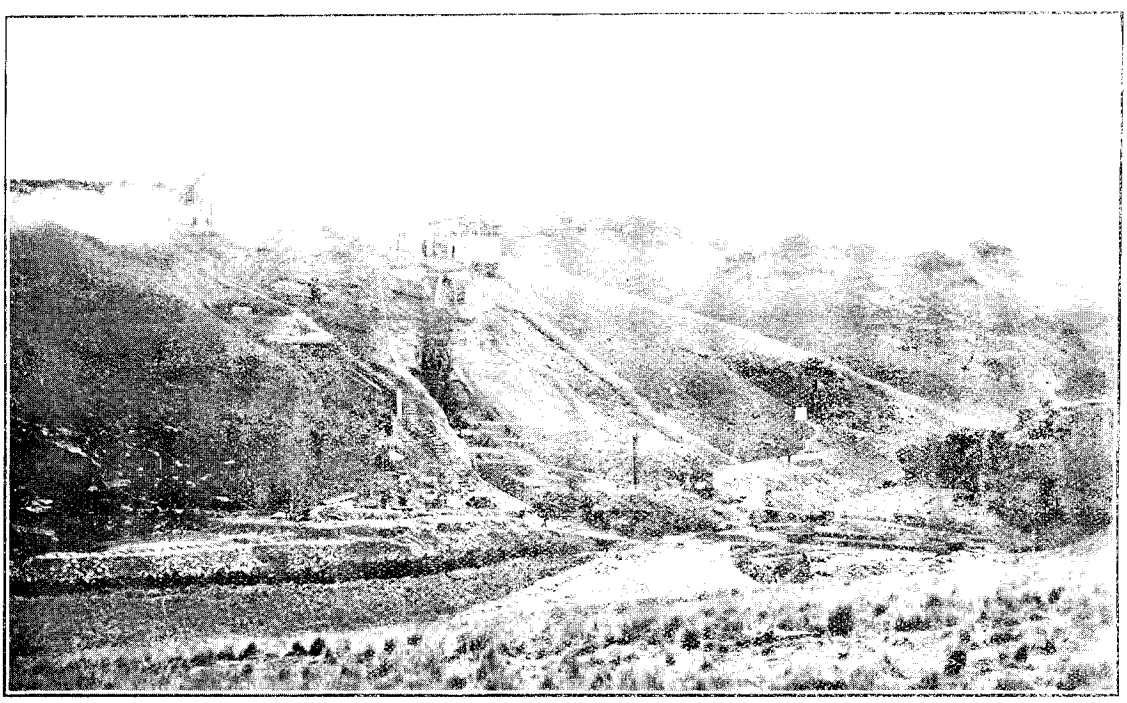


Main Pipe line at Tin Pot

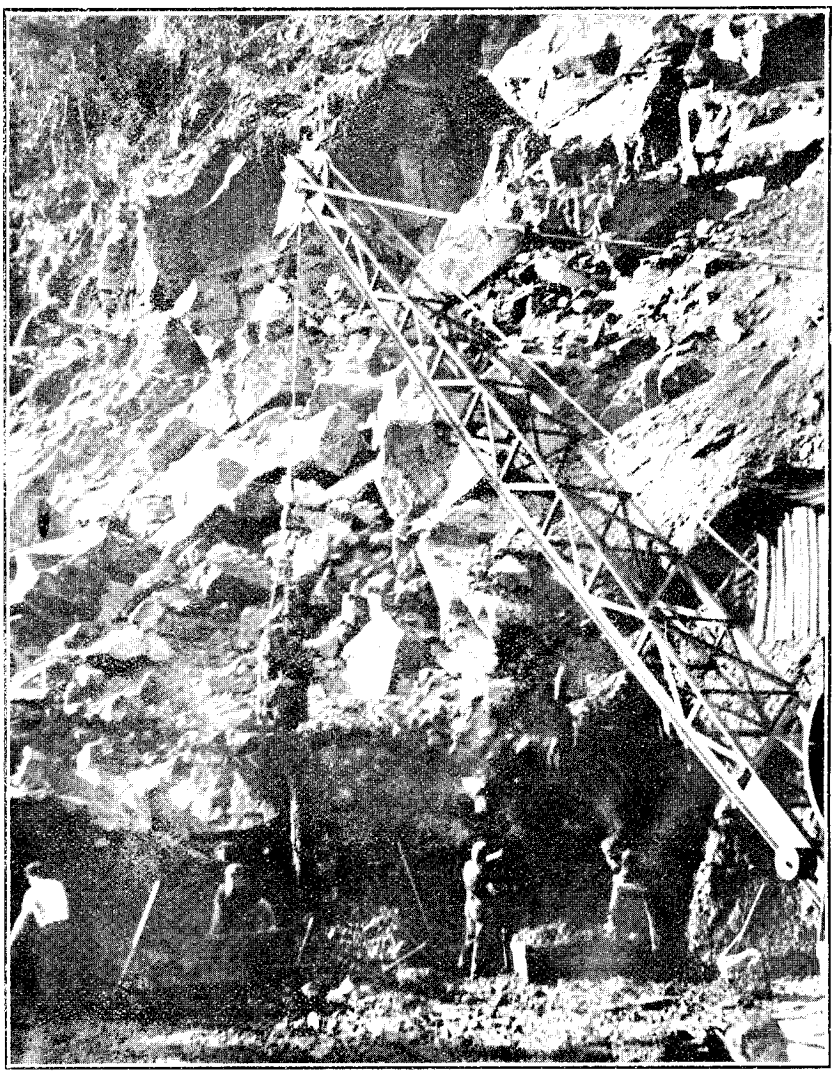
YELLOW RIVER IRRIGATION



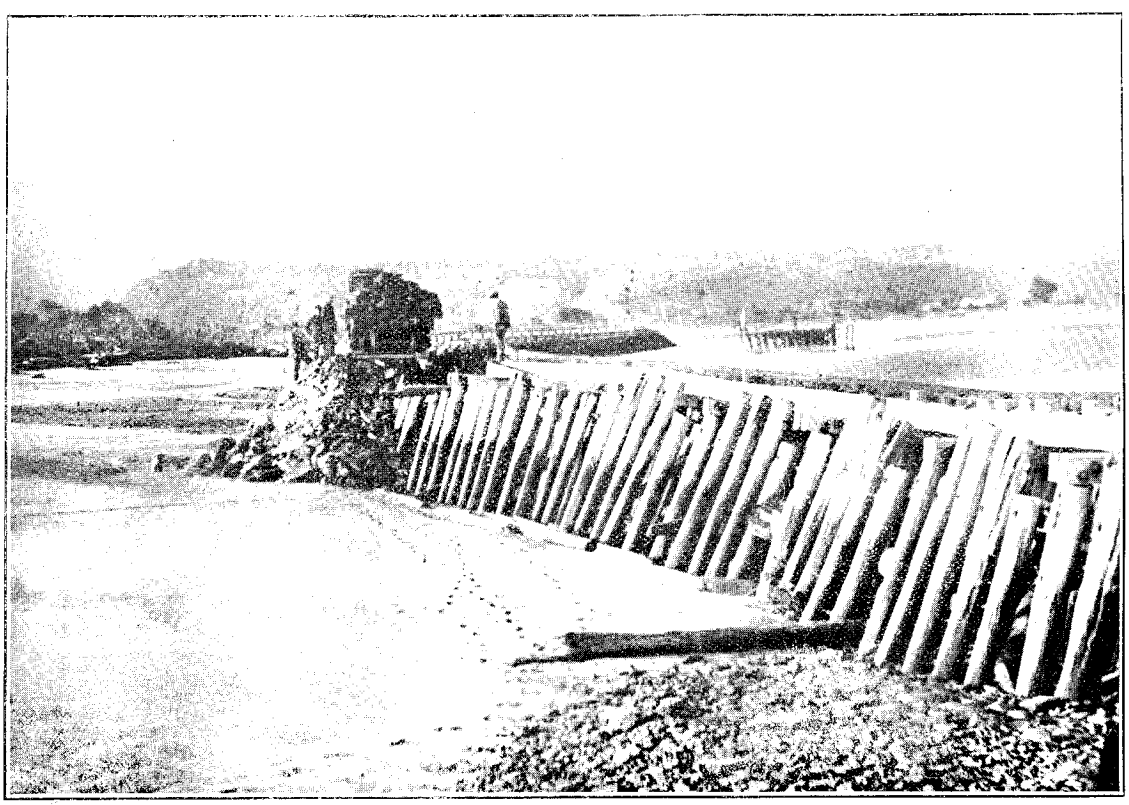
Poolburn Dam: Crusher, Elevator, Stone and Sand Stock Piles.
Portion of country in background will be submerged when reservoir is filled.



Looking Downstream at Poolburn Dam. Showing Excavation for Dam; Construction Plant in Background.

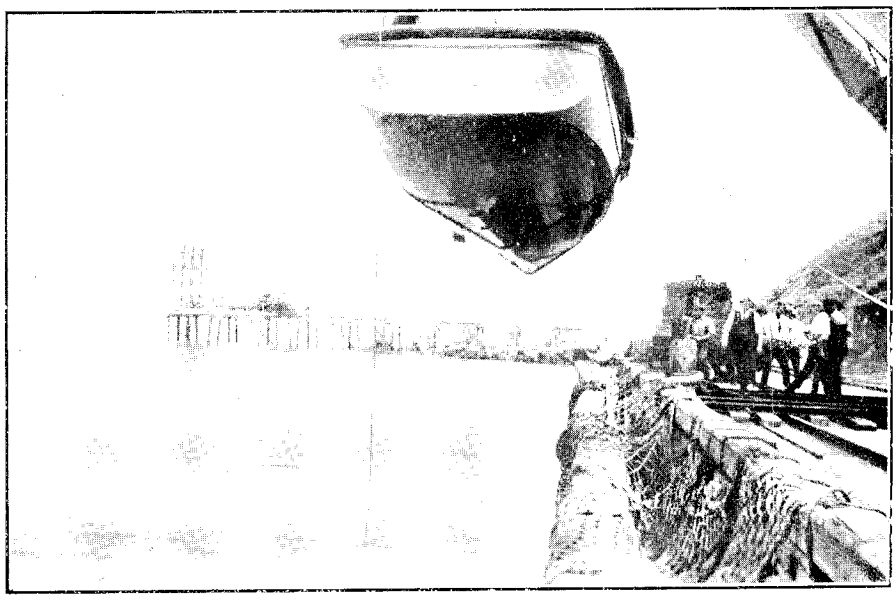


Opawara Quarry.



Reconstructing Old Timber Training-wall in Stone.

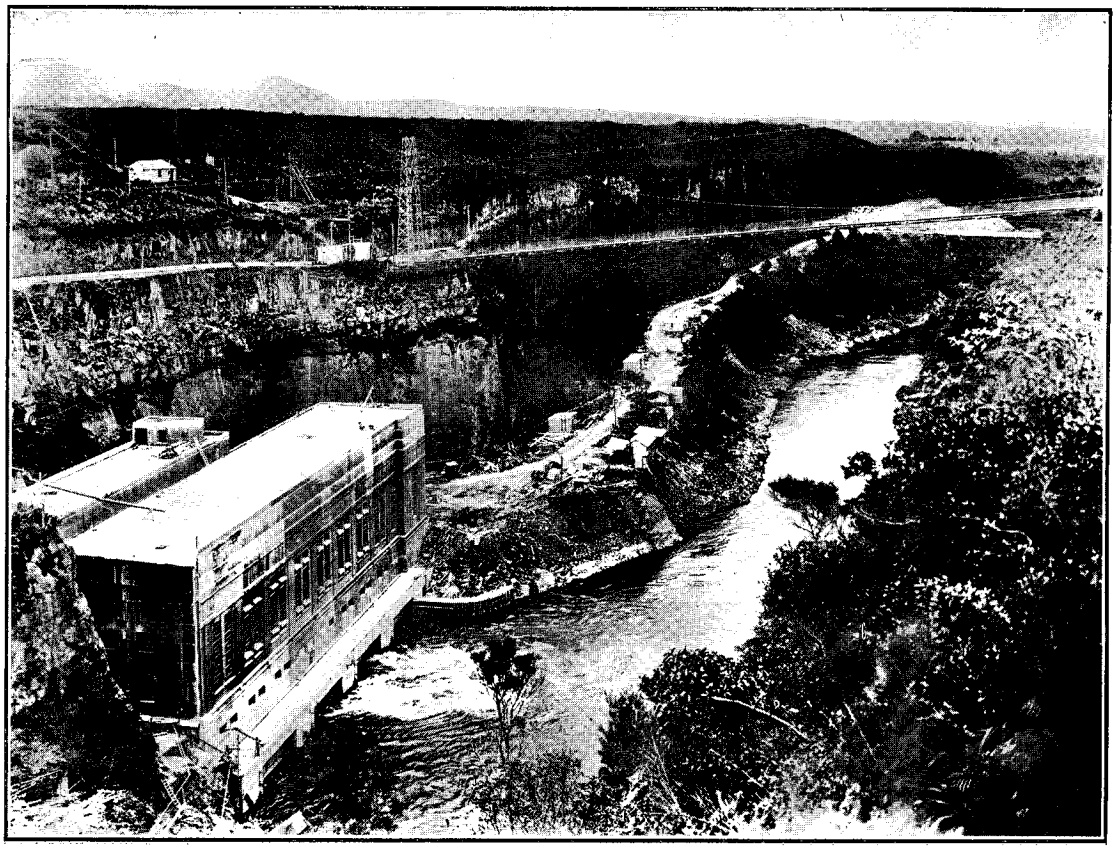
KARAMEA HARBOUR WORKS.



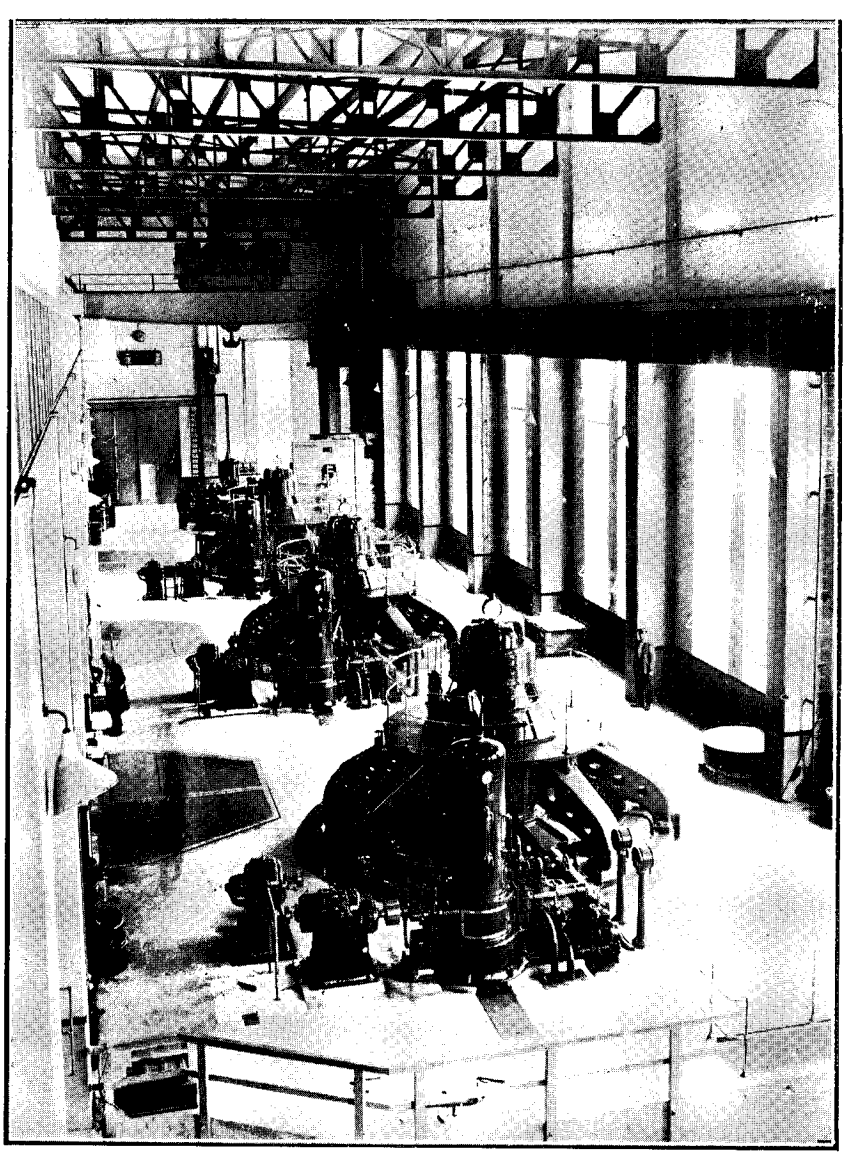
Waikokopu Wharf and Breakwater: Wharf-crane handling Launch for Lake Waikaremoana.



North Cape Lighthouse: Automatic Light. Cableway for hauling up Gas-cylinders on Left.

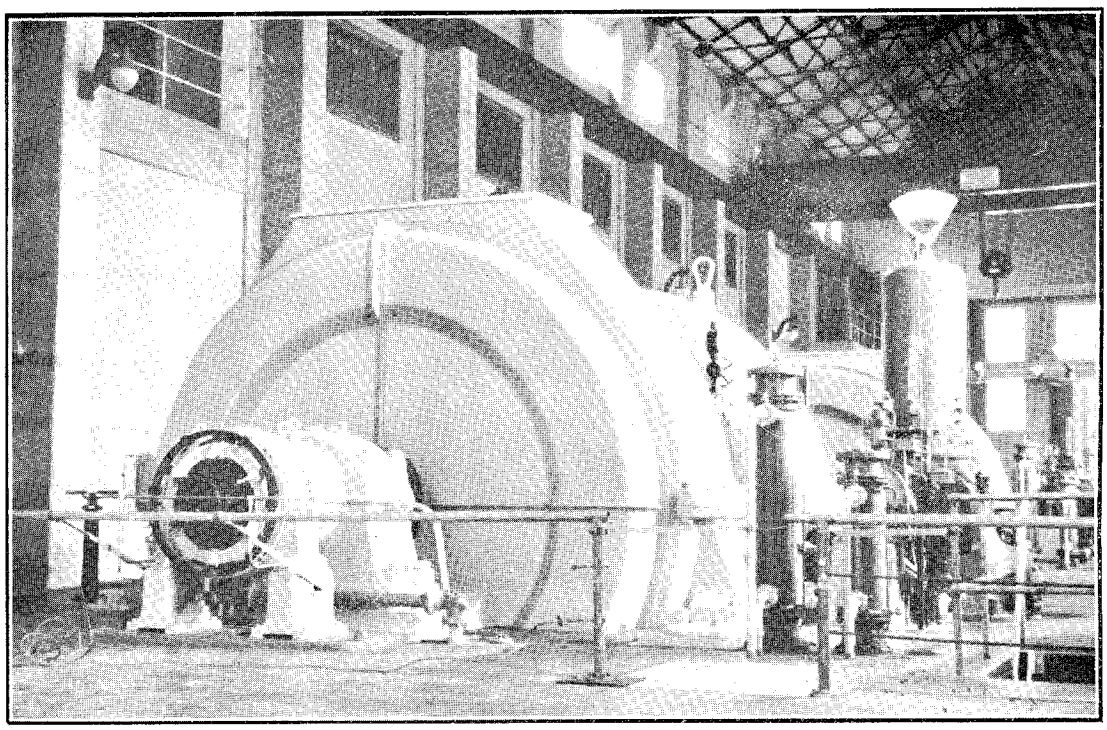


First Section of Power-house.



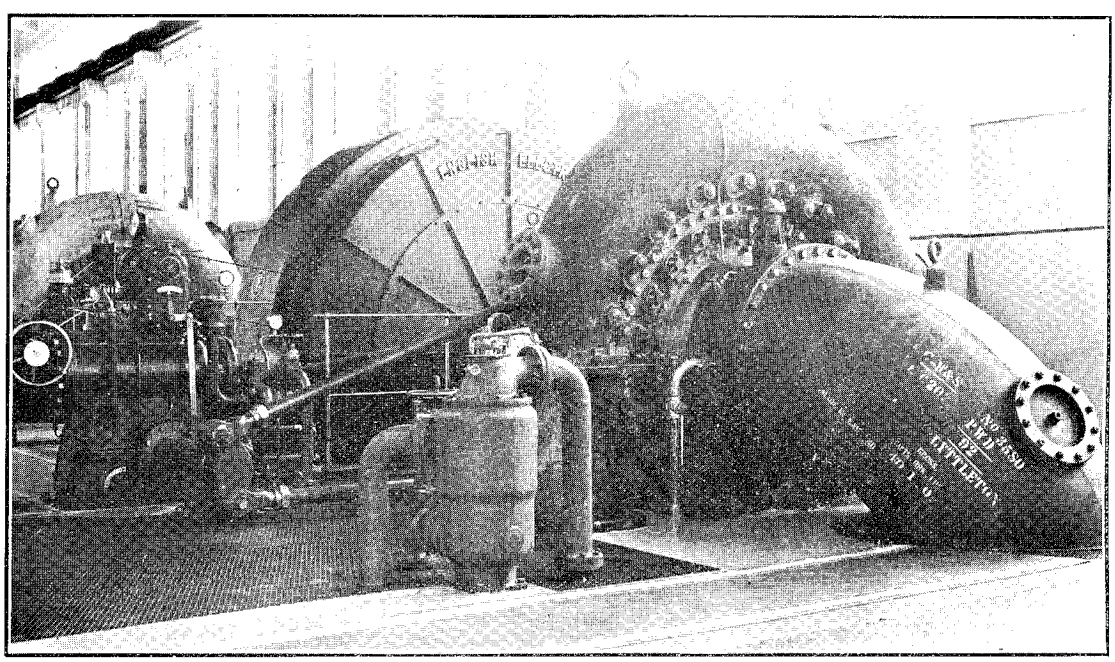
Interior of Power-house.

ARAPUNI POWER DEVELOPMENT.



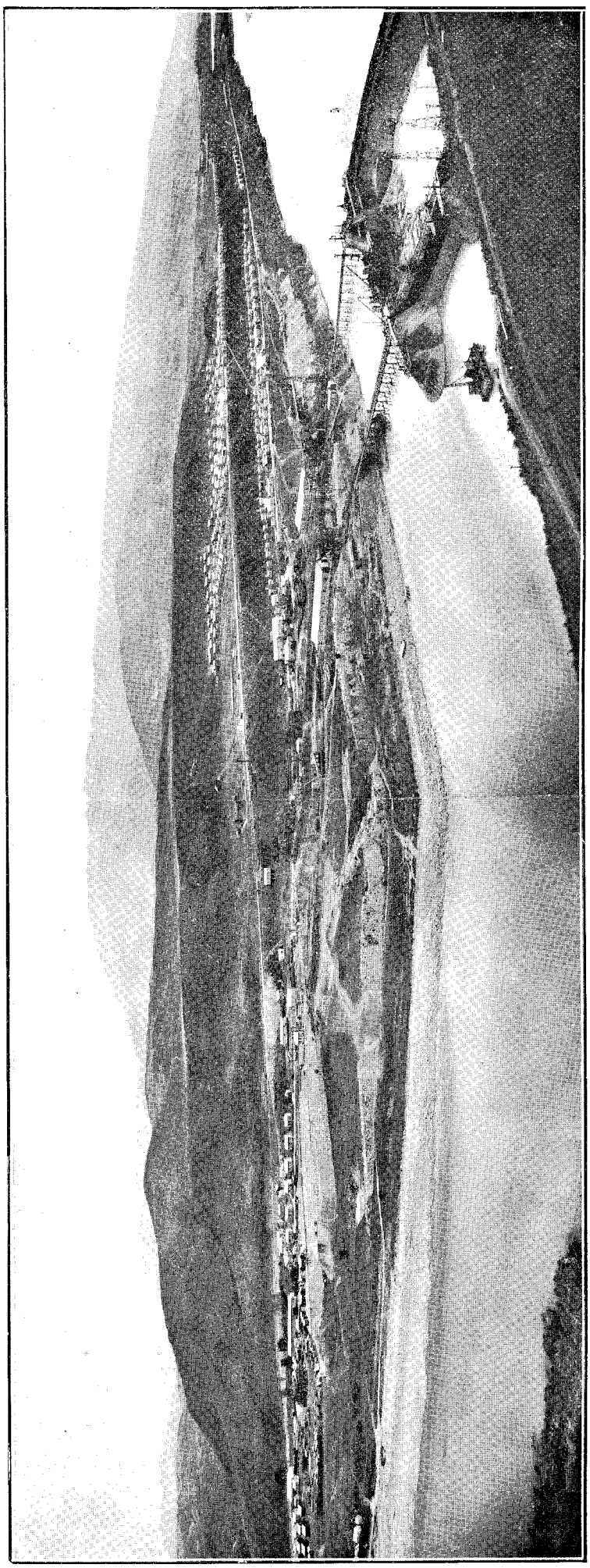
No. 1 Unit. 16,000 kw.

WAIKAREMOANA POWER DEVELOPMENT.



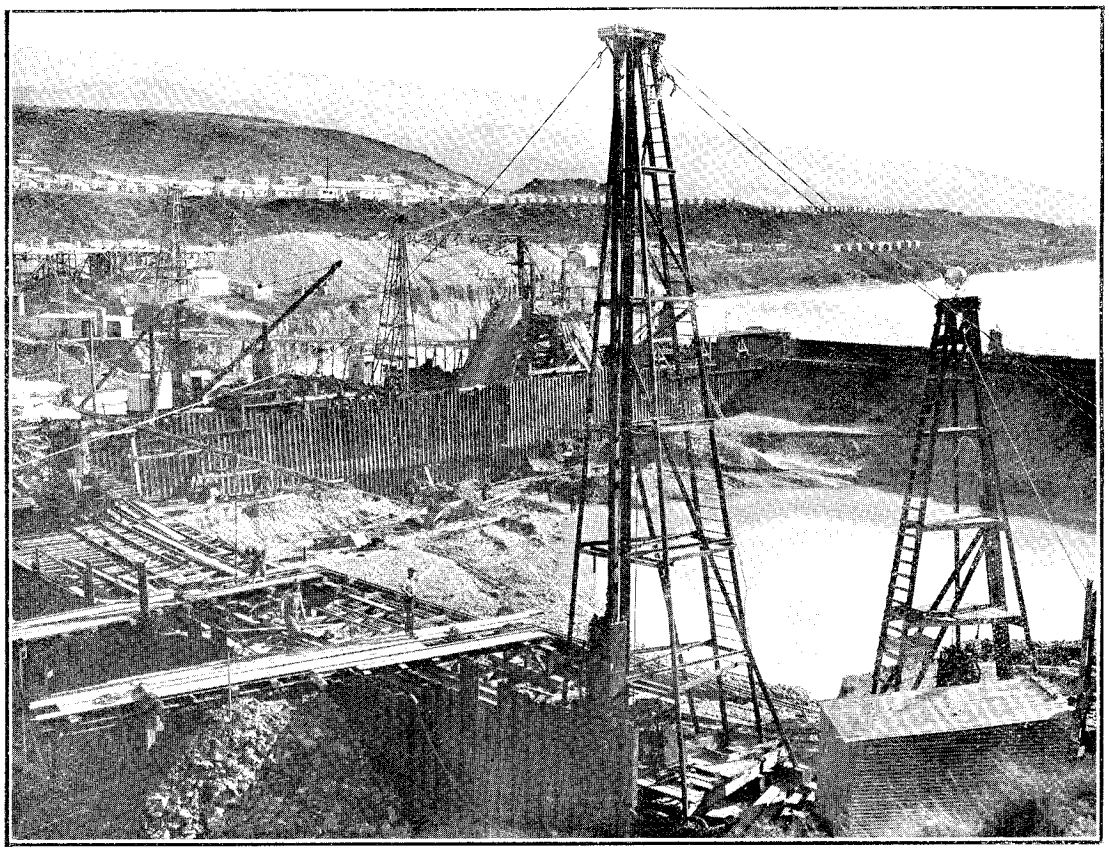
7,500 kw. Generators.

LAKE COLERIDGE POWER DEVELOPMENT.

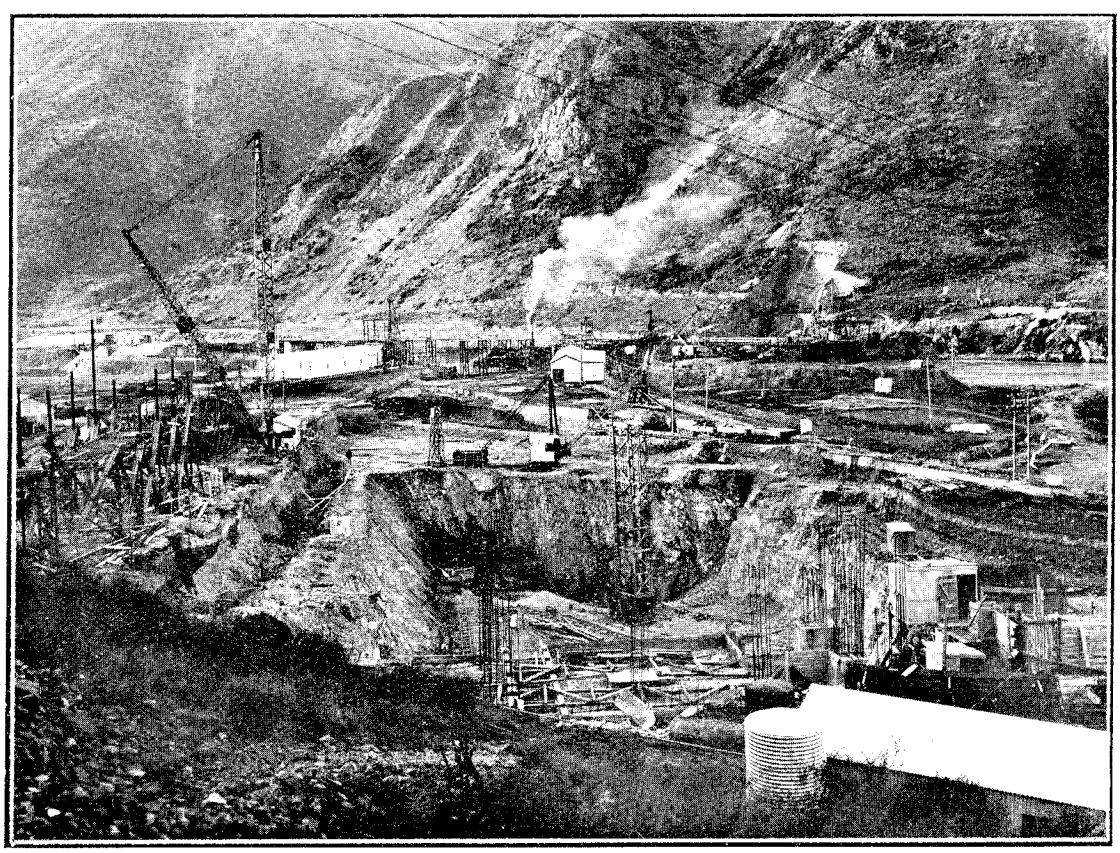


General View of Works, May, 1930.

WAITAKI POWER DEVELOPMENT.

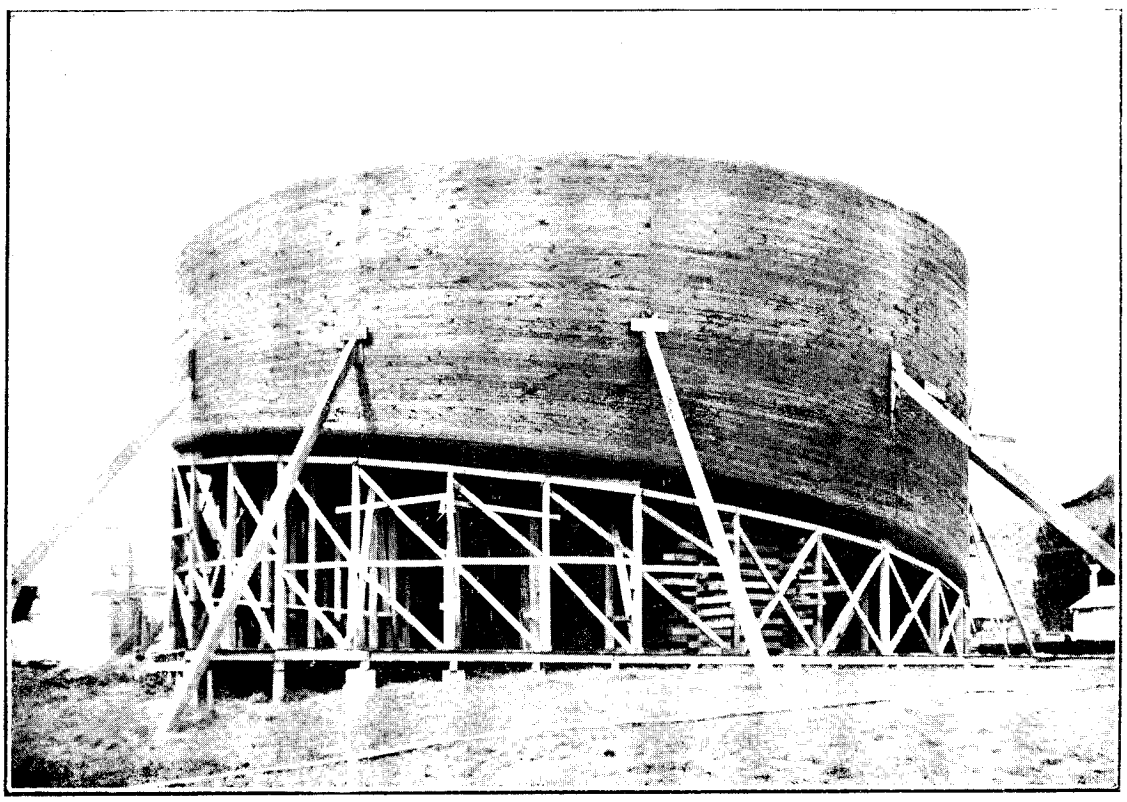


Coffer-dam on Canterbury Side.

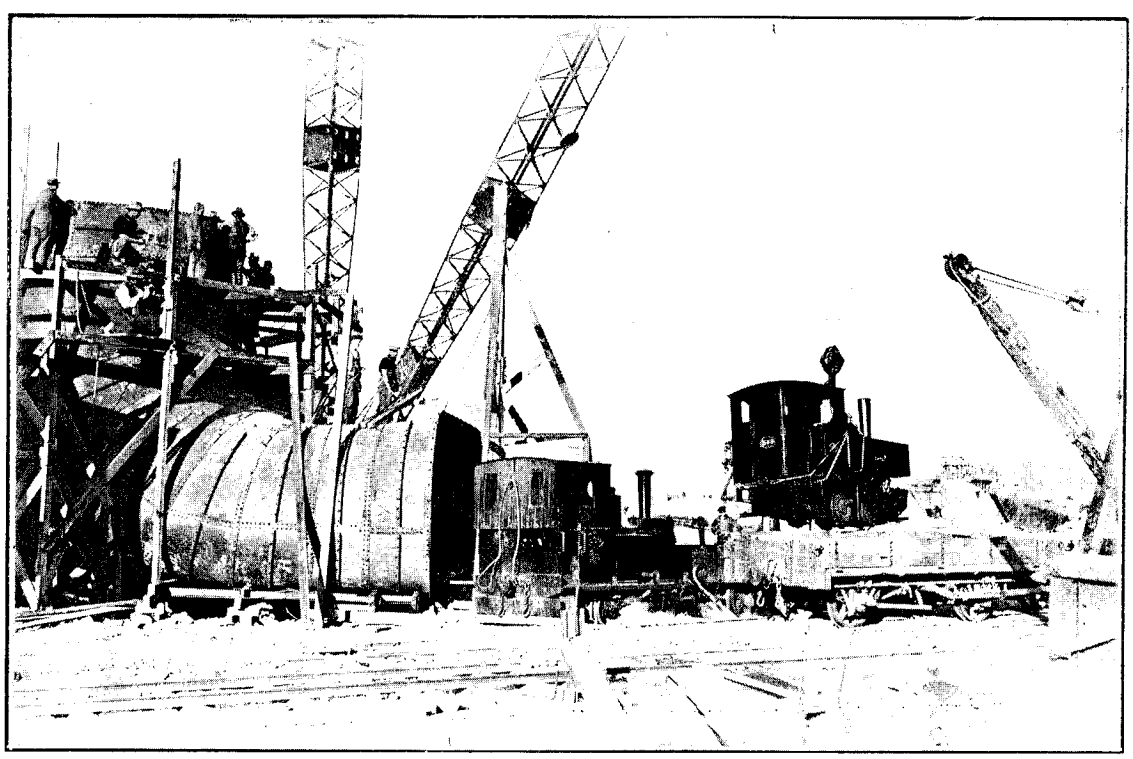


General View, April, 1930. Power-house Excavation in Foreground.

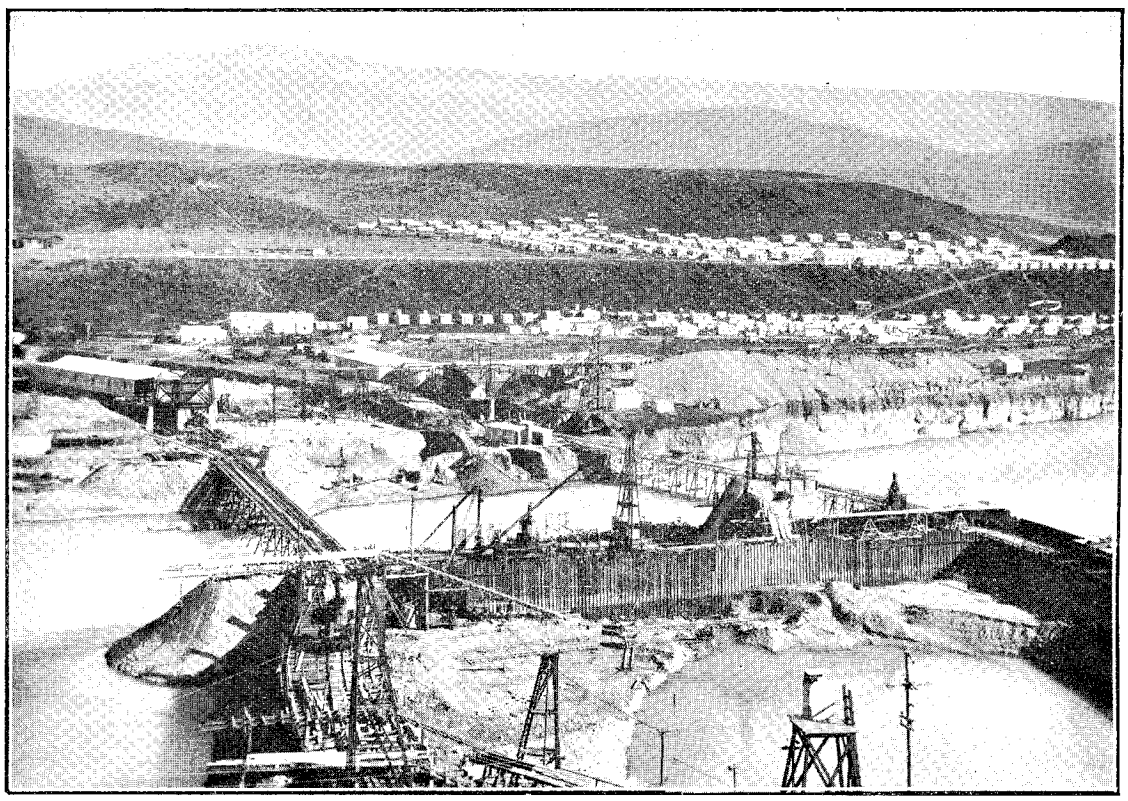
WAITAKI POWER DEVELOPMENT.



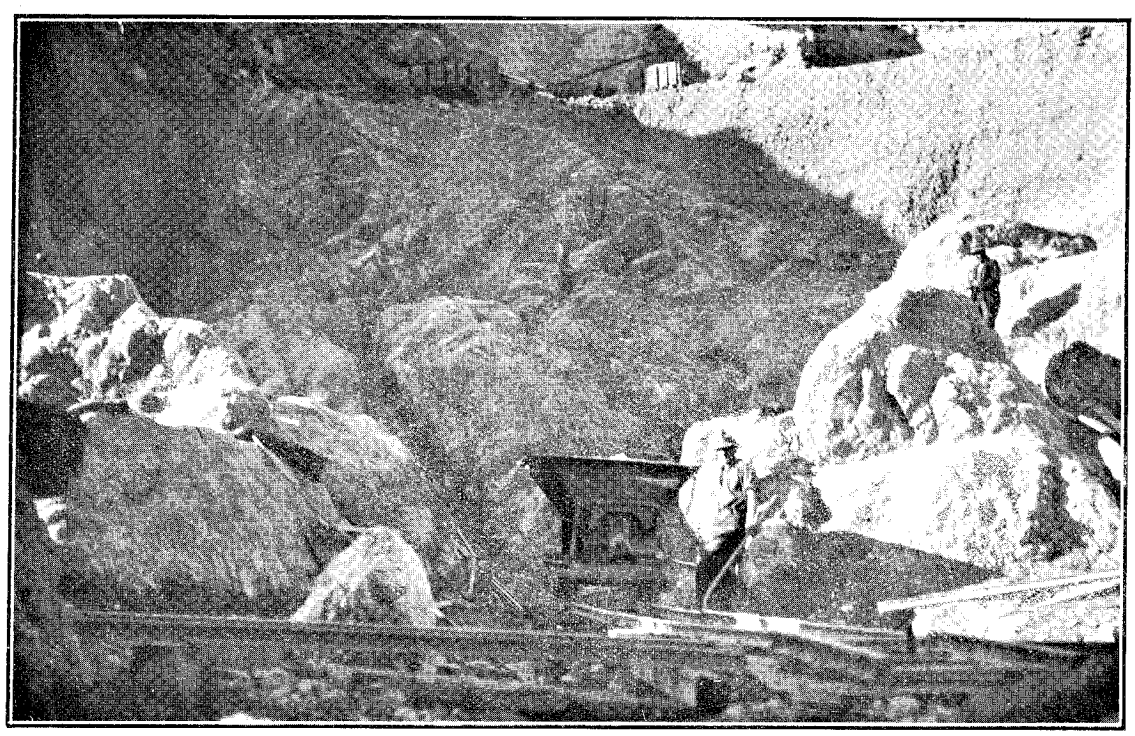
Completed Form-work for Spiral Casing No. 1.



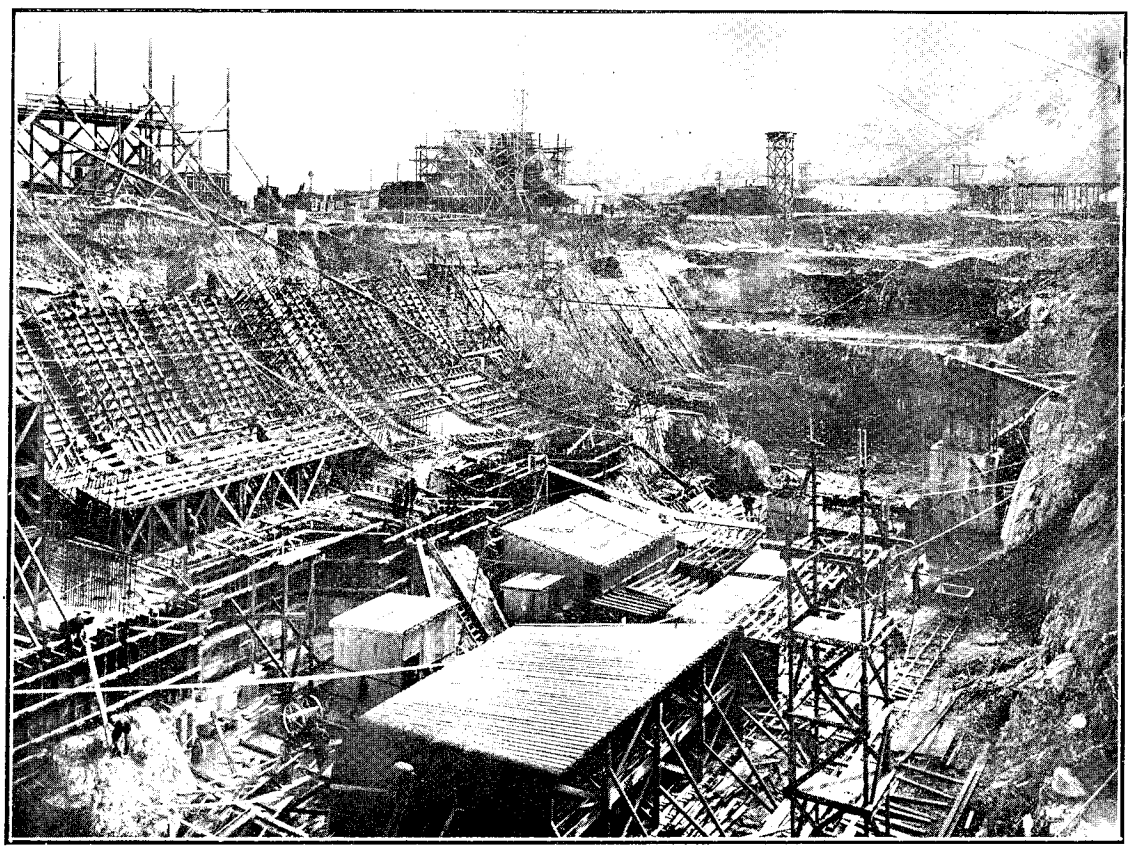
Unloading Locomotive by Crane. Steel Casing for Draught-tube on Left.



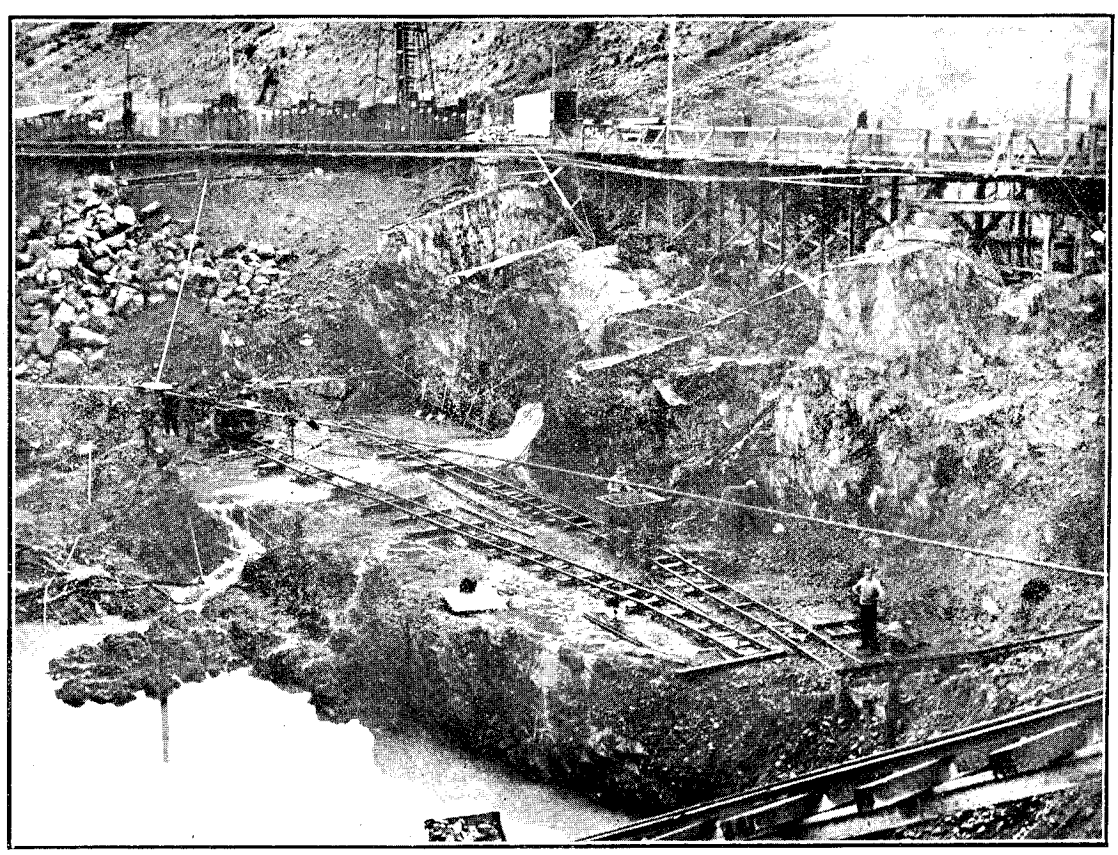
River Section of Works.—Concreting-plant in Centre; Canterbury Coffer-dam partly de-watered.



Rock Foundation of Canterbury Abutment.

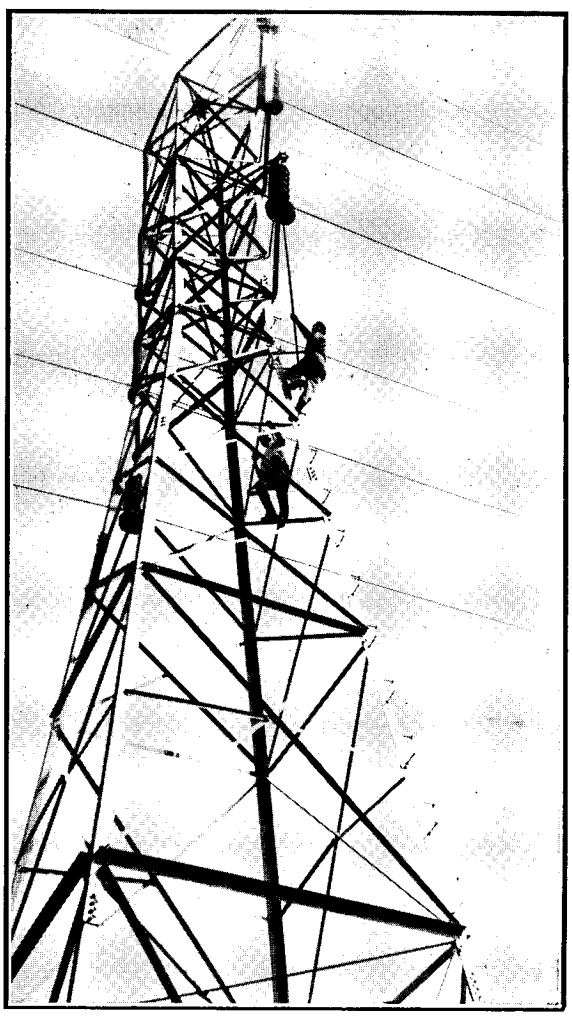


Power-house Excavation, showing Form-work for Concrete.



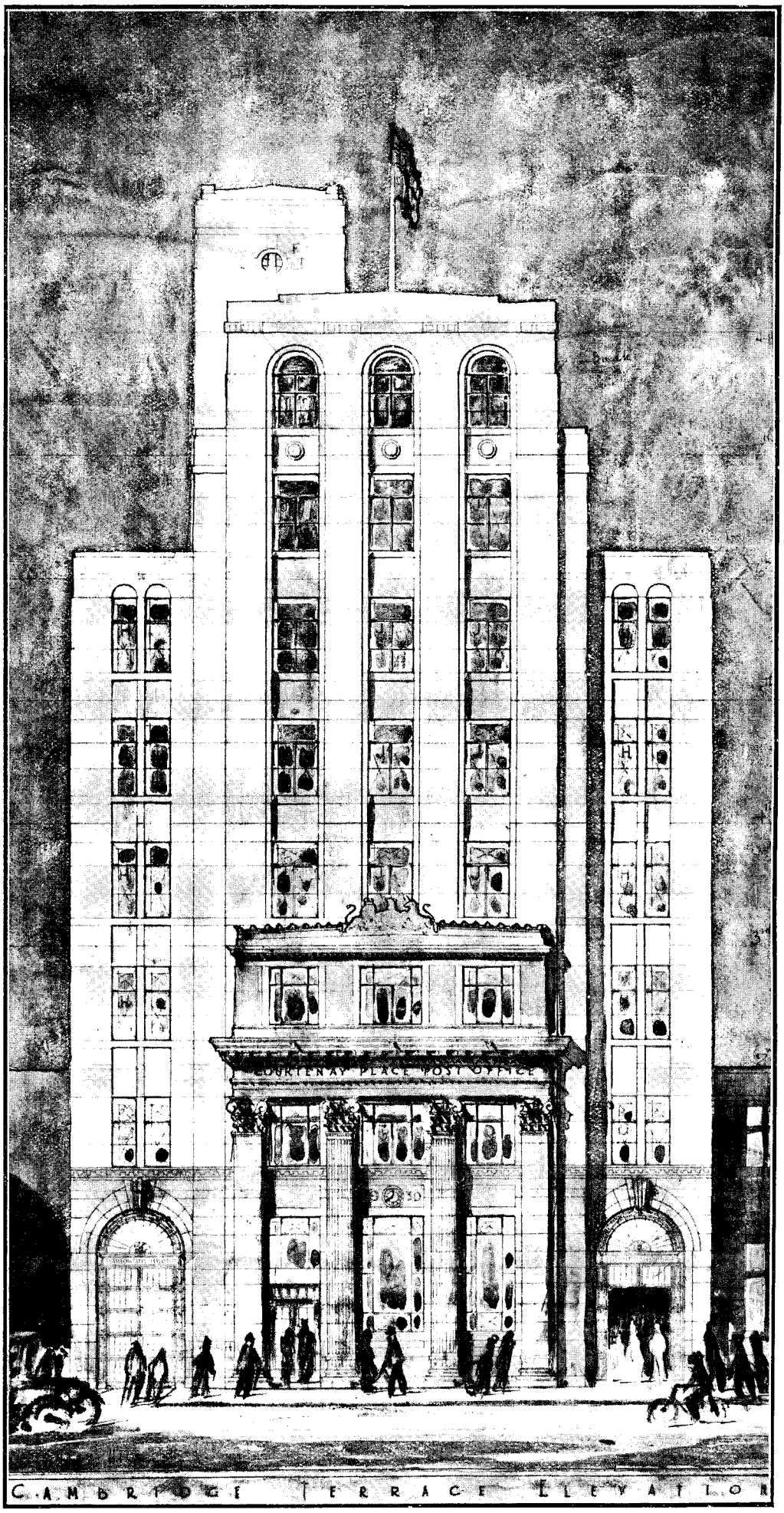
Rock-excavation in Canterbury Coffer-dam.

WAITAKI POWER DEVELOPMENT.



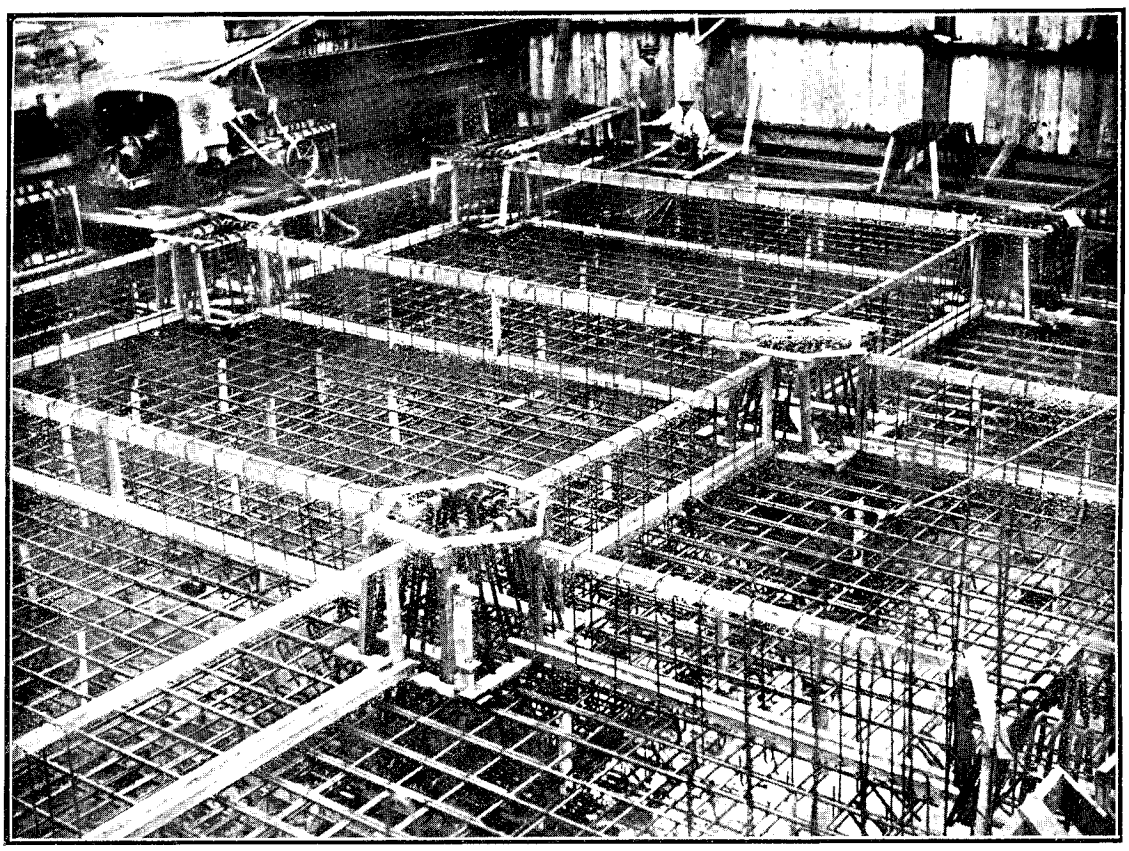
TESTING SUSPENSION INSULATORS.

MANGAHAO-WAIKAREMOANA POWER DEVELOPMENT.

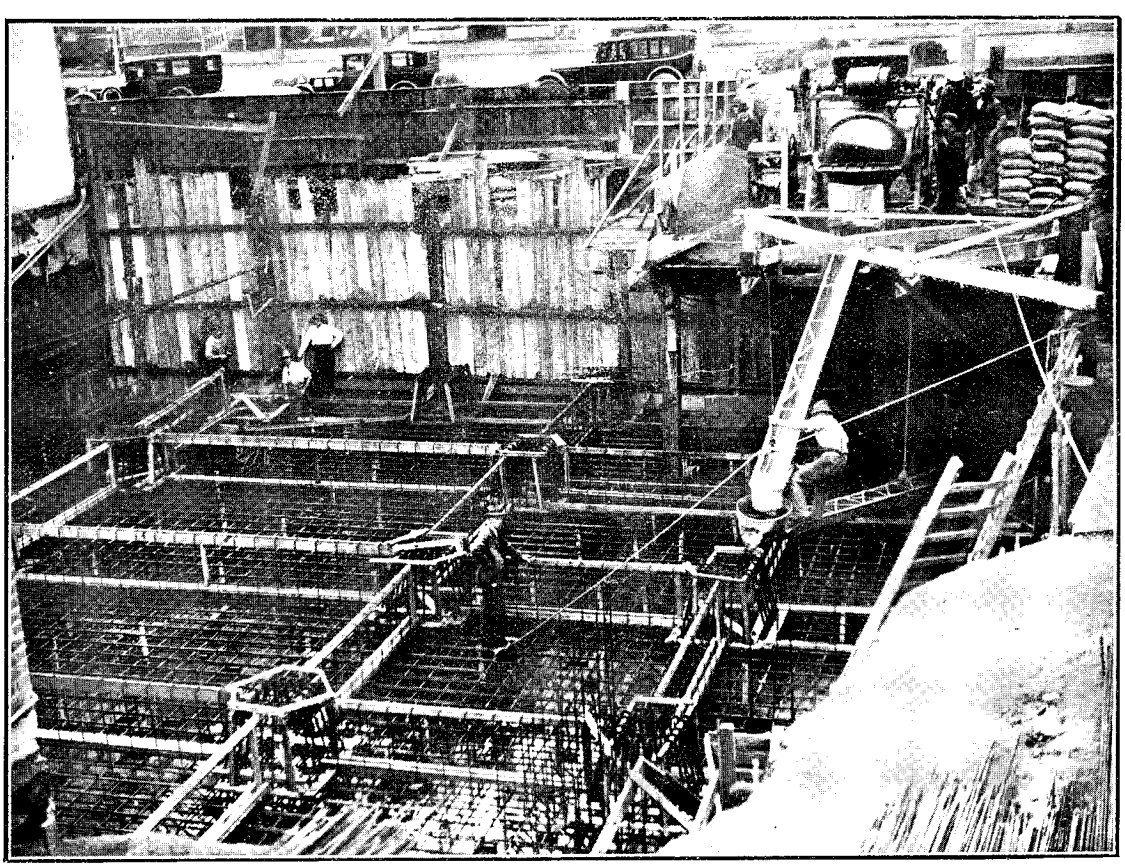


As it will appear when finished.

COURTENAY PLACE POST-OFFICE.

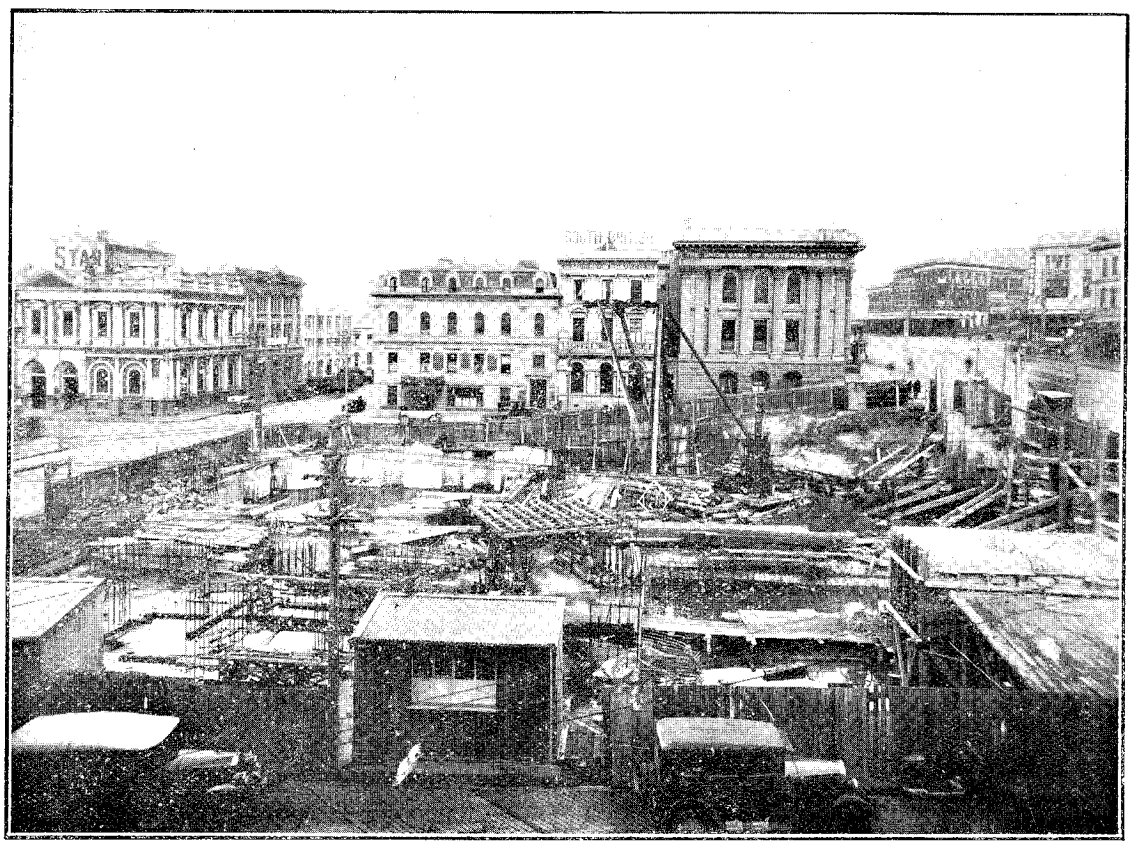


Reinforcement in Foundations.

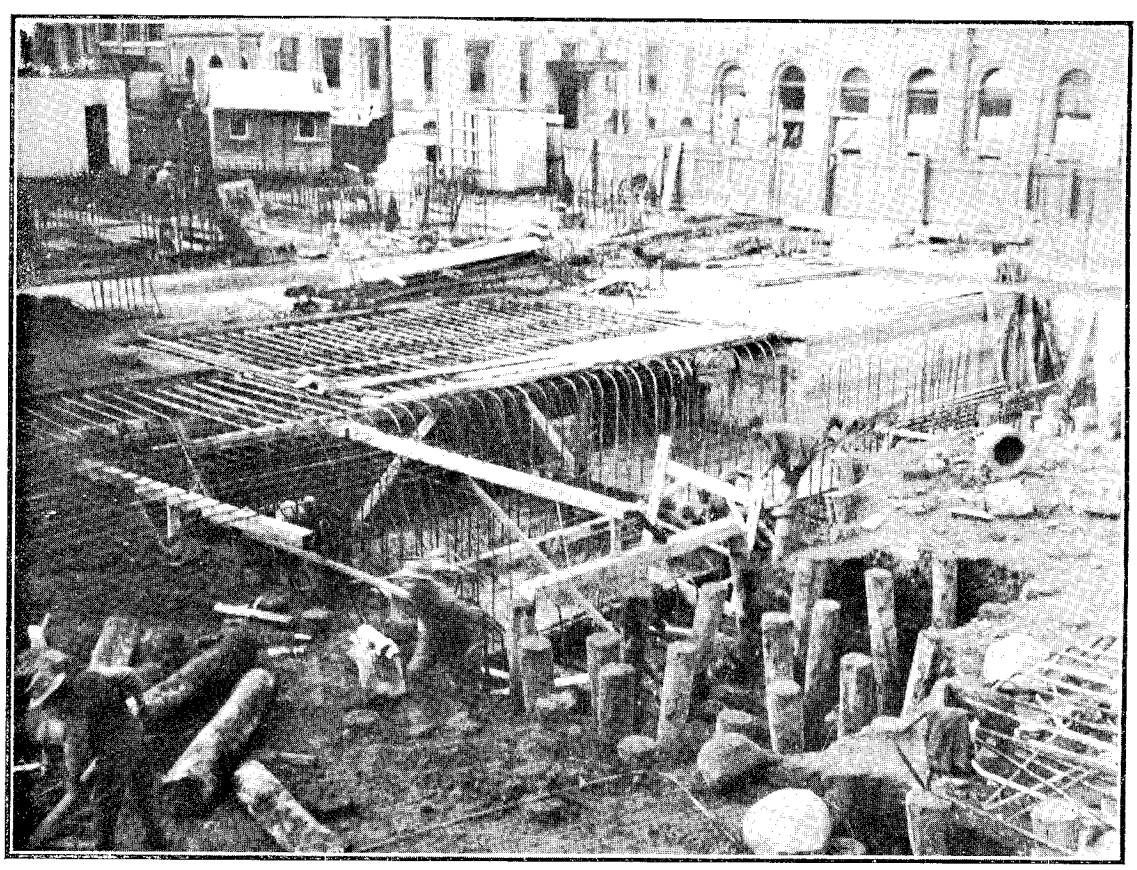


Reinforcement in Foundations and Commencement of Concreting.

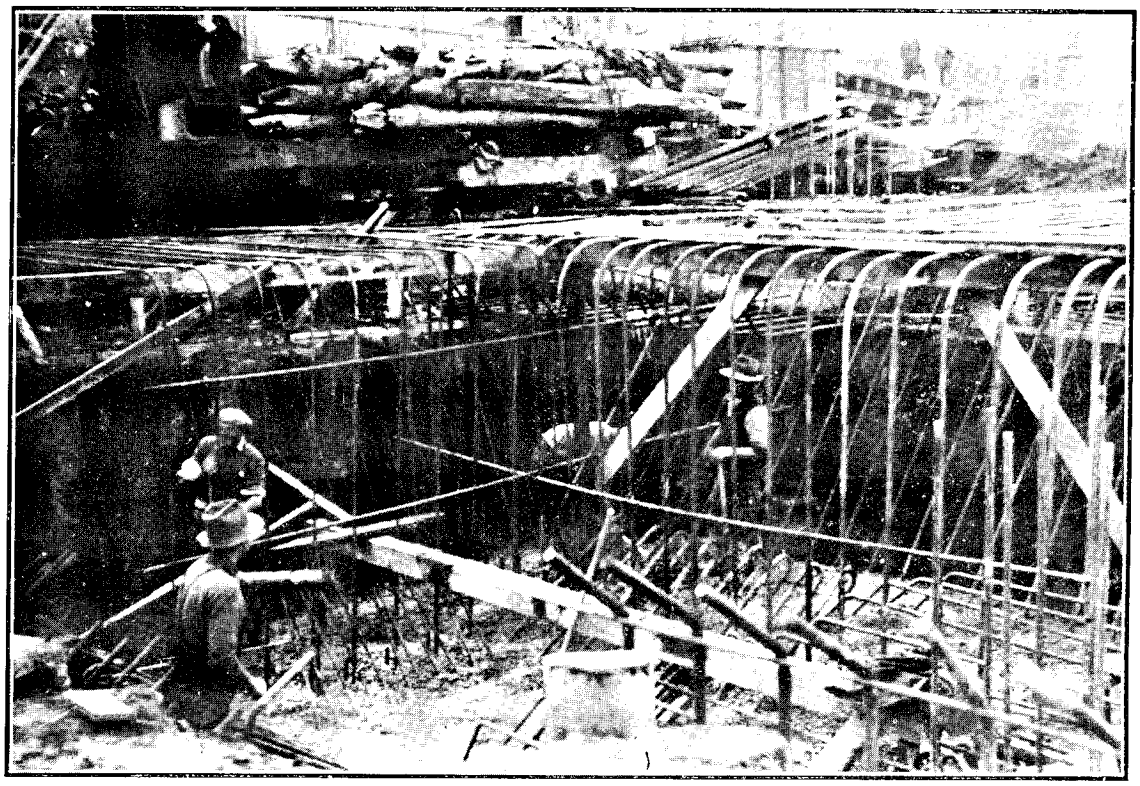
COURTENAY PLACE POST-OFFICE.



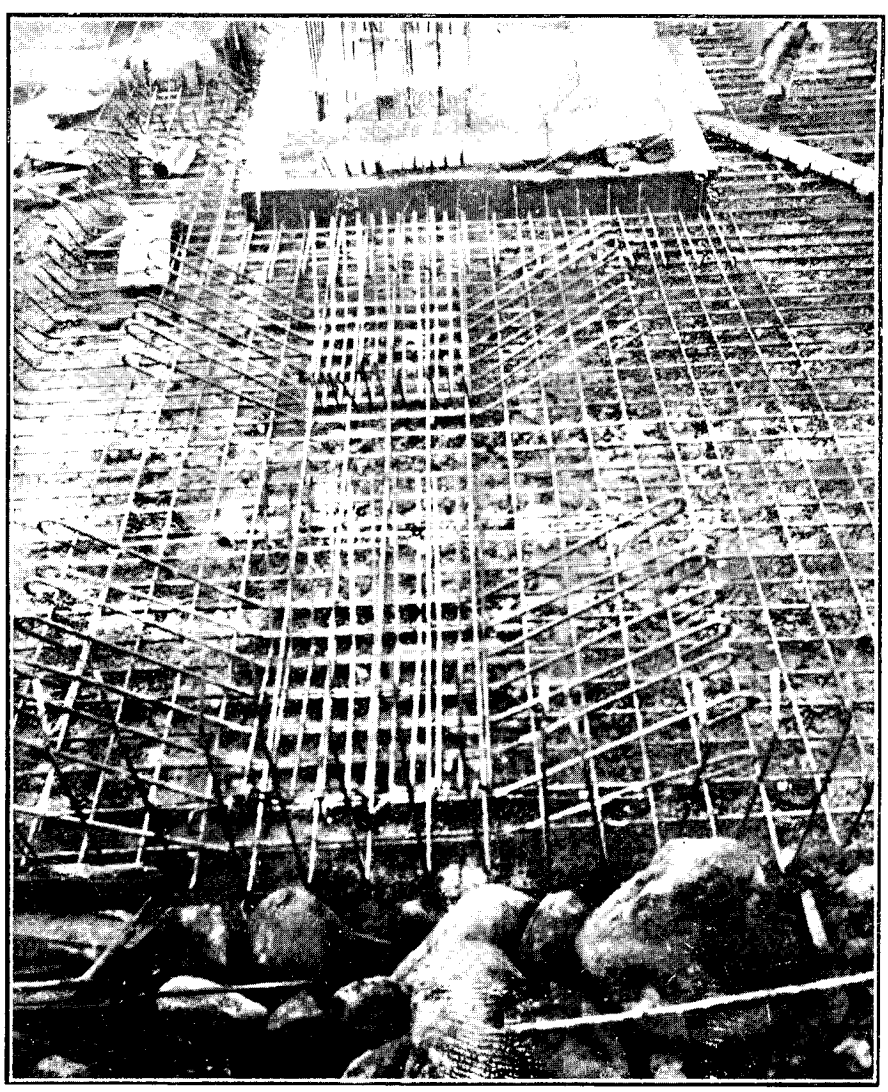
General View of Foundations.



View showing Portion of Finished Concrete of Foundations, and Reinforcing ready for Concreting. Timber Piles, used under Concrete, in Foreground.

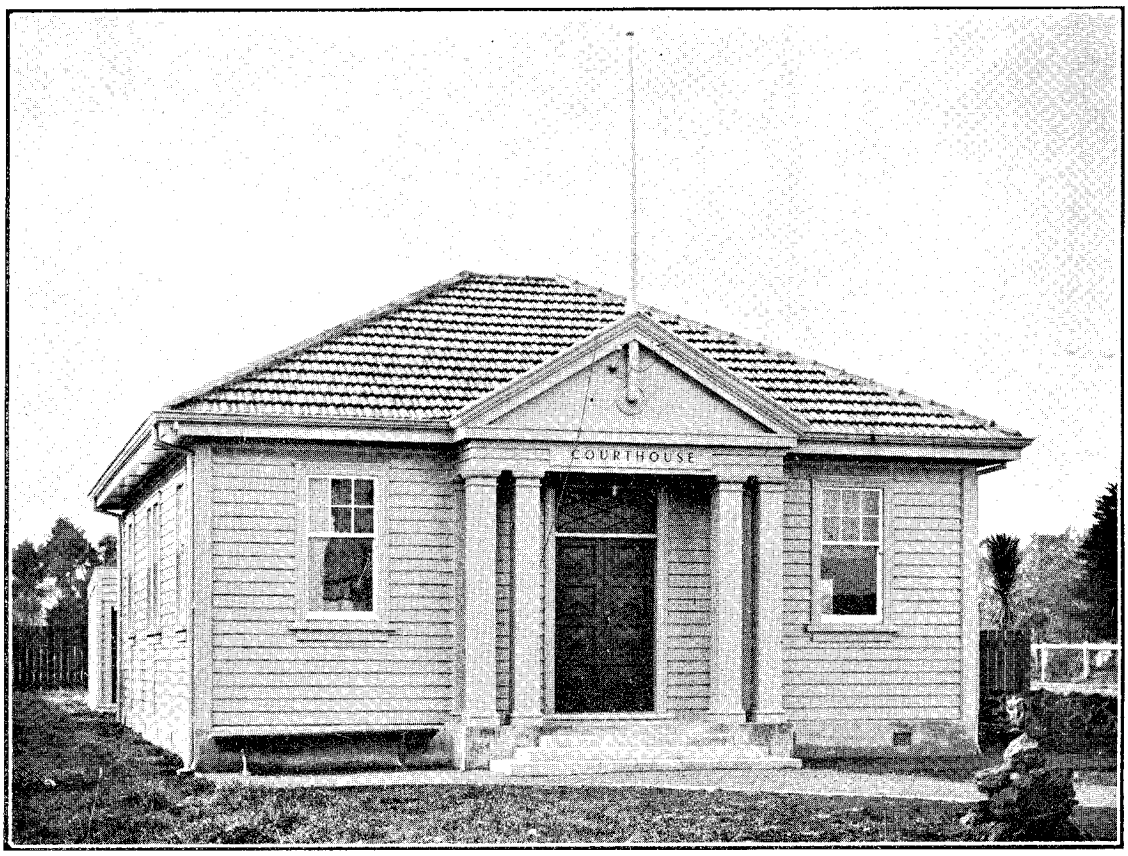


Details of Reinforcing.

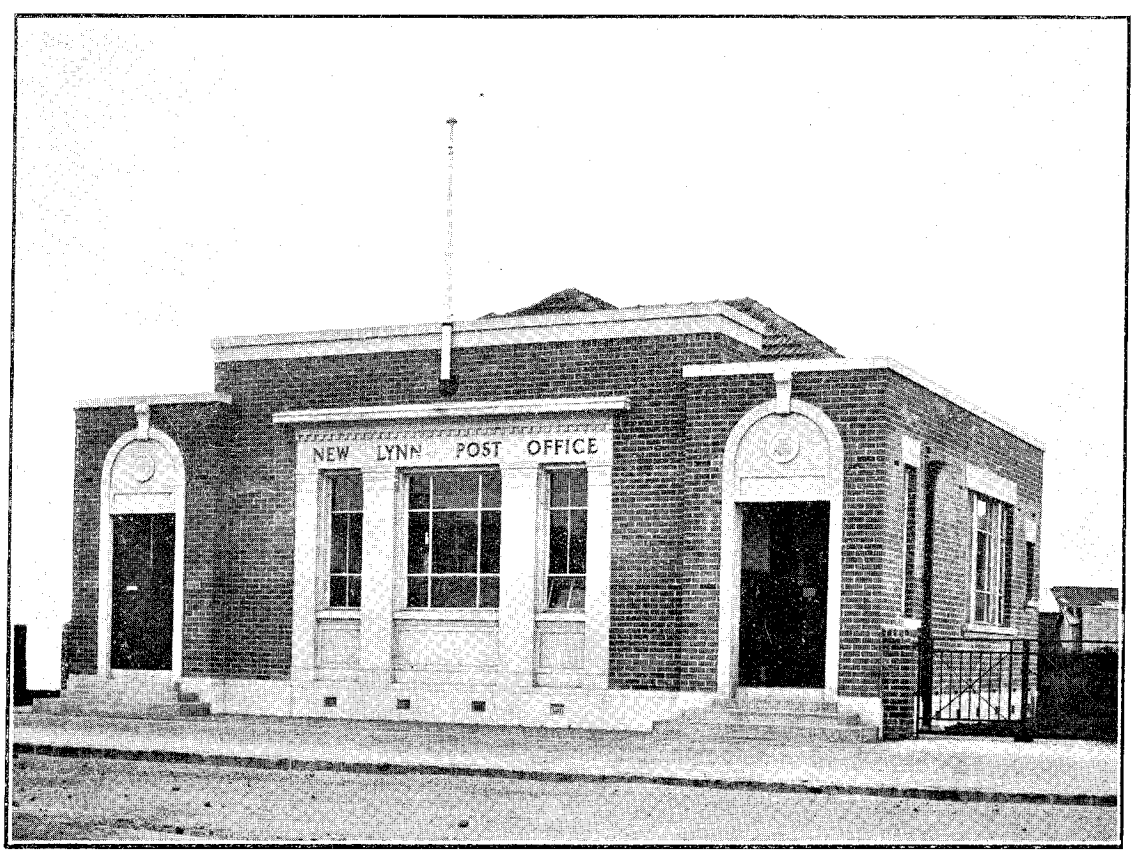


Reinforcing under Columns.

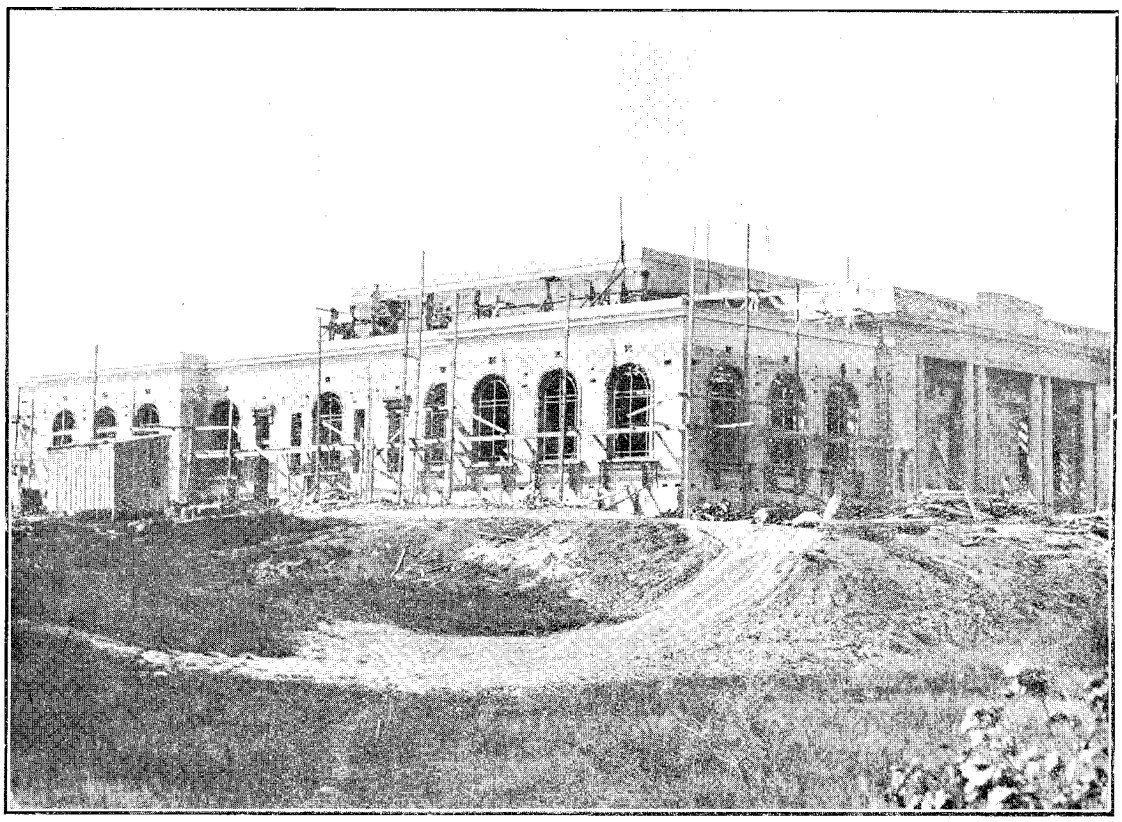
DUNEDIN POST-OFFICE.



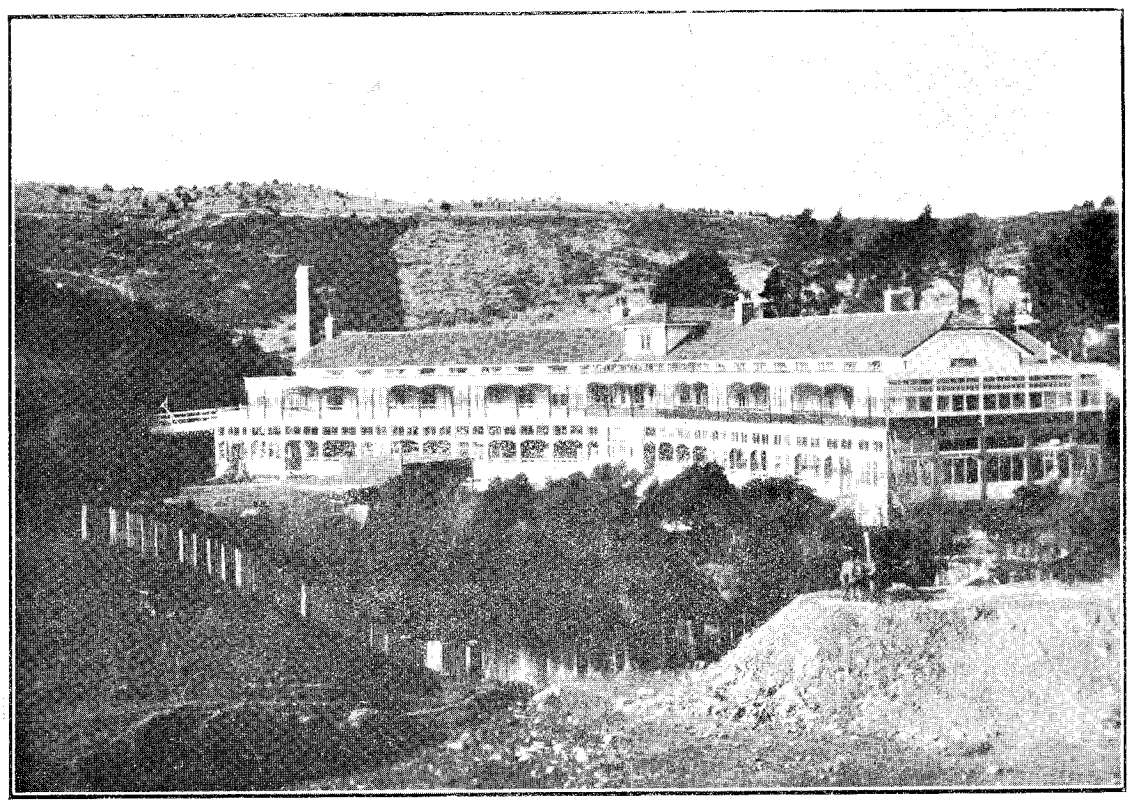
PAPAKURA COURTHOUSE.



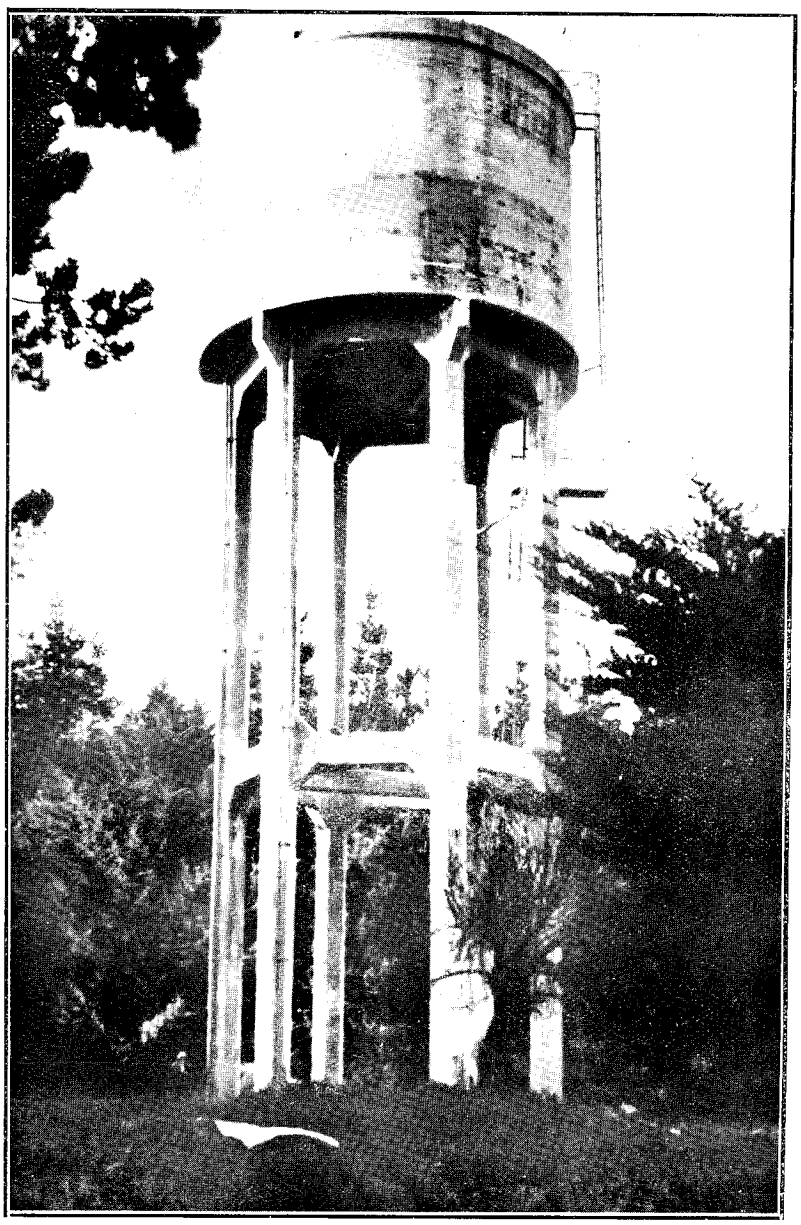
NEW LYNN POST-OFFICE.



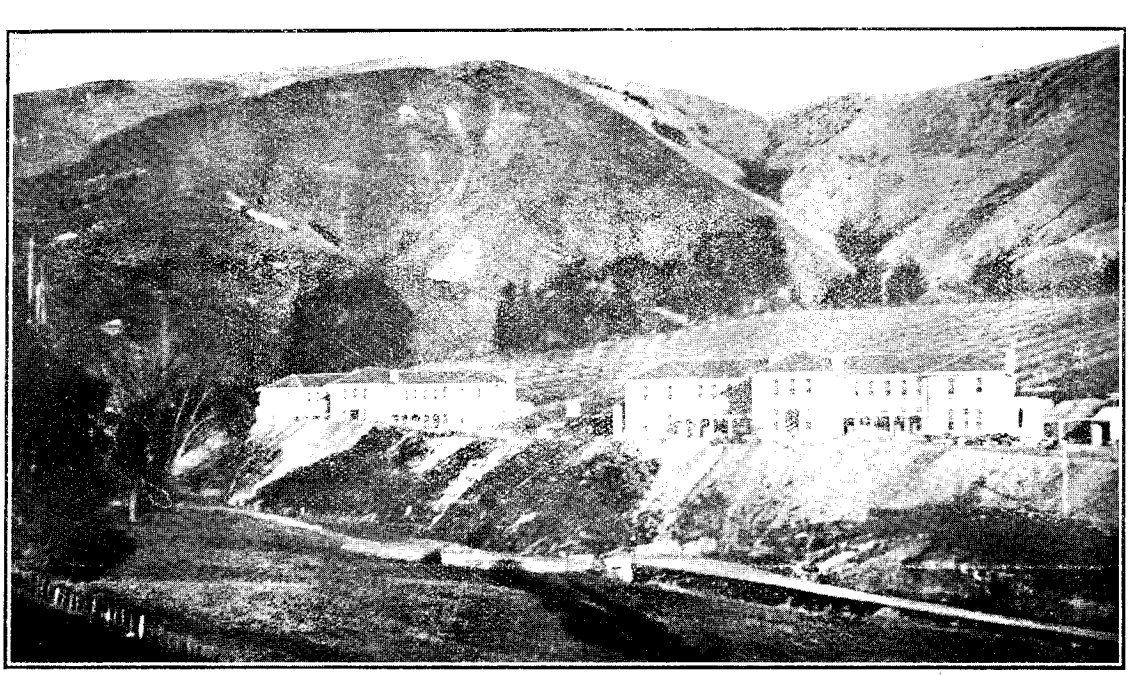
Hamilton Courthouse under Construction.



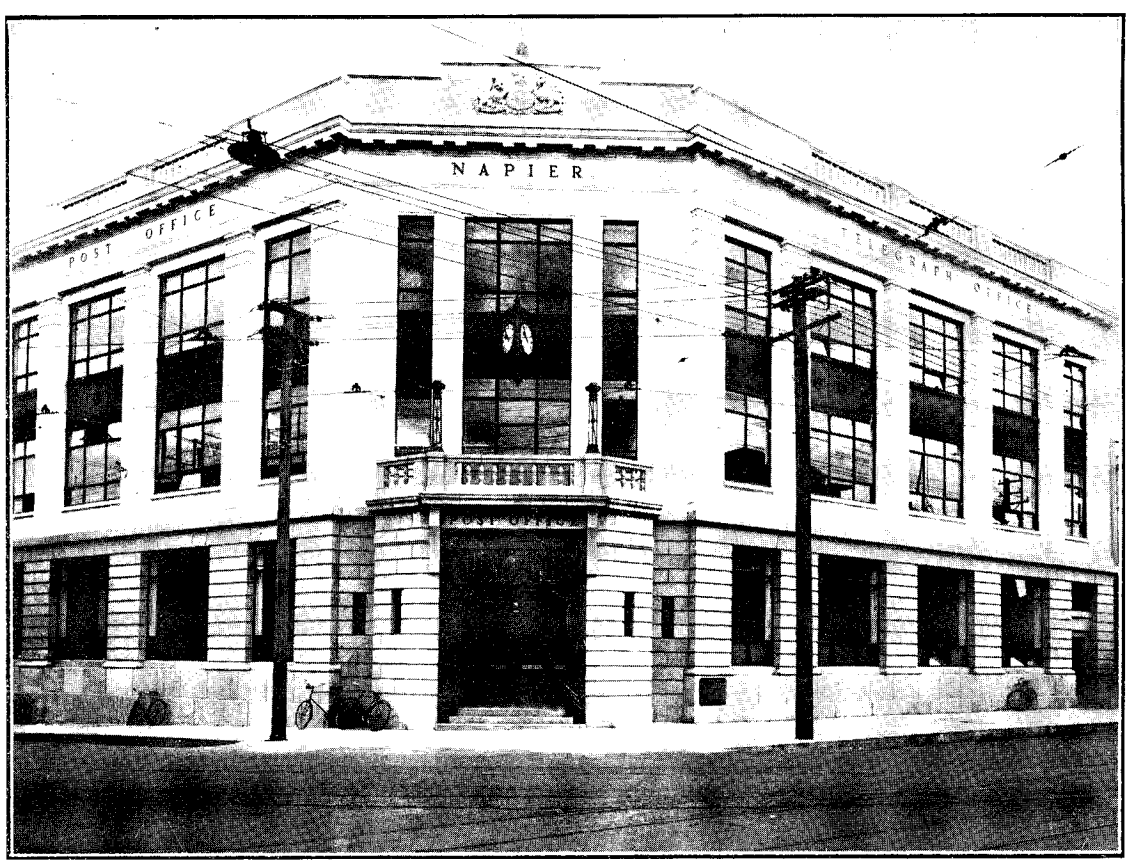
Additions to Ewart Hospital, Wellington.



Hokitika Mental Hospital.—40,000-gallon Elevated Reinforced Concrete Tank.



Stoke Mental Hospital.—Villas Nos. 2 and 3.



NAPIER POST-OFFICE.

PUBLIC WORKS STATEMENT, 1930.

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APPENDICES.

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TABLE No. 1.

SUMMARY SHOWING THE TOTAL EXPENDITURE ON PUBLIC WORKS AND OTHER SERVICES OUT OF PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT) TO 31ST MARCH, 1930, AND THE LIABILITIES ON THAT DATE.

Number of Table containing Details.	Works.	Total Net Expenditure to 31st March, 1929.	Expenditure during Twelve Months ended 31st March, 1930.	Recoveries on Account of Services of Previous Years.	Total Net Expenditure to 31st March, 1930.	Liabilities on 31st March, 1930.	Total Net Expenditure and Liabilities.	Works.
		£	£	£	£	£	£	
3	Railways*..	52,170,085	1,812,521	1,296	53,981,310	148,032	54,129,342	Railways.*
..	Payment to Midland Railway bond-holders	150,000	..	..	150,000	..	150,000	Payment to Midland Railway bond-holders.
..	Roads†	17,799,274	1,060,908	415	18,859,767	128,359	18,988,126	Roads.†
..	Development of mining	831,585	..	260	831,325	..	831,325	Development of mining.
..	Telegraphs	9,916,361	594,383	..	10,510,744	287,732	10,798,476	Telegraphs.
..	Public buildings‡	10,341,786	347,636	5,707	10,696,215	27,786	10,724,001	Public buildings.‡
..	Lighthouses, harbour-works, and harbour-defences	1,266,276	15,196	500	1,280,972	1,129	1,282,101	Lighthouses, harbour-works, and harbour-defences.
..	Departmental	2,544,319	132,783	51,671	2,625,431	4,110	2,629,541	Departmental.
10 of 1878	Coal-exploration and mine-development	10,835	..	..	10,835	..	10,835	Coal-exploration and mine-development.
11 of 1877	Aiding works on Thames goldfields ..	50,000	..	..	50,000	..	50,000	Aiding works on Thames goldfields.
..	Immigration	3,234,549	41,756	..	3,276,305	6,233	3,282,538	Immigration.
..	Purchase of Native lands	2,061,147	..	..	2,061,147	..	2,061,147	Purchase of Native lands.
..	Defence	1,347,920	46,766	1,325	1,393,361	72	1,393,433	Defence.
..	Charges and expenses of raising loans	3,031,051	518,158	..	3,549,209	..	3,549,209	Charges and expenses of raising loans.
..	Interest and sinking fund	218,500	..	..	218,500	..	218,500	Interest and sinking fund.
..	Rates on Native lands	68,672	..	..	68,672	..	68,672	Rates on Native lands.
..	Thermal springs	14,600	..	..	14,600	..	14,600	Thermal springs.
..	Tourist and health resorts	499,580	20,547	1,213	518,914	5,636	524,550	Tourist and health resorts.
..	Lands improvement§	512,380	79,454	112	591,722	8,841	600,563	Lands improvement.§
..	Irrigation and water-supply‖.. ..	836,472	69,657	..	906,129	5,246	911,375	Irrigation and water-supply.‖
..	Plant, material, and stores	351,769	*Cr.* 31,813	335	319,621	3,993	323,614	Plant, material, and stores.
..	Quarries (acquisition and operation) ..	5,114	329	25	5,418	2,239	7,657	Quarries (acquisition and operation).
..	Timber-supply and sawmills for Public Works Department	390	*Cr.* 3,608	..	*Cr.* 3,218	242	*Cr.* 2,976	Timber-supply and sawmills for Public Works Department.
..	Motor Transport Services	33,635	..	..	33,635	..	33,635	Motor Transport Services.
..	Transfer to Main Highways Account, Construction Fund	1,026,000	200,000	..	1,226,000	..	1,226,000	Transfer to Main Highways Account, Construction Fund.
	Totals	108,322,300	4,904,673	62,859	113,176,614	629,650	113,806,264	Totals.

* Exclusive of expenditure on Hutt Railway and Road Improvement and Railways Improvement Accounts. † Includes £4,500 expended under section 16 (1) Native Land Amendment and Native Land Claims Adjustment Act, 1923. ‡ Includes £12,500 expended under Finance Act, 1929, section 32. § £6,727 previously expended on irrigation under this item now transferred to Irrigation and Water-supply. ‖ Includes £115,000 previously expended under Irrigation and Water-supply Account, 1911–12 to 1915–16 and part 1917–18, now included in Public Works Fund; also £6,727 previously expended on irrigation under Lands Improvement now transferred to Irrigation and Water-supply.

TABLE No. 2.

GENERAL SUMMARY.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1908–1909 to 1929–30.

N.B.—The figures in italics, prefixed by "*Cr.*," are either recoveries on account of services of previous years or receipts-in-aid applied in reduction of expenditure.

Description of Services.	Total Net Expenditure to 31st March, 1908.	Expenditure.										
		1908–9.	1909–10.	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	1915–16.	1916–17.	1917–18.	1918–19.
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	2,186,713	15,075	17,003	9,441	11,681	14,694	33,914	33,219	10,010 *Cr. 10*	6,533	3,856	*Cr. 12,018*
Public Works, Departmental	568,386	24,512	41,176	42,733	49,864	57,426	66,650	100,719	111,489	131,701	127,962 *Cr. 2,662*	115,419 *Cr. 4,119*
Irrigation and Water-supply	..	..	..	1,562	2,794	14,689	40,329	32,090	29,874	20,794	11,650	13,665
Railways	24,212,995	1,116,183	1,128,400	1,104,071 *Cr. 652*	1,125,905 *Cr. 6,987*	1,148,832 *Cr. 29,528*	1,104,897 *Cr. 5,485*	2,146,753† *Cr. 6,022*	1,065,171 *Cr. 4,633*	620,947 *Cr. 4,845*	495,771 *Cr. 110*	387,923 *Cr. 4,924*
Payment to Midland Railway Bondholders	150,000	..	..	..	..	..	..	..	..	..	..	..
Roads:—												
Miscellaneous Roads and Bridges	6,763,065	422,174	297,932	229,537	383,511	337,584	353,836 *Cr. 515*	484,365	400,062	203,746	128,730 *Cr. 600*	221,887 *Cr. 997*
Roads on Goldfields..	781,451	47,375	40,830	25,626	41,067	36,761	24,143	30,065	24,432	17,099	6,912	4,186
Development of Thermal Springs and Natural Scenery ..	16,023	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account*	300,930	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	7,861,469	469,549	338,762	255,163	424,578	374,345	377,464	514,430	424,494	220,845	135,042	225,076
Development of Mining	786,658	32,859	18,597 *Cr. 1,000*	10,845 *Cr. 1,000*	21,244 *Cr. 30*	10,644 *Cr. 1,015*	4,889	2,384 *Cr. 255*	6,602	4,592	27 *Cr. 6,545*	518 *Cr. 1,000*
Purchase of Native Lands	1,543,768	2,099	30,567	2,976 *Cr. 2,286*	*Cr. 2,466*	*Cr. 917*	*Cr. 857*	*Cr. 1,060*	*Cr. 972*	*Cr. 868*	*Cr. 57*	..
Native Lands Purchase Account	491,980	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	2,035,748	2,099	30,567	690	*Cr. 2,456*	*Cr. 917*	*Cr. 857*	*Cr. 1,060*	*Cr. 972*	*Cr. 868*	*Cr. 57*	..
Telegraph Extension	1,479,735	163,032	123,423	111,867	147,692	251,375	392,648	288,395	249,554	203,311	213,955	198,611
Public Buildings:—												
General (including Miscellaneous)	318,058	39,635	41,964	44,044	34,721	44,719	43,199	52,239	22,050	12,648	11,646 *Cr. 15,067*	43,168
Parliamentary	67,489	5,172	3,157	237	2,004	18,806	23,612	31,478	17,133	22,586	37,233	..
Judicial { Courthouses	591,169	14,473	11,119	5,759	14,556	20,097	9,423	5,171	4,902	299	21	..
Judicial { Prisons		5,008	4,231	7,506	9,760	6,911	4,928	14,515	17,786	15,685	13,195	16,299
Judicial { Police-stations		17,730	16,256	9,030	19,817	18,423	14,094	19,122	25,484	21,147	18,814	6,157

* Subsequent expenditure under separate class "Lands Improvement," see next page.

† Includes £1,000,000 expended 1908–9 and 1909–10 under Wellington–Manawatu Railway Purchase Account.

[*Continued on page 4.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1908–1909 to 1929–30—*continued.*

Description of Services.	Total Net Expenditure to 31st March, 1908.	Expenditure.										
		1908–9.	1909–10.	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	1915–16.	1916–17.	1917–18.	1918–19.
Public Buildings—*continued.*	£	£	£	£	£	£	£	£	£	£	£	£
Post and Telegraph	528,359	62,262	68,574	117,815	130,815	122,999	78,815	60,838	35,258	22,744	33,525	26,072
Customs	46,699	2,507	233	..	..	..	..	..	..	..	..	..
Quarantine Stations	6,865	..	..	..	..	..	..	..	..	..	..	..
Mental Hospitals	549,794	15,296	19,839	12,707	8,809	46,181	26,001	53,996	54,898 *Cr. 15*	44,602	26,502	14,640
Public Health	27,768	4,402	319	..	..	376	..	..	..	..	..	..
Health and Hospital Institutions	95,340	11,153	7,259	1,484	12,745	8,750	1,435	998	1,426	7,570	4,080	2,332
School Buildings	1,554,446	102,340	98,103	124,926	90,535	105,000	121,954	122,940	97,972	70,367	63,082	115,656
Agricultural	18,508	5,543	6,103	1,160	3,684	6,475	4,398	2,428 *Cr. 34*	2,972	3,046	5,685	4,229
Workers' Dwellings	..	..	..	..	22,644	46,455	41,741	68,275	55,893	35,437	15,505	7,293
Total, Public Buildings	3,804,495	285,521	277,157	324,668	350,090	445,192	369,600	431,966	335,759	256,131	214,221	235,846
Lighthouses, Harbour-works, and Harbour-defences:—												
Lighthouses	164,272	7,481	6,762	1,470	5,428	9,031	5,174	3,887	1,415	449	561	1,663
Harbour-works	336,123	4,439	4,548	4,092	6,004	7,415	3,346 *Cr. 1,462*	12,563	9,355	2,280	2,359	3,729
Harbour-defences	524,125	7,297	5,372	2,865	1,144	339	539 *Cr. 300*	681	2,903	1,038	56	..
Total, Lighthouses, &c.	1,024,520	19,217	16,682	8,427	12,576	16,785	7,297	17,131	13,673	3,767	2,976	5,392
Rates on Native Lands	68,645	27	..	..	..	..	..	..	..	..	..	..
Contingent Defence	888,168	10,766	4,977	6,071	10,437	23,790	30,186	15,221	37,619	9,742	6,714	8,809 *Cr. 922*
Tourist and Health Resorts	158,567	24,286	14,507	5,912	13,361	12,906	14,989	8,232 *Cr. 12*	5,167 *Cr. 500*	1,094	931	1,620
Lands Improvement*	24,575	19,542	6,910	11,125	20,394	22,550 *Cr. 383*	10,269 *Cr. 432*	13,810 *Cr. 522*	5,936	*Cr. 2,731*	1,838	*Cr. 4,268*
Charges and Expenses of raising Loans	1,235,642	575	17,715 *Cr. 12,000*	66,367 *Cr. 66,392*	67,470 *Cr. 66,951*	72,950 *Cr. 71,681*	105,449 *Cr. 96,741*	35,495 *Cr. 34,865*	5,037 *Cr. 5,030*	35	1	..
Interest and Sinking Funds	218,500	..	..	..	..	..	..	..	..	..	..	..
Coal-exploration and Mine-development	10,835	..	..	..	..	..	..	..	..	..	..	..
Thermal Springs	14,600	..	..	..	..	..	..	..	..	..	..	..
Plant, Material, and Stores	..	..	..	..	..	..	..	..	74,418	9,778	6,811	20,638 *Cr. 31*
Total Ways and Means Credits	..	..	..	..	*10,530*	*103,524*	*105,792*	*43,400*	*11,160*	*5,713*	*43,492*	*11,993*
Grand Total—Net Expenditure	46,730,251	2,183,245	2,022,876	1,891,918	2,190,731	2,347,965	2,455,066	2,597,109	2,363,658	1,502,588	1,237,422	1,207,482

* For previous expenditure see Roads Class.

[*Continued on page 5.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1908–1909 to 1929–30—*continued.*

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1930.
	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	*Cr. 62,561*	*Cr. 7,806*	247,528	90,611 *Cr. 140*	92,600 *Cr. 1,267*	136,353 *Cr. 16*	107,521 *Cr. 443*	184,918	67,157	50,266 *Cr. 283*	41,756	3,276,305
Public Works, Departmental	121,677	143,280 *Cr. 6,281*	128,002 *Cr. 525*	111,367 *Cr. 131*	110,445 *Cr. 69*	127,556 *Cr. 19*	126,596 *Cr. 129*	115,866 *Cr. 35,948*	130,951 *Cr. 13,328*	142,252 *Cr. 88,499*	132,783 *Cr. 51,671*	2,625,431
Irrigation and Water-supply*	34,115	55,344	82,713	58,131	95,467	127,995	56,227 *Cr. 31*	56,937	49,735 *Cr. 2,798*	55,198 *Cr. 8*	69,657	906,129
Railways	748,649 *Cr. 105,196*	1,365,466 *Cr. 388*	3,133,200 *Cr. 751*	2,110,859 *Cr. 3,171*	1,776,413 *Cr. 1,167*	1,878,729 *Cr. 37,924*	1,988,614 *Cr. 16,875*	1,480,807 *Cr. 95,647*	1,141,822 *Cr. 1,699*	1,216,277 *Cr. 2,595*	1,812,521 *Cr. 1,296*	53,981,310
Payment to Midland Railway Bondholders	..	..	..	..	..	..	..	..	..	..	..	150,000
Roads :—												
Miscellaneous Roads and Bridges	376,097 *Cr. 603*	527,854 *Cr. 81*	552,895 *Cr. 197*	643,156 *Cr. 244*	751,370 *Cr. 188*	603,968 *Cr. 231*	564,694 *Cr. 4,810*	575,898 *Cr. 981*	669,833 *Cr. 540*	780,990 *Cr. 330*	1,005,330 *Cr. 415*	..
Roads to give access to Outlying Districts	..	..	..	..	..	..	..	..	33,642	51,582	53,693	..
Roads on Goldfields	12,465	11,050	11,264	4,850	2,867	2,755	3,934	2,230	2,330 *Cr. 467*	1,005	1,885	..
Development of Thermal Springs and Natural Scenery	..	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account	..	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	387,959	538,823	563,962	647,762	754,049	606,492	563,818	577,147	704,798	833,247	1,060,493	18,859,767
Development of Mining	1,173 *Cr. 7,008*	2,153 *Cr. 1,606*	2,130 *Cr. 51*	*Cr. 98* *Cr. 1,785*	1,363 *Cr. 2,310*	..	..	..	.. *Cr. 1,130*	.. *Cr. 260*	.. *Cr. 260*	881,325
Purchase of Native Lands	*Cr. 57*	*Cr. 57*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*	..	..	..
Native Lands Purchase Account	..	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	*Cr. 57*	*Cr. 57*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*	..	..	2,061,147
Telegraph Extension	249,379	336,468	590,981	512,657 *Cr. 11,082*	717,409	957,294	931,661	558,042	625,540	624,414	594,383	10,510,744
Public Buildings :—												
General (including Miscellaneous)	64,207	39,504	87,057	113,553	8,160	30,791 *Cr. 35*	29,369 *Cr. 345*	119,864 *Cr. 429*	42,553 *Cr. 1,065*	4,272 *Cr. 420*	14,106‡ *Cr. 3,156*	..
Parliamentary	..	..	..	..	..	..	..	..	..	35	27,142	..
Judicial — Courthouses	868	1,400	4,358	2,018 *Cr. 13*	2,448	5,363 *Cr. 19*	7,209	1,261 *Cr. 13*	7,531 ..	8,387 *Cr. 95*	15,765 *Cr. 29*	..
Judicial — Prisons	20,981	30,038 *Cr. 800*	41,740	23,313	26,484 *Cr. 2,568*	25,279 *Cr. 86*	24,196	22,812 *Cr. 908*	22,359 *Cr. 524*	12,573 *Cr. 321*	18,814 *Cr. 285*	..
Judicial — Police-stations	24,944	36,843	22,544	6,298	12,838	18,553	16,594 *Cr. 102*	7,411 *Cr. 13*	5,561 *Cr. 970*	6,925 *Cr. 605*	8,442 *Cr. 319*	..

* £6,727 previously included under Lands Improvement now transferred to Irrigation and Water-supply. ‡ Includes £12,500 expended under Finance Act, 1929, section 32. [*Cntd. on page 6.*

TABLE No 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1908–1909 to 1929–30—*continued.*

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1930.
	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	
Public Buildings—*continued.*	£	£	£	£	£	£	£	£	£	£	£	£
Post and Telegraph	66,543	93,364	112,906	77,211	108,395	65,917	89,865	86,052	77,194	62,087	104,157	..
		Cr. 560	*Cr. 675*	*Cr. 69*		*Cr. 210*	*Cr. 453*	*Cr. 1,114*	*Cr. 834*	*Cr. 1,980*	*Cr. 197*	
Customs	..	..	..	..	..	..	..	..	..	..	..	..
Quarantine Stations	35,490	15,529	4,581	154	171	284	..	..	..	..	..	..
Mental Hospitals	18,277	27,368	41,838	13,852	26,541	68,438	77,835	68,635	51,119	96,782	152,036	..
							Cr. 283		*Cr. 3,600*			
Public Health	..	..	..	..	..	..	..	..	..	..	..	..
Health and Hospital Institutions	8,484	4,099	26,131	20,981	7,420	27,951	31,177	15,840	14,361	19,637	16,651	..
				Cr. 1,399			*Cr. 306*		*Cr. 310*			
School Buildings	195,500	244,722	2,469	..	..	..	..	..	..	..	..	..
			Cr. 9,255	*Cr. 367*	*Cr. 1,090*	*Cr. 905*	*Cr. 1,050*	*Cr. 7,953*	..	*Cr. 2,428*	..	
Agricultural	7,227	9,345	1,115	514	282	3,242	7,932	4,164	2,863	2,808	2,963	..
				Cr. 27	*Cr. 171*	*Cr. 686*	*Cr. 865*	*Cr. 310*		*Cr. 2,395*	*Cr. 1,721*	
Workers' Dwellings	26,674	..	..	..	..	..	..	..	..	..	..	..
Total, Public Buildings	469,195	500,851	334,809	255,818	188,910	243,877	280,780	315,299	216,237	205,262	354,429	10,696,215
Lighthouses, Harbour-works, and Harbour-defences :—												
Lighthouses	253	758	16,350	3,260	4,473	2,850	5,690	5,758	7,979	2,637	4,460	..
							Cr. 750				*Cr. 500*	
Harbour-works	3,245	4,080	2,424	6,524	6,334	423	3,717	13,263	15,891	14,425	10,736	..
							Cr. 131	*Cr. 204*	*Cr. 165*			
Harbour-defences	..	..	..	..	..	..	..	..	..	..	..	..
				Cr. 1,235	*Cr. 16*							
Total, Lighthouses, &c.	3,498	4,838	18,774	8,549	10,791	3,273	8,526	18,817	23,705	17,062	14,696	1,280,972
Rates on Native Lands	..	..	..	..	..	..	..	..		..	..	68,672
Contingent Defence	10,187	8,701	15,586	1,702	4,931	27,133	89,670	34,014	39,986	67,652	46,766	1,393,361
				Cr. 463	*Cr. 280*	*Cr. 580*	*Cr. 33*	*Cr. 751*	*Cr. 465*	*Cr. 648*	*Cr. 1,325*	
Tourist and Health Resorts	6,194	19,041	17,996	5,435	27,264	12,343	43,486	31,981	36,673	39,254	20,547	518,914
			Cr. 110			*Cr. 81*			*Cr. 516*	*Cr. 440*	*Cr. 1,213*	
Lands Improvement*	2,964	2,064	17,478	26,204	18,182	34,172	70,493	56,267	72,898	85,861	79,454	591,722
							Cr. 19	*Cr. 135*	*Cr. 2,574*	*Cr. 87*	*Cr. 112*	
Charges and Expenses of raising Loans	..	184	174,280	62,399	311,905	241,930	297,180	155,373	100,297	438,238	518,158	3,549,209
										Cr. 3,811		
Interest and Sinking Funds	..	..	..	..	..	..	..	..	..	..	..	218,500
Coal-exploration and Mine-development	..	..	..		..	..	..	..	..	..	..	10,835
Thermal Springs	..	..	..	..	..	..	..	..	..	..	..	14,600
Plant, Material, and Stores	47,682	169,910	106,432	*Cr. 19,708*	*Cr. 52,788*	..	34,471	*Cr. 24,148*	*Cr. 1,288*	4,595	*Cr. 31,813*	319,621
						Cr. 12,230	*Cr. 751*	*Cr. 1,992*	*Cr. 8,985*	*Cr. 1,042*	*Cr. 335*	
Quarries (acquisition and operation)	..	..	..	..	..	1,815	12,351	6,302	*Cr. 9,325*	*Cr. 6,030*	329	5,418
											Cr. 25	
Timber-supply and Sawmills for Public Works Department	..	..	16,369	14,725	3,613	*Cr. 20,537*	*Cr. 9,892*	8,512	*Cr. 6,997*	*Cr. 5,116*	*Cr. 3,608*	*Cr. 3,218*
							Cr. 104			*Cr. 182*		
Motor Transport Service	..	..	..	22,679	962	5,000	4,994	..	..	..	..	33,635
Transfer to Main Highways Account :—												
Construction Fund	..	..	..	..	..	226,000	..	400,000	200,000	200,000	200,000	1,226,000
Total Ways and Means Credits	*112,864*	*19,627*	*11,616*	*20,127*	*61,914*	*73,559*	*27,474*	*146,933*	*40,026*	*106,429*	*62,859*	..
Grand Total—Net Expenditure	2,020,714	3,121,131	5,449,351	3,892,320	4,056,423	4,632,134	4,615,585	3,988,059	3,400,664	3,977,006	4,917,173†	113,176,614

* Expenditure on Irrigation and Water-supply—1905–6, £22; 1906–7, £750; 1907–8, £1,554; 1908–9, £1,966; 1909–10, £2,435, now transferred to Irrigation and Water-supply. † Includes £12,500 expended under Finance Act, 1929, section 32.

TABLE No. 3.

Expenditure on Railways to 31st March, 1930.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1929.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1929-30: New Works.		Expenditure under Special Acts during Year 1929-30.*	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines	Total Expenditure by General Government to 31st March, 1930.	Valuation of Works constructed by Provinces and Midland Railway Company.
			Construction and Surveys.	Works on Open Lines.				
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Kaihu Valley	179,132 6 3	..	..	964 9 3	..	..	180,096 15 6	..
Opua Wharf to Whangarei and Onerahi	609,166 6 2	..	..	387 14 1	98 12 6	..	609,652 12 9	..
Otiria to Ngapuhi	127,635 14 2	..	..	..	*Cr.* 264 18 8	..	127,370 15 6	..
Whangarei Branch (Kioreroa to Waiotira)	420,533 1 0	..	..	..	..	..	420,533 1 0	..
North Auckland Main Trunk—								
Ngapuhi Northwards	645,332 7 8	..	128,083 8 6	..	..	..	773,415 16 2	..
Helensville Northwards	2,983,509 7 5	..	2 18 0	*Cr.* 520 0 0	..	..	2,982,992 5 5	..
North Auckland Main Trunk to Dargaville	203,251 5 1	..	143,999 15 0	..	..	..	347,251 0 1	..
Helensville to Te Awamutu	5,231,980 10 4	291 0 0	..	*Cr.* 36,209 3 2	466,143 7 5	300 0 0	5,661,923 14 7	..
Waiuku Branch (Paerata to Waiuku)	208,909 9 6	..	..	..	..	..	208,909 9 6	..
Huntly to Awaroa	184,034 7 10	..	..	344 17 2	..	..	184,379 5 0	..
Waikokowai Branch	3,442 0 0	..	..	..	..	..	3,442 0 0	..
Frankton to Thames	497,083 0 7	7 10 0	..	4,221 19 4	461 5 7	..	501,758 15 6	..
Cambridge Branch (Ruakura Junction to Cambridge)	61,419 0 10	..	..	..	..	..	61,419 0 10	..
Morrinsville to Rotorua	427,059 8 8	..	1,333 11 5	1,056 15 0	173 15 11	..	429,623 11 0	..
Marton to Te Awamutu	3,040,423 10 4	1 18 1	..	4,900 9 2	1,183 11 3	..	3,046,505 12 8	..
Waipa Gravel Access Branch	114 0 0	..	..	..	..	..	114 0 0	..
Raetihi Branch	89,452 2 1	..	..	..	..	..	89,452 2 1	..
Rotorua to Taupo	39,144 5 6	..	*Cr.* 628 0 4	..	..	..	38,516 5 2	..
Paeroa to Pokeno	22,405 16 5	..	45 1 9	..	..	..	22,450 18 2	..
Paeroa to Tauranga	1,240,754 16 1	..	*Cr.* 730 1 9	4,526 12 6	97 9 0	..	1,244,648 15 10	..
Tauranga to Taneatua, including Te Maunga to Maunganui Branch	1,491,429 14 8	65 0 0	163 0 4	1,643 19 3	23 4 7	..	1,493,194 18 10	..
Taneatua onwards	217 0 4	..	1,527 6 10	..	..	..	1,744 7 2	..
Gisborne to Motu	624,334 11 7	..	..	*Cr.* 189 0 0	761 15 8	..	624,907 7 3	..
Gisborne to Ormond Tramway	4,975 1 7	..	..	..	..	..	4,975 1 7	..
Napier to Gisborne—								
Gisborne Southwards	287,320 0 9	223 6 0	*Cr.* 671 7 1	..	62 8 1	..	286,487 15 9	..
Waikokopu Northwards	9,814 10 10	..	271,813 17 11	..	..	..	281,628 8 9	..
Wairoa Northwards	20,684 10 0	..	..	..	..	..	20,684 10 0	..
Napier Northwards	1,579,477 15 7	..	343,776 16 1	70 17 10	..	..	1,923,325 9 6	..
Waikokopu Branch	582,911 18 3	..	16,899 9 7	..	..	..	599,811 7 10	..
Wellington to Napier—								
Napier to Woodville and Palmerston North	1,115,449 0 1	5 0 0	..	*Cr.* 4,765 7 11	13,247 17 3	..	1,123,926 9 5	..
Wellington to Woodville, including Te Aro Extension	3,039,650 4 11	111 10 2	..	1,683 19 6	90,060 14 7	..	3,131,283 8 10	..
Featherston to Martinborough	399 0 0	..	..	..	..	..	399 0 0	..
Wellington to Waitara—								
Wellington to Longburn	1,888,236 7 6	..	..	8,960 10 2	324,850 16 4	..	2,222,047 14 0	..
Foxton to Waitara and Moturoa	2,025,190 4 11	80 0 0	..	*Cr.* 1,051 1 10	19,947 5 8	..	2,044,006 8 9	..
Mount Egmont Branch	70,686 1 6	..	..	..	..	..	70,686 1 6	..
Moturoa to Opunake	3,105 0 0	..	..	..	..	..	3,105 0 0	..
Opunake Branch (Te Roti to Opunake)	451,717 15 3	..	..	*Cr.* 8,855 0 0	..	..	442,862 15 3	..
Manaia Branch (Kapuni to Manaia)	9,648 6 0	..	..	..	..	..	9,648 6 0	..
Rangitikei River Quarry Line	206 0 0	..	..	..	..	..	206 0 0	..

* Railways Improvement Authorization Act 1914 Account.

TABLE No. 3—*continued.*

Expenditure on Railways to 31st March, 1930—*continued.*

Lines of Railway.	Total Expenditure by General Government to 31st March, 1929.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1929-30: New Works.		Expenditure under Special Acts during Year 1929-30.*	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1930.	Valuation of Works constructed by Provinces and Midland Railway Company.
			Construction and Surveys.	Works on Open Lines.				
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Stratford to Okahukura (East End)	863,502 9 3	..	223,308 14 5	..	..	..	1,086,811 3 8	..
Stratford to Okahukura (West End)	1,207,304 17 0	4 16 5	149,167 9 0	..	..	..	1,356,467 9 7	..
Nelson to Greymouth—								
Nelson to Inangahua	566,175 19 2	..	72,214 13 1	*Cr.* 92 0 0	984 6 11	..	639,282 19 2	78,307 0 0
Stillwater to Inangahua	223,435 4 11	..	..	..	..	..	223,435 4 11	279,685 0 0
Ngahere to Blackball	147,694 15 0	..	..	..	..	..	147,694 15 0	..
Westport to Ngakawau	196,784 19 2	..	..	11,204 3 5	421 0 5	..	208,410 3 0	..
Westport to Inangahua	305,604 18 5	..	88,112 14 10	..	148 14 4	..	393,866 7 7	..
Greymouth to Rewanui	256,370 6 4	..	..	245 18 7	3,617 3 10	..	260,233 8 9	..
Point Elizabeth Branch	74,139 3 1	..	..	..	..	..	74,139 3 1	..
Greymouth to Ross and Mikonui	422,733 9 10	15 7 2	..	..	34 2 1	..	422,752 4 9	..
Picton to Waipara—								
Picton Southwards	657,803 1 5	35 0 0	71,077 4 1	..	677 17 10	..	729,523 3 4	..
Waipara Northwards	381,631 5 11	..	3,779 7 1	1 0 5	..	..	385,411 13 5	..
Christchurch to Greymouth—								
Rolleston to Bealey	1,011,900 14 9	..	..	*Cr.* 270 0 0	*Cr.* 14 0 10	..	1,011,616 13 11	61,579 0 0
Whitecliffs Branch	25,021 0 0	..	..	..	..	..	25,021 0 0	..
Greymouth to Bealey	2,054,726 7 1	7 8 0	..	*Cr.* 95,989 14 6	5,870 12 11	..	1,964,599 17 6	263,889 0 0
Hurunui to Waitaki—								
Main Line (Waiau to Waitaki)	2,579,499 18 10	..	..	4,812 10 4	124,460 19 2	..	2,708,773 8 4	316,135 0 0
Oxford Branch (Rangiora to Oxford West)	53,072 8 2	..	..	..	..	..	53,072 8 2	..
Eyreton Branch (Kaiapoi to Bennett's)	44,277 0 0	..	..	..	..	..	44,277 0 0	..
Lyttelton Branch	197,963 6 8	..	..	..	31,530 2 6	..	229,493 9 2	340,500 0 0
Southbridge Branch (Hornby to Southbridge)	91,759 13 7	..	..	234 1 1	342 19 11	..	92,336 14 7	..
Little River Branch (Lincoln to Little River)	110,852 18 10	..	..	..	..	..	110,852 18 10	..
Rakaia to Methven	77,233 19 4	..	..	..	..	..	77,233 19 4	..
Ashburton to Springburn	64,025 11 3	..	..	..	..	..	64,025 11 3	..
Orari to Geraldine	321 0 0	..	..	..	..	..	321 0 0	..
Fairlie Branch (Washdyke Junction to Fairlie)	70,310 15 4	..	..	..	33 6 0	..	70,344 1 4	75,124 0 0
Waimate Branch	80,669 4 4	..	..	..	193 0 2	..	80,862 4 6	..
Canterbury Interior Main Line—								
Oxford to Malvern	54,248 0 0	..	..	..	..	..	54,248 0 0	..
Whitecliffs to Rakaia	542 0 0	..	..	..	..	..	542 0 0	..
Temuka to Rangitata	5,152 0 0	..	..	..	..	..	5,152 0 0	..
Waitaki to Bluff—								
Main Line, including Port Chalmers Branch	3,911,324 15 8	35 0 0	..	4,109 4 1	118,211 5 5	..	4,033,610 5 2	82,259 0 0
Duntroon Branch (Pukeuri to Kurow)	97,683 6 11	..	..	1,310 17 11	45 14 10	..	99,039 19 8	37,500 0 0
Ngapara Branch (Waiareka Junction to Ngapara)	26,518 2 0	..	..	*Cr.* 1,280 0 0	..	..	25,238 2 0	58,009 0 0

* Railways Improvement Authorization Act 1914 Account.

TABLE No. 3—*continued.*

Expenditure on Railways to 31st March, 1930—*continued.*

Lines of Railway.	Total Expenditure by General Government to 31st March, 1929.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1929-30: New Works.		Expenditure under Special Acts during Year 1929-30 *	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines	Total Expenditure by General Government to 31st March, 1930	Valuation of Works constructed by Provinces and Midland Railway Company.
			Construction and Surveys.	Works on Open Lines.				
Waitaki to Bluff—*continued.*	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Livingstone Branch (Windsor to Tokarahi)	83,623 4 11	..	..	..	..	..	83,623 4 11	..
Waihemo Branch (Palmerston to Dunback)	33,531 8 11	..	..	..	..	..	33,531 8 11	..
Fernhill Railway	1,415 0 0	..	..	..	..	..	1,415 0 0	..
Brighton Road Branch	6,474 0 0	..	..	..	..	..	6,474 0 0	12,829 0 0
Outram Branch (Mosgiel to Outram)	12,051 0 7	..	..	..	..	..	12,051 0 7	29,691 0 0
Lawrence Branch	716,995 13 4	1 10 0	191 4 1	239 11 6	204 19 6	..	717,629 18 5	..
Balclutha to Tuapeke Mouth	2,489 0 0	..	..	..	..	..	2,489 0 0	..
Catlin's River Branch (Balclutha to Tahakopa)	463,291 2 1	..	..	475 18 0	142 6 2	..	463,909 6 3	..
Heriotburn Branch (Waipahi to Edievale)	124,808 4 5	..	..	..	..	..	124,808 4 5	..
Waikaka Branch (McNab to Waikaka)	68,423 0 0	..	..	..	..	..	68,423 0 0	..
Gore to Lumsden	112,344 3 2	..	..	..	..	..	112,344 3 2	..
Edendale to Glenham	53,613 3 7	..	..	..	..	..	53,613 3 7	..
Riversdale to Switzers	82,285 4 0	..	..	..	..	..	82,285 4 0	..
Seaward Bush to Catlin's (Appleby to Tokanui)	185,328 11 0	8 8 0	..	*Cr.* 118 0 0	..	..	185,202 3 0	..
Otago Central (Wingatui to Cromwell)	1,440,450 1 8	..	..	2,887 17 1	..	..	1,443,337 18 9	..
Invercargill to Kingston—								
Main Line	367,642 18 5	251 0 0	..	362 9 5	788 9 7	..	368,542 17 5	91,937 0 0
Mararoa Branch (Lumsden to Mossburn)	27,508 4 4	..	..	..	..	..	27,508 4 4	..
Winton to Heddon Bush	140 0 0	..	..	..	..	..	140 0 0	..
Makarewa to Orepuki and Waiau	360,070 11 4	112 2 10	..	*Cr.* 196 0 0	..	..	359,762 8 6	37,097 0 0
Thornbury to Wairio	93,771 19 8	40 0 0	..	2,375 15 10	..	..	96,107 15 6	23,200 0 0
Forest Hill (Winton to Hedgehope)	23,337 0 0	..	..	..	..	..	23,337 0 0	..
Expenses of Railway Commissions and other Expenditure not chargeable to Individual Lines	10,337 0 0	..	..	..	..	..	10,337 0 0	..
Surveys of New Lines—								
North Island	29,862 3 0	..	421 16 10	..	..	*Cr.* 300 0 0	29,983 19 10	..
Middle Island	5,763 0 0	..	..	..	..	..	5,763 0 0	..
Rolling-stock	10,405,464 1 3	..	..	442,496 13 1	..	..	10,847,960 14 4	..
Motor-omnibus Service, Wellington	618 3 9	..	..	44,494 6 3	..	..	45,112 10 0	..
General	16,511 19 3	..	..	*Cr.* 1,405 10 11	1,408 16 6	..	16,515 4 10	..
Miscellaneous works, R.I.A.	5,422 1 1	..	..	..	*Cr.* 4,748 18 8	..	673 2 5	..
Suspense Account, being porportion of cost of raising loans for Railways Authorization Improvement Act 1914 Account	..	..	..	..	25,819 2 2	..	25,819 2 2	..
Stock of Permanent-way Materials	5,912 19 8	..	117,190 15 10	..	..	..	123,103 15 6	..
Total	60,020,003 11 4	1,295 16 8	1,631,079 15 6	393,071 11 11	1,227,019 5 11	..	63,269,878 8 0	1,787,741 0 0†

* Railways Improvement Authorization Act 1914 Account. † Includes value for £150,000 paid to debenture-holders under the Midland Railway Petitions Settlement Act Amendment Act, 1903.

TABLE No. 4.

EXPENDITURE OUT OF SEPARATE ACCOUNTS ON WORKS UNDER THE CONTROL OF THE PUBLIC WORKS DEPARTMENT.

Year.	Loans to Local Bodies Account. Roads to open up Crown Lands.	Opening up Crown Lands for Settlement Account. Roads to open up Crown Lands.	Land for Settlements Account. Opening up Crown Lands for Settlement Account. Roads to open up Crown Lands.	National Endowment Account. Roads to open up National-endowment Lands.	Land for Settlements Account. Roads to open up Land for Settlements.	Waihou and Ohinemuri Rivers Improvement Account. Waihou and Ohinemuri Rivers Improvement.
	£	£	£	£	£	£
1890–91	25,000					
1891–92	64,000					
1892–93	800					
	89,800*					
1891–92	8,000†					
1892–93	29,833†					
1893–94	30,000†					
1894–95	6,114†					
1894–95	42,971‡					
1895–96	30,057‡					
1896–97	31,017					
1897–98	18,770					
1898–99	16,972					
1899–1900	31,363					
1900–1	37,390					
1901–2	31,979					
1902–3	18,578					
1903–4	25,753					
1904–5	28,895					
1905–6	38,801					
1906–7	47,371					
1907–8	38,524					
1908–9	54,713					
1909–10	40,507	..	..	4,975	..	..
	607,608§					
1910–11	..	45,691	..	5,619	..	..
1911–12	..	49,739	..	6,554	..	3,769
1912–13	..	47,951	..	2,689	..	9,555
1913–14	..	63,245	..	4,282	..	9,633
1914–15	..	..	92,975	9,151	..	10,004
1915–16	..	..	47,974	13,344	..	9,225
1916–17	..	..	24,730	6,787	..	10,407
1917–18	..	..	..	..	43,996	12,025
1918–19	..	..	..	..	51,355	27,402
1919–20	..	..	..	..	61,692	34,806
1920–21	..	..	..	..	28,920	62,249
1921–22	..	..	..	..	51,471	54,379
1922–23	..	..	..	..	78,350	66,708
1923–24	..	..	..	..	49,186	70,533
1924–25	..	..	..	..	23,144	53,887
1925–26	..	..	..	..	17,181	47,908
1926–27	..	..	..	..	12,714	65,855
1927–28	..	..	..	..	6,337	59,644
1928–29	..	..	..	..	..	52,310
1929–30	..	..	..	..	..	27,361
	697,408	206,626	165,679	53,401	424,346	687,660

* Payment to the Public Works Fund under section 31 of the Government Loans to Local Bodies Act, 1886, in reduction of expenditure under Class "Roads."
† Paid into the Public Works Fund, reducing the expenditure under Class "Roads."
‡ Paid into the Lands Improvement Account (now included in Public Works Fund under Class "Roads"), reducing the expenditure on roads.
§ Expenditure under the Government Loans to Local Bodies Act Amendment Act, 1891.

TABLE No. 5.

EXPENDITURE ON PUBLIC BUILDINGS OUT OF PUBLIC WORKS FUND TO THE 31ST MARCH, 1930, AND THE LIABILITIES ON THAT DATE.

—	Total Expenditure to 31st March, 1929.	Expenditure for Year ended 31st March, 1930.	Total Expenditure to 31st March, 1930.	Liabilities on Authorities, Contracts, &c., 31st March, 1930.	Total Expenditure and Liabilities.
	£	£	£	£	£
Judicial*	1,420,779	42,388	1,463,167	3,754	1,466,921
Postal and telegraph	2,136,713	103,960	2,240,673	8,819	2,249,492
Customs	49,441	..	49,441	..	49,441
Offices for public Departments	808,199	10,950†	819,149	645	819,794
Mental hospitals	1,360,050	152,096	1,512,146	12,239	1,524,385
Alexandra Depot, Wellington‡	8,084	..	8,084	..	8,084
School buildings	3,086,965	..	3,086,965	..	3,086,965
Health and Hospital Institutions§	362,117	16,651	378,768	1,967	380,735
Quarantine stations	62,464	..	62,464	..	62,464
Parliament Buildings (old buildings) ..	76,553	..	76,553	..	76,553
Parliament Buildings (new buildings) ..	393,625	..	393,625	..	393,625
Parliament Buildings (alterations to streets surrounding grounds, and purchase of land)	14,187	27,142	41,329	..	41,329
Government House, Wellington (land and new building)	72,645	..	72,645	..	72,645
Agricultural	99,235	1,242	100,477	362	100,839
Workers' dwellings	319,916	..	319,916	..	319,916
Miscellaneous	70,813	..	70,813	..	70,813
Totals	10,341,786	354,429†	10,696,215	27,786	10,724,001

* Includes Courthouses, prisons, and police-stations. † Includes £12,500 expended under Finance Act, 1929, section 32.
‡ Expenditure *re* Defence requirements only. Other expenditure included in "Judicial" class. § Includes £32,754 previously shown under "Public Health."

TABLE No. 6.

ELECTRIC SUPPLY ACCOUNT.

STATEMENT OF ACCOUNTS AT THE 31st MARCH, 1930.

GENERAL BALANCE-SHEET AT 31st MARCH, 1930, COMPARED WITH POSITION AT 31st MARCH, 1929.

1928-29.	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
	Aid to Water-power Works and Electric Supply Accounts—			1,685,557 18 1	Lake Coleridge scheme—		
	Debentures issued—			65,396 1 11	Assets as per separate balance-sheet ..	1,692,794 3 8	
27,500 0 0	At 4½ per cent. interest	27,500 0 0			Investments, Sinking Fund	120,774 1 5	
120,570 0 0	At 5 per cent. interest	120,570 0 0		1,750,954 0 0			1,813,568 5 1
162,400 0 0	At 5¼ per cent. interest	162,400 0 0					
97,900 0 0	At 5½ per cent. interest	96,900 0 0					
	N.Z. inscribed stock—				Horahora–Arapuni scheme—		
806,560 0 0	At 5 per cent. interest (due 1930) ..	806,560 0 0		3,465,698 3 9	Assets as per separate balance-sheet ..	3,758,405 19 9	
577,080 0 0	At 5¼ per cent.	577,080 0 0		52,163 18 3	Investments, Sinking Fund	54,445 6 5	
300,100 0 0	At 5½ per cent. (due 1936)	301,100 0 0			Profit and Loss Account—Loss to date ..	2,617 15 9	
	N.Z. Consolidated Stock—						3,815,469 1 11
2,392,357 10 2	At 4½ per cent. (due 1936–58) ..	2,623,913 18 0		3,517,862 2 0			
2,577,652 19 6	At 5 per cent. (due 1935–46).. ..	2,577,652 19 6					
1,884,642 6 3	At 6 per cent. interest (due 1936–51) ..	1,884,642 6 3			Mangahao–Waikaremoana scheme—		
			9,178,319 3 9	3,506,822 0 0	Assets as per separate balance-sheet ..	3,553,715 16 6	
8,946,762 15 11				377,507 13 5	Profit and Loss Account—Loss to date ..	430,774 11 3	
				3,884,329 13 5			3,984,490 7 9
					Waitaki River scheme—		
	Waihi Gold-mining Company (Limited)—			22,920 4 8	Headworks	78,451 9 7	
	Purchase of Horahora works—Deed of			573 13 10	Power-house, machinery, &c.	100,549 9 1	
	security at 5 per cent. interest (due			15,712 15 10	Accommodation of workmen	48,015 15 8	
212,500 0 0	1/11/1931)	..	212,500 0 0		Transmission line, service line, roads, land,		
				67,090 4 0	&c.	148,861 11 5	
				12,403 1 0	Interest and loan charges	65,003 7 6	
				8,191 1 6	Stocks	40,542 5 3	
	Consolidated Fund—			748 11 9	Sundry debtors	268 15 11	
	Interest accrued on loans to 31st March,						481,692 14 5
94,297 15 4	1930	94,230 2 5		127,639 12 7			
1,496 8 6	Sundry creditors for interest unclaimed ..	179 8 9					
			94,409 11 2		Other schemes, surveys, &c.—		
95,794 3 10				4,288 18 8	North Island	4,256 14 0	
				9,196 0 11	South Island	10,835 2 2	
				13,484 19 7		15,091 16 2	
	Amount set aside as reserve to cover difference between interest payable on loans raised and interest earned from their			295 10 5	£ s. d.		
					Material on hand .. 160 0 0		
28,458 19 5	temporary investment pending use ..	..	31,704 12 10	13,780 10 0	Sundry debtors .. 7 10 0	167 10 0	15,259 6 2
9,283,515 19 2	Carried forward	..	9,516,933 7 9	9,294,565 18 0	Carried forward	..	10,110,479 15 4

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

STATEMENT OF ACCOUNTS AT THE 31st MARCH, 1930—*continued.*

GENERAL BALANCE-SHEET AT 31st MARCH, 1930, AS COMPARED WITH POSITION AT 31st MARCH, 1929—*continued.*

1928-29.	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
9,283,515 19 2	Brought forward	..	9,516,933 7 9	9,294,565 18 0	Brought forward	..	10,110,479 15 4
	Sundry Creditors—						
44,185 11 11	Horahora-Arapuni scheme	23,098 14 4					
11,385 19 4	Lake Coleridge scheme	8,264 4 7			Balance in Electric Supply Account at the end of year—		
52,122 0 6	Mangahao-Waikaremoana scheme ..	14,322 7 1					
7,186 11 7	Waitaki scheme	72,624 13 3		492,186 12 0	Cash in Public Account	121,092 4 7	
102 2 2	South Island surveys	55 15 11			In hands of Government officers in New		
			118,365 15 2	52 12 10	Zealand	783 14 7	
114,982 5 6					In hands of Government officers in		
				4,848 8 9	London	43,505 9 3	
	Depreciation Reserve—						165,381 8 5
103,186 12 8	Horahora-Arapuni scheme	165,757 15 4		497,087 13 7			
192,410 19 9	Lake Coleridge scheme	188,293 18 9					
159,896 2 1	Mangahao-Waikaremoana scheme ..	223,257 6 8					
			577,309 0 9				
455,493 14 6					Investment Account (funds invested until		
				200,000 0 0	actually required for use)	..	176,500 0 0
	Sinking Fund Reserves—						
52,163 18 3	Horahora scheme	54,445 6 5					
115,769 17 9	Lake Coleridge scheme	144,557 1 5					
			199,002 7 10		Proportion of 1929 loan in transit, 31st		
167,933 16 0				60,057 17 11	March, 1929		
	Reserve Fund—						
32,415 2 11	Horahora scheme	..	..		Interest accrued on investments to 31st		
..	Lake Coleridge scheme	..	44,387 16 2	2,630 2 9	March, 1930..	4,042 16 6	
				..	Sundry debtors for interest due but unpaid	2,966 7 5	
	Writings-off in Suspense—						7,009 3 11
0 14 2	Lake Coleridge scheme	..	3,372 0 0	2,630 2 9			
£10,054,341 12 3	Total	..	£10,459,370 7 8	£10,054,341 12 3	Total	..	£10,459,370 7 8

* Sundry creditors—Departmental, £13,438 15s. 5d.; other Government departments, £1,621 15s. 3d.; non-departmental, £103,305 4s. 6d.

I hereby certify that the General Balance-sheet has been duly examined and compared with the relative books and documents submitted for audit, and correctly states the position as disclosed thereby.—G. F. C. CAMPBELL, Controller and Auditor-General.

J. J. GIBSON,
Accountant, Public Works Department.

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929.

Gross Revenue Account.

1928–29.		1929–30.		1928–29.		1929–30.	
£ s. d.	To Generating expenses, headworks, and power-house—	£ s. d.	£ s. d.	£ s. d.	By Sale of energy—	£ s. d.	£ s. d.
3,217 4 8	Salaries	2,819 1 4		184,376 5 2	Wholesale	197,593 7 5	
1,236 9 9	Wages	1,483 7 10		145 8 5	Retail	110 2 2	
64 13 2	Supplies	94 3 11		184,521 13 7		197,703 9 7	
297 5 10	Transport of stores, &c.	290 15 5					
	Maintenance and repairs—				*Less* amount written off Woolston Borough	3,372 0 0	
1,200 18 0	Harper diversion	837 3 10					194,331 9 7
2,048 1 11	Headworks	741 14 10					
211 6 10	Power-house building	334 3 6		25 0 0	Discounts forfeited, &c.	..	6 6 6
1,683 0 0	Power-house machinery	2,130 17 1					
436 6 7	Roads and fences	310 6 1					
975 10 6	Staff residences, &c.	790 3 8			Rents—		
			9,831 17 6	1,242 13 2	Land and buildings	1,253 0 3	
11,370 17 3				312 15 2	Electric lines	327 13 2	
				232 2 5	Electric plant	353 3 8	
	Transmission-lines—						1,933 17 1
540 0 0	Salaries	533 11 5		1,787 10 9			
565 0 4	Transport, including upkeep of horses and motor-vehicles	694 19 0					
2,250 4 11	Repairs to power-lines	5,316 12 7					
20 3 6	Live-line testing	426 15 8			Fees for testing and repairing electrical appliances	..	295 0 4
			6,971 18 8	285 3 8			
3,375 8 9							
	Substation, Addington—						
1,406 6 6	Salaries	1,407 16 11					
599 15 0	Wages	611 4 1					
58 4 8	Supplies	97 1 3					
	Maintenance and repairs—						
300 3 9	Buildings and yards	457 9 7					
889 19 1	Machinery	609 14 6					
			3,183 6 4	344 0 0	Earnings, motor-vehicles	..	81 10 2
3,254 9 0							
	Distribution—						
440 0 0	Salaries	395 0 0					
..	Transport, including upkeep of motor-vehicles (not allocated)	12 18 8					
	Maintenance of feeder cables, transformer						
1,059 12 11	stations, and tools	3,071 15 7					
4,124 1 9	Maintenance of secondary distribution	4,187 3 7					
197 18 1	Maintenance of and testing meters	324 18 2					
242 7 4	Earth-testing	167 17 3					
			8,159 13 3				
6,064 0 1							
24,034 15 1	Carried forward	..	28,146, 15 9	186,963 8 0	Carried forward	..	196,648 3 8

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Gross Revenue Account—continued.

1928–29.	——	1929–30.		1928–29.	——	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
24,064 15 1	Brought forward	..	28,146 15 9	186,963 8 0	Brought forward	..	196,648 3 8
	Management and general expenses—						
2,950 17 11	Salaries	3,720 1 7					
422 9 4	Sick and holiday pay to workmen ..	539 15 5					
63 15 1	Travelling-expenses	140 19 2					
336 0 0	Office-rent	336 0 0					
65 10 0	Rent of other buildings	60 1 5					
92 10 11	Postages and telegrams	100 9 2					
175 12 3	Telephone subscriptions	189 2 6					
86 15 8	Printing and stationery	56 1 2					
13 8 9	Advertising	34 15 0					
77 15 11	Accident pay	1,832 2 6					
121 6 11	Fire insurance	..					
52 0 0	Fire insurance Reserve Account	..					
124 6 0	Audit fees	263 16 5					
287 3 0	Meter-reading and line-inspection ..	250 4 10					
216 13 3	Electrical testing	217 6 8					
9 3 2	Miscellaneous trade expenses	9 11 8					
0 14 2	Bad Debts Suspense Account	..					
970 0 0	Proportion of salaries, rents, and expenses, Head Office, High Commissioner's Staff, and Wiremen's Registration Board ..	910 16 10	8,661 4 4				
6,066 2 4							
30,130 17 5			36,808 0 1				
156,832 10 7	Balance to Net Revenue Account	..	159,840 3 7				
£186,963 8 0			£196,648 3 8	£186,963 8 0			£196,648 3 8

Net Revenue Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
29,846 15 7	To Depreciation on completed work	15,315 4 10	156,832 10 7	By Balance from Gross Revenue Account	159,840 3 7
76,611 19 2	Interest for year ended 31st March	76,354 2 7			
50,373 15 10	Balance to Profit and Loss Appropriation Account ..	68,170 16 2			
£156,832 10 7		£159,840 3 7	£156,832 10 7		£159,840 3 7

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

Profit and Loss Appropriation Account.

1928–29.	——	1929–30.	1928–29.	——	1929–30.
£ s. d.		£ s. d.	£ s. d.		£ s. d.
..	To Balance from previous year's statement	..	50,373 15 10	By Balance from Net Revenue Account	68,170 16 2
50,373 15 10	Sinking Fund Reserve Account	23,783 0 0			
..	General Reserve Account	44,387 16 2			
£50,373 15 10		68,170 16 2	£50,373 15 10		£68,170 16 2

Depreciation Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
	To Amounts written off—		173,231 5 10	By Balance from previous year's statement	192,410 19 9
17,648 6 8	Motor-vehicles, tools, plant, &c.	27,128 14 7	6,929 5 0	Interest at 4 per cent. per annum	7,694 7 2
192,358 19 9	Balance	188,293 18 9	29,846 15 7	Amount set aside as per Net Revenue Account	15,317 6 5
£210,007 6 5		£215,422 13 4	£210,007 6 5		£215,422 13 4

Sinking Fund Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
115,769 17 9	To Balance	144,557 1 5	62,465 1 10	By Balance at close of previous year	115,769 17 9
			50,373 15 10	Amount set aside as per Profit and Loss Appropriation Account	23,783 0 0
			2,931 0 1	Interest	5,004 3 8
£115,769 17 9		£144,557 1 5	£115,769 17 9		£144,557 1 5

General Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
..	To Balance	44,387 16 2	..	By Amount set aside as per Profit and Loss Appropriation Account	44,387 16 2
..		£44,387 16 2	..		£44,387 16 2

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930.

1928–29.	*Liabilities.*	1929–30.		1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
192,410 19 9	Depreciation Reserve	..	188,293 18 9	5,300 14 2	Works at Lake Coleridge—		
				10,977 19 5	Land, including fencing and planting ..	5,417 12 7	
..	Reserve Fund	..	44,387 16 2	7,731 3 8	Coalgate Gorge Road	10,977 19 5	
				310 8 5	Service roads	7,731 3 8	
115,769 17 9	Sinking Fund Reserve	..	144,557 1 5		Service telephones	310 8 5	
				24,320 5 8			24,437 4 1
	Sundry creditors—				Headworks—		
5,675 3 11	Public Works Department	3,193 14 8			First tunnel, including inlet and outlet		
412 18 2	Other Government Departments	1,225 13 2		80,760 11 0	works	80,767 3 2	
5,297 17 3	Non-departmental	3,844 16 9			Second tunnel, including inlet and outlet		
			8,264 4 7	235,701 16 0	works	235,745 4 3	
11,385 19 4				136,180 15 8	Pipe-lines	143,375 12 8	
				4,129 11 3	Tram-lines	4,144 1 9	
				2,192 2 2	Weir at lake outlet, gauges, and fencing ..	2,192 2 2	
0 14 2	Writings-off in suspense	..	3,372 0 0	23,132 11 7	Harper River diversion works	23,157 13 8	
				482,097 7 8			489,381 17 8
	Balance carried to general balance-sheet—						
1,750,954 0 0	Total assets as *per contra*	1,813,568 5 1			Power-house—		
319,567 11 0	*Less* total liabilities as above	388,875 0 11		56,469 14 1	Buildings, &c.	58,705 15 10	
			1,424,693 4 2	151,502 9 8	Machinery, &c.	162,664 0 7	
1,431,386 9 0				238 2 1	Office furniture, fittings, &c.	238 2 1	
				208,210 5 10			221,607 18 6
					Accommodation for staff and workmen—		
				24,610 16 7	Buildings, fencing, &c.	..	24,692 3 5
					Transmission-lines—		
				3,931 11 8	Land	3,931 11 8	
				180,529 4 9	Power-lines to Christchurch	191,603 10 0	
				17,588 9 8	Power-lines to North Canterbury ..	17,989 9 0	
				113,851 17 0	Power-lines to South Canterbury ..	113,851 17 0	
				42,805 1 11	Power-lines, Timaru–Oamaru	44,704 7 1	
				2,480 7 8	Telephone-system	2,696 10 7	
					Linemen's cottages, depots, tools, and		
				3,244 17 3	equipment	3,244 17 3	
				6,588 12 4	Alterations to public telegraph-lines ..	6,588 12 4	
				10,167 16 7	Point Switching Station	10,273 4 0	
				381,187 18 10			394,883 18 11
1,750,954 0 0	Carried forward	..	1,813,568 5 1	1,120,426 14 7	Carried forward	..	1,155,003 2 7

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930—*continued.*

1928-29.	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
1,750,954 0 0	Brought forward	..	1,813,568 5 1	1,120,426 14 7	Brought forward	..	1,155,003 2 7
					Addington Substation—		
				1,643 0 5	Land	1,643 0 5	
				2,000 0 0	Cottages	2,033 6 9	
				9,318 18 9	Substation buildings	9,505 18 5	
				65,654 0 7	Machinery, &c.	64,773 10 5	
				6,003 0 9	Store buildings and workshops	6,003 0 9	
				84,619 0 6			83,958 16 9
					Primary distribution—		
				8,366 1 11	Supply cables—Christchurch City ..	8,431 17 11	
				5,204 0 4	Christchurch Tramways ..	5,255 14 10	
				8,154 6 1	Lyttelton	8,239 4 1	
				14,158 17 6	Northern	11,974 2 8	
				7,590 15 10	Southern	7,592 4 5	
				4,064 7 7	Motukarara	4,064 7 7	
				11,974 14 6	Substations—Hororata	12,948 8 3	
				13,791 17 7	Ashburton	13,832 19 4	
				26,400 0 6	Timaru	26,442 6 5	
				9,327 1 0	Oamaru	9,334 14 9	
				622 9 9	Lightning-arresters	622 9 9	
				300 4 5	Tools and equipment	300 4 5	
				1,516 12 8	Alterations to public telegraph-lines ..	1,516 12 8	
				111,471 9 8			110,555 7 1
					Secondary distribution—		
				17,848 17 5	Supply cables and reticulation	13,903 11 5	
				27,448 3 11	Local substations	27,098 19 8	
				45,297 1 4			41,002 11 1
				6,869 1 10	Service transformers and meters	..	7,083 17 3
				9,541 14 6	Motor-cars, lorries, cycles, &c.	..	8,800 14 7
				129 7 1	Test-room equipment	..	974 13 0
				18,177 12 10	Loose tools, plant, and equipment	..	18,714 19 0
				1,729 3 9	Public telephones to the lake	..	1,729 3 9
1,750,954 0 0	Carried forward	..	1,813,568 5 1	1,398,261 6 1	Carried forward	..	1,427,823 5 1

TABLE No. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930—*continued.*

1928–29.	*Liabilities.*	1929–30.		1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
1,750,954 0 0	Brought forward	..	1,813,568 5 1	1,398,261 6 1	Brought forward	..	1,427,823 5 1
					Telephones to Christchurch City Council and		
				173 19 1	Tramway Board and local offices ..	..	161 11 5
				261 6 0	Christchurch office—Furniture and fittings ..	..	316 9 11
					Engineering, office, and general expenses on		
				56,039 10 11	preliminary surveys and during construction	..	57,517 10 4
					Salaries of Engineers and others on preliminary		
				39,706 11 0	surveys and during construction	..	42,274 0 5
				24,058 0 0	Cost of raising loans	..	28,866 0 0
				62,761 1 11	Interest during construction	..	65,240 6 9
				1,581,261 15 0			1,622,199 3 11
				25,985 4 2	Stocks of material, &c., on hand	..	22,865 1 7
					Telephone subscriptions, fire insurance, &c.,		
				43 9 0	paid in advance	..	58 0 8
					Sundry debtors for current, rent, work carried		
					out, &c.—		
				2,814 7 2	Public Works Department	1,408 19 10	
				32,043 15 8	Other Government Departments	1,595 8 5	
				43,409 7 1	Non-departmental	44,667 9 3	
				78,267 9 11			47,671 17 6
					Sinking Fund—		
				64,447 1 7	Investment and cash in hands of Treasury	119,057 5 7	
				949 0 4	Interest accrued	1,716 15 10	
				65,396 1 11			120,774 1 5
£1,750,954 0 0			£1,813,568 5 1	£1,750,954 0 0			£1,813,568 5 1

I hereby certify that the Balance-sheet and accompanying accounts have been duly examined and compared with the relative books and documents submitted for audit, and correctly state the position as disclosed thereby.—G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE No. 6—*continued.*

MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.

ELECTRIC SUPPLY ACCOUNT—*continued.*

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929.

Gross Revenue Account.

1928–29.		1929–30.		1928–29.		1929–30.	
£ s. d.	To Generating-expenses, headworks, and power-house—	£ s. d.	£ s. d.	£ s. d.	By Sales of energy—	£ s. d.	£ s. d.
	Mangahao.			190,054 4 4	Wholesale consumers	255,618 5 7	
				850 17 9	Retail consumers..	724 8 2	
4,207 14 7	Salaries, wages, and allowances ..	4,396 15 3					
	Maintenance headworks, dams, pipe-			190,905 2 1		256,342 13 9	
1,495 7 6	lines, and tail-race	1,540 15 2		72,563 6 6	Less stand-by, &c.	233 9 6	
	Maintenance power-house building and						256,109 4 3
1,712 3 2	machinery	725 11 0		118,341 15 7			
	Maintenance staff-village and roads,						
771 15 10	transport and general	1,144 17 10			Rents—		
			7,807 19 3	2,356 0 11	Cottages, &c.	2,918 2 4	
8,187 1 1				322 12 6	Poles, land, and plant	327 2 10	
	Waikaremoana.						3,245 5 2
	Temporary development — Salaries,			2,678 13 5			
972 12 8	wages, and supplies	251 14 3					
..	Salaries, wages, and allowances ..	4,663 17 0		..	Tests and inspections	..	26 11 10
	Maintenance headworks and pipe-			68 14 4	Penalties	..	34 0 0
88 15 6	lines	256 11 0		..	Refunds from local bodies	..	45 11 6
	Maintenance power-house building and						
111 13 5	machinery	2,098 4 8					
328 6 0	Maintenance staff-village and roads ..	854 7 2					
			8,124 14 1				
1,501 7 7							
	Transmission-lines, patrol maintenance, &c.—						
2,755 4 7	Mangaore–Khandallah	2,821 15 1					
2,811 2 5	Mangaore–Wanganui	2,632 2 5					
1,553 6 6	Bunnythorpe–Dannevirke	1,428 5 7					
1,566 1 5	Woodville–Masterton	2,194 8 8					
2,186 10 1	Dannevirke–Napier	3,524 19 0					
83 6 5	Waikaremoana–Wairoa	737 12 0					
..	Waikaremoana–Gisborne	3,783 2 7					
..	Waikaremoana–Napier	2,890 2 5					
161 6 0	Miscellaneous 11,000-volt lines ..	187 18 5					
			20,200 6 2				
11,116 17 5							
	Substations — Operating, maintenance, &c.—						
2,025 16 6	Khandallah	2,815 19 10					
11 14 8	Otaki	14 8 1					
460 0 3	Bunnythorpe	987 6 6					
2,497 11 5	Carried forward	3,817 14 5	36,132 19 6	121,089 3 4	Carried forward	..	259,460 12 9

TABLE No. 6—*continued.*

MANGAHAO-WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Gross Revenue Account—continued.

1928-29.		1929-30.		1928-29.		1929-30.	
£ s. d.	——	£ s. d.	£ s. d.	£ s. d.	——	£ s. d.	£ s. d.
2,497 11 5	Brought forward	3,817 14 5	36,132 19 6	121,089 3 4	Brought forward	..	259,460 12 9
	Substations — Operating, maintenance, &c.—*continued.*						
555 16 10	Dannevirke	675 8 6					
211 2 0	Waipukurau	363 10 8					
500 19 10	Woodville	306 14 10					
610 0 3	Mangamaire	600 13 0					
176 11 2	Masterton	316 19 7					
304 13 1	Wanganui	367 6 4					
609 18 8	Napier	535 4 1					
..	Marton	96 11 4					
..	Gisborne	533 17 7					
..	Wairoa	150 3 11					
			7,764 4 3				
5,466 13 3							
	Management and general—						
2,711 1 4	Salaries and allowances	5,706 6 10					
1,734 14 9	Distribution salaries, expenses, and transport	1,943 6 6					
454 0 7	Postages, telephones, &c.	718 6 5					
188 4 9	Printing, stationery, and advertising ..	473 1 8					
745 11 3	Motor-cars and general travelling-expenses	2,219 15 5					
223 4 8	Accident, sick, and holiday pay ..	267 7 11					
10 6 8	Fire insurance	..					
153 2 3	Legal expenses and audit fees ..	55 17 9					
1,021 17 10	Stores administration	530 4 5					
2,695 11 3	Miscellaneous expenses	3,422 6 2					
			15,336 13 1				
9,937 15 4							
84,879 8 8	Balance to Net Revenue Account ..	..	200,226 15 11				
£121,089 3 4			£259,460 12 9	£121,089 3 4			£259,460 12 9

Net Revenue Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
45,457 7 5	To Depreciation on completed works	62,205 3 10	84,879 8 8	By Balance from Gross Revenue Account	200,226 15 11
142,435 15 9	Interest for year ended 31st March, 1930	191,288 9 11	103,013 14 6	Loss for year	53,266 17 10
£187,893 3 2		£253,493 13 9	£187,893 3 2		£253,493 13 9

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Profit and Loss Appropriation Account.

1928-29.		1929-30.	1928-29.		1929-30.
£ s. d.	——	£ s. d.	£ s. d.	——	£ s. d.
274,493 18 11	To Balance from previous year	377,507 13 5	377,507 13 5	By Balance	430,774 11 3
103,013 14 6	Balance from Net Revenue Account	53,266 17 10			
£377,507 13 5		£430,774 11 3	£377,507 13 5		£430,774 11 3

Arrears of Sinking Fund contributions to 31st March, 1930: £124,827.

Depreciation Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
158 12 10	To Motor-vehicles	714 5 0	110,741 14 2	By Balance at close of previous year	159,896 2 1
574 0 0	Meters and regulators	..	4,429 13 4	Interest at 4 per cent. per annum	6,389 12 0
..	Fire loss—Bunnythorpe Substation	3,110 3 3	45,457 7 5	Amount set aside as per Net Revenue Account.. ..	62,205 3 10
..	Switch gear and machinery	550 0 0			
..	Line alterations	859 3 0			
159,896 2 1	Balance	223,257 6 8			
£160,628 14 11		£228,490 17 11	£160,628 14 11		£228,490 17 11

BALANCE-SHEET AS AT 31ST MARCH, 1930.

1928–29.	*Liabilities.*	1929–30.		1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
159,896 2 1	Depreciation Reserve	..	223,257 6 8	9,989 4 7	Mangahao Headworks— Land, headworks, &c.	10,024 8 2	
52,122 0 6	Sundry creditors	..	14,322 7 1	73,225 0 6	Roads, tram-lines, &c.	73,225 0 6	
	Balance carried to General Balance-sheet—			11,179 9 2	Local electric line	11,180 9 2	
3,884,329 13 5	Total assets as *per contra*	3,984,490 7 9		503,369 8 4	Dams 1, 2, and 3	505,195 14 5	
212,018 2 7	Less total liabilities as above ..	237,579 13 9		159,619 19 10	Tunnels 1 and 2	160,455 10 8	
			3,746,910 14 0	113,279 16 5	Pipe-line, &c.	113,492 9 5	
3,672,311 10 10				15,720 7 6	Surge-chamber	15,890 15 3	
				886,383 6 4			889,464 7 7
					Waikaremoana headworks—		
				13,432 10 2	Land, headworks, &c.	13,437 7 11	
				9,146 2 1	Dams, &c.	9,216 5 4	
				12,544 6 11	River diversion, weir, and race ..	12,753 2 4	
				27,446 4 3	Tunnel and approach canal	27,787 5 7	
				75,450 2 9	Pipe-lines	76,272 11 5	
				18,193 18 9	Surge-chamber	18,191 3 9	
				52,402 9 3	Roads, tram-lines, &c.	53,956 10 1	
				216 16 11	Tail-race	1,598 13 3	
				208,832 11 1			213,212 19 8
3,884,329 13 5	Carried forward	..	3,984,490 7 9	1,095,215 17 5	Carried forward	..	1,102,677 7 3

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

MANGAHAO-WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AS AT 31ST MARCH, 1930—*continued.*

1928-29.	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
3,884,329 13 5	Brought forward	..	3,984,490 7 9	1,095,215 17 5	Brought forward	..	1,102,677 7 3
					Mangahao power-house—		
				66,758 1 4	Buildings, &c.	66,968 19 8	
				205,049 1 4	Machinery, &c.	206,320 10 4	
				12,870 8 8	Tail-race	12,870 8 8	
				18,680 16 3	Village, cottages, and water-supply ..	21,309 6 2	
				303,358 7 7			307,469 4 10
					Waikaremoana power-house—		
				77,307 6 10	Buildings, &c.	77,251 13 11	
				174,443 16 5	Machinery, &c.	195,366 17 5	
				26,986 2 11	Staff-village	29,696 0 7	
				278,737 6 2			302,314 11 11
					Transmission-lines—		
				147,545 16 10	Mangaore-Khandallah	147,235 10 0	
				98,307 13 10	Mangaore-Wanganui	98,399 1 11	
				45,894 0 4	Bunnythorpe-Dannevirke	45,806 10 4	
				69,163 19 1	Woodville-Masterton	69,534 0 9	
				76,481 17 2	Dannevirke-Napier	77,117 8 10	
				4,346 8 8	Wanganui-New Plymouth	11,594 17 3	
				..	Masterton-Khandallah	95 6 3	
				3,034 3 8	Mangaore-Shannon	3,034 3 8	
				4,592 12 2	Khandallah-Petone	4,576 1 2	
				155,048 6 2	Waikaremoana-Napier	153,369 8 8	
				1,038 17 6	Waikaremoana-Arapuni	5,196 11 3	
				35,662 8 6	Waikaremoana-Gisborne	35,647 19 9	
				23,620 14 7	Waikaremoana-Wairoa	23,773 5 0	
				231 18 4	Waikaremoana - Maori Pas	204 13 4	
				664,968 16 10			675,584 18 2
					Substations—		
				89,941 5 2	Khandallah	90,236 9 1	
				1,981 12 3	Otaki	1,981 12 3	
				32,922 0 10	Bunnythorpe	30,967 3 8	
				21,385 8 5	Wanganui	22,670 3 7	
				22,529 10 7	Dannevirke	20,532 4 7	
				22,373 7 9	Waipukurau	22,810 0 1	
				38,919 2 6	Napier	39,289 18 9	
				12,633 14 8	Woodville	12,466 17 9	
				26,505 8 10	Mangamaire	26,662 7 5	
				13,026 11 10	Masterton	13,312 17 6	
				166 12 5	Marton	4,933 11 4	
				..	Stratford	1 0 8	
				..	Hawera	5 4 2	
				14,220 9 2	Gisborne	15,498 10 9	
				3,816 18 6	Wairoa	3,858 1 6	
				300,422 2 11			305,226 3 1
3,884,329 13 5	Carried forward	..	3,984,490 7 9	2,642,702 10 11	Carried forward	..	2,693,272 5 3

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

MANGAHAO-WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AS AT 31ST MARCH, 1930—*continued.*

1928-29.	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
3,884,329 13 5	Brought forward	..	3,984,490 7 9	2,642,702 10 11	Brought forward	..	2,693,272 5 3
				12,999 15 9	Plant and motor-vehicles, &c.	..	7,309 17 11
				31,616 3 4	Service buildings, &c.	..	30,889 10 8
				187,426 15 5	Salaries and expenses, &c., of engineers and others on preliminary surveys and during construction	..	198,437 16 0
				79,222 1 2	Housing workmen, &c...	..	73,564 19 10
				285,486 6 6	Interest during construction	..	289,925 12 10
				65,573 19 6	Cost of raising loans	..	71,480 19 6
				19,397 2 5	Construction-tools, plant, equipment, &c. ..	..	18,504 17 7
				58,136 19 5	Temporary development, Waikaremoana ..	..	39,746 19 1
				3,767 16 1	Harbour facilities, Waikokopu	..	3,768 4 7
				3,386,329 10 6			3,426,901 3 3
				45,452 10 8	Stocks on hand, 31st March, 1930 (including 10 per cent. to cover administration, &c.)	43,219 16 8	
				8,634 15 2	Stocks issued but not used	14,957 4 8	
				54,087 5 10			58,177 1 4
				66,404 3 8	Sundry debtors for current, rents, &c. ..	..	68,621 13 11
				1 0 0	Telephone subscriptions, &c., paid in advance	..	15 18 0
				377,507 13 5	Profit and Loss Account—Accumulated loss to date	..	430,774 11 3
£3,884,329 13 5			£3,984,490 7 9	£3,884,329 13 5			£3,984,490 7 9

I hereby certify that the Balance-sheet and accompanying accounts have been duly examined and compared with the relative books and documents submitted for audit, and correctly state the position as disclosed thereby.—G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA-ARAPUNI SCHEME.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929.

Gross Revenue Account.

1928-29.		1929-30.		1928-29.		1929-30.	
£ s. d.	To Generating expenses, headworks, and power-house—	£ s. d.	£ s. d.	£ s. d.	By Sales of electrical energy to wholesale consumers	£ s. d.	£ s. d.
	Horahora—			132,720 16 5		222,243 15 1	
3,653 10 4	Salaries and wages	3,374 1 3		73 4 4	*Less* discounts and rebates	42 4 4	
622 9 2	Supplies	440 11 9		132,647 12 1			222,201 10 9
45 6 10	Transport	105 19 7					
			3,920 12 7				
	Maintenance and repairs—						
1,231 17 8	Headworks and buildings	919 2 6					
678 8 10	Power-house machinery	1,610 17 1		7 10 0	Hire of plant	19 0 8	
222 0 3	Staff village	567 4 3		778 11 0	Rent of lines	778 11 0	
			3,097 3 10	1,647 12 5	Miscellaneous rents	2,225 3 8	
6,453 13 1				2,433 13 5			3,022 15 4
	Arapuni—						
..	Salaries and wages	3,942 8 1					
..	Supplies	113 14 8					
..	Transport	26 12 2					
			4,082 14 11				
	Maintenance and repairs—						
..	Headworks and buildings	67 18 8					
..	Power-house machinery	178 12 6					
..	Staff village	80 16 6					
			327 7 8				
	Operation and maintenance of—						
17,835 12 6	Waihi Grand Junction steam-plant	10,972 7 11					
14,930 6 1	Diesel Station, Penrose	4,791 4 11					
16,641 14 8	Power purchased in bulk	7,947 16 11					
			23,711 9 9				
49,407 13 3							
	Operation and maintenance of main transmission-lines (50,000-volt)—						
2,208 5 8	Horahora–Waikino	3,055 17 9		361 10 5	Testing, oil-drying, and repairs for consumers	..	416 13 9
371 8 8	Horahora–Hamilton	446 1 0					
339 11 10	Mystery Creek – Te Awamutu	437 0 3					
67 17 0	Te Awamutu – Hangatiki	86 1 2					
146 10 8	Waiorongomai–Waihou	268 14 11					
165 12 5	Horahora–Arapuni	270 18 8					
163 12 4	Arapuni–Ngongotaha	811 5 3					
..	Halfway–Paeroa	9 4 5			Fees for inspection of lines and testing of instruments	..	42 0 0
..	Hamilton–Huntly	39 8 8		68 5 0			
225 3 4	Penrose–Waitemata	313 2 5					
290 16 8	Katikati–Waikino	232 8 11					
561 13 6	Bombay–Waikino	540 18 2					
821 15 7	Ngongotaha–Opotiki	1,610 0 7					
			8,121 2 2				
5,362 7 8							
61,223 14 0	Carried forward	..	43,260 10 11	135,511 0 11	Carried forward	..	225,682 19 10

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA-ARAPUNI SCHEME—*continued.*

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Gross Revenue Account—continued.

1928-29.	——	1929-30.		1928-29.	——	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
61,223 14 0	Brought forward	..	43,260 10 11	135,511 0 11	Brought forward	..	225,682 19 10
	To Transmission lines (110,000-volt)—						
100 12 4	Arapuni–Hamilton	1,851 3 9					
952 10 3	Arapuni – Penrose Tower No. 1 ..	416 3 6					
			2,267 7 3				
1,053 2 7							
	Operation and maintenance of main sub-stations (50,000-volt)—						
714 2 9	Waikino	873 14 10					
735 0 3	Hamilton	977 12 9					
309 13 3	Te Awamutu	395 0 10					
358 16 7	Hangatiki	348 8 3					
593 7 8	Waihou	333 2 5					
14 12 2	Arapuni	1 0 0					
318 16 11	Ngongotaha	317 2 3					
70 0 6	Mamaku	110 19 6					
..	Waiotahi	299 7 0					
29 0 3	Edgecumbe	289 17 3					
247 6 11	Henderson	451 11 10					
332 16 5	Takapuna	374 9 1					
116 9 1	Kerepeehi	294 2 2					
..	Huntly	11 5 6					
..	Matamata	180 7 1					
			5,258 0 9				
3,840 2 9							
	Operation and maintenance of main sub-stations (110,000-volt)—						
1,014 9 9	Penrose	1,672 5 10					
165 19 5	Bombay	734 1 10					
..	Hamilton No. 2	17 7 1					
			2,423 14 9				
1,180 9 2							
	Operation and maintenance of distribution						
190 16 0	substations (11,000-volt)	..	29 18 6				
67,488 4 6	Carried forward	..	53,239 12 2	135,511 0 11	Carried forward	..	225,682 19 10

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA-ARAPUNI SCHEME—*continued.*

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Gross Revenue Account—continued.

1928–29.		1929–30.		1928–29.		1929–30.	
£ s. d.	——	£ s. d.	£ s. d.	£ s. d.	——	£ s. d.	£ s. d.
67,488 4 6	Brought forward	..	53,239 12 2	135,511 0 11	Brought forward	..	225,682 19 10
	To Operation and maintenance of distribution-lines (11,000-volt)—						
333 1 9	Horahora–Hamilton–Frankton ..	285 0 0					
13 0 6	Waikino–Waihi	5 5 2					
346 2 3			290 5 2				
..	Live-line testing and changing of insulators	..	380 18 5				
2,187 3 1	General supervision and management of transmission and distributing systems ..	..	2,575 0 7				
	Management and general—						
3,878 4 10	Salaries, wages, and audit fees ..	4,035 19 1					
392 7 1	Accident insurance, sick and holiday pay	377 9 4					
374 3 6	Travelling-expenses and motor-cars ..	275 17 3					
284 4 10	Postages, telegrams, and telephones ..	274 17 11					
72 9 0	Fire insurance	..					
199 1 10	Printing, stationery, and advertising ..	240 11 11					
268 7 5	Office rent, cleaning, and lighting ..	347 13 0					
382 2 10	Experimental testing and miscellaneous expenses	125 0 7					
355 7 0	Testing, oil-drying, repairs, &c., for consumers	399 13 1					
3 8 0	Legal expenses	0 5 0					
..	Amounts written off	7 9 6					
6,209 16 4			6,084 16 8				
76,231 6 2			62,570 13 0				
59,279 14 9	Balance to Net Revenue Account ..	..	163,112 6 10				
£135,511 0 11			£225,682 19 10	£135,511 0 11			£225,682 19 10

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA-ARAPUNI SCHEME—*continued.*

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929—*continued.*

Net Revenue Account.

1928-29.		1929-30.	1928-29.		1929-30.
£ s. d.	——	£ s. d.	£ s. d.	——	£ s. d.
	To Interest on purchase-money for plant purchased from Waihi		59,279 14 9	By Balance from Gross Revenue Account	163,112 6 10
53,044 11 2	Gold-mining Co., Ltd., and on advances from Treasury ..	135,622 3 8	15,291 9 2	Balance to Profit and Loss Appropriation Account ..	32,768 7 7
21,526 12 9	Depreciation on completed works (2 per cent.) and on stocks	60,258 10 9			
£74,571 3 11		£195,880 14 5	£74,571 3 11		£195,880 14 5

PROFIT AND LOSS APPROPRIATION ACCOUNT FOR YEAR ENDED 31ST MARCH, 1930, COMPARED WITH YEAR ENDED 31ST MARCH, 1929.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
15,291 9 2	To Balance from Net Revenue Account	32,768 7 7	..	By Amount transferred from Reserve Account	30,150 11 10
			15,291 9 2	Balance to Reserve Account	..
			..	Balance to general balance-sheet	2,617 15 9
£15,291 9 2		£32,768 7 7	£15,291 9 2		£32,768 7 7

DEPRECIATION RESERVE ACCOUNT.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
528 10 5	To Amount written off for plant sold and replaced	..	84,271 11 6	By Balance at close of previous year	103,186 12 8
3,094 0 0	Amount written off for plant transferred and replaced ..	..	3,370 17 3	Interest for year	4,127 9 3
	Amount written off equal to value set aside in respect to		21,526 12 9	Amount set aside as per Net Revenue Account	60,258 10 9
2,359 18 5	assets destroyed by fire at Horahora on 1/9/28.. ..	567 0 0			
..	Repairs to turbines, Horahora	884 3 1			
..	Cost of replacing Halfway to Wairongomai Section ..	363 14 3			
5,982 8 10		1,814 17 4			
103,186 12 8	Balance to general balance-sheet	165,757 15 4			
£109,169 1 6		£167,572 12 8	£109,169 1 6		£167,572 12 8

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA–ARAPUNI SCHEME—*continued.*

Sinking Fund Account.

1928-29.	——	1929-30.	1928-29.	——	1929-30.
£ s. d.		£ s. d.	£ s. d.		£ s. d.
52,163 18 3	To Balance	54,445 6 5	49,847 8 11	By Balance at close of previous year	52,163 18 3
			2,316 9 4	Interest	2,281 8 2
£52,163 18 3		£54,445 6 5	£52,163 18 3		£54,445 6 5

Reserve Fund Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
15,291 9 2	To Balance from Profit and Loss Appropriation Account ..	..	53,845 2 5	By Balance at close of previous year	32,415 2 11
	Damage by fire at Horahora—				
4,148 17 8	Assets destroyed and replaced	1,442 14 4			
1,989 12 8	Assets destroyed but not replaced	821 16 9			
..	Amount transferred to Profit and Loss Appropriation Account	30,150 11 10			
21,429 19 6					
32,415 2 11	Balance carried to general balance-sheet	..			
£53,845 2 5		£32,415 2 11	£53,845 2 5		£32,415 2 11

Balance-sheet at 31st March, 1930.

1928-29	*Liabilities.*	1929-30.		1928-29.	*Assets.*	1929-30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
103,186 12 8	Depreciation reserve	..	165,757 15 4	2,168 5 9	Works at Horahora—		
52,163 18 3	Sinking Fund Reserve	..	54,445 6 5	1,039 15 3	Roads and bridges	2,168 5 9	
32,415 2 11	General reserve	..	..	11,822 5 1	Land and fencing	1,039 15 3	
	Sundry creditors—			178,011 12 10	Accommodation for staff and workmen ..	12,438 13 2	
	Public Works Department	7,064 19 7		73,988 18 11	Headworks	178,609 9 3	
44,185 11 11	Other Government Departments ..	194 11 6		38,826 4 6	Generating station	71,693 16 8	
	Non-departmental	15,839 3 3		796 8 6	Transformer buildings and machinery ..	38,744 3 5	
			23,098 14 4		Tools and equipment	490 0 10	
	Balance carried to general balance-sheet—			306,653 10 10			305,184 4 4
3,517,862 2 0	Total assets as per contra	3,815,469 1 11					
231,951 5 9	*Less* liabilities as above	243,301 16 1					
			3,572,167 5 10				
3,285,910 16 3							
3,517,862 2 0	Carried forward	..	3,815,469 1 11	306,653 10 10	Carried forward	..	305,184 4 4

TABLE No. 6—*continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA–ARAPUNI SCHEME—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930—*continued.*

1928–29.	*Liabilities.*	1929–30.	1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
3,517,862 2 0	Brought forward	3,815,469 1 11	306,653 10 10	Brought forward	..	305,184 4 4
				Works at Arapuni—		
				Headworks and tail-race	901,973 9 6	
				Machinery	234,356 4 6	
			1,395,365 4 6	Transformers and switch-gear	145,346 6 11	
				Buildings and fittings	193,345 15 7	
			10,703 12 11	Land and fencing	11,101 11 6	
			25,900 18 10	Roads and bridges	25,900 18 10	
			11,613 7 7	Village	47,142 16 11	
			675 15 6	Electric lines and distribution	723 0 7	
			1,444,258 19 4			1,559,890 4 4
				Auxiliary plants—		
			9,202 5 0	Waihi Grand Junction steam-plant ..	9,139 9 4	
			63,656 17 2	Diesel station, Penrose	63,329 5 10	
			72,859 2 2			72,468 15 2
				Transmission-lines, 50 kv.—		
			38,767 2 0	Horahora–Waikino	38,762 18 9	
			11,067 17 11	Waikino–Katikati	11,073 19 5	
			4,561 6 6	Waiorongomai–Waihou	4,561 6 6	
			138 19 2	Waihou–Hamilton	138 19 2	
			22,332 6 7	Horahora–Hamilton	22,332 6 7	
			7,803 2 6	Mystery Creek – Te Awamutu	7,803 2 6	
			12,158 18 5	Te Awamutu – Hangatiki	12,158 18 5	
			4,896 2 7	Horahora–Arapuni	5,164 15 4	
			18,943 3 5	Arapuni–Ngongotaha	19,124 1 4	
			29,449 16 10	Ngongotaha–Opotiki	29,578 5 8	
			46,215 9 2	Penrose–Takapuna	46,219 13 4	
			31,806 1 1	Bombay–Waikino	31,809 3 6	
			8,773 9 0	Hamilton–Huntly	11,225 1 7	
			380 7 5	Henderson – North Auckland	..	
			..	Halfway–Paeroa	12,282 1 0	
			1,550 9 6	Linesmen's cottages	1,550 9 6	
			238,844 12 1			253,785 2 7
3,517,862 2 0	Carried forward	3,815,469 1 11	2,062,616 4 5	Carried forward	..	2,191,328 6 5

TABLE No. 6 *continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA–ARAPUNI SCHEME—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930—*continued.*

1928–29.	*Liabilities.*	1929–30.		1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
3,517,862 2 0	Brought forward	..	3,815,469 1 11	2,062,616 4 5	Brought forward	..	2,191,328 6 5
					Transmission-lines, 110 kv.—		
				148 15 9	Arapuni – Te Kuiti	148 15 9	
				35,234 11 0	Arapuni–Hamilton	35,262 0 3	
				100,195 1 4	Hamilton–Penrose	100,923 17 2	
				202,400 2 11	Arapuni–Penrose (Tower No. 1) ..	209,394 1 10	
				1,571 12 3	Arapuni–Penrose (Tower No. 2) ..	2,043 17 6	
				93 18 8	Arapuni–Waikaremoana	2,241 16 6	
				..	Henderson – North Auckland	1,032 2 6	
				..	Arapuni–Stratford	585 0 2	
				339,644 1 11			351,631 11 8
					Substations, 50 kv.—		
				31,042 4 5	Waikino	30,983 4 9	
				10,522 16 5	Hamilton	15,221 4 5	
				6,966 7 9	Te Awamutu	9,362 11 8	
				10,195 18 8	Waihou	15,284 10 2	
				6,858 5 9	Hangatiki	7,027 1 0	
				2,369 13 6	Arapuni	2,369 13 6	
				4,164 10 5	Ngongotaha	4,172 14 3	
				1,393 13 11	Mamaku	1,547 0 8	
				3,905 1 8	Edgecumbe	12,626 4 9	
				8,185 19 6			
				13,535 7 7	Henderson	14,003 5 5	
				11,529 18 4	Takapuna	11,709 15 2	
				621 8 1	Kerepeehi	12,028 10 10	
				11,198 9 0			
				4,666 5 11	Huntly	7,105 14 6	
				8,395 12 3	Waiotahi	9,111 14 11	
				7,495 2 4	Matamata	8,132 8 3	
				143,046 15 6			160,685 14 3
					Main substations, 110 kv.—		
				37,537 8 6	Penrose	155,321 2 6	
				103,962 1 8			
				13,452 10 3	Bombay	40,275 9 0	
				27,009 4 4			
				13,832 19 2	Hamilton No. 2	13,692 3 2	
				195,794 3 11			209,288 14 8
					Distribution-lines, 11 kv.—		
				33,581 10 5	Horahora–Frankton	34,240 7 5	
				704 11 11	Branch to Waihi Grand Junction ..	704 11 11	
				6,000 0 0	Waikino–Waihi	6,001 15 5	
				3,314 14 3	Bombay–Pukekohe	3,314 14 3	
				43,600 16 7			44,261 9 0
3,517,862 2 0	Carried forward	..	3,815,469 1 11	2,784,702 2 4	Carried forward	..	2,957,195 16 0

TABLE No. 6 - *continued.*

ELECTRIC SUPPLY ACCOUNT—*continued.*

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA–ARAPUNI SCHEME—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1930—*continued.*

1928–29.	*Liabilities.*	1929–30.		1928–29.	*Assets.*	1929–30.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
3,517,862 2 0	Brought forward	..	3,815,469 1 11	2,784,702 2 4	Brought forward	..	2,957,195 16 0
					Distribution substations, 11 kv.—		
				8,642 18 6	Waihi Grand Junction	8,642 18 6	
				2,269 12 6	Taps for consumers	2,269 12 6	
				10,912 11 0			10,912 11 0
					Hamilton Area—		
				3,997 14 6	Land at Ruakura	3,997 14 6	
				9,778 8 10	Stores buildings, fittings, and railway-siding	9,810 16 7	
				4,397 8 2	Staff residences	4,372 4 6	
				696 7 2	Office furniture and fittings	688 8 4	
				227 9 6	Office accommodation	235 3 1	
				19,097 8 2			19,104 7 0
				7,318 3 10	Loose tools and equipment	..	7,441 3 3
				6,484 11 7	Motor lorries, cars, and cycles	..	8,409 11 10
				39,930 16 8	Engineering office and general expenses on surveys and on construction	..	49,127 11 3
				90,797 17 5	Salaries of officers on surveys and on construction	..	103,351 18 9
				308,921 10 6	Interest during construction	..	353,198 4 11
				99,793 12 4	Cost of raising loans	..	132,054 12 4
				..	Stocks of spares, &c., on hand	..	19,631 4 9
				3,367,958 13 10			3,660,427 1 1
				58,322 8 0	General stocks of material on hand ..	..	31,704 7 4
					Debtors—		
				39,417 1 11	For electricity and sales of materials ..	..	66,274 11 4
					Sinking Fund, Horahora—		
				51,406 18 5	Investment and cash in hands of Treasury	53,671 7 9	
				756 19 10	Interest accrued	773 18 8	
				52,163 18 3			54,445 6 5
				..	Net loss	..	2,617 15 9
£3,517,862 2 0			£3,815,469 1 11	£3,517,862 2 0			£3,815,469 1 11

I hereby certify that the Balance-sheet and accompanying accounts have been duly examined and compared with the relative books and documents submitted for audit, and correctly state the position as disclosed thereby.—G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE No. 7.

IRRIGATION AND WATER-SUPPLY.

SCHEDULE OF SCHEMES COMPLETED OR UNDER CONSTRUCTION.

Scheme.	Source of Supply.	River Discharge (Minimum).	Main Canal Discharge (Maximum).		Average Rainfall from Records available.	Rainfall, 1929.	Area commanded (Gross).	Area irrigated at Present.	Works authorized.		Works completed.		Expenditure to 31st March, 1930.	Remarks.
			As per Design.	During 1929–30.					Main Canals.	Distributaries.	Main Canals.	Distributaries.		
		Cusecs.	Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Acres.	M. ch.	M. ch.	M. ch.	M. ch.	£	
Steward Settlement	Waitaki River ..	..	110	..	20·94 (Steward Settlement)	27·37	18,000	..	14 60	50 31	14 60	50 31	12,115	Completed.
Otekaike ..	Otekaike River ..	9	15	..	22·42 (Duntroon)	26·05	1,500	800	14 37	3 47	14 37	3 47	3,631	Completed. Used only on west side of river.
Ida Valley ..	Manorburn, Poolburn, and Moa Creek. (Storage Manorburn Dam)	..	110	85	16·07 (Moa Creek)	15·62	14,000	11,441	73 0	54 0	73 0	29 50	191,495	Completed. Additional storage dam being constructed in Poolburn.
Galloway ..	Manorburn Dam ..	..	30	27·5	14·10 (Galloway)	14·11	3,450	2,453	10 50	10 7	10 50	10 7	24,383	Completed.
Manuherikia – Alexandra–Clyde No. 1	Manuherikia River	77	100	80	15·44 (Alexandra, Ophir, and Clyde)	14·13	7,000	5,722	23 0	46 20	23 0	46 20	236,650	Completed.
Ardgour	Lindis River ..	35	20	20	19·54 (Tarras)	20·03	2,000	1,474	13 0	2 40	13 0	2 40	34,114	Completed.
Arrow River ..	Arrow River ..	40	50	..	27·71 (Arrowtown and Frankton)	29·41	6,536	..	..	..	7 51	18 77	124,324	Practically completed.
Hawkdun (formerly Mount Ida)	Tributaries of Manuherikia River and Eweburn Reservoir	..	60	31	24·74 (Naseby and Naseby Plantation)	25·60	10,000	9,129	66 0	101 0	66 0	90 12	66,764	Completed.
Earnscleugh (Fraser River)	Fraser River ..	10	47 (all races)	68	14·57 (Earnscleugh)	15·78	2,743	2,022	11 30	17 60	11 30	17 60	11,494	Completed.
Last Chance (Fruitlands and Earnscleugh Tops)	Shingle, Coal, Gorge, and Butcher's Creek	8	20	15	15·05 (Earnscleugh and Roxburgh East)	18·17	4,300	2,960	22 0	5 70	20 78	5 70	28,877	Completed.
Tarras	Lindis River ..	35	70	37	19·54 (Tarras)	28·53	6,000	3,115	21 70	17 55	21 70	17 55	138,881	Completed.
Bengerburn ..	Bengerburn ..	1	4	4	..	..	1,000	144	2 6	..	2 6	..	695	Completed.
Teviot River ..	Teviot River and Lake Onslow dam	40	80	58	15·53 (Roxburgh East)	20·57	3,300	3,435	16 51	10 55	16 51	10 55	55,200	Completed and serving all land requiring water.
Teviot River Extension	Ditto	40	80	58	15·53 (Roxburgh East)	20·57	2,000		3 77	4 2	3 77	4 2		Completed.

TABLE No. 7—*continued.*

IRRIGATION AND WATER-SUPPLY—*continued.*

SCHEDULE OF SCHEMES UNDER INVESTIGATION.

Scheme.	Source of Supply.	River Discharge (Minimum).	Main Canals Discharge (Maximum), as per Design.	Average Rainfall from Records available.	Rainfall, 1929.	Area commanded (Gross).	Length of Main Canal.	Length of Distributaries.	Expenditure to 31st March, 1930.	Remarks.
		Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Miles.	Miles.	£	
Maniototo (Upper Taieri)	Taieri River and storage dam	25	500	17·45 (Waipiata)	16·30	100,000	60	..	257	Modified scheme for complete irrigation of 5,000 acres is possible without storage, or for reasonable partial irrigation of 15,000 acres.
Cromwell Flat and Lowburn (Roaring Meg)	Roaring Meg Stream (gravity), Kawarau River (pumping)	29 3,000	40	21·07 (Luggate)	20·01	15,000	10	30	3,367	Development of gravity scheme would be costly. Hydro-electric scheme under investigation. Power would be available for pumping irrigation supplies in Upper Clutha Valley.
Upper Manuherikia ..	Manuherikia and Dunstan Rivers, and storage dam in Manuherikia River at Falls	77	500	20·81 (Clyde, Ophir, and Blackstone Hill)	22·18	96,000	130	..	5,334	Further investigations into water requirements and areas available, and revised estimates have been made.
Hawea Flats (first alternative)	Timaru Creek (gravity)	20	30	26·04 (Hawea Flat)	24·08 (11 mons.)	4,000	11	20	49	To irrigate lower flat only.
Hawea Flats (later alternative)	Hawea River (pumping)	..	..	26·01 (Hawea Flat)	20·58	17,600	..	..	..	Latest tentative proposal. Electric power not necessary, but water to be pumped by direct application of power generated by low-pressure turbines at outlet of Lake Hawea. This appears preferable to alternative No. 1, and appears to be a promising scheme. Further closer survey and estimates are necessary.
Chapman's Gully ..	Butcher's Creek, Conroy's Creek, and storage dam	..	..	14·36 (Alexandra)	11·77	100	..	..	16	..
Bendigo Flat	Lindis River and storage dam	35	30	19·54 (Tarras)	20·03	3,000	7	..	..	The greater portion of this area is now served.
Teviot River Extension *	Teviot River and Lake Onslow dam	40	80	15·53 (Roxburgh East)	20·57	2,300	..	..	207	To irrigate a limited area in the vicinity of Ettrick, on west side of Clutha River.
Miller's Flat	Minzionburn	6	..	..	..	2,000	..	..	192	Survey and proposals completed.
Luggate Burn	Luggate Burn ..	..	12	21·07 (Luggate)	20·01	1,200	..	..	273	To supply water to part of Mount Pisa settlement lands.
Scandinavian	Tributaries of Manuherikia River	..	20	31·28 (St. Bathan's)	35·37	4,000	..	..	..	For lands about St. Bathan's. Includes £12,000 towards cost of Falls dam, Upper Manuherikia scheme.
Soil Survey (Central Otago)	..	..	..	..	..	..	..	..	3,065	This soil survey in the irrigation districts is now complete, and plans are being prepared.
Investigation of proposed schemes	..	..	..	..	..	..	..	..	454	Includes the reading of river and rain gauges.

* Put under Teviot River scheme with which it will be ultimately amalgamated.

APPENDICES TO THE PUBLIC WORKS STATEMENT, 1930.

APPENDIX A.

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1929–30.

Prepared in compliance with Section 8 of the Public Works Act, 1928.

SIR,— Public Works Department, Wellington, 26th June, 1930.

In compliance with the 8th section of the Public Works Act, 1928, I enclose a statement of the expenditure during the preceding financial year on all works and services chargeable to the Public Works Fund.

I have, &c.,
W. B. TAVERNER,
Minister of Public Works.

The Controller and Auditor-General, Wellington.

STATEMENT OF NET EXPENDITURE ON ALL WORKS AND SERVICES CHARGEABLE TO THE PUBLIC WORKS FUND FOR THE YEAR 1929–30.

Vote.	Summary.	Appropriation.	Gross Expenditure.	Credits in Aid.	Net Expenditure.
	General Purposes Account—	£	£ s. d.	£ s. d.	£ s. d.
42	Public Works, Departmental	153,822	298,403 11 8	165,877 1 5	132,526 10 3
43, 44	Railways	2,214,839	2,063,471 19 4	250,950 16 4	1,812,521 3 0
45–52	Public Buildings	425,125	358,624 11 5	10,988 11 11	347,635 19 6
53	Timber-supply and Sawmills, &c., for Public Works Department	7,000	4,872 14 10	8,480 13 6	*Cr.* 3,607 18 8
54	Acquisition and Operation of Quarries for Public Works Department	15,000	29,623 9 9	29,294 12 8	328 17 1
55, 56	Lighthouses and Harbour-works	25,500	15,505 14 0	309 19 5	15,195 14 7
57	Development of Tourist Resorts	36,000	23,697 13 9	3,151 1 8	20,546 12 1
58	Department of Immigration	55,000	87,761 8 0	46,005 3 1	41,756 4 11
59–61	Roads, Bridges, and other Public Works ..	1,272,500	1,136,289 4 9	75,381 9 8	1,060,907 15 1
62	Telegraph Extension	600,000	654,182 13 2	59,799 11 2	594,383 2 0
63	Contingent Defence	60,000	48,680 1 7	1,913 14 0	46,766 7 7
64	Lands, Miscellaneous	122,599	83,169 3 11	3,715 11 8	79,453 12 3
65	Irrigation, Water-supply, and Drainage ..	86,000	73,391 13 6	3,734 7 5	69,657 6 1
66	Plant, Material, and Stores	30,000	74,956 19 3	106,770 7 2	*Cr.* 31,813 7 11
67	Transfer to Main Highways Account, Construction Fund	200,000	200,000 0 0	..	200,000 0 0
..	Unauthorized—Services not provided for ..	..	628 8 11	371 5 0	257 3 11
..	Finance Act, 1929, Section 32	..	12,500 0 0	..	12,500 0 0
	Totals, General Purposes Account ..	5,303,385	5,165,759 7 10	766,744 6 1	4,399,015 1 9
68–69	*Electric Supply Account*	1,124,000	793,031 11 3	103,387 19 1	689,643 12 2
..	Unauthorized—Services not provided for ..	..	1,166 0 0	1,000 0 0	166 0 0
..	*Waihou and Ohinemuri Rivers Improvement Account*	..	32,702 19 3	5,341 12 2	27,361 7 1
	Totals, Public Works Fund.. ..	6,427,385	5,992,659 18 4	876,473 17 4	5,116,186 1 0

APPENDIX A—*continued.*

	Name of Vote.	Appropriation.	Gross Expenditure.	Credits in Aid.	Net Expenditure.
	PUBLIC WORKS FUND.	£	£ s. d.	£ s. d.	£ s. d.
	General Purposes Account—				
42	Public Works, Departmental	153,822	298,403 11 8	165,877 1 5	132,526 10 3
	Railways—				
43	Railway-construction	1,660,000	1,513,994 18 11	61,135 3 5	1,452,859 15 6
44	Additions to Open Lines	554,839	549,477 0 5	189,815 12 11	359,661 7 6
	Public Buildings—				
45	General	39,500	28,883 10 0	135 4 8	28,748 5 4
46	Courthouses	20,000	15,814 5 5	49 10 3	15,764 15 2
47	Prison Buildings and Works	23,625	18,830 16 9	16 9 8	18,814 7 1
48	Police-stations	10,000	8,450 3 3	7 13 7	8,442 9 8
49	Postal and Telegraph	145,000	106,089 3 0	1,932 13 3	104,156 9 9
50	Agricultural	6,000	3,424 0 0	461 8 6	2,962 11 6
51	Mental Hospital Buildings	151,000	152,986 3 10	890 3 11	152,095 19 11
52	Health and Hospital Institutions	30,000	24,146 9 2	7,495 8 1	16,651 1 1
53	Timber-supply and Sawmills, &c., for Public Works Department	7,000	4,872 14 10	8,480 13 6	*Cr.* 3,607 18 8
54	Acquisition and Operation of Quarries for Public Works Department	15,000	29,623 9 9	29,294 12 8	328 17 1
	Lighthouses and Harbour-works—				
55	Lighthouses	7,000	4,459 16 11	..	4,459 16 11
56	Harbour-works	18,500	11,045 17 1	309 19 5	10,735 17 8
57	Development of Tourist Resorts	36,000	23,697 13 9	3,151 1 8	20,546 12 1
58	Department of Immigration	55,000	87,761 8 0	46,005 3 1	41,756 4 11
	Construction and Maintenance of Roads, Bridges, and other Public Works—				
59	Roads, &c.	1,194,000	1,080,320 5 1	74,990 15 6	1,005,329 9 7
60	Roads to give access to Outlying Districts	75,000	54,083 4 4	390 2 2	53,693 2 2
61	Roads, &c., on Goldfields	3,500	1,885 15 4	0 12 0	1,885 3 4
62	Telegraph Extension	600,000	654,182 13 2	59,799 11 2	594,383 2 0
63	Contingent Defence	60,000	48,680 1 7	1,913 14 0	46,766 7 7
64	Lands, Miscellaneous	122,599	83,169 3 11	3,715 11 8	79,453 12 3
65	Irrigation, Water-supply, and Drainage	86,000	73,391 13 6	3,734 7 5	69,657 6 1
66	Plant, Material, and Stores	30,000	74,956 19 3	106,770 7 2	*Cr.* 31,813 7 11
67	Transfer to Main Highways Account, Construction Fund	200,000	200,000 0 0	..	200,000 0 0
..	Unauthorized—Services not provided for	..	628 8 11	371 5 0	257 3 11
..	Finance Act, 1929, Section 32— Refund to Ordinary Revenue Account of amount expended under sections 45 and 47, Valuation of Land Act, 1925, for purchase of part of Town Sections 502 and 503, City of Wellington	..	12,500 0 0	..	12,500 0 0
	Totals, General Purposes Account	5,303,385	5,165,759 7 10	766,744 6 1	4,399,015 1 9
	Electric Supply Account—				
68	Development of Water-power	960,000	609,334 11 0	96,265 19 7	504,068 11 5
69	Working Expenses and Maintenance	164,000	192,697 0 3	7,121 19 6	185,575 0 9
..	Unauthorized—Services not provided for	..	1,166 0 0	1,000 0 0	166 0 0
..	*Waihou and Ohinemuri Rivers Improvement Account*	..	32,702 19 3	5,341 12 2	27,361 7 1
	Totals, Public Works Fund	6,427,385	5,992,659 18 4	876,473 17 4	5,116,186 1 0

NOTE.—This statement includes only the expenditure on works, and does not include expenditure such as interest, sinking funds, and charges and expenses of loans.

J. J. GIBSON,
Accountant.

F. W. FURKERT,
Engineer-in-Chief and Under-Secretary.

Examined and found correct, subject to the foregoing Departmental note.—G. F. C. CAMPBELL, Controller and Auditor-General.

APPENDIX B.

ANNUAL REPORT ON PUBLIC WORKS BY THE ENGINEER-IN-CHIEF.

The Engineer-in-Chief to the Hon. Minister of Public Works.

Sir,—

I have the honour to submit the following report upon the various works under my control completed and in progress throughout the Dominion during the period from the 1st July, 1929, to the 30th June, 1930.

RAILWAYS.

Abstract.

The following table shows the expenditure on Government railways in New Zealand up to the 31st March, 1930:—

Name of Railway.	Total Length of Railway or Section.	Open for Traffic.	Expenditure to 31st March, 1930.
	M. ch.	M. ch.	£
Kaihu Valley	24 32	24 32	180,097
Otiria–Ngapuhi	13 45	13 45	127,371
Opua Wharf – Onerahi	58 6	58 6	609,653
Kioreroa–Waiotira	19 79	19 79	420,533
North Auckland Main Trunk Railway (from Helensville)	189 75	44 39	4,103,659
Helensville – Te Awamutu, with Branches (including Auckland–Westfield Deviation)	215 35	160 63	6,058,654
Frankton Junction – Thames, with Branches	127 35	125 23	1,830,278
Thames Valley – Rotorua	69 33	69 33	429,624
Rotorua–Taupo	54 40	..	38,516
Tauranga–Opotiki, with Branches	145 32	59 09	1,494,939
Gisborne–Opotiki	93 44	49 32	624,907
Napier–Gisborne (including Waikokopu Branch)	231 44	23 44	3,111,938
Wellington – Napier and Palmerston North (including Te Aro Extension, Greytown and Martinborough Branches, and Hutt Valley Railway)	258 62	235 76	4,255,609
Wellington–Waitara, with Branches	350 11	308 42	4,792,562
Stratford–Okahukura	112 47	47 40	2,443,279
North Island Main Trunk (Marton – Te Awamutu), including Raetihi Branch and Waipa Gravel-access Branch	225 79	218 39	3,136,072
Picton–Waipara (South Island Main Trunk Railway)—			
Picton southwards	92 38	56 6	729,523
Waipara northwards	90 45	44 14	385,412
Nelson–Greymouth	177 51	129 50	862,718
Stillwater – Arthur's Pass	51 41	50 41	1,964,600
Rolleston – Arthur's Pass (including Whitecliffs Branch)	92 59	84 45	1,036,638
Westport–Ngakawau	19 56	19 56	208,410
Westport – Ngakawau Extension to Mokihinui*	7 12	7 12	..
Mokihinui Colliery Line†	3 69	3 69	..
Westport–Cape Foulwind‡	7 0	7 0	..
Westport–Inangahua	26 0	5 74	393,866
Ngahere–Blackball	3 40	3 40	147,695
Greymouth–Rewanui and Branches	11 34	11 34	334,373
Greymouth–Waitaha	50 32	38 68	422,752
Waipara–Waitaki, with Branches	459 34	413 70	3,531,593
Canterbury Interior Main Line—Oxford–Temuka	83 0	11 44	59,942
Waitaki–Bluff, with Branches	600 21	570 14	6,105,687
Otago Central	182 51	147 27	1,443,338
Invercargill–Kingston, with Mararoa Branch	117 4	97 44	396,191
Forest Hill Railway—Winton–Hedgehope§	12 40	12 40	23,337
Western Railways	94 8	78 49	455,870
Preliminary surveys	..	..	35,747
General charges not yet apportioned	..	..	43,007
Miscellaneous	..	..	10,337
Stock of permanent-way on hand	..	..	123,104
Rolling-stock and omnibuses	..	..	10,893,073
Total	4,373 54	3,302 69	‖63,264,904
Provincial Government Lines, etc.			
Canterbury (lengths included above)	..	..	731,759
Otago and Southland	..	..	372,522
Gisborne to Ormond Tramway	..	..	4,975
Midland Railway, valuation of works constructed by company	..	..	¶683,460
Grand total	4,373 54	3,302 69	65,057,620

* The funds for this extension—namely, £35,501 2s. 11d.—were provided by the Westport Harbour Board.
† The funds for purchase of this line, £15,745, were provided by the Westport Harbour Board.
‡ The funds for this line—namely, £93,450—were provided by the Westport Harbour Board.
§ The expenditure on this line as a tramway was made by the Lands Department.
‖ Includes expenditure on railways under Hutt Road and Railway Improvement, Railway Improvement Authorization Act, and Railway Improvement Authorization Act 1914 Accounts.
¶ Includes value for £150,000 paid to debenture-holders under the Midland Railway Petitions Settlement Act Amendment Act, 1903.

North Auckland Main Trunk Railway.

Rangiahua Section (24 m. 45 ch. to 38 m. 34 ch.; length, 13 m. 65 ch.).—As indicated in my last annual report, very great difficulty is being experienced in carrying out the formation of this railway, owing to the exceedingly unstable and slippery nature of the country on which it is being built. The bulk of the work done during the year under review has been directed towards the consolidation of 9 miles of formation previously completed, by the removal of slips, rebuilding slumped banks, building stone retaining-walls, and thoroughly draining the country by means of drives and stone drains. It has been necessary to abandon the original centre line, and deviate the line, for a distance of 3¾ miles. So far this consolidation work has given satisfactory results, and very little trouble has been experienced this winter.

Fencing has been erected on 4 m. 65 ch. of line. Earthwork formation is in hand over the whole length of the railway.

The telephone-line has been extended for a distance of 4 m. 26 ch. to Rangiahua Station yard.

Twelve private and three public crossings have been constructed.

Road-deviations to a length of 2 m. 58 ch. have been metalled, and three overhead bridges have been constructed. Sixteen culverts have been placed, varying from a 6-ft.-diameter arch to smaller pipes.

The contract is complete for Waihou Station buildings, consisting of four platelayers' cottages, one station building, one goods-shed, 6,000-gallon water-vat, latrine, and stockyard.

Rails have been relaid on 3¾ miles of new centre line, and the railhead has been extended for a distance of 1 m. 14 ch. to 34 m. 40 ch.

Ballasting is in hand over the whole length of new track, stone being obtained from the Department's own quarry near Okaihau. Here a large plant has been installed, and the output during this year has been 19,000 cubic yards of crushed stone, and 2,000 cubic yards of larger stone. The stone is quarried and crushed under a contract at a very reasonable rate.

The number of men employed at the end of the period was 273, and the average was 249.

Tauraroa Quarry.

During the year a smaller programme than usual was carried out, which involved the supplies of metal of all classes, particularly for the Dargaville Branch Railway and the Auckland–Maungaturoto Main Highway. In addition, metal was sent to the Rodney, Otamatea, and Whangarei Counties for construction and maintenance purposes, and the latter particularly on the main highways.

The cost of metal has been kept down to much about the same prices as last year. The chief reason that the output was less this year was due to the fact that the whole of the crushing-plant was burnt down on the morning of Boxing Day last year. However, in five weeks after this calamity temporary plant was in operation, which consisted of a main crusher, together with temporary screens and bins. No reject crushers were used, and this limited the output of material suitable for bitumen and concrete work. However, the stationary engines were taken down and repaired and any material which was serviceable was put in order. A contract was let for the erection of the new bins, and these should be ready in a few weeks' time.

Arrangements have been made for the installation of one steam unit for the whole quarry, and the engine is coming from Greymouth and the boiler from Auckland. As soon as repairs, &c., have been done to this boiler, arrangements will be made to install the plant.

The output of metal for the year was 60,282 cubic yards.

Dargaville Branch Railway.

This railway, length 17 m. 40 ch., will connect the North Auckland Main Trunk Railway at Kirikopuni with the isolated Kaihu Valley Railway at Dargaville.

Formation has advanced steadily during the year, and satisfactory progress has been made despite certain difficulties due to the weakness of the country along the banks of the Wairoa River. A heavy subsidence on the bank at 7 m., with consequent upheaval of the adjacent country, has been successfully dealt with, and construction-train traffic has been passing over it for some months. The large slip at 10 m. 70 ch. also appears to have been successfully held up. A heavy stone retaining-wall founded on sandstone 22 ft. below the surface has been built, numerous stone drains put in, and the whole moving surface planted with willow. No movement has been observed since this work was done.

In numerous other cases similar retaining-walls of smaller dimensions have been used with success.

The only real difficulty at present is the bank at 13 m. 67 ch. which has sunk into the country, and continues to subside despite the placing of heavy berms on each flank. A 4 ft. concrete culvert on piled foundations carries drainage-water through the bank, and great difficulty is being experienced in keeping the outlet ditch open, owing to upheaval from the bottom.

Earthwork is complete to 15 m. 60 ch., except the bank at 13 m. 67 ch., 30 chains of light formation at 12 m., and the bridge-approaches at 10 m. 20 ch. and 11 m. 73 ch.

Three steam-shovels are in use, at the metal-dump in Kirikopuni Station yard, at borrow pit at 13 m. 10 ch., and at 15 m. 12 ch.

Two miles of main-road deviation have been completed, and one overbridge is under construction.

All culverts to 15 m. 60 ch., except four minor ones, have been placed, the bulk of them being on piled foundations.

During the year 540 ft. of bridging has been completed, including permanent track. Bridges over Omu Creek (11 m. 72 ch.) and Awakino Creek (15 m. 67 ch.) are in hand. In many cases piled foundations have reached a depth of 120 ft.

During the year 5½ miles of permanent track have been placed and mostly ballasted. The line is now ballasted and lifted to Tangowahine Station yard 10 m. 10 ch.

Tangowahine Station yard is completed, except for building of stockyards. Te Wharau Siding station has been prepared, and platform and loading-bank fronts built.

Six miles of fencing has been erected during the year, and the telephone-line extended to Dargaville Station.

Tangowahine is now the main distributing-centre for the railway, and two launches and three barges have been regularly used in transport of men and materials on the river.

For the past seven months all goods traffic offering has been handled between Tangowahine and Kirikopuni by works train.

The number of men employed at the end of the period was 217, and the general average 261.

Auckland–Westfield Deviation.

This double-track deviation, 8 m. 70 ch. in length, connects the new Auckland Railway-station with the existing main lines at Westfield by easy gradients. The work is practically completed, and the tracks have been handed over to the Railway Department, the "down" on 1st September, 1929, and the "up" on 1st May, 1930. Since the previous date the line has been in regular use for goods traffic.

Five electrically-operated weir-gates, each 7 ft. wide, have been fitted between the piers of bridge at 3 m. 23 ch., and with these it is possible to control the water in Orakei Basin to any level between high- and low-water levels.

Drainage systems with septic tanks have been installed at all the stations, also water-supply has been laid on.

All outlying camps have been dismantled and buildings transferred or sold. Construction material has been collected to a main dump at Orakei Station yard.

Platelaying and ballasting has all been done by the Railway Department's workmen.

With the exception of a few small jobs to be completed, the whole section is now under the care of the Railway Department.

The number of men employed over the period was sixty-four.

Gisborne–Napier Railway: Waikokopu–Gisborne.

Construction work on the Waikokopu–Gisborne portion of this railway was put in hand at the end of March, 1929, when the detailed location had been practically completed. From Waikokopu the railway skirts the coast for a mile on heavy formation, when the Kopuawhara Valley is then entered. Four miles of light formation are followed by 6 miles of heavy formation as the railway runs on a rising maximum gradient located above the floor of the valley. Near the head of the valley the railway will pass under the coastal range by a tunnel 123 chains long into the Tikiwhata Valley, which is of a very steep and rugged nature. After 50 chains of unusually heavy formation, including 15 chains of tunnelling, the railway will pass through the coast tunnel 46 chains long, then emerging on the sidling at a height of 450 ft. directly above the sea-coast. After running above the sea for 1½ miles the line as located turns into the Wharekakaho Valley, then after another ½ mile, passing through a coastal spur, by the Waikoura Tunnel (72 chains long), the railway will enter the Waikoura Valley. Continuing the descent on heavy sidling down this valley on a 1 in 50 grade, the floor of the valley is reached at a distance of about 6 miles from the north portal of the Waikoura Tunnel. The railway then will traverse the Gisborne Flats for 11 miles, crossing the Waipaoa River about a mile from its mouth, keeping immediately on the west side of the Awapuni Lagoon, thus giving the shortest practicable route to Gisborne, instead of following an earlier location involving considerable detour through Patutahi. The total length of railway to be built from Waikokopu to junction with the Gisborne–Motu Railway will be 35 miles, making a total distance in to Gisborne Railway-station from Waikokopu of 36¼ miles.

The work done during the year has mainly consisted of construction of service roads, provision of workers' accommodation, construction of culverts and water drives, and opening-up of cuttings. Details are as follow:—

Kopuawhara Section (from 23 m. 0 ch. to 33 m. 72 ch., Wairoa chainage; length, 10 m. 62 ch).—Service roads: The Gisborne–Opoutama Road serves for this purpose to the Kopuawhara Stream Bridge, but it has had to be reformed and metalled for a distance of 3 miles. From the latter point a new road has been formed for 8½ miles to portal of the main tunnel, and of this length 7½ miles are metalled. On this service road 365 lineal feet of bridging has been built mostly, owing to the absence of native timbers, with steel-joist girders and timber deck on mass concrete or timber-pile piers. A service road is also being made from this valley road up on to the East Coast Road on the top of the coastal range for purposes of through connection for service purposes and to transport aggregate for tunnel-concrete requirements. This service road, which rises 700 ft. on a grade of 1 in 12, has its formation nearing completion; metalling has still to be done. It is noted here that these service roads will have considerable value as county roads, and will prove a better through route than the Opoutama Road.

Clearing of the railway is more than half done and 2¼ miles of permanent fencing has been erected.

Culverting: 836 lineal feet of concrete-pipe culvert, in sizes ranging from 1 ft. to 2 ft. 6 in. diameter have been placed, and 272 lineal feet of concrete culverts in sizes from 3 ft. arch to 6 ft. arch have been built. Two water-drives with concrete lining are in hand—one 9 ft. by 8 ft. and the other 7 ft. by 5 ft. The heavy earthwork is in hand over the whole section under co-operative contract, 194,000 cubic yards having been excavated during the year.

Before the south portal of the main tunnel can be opened up, the bed of the Waiau Stream has to be lowered and widened. This is a very substantial work, representing about 75,000 cubic yards of papa and boulder excavation in water. A start was made with this by hand methods, but,

generally, the work is being held up pending the installation of drag-line and crane plant for the work. This installation is in hand. Approaches to three small tunnels on this section are in hand or complete, so that headings can be started.

Telephone line for service purposes has been provided, consisting of 4 miles of permanent construction and 12 miles of temporary line.

Wharerata Section (from 34 m. 60 ch, Wairoa chainage, to 14 m. 0 ch., Gisborne chainage; length, 9 m. 17·75 ch.).—This section requires construction work of major dimensions. The earthwork and tunnelling are unusually heavy, as already described, and access is difficult, owing to the steep and rugged country. Existing roads are mostly on the tops of the high ridges which the railway has to pierce at an elevation of 800 ft. to 1,200 ft. lower. Considering the intricacy of the country, the system of service roads built is convenient, and not unduly costly. To give access to the coast section and to the Tikiwhata Valley, 3¾ miles of service road has been built. Access to the north end of the Coast Road tunnel (the main tunnel, 123 chains long) is given by 80 chains of service road on 1 in 9 grade. This service road connects with a jigway and chute system by which construction material will be lowered down the steep hillside to the tunnel portal. The service roads thus constructed this year on this section represent 60,000 cubic yards excavation.

Culverting: Very substantial progress has been made with the construction of waterways. 558 lineal feet of concrete-pipe culverts from 1 ft. to 2 ft. in diameter are complete, also 195 ft. of concrete culvert in sizes up to 6 ft. arched, 2,429 lineal feet of water-drive, averaging in dimensions 8 ft. by 6 ft. have been constructed, of this the lining in concrete is more than half complete.

Formation: Formation work has been confined mainly to the Waikoura and Wharekakaho Valleys from 14 m. to 19 m. The approaches to the Waikoura Tunnel are being pushed on with. Access to the north portal will be available in a few weeks, but at the south end, on account of the very heavy approach cut, access is being made by driving a heading. During the year 70,000 cubic yards were excavated from railway cuttings.

One of the problems on this railway is that of supply of crushed stone for concrete-aggregate and road-metal purposes. When the works on the section were started first, limestone quarries located 20 miles from works, were used, and though haulage contracts at low rates were let, the cost of stone delivered was very high. However, certain valleys comparatively close to works have been found to contain a fair class of concretionary boulders in large quantities, and these are being crushed and utilized to good advantage.

During this present year, the ordinary earthwork in cut and fill will approach completion, and an extensive tunnelling programme will be in hand. Air-compressor plant is on order for machine drilling, and this should be arriving shortly.

Gisborne Section (14 m. 0 ch. to 0 m. minus 7·35 ch., Gisborne chainage; length, 14 m. 7·35 ch.).—With the exception of 2 miles at the south end, formation work is very light; 2¼ miles of formation have been completed by scooping contract, and other lengths, totalling 1¼ miles, have also been completed. Thus 51,000 cubic yards of earthwork is complete out of a total of 162,000. Two short stream-diversions have been made.

Fencing: A total length of 676 chains of fencing has been erected on the railway-reserve boundaries.

Culverting: 101 lineal feet of 1-ft.-pipe culvert and 461 ft. of concrete culvert, varying from 2 ft. flat-topped to 6 ft. arched have been constructed.

Bridging: This is a big item on the section, no fewer than sixteen bridges being required. Of these, the major one is that over the Waipaoa River, of a length of 720 ft. Action has been taken to obtain the plate girders, &c., and arrangements are in hand for driving test piles at the Waipaoa site. It is intended to push on with the light formation and bridge construction from Gisborne, so as to get the railhead out to the beginning of the heavy work to save cartage and facilitate pushing on of the work. Sufficient material for 17 miles of single track is now stacked at Makaraka Railway Siding, 3 miles from Gisborne.

Workmen's Accommodation: Extensive accommodation has been provided for single and married men at various camps on the Kopuawhara Section in the Kopuawhara Valley. Similar accommodation has been provided on the Wharerata Section, mainly grouped at five principal camps. These various camps are so located as to best serve the heaviest sections of work. Cookhouses and bath-houses are provided on both sections. Schools have also been built, both on Kopuawhara and Wharerata Sections. The total number of men employed between Waikokopu and Gisborne at the end of the year under review was 793, the average number for the year being 634.

Gisborne–Napier Railway.

Napier–Wairoa.

Putorino Section (10 m. 56 ch. to 37 m. 35 ch.; length, 26 m. 59 ch.).—For the greater part of this period this section has been carrying traffic for the public. At the end of the previous year traffic was being worked as far as Matahoura (now called Tatara), but early in this year the track was extended to Putorino, and daily trains have been run and have been well patronized.

The extension of track has also been of great value in transporting materials to the railhead for use in the construction of the sections ahead, and particularly the steelwork for the Waikare Viaduct, which was fabricated in the Tauranga Workshops and railed direct to the job.

The year's work generally has comprised the finishing of work throughout the whole length; completion of platelaying, ballasting, and station buildings being the work of most importance.

The formation work carried out consisted mainly of widening banks, clearing slips, and a road-deviation for grade-separation purposes at 32 m. 44 ch.; this latter consisted of two large embankments approaching an overhead bridge. Fencing has been completed throughout the section, a number of private crossing-gates and station-yard gates having been erected.

All bridges and culverts have been completed, the principal work being the sleepering throughout and the placing of guard-rails on the Waikoau and Matahoura Viaducts.

The platelaying and ballasting was completed, the 70 lb. track having been bedplated at all joint sleepers, the 55 track having been regauged throughout, and 29,152 cubic yards of ballast being laid.

At Waipunga Station-yard a concrete loading-bank was constructed. At Waikoau latrines and buffer stops have been erected. At Tatara buffer stops were erected, concrete troughs installed in stock-holding paddocks, the metalling of the yard completed, and light design sheep-yards erected. At Putorino sidings were laid, ballasted, and the yard metalled, stockyards and holding-paddocks put in, and a water-supply to the latter provided; four platelayers' cottages built, loading-bank and platform constructed; goods-shed, station buildings, and latrines built; a gravity water-supply installed, 6,000-gallon vat built; and concrete buffer stops constructed.

The Department's sawmill at Makomako has been fully employed during the year, the output being 906,926 superficial feet and 4,692 posts. Most of the timber has been supplied to the Wairoa Section for general construction purposes, and the Waikokopu–Gisborne Sections have been supplied with large quantities of timber for accommodation purposes.

Wairoa Section (37 m. 35 ch. to 70 m. 67 ch.; length, 33 m. 32 ch.).—This section has been vigorously pushed on during the year, the maximum number of men having been employed. Several steam-shovel cuttings and other works were carried on with double shifts, and the result is shown by the fact that the purely earthwork jobs are nearly completed. Several very large embankments have been completed, and there is now a considerable length of formation ready for the laying of rails.

The Waikare Viaduct, which is now practically completed, was erected very expeditiously. The steel for this viaduct was fabricated at the Department's workshop at Tauranga, and an excellent job made of it. The work of steel erection went on very smoothly and was completed without any hitch by means of a duplex cableway. Rails are now being laid across the viaduct northwards towards Kotemaori Tunnel.

It is intended that the skilled staff from the Waikare Viaduct shall be transferred to the Maungaturanga Viaduct.

It is proposed to complete the permanent way from Wairoa to the Maungaturanga Viaduct so that steel for this structure may be railed from the port of Waikokopu, meanwhile and during the erection formation between this viaduct and the Mohaka River will be vigorously carried on and finished.

The foundations of the Mohaka Viaduct are already in hand, and it is expected that on completion of the Maungaturanga Viaduct steel erection work at Mohaka may be immediately commenced, the steel being delivered either from Waikokopu or via Napier, whichever appears to be most suitable at that time.

It is interesting to record that rigid concrete control methods have been adopted on the big concrete works on this section. A testing laboratory has been installed at Kotemaori, and proportions of aggregate, cement, and water for the various structures are determined by calculation to provide the required strength, the resulting concrete being carefully tested by crushing, with a consequent economy in cement.

At the present rate of progress in twelve months the Kotemaori Tunnel should be almost complete, the Maungaturanga Viaduct steelwork well in hand, and the earthwork practically complete, so that the northern railhead can be pushed on to 51 m. 50 ch.

The progress on the various portions of this large section is more completely detailed as follows:—

Waikare River to Kotemaori Tunnel (South End) (38 m. 20 ch. to 42 m. 15 ch.; length, 3 m. 75 ch.).—The concrete abutments, pier-foundations, and steel erection at Waikare Viaduct have been completed, and the wind-screen is in hand. The whole bridge has been given one coat of paint, and the remaining two coats will be applied next summer. An interesting part of the erection of the steel was the launching and placing of the 100-ft. steel-plate girders of the three 100-ft. through spans. These are the largest girders of this type to be erected in New Zealand, and with the use of extra heavy blocks and gear no trouble was experienced in handling them.

Cutting at 38 m. 26 ch. has been partly scooped down to grade-level. Cuttings at 38 m. 30 ch., 33 ch., and 37 ch. have been scooped to bank at 28 ch.

Overbridge and approaches at 38 m. 62 ch. have been completed, and now form part of the main highway.

Cutting at 38 m. 58 ch. has been completed with steam-shovel and the material used to complete banks at 38 m. 68 ch., 39 m. 42 ch., and 39 m. 52 ch.

Cuttings 39 m. 75 ch. and 40 m. 3 ch. have also been completed by steam-shovel, the material being tipped to bank at 40 m. 40 ch.

The 10 ft. by 8 ft. heading through the southern approach cutting at 42 m. 12 ch. was completed early in the year, and two shifts were immediately started breaking down the cutting into rakes of trucks in the heading, and the cutting is now practically complete.

A party has been started on the southern bottom heading of the Kotemaori Tunnel, working three shifts; 14 ch. of heading are complete, the face being at 42 m. 29 ch. The country is sound sandy papa, patches of which are slightly damp.

Kotemaori Tunnel (South End) to Mohaka Tunnel (42 m. 15 ch. to 53 m. 30 ch.; length, 11 m. 15 ch.).—The construction of the north end of this tunnel is in hand. Progress was held up for some time owing to a dispute, but this has been settled, and during the year 515 ft. of tunnel has been completed, and 565 ft. of bottom heading driven, the faces being at 42 m. 48·40 ch. and 42 m. 40·70 ch. respectively. It is expected that the headings will meet in about ten weeks' time.

A steam-shovel has completed cuttings at 42 m. 45 ch. and 75 ch., and material has been tipped to complete bank at 43 m. 71 ch., and bank at 44 m. 8 ch., the same shovel has excavated enough material from the south-end cutting at 44 m. 19 ch. to complete bank at 44 m. 12 ch.

Light formation from 49 m. 12 ch. to 49 m. 54 ch. has been graded by scoop teams and the various roads in connection with Mohaka Station yard have also been formed and metalled.

A steam-shovel has completed road-deviation in this vicinity up to peg 36, excavating the spoil into the Mohaka River, and the big bank on the road-deviation is being formed by hand using the balance of the material left by the shovel in the big cutting mentioned above. This deviation should be open to traffic next summer.

Several other smaller cuttings have been completed partly by steam-shovel and partly by hand gangs, and the formation is generally well in hand.

Overhead bridge at 44 m. 79 ch. has been completed, and this deviation now forms part of the main highway.

Similarly overbridge at 47 m. 67 ch. has been built, and is taking the main highway traffic.

One abutment and two concrete piers of subway at 44 m. 31 ch. are complete, and one 20 ft. and one 35 ft. span are in position, but not riveted.

During the year test piles were driven at the Mohaka Viaduct site at 49 m. 35 ch., and it was decided to use concrete caissons for the four river piers. A start has been made on the temporary staging work for these caissons, and material and plant is arriving on the site.

At 46 m. 7·60 ch. a 4 ft. arched culvert has been completed, and also five concrete pipes at 46 m. 17 ch., 48 m. 49 ch., 49 m. 59 ch., 49 m. 68 ch., 51 m. 23 ch., and 51 m. 28 ch.

Three water-drives at 51 m. 73 ch., 52 m. 10 ch., and 52 m. 29 ch. have been practically completed and 192 chains of fencing erected.

At the Maungaturanga Viaduct work is well in hand, abutment A, piers B1, B2, B3, B4, C1, C2, C3, C4, and E3 and E4 have been excavated, while abutment A and piers B1, B2, B3, and B4 have been completed, and C1, C2, C3, and C4 are in hand.

The Mohaka Tunnel has been worked continuously with three shifts and the bottom heading has been pierced. The ground generally has improved considerably, and 10 ch. have been completed during the year, the working face being now at 53 m. 21 ch.

Four concrete-block cottages have been completed at the Mohaka Station yard at 50 m. 40 ch.

Mohaka Tunnel to Wairoa (53 m. 30 ch. to 70 m. 37 ch.; length, 17 m. 7 ch.).—The formation work on this section is completed, except for small portions at the approaches of bridges, and a cutting still left at the northern approach to the Mohaka Tunnel. Three steam-shovels and one petrol-shovel worked on the heavier portions of the section during the year, while scoops, dray-teams, and hand-gangs were employed on the lighter portions.

Six road-deviations were completed during the year, and a considerable amount of road-widening was necessitated by the proximity of the railway to the road.

315 ch. of permanent fencing has been erected between Mohaka Tunnel and 65 m. 47 ch. A start was lately made on fencing up the Te Kumei Valley, and work is in hand there at present. Fencing from 65 m. 47 ch. to Wairoa is now practically completed.

A large amount of culvert work has been carried on during the year as follows:—

Three 2 ft. flat-top culverts, one 3 ft. arched culvert, one 4 ft. arched culvert, four 4 ft. flat-topped culverts, one 6 ft. arched culvert, and 25 pipe culverts ranging from 1 ft. to 2 ft. 6 in., and aggregating a total length of 631 ft.

Two water-drives were completed, one 4 ft. 6 in. by 4 ft. and the other 7 ft. by 5 ft., and two creek-diversions were finished.

A temporary level-crossing has been formed at the main road-crossing at 65 m. 23 ch., and investigations and survey are in hand to determine whether the cost of grade separation is warranted.

A level-crossing at Awamate Road is in hand, and four private crossings have been put in.

From Wairoa Station yard back to 69 m. 15 ch., on the right side of the railway, a road has been formed and metalled. This is to provide access to land which was severed by the railway, thus saving a number of private crossings.

Waihua River Bridge (at 59 m. 31 ch., consisting of one 100 ft., three 50 ft., two 40 ft. spans).—All piles, except two in Pier B, have been driven, and the concreting of Piers C, D, and F has been completed, the abutments have been driven, and the erection of the steel superstructure will be put in hand in about two months' time.

Ohinepaka Stream Bridge (at 64 m. 7 ch., consisting of one 25 ft., one 40 ft., and three 30 ft. spans).—Pile-driving has been completed, and the piers are almost ready for the superstructure.

Ohinepaka Stream Bridge (at 64 m. 47 ch., consisting of four 30 ft. spans).—Pile-driving has been completed, piers finished, and steelwork is now being erected.

Wairoa River Bridge (at 68 m. 58 ch.), consisting of four 105 ft. steel spans on concrete cylinder piers, is now practically completed. Considerable difficulty was experienced during the construction of this bridge due to floods.

Platelaying was completed south from Wairoa to 65 m. 49 ch., and the first lift of ballast has been put on this section, and the second lift is proceeding.

On the completion of the Hurumua Bridge the railhead can proceed south to the Ohinepaka Bridge at 64 m. 47 ch., which can then have its steel-plate girders erected. These spans are already riveted up ready for transport, and after crossing this bridge there will be a comparatively clear run through to Waihua Bridge, which will by that time be ready for its steelwork.

From Waihua Bridge to Mohaka Tunnel platelaying may continue without interruption.

Ballast for this section is being obtained by a contractor who is using two drag-line scoops dredging shingle from the bed of the Wairoa River.

Four concrete cottages have been erected at Waihua. The temporary accommodation throughout the work generally has involved a considerable amount of work in repairs, shifting, &c., and a number of huts, cottages, and other buildings have been transferred to the Waikokopu–Gisborne Railway.

The total number of men employed at the end of the period was 604, and the average over this period was 629.

Waikokopu Branch Railway.

The traffic on this line between Wairoa and the port of Waikokopu has been well maintained during the year; the work on the line itself has consisted mainly of maintenance, but a 6 ft. arched culvert has been built at 18 m. 18 ch. to cope with flood-waters from the Rangitoto Stream.

Five private crossings and gates and one footbridge have been erected.

Between 0 m. 40 ch. and 2 m. 70 ch. the railway reserve on both sides is being ploughed and grassed, to act as a fire-break to the Ohuia Flax Swamp.

STRATFORD MAIN TRUNK RAILWAY.—EAST END.

Matiere Section (0 m. to 10 m.; length, 10 m.).—This section is now completed, and general maintenance has been attended to during the year.

Ohura Section (10 m. to 19 m. 10 ch.; length, 9 m. 10 ch.).—This section is also completed, the work done during the year being the building of an overbridge, and the provision of several crossings.

Goods and passenger services have been operated during the year on this and the Matiere Section.

Tokirima Section (19 m. 50 ch. to 29 m. 70 ch.; length, 10 m. 20 ch.).—This section with its heavy earthwork and six tunnels, aggregating 1¼ miles in length, has been vigorously attacked, and formation is now 90 per cent. complete, and the tunnelling 75 per cent. complete.

Tunnels No. 1 and No. 2 are complete, and No. 3 is practically so.

Tunnel No. 4 at 24 m. 38 ch. (length, 61 yards) is now being lined, the bottom heading having been completed.

Tunnel No. 5 at 25 m. (length, 727 yards) is well forward, and only 130 yards of concrete lining remains to be done. Soft ground was encountered at the south end, necessitating the use of extra heavy lining, and the concreting of the floor for a distance of 185 yards.

Tunnel No. 6 (28 m. 60 ch. length, 585 yards) is now well manned, and 18 chains of bottom heading has been driven. Lining has been commenced from the north end.

Six bridges are in the course of construction, and one road overbridge has been completed. Seven miles of fencing has been completed. The permanent way is laid to 22 m. 69 ch., and ballasting is in hand to that point.

Heao Section (29 m. 70 ch., eastern chainage, to 55 m. 40 ch., western chainage).—This section, 3 m. 50 ch. in length, runs into very heavy work, and is now well manned.

Clearing has been completed and about half the fencing, also the fencing of the Heao Access Road 3 miles long.

Nine culverts of varying size are complete or in hand, the largest being 10 ft. by 8 ft., with a length of 248 ft.

The Heao Stream has been diverted with a heavy cut at 31 m. 27 ch., eliminating two bridge crossings.

All cuttings are opened up, and the earthwork is 50 per cent. complete.

A service tram-line for transport of supplies has been built from 29 m. 70 ch. to 56 m. 50 ch., and will be continued to the tunnel portal at 55 m. 70 ch.

There are three tunnels on this section, aggregating in length five-sixths of a mile: the first at 31 m. 50 ch. is 8 ch. long and is ready for driving; the second at 32 m. is also 8 ch. long, and the bottom heading is driven. The third is being worked from the west end by the Stratford district organization, and from the east end by the Taumarunui district organization; the length is 51 ch., and 20 ch. of bottom heading has been driven at the east end. Lining will be put in hand at this end as soon as the service tram-line can be finished.

The total number of men employed at the end of the period was 405, and the average 405.

STRATFORD MAIN TRUNK RAILWAY.—WEST END.

Raekohua Section (47 m. 40 ch. to 50 m. 60 ch.; length, 3 m. 20 ch.).—Work has been vigorously pushed along on this section in order to enable the permanent line to be opened up to the Tangarakau Station at 50 m. 40 ch. for coal traffic. This object was achieved in December, and the tram-line on which all traffic has been carried to Tangarakau and works further ahead was removed.

All earthwork, with the exception of a few chains beyond 50 m. 50 ch. and a little widening in the station yard, has been finished.

Bridges at 49 m. 16 ch. and 49 m. 63 ch. were completed, the Tangarakau River Bridge at 50 m. 53 ch., consisting of one 25 ft., one 30 ft., one 60 ft., one 80 ft., and one 60 ft. steel-plate-girder spans, was put in hand, Piers D, E, and F being completed, and the piles for the remaining piers are being made.

All culverts were completed, five 1 ft. 6 in. pipes being placed during the year.

At No. 1 tunnel (49 m. 6·29 ch. to 49 m. 12·30 ch.) the breaking-down lining and construction of portals was completed.

Seventy-pound rails and permanent-way sleepers have been laid from 48 m. 54 ch. to 50 m. 37 ch., including the Egmont Coal Co.'s Siding.

The first and second lifts of ballast have been carried through from 48 m. 34 ch. to 50 m. 37 ch., the third lift from 47 m. 40 ch. to 50 m. 35 ch. The ballasting was done with crushed shell-rock from Te Wera Quarry and 1,546 cub. yd. of Mount Egmont ballast supplied by the Railway Department.

The fencing on the left is now completed through from 47 m. 75 ch. to 49 m. 67 ch., and from 50 m. 4 ch. to 50 m. 45 ch., except for a gap at 48 m. 74 ch. to 49 m. 4 ch. On the right, fencing is completed from 47 m. 75 ch. to 49 m. 24 ch. and from 50 m. 3·30 ch. to 44·60 ch. Pieces of this have been done previous to July, 1929.

The tri-weekly passenger service was continued from Tangarakau to connect with the New Zealand railways at Tahora.

The air main to No. 1 tunnel was dismantled on completion of that tunnel, and was gradually taken up as the formation was completed. It is now dismantled (back to 50 m. 40 ch.). The power-line was run through No. 2 tunnel to No. 1 tunnel, and two locomotives were used, one running spoil down from No. 1 tunnel to the bank at 49 m. 20 ch. to 49 m. 30 ch., and one running from 50 m. 5 ch. to 50 m. 10 ch. to widen the bank at 49 m. 40 ch. to 49 m. 70 ch. The power was used to drive a concrete mixer during concreting of No. 1 tunnel.

The accommodation at Tangarakau was kept in repair, and all the married quarters were given a coat of paint.

During this year the Egmont Coal Co. completed its tram-line to the Tangarakau Station yard, and built its bins and screening-plant there. Its siding has been completed. The Public Works goods service brought in most of the company's material, and has hauled out approximately 4,000 tons of coal since the company started active operation early in February, 1930.

Heao Section (50 m. 60 ch. to 55 m. 40 ch. ; length, 4 m. 60 ch.).—Transport has been very difficult on this section, and the heading in No. 3 tunnel was pushed ahead in order to improve this, and the headings met early in November, 1929. Access to the Tikapuiti Valley was particularly bad, and in January, 1930, this part of the job was taken over by the Taumarunui district. The western end of the job now finishes somewhere in No. 4 tunnel (say, 55 m. 40 ch.).

In the Tikapuiti Valley earthwork was well in hand when this section was handed over to the Taumarunui district.

All along this section the cuttings and banks are rapidly being completed ; only the bigger cuttings now being left. The bank from 50 m. 60 ch. to 50 m. 73 ch. is still narrow, and the cutting at 50 m. 75 ch. will not be completed for several months. The service tram-line fouls the permanent line all the way up to No. 1 tunnel, and this is as yet incomplete. The pug cutting at 52 m. 71 ch. gave a lot of trouble, but good progress was made during the dry months. Earthwork is complete from there through to 54 m. 59 ch., and this cutting will soon be finished. The bank at 54 m. 65 ch. is still to be completed, also the cutting at 54 m. 74 ch.

At No. 2 tunnel the lining was completed, the final section lined being 52 m. 45·60 ch. to 51 m. 58 ch.

In No. 3 tunnel heavy and wet ground was encountered, and this made progress slow. The headings met at 54 m. 5·54 ch. at the end of October, line, level, and chainage proving correct. Lining is completed from 53 m. 45·60 ch. to 53 m. 74·11 ch. from the west end, and from the east end lining has been completed to 54 m. 22·85 ch., the portal being at 54 m. 30·54 ch. Work on lining from the east end commenced in January under difficulties due to transport of material, and to concrete having to be mixed by hand.

Bins have now been built there, and an electrically driven mixer installed ; transport is now being effected by an electric locomotive at the tunnel-mouth, but horses must still be used through the bottom heading. Seepage has been so bad that an air-driven pump is kept running on the night shift to make transport possible the next day.

No. 4 tunnel, west end, has caused a lot of trouble, mainly on account of the stream that cuts across it about 3 ch. from the portal. This has held up progress beyond it for several months. Also soft ground in this 3 ch. has made heavy timbering necessary. The heading begun in September at 55 m. 16·96 ch. now extends to 55 m. 33·80 ch. in good solid papa, giving 16·94 ch. of completed heading.

The air-compressor at the east end of No. 3 tunnel was shifted to the west end of No. 4 tunnel, and a fan run by electric motor has been installed.

No. 4 east tunnel : Driving was commenced in September, 1929 ; the ground was good, and rapid progress was made till the handing-over at the end of January. At that time the heading had been taken from 55 m. 69·05 ch. back to 55 m. 59·45 ch., a distance of 9.60 ch.

A 6 ft. by 4 ft. water-drive, 217 ft. long, has been driven at 54 m. 31 ch., and lining has been completed. This replaces a 6 ft. arch concrete culvert about 54 m. 32 ch. The 6 ft. by 4 ft. water-drive at 54 m. 51 ch. is still unlined.

The excavation for a 6 ft. by 4 ft. water-drive, 307 ft. long, at 55 m. 16 ch., is completed, but lining has not been commenced. A 6 ft. by 4 ft. water-drive, 110 ft. long, was excavated at 56 m. 19 ch. before handing over.

The excavation for a 4 ft. arch culvert at 55 m. 70 ch. was completed in October. Excavations were also completed at 56 m. 5 ch. for 1 ft. 6 in. concrete-pipe culvert.

Excavations were made for a 2 ft. concrete-pipe culvert at 56 m. 36 ch. All these were done before handing over the Tikapuiti Valley to the Taumarunui district.

Trouble with slips has been experienced with the water-diverts at 54 m. 50 ch. and 54 m. 65 ch., but they are now diverting the Mangatete successfully.

The quarry at Mangaone was re-opened in September of last year, as concreting in No. 3 tunnel was once more in full swing. A large amount of stripping was necessary, but 1,020 cub. yd. were crushed and taken to the tunnel-bins during the rest of the year. Approximately 7,840 cub. yd. have been taken from the quarry to date.

As work was completed on the Raekohua Section the electric locomotives were moved on to the Heao Section.

The plant in the power-house stood up well for the year, and there was no serious breakdown. The Inspector of Machinery examined all boilers during Easter and renewed all but one certificate.

The power-line was extended to the western portal of No. 4 tunnel, and used to drive the air compressor and fan. The power-line over No. 1 tunnel was taken down and re-erected through the tunnel and along the permanent way. The only breakdowns were caused by falling trees, and the service was well maintained.

Repairs have been efficiently carried out in the fitting-shop and carpenter's shop. All the machines have been kept in use, and a considerable saving in time and cost effected by having them installed.

The accommodation at Mangaone and Mangatete was maintained and kept in repair. Electric light was taken to the cookhouse at Mangatete. A community hall was erected at Mangatete, and the tents were given iron roofs and better walls and floors.

The number of men at the commencement of the year was 373. This rose to 390 in September, and stands at 294 at the end of the year.

Te Wera Quarry.—The quarry was kept busy during the year supplying ballast and road-metal. Crushing continued throughout the year, and a total of 15,354 cub. yd. was put through and disposed of.

Raekohua Road.—The permanent way was brought through to the flat late in December, enabling the tram-rails and ballast on the Raekohua Settlers' road to be removed. The ballast was then spread upon the road-formation wherever possible, but several new deviations and locations have not yet been metalled.

Extensive slips were cleared, and the road opened again about February of this year.

Wellington – Tawa Flat Railway Deviation.

From Kaiwarra Station, at 1 m. 70 ch., where the Public Works Department's work on the deviation commences, to opposite the mouth of No. 1 tunnel at 2 m. 45 ch., the bank is being protected from the sea by stone. During the year 8 ch. of the sea-wall and 10 ch. of the apron were completed. It was found desirable to place heavier rock than could be got in quantity from the quarry in the bottom course of the wall, and concrete blocks of five tons weight are now being used for this purpose. In addition to these blocks in the wall an apron of heavy stone is being placed outside the wall to break the force of the waves and to prevent scour. The whole of the stone has been obtained from the Horokiwi Quarry.

The embankment is being constructed in two lifts with material excavated from the tunnels. The bottom lift, which is 5 ft. above high-water level, is completed for a distance of 30 ch., and the top lift, which is at grade level, is completed to half its width for a distance of 14 ch. A movable trestle is being used to fill in the top lift.

In No. 1 tunnel, which is 61 ch. in length, the bottom heading is completed. From the south end 22 ch. of enlargement have been done, and from the north end 18 ch., leaving 21 chains yet to complete. 25 ch. of enlargement were done during the year. Work on this tunnel is now to be carried on at the south end only, so that it will take thirteen months yet to complete the tunnel.

No. 2 tunnel is 2 m. 53 ch. in length. At the south end 47 ch. of bottom heading has been driven and at the north end 1 m. 17 ch., leaving 69 ch. of bottom heading yet to complete; 75 ch. of the north-end length of heading was done from the shaft.

In order to expedite the piercing of this tunnel by enlarging at several places, a heading parallel to the tunnel and 66 ft. to the west of it is being driven. This heading is now in a distance of 40 ch. from the southern portal, and three cross-cuts have been driven to the main-tunnel heading. A start is just about to be made on enlarging the tunnel by means of this parallel heading ahead of the enlargement from the south portal.

No. 2 tunnel has been enlarged and concrete lined for a distance of 15 ch. from the south end and 15 ch. from the north end.

Very wet conditions have prevailed in the headings of this tunnel, causing much delay. Due to these wet conditions the working-hours per shift are shortened, the men working what is known as "wet time." This, of course, involves increased cost per given quantity of work done.

All concrete in the lining is now being successfully placed by pneumatic concrete placers.

A reinforced concrete overhead bridge has been completed for the Takapu Road crossing.

Piers for the railway bridges at 7 m. 25 ch. and 7 m. 51 ch. have been completed during the year. Steel girders are now being erected on the bridges at 7 m. 25 ch., 7 m. 37 ch., 7 m. 5 ch., and 7 m. 63 ch. The Hutt Road Bridge and the Ngahauranga Bridge have been scraped and painted.

Beyond No. 2 tunnel 86 ch. of formation work have been completed, of which 66 ch. was done during the year.

Stream-diversions at 6 m. 62 ch. and 6 m. 67 ch. were completed.

The road-deviation at 7 m. 30 ch. is now practically completed; 62 ch. of fencing has been erected. Eight concrete culverts have been built in during the year.

Cottages for thirty married men were constructed, making a total of 104 now on the works.

The average number of men employed throughout the year was 400.

Midland Railway.

Murchison Section (63 m. 8 ch. to 85 m.; length, 21 m. 72 ch.).—Formation on this section was practically completed to 67 m. 3 ch. during the previous period, and during the present year the section has been fully manned as far as 76 m. For the first mile and a half beyond 67 m. the work is fairly heavy, from 67 m. 10 ch. to 67 m. 50 ch. there is a large sidling cutting, material from which is being partly used to form the adjacent banking and part of which is being run to bank between 67 m. 3 ch. and 67 m. 10 ch. This cutting is now approaching completion. From 67 m. 50 ch. to 67 m. 64 ch. there is a large breast cutting which is being run to bank between 67 m. 64 ch. and 68 m. 40 ch. This cutting is the key to the position generally, as its completion governs the pushing-forward of platelaying and ballasting, the formation ahead being much lighter, and therefore likely to be completed first.

On account of this, every endeavour is being made to push on with the cutting, steam-shovels being employed on double shifts, and the bank being trestled to facilitate the tipping of spoil.

An electric-lighting plant has been installed for the night shift, and the cutting itself is being shot up with heavy charges placed by means of deep shafts and drives, as otherwise the ground, which consists of heavy granite-boulder formation, is too compact for the shovels to tackle unaided. Good progress is being made, and it is anticipated that cutting should be completed in about six to eight months' time.

From 68 m. 40 ch. to 73 m. the formation is very light, with the exception of two cuttings and banks at 71 m. 60 ch. and 72 m. 36 ch. respectively, which are also being double shifted to push the work on.

The balance of the formation over this length is well in hand. From 72 m. to 76 m. the principal earthworks have been manned, and will be completed by the time the large cutting at 67 m. 60 ch. is completed, and platelaying and ballasting can be pushed forward.

Nine culverts, varying from 1 ft. to 8 ft. have been built between 67 m. and 74 m.

Owing to the close proximity of the road and railway-line it has been necessary to carry out a number of road-deviations where the existing road fouled the railway-line; some of these, owing to the rugged nature of the country in the first two miles, involved very heavy rock-excavations, the principal ones were 67 m. 13 ch. to 67 m. 21 ch., 67 m. 28 ch. to 67 m. 49 ch., 69 m. 10 ch. to 69 m. 50 ch., and 73 m. 22 ch. to 73 m. 27 ch.

Stream-diversions are in hand at 69 m. 11 ch. and 75 m. 14 ch. Bush felling and clearing has been completed from 68 m. 69 ch. to 69 m., and 5 miles 53 chains of fencing has been erected.

The erection of road-overbridge at 66 m. 60 ch. is in hand, the excavation for concrete abutments of overbridge at 67 m. 59 ch. is practically completed, and the steelwork for same has been fabricated. This overbridge is being erected in advance of the cutting-excavation, thus minimizing the staging necessary for the erection of the 80 ft. steel-plate girder.

All platelaying to 67 m. 3 ch. was completed during the previous period as well as the majority of the ballasting; this latter is now completed, and the section between Kawatiri and the Gowan is now complete and ready for traffic.

A large housing programme for the accommodation of the workmen is being carried out, involving the erection of 170 single-men's huts and thirty-nine married quarters; so far, seventeen single huts and twelve married quarters have been completed.

This section of railway suffered considerably in the disastrous earthquake of June last; a number of slips were caused in the various cuttings, and work was practically suspended over portion of the work to enable the workmen to be utilized in the very urgent and necessary work of restoring road communication between Murchison and Glenhope and with the outlying districts.

The number of men employed at the end of the period was 302, and the general average throughout was 239.

Westport-Inangahua Railway.

Cascade Section (5 m. 70 ch. to 8 m. 78 ch.; length 3 m. 8 ch.).—This section was practically completed during the previous year, and has been well maintained for the coal traffic from the Cascade Co.'s Mine at Cascade Creek. In addition, all the steel work on the bridges has been overhauled and painted.

Hawk's Crag Section (8 m. 78 ch. to 18 m.; length, 9 m. 2 ch.).—During the period 60 ch. of bushfelling and clearing was carried out, and this completed all bushfelling and clearing on the section.

The formation throughout the section is well in hand, 172,000 cub. yd. of material being shifted by co-operative parties. The formation on this railway generally is not suited to steam-shovel or other mechanical operations, as the cuttings are not adapted to their use, a great deal of the work consisting of rock-excavation. At the same time, air drills are largely used for drilling the shot holes and petrol locomotives for haulage purposes.

Conditions do not permit of a service road being constructed on the side adjacent to the railway, on account of the precipitious nature of the gorge; and all plant and material therefore has to be transported across the Buller by boats and ropeway from the Main Road on the opposite side of the river.

Large bank at 11 m. 45 ch. to 11 m. 54 ch., containing 40,000 cub. yd., requires filling as soon as possible, to allow platelaying to proceed as far as the shingle-pit at Tiroroa, when ballasting can be put in hand. To obtain material to fill this bank several cuttings back to 11 m. 10 ch. have been reserved and are now being vigorously attacked. Two petrol locomotives are employed conveying the excavated material to the filling, and to further increase the rate of tipping, it has been arranged to put in hand several cuttings on this length at the same time, by laying the service trams round the sidling from one cutting to the next, thus linking up the several cuttings being excavated, and enabling them all to be worked simultaneously.

At two other points on this Hawk's Crag Section petrol locomotives are being economically employed in the conveying of material from cuttings to fillings. The first is at 14 m. 52 ch. where filling 14 m. 45 ch. to 14 m. 52 ch. is obtained from cutting 14 m. 52 ch. to 14 m. 65 ch.; and the other at 17 m. where excavated material from cuttings 16 m. 65 ch. to 16 m. 75 ch. is hauled to fill a bank extending from 17 m. 3 ch. to 17 m. 13 ch.

By the time these banks have been constructed all the remainder of the earthwork on this section will have been completed, and platelaying will be under way. A considerable number of slips are anticipated, but these will also be dealt with before the larger cuttings have been put through.

A start has been made with the erection of the Cascade Creek Bridge at 9 m., which consists of five 80 ft. and one 40 ft. steel span on concrete-cylinder piers.

The erection of staging is in hand, and all material has been received for the construction of the concrete cylinders.

Owing to the transport difficulties mentioned above, it will be necessary to transport all bridge materials by rail from the railhead, and therefore, in order to enable the work ahead to be facilitated to give access to different small bridge-sites, and to lead spoil from various cuttings to fillings further along the line, it has been necessary to construct a number of temporary bridges which will be replaced by the permanent structures as the railhead advances. Some of the principal of these are at 11 m. 34 ch., 100 ft. long; 11 m. 39 ch., 400 ft. long; 13 m. 23 ch., 60 ft. long; 14 m. 46 ch., 60 ft. long; 15 m. 52 ch., 350 ft. long; 15 m. 62 ch., 350 ft. long; 17 m. 13 ch., 130 ft. long.

Three culverts of varying sizes have been completed and the excavations and foundations for several others are in hand.

The approaches to tunnel at 13 m. 25·80 ch. to 13 m. 28·20 ch. are nearly completed, and driving will be commenced shortly.

At 13 m. 41 ch. a start has been made with the tunnel, a co-operative contract having been arranged for driving the bottom heading, the necessary compressor and hauling-plant having been set up. The approach cutting at the other end will shortly be completed, and then a start will also be made from that end to facilitate the completion of the whole tunnel as early as possible. The design of the concreting plant, which involves the provision of the necessary bins, crusher, and a wire-rope transporter for conveying the material across the river has been finalized, and a start has been made with the erection.

As the only suitable camping-grounds are situated on the road side of the river, it has been necessary to operate ten ferries to carry men backwards and forwards across the river daily, and, in addition to this, two suspension bridges of 336 ft. and 440 ft. spans respectively have been completed and a third, 672 ft. in length, is in hand.

A large up-to-date workshop (comprising blacksmith, fitters', and carpenters' shop and garage), with modern machine tools, has been erected at Tiroroa to deal with the machine repairs.

Six small 2 ft.-gauge petrol locomotives designed by the Department have been manufactured and supplied to these works. These locomotives are particularly suited to the conditions on this work, and have given every satisfaction.

The inevitable dislocation after the earthquake of the 17th June, 1929, retarded the work considerably, as a number of men left the works then, and others had to be temporarily transferred to the highway to cope with emergency conditions and damage there; in addition, the heavy rainfall, 158 in. for the year, hampered work considerably; nevertheless, good progress has been made and the formation work generally is well in hand.

Orikaka Section (18 m. to 27 m. 34 ch.; length, 9 m. 34 ch.).—This section was opened up during the latter half of the period, the final survey being only then completed, and 6 m. 31 ch. of bush felling and clearing have been carried out. There are 100 men engaged on the formation, 25,000 cub. yd. of material having been excavated during the period.

A start has been made with the culvert-work and plans are in hand for the Buller River Bridge, 600 ft. long, at 25 m. 42 ch.

Extensive borings were taken with a Keystone drill at this bridge-site to determine the depth of pier-foundations and the most suitable and economical type of structure.

At 26 m. 40 ch. the piers of the combined road and railway bridge had been erected some time ago for road purposes, the piers having at that time been made wide enough to accommodate both road and railway separately. The big earthquake damaged these piers considerably, and the work of repairing and restoring them is now approaching completion.

A contract was let for the steel girders for superstructure, and these are now coming to hand.

A large number of huts have been shifted from the Hawk's Crag Section, and a further three cottages, twenty-four huts, and twenty-four tents, with the necessary bath-houses, &c., have been erected to complete camps at 19 m., 23 m., 25 m. 10 ch., and 26 m. 36 ch.

The average number of men on the works throughout the period was 280, and at the present time 380 are employed.

South Island Main Trunk Railway—North End.

Kekerangu Section (56 m. to 63 m.; length, 7 m.).—On this section formation had previously been completed to 59 m. 27 ch., and 56 lb. permanent-way laid to this point.

During the period work has been vigorously prosecuted as far as 63 m., the formation being largely completed over this section with the exception of the Blue Slip. This slip extends from 60 m. 58 ch. to 61 m. 12 ch.

The formation is being carried through the slip generally in cutting, this cutting assisted by a system of subdrainage through the slip will, it is hoped, help to drain and stabilize a considerable portion of the overburden which is at present on the move, although it is anticipated that in any case the excavation will be heavy, the progress, so far, is satisfactory. This is the only really heavy piece of work on the section between Wharanui and the Clarence River, a distance of approximately 20 m.

Practically all the other formation on this section is through sand areas, which are being stabilized by the planting of marram-grass, and this will be followed up by other vegetation on the lines successfully adopted some years ago on the previous section. In addition, it is proposed to use the excavated spoil from the Blue Slip to clothe the banks over the sand areas on either side of it.

Eighteen culverts varying from 1 ft. 6 in. pipes to a 10 ft. arched culvert have been built, and temporary bridges have been erected over Woodside Creek at 56 m. 50 ch. and over Waima Creek at 59 m. 27 ch.

Owing to the close proximity of the road and railway it has been necessary to deviate the main highway in a number of places, 58 ch. of road-deviation having been completed and 32 ch. being in hand. 130 ch. of fencing have been erected, and platelaying in 70 lb. material has been completed from 59 m. 27 ch. to 60 m. 37 ch.

A great deal of general organization work incidental to the early stages of large construction work has been necessary; an office, four stores, carpenters' shop, blacksmith's shop, engine-shed, two garages, twenty-four single men's huts, twelve married men's huts, and three cookhouses having been erected in addition to the buildings already on the section at the end of last year.

The permanent-line survey and plans have been completed for the whole of this section.

Shades Section (63 m. to 68 m.; length, 5 m.).—Formation is now well in hand throughout the whole of this section; the cuttings are comparatively light; they are mostly through sand areas, and have consequently had to be protected by planting marram-grass. It is anticipated that as soon as the piers of the Kekerangu Bridge, which are just being put in hand, are completed, this section will be ready for platelaying, which can then proceed steadily.

Eighteen concrete culverts of varying lengths and sizes have been built, and the foundations for bridge-sites at 63 m. 15 ch. and 64 m. 6 ch. have been tested with the Keystone drill.

Road-deviation is in hand between 63 m. and 63 m. 10 ch., and as considerable beach-erosion has taken place adjacent to the main highway, which is on the seaward side of the railway, borings have been carried out with a Keystone drill to ascertain the depth of sand over the solid country in case remedial protective measures should be found necessary.

Fencing has been carried out where necessary.

Clarence Section (68 m. to 77 m.; length, 9 m.).—A start has been made with the formation of this section; two culverts have been put in, and 10 ch. of formation completed.

The total number of men employed at the end of the period was 313.

Survey: The permanent-line survey and plans have been completed, except for several deviations, as far as 85 m.

South Island Main Trunk Railway—South End.

Hawkswood Section.—Construction work on the south end of this railway began early in February of this year, when fifty men were despatched to the works. Temporary buildings to house the office, bulk-store, cement-shed, blacksmiths' shop, &c., were erected. Workers' accommodation to the extent of sixty-nine single huts, two married quarters, and two hundred tents with wooden frame and floors have so far been provided. The work of extending the accommodation is proceeding, and a camp water-supply and drainage for Parnassus Camp is being provided. The main line has been extended from the Parnassus Station yard, and two temporary loops laid to facilitate the handling of service material. The usual construction plant on works of this standard is being assembled and put into use, including steam-shovels, locomotives, concrete-mixers, &c.

Most of the heavy cuttings on the Hawkswood Section have been opened up, 36,000 cub. yd. of cutting has been run to bank, and an additional 12,000 cub. yd. of borrow has been put into the approach bank to the Leader River Bridge. Five circular concrete culverts up from 1 ft. to 2 ft. 6 in. in diameter have been placed and three concrete arched culverts built of width of 6 ft., 7 ft., and 9 ft. respectively. Two water-drives are in hand, and considerable stream-diversion and side-drain work has been done.

Conway Section.—A commencement has just been made with the opening-up of this section. Three cuttings have been started and side-drain and creek-diversion work put in hand.

The total number of men employed at the end of the year was 233.

SURVEYS OF NEW LINES UNDER CONSTRUCTION, NEW RAILWAYS, ETC.

Pokeno to Paeroa Railway.

Trial surveys, totalling 10 m. 51 ch. have been carried out with a view to improving the location of the Pokeno to Paeroa Railway as previously planned. These surveys have resulted in the elimination of two bridge crossings of the Piako River, and in the saving of considerable earthwork quantities at the crossing of the large peat swamp at Waitakaruru.

Plans and reports have been prepared.

Gisborne-Wairoa Survey.

The pegging of the permanent line was completed during the year, the portion that had remained to be done being over some of the rough country between Waikura and Kopuawhara.

A deviation from the original location, giving a direct route into Gisborne alongside the Awapuni Lagoon, was surveyed and, as it showed considerable advantages over the original route, it was adopted and pegged ready for construction. The effect of this change in location is to shorten the through distance to Gisborne by rail by some 5 m., the length to be constructed, however, remaining the same.

Midland Railway.

During the year the permanent survey was completed to 86 m., 3 m. beyond Murchison, and the trial line is complete to 93 m. The balance of the permanent survey between 86 m.–93 m. is being proceeded with, and the completion of the trial survey between 93 m. and the Inangahua Junction will be put in hand shortly.

South Island Main Trunk Railway.

Two survey parties have continued the work of locating and permanently pegging this railway. The party working from the north end has completed the permanent survey to the 81 m., and a further 5 m. to 86 m. is almost completed. The trial survey has been completed from 86 m. to 89 m., and a start will shortly be made with permanent pegging.

The country between 81 m. and 89 m. is very rugged, and a great deal of work has been necessary to get the best location.

At the southern end, the railway has been located and permanently pegged for 7 m. over the Hawkswood and Conway Sections, and trial-line work has extended for some miles beyond that.

CONSTRUCTION AND MAINTENANCE OF ROADS AND BRIDGES.

Huehue–Waimatenui (Bay of Islands County).—Formation has been carried out on this road to 18 ft. width for a distance of 9 m., and 1 m. 30 ch. further is now in hand. Material is on order for Huehue Bridges and joists are on the site; 11 m. 45 ch. of engineering survey have been carried out.

Waikare–Kawakawa (Bay of Islands).—5 m. 70 ch. of road has been widened from 10 ft. to 15 ft., and a contract has been let for erection of four bridges.

Kirikopuni–Parakao (Hobson and Whangarei Counties).—During the winter large slips came done on this road, and these have been cleared. Some reconditioning of metalling was carried out, and the whole road was handed over to the local bodies by the end of March. This road has been recommended for inclusion in the main-highways system.

Waimamaku – Donnelly's Crossing (Hobson and Hokianga Counties).—The remaining bridges, totalling 193 ft. in length, were erected. On the Waipoua River Bridge considerable difficulty was experienced and a concrete pier had to be substituted for a pile pier. The road has been cleaned up and maintained by the Department. This road is also recommended for inclusion in the main-highways system.

Hawkins Bridge (Hokianga County).—A 70 ft. bridge in New Zealand timbers has been erected with 12.ft. approaches.

Iwitaua Road (Hokianga County).—Formation has been widened to 18 ft. over a length of $2\frac{3}{4}$ m.; 2,030 cub. yd. of slips cleared; 1 m. 35 ch. metalled 9 ft. by 9 in.; three bridges, totalling 102 ft., were erected and approaches formed.

Mangamuka – Victoria Valley (Hokianga County).—3,904 cub. yd. of shingle has been placed on the road. One 20 ft. platform bridge has been erected, and the Mangamuka Bridge was redecked and painted. Several cuttings were also widened.

West Coast Road: Tapuwae–Whakarapa (Hokianga County).—Engineering surveys have been carried out for a distance of 5 m. 21 ch.; 4 m. of road has been widened to 18 ft.; and the remainder is in hand. The bridge-work will be put in hand immediately.

Whakarapa – Te Karaka (Hokianga County).—Stone-wall approach to Te Karaka Wharf was erected 30 ch. long, 4,644 cub. yd. of filling placed, and the whole metalled to full width. The road has been handed over to the local body for future maintenance.

Whangape–Rotokakahi (Hokianga County).—The erection of the Awaiti Bridge, 60 ft., and Mangonuiowae Bridge, 120 ft., in rolled-steel joists and New Zealand timbers has been completed, together with the approaches.

Duncan Road (Mangonui County).—10 m. of road has been widened to 18 ft. and 2 m. 40 ch. base-course-metalling laid. Engineering surveys have been completed for a distance of $10\frac{1}{4}$ m.

Lake Ohia – Taipa (Mangonui County).—31 ch. of metalling has been completed 9 ft. by 9 in.

Oruru – Fern Flat – Mangamuka (Mangonui County).—1 m. 16 ch. widened to 18 ft., one 30 ft. bridge erected in New Zealand timbers, with 1,200 cub. yd. approaches, and 1 m. 23 ch. of road were metalled 9 ft. by 9 in.

Waipapakauri–Tangoake (Mangonui County).—$24\frac{1}{2}$ m. of road was widened to 18 ft. and 8 m. 46 ch. sanded 9 ft. by 9 in.

Paparoa–Marereturu–Keays (Otamatea County).—3 m. 60 ch. formed 20 ft. wide, and culverted. Reinforced concrete culvert 8 ft. by 7 ft., 40 ft. long, has been completed. Engineering surveys have been carried out for a distance of 10 m. 60 ch.

Kiripaka – Ngunguru Road (Whangarei County).—4 m. 62 ch. of road has been widened to 18 ft.; and two bridges in rolled-steel joists and mixed Australian hardwood have been erected, totalling 50 ft. Tenders have been called for erection of the last bridge over the Waitohi Stream. 4 m. 62 ch. of engineering surveys have been carried out.

One Tree Point – Ruakaka (Whangarei County).—1 m. 73 ch. of road re-formed and base-course metalling laid 12 ft. by 6 in. for 2 m. 70 ch.

Russell–Whangaruru (Whangarei County).—3 m. 26 ch. formed 18 ft. wide and 9 m. 28 ch. base-course metalling placed 12 ft. by 6 in. Three bridges in rolled-steel joists and mixed Australian hardwood have been erected, totalling 220 ft. The through connection has now been made.

Taumaterau – Whangarei Heads (Whangarei County).—Formation widened to 18 ft. for a distance of 8 m. 28 ch., 10 ch. of retaining-wall has been built, and 9 m. 4 ch. of road metalled, thus completing the metalling to Ocean Beach.

Waipu Gorge (Whangarei County).—14 ch. widened to 18 ft. and 20 ch. base-course metalling laid 12 ft. by 6 in. Four bridges in rolled-steel joists, concrete decking on concrete piles, totalling 310 ft. by 20 ft. wide, have been erected, and the fifth is in hand.

Mangaiti Bridge (Whangaroa County).—This bridge, 55 ft. long, has been erected in rolled-steel joists and New Zealand timbers on concrete abutments.

Waiare–Okaihau (Whangaroa County).—6 m. of road has been widened to 18 ft. and culverted. Borings have been taken at Kaeo and Ihumia Bridge sites.

Ararua Road (Otamatea County).—3 m. of this road has been metalled and $\frac{1}{2}$ m. formed 16 ft. wide.

Helena Bay – Whangaruru (Whangarei County).—2 m. 52 ch. formed 20 ft. wide; 40 ch. metalled; and two bridges erected, totalling 35 ft.

Whareora–Horahora (Whangarei County).—64 ch. of road has been formed 16 ft. wide and a platform bridge, 20 ft. long, erected.

Colville to Port Jackson (Coromandel County).—10 ch. of track has been constructed near the granite quarries to connect the old road to the new road as previously constructed.

Coromandel – Whangapoua (Coromandel County).—A commencement has been made on the construction of this deviation to give work for 100 unemployed from Auckland. This road is $2\frac{3}{4}$ m. in length, of heavy construction and will give access to Kennedy Bay, Whangapoua, and Kuaotunu; 64 ch. has been completed, and two bridges, totalling 47 ft. have been erected.

Hikuai–Tairua–Whenuakite Road (Coromandel County).—Formation has been completed from Hikuai in Thames County to Whenuakite, a total distance of 16¾ m. This completes formation for the East Coast route on the Coromandel Peninsula from Waihi to Mercury Bay.

Paul's Creek Bridge (Coromandel County).—Erection of this bridge, consisting of one 40 ft. span with concrete abutments, rolled-steel joists and timber superstructure, with 10 ft. 6 in. roadway, was completed during the year.

Awhitu-Waiuku Main Road (Franklin County).—20 ch. of new formation were completed, and 4 m. 41 ch. of road widened to 18 ft.

Happy Valley – Mangatawhiri (Franklin County).—45 ch. of road has been formed 20 ft. wide. This is part of the main stock route.

Hunua to Cleveland (Franklin County).—1 m. 58 ch. of new formation completed, together with culverts. This is part of the main Waikato–Auckland stock route, which the Department is endeavouring to link through to relieve the highway of stock traffic.

Paparimu–Mangatawhiri and Paparimu–Otau (Franklin County).—A total length of 3 m. 40 ch. has been widened to 18 ft. This road gives access to a comparatively undeveloped portion of Franklin County.

Kerepeehi Block Roads (Hauraki Plains County).—The base course of metal has been completed for a distance of 3 m. 10 ch., and the top course 2 m. 33 ch. A total of 6,127 cub. yd. of metal has been spread on the road.

Ngatea to Kaihere Landing (Hauraki Plains County).—64 ch. has been re-formed and metalled during the year.

Patetonga Riding Roads – Through Main Road (Hauraki Plains County).—During the year 3 m. 25 ch. top-course and 4 m. 50 ch. base-course metal were laid.

Awaroa Bridge (Kawhia County).—Bridge consisting of one 40 ft. and two 30 ft. rolled-steel-joist spans was completed during the year.

Taumatatotara East (Kawhia County). — 53 ch. of formation, widening, and culverting were completed.

Clevedon–Brookby (Manukau County).—1 m. 60 ch. of road was widened to 18 ft. This is part of a stock-route which has been unsafe on account of sharp curves and narrow formation.

Walsh's Road (Manukau County).—76 ch. formation 16 ft. wide and culverting completed. This is part of the main stock-route, and connects outlying areas in Manukau and Franklin Counties.

Hunua–Clevedon (Manukau County).—38 ch. of widening has been completed.

Buckland Road (Matamata County).—122 ch. road has been metalled 10 ft. by 9 in.

Okoroire to Tapapa (Matamata County).—172 ch. of road metalled 12 ft. by 8 in.

Waiomo Stream Bridge (Matamata County).—Second-class bridge of two 16 ft. and one 25 ft. spans on driven piles was completed.

Matangia Road (Ohinemuri County).—1¾ m. of road has been completed and considerable flood-damage repairs have been effected. The road is now practically ready to be handed over to the County Council for future maintenance.

Waihi to Whangamata (Ohinemuri County).—Bridges over the Waiharakeke (100 ft. span) and over Ramarama Stream (40 ft. span) have been completed. There is only one bridge over the Whiritoa Stream required to complete all work on this road.

Carlins Road (Otorohanga County).—Bridge consisting of one 25 ft. and two 10 ft. spans in mixed Australian hardwood, with driven piles, has been completed, together with 10 ch. of approaches. 3 ch. of road metalled.

Mangatutu Stream Bridge (Otorohanga County).—Three-span-rolled-steel-joist bridge, totalling 101 ft. 3 in. long, on concrete piles, was completed.

Puketawai Road (Otorohanga County).—86 ch. of road has been metalled 9 ft. by 8 in., and necessary culverts placed.

Horrell's Road (Piako County).—40 ch. of road has been metalled 10 ft. by 6 in.

Pakarau Soldiers Settlement Road (Piako County).—1 m. 56 ch. of road has been metalled during the year.

Tauhei Road (Piako County).—53 ch. of road has been metalled during the period.

Glen Murray to Waimai via Naike (Raglan County).—114 ch. of road has been metalled 10 ft. by 8 in.

Port Waikato – Tuakau Bridge (Raglan County).—3 m. 25 ch. of road was widened to 18 ft. 2 m. 16 ch. has been lightly surfaced with scoria, and 63 ch. stone wall has been completed.

Pukekawa-Rangiriri (Raglan County).—5 m. of new 14 ft. formation and 1 m. 53 ch. of metalling has been completed.

Te Puroa Road (Raglan County).—85 ch. of road has been metalled 10 ft. by 7 in. Further widening of present formation is in hand.

Waikaretu to Port Waikato (Raglan County).—10 m. 5 ch. of road has been widened to 16 ft.

Glenny's Bridge (Rodney County).—This bridge, 100 ft. in length, which was completed during the year, consists of rolled-steel joists on concrete piers.

Puhoi to Ahuroa (Rodney County).—This road was widened for a distance of 96 ch., and 50 ch. of metalling has been completed.

Hikuai–Whangamata Road (Thames County).—The bulk of formation of this road has been completed, and the following bridges have been erected: Otuwheti Bridge, 60 ft. span; Wharekawa Bridge, 145 ft.; Boom Creek, 40 ft. This completes all work on this road.

Hikutaia Stream Bridge (Thames County).—A new bridge has been constructed consisting of two 45 ft. rolled-steel-joist spans on concrete piers. In addition to this 15 ch. of formation has been carried out. This bridge gives access to the Upper Hikutaia and Whangamata Valleys, and has been handed over to the control of the Thames County.

Tapu to Coroglen (Thames County).—43 ch. of road has been metalled during the year. This completes the total distance of 10 m. 6 ch., and the road is now reasonably passable for all-weather traffic.

Kopuku to Whangamarino Falls (Waikato County).—15 ch. of 18 ft. formation was completed during the year.

Rutherford Road (Waikato County).—119 ch. of road was metalled 9 ft. by 9 in. Further proposals to complete a gap of 107 ch. are in hand.

Ten Foot Road (Waikato County).—192 ch. of road metalled 9 ft. by 8 in. The road has now been metalled throughout.

Webster's Gate to Harris Crossing (Waipa County).—150 ch. of road was metalled 10 ft. by 7 in. during the year.

Brooklyn to Huia (Waitemata County).—This road was widened for a distance of 177 ch., and 29 ch. of metalling 9 ft. by 7 in. was completed.

Wainui to Tahekeroa (Waitemata County).—130 ch. of heavy road-formation was completed by relief workers, and necessary culverts were placed.

Awhitu Central to Orua Bay (Waitemata County).—This road was widened to 18 ft. for a distance of 3 m. 15 ch. It gives improved access to dairy holdings from main road and from wharves on Manukau Harbour.

Orakei Waterfront Road (Waitemata County).—No. 2 bridge has been raised and filling of approaches is in hand. The stone pitching of the abutments of No. 1 bridge is now practically completed, and the only protection work remaining is the ends of No. 2 bridge. The road is being formed as a waterbound macadam road on a hand-packed spall foundation and finally a 2 in. wearing-coat of metal penetrated with bitumen is being applied. The kerbing and channelling has been extended for a further 146 ch.

Storm-water drainage and cesspits have been connected through footpaths by 9 in. concrete pipes draining out through the sea-wall. These have been laid at approximately 4 ch. intervals.

The overhead footbridge at Point Resolution was completed and painted. No. 1 bridge, which is 160 ft. long and 62 ft. wide, and founded on seventy-nine 1 ft. 4 in. octagonal piles has been completed. These piles were driven in holes chopped for 6 ft. in the solid papa, and the piers, which were all in the tidal range, were built in watertight boxing to prevent any action of the swiftly moving current on the cement. At No. 2 bridge 113 of the 124 piles have been driven, and a start has been made on bending the steel and erecting the boxing for the construction of abutment J.

Whakatakataka Bay Road (Waitemata County).—The carriageway of this road was completed and sealed to the same standard as the Orakei Waterfront Road, and it has been open to the public throughout the year.

Purewa Stream Bridge (Waitemata County).—Owing to bad foundations the progress on this work has been slow. Thirty-four piles have been driven and of these eleven were extended from 55 ft. to 80 ft. after the piles had been driven as low as possible. Pier E is half complete, and pier F and abutment G are now completed.

Orakei Block Roads (Waitemata County).—During the year a further mile of streets was constructed, complete with watermains, kerbs, channelling, &c., to city standards, and handed over to the Auckland City Council, making a total to date of approximately 7 m. In addition, special attention was paid to storm-water drainage and a reinforced-concrete culvert was constructed dealing with storm-water from some 300 acres. Various sizes and length of this culvert are as follow: 7 ft. by 4 ft., 670 lin. ft.; 5 ft. by 4 ft., 720 lin. ft.; 4 ft. by 3 ft., 784 lin. ft.; 4 ft. by 2 ft., 514 lin. ft.; and 140 lin. ft. of 1 ft. 6 in. concrete pipes.

Opotiki to East Cape (Opotiki County).—The formation has been completed from Motu Bridge towards Te Kaha as a relief work. 5 m. has been formed 16 ft. wide during the year, and the whole 13 m. 49 ch. has been handed over to the Opotiki County Council for maintenance. Culverts have been placed totalling 1,114 lin. ft., including one arched concrete culvert 6 ft. in diameter. The Haparapara Bridge has been commenced, and a contract has been let for two other bridges at 3 m. 45 ch. and 3 m. 52 ch. pegs. Motor traffic can now go as far as Te Kaha when the weather is fine and the streams low.

Te Kaha to Orete (Opotiki County).—The construction work has been continued as a relief work and the formation from Te Kaha to 11 m. 50 ch. has been practically completed. The gangs are now working between 11 m. 50 ch. and 13 m. and the work is well in hand. The bridge over the Te Wai-o-poahu Stream has been completed, and consists of three spans, two 30 ft. rolled-steel-joists spans and one 61 ft. hardwood-truss span on hardwood piles, a total length of 121 lin. ft. The Whitianga Bridge has also been erected. It is 93 ft. long, consisting of two 16 ft. spans and one 61 ft. hardwood-truss span on concrete piers and abutments. Plans have been prepared for four other bridges on this section. All of these bridges will be 40 ft. long.

Motu to Whitikau via Maromoku (Opotiki County).—The Opotiki County Council has formed 45 ch. of road to 10 ft. wide and erected a 25 ft. stringer bridge.

Opotiki to Matawai via Waioeka (Opotiki County).—The relief workers on this road are making good progress, and have widened 5 m. 42 ch. from 10 ft. to 18 ft. during the year. 2 m. 55 ch. of road has been metalled 12 ft. wide. Concrete-pipe culverts have been laid totalling 1,719 lin. ft.

Manganuku Bridge (Opotiki County).—This bridge consisting of one 31 ft. rolled-steel-joist span and one 81 ft. hardwood-truss span on concrete piers and abutments has been completed.

Te Waiti Bridge (Opotiki County).—Erection of this bridge, consisting of two 40 ft. and one 35 ft. rolled-steel-joist and one 18 ft. hardwood-stringer span on hardwood pile piers and concrete abutments has been completed. 10 ch. of approaches has also been formed.

Waioeka to Opato Junction to Redpaths (Opotiki County).—Work completed during the year consists of 14 ft. formation totalling 41 ch., erection of a 16-ft.-span bridge, and placing of 54 lin. ft. of culverts.

Okere to Hamurana (Rotorua County).—The Department has effected considerable improvement in easing bad bends and has widened from 12 ft. to 16 ft. for a distance of 1 m. 20 ch. This work was carried out with relief workers.

Rotorua to Atiamuri (Rotorua County).—During the year the Department opened up relief works to improve access to Guthrie Settlement. Work has been pushed ahead, and to date 4 m. 42 ch. has been widened and re-formed 16 ft. wide. 53 ch. has been surfaced with pumice.

Rotorua to Taupo (Rotorua and Taupo Counties).—This work also is manned by relief workers, one hundred men being at work and a further fifty will be placed in the near future. Construction work is in hand for a distance of 4½ m.

Tauranga to Oropi (Tauranga County).—The Tauranga County Council has completed metalling 10 ft. by 9 in. for a total distance of 4 m. 30 ch.

Awakaponga Bridge (Whakatane County).—The Whakatane County Council erected this bridge 25 ft. long in Australian hardwood on concrete abutments, and formed and metalled 4 ch. of approaches.

Maungaroa to Taneatua (Whakatane County).—The Whakatane County Council has cleared and formed 3 m. 58 ch. of road 20 ft. wide, including 928 lin. ft. of culverts.

Western Drain Road (Whakatane County).—The final 3 in. of metal has been spread 10 ft. wide over a distance of 48½ ch.

Glenroy Road (Cook County).—The Cook County Council metalled 2 m. 12 ch. of this road during the year.

Hangaroa to Tahora (Cook County).—60 ch. of formation and 3 m. 28 ch. of metalling were completed.

Hangaroa to Waikaremoana (Cook County).—This road was widened from bridle-track to 14 ft. dray-road for a distance of 50 ch.

Manutuke to Wairoa via Mangapoike (Cook County).—2 m. 4 ch. of bottom-course metalling was completed, thus giving metalled access to the last settlers on this road.

Kopuapounamu Bridge (Matakaoa County).—A 110 ft. span suspension bridge with steel-stiffening truss, with a 15 ft. and a 20 ft. approach stringer span, was completed.

Hick's Bay to Whangaparaoa (Matakaoa County).—This road was formed for a further 3¾ m., and surveys for further work are in hand.

Kokomoku Road (Matakaoa County).—This road was widened from an 8 ft. track to a 14 ft. dray-road for a distance of 107 ch.

Anaura Road (Waiapu County).—This road was formed for a distance of 3 m. 5 ch., and 3 m. 28 ch. of metalling was completed.

Makarika Horehore (Waiapu County).—1¾ m. of 8 ft. track has been formed, giving access to the Makarika Bridge.

Makarika Bridge (Waiapu County).—Plans for a 495 ft. span suspension bridge with hardwood truss have been prepared. Material is on site and work has commenced on the co-operative-contract principle.

Takapau Ihungia (Waiapu County).—1 m. 70 ch. of metalling was completed.

Rangitukia Road (Waiapu County).—This road was metalled for a distance of 134 ch.

Armstrong Road (Waikohu County).—This road has been metalled for a distance of 110 ch.

Otipi Block (Waikohu County).—The 8 ft. bridle-track formation was continued for a further 39 ch., and 40-ft.-span bridge was completed during the period.

Rakauroa to Tahora (Waikohu County).—The formation of this road is being carried out as a relief work. 2 m. 58 ch. of formation was completed during the year, and connects up Rakauroa and Te Wera. A small bridge, 35 lin. ft., was erected at Foster's.

Matawai to Waioeka Road (Waikohu County).—Formation of this road to 18 ft. wide was completed to the Waikohu County boundary as a relief work. A further length of 2 m. 64 ch. was completed in the Opotiki County.

Opotiki to Matawai via Waioeka (Waikohu County).—2 m. 66 ch. formation was completed from the county boundary towards Opotiki. This was also done as relief work.

Erua Road (Kaitieke County).—1 m. 60 ch. of metalling was completed.

Kawautahi Valley (Kaitieke County).—4 m. 77 ch. of engineering surveys, 4 m. 51 ch. of formation, 65 ch. of metalling, and 405 ft. culverting were completed during the year.

Mangatepopo Road (Kaitieke County).—Work completed during the year consists of 1 m. 26 ch. of road-formation and the placing of 678 lin. ft. of culverts.

Kokako Road (Kaitieke County).—Dray-road formation was continued for 4 m. 20 ch. during the year.

Te Rata Road (Kaitieke County).—1 m. 22 ch. of dray-road has been formed.

Haparua Road (Ohura County).—1 m. 66 ch. of formation and metalling has been completed during the period.

Miroahuiao to Matiere (Ohura County).—4 m. 68 ch. of formation has been completed and 1,667 ft. of culverts placed.

Ohura North of Paparata (Ohura County).—This road was widened over a distance of 4 m. 50 ch., and necessary culverts placed.

Ongarue to Waimiha (Ohura County).—3 m. 44 ch. of this road was reconditioned and metalled.

Tongaporutu to Mangaroa (Ohura County).—9 m. 53 ch. of engineering survey was carried out, 3 m. 64 ch. widened to dray-road width, and 720 ft. culverts placed during the year.

Turoto Road (Ohura County).—2 m. of metalling has been completed.

Waikaka Road Bridges (Ohura County).—Five bridges, totalling 215 ft., were erected during the year.

Kokakonui Road (Taumarunui County).—4 m. 3 ch. formation and 1 m. of metalling were completed during the year.

Kururau Road (Taumarunui County).—4 m. 10 ch. of dray-road was formed, 1 m. 42 ch. metalled, and necessary culverts placed during the year.

Mangakahu Valley Road (Taumarunui County).—1 m. 3 ch. of dray-road formation was completed, two bridges totalling 140 ft. erected, and 307 ft. of culverts placed.

Ongarue River Road (Right Bank), (Taumarunui County).—6 m. 65 ch. of dray-road formation was retrimmed, pumiced, and metalled.

Wanganui River Road (Right Bank), (Taumarunui County).—2 m. 10 ch. of formation and 195 ft. culverts were completed during the year.

Kokomiko Road (Taumarunui County).—4 m. 16 ch. of metalling was completed during the year.

Fullerton's Road (Waitomo County).—2 m. 56 ch. was surveyed and formed during the year.

Kahuwera to Mapara (Waitomo County).—5 m. of engineering survey has been carried out, and 3 m. of road was widened to dray-road width and metalled during the year.

Mangatea Road (Waitomo County).—This road was metalled for a distance of 2 m. 30 ch.

Paikaka Road (Waitomo County).—2 m. of engineering survey, 1 m. 72 ch. of formation, and 57 ch. of metalling were completed.

Mangapeehi to Poro-o-Tarao (Waitomo County).—1 m. of road was surfaced and three bridges, totalling 107 ft., were erected.

Te Mapara (Waitomo County).—30 ch. of engineering surveys, and 1 m. 40 ch. formation and metalling were completed during the year.

Waipapa Road (Waitomo County).—The dray-road was formed and metalled for a distance of 2 m. 30 ch. during the year.

Mangaoapa Road (Clifton County).—58 ch. at the south end was widened as a relief work, and a length of 1 m. 53 ch. is now in hand at the north end.

Okoke Road (Clifton County).—46 ch. of 12 ft. road-formation was completed and handed over to the Clifton County for future maintenance.

Waikaramarama Bridge No. 2 (Clifton County).—This bridge, which was completed during the year, consists of a 40 ft. rolled-steel-joist span.

Kaweora Road (Egmont County).—2 m. 60 ch. of 14 ft. dray-road formation was completed as a relief work during the year.

Okahu Road (Egmont County).—The Okahu Bridge on this road, consisting of a 40-ft. rolled-steel joist on concrete abutments was erected and also a similar bridge of 30 ft. was completed over the Pungaereere Stream.

Wiremu Road (Egmont County).—This work was carried out by relief workers, 45 ch. of 14 ft. road being formed during the period. Besides this, two bridges of 40 ft. rolled-steel-joist spans were erected over the Oaoiti and Oaonui Streams, and a 25 ft. hardwood-beam span was erected over the Otahi Stream. There are also seven road bridges under construction, most of them nearing completion.

Matau Road (Stratford County).—This road was widened to 14 ft. for a distance of 2 m. 71 ch.

Stratford Mountain House Road (Stratford County).—The first three miles from the Radius Line to the Mountain House has been widened to 18 ft. and metalled, while the continuation up to the plateau is under construction. These works are being carried out by relief workers.

Carrington Road (Taranaki County).—2 m. 75 ch. on the Saunders to Pitone Road section has been widened to 14 ft.

Mangapurua Valley Road (Waimarino County).—2 m. 46 ch. of 12 ft. road has been formed. A bridge has also been erected consisting of one 40 ft. and two 15 ft. spans over the Purua Stream.

Waipapa Valley Road (Waimarino County).—The 12 ft. formation has been continued for a further 40 ch.

Wangaehu River Bridge, Field's Track to Rangiwaea (Wanganui County).—A suspension bridge of 170 ft. span has been completed.

Wangaehu Valley Road (Wanganui County).—This road has been formed 16 ft. wide for a distance of 3 m. 26 ch. during the year.

Wanganui River Road (Left Bank), Ranana to Pitangi (Wanganui County).—8 m. 44 ch. of 14 ft. road has been formed, including 2,156 ft. of water-tunnels.

Jerusalem to Ranana (Wanganui County).—3 m. of 14 ft. dray-road formation has been completed. A bridge, consisting of an 80 ft. truss, was erected over the Oao Stream.

Tangarakau River Bridge, Access to Anderson's.—A suspension bridge of 160 ft. span has been completed during the year.

Makahu Stream Bridge, Makahu Road.—A bridge, consisting of one 40 ft. rolled-steel-joist span and two 15 ft. hardwood spans was erected.

Mangahe (Lower), (Dannevirke County).—This road has been formed for a distance of 2 m. 6 ch. to connect up with the Te Uri Road. The construction was very heavy, involving some 20,000 cub. yd. of earthwork, the bulk of which was sandstone.

Mangatakato Stream Bridge (Waitahora Road), (Dannevirke County).—A ferro-concrete bridge of 45 ft. span, with a 12 ft. roadway was completed during the year.

Tongoio Settlement Road (Hawke's Bay County).—3 m. 60 ch. of metalling was completed, giving access to Crown Settlers, and linking up at both ends of the Napier to Gisborne Main Highway.

Tutira to Pohokura (Hawke's Bay County).—1 m. 30 ch. was formed during the year, and this completes the road to Mohaka River, giving several settlers access. 1 m. of road was also metalled 7 ft. 6 in. by 5 in.

Waikare Inland Road (Hawke's Bay County).—This work was carried out by the Hawke's Bay County Council, and included metalling of 4 m. 54 ch., 8 ft. by 6 in.

Ardkeen Settlement Road (Wairoa County).—The work on this road was carried out by using unemployed workmen and is now practically completed. The work completed consists of 4 m. 52 ch. of 12 ft. formation, together with placing concrete-pipe culverts totalling 402 lin. ft.

Ruakituri to Waimana (Wairoa County).—This work was carried out as a relief work, the 14-ft.-wide formation being extended for a distance of 3½ m. Plans have been prepared for the Mangatahi Stream Bridge.

Waikaremoana Lake House to Hopuruahine (Wairoa County).—Work on this road was continued during the year, with the result that the whole length of 30 m. has been completed. The following bridges have been built—Aniwaniwa Bridge, 104 ft. long; Mokau Bridge, 64 ft.; Waiotukupuna Bridge, 75 ft.; Hopuruahine Bridge, 95 ft. In addition two small bridges, averaging 40 ft. in length, have been erected. The road has been completed to a width of 14 ft.

Willow Flat Road (Wairoa County).—1 m. 30 ch. of dray-road formation, 14 ft. wide, was completed during the year.

Ti Tree Point to Akitio Road (Akitio County).—3 m. 37 ch. of metalling was completed on the Glenora–Eskdale Section, 60 ch. on the Glenora Section, and 3 m. 72 ch. on the Akitio River Road. A small reinforced-concrete bridge, 12 ft. span, was erected and approaches formed.

Whakataki to Mataikona Road (Castlepoint County).—4 m. 60 ch. of dray-road formation was completed by relief workers during the year.

Tinui to Pakowai Road (Castlepoint County).—Slips were cleared over a length of 2 m. 30 ch. 48 ch. of heavy road formation was completed.

White Rock Road (Featherston County).—1½ m. of heavy formation was completed during the year.

Lake Ferry to Cape Palliser Road (Featherston County).—2 m. of heavy road-formation was carried out by relief workers.

Pahao to Glendhu Road (Featherston County).—3 m. of widening to dray-road from 6 ft. track was completed during the year.

Akitio River Bridge (Akitio County).—This bridge was erected during the year, and consists of two 100 ft. truss spans and one 30 ft. rolled-steel-joist span. Approaches have been formed and metalled.

Range Road North (Akitio County).—2 m. 56 ch. of 8 ft. stock-track was completed.

Waitarere Beach Road (Horowhenua County).—2 m. 50 ch. of formation and metalling were completed.

Westella Estate Road (Kairanga County).—50 ch. of formation and metalling were completed and a stringer bridge of one 12 ft. span erected, over the Taonui Stream.

Blenheim to Hope Junction via Tophouse (Marlborough County).—The formation and metalling have been completed. The following bridges were erected: Black Valley Bridge one 35 ft.; and Homestead Creek Bridge one 30 ft., rolled-steel-joist spans on mass-concrete abutments; Howard River Bridge, consisting of one 100 ft. truss span, and Speargrass Creek Bridge one 80 ft. mixed-Australian-hardwood truss span on mass-concrete abutments and gabion protection for approach-banks.

Earthquake Damage, Nelson District.—The county roads were severely damaged by the earthquake of the 17th June, 1929, and heavy restoration work has been carried out by the Department and local bodies concerned.

Riwaka to Sandy Bay Road (Waimea County).—2 m. of 10 ft. formation has been completed. A bridge of one 22 ft. span on mass-concrete abutments has been erected, and the formation of the approaches is now in hand.

Korere to Tophouse Road (Waimea County).—The relief work undertaken by the Department on this road was put in hand towards the end of the year, and work has been commenced at the Tophouse end, 52 ch. being widened.

Picton to Grove Road (Marlborough County).—This work was undertaken as a relief work and has been completed, widening and improvements to curves being carried out for a distance of 3 m. 32 ch.

Earthquake Damage, Greymouth District.—Very considerable damage was caused to 60 m. of roads in the Buller County and the greater part of the restoration work has been carried out, involving renewal and repair of bridges, culverts, filling of fissures and subsidences, and the removal of slips. Floods in July and December caused further damage to the roads at Seddonville and Karamea, involving additional restoration work, which has now been completed.

Little Wanganui to Kongahu (Buller County).—This road was used as a detour road owing to the destruction of the main highway by the earthquake, and was improved by metalling 5 m. 41 ch. 12 ft. wide.

Oparara River to Simpson's (Buller County).—This is on the coast route to Heaphy, and part of the future Karamea to Collingwood Road. Four timber bridges, aggregating 141 lin. ft. have been built, and one 18 ft. culvert placed.

Access to Karamea (Buller County).—A pack-track 17 m. long was formed approximately on the line of road from Mokihinui to Te Namu which was destroyed by the earthquake.

Westport to Greymouth Coast Road (Buller County).—Unemployment relief work was carried out by the Department during the year. 50 ch. of new formation was completed, also 3 m. 30 ch. of metalling. The Punakaiki Stream Bridge, 162 ft. long, and the Porarari Stream Bridge, 208 ft. in length, were completed during the year. The bridge over Fox's River, 208 ft. long, is being expedited as much as possible. All material has been delivered at the site and the construction of the left-bank concrete abutment is well under way, and the piles have been driven for the first pier. The completion of the above works and bridges, with the use of the upper ford on Fox's River has made the Coast Road available for through traffic.

Grey Valley to Taramakau Road (Grey County).—The approaches to Crooked River Bridge were completed. Access to Rotomanu and Inchbonnie Settlements is being further improved by the erection of four additional bridges—viz., Deep Creek, Rough and Tumble Creek, Dry Creek, and Camp Creek. These are all under construction.

Lake Brunner to Inchbonnie Road (Grey County).—This work was undertaken as relief work. 31 ch. of new formation was carried out in heavy rock.

Haupiri Junction to Haupiri (Grey County).—This road is being extended to the Kopara Settlement. 2 m. 52 ch. of formation and 2 m. 56 ch. of metalling were completed.

Lady Lake to Bell Hill (Grey County).—1 m. 19 ch. of formation and 77 ch. of metalling were completed on this road.

Murchison to Maruia Hot Springs (Springlands Junction to Hot Springs), (Inangahua County).—This is part of Lewis Pass Road. Relief workers were employed on the formation and metalling to the Springs, which is now completed. The work comprises 1 m. 26 ch. of formation, 7 m. 8 ch. of metalling, erection of five small bridges, totalling 108 ft., and sixteen culverts, totalling 380 ft. Plans and estimates have been prepared for the two remaining bridges.

Bruce Bay Inland Road (Westland County).—Access to Bruce Bay was completed by the formation of 2 m. 16 ch. of road by the Department.

Little Wanganui River Flood Protection Works (Westland County).—In order to prevent the Little Wanganui River breaking through into the La Fontaine Settlement at Hari Hari a main stop bank 45 ft. long with 15½ ch. of spur banks was built. The latter included a length of 558 lin. ft. of pile and gabion work. Two particularly heavy floods were experienced during the construction, both of which did considerable damage.

Great South Road (Westland County).—Relief workers have been employed on the 18 m. section between Waiho and Weheka. Access to the latter place and to Fox Glacier Tourist Resort has been considerably improved by the erection of three bridges; Docherty Creek, four rolled-steel-joist spans, length 150 ft.; Omoeroa Creek, four rolled-steel-joist spans, length 150 ft.; O'Connor's Creek, one 16 ft. stringer span; all on concrete abutments. The work is being continued on the 8 m. deviation of the Great South Road between Weheka and the Ohinetamatea. 3½ m. of bush-felling, 4 m. formation, and 1 m. metalling were completed.

Glynn Wye Road (Amuri County).—During the period 96 ch. of road were widened and small deviations in heavy side cuttings have been completed.

Tekoa Road (Amuri County).—A road-deviation 30 ch. in length has been formed 16 ft. wide in heavy side and block cuttings, mostly through rock. The work was carried out by unemployed labour.

McFarlane's Access Road Bridge (Cheviot County).—This bridge, 575 ft. long, consisting of 23 beam spans of 25 ft. on ironbark-pile piers and concrete abutments, was erected.

Parnassus to Waiau (Cheviot County).—A river-diversion of approximately 8 ch. in length was completed and a stopbank 100 ft. long constructed to protect the filling on part of this road. During the period several large slips which blocked the road at various points were cleared.

Crow's Hill Deviation (Geraldine County).—A road-deviation 35 ch. in length has been formed 16 ft. wide in heavy side cutting. This work was done by relief workers.

Gapes Valley Road (Geraldine County).—The grades on Woodside Cutting were lowered for a distance of 20 ch. and on Patrick's Cutting, 16 ch. The work consists of heavy block cuttings, and was carried out as a relief work.

Reid's Cutting (Geraldine County).—A road-deviation 20 ch. in length was formed 18 ft. wide in heavy side cutting, mostly limestone-rock formation.

Te Moana Gorge Road (Geraldine County).—225 ch. of old road has been widened and improved and 100 ch. of new road has been formed 14 ft. wide, mostly through rock.

St. Andrew's Hill Road (Heathcote County).—During the period 35 ch. of heavy side and block cutting were completed to a width of 25 ft. The work has now been finished.

Summit Road, Kiwi to Kennedy's Bush (Heathcote County).—30 ch. of road, mostly in rock, has been widened by relief workers.

Puhipuhi Valley Widening (Kaikoura County).—A total of 3 m. 8 ch. of widening was completed in heavy side cutting. This also was a relief work.

Rampaddock Road (Kowai County).—53 ch. of road has been widened, cuttings lowered, and banks made up. The deviation at Forresters, 36½ ch. in length, is now in hand.

Ball Hut Road (Mackenzie County).—103 ch. of road has been formed and metalled.

Pareroa Bush Road (Mackenzie County).—75 ch. of road has been metalled.

Grampion Creek Bridge and Protective Works (Waimate County).—A bridge 46 ft. long, consisting of two 23 ft. beam spans on pile pier and abutments, has been erected.

Slip Road (Waipara County).—60 ch. of road has been improved and 46 ch. of new road-deviation has been completed.

Waitohi River Bridge (Lankey's Cutting), (Waipara County).—This bridge, 157 ft. in length, consisting of two 41 ft. truss spans and three 25 ft. beam spans on three concrete piers, one ironbark stud pier, and two ironbark stud piles, and gabion abutment, has been completed, together with approaches.

Kinloch Settlement Road (Wairewa County).—The metalling of 40 ch. of Gap Road, 40 ch. of Robinson's Road, and 40 ch. of Harrison's Road has been completed.

Hyslop's to Cairn Road (Bruce County).—1 m. 26 ch. of dray-road formation has been completed and 26 ch. of metalling.

Centre Road, Stuart's to Joe's Saddle (Clutha County).—This road has been metalled for a distance of 60 ch. during the year.

Kaka Point to Nuggetts (Clutha County).—1 m. 5¼ ch. of dray-road has been formed and one bridge, 45 ft. long, erected over the Karora Stream.

Papatowai to Longbeach Road (Clutha County).—2 m. 37 ch. of dray-road formation and 2 m. 31 ch. of metalling have been completed by the Department.

Puaho Road (Clutha County).—The formation of this road has been extended for a distance of 67 ch. and 35 ch. of road has been metalled.

Kingston to Queenstown Road (Lake County).—This road has been formed as a dray-road for a distance of 28½ ch. in very heavy rock.

Milford to Lake Wakatipu via Hollyford (Lake County).—The 6 ft. track-formation has been extended for a distance of 3 m. during the period.

Idaburn Bridge (Maniototo County).—One bridge, 50 ft. in length, has been erected.

Dick Road (Peninsula County).—23 ch. of road has been formed, and 9 ch. of sea-wall erected.

Nenthorn Stream Bridge (Taieri County).—This bridge has been erected, total length, 104 ft.

Heriot to Roxburgh via Moa Flat (Taieri County).—40 ch. of dray-road formation and 54 ch. of metalling were completed and three bridges, totalling 73 ft., were erected.

Knobby's Road (Taieri County).—50 ch. of dray-road formation and metalling has been completed.

Wilden Estate Road (Tuapeka County).—This road has been metalled for a distance of 4 m. 30 ch. during the period.

Hawea to Makarora Track (Vincent County).—Formation work, totalling 8 m. 10 ch. was completed during the year. The road is now practically completed for a distance of 14½ m., and further work is in hand on the Lake Wanaka side of the Neck for a distance of 2½ m. A length of 9 m. 20 ch. received a first coat of gravel and a length of 7 m. a second coat. Three bridges of rolled-steel joists and timber-deck type were erected as follows: Long Valley Creek, 30 ft. span; Dinner Creek, 30 ft; Hall's Creek, 40 ft.

Shag River Bridge (Waihemo County).—A bridge was erected over this river—length, 140 ft.

Endowment Road (Southland County).—1 m. 66 ch. of dray-road formation has been completed, together with necessary culverts, totalling 338 lin. ft.

McManus Road (Southland County).—2 m. 33 ch. of dray-road formation and culverts, totalling 694 lin. ft. were completed during the year.

Morrison Road (Southland County).—71 ch. of dray-road formation has been completed.

Thompson Road (Southland County), (Tokanui).—63 ch. of dray-road formation and culverts, totalling 190 lin. ft., have been completed.

Domain Road (Wallace County).—3 m. of dray-road formation with necessary culverts, totalling 1,112 lin. ft., and small wooden bridge on concrete abutments were completed.

Te Anau to Te Anau Downs Road (Wallace County).—This road has been widened in sections over a distance of 13 m., and eighty-two culverts, totalling 2,575 lin. ft., have been placed. Six bridges, a total length of 230 ft. have been erected. 7 m. of road has been gravelled. At present there are 210 relief workers employed on this work.

Traill Road (Wallace County).—1 m. 2 ch. dray-road formation and necessary culverts have been completed.

HYDRO-ELECTRIC WORKS.

Waitaki River Power Development.

At the commencement of the year covered by this report, work on this scheme had been in hand for a period of twelve months. The nature of the preparatory work was described in my report of last year, and, as a result of that work, the way was opened for the vigorous prosecution of the main construction work.

The works involved in the scheme are all of a very substantial nature, though much of the work is straight-forward and does not involve big construction hazards. For that section of the dam, however, that has to be built in the Waitaki River Channel, the Waitaki River has to be controlled, and as the river is a powerful stream and is subject to severe floods, the whole of the river construction layout has to be of a bold and substantial character. Even so, the flood hazard has to be faced, and there is the possibility of hindrance and delay due to damage to coffer-dams, &c., by floods.

The river section of the dam is 500 ft. long, and involves the placing of about 40,000 cubic yards of concrete below ordinary river-level, to a maximum depth of 40 ft. below that level. The scheme of operation in the river-work is the construction, under the protection of a steel-sheet piling coffer-dam, of a central section of the dam to a width of 26 ft. With this completed, the coffer-dam was extended to connect with the shore on the Canterbury side, the Canterbury section of the dam then being built up to water-level within the extended coffer-dam. When that is done the coffer-dam will in turn be extended to the Otago shore, and the remaining portion of the river section of the dam built to a level clear of flood risk. During this latter operation, the river-flow will be by-passed through temporary sluices left in the dam on the Canterbury side.

Owing to the severe floods to which the Waitaki River is liable during the late spring and summer, it is necessary to use the low winter stage of the river for the work of closing the coffer-dams. Thus, though the river-work must be carried on at high pressure during the whole year, the order of operation becomes seasonal, and this regulates the programme and the minimum period within which the power-house can be put into operation.

At the beginning of this year the sheet piling for the coffer-dam for the central section of the dam had been driven. By December last this coffer-dam had been dewatered, excavated, and concrete carried to a level above river-flood level. This section of the dam, though relatively small, is of great importance to the succeeding stages of the work, as besides forming a safe and convenient base for the operation of plant, it serves as a secure wall from which to build each of the two succeeding coffer-dams.

In January last a commencement was made with driving the sheet piling, and the placing of the gravel and boulder backing, for the second coffer-dam extending on to the Canterbury side, and with the building of the steel trestle on the downstream side of dam right across the river. Good progress was made with these works, several pile-driving plants being in use simultaneously, and no difficulty was experienced in closing the coffer-dam on to the solid rock of the river-bank. The area enclosed in the coffer-dam is about 1½ acres. Without delay a cableway drag-line commenced operations, excavating the gravel from below water-level, and as soon as the coffer-dam was closed and dewatering started with a battery of pumps, several parties of men were started excavating by hand, using power-operated inclines for discharge of spoil. By the end of June, the water in coffer-dam had been lowered 25 ft., 90 per cent. of the excavating had been done, this being represented by 30,000 cubic yards of gravel and boulders. So far, the rock bottom on one-half of the coffer-dam has been bared, exposing a good foundation of solid and rugged rock. Concreting in this coffer-dam will start early in August.

At the same time the heavy excavation for the abutment of the dam on the Canterbury side has been pushed on, under the co-operative-labour system, and is now nearly completed. The rock bottom has been trimmed and cleaned ready for concreting. The rock foundation here is good, and concreting began a fortnight after the close of the year now being reported on.

The programme provides for carrying the concrete on the Canterbury half of the river section to a safe level by early in 1931, so that the autumn and winter seasons of that year can be utilized to the full for the construction of the coffer-dam and building of the dam in the Otago half of the river.

Simultaneously with the work in the river, excavation has proceeded for the foundation of that section of the dam between the river and the power-house. Concreting of this section is independent of the river, and can proceed as foundation excavation is ready.

Excavation on this section, as well as of the tail-race and coffer-dam, has provided large quantities of gravel of excellent quality for concrete, requiring only to be screened into sand and stone and regauged for use. Concrete of good quality has been made from this gravel with very economical proportions of cement, and it is anticipated that the full requirements of aggregates will be obtained from excavations essential for other purposes.

Power-house.—The chief work accomplished has been that portion of the excavation necessary to permit of the commencement of structural work. The total excavation required is 20,000 cubic yards of stripping and 45,000 cubic yards of rock. At the close of the year this work had been 85 per cent. completed. The concrete-work, which is designed to extend over fourteen months, commenced on the 12th June. The quantity of concrete to be placed is 42,000 cubic yards, and the reinforcing steel required amounts to 1,000 tons. Intricate and massive form-work for the intakes, draft tubes, scroll-cases, &c., has been fabricated, and large quantities of reinforcing-steel have been bent. The site is admirably adapted for expeditious and economical work, and full advantage of the configuration of the ground has been taken in the layout of forms, yards, service railways, concrete-mixing plants, &c., whilst modern plant is being utilized in each phase of construction.

Large quantities of permanent equipment and machinery are now on the site, including some heavy packages of over-gauge dimensions in the transport of which the benefit of the service railway was fully demonstrated. Work on the assembly of this has commenced, and is well advanced on the portions first required for erection. Riveting of roof-trusses and draft-tube liners is in hand, and the erection of steel towers for the outdoor switching-station is proceeding. The site of the latter was formed with spoil derived from the power-house excavation, and the concreting of eight reinforced-concrete tower-pads has been completed whilst the remainder are in hand.

Tail Race.—This work involves the excavation of 50,000 cubic yards of stripping, 125,000 cubic yards of gravel, and 15,000 cubic yards of rock. To date some 6,000 cubic yards of rock and 13,000 cubic yards of stripping and gravel have been removed; but as it is intended to use the gravel for concrete aggregates when required, excavation on a large scale has been deferred until the demand for aggregate arises.

A road-deviation 1¾ miles in length has been formed and is in use. Another section of similar length has been formed, but is not yet metalled.

One permanent residence has been completed and a contract has been let and work begun for the erection of ten additional cottages, a large hospital building, and a garage. Concrete-block type of construction has been adopted for these permanent buildings. Roading, water-supply, drainage, and electric-light reticulation are in hand.

Workmen's accommodation has been provided on a large scale. 224 cottages for families have been built, and also 366 single men's huts. In addition, a fine recreation hall comprising picture-theatre, social room, billiard-room, &c., three large cook-houses, post-office premises, medical quarters, and bath-houses, have been built.

Construction buildings, including large stores, sheds, and fitting-shops of all kinds have been provided on the scale that a work of this magnitude demands.

The first-class construction plant that has been assembled is mainly electrically driven from the Lake Coleridge system, the total connected load being 770 horse-power.

The service railway four miles long, built from Kurow to the works, has amply justified itself, and the quantity of goods transported has been very heavy. The uniform system of transport from port or city to works has meant economy and despatch. It is no exaggeration to say that the saving by the continuous rail transport to the works over what would have been the cost by road will amount to the whole capital cost of the Kurow Branch Railway and its special extension.

The number of men employed on the works at the close of the year was 988, while the average number for the year has been 498. Most of the work has been run on two or more shifts, the vital river-work being maintained on three shifts. The programme provides for the river-work being beyond the risk of flood damage by the beginning of summer at the end of 1931, subject, of course, to no severe interruption of work due to abnormal floods. The completion of the higher levels of the dam and of the power-house building, and installation of equipment, will require six months additional. Thus, subject to finance being available, and to the flood hazard not introducing losses or delays much greater than it is reasonable to allow for, the programme that the Department is working to is to have power available by the middle of 1932.

RIVER IMPROVEMENT AND PROTECTIVE WORKS.

Waihou and Ohinemuri Rivers Improvement.

The need for strengthening the stop-banks on the upper Waihou River was referred to in my annual report last year. This work has constituted the major operation during the past year, and commencing from the junction of the Ohinemuri and Waihou Rivers the raising and strengthening has been completed for a distance upstream of 5 m. 12 ch. on the left bank, and 4 m. 33 ch. on the right bank. Two 1½-cub.-yd. drag-line excavators have been engaged on this work. The flood-channe between the stop-banks on this length has yet to be cleaned of blackberry, and evened up by filling in borrow-pits.

Thirteen chains of stop-bank in the lower Waihou have been raised to final level.

The machine-built stop-bank on the left bank of the lower Waihou has been extended by hand-work, the size of the bank being too small to warrant a machine, for a distance of 2 m. 62 ch., and flood-gates placed.

The small drag-line excavator has been engaged all the year on improving and reconditioning internal drains serving the country protected by the main stop-bank. The main drains in the Kaimanawa Drainage District have been so reconditioned, and now the drains in the Rotokohu Drainage District are being attended to.

In the upper Waihou, above Te Aroha, 2 m. of willows have been ring-barked in extension of work done during the previous year. Such work done the previous year has proved effective, and practically all the willows so treated are now dead.

Two 4 ft. culverts have been fitted with concrete headwalls and wing-walls with aprons front and back.

General maintenance of all river-works has been attended to, and plant and machines kept in good order. Two gauging stations have been established in the lower Waihou, and an automatic flood-gauge erected in the Waitawheta Stream.

Taieri River.

During the year the work of extending the Otokia Railway Bridge by 400 ft. has been completed, the work being done by the Railway Department's staff.

The main canal from the new pumping-station, through Maori Lake, connecting with the general drainage system on the plain, was completed, the 1½-cub.-yd. drag-line excavator being utilized for the work. Various other smaller drainage works were completed. Wain's drain culvert ha been constructed in hardwood timber under the main bank.

The contour-channel embankment at its lower end was completed by drag-line operation. My report for last year referred to proposals for improving the effectiveness of the contour channel which discharges the hill-waters direct to Waipori Lake. These proposals were accepted by the Taieri River Trust, and the necessary work has been put in hand by the Department.

With the exception of the contour-channel work, which is relatively a small matter, this scheme of protection-works is now complete, and is ready for handing-over to the Taieri River Trust fo maintenance. The adequate maintenance is vital to the security of the Taieri Plains, and indication are that that need will be fully realized by the Taieri River Trust.

MARINE.

Lighthouses.

Cape Egmont.—The original light, which was one of the older type of fixed incandescent oil-burning lights, has been replaced by one comprising an up-to-date revolving lens with a fixed incandescent acetylene burner and sun-valve. The whole apparatus, both lighting and revolving, is operated by the pressure of the gas, and is automatically turned on and off at sunset and sunrise by means of a sun-valve which is operated by the difference between daylight and darkness.

This light is now the most up-to-date installation in this country, and represents the most advanced type of automatic installation so far devised.

Godley Head Lighthouse.—Plans are being prepared for the conversion of this light from a fixed to a flashing light, and it is hoped to complete it during the ensuing year.

Tory Channel Leading Lights.—These leading lights have now been converted from fixed low-powered oil-burning lights to automatic flashing acetylene burners. It was necessary to adopt quick-flashing characteristics for both back and forward lights in order to give the same facility for keeping direction as with a pair of fixed lights, but without the disadvantages of the latter.

Westhead Light, Tory Channel.—This light, which consists of a 300 mm. lens lantern with a 25-litre acetylene open-flame flashing burner, all mounted on a steel pedestal, is wholly automatic, and was erected during the period. Its function is to mark the entrance to Tory Channel, and enable shipping to readily pick up the leading-lights, which are only visible through the narrow arc of the entrance, and thus difficult to pick up in thick weather, or if a vessel is approaching on a course widely different from the line of the leading-light.

Jack's Point.—This light, which was originally a watched oil-burning light of the third order, ha been converted to automatic operation by the provision of an automatic flashing-apparatus. In addition to this, a new 800 mm. lens has also been installed.

Kahurangi Point Lighthouse.—This lighthouse was severely damaged in the earthquake of June, 1929—two of the cast-iron segments of the tower were cracked and the lens was completely shattered. The keeper's house was overwhelmed by a landslide, and the keeper's wife and family had a miraculous escape. A temporary light was put into operation as soon as possible, and a new lens has been ordered and should be delivered shortly.

New cast-iron sections for the tower to take the place of those damaged have also been manufactured and delivered.

Moeraki Lighthouse.—Plans of a new automatic flashing apparatus, in place of the existing watched oil-burning apparatus, are being prepared.

Harbours.

Westport Harbour—Entrance and Bar.—The position generally in regard to the entrance of this harbour has not been satisfactory during the past year, the condition of the bar not being good for a large part of the year, in spite of the fact that three dredges were kept in operation for the greater part of the period. The cause of the trouble has been partly due to the gradual accumulation of detritus adjacent to the breakwater, and partly to the phenomenal dry spell in the latter half of the period keeping the natural flow of the Buller River at a very low stage. The first cause will be, it is hoped, remedied by extension of the breakwaters, and a start has been made with this work, approximately 8,000 tons of stone having been deposited. The second cause is due to the exceptionally dry weather, consequent lack of freshes; and all other ports on the coast are suffering in the same way. It is hoped that there will be more rain shortly, and given reasonable freshes the position should improve. During the period the "Eileen Ward" and the "Rubi Seddon" removed 694,770 cubic yards from the bar.

Lower River: The bucket dredge "Maui" has been engaged for the greater part of the year in the fairway and berthages, and for part of the time the "Eileen Ward" and the "Rubi Seddon" also dredged in this area, the total amount dredged being 314,235 cub. yd.

Eastern Breakwater: The railway to this breakwater has been repaired and 7,804 tons of stone deposited towards the extension of 300 ft.

Western Breakwater: The principal work here has consisted of repairs to the track and the construction of a pile derrick for the staging necessary to proceed with the extension in which 655 tons of stone were deposited.

Quarry: The output for the quarry during the seven months it was in operation was 12,584 tons; the plant has been well maintained, and the quarry-faces show a good supply of suitable stone for the breakwater construction.

River Protective Works: The track to Organs Island has been repaired to enable a further extension of the protective wall to be carried out, and 1,969 tons of stone were deposited at McPaddons. The fencing of the willow reserve at Hannas was completed. The willows planted in this reserve are doing well, and should now be able to withstand any reasonable flood.

During the year the dredge "Maui" which has been on hire from the Gisborne Harbour Board was purchased; and the new pilot launch, which was built for the service, was put in commission, and is proving very satisfactory for piloting and sounding operations. Additional equipment has been provided at the workshops, and the plant generally has been well maintained.

Karamea Harbour.—The area surrounding this harbour was unfortunately situated close to one of the centres of disturbance in the earthquake of June, 1929, and the harbour suffered very considerable damage accordingly. The wharf was wrecked; the wooden training-wall, which was being used as a staging for depositing stone for the new training-wall, was so damaged as to render it useless for the latter purpose, thus increasing the cost of this work, and in the flood which occurred on the 29th December enormous quantities of sand and silt were deposited in the bed of the river between the gorge and the sea. This debris was due to the large earthquake slips which had occurred on the higher reaches being washed down by flood waters. As a consequence of this, the river-channel is at present bad for navigation, and it is somewhat difficult to forecast what course the river will take in the next flood. Plans were prepared for the erection of a new wharf on standard lines, but work was not commenced pending consideration of alternative proposals on lines locally suggested as being more suitable to the needs of the district. In the meantime, the working of the harbour by shipping has become so impaired as the result of the bad condition of the channel which followed the flooding of the river on the 29th December, that it is generally recognized that it would be unwise to take any further steps until the position has definitely improved, it being anticipated that such will not become manifest until after the heavy rains of the coming spring have passed, if then. A considerable amount of snagging has been carried out in the main channel, in order to, as far as possible, keep the water in that channel and remove any obstruction which would tend to form sand-banks with the consequent detrimental changes in the channel. A comprehensive survey of the harbour area and adjacent portions of river and overflow channel is being carried out for future reference. Prior to the earthquake the laying of tram-line from the quarry to the training-wall had been completed, and a certain amount of stone had been run out to strengthen the end of the tramway, and it was fortunate that this had been done, otherwise the whole of the outer end of the existing wall would inevitably have collapsed. Before the tipping of stone could be resumed a very considerable length of the tram-line had to be lifted, straightened, and repacked; 4 chains of stone bank had to be built, the trestle leading on to the shoreward end of the wall having collapsed; 13 chains of the old timber wall had to be straightened up again and reconditioned; and the last 4 chains of the wall being beyond reconditioning, the permanent replacing of this length with a stone wall is now in hand. The lower quarry near the mouth of the Oparara Gorge has never been satisfactory, the stone breaking out too small, and a better face was located half a mile further up the gorge; this has been opened up, and a large shot fired with very satisfactory results. A thoroughly adequate supply of large stone is now assured to complete the works. On account of the subsidence of the land on which the Harbourmaster's house was situated it became uninhabitable, so that it has been necessary to acquire a new section and shift the house to it.

Waikokopu Harbour.—During the year this port has been well patronized by shipping, and the wharf facilities have been well maintained. The contractor for the rock breakwater has completed approximately 50 per cent. of his original contract, and to date approximately 16,000 tons of stone have been tipped. This has already reduced the range, and increased the number of workable days at the wharf. The Tahaenui Quarry from which the rock for the breakwater is being obtained has opened up well. The quality of the rock is good, and the present indications point to it resisting the action of sea and atmosphere very well. The shelter-shed on the wharf was burnt down during the year, and was re-erected on a larger scale, and a waterside workers' accommodation building has been built. Electric power from Waikaremoana will shortly be available at Waikokopu, when it can be used for all lighting and harbour facilities in place of the present small petrol-lighting set.

Karaka Point Wharf.—The approach work at this wharf has been completed, and the wharf is now connected up with the Whakarapa Road inland.

Matiotawa Wharf.—This wharf has been built, and the approaches are in hand.

Rawene Launch Motor Landing.—This work has now been completed, and both the incline ramp and the pontoon landing have been working satisfactorily.

Tikinui Wharf.—The new wharf has been completed during the year, together with small tram-line, portable crane, and shed.

Tutukaka Wharf.—Plans have been prepared for the construction of a new wharf on the south side of the harbour.

Coromandel Wharf.—General repairs to this structure have been carried out by the County Council, and a detailed survey of the harbour was made by the Department to determine the best location for the proposed new wharf.

Port Jackson.—The removal of the reef near Port Jackson has been satisfactorily completed.

Whangamata Wharf.—This wharf was erected during the year. It consists of a hardwood superstructure with turpentine piles.

French Pass.—Repairs were effected to the wharf, and portion of the overhanging cliff adjacent to the lighthouse was removed, it having been damaged by the earthquake.

Motueka Harbour.—A comprehensive survey has been made of the harbour and neighbouring coast-line to keep in touch with the remarkable changes occurring there.

General.

A large number of applications have been received from local bodies and private individuals for the approval of works involving marine interests. Among the various applications were the following:—

Wharves.—Waihou River; Pine Island, Auckland Harbour; Oamaru Harbour; Picton; Te Wairere Wharf, Kawhia Harbour; McLeod's Bay, Whangarei Harbour; Waitangi, Chatham Islands.

Boatshed and Landing.—Paremata; Evans Bay, Wellington Harbour; Matawhi Bay; Bay of Islands; Westshore, Napier.

Sewerage Outfalls.—New Plymouth; New River Estuary; Island Bay, Wellington.

Foreshore Licenses and Buildings.—Tutukaka Harbour; Parengarenga Harbour; Pine Island, Auckland Harbour; Paremata; Porirua Harbour; Rawene, Hokianga; Golden Bay; Te Karae, Mangamuka; Rangitoto, Auckland Harbour; Papoka River, Raglan County; Waimeha Beach, Waikanae; Bon Accord Harbour, Kawau Island, Kohukohu, Hokianga Harbour, Shelly Beach, Kaipara Harbour; Dargaville.

Harbour-Works.—Wanganui Harbour Board; New River Harbour; Wairau Harbour Board; Greymouth Harbour Board.

Reclamations.—Napier Harbour Board; Manukau Harbour, Bayswater, Auckland.

Bridges.—Auckland Westfield Railway; Orakei Waterfront Road, Auckland Harbour; Avon River, New Brighton.

DEFENCE WORKS.

New Zealand Air Force Base, Auckland.

The combined aeroplane and seaplane base at Hobsonville has been under construction for the whole year. The aeroplane-landing field and its hangar have been in use for over twelve months, and the bulk of the work done during the year has been on the seaplane portion of the establishment.

Two seaplane-hangars, each of 5,525 square feet floor-space, with attendant workshops and office accommodation, the whole covering three-fifths of an acre, have been built in concrete, and are now approaching completion. The only work remaining to be done is a small amount of painting and plastering, and the erection of the tackle for the electrically operated doors.

A general store and an oil-store in concrete have been commenced; and the former is complete, except for bituminous covering for flat roof and the concreting of the floor. The oil-store walls are complete, and the steel roof is in position.

The reclaimed area in front of the seaplane-hangars has been surfaced with scoria and rolled, and sufficient of it has been covered with a concrete slab to enable the planes to be manœuvered from the slipway into the hangars. The slipway by which the planes are hauled from the water on to the concrete slab is complete, as is also the jetty and mooring dolphin.

A fuelling system with 5,000 gallons of storage in zinc-sprayed steel tanks placed underground has been provided for seaplanes, and connected to the hangars by gravity feed.

Erosion of the batters of the excavation on which the seaplane-hangars is built has been dealt with by turfing with paspalum grass, and some slips have been held by dry-stone retaining-walls.

Three cottages for married airmen have been completed and are now in occupation, making a total of six, also a house for married officer.

A carrier-pigeon loft has been completed.

Sewage and storm-water mains are complete, and all buildings connected thereto.

A small amount of tile draining has been done on the landing-field.

Metalled areas, totalling 1,535 square yards, in front of land-hangar and transport-store have been penetrated and sealed with "Distar"; 57 ch. of access roading have been bitumen-sealed, and 14 ch. of metalled path constructed; 25 ch. of fencing have been built round quarters.

A six-stall garage has been completed.

A fuelling system has been installed at the land hangar, consisting of 2,500 gallons underground storage with petrol-service pump and field fuelling-point. At the transport shed a 500-gallon tank has been placed with pump.

It is expected that the base will be complete to present requirements in two months' time.

Waikato Camp, Ngaruawahia.

This establishment has now been completed, and handed over to the Defence Department for maintenance.

IRRIGATION.—CENTRAL OTAGO.

Operation of Completed Irrigation Schemes.

During the past year the several completed schemes have been maintained in good condition and all lands requiring water have been supplied. The irrigation season was a fairly successful one, no large interruptions to supplies of water were experienced, and generally these supplies were good. As indicated in my last report, the storage in Manorburn reservoir for the supply of Ida Valley had become seriously depleted, and it had been decided to supplement the supply by building the Poolburn dam. To carry the irrigators over the two years that the construction of the Poolburn dam requires, a temporary reduction of the supply to Ida Valley irrigators has had to be made. Last season a sliding scale reduction on the basis of no reduction to irrigators holding small areas, and 40 per cent. reduction on the largest holdings was made. The settlers have co-operated in this matter, and managed with the reduced water very well. The water delivered to Ida Valley was equivalent to a normal supply to 7,771 acres.

To further conserve the water in Manorburn reservoir, a pumping-plant was installed to pump irrigation-water from the Manuherikia River to Galloway, by which means 1,100 acres were supplied. This pumping-plant will continue in operation next irrigation season, thereafter the whole supplies again being drawn from the Manorburn source.

Of the schemes in operation, the following are on a trading basis: Ardgour, Bengerburn, Earnscleugh, Galloway, Ida Valley, Last Chance, Manuherikia, Tarras, and Teviot. For the year the total revenue for these schemes was £14,989, working-expenses £11,151, profit on working £3,828; the profit being an increase of £1,201 on the previous year.

The number of irrigators in the total area irrigated on all Government schemes for the past year is as follows:—

Scheme.	Number of Irrigators.	Acres under Irrigation.	Remarks.
Ida Valley	49	11,441	A temporarily reduced supply given.
Galloway	22	2,453	A temporary pumping-plant in use.
Manuherikia	75	5,722	Only normal maintenance required this year.
Earnscleugh	52	2,022	Normal maintenance carried out.
Ardgour	12	1,474	Normal maintenance carried out.
Tarras	18	3,115	Maintenance has continued to be heavy.
Last Chance	23	2,960	Normal maintenance carried out.
Teviot and Teviot Extension	55	3,435	Normal maintenance carried out.
Bengerburn	14	144	Scheme operated under Board of Control.
Hawkdun	75	9,129	Normal maintenance carried out.
Arrow	..	..	Scheme not yet in operation.
	395	41,895	

For the previous year the totals were 335 irrigators, with 38,255 acres under irrigation, the increase being mainly due to the Hawkdun scheme coming fully into operation.

New Schemes and Additions to Schemes under Construction.

Arrow River Scheme.—This scheme is now practically complete, and will be ready for operation next season. The work done during the year has been the erection of all pipe-line, including the three-mile pipe-line in the gorge, the construction of distributory races and boxes, and of the large concrete structure at the intake for freeing the irrigation water from gravels and silts. The intake weir across the Arrow River is now nearly completed.

Poolburn Dam, Ida Valley Scheme.—This dam, which is necessary to supplement the Ida Valley supply, is designed to conserve all the waters of the portion of the Poolburn watershed above it. The dam, which is of concrete-arch type, will be 86 ft. high from stream bed, or 107 ft. from the bottom of the foundations, will contain 13,700 cub. yd. of concrete ; and will store 903,000,000 cub. ft. of water, or a quantity equal to one-half that of the Manorburn reservoir. An adequate plant, comprising two Diesel sets, for generating electric power for air-compressor, drilling-plant, rock-crusher, screens, conveyor system, concrete-mixer, &c., was assembled. About a hundred men were employed, the work being run on two shifts. The considerable rock-excavation has been almost completed, a good foundation being obtained. The base of the dam, containing approximately 2,000 cub. yd. of concrete, has been placed. The location of this work is at an elevation of 2,600 ft. above sea-level, and, owing to severe snow and frost, it is inadvisable to attempt to carry work on throughout the winter. Accordingly, work shut down towards the end of June, and will be resumed in the spring. It is anticipated work will be completed next summer.

Teviot Scheme.—A small extension has been put in to serve the settlers.

Surveys and Investigations.

River-gaugings and meteorological records have been fully kept up. Investigations and reports on several schemes have been made, including the Roaring Meg combined power and irrigation development for pumping to irrigable lands in Clutha Valley, and a scheme for consolidating Thompson and Lauder Creeks water rights.

An aeroplane photographic survey has been authorized of the large area of land that would come under the Maniototo irrigation scheme in the Upper Taieri Valley, and an actual commencement has been made with the work, which, however, has been delayed by unfavourable weather.

This photographic survey will be of great value in locating the main race and distributory race systems, preparatory to work in the field.

ENGINEERS REGISTRATION ACT.

The Engineers Registration Act was passed in 1924, and came into operation on the 1st April, 1925.

The Board set up under the Act, consisting of six members, three of whom were nominated by the New Zealand Society of Civil Engineers and three by the Government, was duly constituted and at its first meeting held soon after the coming into operation of the Act, drafted the various regulations required for the administration of the Act.

Up to the 1st March, 1926, registration could be obtained by any one having six years' engineering experience in a responsible position, examination qualifications being unnecessary. Since that date, however, in order to obtain registration it is necessary to possess a "recognized certificate" as defined by the Act, or pass an approved examination. In both cases three years' satisfactory practical experience is also required, apart from any period of training. The "recognized certificates" accepted by the Registration Board are the diplomas of the three English Engineering Institutions—viz., the Institution of Civil Engineers, the Institution of Electrical Engineers, and the Institution of Mechanical Engineers, or any university degree recognized by those institutions as exempting from their own examinations.

Each year since the coming into operation of the Act the Board has conducted examinations, the standard of examination being equal to that required for associate membership of the English institutions mentioned. Six candidates sat for examination in 1926, 5 passed the whole examination or parts of it, and as a result of the examination 2 candidates were registered. In 1927 the figures were 16 candidates, 14 passed, and 5 registered. In 1928 there were 11 candidates, 10 passed, and 3 were registered. In 1929 there were 11 candidates, 9 passed, and 3 were registered. This year the figures were 11 candidates, 11 passed the whole examination or parts of it, and 5 were registered after completing the examination. The total number of applications dealt with by the Board is 1,415, and of these 833 have been registered.

Under the original Act a number of licensed surveyors who had had a certain amount of engineering experience were found by the Board not to have had sufficient experience to obtain registration under the heading of six years' responsible practical experience.

It was realized that the possession of a licensed surveyor's certificate, although it could not be regarded as a "recognized certificate" under the Act, connoted educational qualifications which were worth a certain amount of practical experience; and in 1928 an amendment to the Act was passed which enabled licensed surveyors who had had substantial engineer's experience, but not necessarily six years, and who applied within six months of the passing of the amendment, to obtain registration. About forty licensed surveyors obtained registration under the provisions of this amendment.

Under both the original Act and the amendment applicants whose applications had been declined by the Board had the right of appeal to an Appeal Board consisting of a Magistrate and two Assessors, which could be set up under the provisions of the Act. More than five hundred of the total applications were declined by the Board, but only twenty-four applicants took advantage of the provisions of the Act to appeal, and in fourteen of these appeals the decisions of the Registration Board were upheld.

Although, unfortunately, registration is not compulsory, and any one can still practice as an engineer without being registered, there is no doubt that the operations of the Act have done much to raise the standard of engineering in New Zealand, and the effect will be more marked as the years pass.

TRAMWAYS.

Auckland.—The past year has been a busy one in regard to new construction by the Auckland Transport Board. The following works were carried out and approved: Point Chevalier Extension, 132 ch. of double track; Remuera extension, 95 ch. of double track; Stanley Street, 16 ch. single track; Dominion Road extension, 96·77 ch. double track. The Onehunga duplication of 19 ch. is almost ready for final inspection. Twelve new cars were tested and passed.

Wellington.—The following new construction was carried out this year, the works being examined and approved: Karori line duplication—Chaytor Street, 14·14 ch.; Molesworth Street loop, 4·63 ch.; Upper Cuba Street, 16·3 ch.; Park Street, 18·66 ch.; Glenmore Street, 4·32 ch. of temporary track and 7·57 ch. of double-track duplication. Twelve new cars of the standard combination type were tested and passed for traffic.

New Plymouth.—One two-man car was satisfactorily converted to one man operation, and tested accordingly.

Wanganui.—Two new cars operating on the one-man principle were added to the rolling-stock. These were tested and approved.

Christchurch.—The following works were completed and passed for traffic: Tramway-tracks relaid in Colombo Street between Bealey Avenue and Armagh Street, a distance of 42 ch. A double line of track extended for 6¼ ch. from High Street to Liverpool Street; the trailer loop at Fendalton altered, and new loops put in in Colombo Street near Dean Street and in South Crescent Road near Barrie Street.

Dunedin.—During the year the Caversham duplication, involving 28 ch. of new construction was completed and passed for traffic.

Invercargill.—The only new work carried out in this area was the removal of the loop at the intersection of Mary Street, St. Andrew Street, and Sydney Street, an extension of track and a new loop in place of the former.

PUBLIC BUILDINGS.—MAINTENANCE.

The maintenance of public buildings has been carried out by the District Engineers and their staffs in accordance with proposals and reports prepared in District Offices. Maintenance work is, for more ready reference, included with public-building work reported on by the Government Architect.

PUBLIC-BUILDING WORKS AND ELECTRICAL OPERATIONS.

For details of the public-building works and of the operations of hydro-electric enterprises please see separate reports by the Government Architect and the Chief Electrical Engineer. In the latter, for purposes of continuity, the work done by the civil engineering officers on hydro-electric work is included.

F. W. FURKERT, C.M.G.,
M.Inst.C.E., M.I.Mech.E.,
Engineer-in-Chief.

ANNEXURE I TO APPENDIX B.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930.

NORTH ISLAND.

NOTE.—Column 11: For detail information as to dates of openings of such portions of lines as are not given in this table see tables of lengths of lines in Public Works Statements, 1904–25.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch	M. ch.	M. ch.	M. ch.
Kawakawa-Grahamtown (Onerahi)	Kawakawa ..	7 16	Opua Wharf - Kawakawa	7 16	0 57	7 73	..	..	..	..	..	..	..	..	..	7 16
	Kawakawa-Kamo ..	41 48	Kawakawa-Towai ..	21 18	0 61	21 79	..	..	..	12 April,1911	..	..	..	..	..	21 18
			Towai-Hukerenui ..	4 30	0 33	4 63	..	..	..	2 May, 1910	..	..	..	..	..	
			Hukerenui-Kamo ..	16 0	3 29	19 29	..	..	..	..	..	..	..	..	..	27 2
	Kamo-Grahamtown	9 22	Kamo-Kioreroa ..	6 52	2 27	8 79	..	..	..	..	..	..	..	..	..	
			Kioreroa-Onerahi ..	2 50	1 16	3 66	..	..	..	2 Oct., 1911	..	..	..	..	..	2 50
	Kawakawa-Hokianga	48 38	Otiria-Kaikohe ..	16 25	1 45	17 70	..	..	..	1 May, 1914	..	..	..	..	..	16 25
			Kaikohe-Okaihau ..	8 20	0 34	8 54	..	..	..	29 Oct., 1923	..	..	..	..	..	8 20
			Okaihau-Hokianga ..	23 73	2 06	25 79	10 00	4 09	9 64	..	..	..	..	..	..	..
Kaihu Valley	Kaihu Valley ..	24 32	Dargaville-Booms ..	17 21	0 75	18 16	..	..	..	..	..	..	..	..	..	
			Booms-Tarawhati ..	2 37	0 25	2 62	..	..	..	1 June, 1914	..	..	..	..	..	19 58
			Tarawhati-Donnelly's Crossing	4 54	0 38	5 12	..	..	..	5 Feb., 1923	..	..	..	..	..	4 54
North Auckland Main Trunk Railway	Dargaville-N.A.M.T. Railway	17 28	Kirikopuni–Dargaville	17 28	..	17 28	..	7 12	10 16	..	..	..	..	..	..	..
	Kaipara Northwards	83 39	Kirikopuni–Waiotira	13 56	1 44	15 20	..	..	..	15 May, 1928	..	..	..	13 56	..	13 56
			Waiotira–Mareretu ..	9 44	1 20	10 64	..	..	..	29 Nov., 1925	9 44	..	..	..	..	9 44
			Mareretu–Paparoa ..	4 16	0 25	4 41	..	..	..	29 Nov., 1925	4 16	..	..	..	..	4 16
			Paparoa-Huarau ..	1 56	0 36	2 12	..	..	..	29 Nov., 1925	1 56	..	..	..	..	1 56
			Huarau-Maungaturoto	2 5	0 38	2 43	..	..	..	1 April, 1920	..	..	..	..	..	2 5
			Maungaturoto-Ranganui	4 25	0 61	5 6	..	..	..	1 April, 1920	..	..	..	..	..	4 25
			Ranganui-Kaiwaka ..	2 35	0 62	3 17	..	..	..	1 Aug., 1914	..	..	..	..	..	2 35
			Kaiwaka - Te Hana ..	8 65	1 3	9 68	..	..	..	18 Mar. 1913	..	..	..	..	..	
			Te Hana-Wellsford ..	3 27	0 58	4 5	..	..	..	16 May, 1910	..	..	..	..	..	
			Wellsford-Wayby ..	3 18	0 28	3 46	..	..	..	1 April, 1909	..	..	..	..	..	
			Wayby-Hoteo ..	3 40	0 13	3 53	..	..	..	13 May, 1908	..	..	..	..	..	
			Hoteo-Kaipara Flats	2 45	0 13	2 58	..	..	..	11 June, 1907	..	..	..	..	..	45 42
			Kaipara Flats-Woodcock's	3 5	0 16	3 21	..	..	..	17 Nov., 1905	..	..	..	..	..	
			Woodcock's-Ahuroa	2 41	0 16	2 57	..	..	..	18 May, 1905	..	..	..	..	..	
			Ahuroa-Helensville ..	18 41	1 75	20 36	..	..	..	..	..	..	..	..	..	

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Whangarei Branch Railway	Whangarei Branch ..	19 79	Kioreroa-Portland ..	5 23	0 37	5 60	..	..	..	3 April, 1920	..	..	..	..	..	5 23
			Portland-Waiotira ..	14 56	1 39	16 15	..	..	..	29 Nov., 1925	14 56	..	..	..	..	14 56
Kaipara-Waikato	Kaipara-Newmarket	35 73	Helensville-Newm'rk't	35 73	6 66	42 59	..	..	..	..	..	..	..	..	..	35 73
	Onehunga Branch ..	2 73	Penrose - Onehunga Wharf	2 73	1 70	4 63	..	..	..	..	..	..	..	..	..	2 73
	Auckland-Waikato ..	100 13	Auckland-Te Awamutu	100 13	16 66	116 79	..	..	..	..	..	..	..	..	..	100 13
	Auckland-Westfield	9 68	Deviation via Orakei	9 68*	1 64	11 52	..	..	9 68*	..	..	..	..	..	..	..
	Auckland City Branch —Kingsland Station to Auckland Station via Western Park and Freeman's Bay	2 60	Auckland City Branch	2 60	..	2 60	..	..	..	..	..	..	..	..	..	..
Waiuku Branch	Waiuku Branch Railway	12 69	Paerata-Patumahoe	5 4	0 78	6 2	..	..	..	10 Dec., 1917	..	..	..	..	..	5 4
			Patumahoe-Waiuku	7 65	1 3	8 68	..	..	..	10 May, 1922	..	..	..	..	..	7 65
Huntly-Awaroa	Huntly-Awaroa ..	8 75	Huntly-Awaroa ..	8 75	1 18	10 13	..	..	..	16 June, 1924	..	..	..	..	..	8 75
Survey, new lines	Waikokowai Branch Railway	8 25	Waikokowai ..	8 25	..	8 25	8 25	..	..	..	..	..	..	..	..	..
Surveys, new lines	Paeroa-Pokeno ..	42 15	Paeroa-Pokeno ..	42 15	..	42 15	42 15	..	..	..	..	..	..	..	..	..
Waikato-Thames	Waikato-Thames ..	62 58	Frankton Junction-Thames	62 58	10 17	72 75	..	..	..	..	..	..	..	..	..	62 58
Hamilton-Cambridge	Hamilton-Cambridge	12 2	Ruakura Junction-Cambridge	12 2	3 14	15 16	..	..	..	..	..	..	..	..	..	12 2
Paeroa-Waihi	Paeroa-Waihi ..	12 40	Paeroa-Waihi ..	12 40	1 30	13 70	..	..	..	9 Nov., 1905	..	..	..	..	..	12 40
East Coast Railway	Waihi-Opotiki, or East Coast Railway	139 53	Waihi-Tahawai ..	14 0	4 42	42 75	..	..	..	1 May, 1927	..	..	14 0	..	..	14
			Tahawai-Tauranga ..	24 33						18 June, 1928	..	..	..	24 33	..	24 33
			Tauranga-Taneatua	59 9	9 41	68 50	..	..	..	3 Sept., 1928	..	..	..	59 9	..	59 9
			Taneatua-Opotiki ..	26 26	..	26 26	26 26	..	..	..	..	..	..	..	..	..

* Double track.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
East Coast Railway—*contd.*	Branch Lines ..	..	Mount Maunganui - Te Maunga Junction	4 27	0 67	5 14	..	..	4 27	..	..	..	..	..	..	..
			Te Puke Quarry § ..	3 0	0 20	3 20	..	..	3 0	..	..	..	..	..	..	..
			Moturiki Quarry § ..	1 0	0 10	1 10	..	..	..	..	..	..	..	..	..	..
			Whakatane Branch	7 5	..	7 5	7 5†	..	..	..	..	..	..	..	..	..
			Whakatane Ballast Siding §	0 33	..	0 33	..	..	0 33	..	..	..	..	..	..	..
Thames Valley - Rotorua	Thames Valley-Rotorua	69 33	Morrinsville-Rotorua	69 33	5 27	74 60	..	..	..	..	..	..	..	..	..	69 33
New survey	Rotorua-Taupo ..	53 30	Rotorua-Taupo ..	53 30	..	53 30	53 30*	..	..	..	..	..	..	..	..	..
Gisborne-Rotorua	Gisborne-Opotiki ..	92 44	Gisborne Wharf-Kaiteratahi	13 10	2 45	15 55	..	..	..	..	..	..	..	..	..	
			Kaiteratahi-Karaka	5 5	0 71	5 76	..	..	..	13 April, 1905	..	..	..	..	..	
			Karaka-Puha ..	1 75	0 24	2 19	..	..	..	20 May, 1907	..	..	..	..	..	
			Puha-Waikohu Bridge	3 29	..	3 29	..	..	..	28 May, 1908	..	..	..	..	..	
			Waikohu Bridge-Waikohu	0 35	0 32	0 67	..	..	..	1 April, 1909	..	..	..	..	..	49 32
			Waikohu-Otoko ..	7 75	0 32	8 27	..	..	..	6 April, 1912	..	..	..	..	..	
			Otoko-Rakauroa ..	6 60	0 32	7 12	..	..	..	2 Nov., 1914	..	..	..	..	..	
			Rakauroa-Matawai ..	5 65	0 50	6 35	..	..	..	2 Nov., 1914	..	..	..	..	..	
			Matawai-Motuhora	4 78	0 61	5 59	..	..	..	26 Nov., 1917	..	..	..	..	..	
			Motuhora-Motu ..	2 10	..	2 10	2 10	..	..	..	..	..	..	..	..	..
			Motu-Opotiki ..	41 2	..	41 2	41 2	Estim.	..	..	..	..	..	..	..	..
Gisborne-Napier	Napier-Wairoa ..	72 14	Napier-Eskdale ..	11 73	1 31	13 24	..	..	..	23 July, 1923	..	..	..	..	..	11 73
			Eskdale-Putorino ..	26 69	1 49	28 38	..	..	26 69	..	..	..	..	..	..	..
			Putorino-Wairoa ..	33 32	3 4	36 36	..	30 52	2 60	..	..	..	..	..	..	..
	Gisborne-Wairoa .. (Inland Route)	72 42	Gisborne Station - Makaraka	3 5	..	3 5	..	..	..	..	..	..	..	..	..	..
			Makaraka-Ngatapa ..	11 51	1 29	13 0	..	..	..	15 Dec., 1924	..	..	..	..	..	11 51
			Ngatapa-Wharekopae	4 69	..	4 69	0 19	3 0	1 50§	..	..	..	..	..	..	..
			Wharekopae-Waikura	5 40	..	5 40	5 40	..	..	..	..	..	..	..	..	..
			Waikura-Waterfall ..	6 66	..	66	5 6	Perm.	..	..	..	..	..	..	..	..
							1 60	Prelim.	..	..	..	..	..	..	..	..
			Waterfall-Hangaroa	4 0	..	4 0	4 0	"	..	..	..	..	..	..	..	..

* Trial survey. † Preliminary survey. ‡ Permanent survey. § Rails taken up.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued*.

NORTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Gisborne-Napier	Gisborne-Wairoa—*continued*.		Hangaroa-Te Reinga	17 11	..	17 11	17 11	"	..	..	..	..	..	..	..	..
			Te Reinga-Marumaru	9 40	..	9 40	9 40	"	..	..	..	..	..	..	..	..
			Marumaru-Wairoa ..	10 0	..	10 0	4 0	Perm.	..	..	..	..	..	..	..	..
							6 0	Prelim.	..	..	..	..	..	..	..	..
	Wairoa-Gisborne (Waikokopu Route)	59 75	Wairoa-Nuhaka ..	18 24	1 18	19 42	..	..	18 24	..	..	..	..	..	..	..
			Nuhaka-Waikokopu	6 11	0 49	6 60	..	..	6 11	..	..	..	..	..	..	..
			Waikokopu-Kopuawhara	10 72	..	10 72	..	10 72	..	..	..	..	..	..	..	..
			Kopuawhara-Whareratta	9 18	0 34	9 52	5 18	4 0	..	..	..	..	..	..	..	..
			Wharerata-Gisborne	15 30	..	15 30	6 30	9 0	..	..	..	..	..	..	..	..
			Wairoa-Freezing-works Siding	..	0 34	0 34	..	..	0 34	..	..	..	..	..	..	..
Napier-Woodville and Palmerston North	Napier-Woodville ..	96 65	Napier Spit-Woodville	96 65	15 5	111 70	..	..	..	..	..	..	..	..	..	96 65
	Woodville-Palmerston North	17 21	Woodville-Palmerston North	17 21	0 51	17 72	..	..	..	..	..	..	..	..	..	17 21
Wellington-Woodville	Woodville-Wellington	115 79	Woodville-Wellington [Te Aro]	115 79	21 73	137 72	..	..	..	..	..	..	..	..	..	115 79
	Greytown Branch ..	3 7	Woodside-Greytown	3 7	0 64	3 71	..	..	..	..	..	..	..	..	..	3 7
	Featherston-Martinborough	11 50	Featherston-Martinborough	11 50	..	11 50	11 50	..	..	..	..	..	..	..	..	..
	Greytown-Martinborough	4 62	Greytown-Martinborough	4 62	..	4 62	4 62	Trial	..	..	..	..	..	..	..	..
	Lower Hutt–Silverstream	9 34	Lower Hutt-Waterloo Road	9 34	1 62	11 16	6 50	..	..	25 May, 1927	..	..	2 64	..	..	2 64†
Rimutaka Incline Deviation Surveys	Coach-road Route ..	9 0	Kaitoke-Featherston	9 0	..	9 0	9 0	Prelim.	..	..	..	..	..	..	..	..
	Tauherenikau Route	21 30	Upper Hutt-Woodside	21 30	..	21 30	21 30	..	..	..	..	..	..	..	..	..
	Wainui-o-mata Route	31 40	Petone-Pigeon Bush	31 40	..	31 40	31 40	..	..	..	..	..	..	..	..	..
	Coast Route ..	52 0	Petone-Pigeon Bush	52 0	..	52 0	52 0	..	..	..	..	..	..	..	..	..
	Coast Route ..	70 0	Petone-Carterton, via Martinborough	70 0	..	70 0	70 0	..	..	..	..	..	..	..	..	..
Wellington-New Plymouth	Wellington-Manawatu	83 37	Wellington-Longburn	83 37	15 76	99 33	..	..	..	7 Dec., 1908*	..	..	..	..	..	83 37
		7 7†	Tawa Flat Deviation	7 7†	0 45	7 52	7 7	7 7†	..	..	..	..	..	..	..	..
		6 78‡	Palmerston North Deviation	6 78‡	16 11	23 9	..	6 78‡	..	..	..	..	..	..	..	..

* Date of purchase. † Double track. ‡ Works closed down.

Table of Lengths of Government Lines Authorized, Constructed, and Surveyed up to 31st March, 1930—*continued*.

NORTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Foxton-New Plymouth	Foxton-Patea ..	120 44	Foxton-Patea ..	120 44	14 75	135 39	..	..	..	..	..	..	..	..	..	120 44
	Route Improvement Surveys	26 7	Turakina-Matarawa	11 67	..	11 67	11 67	..	..	..	..	..	..	..	..	..
			Aramoho-Goat Valley Tunnel	7 40	..	7 40	7 40	..	..	..	..	..	..	..	..	..
			Kai Iwi-Okehu ..	3 60	..	3 60	3 60	..	..	..	..	..	..	..	..	..
			Nukumaru-Waitotara	3 0	..	3 0	3 0	Prelim.	..	..	..	..	..	..	..	..
	Patea Waitara and New Plymouth	72 29	Patea-New Plymouth Breakwater	72 29	11 52	84 1	..	..	..	..	..	..	..	..	..	72 29
	Bulls Branch ..	3 79	Bull's Branch ..	3 79	..	3 79	3 79	Prelim.	..	..	..	..	..	..	..	..
	Wanganui Branch ..	3 29	Aramoho-Wanganui	3 29	2 23	5 52	..	..	..	..	..	..	..	..	..	3 29
Stratford-Main Trunk	Stratford-Main Trunk	89 0	Stratford-Toko ..	6 26	0 40	6 66	..	..	..	..	..	..	..	..	..	
			Toko-Oruru ..	4 72	0 36	5 28	..	..	..	1 Mar., 1905	..	..	..	..	..	
			Oruru-Huiroa ..	4 50	0 35	5 5	..	..	..	1 April, 1908	..	..	..	..	..	
			Huiroa-Te Wera ..	6 77	1 16	8 13	..	..	..	20 June, 1910	..	..	..	..	..	
			Te Wera-Pohokura	8 55	0 65	9 40	..	..	..	1 Aug., 1912	..	..	..	..	..	
			Pohokura-Whangamomona	6 13	0 45	6 58	..	..	..	1 July, 1914	..	..	..	..	..	47 40
			Whangamomona-Kohuratahi	4 53	0 29	5 2	..	..	..	7 Jan., 1918	..	..	..	..	..	
			Kohuratahi-Tahora	5 14	0 37	5 51	..	..	..	21 Nov., 1924	..	..	..	..	..	
			Tahora-Raekohua ..	3 20	..	3 20	..	..	3 20	..	..	..	..	..	..	..
			Raekohua-Heao ..	4 63	..	4 63	..	4 63	..	..	..	..	..	..	..	..
			Heao-Tokirima ..	3 47	0 15	3 62	..	3 47	..							
			Tokirima-Ohura ..	10 60	0 25	11 5	..	6 30	4 30	..	..	..	..	..	..	..
			Ohura-Matiere ..	8 67	1 21	10 8	..	..	8 67	..	..	..	..	..	..	..
			Matiere-Okahukura ..	10 23	1 10	11 33	..	..	10 23	..	..	..	..	..	..	..
	Stratford-Ongarue—Deviations	33 40	Mangaroa-Puketutu	33 40	..	33 40	33 40	Prelim.	..	..	..	..	..	..	..	..
		14 0	Aramatai-Hangatiki	14 0	..	14 0	14 0	Prelim.	..	..	..	..	..	..	..	..
	Puketutu-Mangaroa Deviation	30 0	..	30 0	..	30 0	30 0	Prelim.	..	..	..	..	..	..	..	..
	Opunake-Mountain Rd.	23 10	Opunake-Eltham ..	23 10	..	23 10	23 10	..	..	..	..	..	..	..	..	..
	Te Roti-Moturoa ..	56 18	Te Roti-Opunake ..	22 63	3 2	25 65	..	..	..	12 July, 1926	..	22 63	..	..	..	22 63
			Opunake-Stony River	18 70	..	18 70	18 70	..	..	..	..	..	..	..	..	..
			Stony River-Moturoa	14 45	..	14 45	14 45	..	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch	M. ch.	M. ch.	M. ch.	M. ch.		ch.	M. ch.	M. ch.	M. ch.	M.	M. ch.
Stratford-Main Trunk —*contd.*	Te Roti-Moturoa Deviation	..	Oakura-Breakwater	..	..	..	2 30	..	..	..	..	..	..	..	..	..
	Manaia Branch	5 50	Manaia-Kapuni	5 50	0 78	6 48	..	4 25	1 25*	..	..	..	..	..	..	..
	Mount Egmont Branch	8 77	Manganui Section	5 74	2 3	7 77	..	..	..	1 April, 1908	..	..	..	..	..	6 0
			Quarry Section	3 3	0 60	3 63	..	1 58	1 25	..	..	..	..	..	..	..
North Island Main Trunk Railway	Marton-Te Awamutu	209 69	Marton Junction-Mangaweka	31 67	4 61	36 48	..	..	..	..	..	..	..	..	..	
			Mangaweka-Taihape	13 1	1 61	14 62	..	..	..	10 Sep., 1904	..	..	..	..	..	50 58
			Taihape-Mataroa	5 70	0 61	6 51	..	..	..	1 June, 1907	..	..	..	..	..	
			Mataroa-Waiouru	18 10	12 50	97 28	..	..	..	30 June, 1908	..	..	..	..	..	
			Waiouru-Erua	30 63			..	..	..	13 Feb., 1909	..	..	..	..	..	84 58
			Erua-Taumarunui	35 65			..	..	..	9 Nov., 1908	..	..	..	..	..	
			Taumarunui-Te Awamutu	74 33	6 20	80 53	..	..	..	..	..	..	..	..	..	74 33
	Waipa Gravel Access Branch	7 40	Otorohanga	7 40	..	7 40	..	..	..	..	..	..	..	..	..	..
	Raetihi Branch	8 50	Raetihi Section	8 50	1 7	9 57	..	..	..	18 Dec., 1917	..	..	..	..	..	8 50
	Central Route Deviation Surveys	30 0	Ohakune to Mokau-Retaruke Divide	30 0	..	30 0	30 0	Prelim.	..	..	..	..	..	..	..	..
		34 0	Makatote Gorge-Marae-Kowhai	34 0	..	34 0	34 0	Prelim.	..	..	..	..	..	..	..	..
		20 0	Marae-Kowhai-Ohura Valley	20 0	..	20 0	20 0	Explor.	..	..	..	..	..	..	..	..
	Ngaire-Ongarue	103 58	Ngaire Section	38 73	..	38 73	38 73	..	..	..	..	..	..	..	..	..
			Tangarakau Section	26 0	..	26 0	26 0	..	..	..	..	..	..	..	..	..
			Heao Section	10 70	..	10 70	10 70	..	..	..	..	..	..	..	..	..
			Ohura Section	27 75	..	27 75	27 75	..	..	..	..	..	..	..	..	..
	Waitara-Tangarakau	46 75	Waitara Section	46 75	..	46 75	46 75	..	..	..	..	..	..	..	..	..
	Urenui Route	12 0	Urenui to Tangitu River	12 0	..	12 0	12 0	Prelim.	..	..	..	..	..	..	..	..
	Hastings-Te Awamutu	170 0	Hastings-Te Awamutu	170 0	..	170 0	170 0	Prelim.	..	..	..	..	..	..	..	..
	Totals	2792 29	..	2792 29	252 52	3045 1	1052 30	103 53	123 6	..	30 12	22 63	16 64	97 18	..	1508

NOTE.—Taonui and Lichfield Branches not mentioned above, as the rails have been taken up. * Rails taken up.

Table of Lengths of Government Lines Authorized, Constructed, and Surveyed up to 31st March, 1930—*continued.*

SOUTH ISLAND.

Note.—Column 11: For detail information as to dates of openings of such portions of lines as are not given in this table see tables of lengths of lines in Public Works Statements, 1904-25.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Nelson-Roundell	Nelson-Belgrove ..	22 73	Nelson-Belgrove ..	22 73	2 52	25 45	..	..	..	..	..	..	..	..	..	22 73
Midland Railway	Stillwater - Belgrove (via Tadmor)	146 75	Stillwater-Reefton S.	37 30	4 79	42 29	..	..	..	..	..	..	..	..	..	
			Reefton S.-Reefton N.	1 30	1 0	2 30	..	..	..	31 Mar., 1907	..	..	..	..	..	
			Reefton N.-Cronadun	5 38	0 56	6 14	..	..	..	7 Aug., 1908	..	..	..	..	..	57 32
			Cronadun-Landing ..	8 40	0 45	9 5	..	..	..	June, 1914	..	..	..	..	..	
			Landing-Inangahua	6 0	0 10	6 10	..	1 26	..		..	..	..	..	..	
			Inangahua-Murchison	23 53	..	23 53	7 0	Trial	..	..	..	..	..	..	..	..
							16 53	Prelim.	..	..	..	..	..	..	..	..
			Murchison-Kawatiri	22 70	0 38	23 28	6 65	10 62	5 23	..	..	..	..	..	..	..
			Kawatiri-Glenhope ..	3 73	0 15	4 8	..	..	..	21 June, 1926	..	3 73	..	..	..	..
			Glenhope-Tui ..	9 42	0 55	10 17	..	..	..	2 Sep., 1912	..	..	..	..	..	
			Tui-Kiwi	3 17	0 34	3 51	..	..	..		..	..	..	..	..	
			Kiwi-Tadmor ..	5 9	0 29	5 38	..	..	..	18 Dec., 1908	..	..	..	..	..	41 54
			Tadmor-Kohatu ..	10 29	0 69	11 18	..	..	..	7 Aug., 1906	..	..	..	..	..	
			Kohatu-Belgrove ..	9 44	0 62	10 26	..	..	..	..	..	..	..	..	..	
	Brunner-Springfield	92 68	Brunner-Otira ..	42 27	2 68	45 15	..	..	..	..	..	..	..	..	..	
			Otira-Arthur's Pass	8 14	5 38	13 52	..	..	..	26 May, 1924	..	..	..	..	..	
			Arthur's Pass - Cass	14 67	0 20	15 7	..	..	..	1 July, 1914	..	..	..	..	..	
			Cass - Broken River ..	15 22	1 29	16 51	..	..	..	10 Dec., 1910	..	..	..	..	..	92 68
			Broken River - Otarama	7 40	0 30	7 70	..	..	..	29 Oct., 1906	..	..	..	..	..	
			Otarama-Springfield	4 58	0 16	4 74	..	..	..	29 Oct., 1906	..	..	..	..	..	
Blackball Railway	Ngahere-Blackball ..	3 40	Ngahere-Blackball ..	3 40	1 20	4 60	..	..	..	16 July, 1910	..	..	..	..	..	3 40
Greymouth-Nelson Creek	Greymouth - Nelson Creek	7 51	Greymouth-Brunnerton-Stillwater	7 51	6 18	13 69	..	..	..	..	..	..	..	..	..	7 51
Westport-Ngakawau	Westport-Ngakawau	19 56	Westport-Ngakawau	19 56	8 12	27 68	..	..	..	..	..	..	..	..	..	19 56
Westport-Ngakawau Extension	Ngakawau - Mokihinui	7 12	Ngakawau-Mokihinui	7 12	1 18	8 30	..	..	..	..	..	..	..	..	..	7 12
	Mokihinui Colliery Line	3 69	Mokihinui-Seddonville	3 69	0 25	4 14	..	..	..	..	..	..	..	..	..	3 69
Westport-Cape Foulwind	Westport-Cape Foulwind	7 0	Westport-Cape Foulwind	7 0	0 60	7 60	..	..	..	..	..	..	..	..	..	7 0
Westport-Inangahua	Westport-Inangahua Junction	26 0	Westport-Te Kuha ..	5 74	0 10	6 4	..	..	..	1 April, 1912	..	..	..	..	..	5 74
			Te Kuha - Inangahua Junction	20 6	0 39	20 45	..	16 6	4 0	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
State Colliery, or Coal Creek Railway	Greymouth - Point Elizabeth Collieries	5 1	Greymouth-Runanga Colliery	5 1	2 10	7 11	..	..	..	1 Dec., 1904	..	..	..	..	..	5 1
	Extension ..	3 69	Runanga Colliery-Point Elizabeth Collieries	3 69	2 20	6 9	..	..	..	21 Jan., 1914	..	..	..	..	..	3 69
	" ..	2 44	Runanga to Seven-mile	2 44	1 40	4 4	..	..	..	3 Sept., 1923	..	..	..	..	..	2 44
Greymouth-Hokitika	Greymouth-Hokitika	24 37	Greymouth-Hokitika	24 37	2 10	26 47	..	..	..	..	..	..	..	..	..	24 37
Kumara Branch	Kumara Branch ..	4 10	Kumara Branch ..	4 10	..	4 10	4 10	..	..	..	..	..	..	..	..	..
Hokitika-Ross	Hokitika-Ross ..	15 75	Hokitika-Ruatapu ..	7 10	0 61	7 71	..	..	..	9 Nov., 1906	..	..	..	..	..	7 10
			Ruatapu-Ross ..	7 21	0 69	8 10	..	..	..	1 April, 1909	..	..	..	..	..	7 21
			Survey to Ross Township	1 44	..	1 44	1 44	..	..	..	..	..	..	..	..	..
New survey	Ross-Waitaha ..	10 0	Ross-Waitaha ..	10 0	..	10 0	2 54	..	..	..	..	..	..	..	..	..
Picton-Waipara	Picton-Hapuka River	92 38	Picton-Seddon ..	33 45	3 26	36 71	..	..	..	..	..	..	..	..	..	
			Seddon-Kaparu ..	6 30	0 76	7 26	..	..	..	13 April, 1911	..	..	..	..	..	56 6
			Kaparu-Ward ..	8 15	1 20	9 35	..	..	..		..	..	..	..	..	
			Ward-Mirza ..	3 38	0 30	3 68	..	..	..	4 Dec., 1915	..	..	..	..	..	
			Mirza-Wharanui ..	4 38	0 34	4 72	..	..	..		..	..	..	..	..	
			Wharanui-Kekerangu	7 0	..	7 0	..	7 0	3 20	..	..	..	..	..	..	..
			Kekerangu - Hapuka River	29 32	..	29 32	25 54	3 58	..	..	..	..	..	..	..	..
	Hapuka River-Conway River	32 0	Hapuka River-Kahautara River	11 0	..	11 0	11 0	Prelim.	..	..	..	..	..	..	..	..
			Kahautara River-Conway River	21 0	..	21 0	21 0	Prelim.	..	..	..	..	..	..	..	..
	Conway River - Parnassus	6 0	Hawkswood ..	6 0	..	6 0	..	6 0	..	..	..	..	..	..	..	..
	Parnassus-Waipara	44 14	Parnassus-Mina ..	8 43	1 14	9 57	..	..	..	1 Sept., 1912	..	..	..	..	..	
			Mina-Domett ..	3 63	0 70	4 53	..	..	..	1 Aug., 1910	..	..	..	..	..	
			Domett-Tormore ..	3 10	0 66	9 24	..	..	..	14 Nov., 1906	..	..	..	..	..	44 14
			Tormore-Ethelton ..	5 28			..	..	..	21 Mar., 1907	..	..	..	..	..	
			Ethelton-Scargill ..	8 51	0 51	9 22	..	..	..	3 Nov., 1905	..	..	..	..	..	
			Scargill-Waipara ..	14 59	1 2	15 61	..	..	..	..	..	..	..	..	..	
Hurunui-Waitaki	Main Line.. ..	206 7	Culverden-South Waitaki	206 7	64 68	270 75	..	..	..	..	..	..	..	..	..	206 7
		13 0	Culverden-Achray ..	5 23	0 10	5 33	..	..	..							
			Achray-Rotherham..	1 75	0 43	2 38	..	..	..	15 Dec., 1919	..	..	..	..	..	13 0
			Rotherham-Waiau ..	5 62	1 3	6 65	..	..	..							

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Hurunui-Waitaki —*contd.*	*Branches,—*															
	Rangiora - Oxford	21 76	Rangiora-Oxford West	21 76	2 36	24 32	..	..	..	..	..	..	..	..	..	21 76
	Eyreton (from Main Line)	20 7	Main Line - West Eyreton-Bennett's	20 7	1 61	21 68	..	..	..	..	..	..	..	..	..	20 7
	Lyttelton ..	6 26	Lyttelton - Christchurch	6 26	..	6 26	..	..	..	..	..	..	..	..	..	6 26
	Southbridge ..	25 31	Hornby-Southbridge	25 31	3 17	28 48	..	..	..	..	..	..	..	..	..	25 31
	Little River-Akaroa	42 10	Lincoln - Little River	22 46	2 5	24 51	..	..	..	..	..	..	..	..	..	22 46
			Reconnaissance ..	19 44	..	19 44	19 44	Prelim.	..	..	..	..	..	..	..	..
	Springfield ..	30 60	Rolleston-Springfield	29 63	3 7	33 67	..	..	..	..	..	..	..	..	..	30 60
			Springfield-Coal-mine	0 77												
	Whitecliffs ..	11 38	Darfield-Whitecliffs	11 33	1 53	13 11	..	..	..	..	..	..	..	..	..	11 38
			Whitecliffs to Bridge	0 5												
	Rakaia - Ashburton Forks	22 20	Rakaia-Methven ..	22 20	2 65	25 5	..	..	..	..	..	..	..	..	..	22 20
	Ashburton ..	29 46	Tinwald-Springburn	27 29	1 52	29 1	..	..	..	..	..	..	..	..	..	27 29
			Extension ..	2 17	..	2 17	2 17	..	..	..	..	..	..	..	..	..
	Opawa and Albury to Fairlie Creek and Burke's Pass	55 8	Washdyke-Eversley	36 5	2 45	38 50	..	..	..	..	..	..	..	..	..	36 5
			Preliminary survey ..	19 3	..	19 3	19 3	Prelim.	..	..	..	..	..	..	..	..
	Waimate ..	17 43	Studholme-Waimate	4 42	1 3	5 45	..	..	..	..	..	..	..	..	..	12 63
			Waimate-Waihao Downs	8 21	0 54	8 75	..	..	..	..	..	..	..	..	..	
			Waihao Downs-Serpentine	2 65	..	2 65	..	2 65	..	..	..	..	..	..	..	..
			Serpentine-Kelcher's	1 75	..	1 75	..	1 75	..	..	..	..	..	..	..	..
Canterbury Interior Main Line	Oxford-Temuka ..	83 0	Oxford-Sheffield ..	11 44	0 27	11 71	..	..	..	..	..	..	..	..	..	11 44
			Surveyed ..	21 7	..	21 7	21 7	..	..	..	..	..	..	..	..	..
			Reconnaissance ..	50 29	..	50 29	50 29	Prelim.	..	..	..	..	..	..	..	..
	Orari-Rangitata, via Geraldine	10 25	Orari-Geraldine ..	4 17	..	4 17	4 17	..	..	..	..	..	..	..	..	..
			Geraldine-Rangitata	6 8	..	6 8	6 8	..	..	..	..	..	..	..	..	..
Waitaki-Bluff and Branches	Main Line ..	246 69	South Waitaki-Bluff	246 69	59 13	306 2	..	..	..	..	..	..	..	..	..	246 69
	Branches,—															
	Duntroon - Hakataramea	37 33	Pukeuri-Duntroon ..	21 75	1 35	23 30	..	..	..	..	..	..	..	..	..	21 75
			Duntroon-Hakataramea	15 38	1 5	16 43	..	..	..	..	..	..	..	..	..	15 38
	Ngapara ..	14 76	Waiareka-Ngapara ..	14 76	1 31	16 27	..	..	..	..	..	..	..	..	..	14 76
	Livingstone ..	16 40	Windsor-Tokorahi ..	12 0	0 50	12 50	..	0 5	..	..	..	..	..	..	..	11 75
			Survey (trial) ..	4 40	..	4 40	4 40	Prelim.	..	..	..	..	..	..	..	..
	Palmerston - Waihemo	8 55	Palmerston-Dunback	8 55	0 54	9 29	..	..	..	..	..	..	..	..	..	8 5
		0 65	Surveyed ..	0 65	..	0 65	0 65	..	..	..	..	..	..	..	..	..

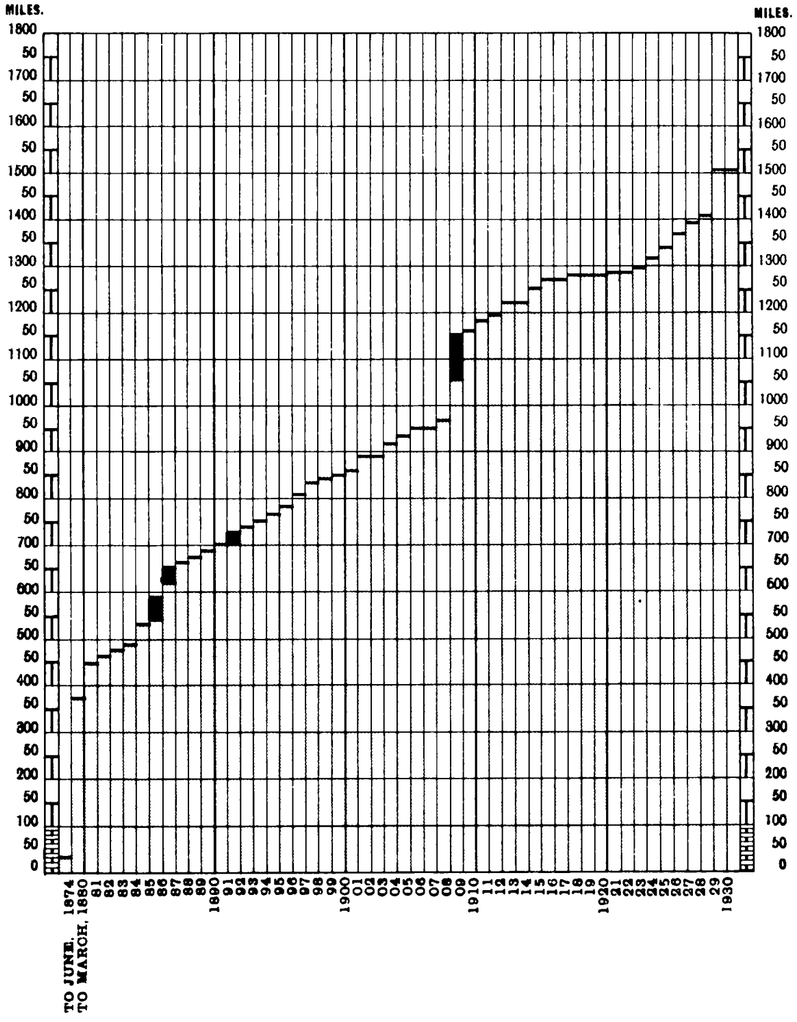
TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930 —*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Waitaki-Bluff and Branches —*contd.*	*Branches*—contd.															
	Inch Valley Railway	2 29	Inch Valley-Lime Kiln	2 29	0 23	2 52	..	..	..	..	..	..	..	..	..	2 29
	Port Chalmers ..	1 9	Glendermid - Port Chalmers	1 9	3 40	4 49	..	..	..	..	..	..	..	..	..	1 9
	Green Island ..	2 44	Burnside-Saddle Hill	2 44	0 52	3 16	..	..	..	..	..	..	..	..	..	2 44
	Green Island to Brighton	4 65	Surveyed	4 65	..	4 65	4 65	..	..	..	..	..	..	..	..	..
	Fernhill Colliery Line	1 60	Abbotsford to Fernhill Colliery	1 60	0 24	2 4	..	..	..	..	..	..	..	..	..	1 60
	Kaikorai Valley Railway	2 60	Surveyed	2 60	..	2 60	2 60	..	..	..	..	..	..	..	..	..
	Outram ..	8 78	Mosgiel-Outram ..	8 78	0 68	9 66	..	..	..	..	..	..	..	..	..	8 78
	Lawrence ..	21 76	Clarksville-Lawrence	21 76	2 2	23 78	..	..	..	..	..	..	..	..	..	
	Lawrence - Roxburgh	36 71	Lawrence - Big Hill	7 33	0 44	7 77	..	..	..	1 Aug., 1910	..	..	..	..	..	
			Big Hill - Beaumont	5 36	0 45	6 1	..	..	..	15 Dec., 1914	..	..	..	..	..	
			Beaumont - Miller's Flat	14 70	0 38	15 28	..	..	..	16 Dec., 1925	14 70	..	..	..	..	58 67
			Miller's Flat - Roxburgh	9 12	0 68	10 0	..	..	..	19 Apr., 1928	..	..	..	9 12	..	
	Lovell's Flat - Tuapeka Mouth	23 20	Surveyed	23 20	..	23 20	23 20	..	..	..	..	..	..	..	..	..
	Balclutha - Tuapeka Mouth	22 0	Surveyed	7 0	..	7 0	..	..	..	..	..	..	..	..	..	..
			Trial Survey ..	15 0	..	15 0	..	..	..	..	..	..	..	..	..	..
	Crichton-Tuapeka Mouth	11 60	Surveyed	11 60	..	11 60	11 60	..	..	..	..	..	..	..	..	..
	Stirling - Hill End (via Stoney Creek)	11 43	Trial Survey ..	11 43	..	11 43	11 43	..	..	..	..	..	..	..	..	..
	Balclutha - Appleby Junction or Catlin's - Seaward Bush	105 49	Balclutha-Owaka ..	19 20	1 63	21 3	..	..	..	..	..	..	..	..	..	
			Owaka-Catlin's ..	3 38	0 30	3 68	..	..	..	1 Aug., 1904	..	..	..	..	..	
			Catlin's-Houipapa ..	2 30	0 9	2 39	..	..	..	17 Dec., 1909	..	..	..	..	..	
			Houipapa-Puketiro..	7 11	0 43	7 54	..	..	..	1 Feb., 1915	..	..	..	..	..	42 67
			Puketiro-McLennan	5 29	0 59	6 8	..	..	..	1 Feb., 1915	..	..	..	..	..	
			McLennan-Tahakopa	5 19	0 38	5 57	..	..	..	1 Feb., 1915	..	..	..	..	..	
			Tahakopa-Marinui ..	23 63	..	23 63	23 63	Prelim.	..	..	..	..	..	..	..	..
			Marinui-Tokanui ..	6 0	..	6 0	6 0	..	..	..	..	..	..	..	..	..
			Tokanui-Waimahaka	8 27	0 64	9 11	..	..	..	20 Sept., 1911	..	..	..	..	..	
			Waimahaka-Appleby	24 52	1 50	26 22	..	..	..	..	..	..	..	..	..	32 79
	Waipahi - Heriot Burn	26 23	Waipahi-Heriot ..	20 3	2 3	22 6	..	..	..	..	..	..	..	..	..	
			Heriot-Edievale ..	6 20	0 45	6 65	..	..	..	15 Feb., 1905	..	..	..	..	..	26 23
	Extension to Roxburgh, via Rae's Junction and Ettrick	28 10	Surveyed ..	28 10	..	28 10	28 10	Prelim.	..	..	..	..	..	..	..	..
	Via Spylaw ..	25 70	Surveyed ..	25 70	..	25 70	25 70	Prelim.	..	..	..	..	..	..	..	..

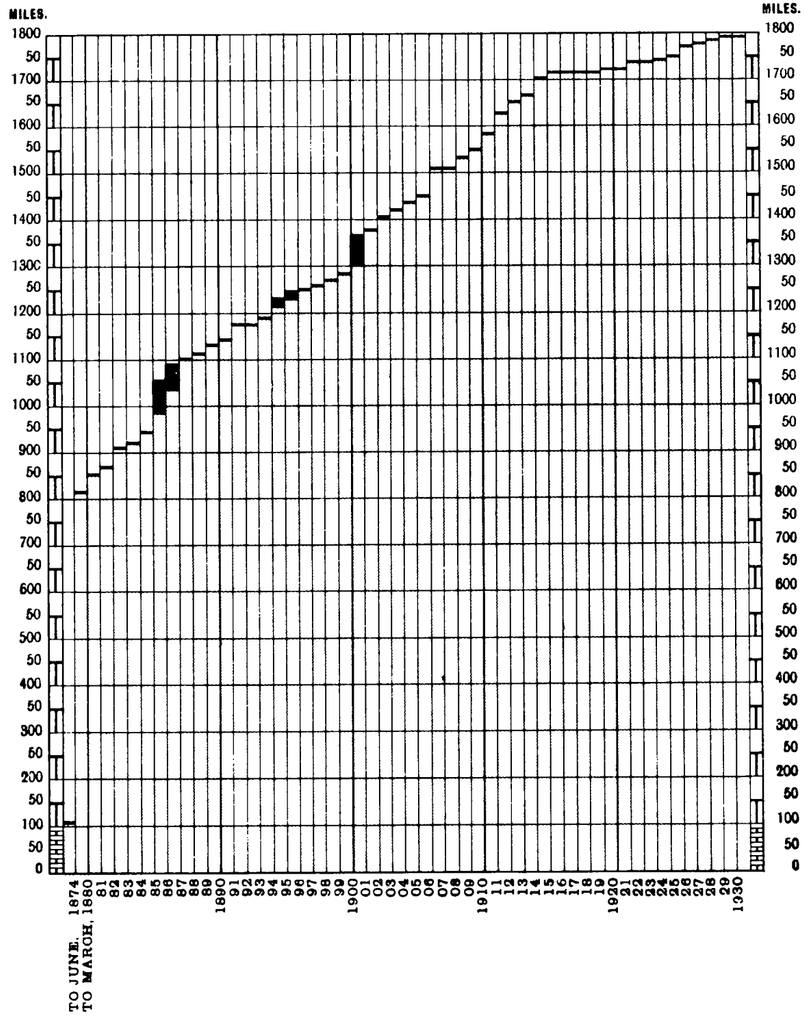
NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

NORTH ISLAND.



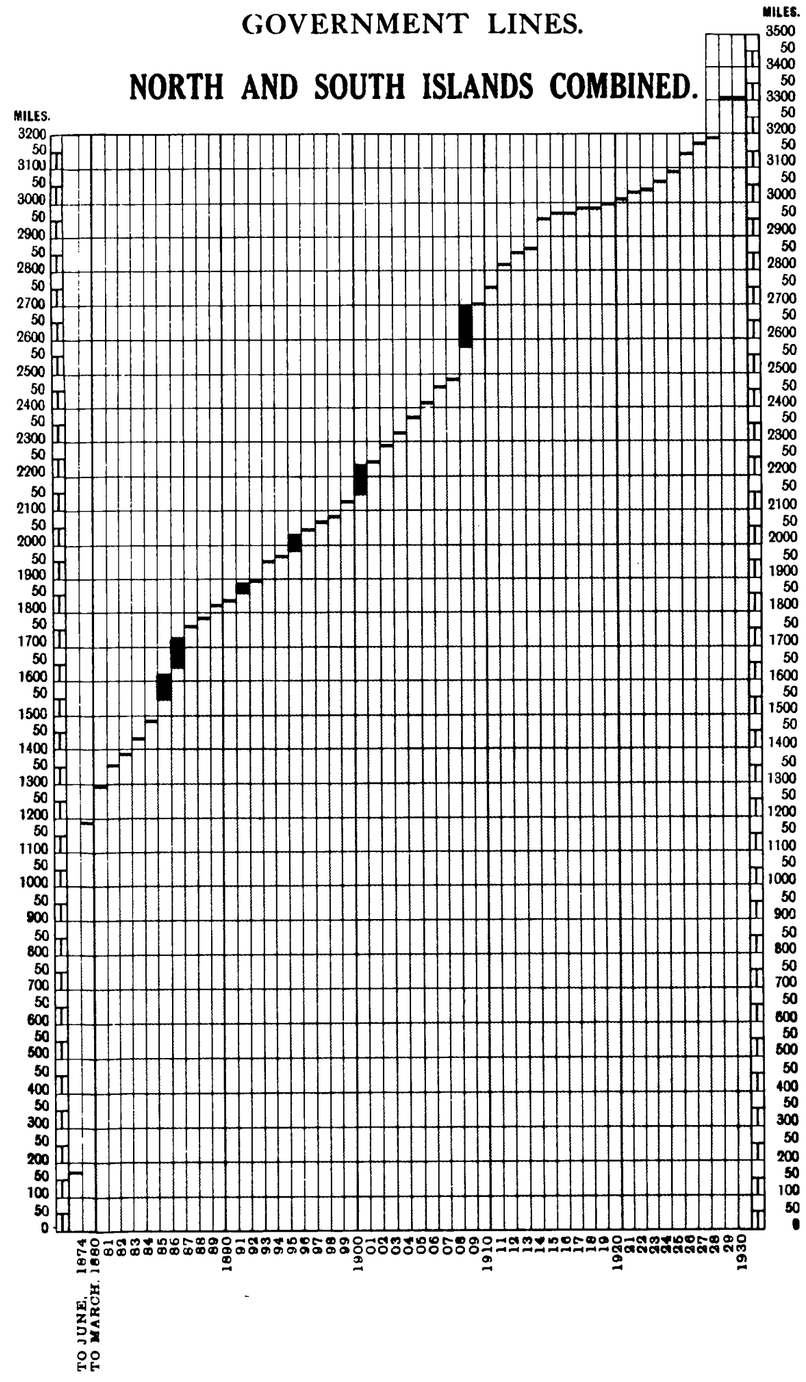
NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

SOUTH ISLAND.



NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

NORTH AND SOUTH ISLANDS COMBINED.



Private railways acquired by the Government shown thus : ■

PUBLIC WORKS
Engineer's Department
NEW ZEALAND.
F. W. FURKERT, M.INST.C.E.
ENGINEER-IN-CHIEF

PUBLIC WORKS MAP
SHOWING THE RAILWAYS
NORTH ISLAND
OF
NEW ZEALAND
1930

— Scale of Miles —

10 0 10 20 30 40 50 60 70 80

— REFERENCE —

GOVERNMENT RAILWAYS.

Opened - - ——————
Under construction - - - - - - - - - - -
Proposed - - ——————
Explored - - - - - - - - - - -

PRIVATE RAILWAYS.

Opened ——————

C.Maria van Dieman
North Cape
Motu Pia
Mangamui R.
RANGAUNU BAY
DOUBTLESS B.
Utea.
WHANGAROA HAR.
Cavalli Is
TAKOU BAY
AHIPARA BAY
Reef Pt
BAY OF ISLANDS
C.Brett
Herekino R.
Whangape
Poor Knights
HOKIANGA HAR.
WHANGARURU B.
NGUNGURU B.
Maunganui Bluff
Bream Hd
WHANGAREI HAR.
Bream Tail
Aiguilles Pt
GT BARRIER Id
LI BARRIER Id
HAURAKI GULF
KAIPARA HAR.
Kawau Id
C. Colville
Waiwera
KENNEDY B.
COROMANDEL
MERCURY B.
HELENSVILLE
Frith of Thames
TAIRUA H.
MANUKAU HAR
THAMES
WHANGAMATA H.
Waikato R.
White Id
BAY OF PLENTY
C.Runaway
HICKS B.
East C.
TAURANGA HAR.
KAWHIA HAR.
WHAINGAROA HAR
ROTORUA
Springs
Thermal
KAINGAROA PLAINS
T.E UREWERA COUNTRY
RAUKUMARA RANGE
L.Taupo
Waikare
Moana
POVERTY BAY
Mahia Peninsula
Portland Id
HAWKE BAY
NAPIER
C.Kidnappers
Bare Id
Pourerere R.
Porongahau R.
C.Turnagain
Castle Point
Wharawhara R.
Flat Point
C.Egmont
NORTH TARANAKI BIGHT
Mokau R.
NEW PLYMOUTH
SOUTH TARANAKI BIGHT
Kaupokonui R.
Patea R.
Waitotara
Wanganui R.
Rangitikei R.
Manawatu R.
Kapiti I.
PORIRUA H.
Mana I.
WELLINGTON
L. Wairarapa
PALLISER B.
C.Palliser
C.Campbell
COOK STRAIT
TASMAN SEA
PACIFIC OCEAN

DISTANCES BY RAILWAY BETWEEN PRINCIPAL PLACES.

	Miles.	Miles.
Wellington to Palmerston North	87	
Palmerston North to Wanganui (Aramoho Junction)	60	
Aramoho to New Plymouth	104	
Wellington to New Plymouth		251
Wellington to Palmerston North	87	
Palmerston North to Woodville	18	
Woodville to Napier (Spit)	97	
Wellington to Napier via Manawatu		202
Wellington to Woodville	115	
Woodville to Napier (Spit)	97	
Wellington to Napier via Wairarapa		212
Auckland to Onehunga		8
Auckland to Hamilton (Frankton Junction)	85	
Hamilton to Ongarue	75	
Ongarue to Taumarunui	15	
Taumarunui to Ohakune	50	
Ohakune to Waiouru	17	
Waiouru to Marton	68	
Marton to Wellington	116	
Auckland to Wellington		426
Auckland to Hamilton (Frankton Junction)	85	
Hamilton to Te Aroha	30	
Te Aroha to Thames	33	
Auckland to Thames		148
Auckland to Taneatua		227
Auckland to Rotorua		171
Auckland to Whangarei		133
Dargaville to Donnelly's Crossing		24
Whangarei to Opua		53
Kawakawa to Okaihau		29
Gisborne to Motuhora		49
Thames to Waihi		33
Stratford to Tahora		48

A. R. SHINNER, GOVERNMENT PRINTER, WELLINGTON

PUBLIC WORKS
Engineer's Department
NEW ZEALAND.

F. W. FURKERT, M.INST.C.E.
ENGINEER-IN-CHIEF

PUBLIC WORKS MAP
SHOWING THE RAILWAYS
SOUTH ISLAND
OF
NEW ZEALAND
1930

— Scale of Miles —

10 0 10 20 30 40 50 60 70 80

— REFERENCE —

GOVERNMENT RAILWAYS.

Opened - - ———
Under construction - - - - - - - -
Proposed - - ———
Explored - - - - - - - -

PRIVATE RAILWAYS.

Opened ———

C. Farewell
GOLDEN BAY
D'Urville Id
French Pass
COOK STRAIT
TASMAN BAY
Karamea R.
KARAMEA BIGHT
Mokihinui R.
C. Foulwind
C. Campbell
CLOUDY BAY
WELLINGTON
PICTON
NELSON
WESTPORT
GREYMOUTH
Pt Elizabeth
Arahura R.
HOKITIKA
Arthur's Pass
Abut Hd
OKARITO
Mt Cook
Mt Sefton
Haast R.
JACKSON'S BAY
Pukaki L.
L. Tekapo
Rangitata R.
CANTERBURY BIGHT
L. Wanaka
L. Hawea
Milford Sound
L. Wakatipu
L. Te Anau
Manapouri L.
Monowai L.
Hauroto L.
Waitaki R.
Clutha R.
Kaikoura Peninsula
Clarence R.
Banks Peninsula
PEGASUS BAY
Ashley R.
Waimakariri R.
Rakaia R.
Ashburton R.
Rangitata R.
Hurunui R.
Waiau-ua R.
Conway R.
Waiau R.
Mataura R.
Taieri R.
C. Saunders
Shag Point
Nugget Pt
The Bluff
SOLANDER Id
RUAPUKE Id
STEWART Id
Port William
East Head
Port Pegasus
S.W. Cape
FOVEAUX STRAIT
TASMAN SEA
PACIFIC OCEAN
SOUTH

DISTANCES BY RAILWAY BETWEEN PRINCIPAL PLACES.

	Miles.	Miles.
Bluff to Invercargill	17	
Invercargill to Lumsden	50	
Lumsden to Kingston	37	
Bluff to Kingston		104
Invercargill to Gore	39	
Gore to Balclutha	47	
Balclutha to Milton	17	
Milton to Dunedin	36	
Invercargill to Dunedin		139
Invercargill to Orawia		64
Invercargill to Tokanui		34
Balclutha to Tahakopa		43
Dunedin to Cromwell		155
Dunedin to Port Chalmers		8
Gore to Lumsden		37
Gore to Waikaka		16
Waipahi to Edievale		26
Milton to Roxburgh		61
Dunedin to Oamaru	78	
Oamaru to Timaru	53	
Timaru to Ashburton	47	
Ashburton to Rolleston	38	
Rolleston to Christchurch	14	
Dunedin to Christchurch		230
Christchurch to Lyttelton		7
Oamaru to Hakataramea		43
Timaru to Fairlie Creek		39
Christchurch to Greymouth		147
Christchurch to Little River		36
Christchurch to Waiau		82
Christchurch to Parnassus		85
Picton to Wharanui		56
Nelson to Glenhope		59
Greymouth to Reefton		47
Reefton to Inangahua		19
Greymouth to Ross		39
Westport to Mokihinui Colliery		31

BY AUTHORITY: W. A. G. SKINNER, GOVERNMENT PRINTER, WELLINGTON.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1930—*continued.*

SOUTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.										
							Surveyed.	Under Formation.	Under Platelaying.	Opened.							
										Date.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.
Waitaki-Bluff and Branches —*contd.*	*Branches*—contd.															
	Waimea Plains District Ry.	36 39	Gore-Lumsden ..	36 39	1 34	37 73	..	..	..	..	..	..	..	..	..	36 39
	Kelso-Gore ..	24 0	Surveyed ..	9 58	..	9 58	9 58	..	..	..	..	..	..	..	..	..
			Preliminary survey ..	14 22	..	14 22	14 22	Prelim.	..	..	..	..	..	..	..	..
	Gore-Waikaka ..	12 65	Waikaka Section ..	12 65	1 51	14 36	..	..	..	26 Nov., 1908	..	..	..	..	..	12 65
	Riversdale-Switzers	13 70	Riversdale-Waikaia	13 70	1 40	15 30	..	..	..	1 Oct., 1909	..	..	..	..	..	13 70
	Edendale-Toitois ..	19 30	Edendale-Glenham	9 36	0 72	10 28	..	..	..	..	..	..	..	..	..	9 36
			Surveyed ..	9 74	..	9 74	9 74	..	..	..	..	..	..	..	..	..
Otago Central	Waitaki Bluff Main Line to Lake Hawea	182 45	Wingatui-Ida Valley	98 18	5 62	104 0	..	..	..	..	..	..	..	..	..	
			Ida Valley-Omakau	13 20	1 16	14 36	..	..	..	1 Sept., 1904	..	..	..	..	..	
			Omakau-Chatto Creek	7 36	0 34	7 70	..	..	..	14 July, 1906	..	..	..	..	..	147 27
			Chatto Ck.-Alexandra	10 39	1 6	11 45	..	..	..	15 Dec., 1906	..	..	..	..	..	
			Alexandra-Clyde ..	5 45	0 77	6 42	..	..	..	27 Mar., 1907	..	..	..	..	..	
			Clyde-Cromwell ..	12 29	0 69	13 18	..	..	..	10 July, 1921	..	..	..	..	..	
			Surveyed ..	35 18	..	35 18	..	..	..	..	..	..	..	..	..	..
Invercargill-Kingston and Branch, Lumsden-Mararoa	Invercargill-Kingston	87 4	Invercargill-Kingston Wharf	87 4	5 15	92 19	..	..	..	..	..	..	..	..	..	87 4
	Lumsden-Mararoa ..	30 0	Lumsden-Mossburn	10 40	1 0	11 40	..	..	..	..	..	..	..	..	..	10 40
			Surveyed	8 20	..	8 20	8 20	..	..	..	..	..	..	..	..	..
			Reconnaissance ..	11 20	..	11 20	11 20	Prelim.	..	..	..	..	..	..	..	..
	Winton-Heddon Bush	11 0	Surveyed	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..
Forest Hill Railway	Winton to Hedgehope	12 40	Winton-Hedgehope	12 40	0 65	13 25	..	..	..	..	..	..	..	..	..	12 40
Western Railways, Orepuki-Waiau River	Orepuki-Waiau ..	60 74	Makarewa-Orepuki ..	35 41	6 37	41 78	..	..	..	..	..	..	..	..	..	
			Orepuki-Waihoaka ..	4 48	0 58	5 26	..	..	..	..	..	..	..	..	..	
			Waihoaka-Tuatapere	8 7	1 10	9 17	..	..	..	1 Oct., 1909	..	..	..	..	..	56 34
			Tuatapere-Orawia ..	8 18	..	8 18	..	..	..	20 Oct., 1925	8 18	..	..	..	..	
			Orawia-Clifden ..	4 40	..	4 40	4 40	..	..	..	..	..	..	..	..	
	Otautau Branch ..	22 15	Thornbury-Wairio ..	22 15	..	22 15	..	..	..	..	..	..	..	..	..	22 15
	Orawia Branch ..	11 0	Surveyed	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..
	Totals ..	2359 56	..	2359 56	267 57	2627 33	442 16	49 57	12 43	..	23 8	3 73	..	9 12	..	1793 77

APPENDIX C.

ANNUAL REPORT ON BUILDINGS BY THE GOVERNMENT ARCHITECT.

The Government Architect to the Hon. the Minister of Public Works.

Sir,—

I have the honour to submit the following report on the activities of the Architectural Branch of the Department for the year ended 30th June, 1930.

During the period plans were prepared for sixty new works, of a total estimated value of £391,200, of which twenty-six contracts, to the amount of £150,201, have been let. In addition, thirty-two contracts, to the amount of £267,826 for buildings designed prior to the 30th June, 1929, have also been let, making the total of works completed or under construction £427,027.

The latter total includes £119,703 for secondary-school buildings, and £25,899 for hospitals, &c., designed for Hospital Boards.

In addition to the above totals for buildings designed in Head Office, a large amount of minor additions, alterations, and repairs, and general maintenance of public buildings has been carried out by District Engineers, and a considerable quantity of furniture and fittings has been manufactured in the Public Works workshops for various Government Departments.

New Zealand materials and manufactures have been used, except where the use of imported material was unavoidable, with generally satisfactory results. Competition for Government contracts has been keen, with prices generally showing a downward tendency, and the standard of workmanship has been satisfactory.

The following is a schedule of the works carried out during the year :—

Viceregal Residences.

Auckland District.—General renovations and repairs were carried out as required during the year.

Wellington District.—The 230-voltage change-over was completed in the main buildings and in the cottages. A new hot-water service was installed, and general maintenance attended to.

Parliament Buildings.

Wellington District.—The 230-voltage change-over was completed; two new gas fires were installed, and all bells, telephones, electric lights, &c., were overhauled; renovations were carried out to various suites of rooms as required.

Post-offices.

Whangarei District.—A contract was let in December for extensive additions and alterations to Whangarei Post-office in brick and concrete, and good progress is being made. Repairs and renovations have been carried out to eight offices and residences.

Auckland District.—A contract has been let for the erection of a three-storied post-office in steel and concrete at Upper Symonds Street, Auckland; the old building has been demolished and excavations are in hand. New post-offices in brick have been erected at Mercer, Northcote, and New Lynn, and a new garage, &c., at Walton. Additions and alterations were made to Newton Post-office, and repairs and renovations carried out to a number of other offices.

Taumarunui District.—Alterations, repairs, and renovations were carried out to twelve post-offices.

Tauranga District.—Repairs and renovations have been carried out at a number of post-offices.

Gisborne District.—Alterations, repairs, and renovations were carried out to a number of post-offices.

Stratford District.—A building in brick and concrete was erected at Ohakune for the carrier telephone equipment; additions and alterations were made to Hawera Post-office; alterations and renovations to New Plymouth Post-office; and repairs and renovations were carried out to sixteen other buildings.

Napier District.—The new three-storied post-office at Napier is now nearing completion, and will be ready for occupation at an early date. The building is of steel-frame construction, encased in concrete, with brick panels, the street frontages being finished with Coromandel granite and Oamaru stone. Extensive repairs and renovations have been carried out to twelve offices.

Wellington District.—A contract was let for a new eight-storied post-office at Courtenay Place, Wellington. The building, on which a considerable amount of work in connection with foundations, &c., has been done, will be a steel-frame structure with reinforced-concrete walls and floors, the front elevation being finished in moulded terra-cotta work and white plaster. The building will be used extensively for Post and Telegraph purposes, the ground floor forming the post-office, and the remaining floors forming an extension of the General Post Office services. It is anticipated that the building will be ready for occupation about the middle of 1931. At Masterton Post-office extensive additions and alterations are well advanced; additions to store and garage at Palmerston North were completed; and repairs and renovations carried out to a number of post-offices and telephone exchanges.

Nelson District.—Extensive damage caused by the big earthquake last year has been repaired at a number of post-offices in the district. Extensive additions and alterations to the Chief Post-office, Nelson, are nearing completion, the expenditure to date being over £12,000. A contract was also let for strengthening the tower. At Blenheim the erection of a large store and garage is nearing completion. Repairs and renovations have been carried out to other offices as required.

Christchurch District.—At Cust a new post-office in brick and a Postmaster's residence in wood have been erected. Extensive alterations and renovations were carried out to Ashburton Post-office. Additions, repairs, and renovations were carried out as required to seventeen post-offices.

Dunedin District.—During the year extensive excavation work, piling, and the provision of a concrete raft were carried out at a cost of £17,566, in preparation for the new Chief Post-office at Dunedin. Extensive additions were made to Cromwell Post-office; and alterations, repairs, and renovations were carried out to twenty-seven offices, residences, and exchanges in the Dunedin district. During the year considerable alterations were carried out to the Chief Post-office, Invercargill, and repairs and renovations carried out to seventeen offices in the Invercargill sub-district; also to the Awarua Radio Station.

Greymouth District.—The extensive additions in brick and concrete to Greymouth Post-office, commenced last year, were completed during the current year. The damage done by the earthquake was made good, and the old building was strengthened by means of steel and reinforced concrete. At Westport the two-story brick building, which was seriously damaged by the earthquake, was demolished, and temporary accommodation provided for the Post and Telegraph Department in the Public Works Offices, to which additions and alterations were made as required. At Hokitika the two-story wood post-office, also seriously damaged, was repaired and strengthened. Restoration of earthquake damage, and repairs and renovations were carried out to twelve other offices.

Courthouses.

Whangarei District.—A new Courthouse was erected at Maungaturoto.

Auckland District.—At Hamilton a contract was let for a large building in brick and concrete, comprising Supreme Court, Magistrate's Court, Library, offices, &c. The building is nearing completion, and will be ready for occupation at an early date. At Papakura a wooden Courthouse was completed during the year. Repairs and renovations were carried out to other Courthouses as required.

Tauranga District.—Plans, &c., have been prepared for extensive additions and alterations to the Rotorua Native Land Court, and to the Rotorua Courthouse.

Gisborne District.—Renovations, &c., were carried out at Waipiro Bay and Gisborne.

Stratford District.—A new Courthouse, in wood, was erected at Patea; repairs and renovations were carried out to ten other buildings.

Napier District.—Renovations and repairs have been carried out to Courthouses at Napier and Waipukurau.

Wellington District.—A new Courthouse in brick and concrete was erected at Upper Hutt; a room was added to Greytown Courthouse; furniture and fittings were installed in the new Foxton Courthouse; and renovations were carried out to other buildings as required.

Nelson District.—Earthquake damage was repaired and renovations carried out to Courthouses at Motueka and Takaka.

Christchurch District.—Renovations and repairs were carried out to Courthouses at Timaru, Temuka, and Akaroa.

Dunedin District.—Renovations and repairs were carried out to nine Courthouses.

Greymouth District.—At Greymouth and Westport the Courthouses have been repaired and renovated.

Police-stations and Gaols.

Whangarei District.—Alterations and repairs were carried out to two police-stations.

Auckland District.—At Auckland Central Police-station an additional story was completed during the year, and sundry alterations and renovations were effected. Additions, repairs, and renovations were carried out to five stations and residences.

Taumarunui District.—Repairs were carried out to the police-station at Taumarunui.

Tauranga District.—Renovations were carried out to a number of stations as required.

Gisborne District.—Tenders are being invited for a new police residence at Te Araroa; repairs and renovations have been carried out to five buildings.

Stratford District.—Alterations, repairs, and renovations were carried out as required to twenty police-stations, residences, and gaols.

Napier District.—Repairs and renovations were carried out to six police-stations.

Wellington District.—Two warders' cottages were erected at Mount Crawford Prison; formation and metalling of the new access road was completed, and yards and paths were asphalted; and various other works were attended to. A new police-station was erected at Eastbourne, and repairs and maintenance work were carried out to seven stations.

Nelson District.—Extensive earthquake damage was repaired at Nelson, Murchison, Takaka, and Motueka Police-stations; also at the gaol, Nelson. Repairs and renovations were carried out to four stations.

Christchurch District.—Alterations, repairs, and renovations were carried out to seven police-stations. At Paparua Prison extensive repairs and general maintenance work were carried out as required.

Dunedin District.—Repairs and renovations were carried out to twenty-four police-stations. At the Invercargill Borstal Institution reclamation and drainage work were carried out, and heating provided for the farm buildings.

Greymouth District.—Extensive repairs and renovations were carried out to Ahaura and Seddonville stations. The restoration of earthquake damage and other maintenance repairs were carried out to fourteen stations and six residences.

Mental Hospitals.

Auckland.—At Auckland Mental Hospital, additions and alterations to the laundry have been completed. A contract was let for a new residence for the Medical Superintendent. Extensive alterations, repairs, and renovations were carried out to the various buildings.

Puhitahi.—A water-supply of 100,000 gallons per day was brought into service during the year. Five miles of 6 in. cast-iron pipes and one mile and a quarter of 8 in. pipes were laid and one 80,000-gallon reservoir constructed. Dining-room extension was completed and a summer camp for twenty men fitted up. Excavation work for the proposed kitchen block and two villas was carried out, and surveys of building-sites, drainage, &c., were made during the year. Plans, &c., have been prepared and tenders called for two villas in brick and concrete.

Tokanui.—Three villas for women patients were completed; a contract let for a new Nurses' Home in brick and concrete, and the work is well in hand. Various alterations and renovations were carried out to the main building.

Porirua.—Extensive repairs and renovations were carried out to a number of the buildings; an incinerator-shed was built; the baker's oven was rebuilt, and the bakehouse renovated; new steel fire-escapes were erected at the main building.

Nelson and Stoke.—Extensive earthquake damage was repaired, and repairs and renovations carried out as required at Nelson. At Stoke three new villas in brick and concrete are nearing completion; new bakery and store were completed and oven, &c., installed. Earthquake damage was repaired and repairs and renovations carried out. Additions to York Cottage are in hand.

Sunnyside.—The new boilerhouse was completed and boilers, &c., were installed; various maintenance works were carried out as required.

Templeton.—Villa No. 3, a wood building to accommodate forty-eight patients, was erected during the year.

Seacliff.—The new kitchen and laundry were equipped and placed in commission, and alterations to the Nurses' Home and "G" Ward were carried out.

Hokitika.—A large villa, in wood on concrete foundations, is in course of erection. The erection of a 40,000-gallon reinforced-concrete water-tower was completed, and 23 ch. of 4 in. water-pipes laid, while two reinforced-concrete pump-houses are being erected. Tenders have been invited for the supply and erection of a motor-driven pumping-plant.

Education Department.

Whangarei District.—Renovations and repairs were carried out to sixteen Native schools, and various works completed at Whangarei High School.

Auckland District.—An additional room has been erected at the Auckland Receiving-home, and general renovations were carried out. At Hamilton a technical high school of three stories, in brick and concrete, was completed during the year. Additions of a cookery-room and store were made to Pukekohe Technical School, and a new heating-system was installed throughout the Seddon Memorial Technical College at Auckland. Renovations and repairs were carried out to two Native schools.

Taumarunui District.—A new shed was erected at Tokaanu Native School, and minor repairs carried out; also repairs at Otukou Native School.

Tauranga District.—A contract was let for extensive additions, &c., at Raukokore Native School, and additions, renovations, and repairs were completed at Te Kaha Native School.

Gisborne District.—A new school was erected at Bartletts; a new residence was erected for the Tokata Native School; a new Native school and residence were commenced at Whangaparoa; and a new class-room and new foundations for the existing Native school were erected at Hiruharama. Extensive alterations, repairs, and renovations were carried out to the Gisborne High School. Repairs and renovations were carried out to six Native schools and residences.

Stratford District.—Extensive additions were made to the Hawera Technical College; additions and repairs were carried out at Wanganui Technical College.

Napier District.—A start has been made on the new technical school at Napier, in brick and concrete; this building will cost approximately £15,000. Two classrooms, a chemistry laboratory, and store were completed at Hastings High School. Repairs and renovations were carried out to three Native schools. Plans have been prepared and tenders called for a new girls' high school at Napier, in brick and concrete.

Wellington District.—Extensive additions were made to Rongotai Boys' College and Hutt Valley High School; renovations and repairs were carried out at the Boys' Home, Austin Street, and at the Children's Home, Miramar.

Nelson District.—A contract was let for the erection of classrooms, &c., for the Nelson Girls' College at a cost of approximately £10,000, and fair progress has been made with the work. Foundation-tests were made for new hostels for the Boys' College, and reports and supervision supplied in connection with earthquake damage. A contract was let for the erection of a recreation and dining block at the Special School for Girls, Richmond, and the work is nearing completion; extensive renewal of plaster-work, &c., was completed at the cottage homes.

Christchurch District.—At Waimate, a high school was completed early in the year. The building, which is of one story in wood, includes six classrooms, chemistry laboratory, two masters' rooms, stores, &c., together with sanitary blocks, cloak-rooms, shelter-sheds, &c. Two classrooms were added to Timaru Boys' High School; a chemistry laboratory was fitted up; extensive alterations and additions were made to the Rectory; a new open-air dormitory was erected, with master's rooms, sanitary block, &c., complete. Extensive alterations and additions were made to the Timaru Girls' Home (Child Welfare Branch).

Dunedin District.—A contract, amounting to approximately £10,000, was let for additions to the home-science wing of the Invercargill Technical College. Good progress has been made with the job, and the building will be ready for occupation in about three months. A new cottage was erected for Otekaike Special School, and extensive additions completed. Repairs and renovations were carried out to other schools as required.

Greymouth District.—Extensive earthquake damage was repaired at Westport State School, Westport Technical School and School of Mines; five schools and one residence in the Karamea district were repaired.

Health Department.

Auckland District.—A new maternity hospital, in brick and concrete, was erected during the year at Paeroa for the Thames Hospital Board.

Stratford District.—An ante-natal clinic and additions to the Nurses' Home were erected at the Wanganui St. Helens Hospital.

Napier District.—At the Napier Public Hospital, a subway was built between the main hospital and the Jellicoe Ward.

Wellington District.—Rooms for the dental clinic were fitted up in the Masonic Hall, Wellington. Additions, repairs, and renovations were carried out to the Otaki Sanatorium. Extensive additions and alterations are being made to Ewart Hospital, for the Wellington Hospital Board. This Hospital is for tubercular patients. The existing one-story brick building was partly demolished, and another story added, together with lift, new kitchen, and sanitary blocks. The existing Nurses' Home was altered, and a new wing containing fifteen bedrooms and a sanitary block is being added. A new boiler-house and chimney-stack, together with boilers, machinery, hot-water, and steam services, are being installed. The various works, when completed, will cost well over £25,000.

Canterbury District.—At Queen Mary Hospital, Hanmer, the old bath and massage block was demolished, and a new building in brick and concrete was erected and equipped. The new Nurses' Home was completed and fitted up; various minor works were carried out to existing buildings.

Dunedin District.—At Dunedin a large concrete wall was erected at St. Helens Hospital. At Invercargill a contract was let for the erection of a Nurses' Home for St. Helens Hospital, and the work commenced.

Greymouth District.—Extensive damage caused by the earthquake to the Buller Hospital at Westport was repaired; a sun-porch was added to the Female Ward; and rooms renovated and repaired. Assistance was rendered to the Grey River, Inangahua and Westland Hospital Boards in restoring earthquake damage done to buildings.

Defence Department.

Auckland District.—The following works have been carried out in connection with the Hobsonville Aerodrome: A further three cottages for married airmen have been completed, and handed over to the Defence Department, making a total of six. A house for married officer has been completed, and is occupied by the Defence Department. A pigeon-house for carrier pigeons has been built. Other works: Sewage and stormwater mains to septic tank are complete and all completed buildings have been connected up. Seaplane building block in reinforced concrete: This block comprises two hangars each of 5,525 sq. ft. floor-space with workshops attached, the whole covering a total area of 0·6 acres. The state of work on this block at present is: All concrete work is completed; asbestos roof-covering is fixed, with the exception of about 60 ft. ridging on No. 2 Hangar. Robertson's protected metal for hangar-door covering is held up, pending delivery; the door winches are erected, and cut-off switches connected; the erection of operation tackle is in hand; all windows are glazed, and all doors are hung; painting is in hand; no plastering has been done. General store: The concrete in this building is complete, with the exception of the floor, which is now being packed with hard-filling ready for concreting. Plastering outside and bituminous-material covering for flat roof will be put in hand immediately. Oil-store: The concrete walls of this building, with the exception of the gable-ends are complete; the steel roof-trusses are in position, and the floor is filled ready for concreting. Six-stall garage: This building for airmen's cars has been completed, except for painting. These four buildings will be finished in about a month, and no work has been authorized on any other building.

At Hamilton the floor of the drill-hall has been covered with clay and rolled, so as to bind the shingle. Repairs and drainage have been carried out. At Ponsonby two storerooms and an office were erected, while sundry works were carried out as authorized at Waikato Camp.

Taumarunui District.—A new building for the storage of explosives was erected at Taumarunui.

Stratford District.—Various maintenance works were attended to.

Wellington District.—At Headquarters, Buckle Street, the change-over to the 230-voltage was completed; two cottages were removed from Buckle Street and re-erected complete in Taranaki Street. Extensive renovations, &c., were carried out to Trentham Military camp, and minor renovations at Fort Dorset.

Nelson District.—Repairs and renovations were carried out to the Nelson Drill Hall. At Blenheim the drill hall was reconditioned after a fire which occurred there.

Christchurch District.—Electric light was installed throughout the ordnance workshops at Burnham Camp, and other works attended to. Waimate Drill Hall was renovated and repaired.

Dunedin District.—Repairs and renovations were carried out to five institutions in Dunedin, and, at Invercargill, to the drill hall and artillery barracks.

Greymouth District.—Repairs were carried out to Greymouth and Westport Drill Halls, and office accommodation was fitted up at Westport.

Tourist Department.

Taumarunui District.—Repairs were carried out to the Chief Guide's residence at Waitomo Caves; and the bath-houses at Tokaanu Hot Springs were renovated and repaired.

Tauranga District.—The reconstruction of the Rotorua bath buildings includes the demolition of the Pavilion and Blue Bath buildings, and the erection of new and larger buildings. Extensive testing of foundations and materials has been carried out, and the various works are now actively in progress. In connection with the Pavilion Bath buildings, the progress has been made as follows: Private bath block: Foundations in, frame up, roof and sarking on. Outside weatherboarded above plinth cap, soffits and fascias fixed. Flooring inside practically complete, and lining well in hand. The concreting of private baths complete. Concreting of bath drainage complete with tiling and concrete covers. Sewer drains in hand. Electric conduits for this block practically complete. Men's swimming-pool: Laying of gas drain with concrete work complete. The concreting of main bath and drains complete with the exception of the steps. Foundations in, frame up, roof and sarking on. Work of tiling roof in hand. Inside walls lined. Laying of floor and erection of dressing-cubicles in hand. Electric conduits for this block completed. Open court: Excavations and concrete work in hand. Foundations in, joists on, floor laid. The work of erecting veranda well in hand. Priest and Radium Bath Block: Sheet piling to Priest Bath complete; foundations in, joists on, frame up, and roof on and sarked; lantern or clerestory well in hand, and outside weatherboarded; floor laid inside, and caulking of same in hand; making and erection of staircases to baths well in hand. Massage and waiting-room section of this block have foundations in, joists on, frame up, roof on and sarked, and are weatherboarded outside; floor down, including concrete floor to lavatories; inside partitions up, nogged, and lined; concrete drains in, tiled, and completed with slab covers; electric conduits for this block well in hand. Men's and Women's Rachel Baths: Excavations and foundations in, joists on, frame up, and roof on with clerestories complete; outside weatherboarded, and inside of walls lined; most of the floors down; work of erecting dressing-cubicles in hand; concreting of pools and drains completed with tiling of drains. Main hall, lounge hall, and office block: Foundations in, joists on, frame up, weatherboarded outside; roof on, complete with skylights; and ceilings and inside of walls lined; work of laying floors in hand; concrete work and tiling of roof well in hand; electric conduits for this block complete. Women's swimming-pool block: Concreting of drains complete, except tiling; foundations well in hand; frame up and nogged and braced; roof-framing on, and sarking well in hand; the manufacture of staircases, joinery, frames, sashes, &c., is being carried out by means of plant on the site; some 10,000 roof-tiles have been fixed in position; construction of two large overflow drains from the Priest and Radium Baths is well in hand. Painting of the whole of the building is making good progress. The following work has been done in connection with the Blue Bath buildings: Site has been cleared, and fencing, with exception of cartways, is completed. The main lines of buildings have been pegged; the concreting of large culvert and main drains from the bath to the lake is finished; excavation of main line of sewer drains has been carried out and most of the 4 in.-pipe sewers have been laid and shouldered with concrete; a quantity of stone, sand, and cement are on the site ready for work on the foundations; excavations for the Juvenile Bath are in progress.

Gisborne District.—At Te Puia Springs the bathhouse was overhauled, and general painting renovations effected; the old pipe-line was removed and a new one laid. A new roof was fixed on the caretaker's accommodation and other repairs carried out.

Dunedin District.—A new wood building was erected to replace Glade House (Lake Te Anau), which was destroyed by fire. The main building consists of two dormitories, with sleeping accommodation for twenty guests, a large dining-hall, kitchen, and office; a four-roomed cottage for the manager, and a hut for the wireless telephone outfit were also erected.

Greymouth District.—A hut was erected on the east side of Lake Kanieri; at Lake Mahinapua the creek was cleared and a landing-stage erected; a large amount of work was carried out in connection with Fox Glacier and Franz Josef Glazier.

Department of Agriculture.

Auckland District.—New office accommodation was provided in Auckland and Hamilton and fittings and furniture were supplied and fixed.

Taumarunui District.—A motor-garage was erected for the Department at Te Kuiti.

Tauranga District.—Additions were made to the Public Works Office at Rotorua to provide accommodation for the Instructor in tobacco-culture.

Gisborne District.—Office accommodation was arranged and fittings supplied at Tolaga Bay.

Stratford District.—Fittings and furniture were supplied for departmental offices at Wanganui and New Plymouth.

Napier District.—New office accommodation was provided in Napier, and fittings supplied. In connection with the Smedley Estate a new wool-shed was erected.

Wellington District.—Additions to Wallaceville Laboratory were completed; the Stock-keeper's house at Somes Island was renovated; and a number of rooms were renovated for the Department in the Dominion Farmers' Institute, Wellington.

Christchurch District.—At Hanmer Springs the departmental cottage was renovated and repaired, and the Rotherham Stock Inspector's residence was repaired.

Dunedin District.—At Dunedin the Department's offices were renovated; sundry repairs and renovations were carried out at Clyde, Palmerston, Owaka, Green Island, Lawrence, and Lumsden.

Soldiers' Graves.

A large number of soldiers' graves have been attended to, headstones and concrete surrounds being fixed as required. The contract for the erection of the Cross of Sacrifice was completed at Featherston Military Cemetery.

General.

A new meteorological office is in course of erection at Kelburn, Wellington. Repairs and renovations have been carried out to various departmental buildings, and furniture and fittings were made and supplied as required.

In connection with the disastrous earthquake of the 17th June, 1929, a great deal of reconstruction work was attended to. In the Greymouth district alone technical officers of the Department supervised the restoration of seven hundred buildings in the Karamea, Mokihinui, Seddonville, Charleston, Westport, Lyell, and Greymouth areas; assessment of damage was made in connection with 1,100 buildings and properties. This was apart from valuations made by members of various relief committees, which rendered valuable service.

In conclusion, I desire to place on record my appreciation of the co-operation of the district offices, and the efficient and loyal manner in which the members of the architectural staff carried out their duties.

John T. Mair, A.R.I.B.A., Government Architect.

APPENDIX D.

ANNUAL REPORT OF THE CHIEF ELECTRICAL ENGINEER.

The Chief Electrical Engineer to the Hon. Minister of Public Works.

Sir,—

I beg to report on the position of the development of electric power in the Dominion for the past year as follows:—

GOVERNMENT SCHEMES IN OPERATION.

LAKE COLERIDGE ELECTRIC-POWER SUPPLY.

The year ending 31st March, 1930, represents the fifteenth year of operation of the Lake Coleridge undertaking, and the year's working again shows very satisfactory results.

The attached tables I, II, III, IV, and V give the analysis of results obtained for the year's operation.

Financial.

The capital outlay at the end of the year was £1,622,199, as against £1,581,262 for the previous year, showing an increase of £40,937 and is analysed in Table II. The total revenue for the year was £196,648, as compared with £186,963 for the year ending 31st March, 1929; and, after payment of all charges, including interest, depreciation, and sinking fund, the net profit was £44,388. This amount has been placed to the credit of the Reserves Account. For the first time since the scheme came into operation it has been possible to wipe off the accumulated deficiency on the Sinking Fund Account and to establish a reserve fund.

Table I shows particulars of financial results and load records.

The total cost per unit generated was 0·25d., a decrease of 0·053d. on that of the year previous; the reduction being due to increased unit output with small additional increase of capital.

Operating-costs have increased by £6,678, represented mainly by increased maintenance on transmission and distribution lines. Details of operating-costs are shown on Table III.

Connected Load.

The total connected load at the end of the year was 181,310 kw., being an increase of 5·2 per cent. over the previous year's figure of 157,401 kw. Details are to be found on Table IV.

Power-house Load and Operation.

The maximum half-hourly output from the power-house for the year was 27,540 kw. on 19th June, representing an increase of 13 per cent. over that of the previous year, the increase being of normal character.

Units output from the power-house totalled 124,375,245, as against 108,011,955 for the previous year, an increase of 15 per cent. The maximum units generated in any one day of the year under review was 419,420, as against 371,070 for the previous year.

The annual load-factor was 51·6 per cent., representing an increase of 1·8 per cent. over that of the previous year. The maximum demand of 27,540 kw., stated above, represented an overload on the installed capacity of the plant of 540 kw., but there was no difficulty experienced in coping with this, nor was any call made on standby plants due to this or to any interruptions to supply.

During the period 31st March to 30th June, 1930, the maximum half-hourly load twice exceeded 30,000 kw.—viz., on the 9th June, when the record load of 30,800 kw. for the power-house was reached, and on the 25th June, when the figure was 30,120 kw. On both these occasions the demand occurred between 4.30 p.m. and 5 p.m., with the weather conditions in Christchurch very cold and wet.

Transmission-lines.

During the year the work of changing the 7/·135 S.W.G. aluminium conductors to 19/13 S.W.G. copper on the Homebush–Bealey Section of the north line was completed, and all three lines between the power-house and Addington are now of copper.

Steady progress has been maintained in live-line operation, with the consequent reduction in interruptions to consumers. Buzz-stick testing of all insulators on the transmission-lines was carried out during the year. Of the 10,446 pin-type insulators tested, 524 were found defective; of the 26,850 suspension-type insulators tested, 82 were found defective. In connection with the live-line testing of insulators, it is with regret that I have to record the death of one of the linesmen engaged on this work. This linesman was drowned in the Waitaki River when attempting to reach one of the towers, and I would like to put on record my sympathy with his relatives in their loss, and my appreciation of his services on this class of work.

66 kv. Substations.

The capacity and output of each of the 66 kv. substations is outlined hereunder:—

Substation.	Capacity.	Maximum Demand.	Units.
	Kv.A.	Kv.A.	
Addington	29,000	20,792	91,948,682
Timaru	5,000	2,395	10,747,924
Ashburton	5,000	1,370	6,072,640
Oamaru	1,050	1,061	5,033,815
Hororata	295	275	1,051,167
Point	100	37	117,705
Totals	40,445	25,574 (Table I)	114,971,933 (Table I)

Headworks and Power-house.

During the year additions were made to the groyne near the intake cylinder to prevent the travel of shingle during the high lake-level. Additional work and consolidation of existing groyne have been carried out since the end of the year, the lower lake-level making this possible.

Installation of the new 7,500 kw. generating-unit was completed, and a preliminary run was carried out in October, 1929. Owing, however, to the late arrival of the switch-gear, it was not until January, 1930, that load was carried on the set. The pipe-line supplying this unit was finally completed in January. Efficiency tests have yet to be carried out on the new unit, and for that purpose a special load test tank has been erected.

Considerable trouble has been experienced with the governors of Nos. 2 and 3 units, and this trouble was directly responsible for the delay in restoring supply during the unfortunate series of interruptions in January, 1930.

The ironclad switch-gear has occasioned some trouble during the year due to overheating of certain generator-switches. The supply by the manufacturers of gun-metal levers to replace those made of steel has resulted in a lowering of the temperature.

The replacement of the low-tension coils in the transformer banks has progressed, and seven of the total of ten transformers have been dealt with. Replacement coils for the remaining three transformers are on order, and on arrival the work of replacement will be put in hand.

During December, 1929, a start was made with the reorganized layout of the 66 kv. system at the power-house, and at the end of the year the outdoor steelwork for the south transmission-line was erected, together with the relocation of the indoor 66 kv. transformer-breaker with isolators. Up to the 30th June, 1930, steady progress has been made with this work, despite the heavy load on the power-house and the necessity of maintaining supply. The outdoor steelwork with airbreak switches and isolators has been completed, and the three arrester-banks erected. The main 66 kv. indoor bus with tie switches, and transformer-bank O.C.Bs. and isolators, have been erected, and the work should be completed in the next two months. The outdoor O.C.Bs. to control each transmission-line are on order, and it is anticipated that these will be installed before the end of the next financial year. The installation of these oil circuit-breakers will give direct control of the transmission-lines, and will facilitate the removal of a faulty line without cutting out a transformer-bank as well.

Addington Substation.

The synchronous condenser has been in operation throughout the year without any trouble. A new type of oiling-rings for the bearings was designed and fitted with satisfactory results.

A new bank of 12,000 kv.a. capacity was installed and placed in commission on the 29th July, 1929. This bank replaced the 5,000 kv.a. bank, which will be converted for outdoor use.

The earthquake of the 17th June, 1929, caused a heavy short on the Northern and Fendalton feeders, and No. 4 condenser running-switch blew up and caught fire. The main supply was cut off for ten minutes owing to the substation being filled with dense smoke.

A transformer-bank of 5,000 kv.a. was converted from water-cooled to air-cooled type. Except for the imported bushings and thermometers, the whole work of conversion was done locally.

An order has been placed for an additional 12,000 kv.a. bank of transformers to replace the remaining 5,000 kv.a. banks. When installed, the capacity of Addington Substation will be 36,000 kv.a.

Point Substation.

All the original airbreak-switches have been refitted to a new design, the existing insulators being replaced with a pillar type.

The 100 kv.a. 66/11 kv. transformer broke down in March and, after being repaired at Addington, was placed in service on the 25th April, 1930. Gang-operated 66 kv. T.P. isolating-switches are to replace stick-operated switches, and arrangements have been made for this improvement,

Hororata Substation.

A staff cottage was erected during the year, and was completed on the 27th February, 1930.

Arrangements are in train for improving the efficiency of this station by increasing the present number of O.C.Bs. from four to eight. The present 295 kv.a. transformer is to be replaced by a 750 kv.a. transformer-bank to be transferred from Oamaru.

The original airbreak-switches have been remodelled and fitted with a better type of insulators and a new type of gang-operated isolating-switch is to replace the present type, which is stick-operated.

Ashburton Substation.

No alterations were carried out at this substation during the year, but arrangements have been made to install additional switch-gear during the coming year to increase the efficiency of the station. An induction-regulator will also be installed to regulate the voltage of supply to the Power Board.

Timaru Substation.

Preparatory to altering this substation from a wood pole type to steel, a contract has been let for the removal of the two staff cottages to a more convenient position, and the area of the site has been considerably increased to accommodate the equipment. The alterations will make due provision for the additional supply from Waitaki Hydro Electric Works.

Oamaru Substation.

The existing banks of transformers at this substation have been overloaded during the year, and arrangements have been made to install a 5,000 kv.a. bank. This bank will be located in the position selected for the final steel layout, the latter being necessary shortly, due to the installation of the Waitaki Hydro Electric Works.

Interruptions to Supply.

(*a*) *Christchurch Supply.*

The total number of interruptions to supply exceeding one minute during the year was eleven, and the total time of same was one hour forty-five minutes.

The longest period was on the 22nd January, 1930, when the time of interruption was 45 minutes. The month of January represented a series of interruptions to supply which were most regrettable. In all, there were six interruptions, totalling 1 hour 24 minutes. These interruptions were due chiefly to failure of insulators on airbreak-switches at the Point and Hororata Substations, together with simultaneous trouble with the governors on Nos. 2 and 3 machines at the power-house. The causes of these troubles have been dealt with, all the airbreak-switch insulators being replaced with more reliable type and the machine-governors overhauled and readjusted.

There was an interruption of 10 minutes on the 17th June, 1929, caused by the severe earthquake affecting the condenser at Addington Substation. One other outage of 1½ minutes was due to a fault in the voltage-regulator at the power-house, and one of 2½ minutes due to a conductor breaking on one of the transmission-lines. So far as can be ascertained, no interruptions were caused by failure of insulators on the actual transmission-lines, and this fact is due to the sorting out of the defective units by buzz-stick testing. The failure of insulators due to fog conditions was prevented this year by a systematic wiping of the insulators on the foggy section of the lines.

(*b*) *Ashburton Supply.*

The total number of interruptions to supply at Ashburton, apart from those prearranged, was twenty-one, the total period of same being 8 hours 39½ minutes. Of these, eight affecting Christchurch also affected Ashburton, the total time being 1 hour 35 minutes. Of the remaining thirteen, five were caused by the blowing of E.H.T. fuses due to trouble on the 11 kv. side; two, causes were unknown; one to direct overload; and one due to failure of 11 kv. underground cable.

(*c*) *Timaru Substation.*

The total number of interruptions to this supply was twenty-one (neglecting one interruption by arrangement), and the total period of same was 2 hours 54 minutes. Of these, the majority were caused by troubles which affected Ashburton Substation also. Interruptions at the substation itself numbered seven, totalling 50½ minutes. Four of these were due to E.H.T. fuses blowing, owing to faults on the 11 kv. system, two by insulators flashing over, and one due to flashover of the arresters.

(*d*) *Oamaru Supply.*

Apart from prearranged shut-downs, the total number of interruptions was twenty, and the duration was 172 hours 2½ minutes. The longest period of a single interruption was 170 hours 7½ minutes, and this occurred due to the washing-out of centre tower on the Waitaki River crossing during a flood in the river on the 29th January, 1930. A temporary H pole was erected under great difficulties, owing to the flood conditions, and the wires restrung, but a week elapsed before power was again restored. Arrangements have been made to erect the permanent tower-crossing with special foundations to withstand maximum scouring-conditions of the river.

Of the other interruptions, totalling 1 hour 55 minutes, only two were due to trouble at the substation, both on the 11 kv. side, the remainder of the interruptions being due to the trouble affecting Timaru.

General.

With a view to improving the service generally on the transmission-lines and to enable the correct elimination of faulty sections of line, orders have been placed for a complete scheme of relay protection, together with the necessary switch-gear. This will involve considerable alterations in the substation layouts, and these alterations will make provision for the bringing-in of the Waitaki hydro-electric scheme. The equipment should arrive during the next financial year.

With the formation of the Hurunui Electric-power Board, arrangements will be made during the coming year to extend the existing 33 kv. line between Addington and Southbrook to Waipara, where the Board will take supply.

With the erection of the new 11 kv. substation at Woolston for railway-electrification purposes, all the Department's consumers in Woolston area were changed over from 400 volts to 11,000 volts, and supply to Heathcote County (Bromley and Mount Pleasant) and Sumner Borough also changed to the same voltage. A new duplicate 11 kv. line was also erected between Woolston Substation and Heathcote Valley, replacing the original line. This new line is of greater capacity, and, being controlled by automatic reclosing breakers at Woolston, localizes faults which, previously occurring on the Lyttelton Section, affected the whole feeder back to Addington Substation.

Considerable maintenance-work was carried out during the year on the 11 kv. feeders, the condition of many of the mixed hardwood poles being such that they had to be replaced. The aluminium cable also has given a great deal of trouble, and has deteriorated considerably. The trouble, however, is confined to two sizes only—viz., 7/14 and 7/12—the 7/·135 aluminium removed from the main transmission-lines appearing quite sound. The problem of replacing all of the defective aluminium will have to be faced shortly. In all, twenty-six poles were renewed during the year—thirteen of these with both feeders in service, and the remainder with one feeder alive. The increasing load on the 11 kv. feeders and the number of consumers is making it increasingly difficult to carry out repairs by cutting off supply, and recourse has to be taken to repair work under live-line conditions.

Lake-level and Rainfall.

At the beginning of the year the lake-level was 1,669·75 ft. or 2·25 ft., lower than the new normal lake-level of 1,672 ft. The level dropped to 1,666·2 ft. at the end of May, 1929, but by the middle of December the level was restored to 1,672·1 ft., where it was maintained until the end of February, 1930. From that period onwards the level has steadily fallen till at the 29th June, 1930, it stood at 1,664 ft.

The maintenance of supply of water for the lake from the Harper River has been greatly facilitated by the use of the new high-level gate, which permits considerable volume of water to be taken by the race during flood periods on the Harper, without the drawback of silting up the diversion channel by travelling shingle.

The rainfall at the power-house for the financial year was 36·28 in., but from the 1st March till the 31st May, 1930, the rainfall was only 2½ in.

MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.

I. Financial Results.

During the year the two systems—Mangahao and Waikaremoana—were amalgamated, making a capital outlay at the close of the year of £3,426,901, which is analysed in Table X. The net revenue for the year was £259,461, and working-expenses £59,235. After paying interest totalling £191,288, a net surplus of £8,938 was shown. Depreciation charges amount to £62,205, which leaves a deficiency on the year's working of £53,267.

The financial results and load records are analysed in Table IX, whilst Tables X and XI give an analysis of the capital outlay and working-expenses. The gross financial results of the system are given in Table XIII.

II. Operation and Maintenance.

(a) Mangahao Headworks and Power-house.

Throughout the year the plant operated very satisfactorily.

The main 110,000-volt transformers were overhauled and rubber gaskets renewed. A set of stainless steel buckets was placed on one of the turbines and the usual amount of welding had to be done to the buckets on the other turbines.

Several culverts had to be replaced on the Mangahao Road, and slips removed. On the tail-race, with the exception of the replacing of a flood-gate, very little maintenance was necessary.

(b) Waikaremoana Headworks and Power-house.

The station was officially opened on the 20th November, 1929, by His Excellency the Governor-General.

During the year the station has operated satisfactorily, although a few adjustments, &c., inevitable with a new power-station, were required. The stone-dam built in the tail-race had to be topped up several times as the stone settled.

On the 110 kv. air-break switches and isolating-switch the original push-rods were not satisfactory, and had to be replaced by others of an improved design. There were two failures of 110 kv. bushings on oil switches, due to water getting into them. This necessitated removing all the bushings and refilling them and altering the design thereof to prevent the ingress of water, and several of the cast-iron covers on the operating-boxes of these oil switches cracked and had to be replaced by sheet-steel covers. Alterations to some of the 11 kv. joint boxes were required due to sheath currents.

The original waterflow alarms on the 110 kv. and 50 kv. transformers did not operate satisfactorily, and these were replaced by new ones which are giving satisfaction.

In the village, the usual maintenance work on roads, &c., has been carried out during the year.

(c) Transmission-lines.—General.

The fourth year's series of tests on insulators has been completed, one make not being tested. In the next year two other makes will not be tested, the experience of previous years having shown that these three makes have a very small percentage of failures. All units reported defective have been removed from the lines and tested at Khandallah, these tests again confirming the value of the buzz-stick test.

A live-line-testing class was held at Waikaremoana and the linesmen in that area trained in the buzz-stick method of testing both pin and suspension types of insulators.

Most of the troubles on the main transmission-lines in the past two years having been due to salt deposit, all insulators have been cleaned by hand wiping during the past year. A method of cleaning insulators while the lines are alive has been developed, and tests are being carried out to enable the equipment to deal with all makes of suspension-insulators on the system. It is hoped that by this means there will be very little necessity to arrange shut-downs on the lines for the purpose of cleaning insulators, and that interruptions due to salt spray will be greatly reduced.

A high-tension paralleling equipment was installed at Mangahao during the year, to enable the Mangahao and Waikaremoana Power-houses to be paralleled on the 110 kv. side of the main transformers. This has increased the flexibility of the system to a marked extent.

Pole-strengthening work is being carried out on the Wellington lines, and during the coming year the work will be carried out on the other lines in turn. It is worthy of note that except for flash-overs due to salt spray there has been no flash-over on insulators which are on unearthed wood-poles. This emphasizes the value of wooden poles for transmission lines.

Further trouble was experienced with vibration on A.C.S.R. cables during the year, a cable breaking from this cause on the Woodville–Dannevirke line at pole 415. Arrangements have been made to fit damping-devices at all points in the lines where vibration is known to be liable to take place.

Lightning storms recorded during the year numbered fifteen. None did any damage to lines or substations, and only one was responsible for a main-line interruption.

Transmission-lines.—Operation and Maintenance.

110,000-VOLT LINES.

Mangaore–Khandallah Duplicate Line.—This duplicate line has been in service throughout the year, transmitting electricity to the customers taking supply at Khandallah Substation.

During the year there were three outages due to faults on this line, totalling 8 minutes, all the faults being on the west line. One outage of 2 minutes was probably due to straw from farmers' haystacks being blown by heavy winds on to the insulators; a cable at Newlands coming out of its clamp owing to the shearing of a brass split-pin caused the line to be out of service for 4 minutes; and a third outage of 2 minutes was caused by a guard wire above the telephone-line at the Otaki River crossing being blown up against a conductor during a heavy gale. Subsequent examination of the guard wire in question showed that another outage in the past had had the same cause. In addition to the above, an accidental outage of 1 minute on the east line was due to an operator accidentally knocking the controller of the switch controlling this line at the Mangahao Power-house.

During the year the cable-clamps on the west line were replaced by a superior type, with satisfactory results. Preparations are in hand for shifting the telephone-line crossing at the Otaki River on to separate poles. The deviation has been surveyed and some piled poles will be necessary. The poles on this line were thoroughly examined last winter for deterioration, the sap being tested at ground-level and at 10 ft. above. All poles showing an undue reduction of the factor of safety are marked for stubbing and on one section, from Mangaore to Ohau River, the stubs have all been erected. A few poles have weakened considerably and will be entirely replaced. The year has been free from salt-spray troubles; slight salt deposit was just discernible last December on the insulators near Otaki just before the annual cleaning-period came round.

Mangaore–Bunnythorpe East Line.—This line gave excellent service throughout the year. None of the troubles experienced on the sections between Mangaore and Tuai were traced to this section. The line was, however, out of service on twenty-two occasions, due to troubles on various parts of the system, the outage times totalling 3 hours 31 minutes. There can be no doubt that the absence of the earth wire on this section contributed largely to the freedom of this section from line faults. Six outages, totalling 5 hours 32 minutes, were prearranged.

During one of the regular patrols a string of insulators was found wantonly damaged, but it is not possible to say whether with stone or gun. Incipient vibration breaks were found during the annual insulator-cleaning on this as also on the west line, and were fixed up. These were on the Manawatu River towers, and vibration dampers have been installed on the towers. Of the two telephone circuits, the galvanized iron one is beginning to deteriorate rapidly. The telephone-line

is accordingly scheduled for reconstruction, and this work will be carried out during this year. The 1-mile section out from the power-station at Mangaore, formerly carried under the Mangaore–Shannon 11,000-volt transmission-line, has been taken down and put on separate poles (the whole line is now on separate poles), with a marked improvement in clarity of speech.

Mangaore–Bunnythorpe West Line.—Of the troubles experienced on the line sections between Mangaore and Tuai, two were traced to faults on this section. During one of the worst storms experienced in these parts a line outage of 22 minutes was caused by arcing between a swinging jumper and a cross-arm stay; and another outage of 12 minutes was due to a string of insulators flashing over, there being evidence of birds having caused the flash-over. In addition to the above, there were six more accidental outages, totalling 25 minutes, on this section due to other troubles on the system; and two outages, totalling 3 hours 37 minutes, were prearranged.

Bunnythorpe–Marton–Wanganui Line.—During the year, with the erection of an air-break switch at Marton, this line has been divided into two sections—from Bunnythorpe to Marton and from Marton to Wanganui. Since the destruction by fire on the 28th January of the relays on the O.C.B. at Bunnythorpe Substation controlling this line, the line has been operated without protective relays. Only two troubles were experienced on the Bunnythorpe section, both being on the same night. The prime cause of the trouble was salt and dirt on the insulators.

In addition to the above, accidental outages on the Bunnythorpe–Marton and Marton–Wanganui sections numbered seventeen, totalling 1 hour 56 minutes, all being due to troubles originating elsewhere on the system. Fourteen outages, totalling 54 hours 56 minutes, on the Bunnythorpe–Marton section and thirteen outages, totalling 63 hours 11 minutes, on the Marton–Wanganui section were prearranged. These prearranged interruptions were arranged at such times as the Wanganui–Rangitikei Power Board was able to carry its own load on its steam plant so that the shut-downs on the line did not inconvenience the Board's customers.

The insulators on these particular line-sections will in future be cleaned twice a year, it having been made evident that one annual cleaning is not sufficient to cope with the salt-spray troubles to which these sections are so liable. Strings of the two types of insulators in use on these sections have been erected on a dummy pole in the Marton Substation yard. These are inspected at frequent intervals so that a very fair estimate can be made of the amount of salt (if any) on the transmission-line.

Experiments have been made on the possibilities of cleaning the insulators with the conductors alive: the results so far are very encouraging, and it is hoped that in the coming year live-line cleaning will be put on an operating basis. An extra unit has been placed on each of the 6-unit strings so as to have maximum leakage-resistance to hold up the line. Although this has reduced the clearances available against heavy winds, it is considered warranted inasmuch as wind conditions in this district are not so violent as along other lines.

Bunnythorpe–Woodville Line.—This line gave excellent service during the year under review. None of the troubles experienced on the sections between Mangaore and Tuai were traced to this section. However, there were twenty accidental outages, totalling 3 hours 20 minutes, due to troubles on various parts of the system. Prearranged outages numbered six, totalling 4 hours 44 minutes.

During a prearranged shut-down the U-bolts on the towers on the Ruahines we respecially examined for undue wear and found O.K. In common with all other lines buzz-stick testing and cleaning of insulators, examination of cable and hardware and other duties in the efficient maintenance of the lines have been carried out. Two telephone-huts have been rewired.

Woodville–Mangamaire Line.—There were no faults on this line during the year. The line was, however, out of service twenty-nine times for periods totalling 6 hours 15½ minutes, owing to troubles elsewhere on the system. In addition, fourteen outages, totalling 35 hours 36½ minutes, were prearranged.

All poles were thoroughly examined last winter for excessive sap and in a few cases, where the poles had obviously deteriorated below standard, they have been stubbed in advance of the general stub-erecting. An extra telephone-pole was put in on the north bank of the Manawatu River.

Mangamaire–Masterton Line.—There was only one fault on this section during the year, a string of insulators having flashed over and badly punctured the top unit. The line was out four times for this cause, the outage time totalling 20 minutes. There were also twenty-seven accidental outages, for periods totalling 8 hours 0½ minute, owing to troubles elsewhere on the system. Thirty outages, totalling 110 hours 37 minutes, were prearranged.

The U-bolts on the towers on Mount Bruce have been wearing excessively and have been replaced. One pole was replaced during an arranged shut-down. A telephone-hut was rewired.

Woodville–Dannevirke Line.—Of the faults experienced on the line sections between Mangaore and Tuai, three were definitely on this section. An accidental section outage of 29 minutes was caused by a cable vibration break. Three other accidental outages, totalling 20 minutes, were caused by a jumper breaking short in a parallel-groove clamp, this also being due to vibration. Three accidental outages, totalling 1 hour 55 minutes, were due to earth wire contacting with a conductor. A further accidental outage of 9 minutes on this section was probably due to heavy winds near

Dannevirke swinging a conductor too close to a cross-arm stay. Sixteen more accidental outages, totalling 1 hour 47 minutes, were experienced by this section from other troubles on the system. Eight section outages, totalling 13 hours 17 minutes were prearranged.

The Department has been in communication with aluminium cable manufacturers and other operating authorities throughout the world on the question of vibration and the use of vibration-dampers. What appears to be a practical and effective design of damper has been arrived at and this will be tried out on this and other sections particularly subject to this trouble.

Dannevirke–Waipukurau Line.—Of the faults experienced during the year on the line sections between Mangaore and Tuai it is quite possible that the one referred to above as due to arcing from a conductor swinging in heavy winds near Dannevirke may have been on this section, the section being out of service for a period of 9 minutes. Besides this one, there were twenty-four other accidental section outages, totalling 4 hours 37 minutes, due to other troubles on the system. Seven section outages, totalling 6 hours 57 minutes, were prearranged.

Waipukurau–Napier Line.—None of the faults experienced during the year on the several line sections between Mangaore and Tuai were found on this section. Accidental outages, due to troubles on various parts of the system, numbered twenty-seven, totalling 5 hours 54 minutes. Nine section outages, totalling 12 hours 7 minutes, were prearranged. The telephone-line was taken down from the towers and put on separate poles, some of which were piled. Insulators were fitted in all jumpers on this section.

Tuai – Napier Duplicate Line.—The east line was livened up at 110,000 volts for the first time on the 18th July, 1929, but the two lines were not operated in parallel until after Christmas. The only trouble during the year was a broken strand (due to a hard-soldered joint) on a tower near Pihanui, which was fixed up before it caused a flash-over. There were twenty-eight accidental outages, totalling 22 hours 6 minutes; one of 18 minutes was due to lightning stroke on the east line and the remaining twenty-seven outages were all due to troubles originating elsewhere on the system. Prearranged outages, at times when Mangahao could supply the southern Power Boards, numbered sixteen, totalling 10 hours 56 minutes. This line has given excellent service.

Regular patrols have been maintained, and general work has been carried out to keep the patrol-tracks in good order and accessible during all weathers. Two foot-bridges were erected between Towers 264 and 265. All insulators have been tested by the buzz-stick method, and no defects were found. The H.T. telephone-line has been maintained in good order.

Line Sections between Mangaore and Tuai: General.—During the year there were five faults on the sections which could not be located, causing outages of approximately 50, 6, 10, 6, and 7 minutes respectively, affecting all the sections. Owing to delays in the delivery of the new system of protective relays, referred to in the last annual report, these lines have had to be operated without any protective relays other than those at the power-stations.

50,000-volt Lines.

Tuai–Wairoa Line.—This line, formerly operated at 11,000 volts to transmit power from the former temporary power-station at Tuai to the Wairoa Electric-power Board, was reinsulated for 50,000 volts during the year preceding the one under review. On the 5th April, 1929, the line was changed over to the main power-station at the Tuai end and to the new departmental substation at the Wairoa end, and on the 6th *idem* was livened at 50,000 volts. Accidental outages to this line numbered seventeen, totalling 5 hours 26 minutes, one of 26 minutes being due to a conductor coming adrift from its tie, and the rest on account of troubles on other transmission-lines. Prearranged outages numbered six, totalling 7 hours 22 minutes. This line, as reconstructed, has given very good service.

The buzz-stick testing of insulators has been carried out. Sap testing of poles has been carried out, and the guying, strutting, and replacements as required are proceeding.

A cage has been installed at the river crossing between poles 76 and 77 to facilitate patrol. Regular patrols were maintained and the tracks are in good order.

Tuai–Gisborne Line.—Accidental outages to this line during the year numbered fifty-one, the outage times totalling 100 hours 53 minutes. The longest was one of 75 hours 53 minutes, due to the line being blown down in the Ohuka. The inaccessible and wind-swept nature of the country presented great difficulties to the break-down gangs in restoring the line to service. Of the remaining outages, one was due to lightning, one to trouble with a transformer at Gisborne Substation, seven were probably caused by the telephone-line being blown against conductors on the transmission-line, five were due to troubles at Tuai, twelve were due to surges on other transmission-lines, four were occasioned by troubles on the Power Board's system, and the causes of the remaining twenty outages could not be ascertained; but there is little doubt that most of them should be attributed to the high winds prevalent in the district. Outages prearranged to work on the line or at the substation numbered ten, totalling 47 hours 25 minutes.

On account of slips threatening the line, a deviation of about half a mile was carried out at Gentle Annie Hill. This entailed the erection of two steel towers and three poles.

Spare poles have been distributed along the transmission-line and along the telephone-line in windy sections in case of further trouble. Several additional poles have been erected on the telephone-line in windy sections to prevent excessive movement of the conductors. All insulators have been tested by the buzz-stick method. Regular patrols have been maintained and general work carried out on patrol-tracks.

11,000-VOLT LINES.

Khandallah – Lower Hutt Workshops Duplicate Line.—During the year there was only one fault on this line, a cotter-pin coming out of a suspension-insulator at pole 77, the outage time being 25 minutes. Fourteen more accidental outages totalled 21 minutes. Of these, five totalling 5 minutes were due to overload, four outages totalling 9 minutes were the same as given above for the Mangaore–Khandallah Line, and for the remaining five outages totalling 7 minutes the causes could not be found. Fourteen section outages, totalling 94 hours 29 minutes, were prearranged. During the year the insulators were cleaned on this line.

Khandallah–Hutt Power Board Duplicate Line.—During the year the only line-fault on this line was a jumper out of its socket at the terminal pole at Petone, causing four outages, totalling 45 minutes. There were eighteen more accidental outages, totalling 51 minutes. Of these, one outage of 20 minutes was due to a mistake in switching-operations; four outages totalling 9 minutes were the same as given above for the Mangaore–Khandallah line; five totalling 8 minutes were due to Power Board troubles, and for the remaining eight accidental outages, totalling 14 minutes, the causes could not be found. One section outage of 1 hour 32 minutes was prearranged. The insulators on this line were cleaned during the year.

Khandallah–Meatworks Line.—There were no line faults on this section during the year. There were four accidental outages, totalling 9 minutes, the same as given above for the Mangaore–Khandallah line; and two section outages, totalling 7 hours 25 minutes, were prearranged.

Mangaore–Shannon Duplicate Line.—The outages on this line during the year numbered three, totalling 8 minutes, all due to Power Board troubles.

(d) Substations.—General.

At all substations and in all buildings careful inspections were made of the wiring and, where necessary, alterations were carried out in order to bring the wiring up to the standard called for by the Wiring Regulations. The 110 kv. bus-bar insulators, &c., at all substations were cleaned twice during the year. The earths at all substations were bonded together. During the year particular attention was given to the metering equipment at each substation, and periodical checks made on all equipments. The synchronous condensers at Dannevirke, Napier, Mangamaire, and Khandallah were run as required throughout the year for voltage-regulation purposes.

Khandallah Substation.—There were no troubles at this substation during the year, and the only accidental interruptions were four, totalling 9 minutes, due to outages on the Mangaore-Khandallah transmission-line. Except for the 11,000-volt lines (detailed above), there have been no prearranged interruptions.

During the year a good deal of work was necessary on the synchronous condenser bearings, but these are now satisfactory. The 110-volt control-battery was replaced by a new and larger one. New totalizing metering-equipment was installed on the Hutt Valley Power-board feeders and a reactive kv.a. meter installed on the Railway Workshops feeder.

Bunnythorpe Substation.—During the year only two troubles originated at this substation. One was the cable failure and subsequent disastrous fire, referred to below, causing an interruption of 2 hours 32 minutes. The other interruption of 4 minutes was due to an attendant at Bunnythorpe accidentally knocking the controller of an oil circuit-breaker while cleaning; and thirteen interruptions, totalling 1 hour 33 minutes, were due to troubles elsewhere on the system. Altogether there were fifteen accidental interruptions, totalling 4 hours 8 minutes. Prearranged interruptions numbered eight, totalling 12 hours 40 minutes, and were made at times to suit the Manawatu-Oroua Power Board.

The main building of this substation, housing the control, metering, and protective equipment, was completely gutted by fire on the afternoon of the 28th January. 1930. The fire was primarily due to the failure of the main outgoing cable to the Power Board's substation. The equipment was completely ruined; and the tanks and operating-boxes of two 110 kv. O.C.B.s stored there awaiting erection were also badly damaged and their bushings destroyed. The crane was badly damaged and the roof, windows, temporary wooden end wall, furniture, and interior generally destroyed. Other than concrete breaking away in certain parts, the concrete shell of the building was unaffected. Plans are well forward for renovation and additions, notably provision for a future Load Despatcher's Office, rendered necessary by the continuous growth of the system.

Marton Substation.—This automatic substation went into operation with temporary 11 kv. switchgear on the 28th July, 1929, to provide a second point of supply to the Wanganui–Rangitikei Electric-power Board. From then to the 31st March last, there were twenty accidental interruptions, totalling 16 hours 32 minutes. Of these, one of 2 minutes was necessary to adjust a bad contact on the air-break switch; twelve, totalling 10 hours 58 minutes, were due to troubles on the transmission-lines; and the remaining seven interruptions, totalling 5 hours 32 minutes, were caused by troubles on the Power Board's system. Interruptions prearranged with the Power Board, of which there were six, totalled 18 hours 7 minutes.

Wanganui Substation.—Power-supply was accidentally interrupted thirty-one times, of a total duration of 12 hours 35 minutes. Of these, eleven, totalling 39 minutes, were due to troubles on the Wanganui-Rangitikei Power Board's system, and the remaining twenty interruptions were due to troubles on the transmission-lines and elsewhere. In addition there were sixteen prearranged interruptions, totalling 66 hours 54 minutes.

Mangamaire Substation. — Accidental interruptions during the year numbered twenty-nine, totalling 6 hours 15½ minutes, and of these twenty-six, totalling 6 hours 12½ minutes, were due to troubles on the transmission-lines and elsewhere; and three, totalling 3 minutes, were due to troubles on the Power Board's system. In addition, eighteen interruptions, totalling 42 hours 22½ minutes, were prearranged at times to suit the Tararua Power Board.

Masterton Substation.—During the year there were forty-eight accidental interruptions, totalling 8 hours 49 minutes. The accidental interruptions are analysed as follows: Thirteen, totalling 25 minutes, were due to faults on the Wairarapa Power Board's system; twenty-eight, totalling 7 hours 2 minutes, were due to troubles on the transmission-lines and elsewhere; and for the remaining seven accidental interruptions, totalling 1 hour 22 minutes, the causes could not be ascertained. In addition, thirty-seven interruptions, totalling 112 hours 13 minutes, were prearranged with the Power Board.

Woodville Switching Station.—A hollow rotating insulator which exploded was replaced by a solid post-type one and so also were the other two hollow ones on the same switch. Corroded aluminium clamps on the 110 kv. bus-bars were replaced. Sundry repairs were carried out to fences, and drains laid through the property.

Dannevirke Substation.—During the year there were twenty-six accidental interruptions, totalling 4 hours 13 minutes. Of these accidental interruptions, one of 7 minutes was due to the blowing-up of a rotary insulator of the bitumen-filled type on an air-break switch at the substation; seventeen, totalling 3 hours 1 minute, were due to troubles on the lines and elsewhere; and for the remaining eight, totalling 1 hour 5 minutes, the causes could not be found. Prearranged interruptions at times to suit the Dannevirke Power Board numbered eight, and totalled 13 hours 1 minute.

Waipukurau Substation.—During the year there were sixty-eight accidental interruptions, totalling 6 hours 25 minutes, which are analysed as follows: Twenty-nine interruptions, totalling 1 hour 11 minutes, were traced definitely to troubles on the Central Hawke's Bay Power Board's system; seven more interruptions totalling 9 minutes, there is good reason to believe, were also due to faults on the Board's side; five interruptions, totalling 41 minutes were due to faulty operating-mechanism on an air-break switch at the substation; twenty-three, totalling 3 hours 26 minutes, were due to system line troubles and the like; and for the remaining four accidental interruptions, totalling 58 minutes, the causes could not be found. Prearranged interruptions, at times to suit the Power Board, numbered sixteen, totalling 8 hours 6 minutes.

Napier Substation.—During the year there were twenty-eight accidental interruptions, totalling 5 hours 59 minutes. Of the accidental interruptions, one of 1 minute was due to trouble on the Hawke's Bay Power Board's system; one of 11 minutes was caused by one phase of an air-break switch being blown by a heavy wind on to an earthed line; twenty-two interruptions, totalling 4 hours 45 minutes, were due to troubles on transmission-lines and the like; and for the remaining four accidental interruptions, totalling 1 hour 2 minutes, the causes could not be found. Prearranged interruptions, at times to suit the Power Board, numbered eighteen, totalling 10 hours 26 minutes.

Wairoa Substation.—This substation, which supplies the Wairoa Electric-power Board, went into operation on the 6th April, 1929, and since then there have been seventeen accidental interruptions to supply, totalling 5 hours 36 minutes. Of these, one of 1 hour 6½ minutes was due to a conductor coming adrift at the terminal air-break-switch structure at the substation; one of 26 minutes was due to a fault on the line; three, totalling 2 hours 37 minutes, were caused by troubles at Tuai; and the remaining twelve, totalling 1 hour 26½ minutes, were due to surges on other lines.

The operation of this substation was satisfactory during the year, the only work other than that of a routine nature which was necessary was an alteration to the choke-coil leads and the replacement of a roof-bushing.

Gisborne Substation.—This substation (at Patutahi) supplies the Poverty Bay Electric-power Board. Accidental interruptions during the year numbered forty-six, totalling 103 hours 4 minutes. The causes of these interruptions are the same as given above for outages on the Tuai–Gisborne line, the slight discrepancies between the respective figures being due to switching operations at Gisborne and to the Power Board not being ready on certain occasions to take supply. Prearranged interruptions, at times to suit the Power board, numbered nine, totalling 46 hours 24 minutes.

The operation of this substation has been satisfactory during the year.

III. Construction.

Mangahao Power-station.—During the year very little construction work was done. A 110 kv. potential transformer and switch-gear were installed on the roof, to enable Mangahao to parallel with Waikaremoana on the 110 kv. side. A new board-room and single men's quarters were built. A new service line to the village was also built.

Waikaremoana Power-station.—Erection of overhead lines, installation of water-measuring instruments and control-gear for Nos. 1 and 2 pipe-line gates, were carried out during the year. The temporary spillway has been permanently sealed with concrete and back-filled. The temporary pipe-line intake has been permanently sealed with an earth wall. An earth filling has still to be made between the old temporary spillway and the head of the race, the weir-level transmitter has still to be placed in service to make construction work on the headworks complete.

All hardwood blocks have been removed from the pipe-line cradles. Surface-drains have been cut in the bench, which has been widened in several places where slips occurred, and the embankment at these places stone-pitched. A fair amount of work has still to be done where slips have occurred

and additional surface-drains will have to be cut to prevent trouble during the wet weather. A crib dam was built across the tail-race at the beginning of the period.

No. 4 exciter set has been erected and placed in service. All units have been painted, floors have been painted, and linoleum laid where required. A wood-block floor has been laid in workshop, and workshop fully equipped.

Two 500 kv.a. transformers were transferred from the temporary station and installed in the main station. The operator's desk in the control-room has been placed on an insulated platform, so that the H.T. telephone cannot be used except from the platform. Lighting, heating, and power wiring in the station has been completed. All low-tension panels have been erected in the control-room, and, with the exception of a few minor details, the wiring is complete. The alarm circuits on the main control-board have been wired up, and are now operative.

The pressure-relief valves originally supplied did not operate satisfactorily, and the makers supplied replacements which were installed during April, 1930. Operation of these was not satisfactory, due to bending of the dash-pot piston-rod. This trouble has been overcome by strengthening the fixture of the dash-pot and fitting guides to prevent lateral movement of the rods.

Nos. 1 and 2 governors and relief-valves have been adjusted, and are now operating satisfactorily. On the 25th and 26th May, 1930, the following tests were carried out on No. 1 unit: (1) Overspeed test; (2) short-circuit test; (3) speed-regulation test; (4) full-load-efficiency test. Both machines were also tested for the maximum load which they will carry. Tests Nos. 1 and 2 were quite satisfactory, and proved the unit up to specification. Tests Nos. 3 and 4, however, showed the turbine to be below the guaranteed figure. Neither turbine would carry the maximum load called for in the specification.

Floodlights have been erected in the yard to facilitate inspection and operation at night. Protective fencing round the yard has been completed, and a fire-break cut in the fern around the fence. Wiring to the distribution-board in the transformer-house has been completed. A drying-oven has been constructed and installed in the transformer-house for the purpose of drying out H.T. bushings and live-line gear.

It was considered advisable to change the source of water-supply to the main pipe-line and a new main was run, the village being now connected up to this. Fire hydrants and hoses have been installed. A sump has been installed below the married quarters' septic tank, and alterations to the drainage system have been made, so that all wastes and sewage effluent are piped direct from here to the Kahutangaroa Stream.

Permanent power-lines and telephone-lines have now been laid from the power-house to the village, and the permanent street-lighting fittings have been erected on the power-line poles.

Khandallah Substation.—During the year earthing-switches were erected on both the 110 kv. lines. The stable was converted into single men's quarters.

Bunnythorpe Substation.—Plans have been prepared for the reconstruction of the building after a fire in January, 1930, and also for additions to house larger 11 kv. switch-gear, &c., necessitated by the growth of load. Tenders have been called for the work, and it is hoped to have this put in hand shortly. Tenders have also been called for a second bank of transformers.

Material and apparatus have been ordered to replace that damaged and destroyed by fire. The new relay equipment has come to hand, but cannot be installed until the new building is completed.

Wanganui Substation.—The well for permanent water-supply has been deepened and lined. A pump-house has been erected and an electrically-driven deep-well-type pump installed. A 600-gallon tank is being mounted on a 25 ft. tank-stand to provide storage from day to day.

A more suitable type of lightning arrester has been obtained for this substation and will be installed shortly, when the old type will be removed for use at Hawera Substation when same is built.

Marton Substation.—This substation has now been completed, the 11 kv. switch-gear, with automatic reclosing mechanism, having been put into service in May, 1930.

Woodville Switching-station.—A new 110 kv. potential transformer for the new relay system, with auxiliary winding to provide power at 400/230 volts, has arrived, together with the necessary steelwork for mounting the switch-fuse protection. The pads for these have been laid and the steelwork is being erected.

The erection of the new 110 kv. O.C.B. has been delayed until the arrival of the new bushing current-transformers to suit the relay protection being installed. These current-transformers have now arrived and will be installed shortly, when the switch will be placed in service. The concrete pads for the new switch have been laid and the isolating-links erected.

A contract has been let for the erection of a new battery-house, and this will be completed shortly.

Dannevirke Substation.—The 1,500 kv.a. transformer ordered for Marton Substation has been received and dried out, and will be put into operation shortly. This replaces the 1,500 kv.a. transformer which was transferred from Dannevirke to Marton. Concrete pads have been laid for potential transformers and for the new 110 kv. switch. The isolating-links for these have also been erected.

A new building has been erected as quarters for the single men at this station.

Waipukurau Substation.—The stable has been converted into single men's quarters. The concrete pads for the new 110 kv. oil switch and the potential transformers have been laid. The isolating-switches for both these have been erected.

Napier Substation.—The erection of the 110 kv. switch-gear, &c., was completed early in the year. The new relay equipment has now arrived, and a start has been made with the erection thereof.

Wairoa Substation.—A recording voltmeter has been installed.

Gisborne Substation.—Only a small amount of work necessary to complete this substation was carried out during the year. This included the installation of a reverse-power relay and the installation of synchronizing equipment to enable synchronizing with the Poverty Bay Power Board's plant to be carried out. A recording voltmeter was installed and a flood-light erected. A protective fence was erected round the outdoor 50 kv. switch-gear.

Stratford Substation.—A site for this has been selected, the legal surveys carried out, and the land acquired. A topographical survey has also been carried out, and preliminary lay-outs made.

Hawera Substation.—A site for this has been selected, the legal surveys carried out, and the land acquired. A topographical survey has also been carried out, and preliminary lay-outs made.

New Plymouth Substation.—This will be contiguous with the New Plymouth Borough Council's Power-house, and surveys have been made to determine the most suitable lay-out for the outdoor switch-gear and transformers.

Belmont Substation.—A site for the substation to give additional supply to the Hutt Valley Electric-power Board has been selected, and a topographical survey and preliminary lay-out made.

Stratford – New Plymouth 50 kv. Transmission-line.—This line was completed during the year and leased to the New Plymouth Borough Council for obtaining supply from the Taranaki Power Board until such time as the Department has completed the Wanganui–Stratford line. It is at present being operated at 33 kv.

Wanganui–Stratford 110 kv. Transmission-line.—The preliminary survey of this line has been completed and the final pegging and checking of plans is well in hand. A considerable number of poles and some material have come to hand and are at present being stored at Castlecliff until construction is under way. It is hoped that construction will be commenced by the end of July, 1930.

This line will feed two substations, one at Hawera, supplying the South Taranaki Electric-power Board, and one at Stratford, whence supply will be given via the Stratford – New Plymouth line to the New Plymouth Borough Council, this supply being at 50 kv.

Khandallah–Masterton 110 kv. Transmission-line.—Survey of this line is practically complete as far as new substation-site for Hutt Valley Power Board at Melling.

Further Supply to Wellington City.—Investigations made as to the best means of providing for growth of load.

Waikaremoana–Arapuni Transmission-line.—A survey of the proposed route for this line was completed during the period, and plans prepared. A total length of line of 35¼ miles from Tuai to Murapara being located, and the final section Hopuruahine to Huiarau completed during January, 1930. The survey parties met with serious difficulties which impeded progress, and made the survey a lengthy one. The country is of an unusually precipitous nature, and quantities of very dense bush had to be traversed, added to which long periods of rainfall during which no work could be done, all contributed to retard progress.

Waikaremoana Upper Development.—The preliminary survey was completed during the period, and two plans were prepared showing—

(*a*) Two alternative routes for a pipe-line from the outlet to Kaitawa.
(*b*) Contours of the bed of Lake Waikaremoana, in the vicinity of the Outlet.

Borings were also taken at the outlet and at Kaitawa. At Kaitawa a hand-operated auger was used, while the outlet boring was carried out with a Calyx drill, and in addition a further boring-plant was employed on contract. At Kaitawa ten holes were drilled on the north side of the river, and twenty-eight on the south side. At the outlet eight holes were drilled, three by the Calyx drill and five by the contractor.

IV. Load.

During the year the Mangahao and Waikaremoana Power-stations have operated very satisfactorily in parallel, Waikaremoana acting as a base-load station and Mangahao as a peak-load station, thereby making the best use of the water available at both. With this arrangement, the only occasions when the standby stations were required to come into operation were during the early troubles with machines at Waikaremoana or during troubles on transmission-lines, when it was necessary to take the two stations out of parallel and the load on Mangahao Power-station was greater than the capacity of that station.

Wellington City steam plant was brought in on eight occasions during the year, for a total running time of 31 hours 45 minutes, the greater part of which was due to a flood threatening the transmission-line at the Makaretu River, which necessitated the Dannevirke–Waipukurau section being kept out of service for nearly two days. Palmerston North Borough plant came into operation twice, for a total period of 1 hour 35 minutes. Hastings Borough plant was called on once for a period of two hours. The assistance required in each case was not very great.

The maximum load on the system for the year was 37,880 kw. and the total number of units generated during the year was 182,148,043.

The results of operation are given in Table IX and the connected load in Table XII. The connected load on the system is 267,598 kw.

ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.

1. Arapuni Development.

During the period under review constructional operations and remedial measures in connection with the safeguarding of the overflow-channel were generally in hand until the middle of the month of June, 1930, when, owing to a serious and comprehensive movement of the block of country situated between the forebay and the tail-race, all work was postponed pending a complete investigation. Operations were generally carried out on shifts and, as favourable conditions were experienced, good progress was made.

At the beginning of the year the southern portion of the power-house structure was sufficiently advanced to provide cover for No. 3 unit, the foundations of the northern portion were well advanced, the tail-race completely excavated and allowed to fill, and No. 3 unit, the first of the three provided for in the original contract, was actually completed and in service for almost a month.

At the end of the year the power-house structure was completed, except for a little painting, and the three turbines and generators, together with all necessary switch-gear, cables, and transformers, were erected and in service prior to the 11th June, 1930. Measures to divert the surplus water from the forebay into the gorge by the construction of Nos. 7 and 8 tunnels were well advanced, and preparatory work in connection with the proposals to protect the rock at the falls in the overflow-channel was almost completed. No. 4 penstock tunnel was in hand, the excavation having been finished. Owing, however, to the serious position due to the damage resulting from the earth-movement of the 7th June, 1930, the Arapuni Lake was emptied, the station consequently going out of service on the 11th June, and, as constructional operations were stopped, no men were employed, except a few on surveys and exploratory work.

Power-house.—Details of the work carried out are as follows: The remaining excavation for wall-foundations at the northern end of the structure, together with the back filling under the slab comprising the workshop bay, was completed. Good progress was made with the completion of the concreting of the structure, most of the work having been done early during the year. The foundations of the workshop and the unloading bay, the upper section of the foundation of No. 1 unit, and the east, west, and north walls, together with the roof slab around and about No. 1 unit and the workshop bay, were poured. The top portion of the switch-gear annex, including the roof slab and the foundation walls, and roof of the low annex, were also completed. A total of 1,900 cubic yards of concrete and 47 tons of steel reinforcing were placed in the structure.

During the middle and latter end of the year work has been confined to cleaning down and painting the inside and outside of the whole structure, the laying of the bituminous roofing, the floor tiling of and finishing of the control-room, the making and fitting of furniture and doors, the fitting and glazing of windows, the installation of the sewerage system and conveniences, the provision of water, compressed-air, and fire-prevention services, the construction of the protecting wall on the road above the power-house, and the levelling and metalling of the road-approach immediately to the north of the structure. The whole of the work at the power-house provided for under the original contract is now complete, with the exception of the painting of the generator-room floor, the completion of the metalling of the approach-road and finishing of the track down the cliff from the suspension bridge, together with a little cleaning-up of surplus material and removal of temporary buildings. In addition a considerable amount of work not included in the original contract has been done in preparation for further extensions.

Penstock Pipes.—The adjusting length of No. 1 penstock was drilled, riveted, and caulked, and the bituminous painting completed.

Turbines and Valves.—The erection of the control equipment of No. 2 main-control valve, together with the erection of No. 2 governor and details, comprising compressed-air and oil-pressure systems, completed the unit, which was ready for service during August, 1929, when the drying-out of No. 2 generator was commenced. No. 1 turbine and valve, the outside casings of which had been erected last year, were assembled, erected, and completed in all respects, and were ready for service by the month of January, 1930, when the drying out of No. 1 generator was commenced.

Electrical Equipment: Generators.—The assembling and erection of No. 2 generator, which was well advanced at the end of last year, was completed by August, 1929, when the drying-out of the unit on short-circuit was commenced. This was completed by the 16th September, 1929. The erection of No. 1 generator was commenced during the same month, and was ultimately completed by the 15th January, 1930. The machine was then dried out on short-circuit, and, after the various tests and adjustments, was ready for load by the end of February, 1930. Trouble, however, was experienced owing to vibrations which occurred when the machine was loaded. The machine was therefore tested in various ways, both mechanically and electrically. The trouble appeared to be in some way due to a fluctuating vacuum in the draught tube. Similar vibration has been experienced in large vertical machines in other parts of the world, and the exact cause has always been very difficult to locate. In this case the source of the trouble had not been definitely located at the time of the shutting-down of the station on the 11th June, 1930.

Switch-gear, &c.—The erection of the 11 kv. switch-gear was not sufficiently advanced to allow it to be put into service with the first two generators; therefore temporary connections were made and all necessary switching carried out with the 110 kv. equipment.

In the control-room, further work of erecting indicating and recording instruments and other control equipment, wiring behind panels, and connection to control cables was carried out, the different sections of the apparatus being brought into service with the respective generating-units.

The remaining power and pilot cables for Nos. 1 and 2 units were run and tested, cables for auxiliaries such as machine-room telegraph, main-valve controls, battery, workshop tools, service transformers, were run, boxed, and put into service.

The whole of the equipment, comprising the winding-gear, the electrical controls, and the cage of the goods-lift, was erected, and the lift put into action.

The lines for the high-tension telephone system, together with the messenger cable for the low-tension system, have been run to the power-house, and connections with temporary telephones made until such time as the permanent switchboards are erected in the control-room.

The erection of poles, wire, and fittings for the track-lighting between the permanent village and the power-house and outdoor station is well advanced, and the greater portion of the system has been put into service during the year.

The work on heating and lighting has been confined chiefly to the power-house structure, where the whole of the installation has been practically completed.

No. 4 Unit.—The manufacture of an additional generating-unit (No. 4) of 15,000-kilowatt capacity is in hand overseas, and delivery was due to commence during October, 1930. The construction of the necessary penstock tunnel was therefore put in hand during October, 1929, and to date has been excavated ready for the placing of the steel lining. In conjunction with this tunnel a 2 ft.-6 in.-diameter pipe is being provided for the purpose of delivering water to a small hydraulically operated generating-set for auxiliary purposes.

A commencement was also made with the work of preparation of the foundation for this unit during March, 1930, and the temporary floor supported by 2,000 railway sleepers on which Nos. 1, 2, and 3 units were assembled was dismantled, and a start made with the complicated falsework required for constructing the concrete foundation of the unit. This work was in hand immediately prior to the 19th June, 1930, but has been held up pending investigation of the trouble in the headrace mentioned earlier.

Overflow-channel.—During the first two months of the year very serious erosion occurred at the site of the waterfall in the overflow-channel. This comprised a general widening of the basin formed, together with a cutting-back of the crest. At the time of reporting last year, the crest had been eroded to the extent of 3¼ chains. During the months of July and August, 1929, however, the rate of retrogression increased to such an extent that by the end of the latter month the top crest of the falls was 8½ chains upstream from its original position and only 17 chains below the spillway structure. The only alteration of note since August, 1929, occurred on the 7th June, 1930, when about 30 ft. of the crest of the lower fall was eroded, this apparently being due to the earth-movement which occurred on that day. Owing to this increased rate of retrogression preparations were made to divert the surplus water back into the gorge at the power-house, by immediate construction of Nos. 7 and 8 tunnels. Preliminary work in the nature of making access roads, opening up aggregate deposits, erection of plant and temporary buildings was undertaken near the site of the proposed protection-works at the falls. At the end of the year the preparatory works were finished, and on the dewatering of the overflow-channel being effected the major work of protection could have proceeded. The actual excavation and removal of a quantity of unstable rock on the batters of the crater had been in hand during the month of June, 1930.

Penstock Tunnels.—For the purpose of dewatering the overflow-channel so that remedial works there could be carried out in the dry, it was decided to proceed with the construction of Nos. 7 and 8 penstock tunnels before they would be required in connection with the extensions of the power-house plant. These tunnels are circular in section, 12 ft. in diameter, and are steel-lined throughout, the length being approximately 430 ft. Excavation of the headings was commenced by three shifts during the month of July, 1929, work proceeding satisfactorily and without difficulty. Both tunnels had been steel-lined and concreted and were ready for service at the end of the year under review.

The necessary intake gates were manufactured overseas and were delivered, assembled, and erected.

For the purpose of dissipating the energy of the water issuing from these tunnels at high velocity, specially designed 6 ft.-6 in.-diameter disperser jets, each capable of discharging 3,000 cusecs, were manufactured overseas and delivered at Arapuni. These had not been erected at the end of the year, the delay being due to the necessary excavation not being completed.

Power-house Extensions Excavation.—The excavation of a portion of the space necessary for the extension of the power-house structure was undertaken in connection with the construction of Nos. 7 and 8 penstock tunnels. This was necessary to make provision for the foundations of the disperser jets. This work was originally commenced towards the end of October, 1929, on three shifts, and

it was continued until the 7th June last, when the opening of the diversion tunnel necessitated stopping work. Excellent progress was made, considering that the whole of the excavated material had to be elevated 160 ft. from the bottom of the gorge and then hauled to a suitable dumping-ground. This was effected by a 4-ton cableway which handled a total of 37,900 cubic yards, over 5,000 of which represented a portion of the spoil from Nos. 4, 7, and 8 penstock tunnels. When the work was commenced it was anticipated that only a comparatively small quantity would require to be removed, but owing to the nature of the cliff above the outlet of the tunnels it was found necessary to remove a block of country back to the limits of excavation required for the extensions of the power-house building. The handling of this extra quantity resulted in considerable delays, which were largely responsible for Nos. 7 and 8 penstock not being put into temporary service during the month of May, 1930, according to programme.

Diversion Tunnel.—As a further measure for safeguarding the overflow channel by making provision for discharging water down the gorge, an arrangement was put in hand to strengthen the concrete immediately below the diversion-tunnel valves by fixing protecting steel plates to the concrete and the gate-frames. This was done for a distance of 8 ft. downstream of the gates, and covered that area of concrete which showed signs of disintegrating during the period of high velocity discharge at the time of filling the Arapuni Lake at the end of the year 1927.

The security of the platework was tested by trials during the month of September, 1929, as a result of which extra holding-down bolts were provided, the plates securely welded and grouted. Further trials during December, 1929, gave satisfactory results.

From the 8th until the 23rd June, 1930, when the Arapuni Lake was being emptied, the diversion tunnel was subjected to the most severe conditions since its construction. It was later ascertained, however, that the steel-plate work had done its work well, having apparently not in the least been affected by the combined big discharge and high velocity.

Earth-movement.—On the morning of the 7th June, 1930, a movement of the block of country between the forebay and the tail-race occurred. This movement resulted in serious cracks developing in the rock, extending in a northerly and southerly direction from the penstock intake structure, and caused water from the forebay to seep through the country towards the gorge; the northern end of the penstock intake structure being damaged by cracks in the concrete. As a result it was considered advisable to empty the Arapuni Lake by discharging it through the diversion tunnel. The emptying was completed by the 23rd June, 1930, the station, however, going out of service on the 11th June on account of the lowering of the water in the head-race. To carry the load King's Wharf Station was recommissioned and put into service by the Auckland Power Board, while other plants in the district were either brought into service or carried extra load to supplement the supply of the Horahora Station. During the period of the lowering of the head-race it was noted that cracks which had been found subsequent to the 7th June were gradually closing, and as a result of investigations it was ascertained that the block of country between the forebay and the tail-race was returning towards its original position.

On account of the comprehensive and serious nature of the movement it was decided to suspend all constructional operations pending an investigation. At the close of the period the only work being done was in the nature of investigations as to the exact nature and cause of the movement.

2. Capital Outlay.

The total capital outlay at the end of the year, as shown in Table XVII herewith, was £3,660,427, an increase during the year of £2,518,081. This includes £330,416 of assets not yet put into operation, which includes £237,000 on No. 1 unit and other works not yet in operation at Arapuni, and £25,000 for lines and substations.

The increase for the year is due to the inclusion, for the first time, of cost of the Arapuni Station, the transmission-lines and the main substations at Penrose, Hamilton, and Bombay; these three items amounting respectively to £1,559,890, £240,148, and £215,879. There are increases also of £101,913 in engineering and other general expenses on surveys and construction, of £287,184 on interest during construction, and of £102,190 on cost of raising loans. These represent expenses incurred over the whole of the construction period, and now for the first time included in the assets of the combined Horahora-Arapuni scheme.

3. Financial Results of Operation.

The year ended with a loss, after allowing for all working-costs, interest, and depreciation, of £32,768, as compared with a loss in the previous year of £15,291. Annual revenue increased from £135,511 to £225,683. Working-costs decreased from £76,231 to £62,571. Gross profit increased from £59,280 to £163,112. Capital charges increased from £74,571 to £195,880. No payment was made to Sinking Fund this year or last year.

The decrease of £13,660 in working-costs results from a decrease of £8,694 in power purchased (which includes payments to the Tourist Department, Rotorua, for running their plant at Okere), a decrease of £6,863 in cost of operation of the Grand Junction plant, and of £10,139 in cost of operation of the Diesel plant. The decrease in these three items totals £25,696. Other working-costs have increased by £12,167, owing to the bringing into operation of Arapuni, and the general growth of the system.

Details of the items which make up this increase as shown in the Profit and Loss Account are as follows:—

	1929-30. £	1928-29. £		£
Operating and maintenance—				
Arapuni	..	..	Total,	4,410
Horahora	7,018	6,454	Increase,	564
50,000-v. lines	8,121	5,363	,,	2,759
110,000-v. lines	2,267	1,053	,,	1,214
50,000-v. substations	5,258	3,840	,,	1,418
110,000-v. substations	2,424	1,180	,,	1,244
Live-line-testing of insulators	..	..	,,	381
Supervision of transmission and distribution system	2,575	2,187	,,	388
Management and general	6,216	6,209	,,	7
				12,385
Decrease in maintenance and operation of 11,000-v. lines and substations	320	537		218
				£12,167

Although there was a considerable decrease in cost of purchased power and of operating the standby plants, it was still necessary to incur expenses of £23,711 on these items during the year, the greater part of this being in the early part of the year, before Arapuni was started, and up to the time of bringing the second unit into operation in September, 1929.

The revenue from the four original Power Boards (Cambridge, Central, Te Awamutu, and Thames Valley) has increased from £60,553 to £66,427, and thus maintains the average rate of increase of the past few years; the revenue from the later Power Boards (Franklin, Waitomo, Waitemata, and Bay of Plenty) shows a larger rate of increase; and the revenue from the Auckland Power Board increased from £10,556 to £78,164, this being for partial supply only.

4. Extensions during the Year, and Future Extensions.

(a) General, Additional Consumers, and Connected Load.

During the year supply has been given at the following additional points:—

Consumer.	Point of Supply.	Date.
Bay of Plenty Power Board	Waiotahi (50 kv. equipment) ..	10th May, 1929.
Auckland Power Board	Penrose (at 22 kv.)	2nd June, 1929.
Thames Valley Power Board	Matamata	4th October, 1929.
Central Power Board	Huntly	25th October, 1929.

The connected load (not including Auckland) has increased from 77,121 kw. to 89,524 kw., and including Auckland to 260,524 kw.

The number of milking-machines supplied has increased from 4,292 to 5,012, electric ranges (not including Auckland) from 2,025 to 2,807, and water-heaters (not including Auckland) from 5,431 to 7,088.

The system maximum load increased from 15,900 kw. to 41,520 kw., and the total units generated and purchased increased from 104,992,762 to 190,710,247.

The demand factor (maximum load divided by connected load) changed from 0·206 (not including Auckland load) to 0·16 approximately, and would have been about 0·17 if we had supplied all Auckland load in the winter.

(b) Power-stations.

Horahora.—No extensions during the year.

Arapuni.—Practically all 110 kv. switch-gear and transformers had been completed some time before the 2nd June, 1929, when the first unit completed (No. 3) was ready to supply power. This unit was connected through isolating switches to the cables to No. 3 transformer-bank, the 11,000-v. switch-gear being incomplete. No. 2 unit was similarly put in service on the 20th September, 1929. The 11,000-v. switch-gear was put in service in February, 1930. No. 1 unit was completed in February, 1930. The station battery was completed and in service in December, 1929. The main object that had been aimed at for the eighteen months previously was to get No. 3 unit in service early in June, 1929, and as each part of the power-house building necessary for this purpose was completed, the work on the main valve, the turbine, and the generator was pushed on to completion as rapidly as possible.

(c) Transmission-lines.

Hamilton–Huntly 50-kv. Line.—The gaps at the ends of this line were completed during the year. At the Hamilton end this line is carried on steel towers, with provision for a second circuit later, and on part of the route these towers carry the 110-kv. line (single circuit) also.

Matamata–Waihou–Paeroa Line.—A new section of line, from near Half-way (between Matamata and No. 8 hut on the original Horahora–Waikino line) direct to Waihou, was built and put in service about the end of October, 1929. The line is being extended from Waihou to join up with the Bombay–Waikino line at Paeroa.

Survey of New Lines.—New lines are being surveyed as follows, all for 110 kv. :—

Arapuni–Edgecumbe, thence to Waikaremoana : Detailed survey complete to Edgecumbe.

Arapuni–Penrose—second steel tower line : Detailed survey practically complete.

Henderson – North Auckland : Detailed survey practically complete.

Arapuni–Stratford : Route selected and detailed survey is in hand.

(d) Substations.

Penrose (110/22 kv. : Two banks each 15,000 kv.a., and one 30,000 kv.a. 22/50 kv. : One bank, 5,000 kv.a.).—Prior to the starting-up of Arapuni in June, 1929, work done at Penrose consisted in the completion of the initial installation of 110 kv. switch-gear, which, with the phasing of the lines to Bombay, was tested out in May, 1929.

In July the temporary pole structure which had served as a termination for the first 110 kv. line (wood-pole line) while it was being operated at 50 kv. was removed, and the permanent steelwork of No. 1 bay erected in its place.

In August, 1929, the synchronous condenser was dried out and run for trial, but there was no necessity to put it into regular service.

In September the earthing arrangements were improved by running a 19/13 s.w.g. copper wire in place of the 7/13 s.w.g. usual transmission-line earth wire on the pole-line to Tamaki Basin and earthing it there. This, with the water-mains, forms the main substation earth.

Assembly, drying-out, &c., of the new bank of transformers (four 110/22 kv., 10,000 kv.a. each) took place from October, 1929, to February, 1930, when they were placed in service.

A 50 kv. oxide-film arrester from Horahora was installed on the Takapuna line, east circuit, in December, 1929.

In February, 1930, installation of two special capacitors for protective equipment was commenced.

Hamilton No. 1 (50/11 kv. : Two banks each 1,500 kv.a. capacity).—The new substation building and a blacksmith's shop were completed.

Waihou (50/11 kv. : One bank 2,250 kv.a. capacity).—A new feeder panel (No. 5) was installed by the Thames Valley Power Board. New steelwork and 50 kv. switch-gear were erected, replacing the original wood-pole structure, and providing for use of 50 kv. oil circuit-breakers. The transformers were moved into their new positions, with cables connecting them to the 11 kv. switch-gear. The substation building has been extended to include a workshop and crane.

Matamata (50/11 kv. : One bank 2,250 kv.a.).—This substation was practically complete in May, 1929, and the Thames Valley Board switch-gear in it was put in service in that month. The 50 kv. switch-gear and the transformers were put into service in October, 1929.

Edgecumbe (50/11 kv. : One bank 750 kv.a.).—The outdoor 50 kv. switch-gear was completed early in June, 1929, when the transformers were moved from a temporary position to the permanent one, and all the permanent equipment put into service.

Waiotahi (50/11 kv. : One bank 750 kv.a.).—Construction work was completed, and substation put in service at 50 kv. on the 9th May, 1929.

Te Awamutu (50/11 kv. : Two banks each 750 kv.a.),—A second bank of three 250 kv.a. transformers was erected at Te Awamutu, with the necessary air-break switch-gear.

Huntly (50/11 kv. : One bank 1,500 kv.a.).—Construction of this substation was commenced in March, 1929, the steel structure was erected and connected to the line in April, and the remainder of the construction work completed in June. Owing to delay in completion of the towers at the Hamilton end of the transmission-line to Huntly, the substation was not put into service until October, 1929.

5. Operation and Maintenance.

(a) Power-stations.

Horahora.—On the 11th May, 1929, the down-stream runner of No. 3 turbine collapsed. The gates on this and the adjacent runner were then fixed to remain closed, so as to enable the turbine to give about half-load (600 kw.) on the remaining pair of runners.

In June, 1929, to avoid a similar collapse on No. 1 turbine, No. 2 runner, which was badly worn, was dealt with in the same way.

In July, 1929, one of the automatic gates was lifted and the roller-trains repaired by replacing six crushed rollers on one train and two on another.

In July, 1929, high water with debris in the river reduced the station output on two days to about 6000 kw.

In August, 1929, a break in the gate-operating ring of the down-stream runner of No. 2 turbine caused it to be out of service for two days until repairs could be made. Two gates and spindles were replaced on No. 4 turbine—No. 2 runner.

On the 12th November, 1929, the up-stream runner of No. 7 turbine (2,000 kw. unit) collapsed for no apparent reason, and the unit was out of service for several days until the runner could be replaced.

In January, 1930, a defect in No. 4 governor oil-pump made it necessary to replace it with a spare pump.

No. 3 turbine was out of service for overhaul from the 29th August to the 7th November, 1929. All runners and guide-wheel castings were replaced with new ones, and the turbine made practically as good as a new machine. Similar overhaul of No. 5 turbine was started in February, and it, as well as No. 1, was completed in June, 1930.

Two new 5/50 kv. transformers were installed to replace those damaged by the fire, and new reactors were installed in No. 1 bank, thus bringing the transformer capacity of the station up to its normal amount.

A condenser bushing failed on the Arapuni line O.C.B. in August, 1929, and was replaced, and a failure occurred in one of the 220 kw. exciter M.G. sets, three bars on the squirrel cage rotor coming adrift from the short-circuiting ring, and requiring repairs.

A 50-kv. wall-bushing on the leads from No. 3 transformer-bank flashed over to ground at a time of breakdown on the Waikino line.

Arapuni.—On the 9th June, 1929, the top guide-bearing of No. 3 unit became warm, requiring a shut-down to scrape it.

On the 27th August, 1929, a gear wheel driving No. 3 pendulum broke and the unit had to be shut down immediately to replace it with a spare.

In September, 1929, one of the bearings on No. 3 oil-pump seized, and the unit had to be shut down immediately to repair it.

In January, 1930, a broken roller band in No. 3 governor-pendulum caused this unit to speed up, and it had to be shut down immediately.

There were no failures of electrical equipment.

Owing to trouble with vibration on No. 1 unit, it was operated only intermittently on commercial load between the completion of erection in February, 1930, and the end of the year.

(b) Transmission-lines.

110 kv. Lines.—A considerable amount of work was done during the summer months in improving the foundations of towers where boring showed soft clay in the bottoms of the stub holes. There were only four line-faults in ten months' operation, one on the east circuit and two on the west circuit of the tower-line, all of these being almost certainly due to contact between the power wires and earth wire during windy weather, and one on the wood-pole line, due to contact with willow-trees. After resagging the earth wire to give greater clearance, and cutting the willow-trees, there were no further line-faults during the remainder of the period of operation.

110 kv. Live-line Testing.—On the wood-pole line, four units were found defective and replaced. All units on the tower-line tested correct.

Faults on 50 kv. Lines :—

On these lines the principal causes of failure and times to repair lines were as follows (but it should be noted that these failures did not necessarily cause interruptions to service) :—

Penrose–Henderson.—In June, 1929, during a gale, sheet-iron blown from a building severed several conductors on both the east and west circuits, causing interruptions totalling 3 hours 25 minutes on the east circuit and 3 hours 2 minutes on the west circuit before regular supply was restored. In July, 1929, a kite blown against an insulator caused four flash-overs in succession and four interruptions, totalling 36 minutes, on the east circuit, and this section was out for 7 hours 13 minutes to find and repair the damaged insulator.

Bombay–Kerepeehi.—June, 1929 : Punctured insulator on pole 176, 6 hours 3 minutes ; punctured insulator on tower 368, 9 hours 50 minutes.

Horahora–Matamata.—November, 1929 : Shattered insulator at tower 161, 15 hours 42 minutes. December, 1929 : A shattered insulator at tower 118, 3 hours 54 minutes.

Matamata – Half Way – Waiorongomai.—April, 1929 : Insulator breakdown at tower 273, 2 hours 24 minutes. August, 1929 : Broken binder at tower 280, 4 hours 2 minutes.

Matamata – Half Way – Waihou.—March, 1929 : Faulty insulator, 3 hours 34 minutes.

Waihou–Waiorongomai.—May, 1929 : A connection at Waihou termination broke, 2 hours 28 minutes. July, 1929 : A connection broke at Waiorongomai termination, 8 hours 19 minutes.

Waiorongomai–Waikino.—April, 1929 : Defective insulator at tower 444, 19 hours 54 minutes. September, 1929 : Scrub fires under line near Waikino, 57 minutes.

Horahora – Mystery Creek.—February, 1930 : Defective insulator at pole 238, 5 hours.

Mystery Creek – Hamilton.—March, 1930 : Defective insulator at pole 338, 3 hours 37½ minutes.

Horahora–Arapuni.—June, 1929 : Telephone-wire in contact with power wires, 7 hours 34 minutes.

Ngongotaha–Edgecumbe.—May, 1929 : Tree felled on telephone-line caused it to swing up in contact with power wires, 2 hours 8 minutes.

Horahora–Matamata–Waihou.—The alteration to the tower-tops on this line—mounting the top insulator on a short wooden extension to the towers, and the side insulators on wooden cross-arms —has been effective in reducing troubles caused by birds.

Replacements of Poles and Insulators.—Measurements are being made systematically of the amount of sapwood and of sound heart-wood in poles on all lines, and all undersize poles are being replaced. A total number of twenty-six poles have been replaced during the year. A total of 179 pin insulators were found defective on the 50 kv. lines by live-line testing during the year and replaced, and nine pin insulators which had failed in service were replaced.

(c) Substations.

Penrose.—During April and May, 1929, as previously, incoming power from Horahora at 50,000 v., assisted by the various emergency plants, was transmitted direct to Henderson and Takapuna at 50 kv., and transformed through the temporarily-connected 50/6·6 kv. transformers for supply to Auckland. In June, 1929, incoming power was supplied at 110 kv. from Arapuni, and to the Auckland Power Board at 22 kv.

Bombay.—The operating-gear of the 110 and 50 kv. oil circuit-breakers has required considerable attention to make it work satisfactorily. One 50 kv. condenser-bushing on the 50/11 kv. transformers broke down in January and another in February, 1930. The cause of these failures was found to be the presence of moisture inside the porcelain shell, and steps were taken to prevent this on all similar bushings.

Hamilton No. 1.—One of the 500 kv.a. 50/11 kv. transformers broke down, probably owing to lightning, on the 27th June, 1929. It was replaced by the spare and repaired. Another of these transformers broke down in September, 1929, it having probably been damaged at the same time as the first one above.

Waikino.—In April, 1929, a mouse caused a flash-over on the 11 kv. O.C.B. of No. 2 11,000/525 v. transformer. Also a flash-over occurred on a 50 kv. lightning-arrester isolating-switch insulator. The original oil-circuit-breaker bushings were replaced with new bushings.

Waihou.—In April, 1929, a rat caused a flash-over on the 11 kv. bus.

Matamata.—Nothing to report.

Kerepeehi.—Nothing to report.

Henderson.—The second 1,000 kv.a. 50/11 kv. 3-phase transformer was connected up ready for use, and the other one taken out of service and overhauled.

Takapuna. — In June, 1929, a trifurcating-box broke down on the Power Board No. 2 feeder. The two 1,000 kv.a. 50/11 kv. transformers were taken out of service in turn, examined, and overhauled.

Huntly.—Nothing to report.

Te Awamutu.—A flash-over on a horn gap arrester was caused by a bird. A fire hydrant was installed at the substation.

Hangatiki.—The 11 kv. metal-clad switch-gear damaged in the previous year was repaired and put in service in June, 1929. 50 kv. liquid-type fuses were installed as a protection to the transformers.

Mamaku.—A damaged transformer was repaired and held as a spare.

Ngongotaha.—A 50 kv. transformer-bushing on which the compound inside the porcelain was leaking was removed.

Edgecumbe.—A faulty trifurcating-box was removed in June, 1929. Water-supply pumped from the Rangitaiki River was put in about the end of the year.

Waiotahi.—At this substation and at Edgecumbe there have been a number of total interruptions caused by earth-faults on the Power Board feeders tripping off the total supply.

(d) Grand Junction Plant and 550/11,000-v. Substation.

This plant was run at fairly heavy load from 6 a.m. to 10 p.m. for six days per week, and for several hours on Sundays in the early part of the year until Arapuni started in June, 1929. The maximum load carried was 3,400 kw. After June it was not in regular service, but ran occasionally in emergency, and from October onwards was run a good deal for regulating voltage and supplying a small amount of power to make up the deficiency in the amount available from the Bombay 110/50 kv. transformers.

In August, 1929, a cat caused a short-circuit on one of the oil circuit-breakers.

(e) Diesel Plant—Penrose.

This plant was run at fairly heavy load from 5 a.m. to 10 p.m. for six days a week until Arapuni started in June, 1929. The maximum load carried was 4,240 kw. on the 24th April, 1929. After June it was not normally required.

The three units were overhauled in turn, and to keep the plant ready for service it was run for fifteen minutes once a week.

(f) 11,000-volt Lines and Substations.

There has been little trouble with these during the year.

On the Waikino–Waihi line, to prevent contact between the power and telephone wires, the telephone wires were lowered 18 in. on a number of the towers.

A new terminal structure was built at Frankton, for supply to the Railway Department's new substation.

(g) Power purchased and generated by Standby Plants.

Power purchased during the year amounted to 7,664,438 units from McLaren's Falls and 42,110 from the Auckland Power Board, as compared with 10,514,730 units and 1,762,070 in the previous year. In addition to this, the Grand Junction plant generated 2,682,100 units as compared with 5,046,740 the previous year, and the Diesel plant 2,608,248 as compared with 7,070,912. Most of the power from these plants was obtained before Arapuni came into operation, the figures for April, May, and June, 1929, being—

	Units.
McLaren's Falls	2,796,898
Junction plant	2,002,800
Diesel plant	2,527,178

The supply from McLaren's was maintained at about the same rate throughout the year, as with only two units in service there was not quite enough power available from Arapuni and Horahora to supply the full demand.

The Okere plant of the Tourist Department, Rotorua (180 kw. capacity), was run throughout the year, part of the time for two shifts and part for one shift daily, for six days per week.

(h) System Operation.

After No. 3 unit at Arapuni took up load for the first time on the 2nd June, 1929, it was run in parallel with King's Wharf station for short periods on the 2nd and 3rd June, and regularly from the 4th June, at first from 3 p.m. to 9 a.m., and then from the 25th June continuously, carrying occasionally up to full load.

Parallel operation of the two plants caused some inconvenience and delay in restoring supply on one or two occasions of trouble, and it was then considered advisable to put the Arapuni supply on a separate portion of the load. This was done on the 7th July, when Arapuni took over the following load :—

From Penrose Substation : Penrose area and Southern area of Auckland Power Board 50 kv. supply to Henderson and Takapuna.

From Bombay Substation : Franklin Power Board load. 50 kv. supply to Kerepeehi and Hamilton substations.

This amounted to about 15,000 kv. total peak load, and daily output of 250,000 units.

Horahora, with McLaren's Falls and occasionally the Grand Junction plant, supplied the rest of the system — *i.e.*, the Horahora – Mystery Creek – Te Awamutu – Hangatiki line ; Horahora–Waihou–Waikino line ; Horahora–Arapuni–Ngongotaha–Edgecumbe–Waiotahi line — with maximum load of about 9,500 kw.

In October, 1929, with No. 2 unit at Arapuni in operation, Arapuni supplied the following load :—

Penrose Substation : All Auckland Power Board load, except about 2,000 kw., which was still supplied from King's Wharf ; 50 kv. supply to Henderson and Takapuna.

Bombay Substation, Franklin Power Board : 50 kv. supply to Kerepeehi and Waikino.

50 kv. line Arapuni–Ngongotaha–Edgecumbe–Waiotahi.

McLaren's Falls was then running in parallel with Arapuni, being connected in to Waikino substation.

Horahora was then left supplying the following :—

Horahora – Mystery Creek line to Hamilton and Huntly.

Horahora – Mystery Creek line to Te Awamutu and Hangatiki.

Horahora–Matamata–Waihou line.

Arapuni then had a maximum load of 33,900 kw., and Horahora of about 7,000 kw.

(i) General.

As already stated, vibration had developed on No. 1 unit at Arapuni, but the unit was still available for service up to about 6,000 kw. load. In May, 1930, it was shut down and the draught tube dewatered, and a central division-wall was erected in it with the object of improving conditions.

At about 3 a.m. on Saturday, the 7th June, 1930, the operator on duty noticed that water was coming up from the drainage system into the battery-room. He informed the Superintendent, who, with the 1st Operator, found that water was coming down the face of the cliff behind the power-house. A broken water-pipe was suspected as the cause of this, but search showed that water was coming through the cliff in several places, and at about 3.30 a.m. the outdoor station attendant discovered a crack in the north end of the concrete intake structure near the spillway.

The Auckland Power Board were informed of the position, and requested to have King's Wharf plant in readiness for full service, and work on the overhaul of No. 1 unit at Horahora was pushed on to complete it over the week-end.

Meanwhile a decision had been made to empty the lake, and the diversion-tunnel gates were opened on Sunday, the 8th June, at 1.45 p.m. At about 6 a.m. on Monday, water ceased to flow over the spillway-weir.

On Wednesday, the 11th June, the Grand Junction plant and Diesel plant were ready to assist Horahora and McLaren's Falls to take over all the system load except that of the Auckland Power Board. A reduction of about 15 per cent. in the peak load taken by the different Power Boards was requested by the Department, and these plants took over the load at 8.33 a.m.

King's Wharf Station ran in parallel with Arapuni until 3.40 p.m., gradually taking up load, and at that time the Arapuni station shut down.

ELECTRICAL DESIGN OFFICE WORK.

During the year under review the following design work was carried out in connection with new developments and extensions to existing developments :—

Lake Coleridge System.

The tying-in of the Lake Coleridge system with the Waitaki Power-station, which amounts to a change from a radial system fed by one power-station to an interconnected system fed by two power-stations with provision for future interconnection of other power-stations and substations, necessitated a review of the whole of the switch-gear and protective equipment on the system.

The existing main lines from Lake Coleridge Power Station are operating at 66,000 volts, and the new lines from Waitaki Power-station are to operate at 110,000 volts. To economically transmit the future power requirements of the territory served, all the main lines south of Timaru will operate at 110,000 volts, and ultimately all main lines south of Horarata will operate at this voltage.

The interrupting capacities of existing switch-gear and the maximum short-circuit capacities required for all switch-gear for future operating conditions were further investigated.

The necessary alterations and additions to the switch-gear, protective equipment, and voltage-regulating equipment at each of the substations and the power-stations to provide for all future operating conditions and reduce interruptions and disturbances to a minimum were considered. Specifications were drawn up for the necessary protective equipment, and an order was placed for same.

Power-station.—Final detail drawings were prepared in connection with the installation of No. 1 Unit (8,830 kv.a.). Lay-out drawings were prepared for the new lightning arresters and switch-gear for controlling the outgoing lines, and the supporting steelwork was designed.

Addington Substation.—Lay-out drawings of site were prepared, showing the location of the proposed new workshop, test-room, and office buildings, the proposed new 66 kv. switch-gear and steelwork, and the new position of main transformers with provision for a railway siding to the substation and workshop. Drawings of the proposed new switch-gear and steelwork were prepared for tendering purposes. Drawings for No. 2 synchronous condenser were prepared for tendering purposes.

Timaru Substation.—To provide for new operating conditions and the change-over at a later date reconstruction of the whole substation and outdoor equipment will have to be undertaken. Lay-out drawings of site were prepared showing the position of the new buildings, outdoor switch-gear, steelwork, and transformers. Drawings of the new 110,000-volt switch-gear and steelwork and the auto-transformers with their switch-gear were prepared for tendering purposes.

Oamaru Substation.—Layout drawing of site and drawing of outdoor switch-gear and steelwork for tendering purposes were prepared.

Transmission-lines.—A layout was prepared for two miles of steel tower line from Timaru Substation in connection with the duplication of the Timaru–Oamaru line. Details were also prepared for the protection of the temporary wooden pole in the Waitaki River bed, which was erected after the central steel tower of the crossing was washed out by a change in the course of the river during a heavy flood. Alternative proposals for the reconstruction of the line in one and two spans were investigated, the latter being adopted. A cylinder foundation for the central tower was designed, and calculations were made for the towers and conductors. The river-diversion cut in connection with the Waimakariri River protection-works will necessitate the reconstruction of the section of the North Canterbury lines in the area affected. The reconstruction of this section on two steel towers was investigated, and calculations were made for towers and conductors.

Mangahao–Waikaremoana System.

The extension of the system from Wanganui to New Plymouth with new substations at Hawera, Stratford, and New Plymouth, extensions at Wanganui Substation, and an additional substation on the existing system at Marton, involved a considerable amount of layout-design work and drawings for tendering purposes.

The interrupting capacities of existing switch-gear and the maximum short-circuit capacities required for future operating conditions were further investigated.

Phasing and wiring diagrams and foundation drawings were prepared in connection with the protective relay equipment.

Power-station, Mangaore.—Wiring diagrams and panel drawings were prepared for the main line protective relay equipment.

Power-station, Tuai.—Wiring diagrams and panel drawings were prepared for the protective relay equipment, also foundation drawings for the 110,000 volt current transformers. To provide an alternative supply of cooling water for the transformers and other power-station equipment and a more efficient fire-fighting service for the power-station and village, a layout for extensions to the water-service was prepared, the supply being taken from a second reducing valve on the pipe-lines.

Woodville, Dannevirke, and Waipukurau Substations.—Foundation drawings were prepared for potential transformers for the protective relay equipment.

Bunnythorpe Substation.—A layout drawing was made for the new switch-room, which was decided upon as part of the building-restoration programme following the fire.

Wanganui Substation.—Drawings were prepared for tendering purposes showing the additions to steelwork and switch-gear to provide for the extension of the transmission-line and an additional bank of transformers.

Hawera and Stratford Substations.—Preliminary layouts of the buildings and equipment on sites, also drawings for tendering purposes of the steelwork and switch-gear were prepared.

New Plymouth Substation.—Drawings of switch-gear and steelwork for tendering purposes and a preliminary layout of site were prepared.

Marton Substation.—Specifications and drawings for the switch-room and layout and foundation drawings for the substation equipment were prepared.

Transmission-lines.—Transmission-line structures and details for the Wanganui–Hawera–Stratford line were designed, and quantities for transmission-line poles, insulators, line hardware, telephone poles, and telephone-line conductor prepared for tendering purposes.

Arapuni–Horahora System.

With Arapuni Power-station coming into operation the whole of the switch-gear and protective equipment was reviewed. The interrupting capacities of existing switch-gear and the maximum short-circuit capacities required for future operating conditions were further investigated. Specifications were drawn up for a protective relay scheme with all necessary equipment, together with additional switch-gear to give greater protection and reduce outages to a minimum.

Arapuni Power-station.—Drawings for tendering purposes were prepared for No. 4 main transformer bank, No. 4 main generating-unit (15,000 kw.), and for the auxiliary generating-units which are to supply power for the auxiliaries of the main units and render them independent of the rest of the system. A preliminary layout was prepared for the ultimate equipment at the outdoor station.

Hamilton Substation.—The specifications and drawings for the new substation buildings were completed. Drawings of the proposed new 50,000-volt switch-gear were prepared for tendering purposes.

Penrose Substation.—Wiring diagrams and drawings of the panels for the transmission-line protective relay equipment were prepared.

Waihou Substation.—Specifications and drawings were prepared for a workshop and for foundations for the outdoor switch-gear and transformers. A turntable for the traverser-tracks was designed.

Waitaki Power Development.

Throughout the year a large amount of intricate design work was carried out in connection with the Waitaki Power-station and substations. The physical dimensions of the main units at the power-station are much larger than those of any unit previously installed, and parts of the turbine (such as the scroll case)—which are usually built of steel at the maker's works—are constructed in reinforced concrete on site for the present installation. The machine foundations, water-inlet passages, and the power-house building are of correspondingly large dimensions.

Power-station.—A large part of the design work in connection with the building and outdoor station was carried out during the year. The following are some of the subjects dealt with:—

(*a*) General layout on site showing contours and position of dam, power-station, outdoor station, tail-race, road, railway, and traverser-tracks.
(*b*) Plans and elevations of the power-station building.
(*c*) Drawings of footings and wall and column reinforcement.
(*d*) Outline and reinforcement drawings for draught tubes, scroll cases, and inlet-water passages for main units.
(*e*) Outline of main-unit foundations.
(*f*) Outline and specifications for steel windows.
(*g*) Design and specifications for steel roof-trusses.
(*h*) Design of foundations for outdoor steelwork, switch-gear, and transformers.
(*i*) Design and specifications for traverser trucks and turntables.
(*j*) Design of water rheostats.
(*k*) Layout of equipment in the power-station.
(*l*) Drawings for the machinery contractors to enable them to provide equipment to fit in with the layout on site.

Drawings and specifications were prepared for a hostel, single men's quarters, six-car garage, and permanent cottages in the Waitaki Village Settlement. A water-supply and drainage system for the settlement was also designed, the water being pumped from the Waitaki River to a high-level reservoir.

Glenavy Substation.—A layout of the site showing the position of access road, cottages, substation buildings, outdoor station, and incoming and outgoing lines was prepared. For tendering purposes drawings and specifications for the buildings were prepared, also drawings of the switch-gear and steelwork.

Transmission-lines.—The positions of towers on the Waitaki–Glenavy line were plotted on the route plans, also sag and tension data for line-conductors and earth wire calculated. Tower and insulator charts were prepared. Tenders for copper and steel-core aluminium conductors and for steel towers were analysed and the designs of towers were checked. Quantities of insulators and clamps were prepared for tendering purposes. A specification was prepared for the cadmium-copper telephone conductor on the Waitaki–Glenavy telephone-line. This is the first long-distance telephone-line of the Department on which this conductor is being used. The preliminary locations of line structures were plotted on the route plans for the Oamaru–Palmerston transmission-line.

Transmission-lines: General Investigations.

Extensive investigations were carried out in connection with problems arising out of transmission-line operation, and matters affecting the mechanical and electrical design of the lines. Following are some of the subjects dealt with:—

Supporting Structures.—Piled foundations for poles. The deterioration of wood poles in service and sap-testing. Steel poles and Stobie poles.

Conductors.—Aluminium-alloy conductors. Conductor-vibration troubles and dampers to eliminate vibration. Corrosion of aluminium clamps. Corrosion of copper wires near Rotorua. Repair sleeves for steel-cored aluminium cable. Use of tension indicators for conductors.

Insulators and Hardware.—Insulator-ties for Gisborne line. Trunnion-type and releasing-slip clamps. Worn "U" bolts on towers.

Power Board Lines.—Analysis of concrete-pole designs.

POWER RESOURCES.

Investigation of the power resources of Lakes Te Anau and Manapouri for which surveys had been in progress for three summers was completed during the year. Schemes of development have been outlined and preliminary estimate prepared. The geology of the district so far as it affects construction has also been studied.

In response to a desire for power in the Nelson District several new sources of supply were inspected with a view to finding a more suitable source than the Gowan River. No further investigation has been made.

A close study has been made of the benefits to be derived from and the many problems arising out of interconnection of the principal power-stations. In the North Island these include the connection of Mangahao with Waikaremoana and of both with Arapuni and Horahora. The relationships of the connected or combined output to the estimated requirements up to the year 1940 have also been studied.

In the South Island the combination of Lake Coleridge with Waitaki and the two with Waipori have also been studied.

Arrangements have been made to install automatic recorders for measuring stream-flow wherever conditions are suitable. The Department is deeply indebted to those who in the past years have kept daily records.

HYDRAULIC DESIGN.

The major work of the year has been in connection with the Waitaki dam, and in this the method of construction, the handling of the river during construction, the dissipation of the energy of flood-water falling over the dam, and the protection of the foundation rock below the dam, have all received attention. Details have also been worked out for the penstock intake and for screens and gates.

ELECTRIC-POWER BOARDS.

Amendments to the original (1918) Act, based on the results of experience, were passed in 1919, 1920, 1921, 1922, and 1923. The legislation was consolidated and amended in the Electric-power Boards Act, 1925, with subsequent amendments in 1927 and 1928.

The development of the reticulated area of Electric-power Boards has continued to make substantial progress during the year. There are now forty-five districts constituted, and forty actually carrying out the distribution and sale of electrical energy (August, 1930). The total area covered is 67,862 square miles, or 63 per cent. of the total area of the Dominion; the total population concerned is 993,737, or 64 per cent. of the total population of the Dominion; and the unimproved value of the land included in the electric-power districts and outer area is £258,277,326, or 74 per cent. of the total unimproved value of the Dominion.

The attached coloured maps show the location of the various districts already constituted and the proposed districts. The areas in which Electric-power Boards have not been set up are, on the whole, comparatively sparsely populated, but there is one locality where it would appear that such a Board could with advantage be formed—viz., the suggested Waimarino Electric-power District, which includes Ohakune, Raetihi, and surrounding district. During the year the Hurunui and Waimea Electric-power Districts were duly constituted, and the Hobson (now North Auckland) Electric-power District has been extended to include Whangarei and Otamatea Counties.

So far, only one of the four main cities—viz., Auckland—has been included in the inner area of a power district, but of the secondary centres the boroughs of Wanganui, Palmerston North, Invercargill, Timaru, Napier, Hastings, Blenheim, Greymouth, Gisborne, and Oamaru are included. The advantage of Power Board organization is more obvious to rural than to urban ratepayers, and yet the above position indicates that some of the more important centres have realized that it is to their advantage generally to be associated with the country in undertaking the work of reticulation of electric power on a comprehensive scale.

The Boards already formed are working energetically in carrying out their functions. Twenty-four Boards—viz., Waitemata, Thames Valley, Bay of Plenty, Cambridge, Central, Franklin, Waitomo, Te Awamutu, Hutt Valley, Horowhenua, Manawatu-Oroua, Wanganui-Rangitikei, Central Hawke's Bay, Hawke's Bay, Dannevirke, Tararua, Wairarapa, Malvern, Banks Peninsula, Springs-Ellesmere, Ashburton, North Canterbury, South Canterbury, and Waitaki—have carried out fairly complete reticulation of their areas, and are distributing power taken in bulk from the plants at Horahora, Arapuni, Mangahao, Waikaremoana, and Lake Coleridge. The Auckland Board has taken over the city electric-power station, and is providing for large extensions of both plant and mains. It has also entered into a contract to take the whole of its power, with a minimum of 15,000 kw., from Arapuni, the first unit of which went into commercial operation in June, 1929. Taranaki is now giving a supply from its own generating-station at Tariki. South Taranaki has purchased the assets of the Hawera Electric-supply Co., and is also arranging to take bulk supply from the Department. Wairoa and Poverty Bay are taking power in bulk from the Department's station at Waikaremoana, Wairoa Board supplying the Borough of Wairoa and a large portion of Wairoa County, and Poverty Bay Board supplying Gisborne and surrounding district. Seven—viz., Opunake, Taranaki, Southland, Wairere, Marlborough, Golden Bay, and Teviot—have local water-power stations in operation. The Westland Power Board has delegated its license to Westland Power, Ltd., for a term of years. The Grey Power Board has erected a steam station of its own and is at present (August, 1930) constructing a hydro-electric station (2,500 kw.) on the Arnold River near Kaimata. The Tauranga, Otago, and Otago Central Boards have arranged to purchase power in bulk from other authorities. The other five—viz., North Auckland, Buller, Reefton, Hurunui and Waimea—are making arrangements which have not yet been finalized.

Table XXVI gives details of the date of constitution, the area, population, and rateable value of each of forty-five power districts already formed, also the amounts of the loans already authorized, and the voting on each poll taken. The total amount of the loans authorized by the thirty-nine districts which have taken their polls is £12,821,666. The population of the districts concerned is 934,454, so that the loans authorized amount to £13·8 per head of population, as compared with £13·9 last year. The unimproved valuation of the districts is £226,902,042, the loans authorized amounting to 5·68 per cent. of the unimproved rateable value of the lands pledged as security for the loans. The voting at the polls totalled 63,215 to 11,225—*i.e.*, a majority of 71·5 per cent.

Table XXVII shows the capital outlay incurred by each Board up to the end of the financial year 1929–30, the revenue, and annual expenditure, and the amount of rates struck and collected.

The total capital outlay by the thirty-nine Boards which have started construction is £12,920,150, and a small proportion of this is on works not yet in service. The gross revenue from the sale of electricity by the thirty-nine Boards which have commenced supply was £2,092,169, of which 30·9 per cent. was received by the Auckland Board. The general result is a profit over the whole business of the Power Boards of £204,669 for appropriation to Depreciation and Reserve Funds, &c.

During last year six of the Boards struck a general rate, which was collected in three cases, and ten of the Boards struck special rates for the security for loans, which were collected in six cases.

Several of the Boards have been passing through a critical stage owing to the high cost and high-interest rates ruling in 1921 when they started construction work, and to the fact that they have undertaken the construction of many lines without requiring the guarantees from consumers authorized by clause 7 (*d*) of the 1922 regulations, and since amplified in the 1927 regulations. But costs and rates of interest are now substantially lower, and other Boards are profiting by such experiences, and much better results are being attained by the Power Boards generally as the result of the experience of these earlier districts.

LOCAL ELECTRIC-SUPPLY SYSTEMS.

Including the Government plants, there are now (31st March, 1930) thirty-eight public electric-power stations in the Dominion, as compared with thirty-eight last year. One new hydro station (Golden Bay) came into operation, and one oil (Gisborne) station was shut down from regular operation when bulk supply became available.

The total installed capacity (excluding stand-by plant) has increased during the year by 90,579 kw., or 55 per cent. (from 163,459 kw. to 254,038 kw.), while the sum of the maximum loads has increased by 30,985 kw., or 21·4 per cent. (from 144,226 kw. to 175,211 kw.).

The proportion of installed plant is now as follows:—

	Stations.	Kilowatts.	Proportion per Cent.
Water-power (including Diesel stand-by, Penrose) ..	31	226,078	89·0
Steam-power (excluding hydro stand-by plants at Wellington (10,000), Invercargill (2,450), Waihi (2,500)	3	27,637	10·9
Gas-power	2	112	..
Oil -power	2	211	..
	38	254,038	100·0

The number of consumers supplied has increased from 266,306 to 284,235, an increase of 17,929, or 6·75 per cent., for the year.

The total population included in the various areas of electric-power supply is 1,370,434, or 93·5 per cent., of the total population of the Dominion, so that the ideal of a supply being available to every home in the Dominion is well on the way to realization.

The maximum demand per head of population in the areas supplied is 0·127 kw., which is nearing the allocation of 0·15 kw., or 0·2 h.p. per head of population, the basis of the design of the Government schemes. The units sold per head of population supplied were 490, as compared with 398 last year.

The total length of distribution-line is 19,128 route-miles, as compared with 17,759 last year, an increase of 1,369 miles, or 7·75 per cent. The number of consumers per route-mile is 14·9, as compared with 15 last year, the decrease being due to the extra mileage of new lines erected during the year to which the full number of services are not yet connected, and to the increased proportion of country lines.

The maximum power-demand per route-mile is now 10·9 kw., the sales 35,000 units, and the revenue £220. The units are better than last year (30,600), and there is a slight increase in revenue, as against £211 last year, and there is an increase over the corresponding maximum demand of 8·15 kw. last year.

The revenue per kilowatt of maximum load of all stations was £24, as compared with £26 last year. The water-power stations show a revenue of £24·3 per kilowatt, steam stations of £23·3 per kilowatt, oil stations of £57 per kilowatt, and gas stations of £44·6 per kilowatt. These are valuable figures for use in forecasting the revenue from systems of various descriptions. The water-power systems include the greatest proportion of large consumers, and the gas-engine stations the greatest proportion of small consumers.

Out of the ninety-eight distributing authorities, seventy-seven showed a profit for the year amounting to £841,410, and twenty-one showed a loss amounting to £76,916. The general result is a net profit for the whole Dominion of £764,494, after paying working-costs (£1,871,670) and capital (interest and sinking fund) charges (£1,578,823) at the rate of 5·75 per cent. on the total capital outlay of £27,661,154. This shows a net profit of 2·76 per cent., as compared with 2·16 per cent. last year. The business on the whole is thus a thoroughly sound and remunerative one, as well as supplying a public necessity to 93·5 per cent. of the population of the Dominion.

The following table summarizes the results of the year's operations in connection with electric supply throughout the Dominion, and Table XXXIII shows in condensed form the financial statistics for each supply authority.

Summary of Results for Year ended 31st March, 1930.

—		Water.	Steam.	Gas.	Oil.	Total.
Number of stations		31	3	2	2	38
Installed capacity, main plant only	(Kilowatts)	226,078	27,637	112	211	254,038
Average capacity	(Kilowatts)	7,300	9,212	56	105	6,700
Number of consumers		234,917	48,401	462	455	284,235
Connected load	(Kilowatts)	704,880	181,165	301	559	886,905
Maximum load	(Kilowatts)	144,954	30,090	87	80	175,211
Units generated		651,784,081	57,630,310*	105,593	163,125	709,683,109
Annual load-factor	(Per cent.)	51·33	22·0*	13·9	23·23	46·5
Units sold		570,826,654	108,726,727	76,417	123,606	679,753,404
Total capital outlay in operation, including distribution systems	(£)	24,375,823	3,234,195	25,770	25,366	27,661,154
Total capital per kilowatt installed, including distribution system	(£)	108	117	229	120	108
Total annual working-costs ..	(£)	1,547,560	317,642	3,711	2,757	1,871,670
Total annual working-costs per unit sold	(d.)	0·655	0·70	11·65	5·35	0·66
Total annual working-costs per kilowatt, maximum	(£)	10·69	10·6	42·66	34·46	10·7
Total annual capital charges ..	(£)	1,365,939	209,289	1,708	1,887	1,578,823
Total annual capital charges per unit sold	(d.)	0·575	0·46	5·36	3·67	0·56
Total annual capital charges per kilowatt, maximum	(£)	9·42	6·95	19·63	23·6	9·0
Total annual capital charges as percentage of capital outlay		5·65	6·5	6·65	7·45	5·75
Total annual costs	(£)	2,913,499	526,931	5,419	4,644	3,450,493
Total annual costs per unit sold ..	(d.)	1·23	1·16	17·01	9·02	1·22
Total annual costs per kilowatt, maximum	(£)	20·11	17·55	62·29	58·06	19·7
Total annual revenue, not including rates	(£)	3,508,109	698,446	3,871	4,561	4,214,987
Total annual revenue per unit sold	(d.)	1·48	1·52	12·19	8·85·	1·5
Total annual revenue per kilowatt, maximum	(£)	24·1	22·94	44·5	57·1	24·0
Net profit	(£)	594,610	171,515	—1,548 *Dr.*	— 83 *Dr.*	764,494
Ratio of working-costs to revenue	(Per cent.)	44·2	45·5	96	60·5	44·4

* Also purchased 72,752,689 units, which brings annual load-factor up to 49·46.

BROKEN WIRES AND POLES.

During the year ending 31st March, 1930, there were 1,811 instances of broken wires reported by electric-supply authorities, as per schedule below. The corresponding figures for the previous year were 1,547 broken wires and 85,613 miles of conductor in use.

Falling trees were the principal cause of the breaks, and accounted for 40·6 per cent. of the total, as against 34·32 per cent. for 1929.

As regards broken poles, 561 instances were reported for the year, of which 359 were New Zealand blue-gum. For 1929 the total number of broken poles reported was 128, and it is becoming increasingly evident that electric-supply authorities who experimented with New Zealand blue-gum and nondescript Australian "hardwoods" are now being called upon to make early replacements after approximately five to seven years of pole-life.

Actual Mileages and Sizes of Overhead Conductors in Use at 31st March, 1930.

Size of Conductors (S.W.G.).	Copper.	Failures.	Aluminium.	Failures.	Galvanized Steel.	Failures.	Galvanized Iron.	Failures.	Copperweld.	Failures.	Steel-cored Aluminium.	Failures.	Bronze.	Failures.	Total Failures.
	Miles.		Miles.		Miles.		Miles.		Miles.		Miles.		Miles.		
7/20	5,660	330	..	..	..	..	..	..	..	..	..	..	..	..	330
7/18	8,745	272	..	..	..	..	..	..	..	..	..	..	..	..	272
7/17	1,718	9	..	..	..	..	..	..	..	..	..	..	..	..	9
7/16	14,057	147	22	3	155	..	31	..	..	..	56	..	..	..	150
7/15	115	..	..	..	..	..	..	..	..	..	100	2	..	..	2
7/14	9,272	54	67	1	44	..	..	..	..	..	372	..	..	..	55
7/13	1,076	..	133	..	2	..	..	..	..	..	..	..	..	..	..
7/12	410	4	18	6	..	..	..	..	3	..	..	..	..	..	10
7/10	26	3	24	..	..	..	..	..	10	..	..	..	..	..	3
7/9	75	..	12	..	4	..	..	..	..	..	..	..	..	..	..
19/18	294	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/17	543	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/16	1,340	1	..	..	..	..	..	..	..	..	..	..	..	..	1
19/15	101	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/14	578	6	..	..	..	..	..	..	..	..	..	..	..	..	6
10/13	1,817	14	..	..	..	..	..	..	..	..	..	..	..	..	14
19/12	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/16	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/15	405	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/14	85	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/13	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/12	3	1	..	..	..	..	..	..	..	..	..	..	..	..	1
61/13	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	3,534	201	..	..	..	..	96	..	..	..	..	..	..	..	201
10	10,818	379	..	..	154	..	290	..	571	..	..	..	30	..	379
8	11,500	199	..	..	3,802	15	5,495	87	1,113	..	..	..	..	..	301
7	775	24	..	..	..	..	65	..	91	..	..	..	..	..	24
6	299	4	..	..	16	..	15	..	158	4	..	..	..	..	8
4	608	2	..	..	..	..	..	..	74	..	..	..	..	..	2
2	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..
0	102	..	..	..	..	..	..	..	..	..	..	..	..	..	..
00	..	..	11	8	..	..	..	..	..	..	..	..	..	..	8
3/0	..	..	..	..	..	..	..	..	..	..	1,239	7	..	..	7
6/·144	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..
3/8	..	..	19	7	..	..	..	..	..	..	..	..	..	..	7
3/12	94	..	28	..	..	..	..	..	..	..	..	..	..	..	..
4/14	70	..	..	..	217	..	..	..	..	..	..	..	..	..	..
5/14	..	..	..	..	130	1	..	..	..	..	..	..	..	..	1
3/10	..	..	39	3	..	..	..	..	..	..	..	..	..	..	3
4/16	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..
7/·135	..	..	175	2	..	..	..	..	..	..	..	..	..	..	2
7/·122	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..
7/·083	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..
7/·074	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..
6/·186	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..
Miscellaneous	..	15	..	..	..	..	..	..	..	..	..	..	..	..	15
	74,280	1,655	627	30	4,524	16	5,992	87	2,020	4	1,788	9	30	..	1,811

Grand total, 90,710 miles.

GROWTH OF LOAD.

The total connected load at end of the year under review was 886,905 kw., as against a total of 794,938 kw. for 1929, an increase of 91,967 kw., or 11·55 per cent.

In the early days of electric supply the principal use was confined to lighting, and as time progressed it extended to the industrial field. Later developments point to the domestic field becoming predominant in the future, and instead of the peak load being an evening one as in past years, it is now a pronounced feature of the forenoon load curve, the reason being, no doubt, attributable to the growth of the domestic cooking load overlapping the industrial demand. The development of this domestic load is the supply authorities' greatest immediate opportunity for expansion, more particularly in the rural areas, where the population can put electric service to greater use than in city residential areas.

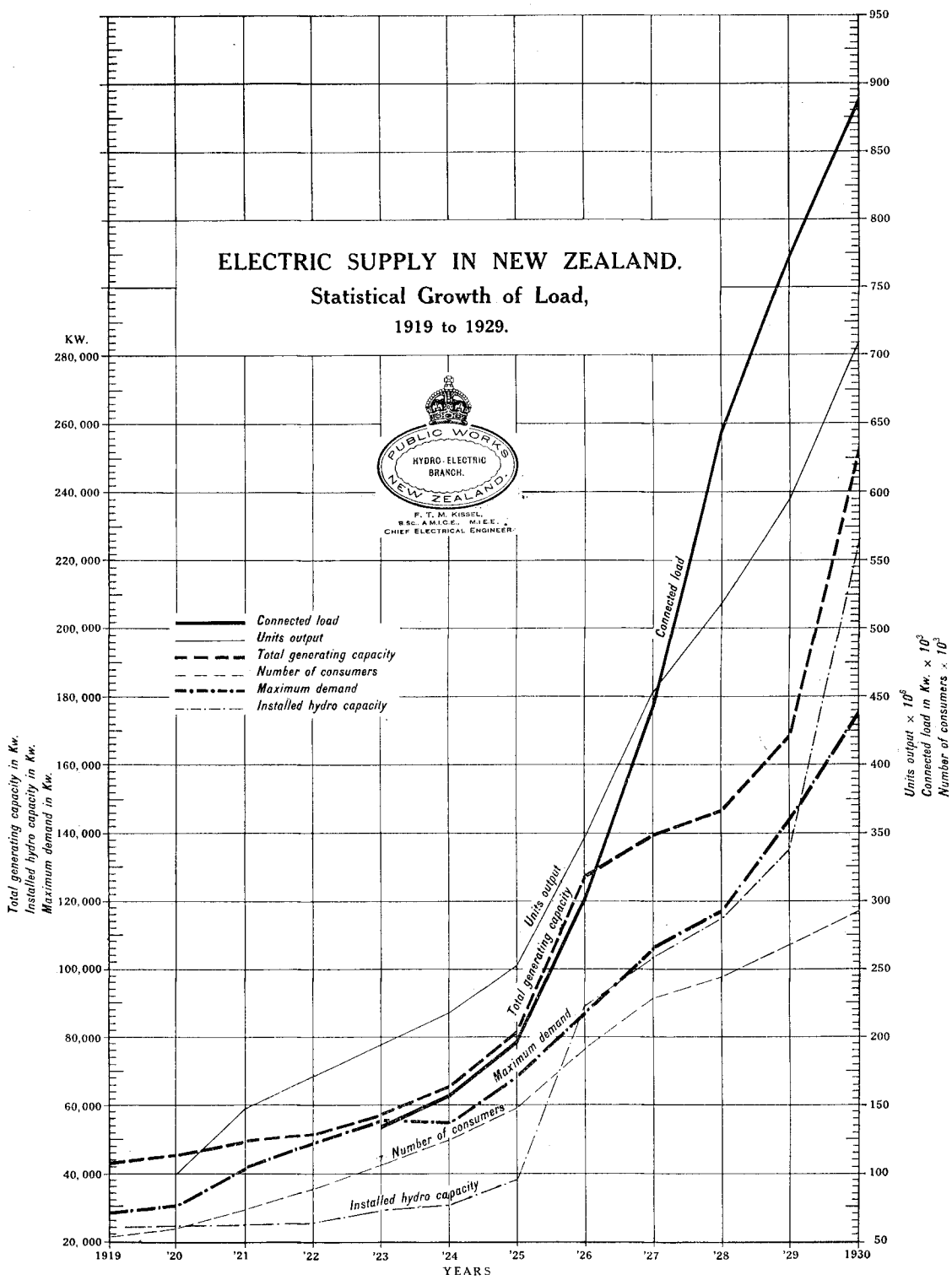
Statistics pertaining to the increase in electric ranges, electric water-heaters, and milking-machines, have been collected and scheduled for some years past, and from the following table it will be seen that during the period 1925 to 1930 the growth has been phenomenal, as indicated by the percentages at the foot of each column.

Year.	Consumers.	Electric Ranges.	Electric Water-heaters.	Electrified Milking-machines.
	Number.	Number.	Number.	Number.
1925	148,699	1,526	..	3,581
1926	192,392	4,671	6,654	4,856
1927	228,345	9,511	14,160	6,738
1928	243,795	15,766	21,513	8,514
1929	266,306	20,254	29,257	10,161
1930	284,235	25,997	37,564	11,922
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Increase over five-year period ..	91	1,600	465*	232

* Four years only.

See Table XXXI for details for year ended 31st March, 1930.

The graph published below also shows progress made during the last decade—viz., 1920-30.



The substantial increase shown in installed generating-capacity is principally due to the bringing into operation of Arapuni (45,000 kw.) and Waikaremoana (40,000 kw.).

ELECTRICAL SUPPLY AND WIRING REGULATIONS.

The Electric Supply and Wiring Regulations, which were gazetted in 1927, with the intention of revising same after two years' trial, are now being revised.

Last year all electric-supply authorities were circularized and asked for suggestions which would be considered in conjunction with this Department's experience of the regulations in operation. From the replies received it is evident that the electric-supply authorities are keenly interested in seeing that the wiring regulations ensure high-grade installations without being unduly expensive. Very few comments were received in connection with the supply regulations, which were first issued in 1915 and subsequently revised in 1919, 1922, and 1927 respectively. It is expected that the work of revision will be completed towards the middle of 1931.

INSPECTION OF ELECTRIC LINES.

The periodic inspection of the electric lines throughout the Dominion has been maintained in conjunction with the inspections necessitated by the addition of new lines erected during the year. Two maps (X 43 and X 44) accompany this report, and show the extent to which the Dominion is served by E.H.T. and H.T. lines.

The following supply authorities have made extensions to their electric lines during the year ending 31st March, 1930 :—

Ashburton Power Board
Auckland Power Board
Banks Peninsula Power Board
Cambridge Power Board
Central Power Board
Central Hawke's Bay Power Board
Christchurch City Council
Dannevirke Power Board
Dunedin City Council
Franklin Power Board
Golden Bay Power Board
Grey Power Board
Hamilton Borough Council
Hastings Borough Council
Havelock North Town Board
Hawke's Bay Power Board
Heathcote County Council
Horowhenua Power Board
Hutt Valley Power Board
Invercargill City Council
Kaponga Town Board
Lyttelton Borough Council
Malvern Power Board
Manawatu-Oroua Power Board
Marlborough Power Board
Napier Borough Council
Nelson City Council
New Plymouth Borough Council
North Canterbury Power Board
Ohakune Borough Council
Opunake Power Board
Otago Central Power Board
Otago Power Board
Poverty Bay Power Board
Raetihi Borough Council
Rangiora Borough Council
Riccarton Borough Council
Rotorua (Tourist Department)
South Canterbury Power Board
Southland Power Board
Springs-Ellesmere Power Board
South Taranaki Power Board
Taranaki Power Board
Tararua Power Board
Tauranga Power Board
Te Aroha Borough Council
Te Awamutu Power Board
Te Puke Town Board
Teviot Power Board
Thames Valley Power Board
Timaru Borough Council
Waimairi County Council
Waimea Electric-supply Company
Wairarapa Power Board
Wairere Power Board
Wairoa Borough Council
Wairoa Power Board
Waitaki Power Board
Waitara Borough Council
Waitemata Power Board
Waitomo Power Board
Wanganui-Rangitikei Power Board
Wellington City Council
Westport Borough Council
Whangarei Borough Council
Whakatane Borough Council.

The following is a list of the various electric-supply authorities and companies whose lines have been inspected during the past year :—

Power Boards (30).

Ashburton	Franklin	Otago Central	Te Awamutu
Auckland (part)	Golden Bay	Poverty Bay	Teviot
Bay of Plenty	Hawke's Bay	Southland	Thames Valley
Banks Peninsula	Horowhenua	Springs-Ellesmere	Wairere
Cambridge	Hutt Valley	Taranaki	Wairoa
Central	Manawatu-Oroua	Tararua	Waitaki
Central Hawke's Bay	North Canterbury	Tauranga	Waitemata.
Dannevirke	Otago		

Cities (3).

Dunedin Invercargill Nelson.

Boroughs (19).

Bluff	Motueka	Raetihi	Tauranga
Inglewood	Napier	Stratford	Te Aroha
Hastings	New Plymouth	Taumarunui	Thames
Lyttelton	Ohakune	Timaru	Wairoa.
Mataura	Queenstown	Taihape	

Town Districts (4).

Havelock North	Mangaweka	Manunui	Te Puke.

County Councils (4).

Heathcote	Murchison	Uawa	Waimairi.

Companies, &c. (21).

J. D. Barry, Tokomaru Bay
Farmers' Co-operative Co., Tokomaru Bay
Auckland Farmers' Freezing Co., Horotiu
Golden Bay Cement Co.
Hermitage, Mount Cook
Golden Terrace Extended Gold-mining Co.
L. J. G. Hamilton, Tokoroa
Naseby Hospital
Oparau Dairy Co.
N. L. Newdick, Taupo
Onakaka Ironworks
Waimea Electric-supply Co.
Wairakei Ltd.
Waipiro Trading Co.
Waipiro Hotel
Waipiro (H. Williams)
Waipiata Sanatorium
Weheka (Sullivan Bros.)
M. Wallis, Okete
Westland Power, Ltd.
Wharetoa Dairy Co., Tokaanu.

It is satisfactory to be able to say that the electric-supply authorities facilitate these inspections and almost without exception give prompt attention to the rectifying of any defects discovered.

Last year it was intimated that more attention would be paid to the inspecting of consumers' installations, and during the early part of 1930 an inspection of all electric-supply authorities' areas of supply in the Auckland Province was carried out as a check on the registered Inspectors responsible for seeing that the Electrical Wiring Regulations are being complied with. The results showed that in some areas the need for stricter inspection is necessary, and steps are being taken to see that this is done in future. Periodical inspections of this nature will be continued in co-operation with the activities of the Electrical Wiremen's Registration Board.

LICENSES ISSUED.

The following water-power and electric-line licenses have been issued during the period from July, 1929, to July, 1930: Alderton Utility Company, Kerikeri; Hutt Valley Power Board (extensions); Dannevirke Power Board (extensions); H. Williams, Waipiro Bay; Waimea Electric-supply Company (consolidating license); Christchurch Tramway Board (two); E. Doel, Kawakawa; Maniototo Hospital Board, Naseby; New Zealand Sounds Hydro-electric Concessions, Ltd.; W. Jacentho, Mangonui; Uawa County Council (amendment); Waipiata Sanatorium Committee, Waipiata.

ELECTRIC APPLIANCES BOARD.

Pressure from the electric-supply authorities and supported by the Electrical Traders' Federation has again been brought to bear on the Department for the setting-up of some authority with constitutional powers to prohibit the sale and use of unsafe electrical appliances to the public, and in response thereto a draft Bill has been prepared.

ELECTRICAL FIRES.

During the year there were twenty-four fires reported to the Department by the electric-supply authorities and attributed to electrical causes. The following schedule shows the circumstances which caused these fires:—

3/8/29. G. H. Lester. Back of house gutted. Wires fused in ceiling-rose used as a connecter between wood casing and conduit. (Raetihi.)

10/8/29. H. J. Wellsford, 283 Nelson Street, Invercargill. Slight damage to ceiling by fire caused by lightning striking conduit in contact with compo. gaspipe.

10/8/29. H. Phillips, 43 Tramway Road, Invercargill. Ditto above.

22/8/29. House burnt down. Iron switch left on. (Tararua Power Board.)

31/8/29. P. Loyde. Half house destroyed. Electric iron left on. (Tauranga Borough Council.)

31/8/29. Rutene Takina, Crawford Road, Gisborne, one room extensively damaged through electric iron being left switched on. (Poverty Bay Power Board.)

31/8/29. G. R. Brown, 70 Maitland Street, Invercargill. Conduit in contact with compo. gaspipe.

5/9/29. E. Paterson, 73 Glen Road, Dunedin. Iron left switched on caused fire.

7/9/29. A. Aulen, 14 William Street, Wellington. Radiator left switched on.

10/10/29. Fire started by a short circuit in an unauthorized flexible extension. (Christchurch City Council.)

11/10/29. Mr. Robinson, 32 Bronti Street, Nelson. Table burnt through iron being left switched on.

31/10/29. English Mail Order Co., Dowling Street, Dunedin. Fire started in ceiling block through wires being jammed by block and water leaking in from floor above.

9/12/29. Patton, Cooper Street, Mornington. Outhouses burnt. Fire caused by unauthorized extension by an unlicensed boy. (Dunedin City Council.)

24/12/29. L. Yokovitch, Hammond Road, Taradale. Floor and walls of kitchen damaged by fire caused by electric iron being left switched on. (Hawke's Bay Power Board.)

9/1/30. A. Pettit, Grey Street, Shannon. Insulation at back of board burnt through mains shorting outside in gale and caused neutral to burn through.

29/1/30. Miss I. M. Larkin, Seddon Street, Raetihi. House partially gutted through defective fitting of 3 in. by 5 in. wood block cutting insulation.

31/1/30. R. Denny, Stanley Street, Eketahuna. House partially gutted through electric iron being left switched on.

19/2/30. J. Mashion, Hakeaha. Wall damaged through electric iron being left switched on. (Taumarunui Borough.)

20/2/30. P. Schneideman, Farish Street, Wellington. Table burnt and door damaged through electric iron being left on.

24/2/30. Mr. Thomas. Walls and ceiling of two rooms damaged by fire through iron being left switched on. (Wellington City Council.)

12/3/30. D. O'Sullivan. Wall charred through bare spot on phase wire making contact with service neutral caused short through consumer's earth. (Wellington City Council.)

21/3/30. Office, show-room, and workshop extensively burnt through electric kettle being accidently switched on and boiling dry. (Poverty Bay Power Board.)

2/4/30. Mr. Tombes. Four rooms damaged by fire through electric iron being left switched on. (Wellington City Council.)

16/4/30. Plan cabinet and wall damaged by fire through radiator being accidently switched on and not noticed. (Hamilton.)

ELECTRICAL ACCIDENTS.

The following is a list of various electrical accidents reported to the Department for eight months ending 31st March, 1930 (the remaining four months were inadvertently included in report for year ending 1929, and the correct total for the complete year ending 31st March, 1930, is twenty-three accidents) :—

7/8/29. Boy electrocuted by defective and unprotected hand-lamp. (Auckland Power Board.)

17/8/29. Linesman electrocuted while working on dead L.T. being run under line 11,000-v. lines. The wires were being strained by a rope attached to a motor-lorry. The rope broke and the dead line contacted with the live E.H.T. (Waitomo Power Board.)

24/8/29. Child electrocuted through touching element in electric range from which the guard had been removed. (Wairarapa Power Board.)

29/8/29. A woman received severe shock when using an iron connected to three-pin plug on range by two-core flex. Defect in iron caused by frequent blackleading, with the result that the blacklead penetrated to the element and shorted to frame. (Christchurch City Council.)

30/8/29. A man electrocuted through using a faulty and unprotected hand-lamp while installing a wireless earth under the house. (Auckland Power Board.)

9/9/29. Linesman received slight burn to fingers through using ladder with steel reinforced sides. (Otago Power Board.)

11/9/29. Linesman received severe burns while engaged in binding dead L.T. under live H.T. through binder contacting with latter. (Banks Peninsula Power Board.)

14/9/29. Engineer received serious injury through accidental contact with live lines. (Wairere Power Board.)

14/10/29. Two cows killed by contact with fallen L.T. wire. (Springs-Ellesmere Power Board.)

3/11/29. Linesman severely burnt while working on H.T. lines. This man *assumed* the lines were dead, and failed to carry out the regulation *re* earthing. (Hutt Valley Power Board.)

18/11/29. Linesman burnt while working on transformer. (New Plymouth Borough Council.)

30/11/29. Linesman received shock through foot slipping while working on pole without safety belt. (Hawke's Bay Power Board.)

4/12/29. Linesman electrocuted while running H.T. under live E.H.T. (Dunedin City Council.)

12/12/29. Workman received slight burns to hand and feet and shock while assisting with the fitting of end box to 11 kv. cable through coming in contact with live side of isolating links. (Public Works Department, Christchurch.)

10/1/30. Man electrocuted while driving piles for river crossing for electric lines through guy wire of derrick coming into contact with live lines. (North Canterbury Power Board.)

10/2/30. Assistant linesman electrocuted while working on transformer-platform, apparently ignoring safety rules. (South Canterbury Power Board.)

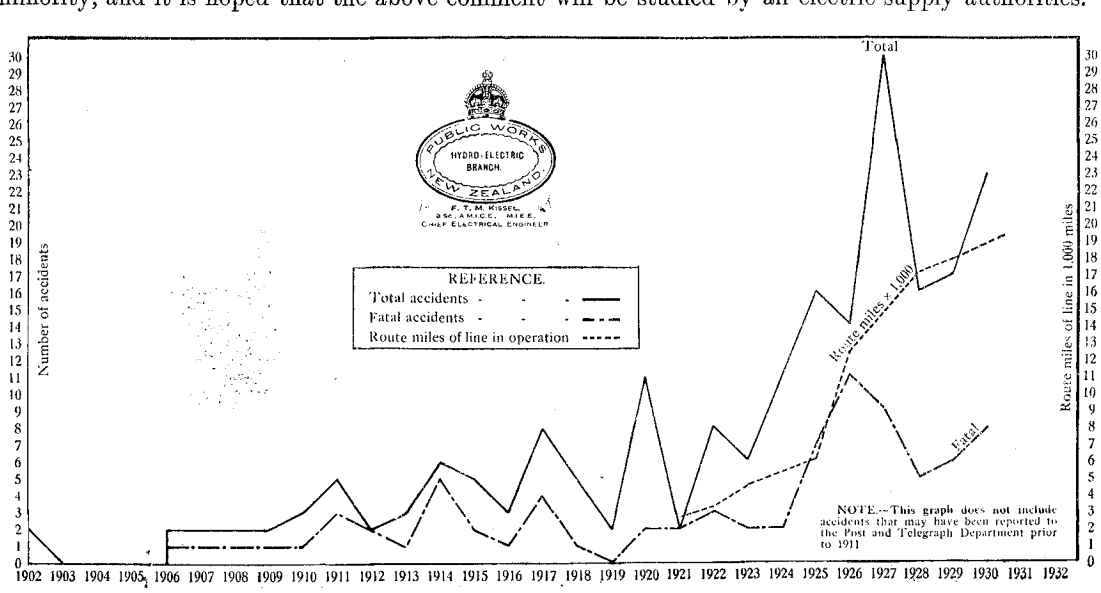
5/3/30. Post and Telegraph linesman killed at Kaponga, accidental contact with power lines. (Kaponga Town Board.)

1/3/30. Engineer received shock while working on switch-board. (Cambridge Power Board.)

19/3/30. Linesman received shock and burns through contact with bare connector while lifting live 230-v. phase wire on to insulator and simultaneously touching neutral. (Palmerston North City.)

21/3/30. Linesman received slight shock and burns while changing cross-arm below live lines. (Auckland Power Board.)

It is regretted that eight of these accidents caused loss of human life. The following graph has been prepared to show over a period of years the incidence of electrical accidents, the majority of which have occurred to employees of the supply authorities. Accidents to consumers are in the minority, and it is hoped that the above comment will be studied by all electric-supply authorities.



REGISTRATION OF ELECTRICAL WIREMEN.

The Electrical Wiremen's Registration Act, which provides for the registration of electrical wiremen and inspectors of electrical wiring, was passed by Parliament in 1925, and came into operation on the 1st April, 1926. Amendments were made to the Act in 1926 and 1928 to provide for several matters not included in the principal Act and to make for better working in other directions. Regulations under the Act were gazetted in 1926 and were revised and reissued in 1929.

The Act was passed in the interests of public safety, and a Board of five members was set up to administer the Act. The Chief Electrical Engineer is Chairman of the Board, and the other members represent the electrical-supply authorities, electrical contractors, electrical wiremen, and the fire and accident underwriters. The members, with the exception of the Chief Electrical Engineer, are appointed for a period of three years.

The main points covered by the Act are—

Every wireman must have reached the age of nineteen years before he can be registered.

All electrical-wiring work must be carried out by wiremen who are registered or licensed, but these may be assisted by apprentices or improvers, who must work under the supervision and in the presence of the wireman. An improver is defined as a person who, having completed an apprenticeship to the electrical-wiring trade, has sat for but failed to pass the Board's examination.

The wiring and repairing of apparatus on premises other than that on which it will be used must either be done by a wireman registered or licensed under the Act, or be inspected and tested by him before it is put into use.

The Act applies to all electrical-wiring work, whether such work is connected to the mains of an electrical-supply authority or to a private plant.

Before any wiring work is commenced the contractor for such work must give notice to the electrical-supply authority concerned or to the Chief Electrical Engineer of the Public Works Department in the case of private plants.

Before any wiring or electrical apparatus is connected to the source of supply such apparatus and wiring, including extensions and alterations, must be inspected, tested, and approved. All inspections made by an electrical-supply authority must be carried out by an Inspector of Electrical Wiring registered under the Act.

Every wireman and Inspector is supplied with certificates for identification purposes, and these must be produced on demand by certain persons, including the person for whom the work is being performed, and the occupier of the premises on which the work is being performed.

Any person who employs or permits anyone to carry out work contrary to the Act commits an offence.

Any person who possesses information which may lead to the identification of the person who did any wiring work must, on demand, give such information to an Inspector. If the occupier of the premises refuses or fails to give such information he can be charged with permitting the work to be done.

The stage-lighting switchboard in a theatre must in certain cases be under the control of a wireman.

Limited registration may be approved in certain cases where the qualifications for full registration are insufficient, and is intended to apply to those cases where a man has been engaged in a limited class of wiring work.

One of the objects of the Act is to raise the standard of electrical-wiring work by providing that only qualified men shall carry out the work. To this end it is necessary for every apprentice to pass an examination before he can become a registered wireman. Examinations are held twice each year, and eight examinations have been held to date. An average of 262 candidates have presented themselves for the written part of the examination and an average of 234 candidates have presented themselves for the practical part. The largest number of candidates for any examination was at the examination held in September, 1929, when 318 presented themselves for the written part and 282 for the practical part. The highest marks obtained by any candidate were 91 in the written part and 96 in the practical part respectively out of a maximum of 100. Details of the examinations held will be found in the accompanying tables and curves.

The regulations provide for the periodical clearing from the registers of dead names, and the first purging took place during the year just closed. On the 31st March, 1929, notice was sent to every registered wireman to the effect that if he wished to have his name retained on the register, application had to be made not later than the 30th June. Two hundred names were removed from the register on the 1st July, 1929, and up to the end of June, 1930, ninety-five requests had been received for reinstatement of the names of wiremen who had failed to make application within the prescribed period. The majority of these requests came from wiremen who had failed to notify the Board of changes of address as required by the regulations, consequently the notices sent out to them had been returned as dead letters. There still remain 105 names removed from the register, and, while a number of these represent wiremen who have left the country or who have died, there are undoubtedly a number of wiremen who are working without being registered, as is evidenced by the fact that applications for reinstatement are still being received. The wiremen whose names were removed from the register retained their registration certificates, but these are no proof of their registration, and every endeavour should be made to see that the names of these wiremen are reinstated.

A copy of the registers giving the names entered therein at the 31st day of March is published every year in the *New Zealand Gazette*, and a copy, available to the public, is kept in the office of every electrical-supply authority.

Provision is made in the Act to cover the case of any wireman who has not previously had an opportunity to apply for registration, so that he can be granted permission to work pending his application being considered by the Board. This provision was made to prevent hardship in the case of wiremen arriving from overseas, and has proved of considerable value.

For the year ended the 30th June, 1930, there have been sixty-two reports of defective work, and these have been dealt with as follows: Two names have been removed from the register, the certificates of nine wiremen were endorsed for bad worksmanship, fifteen wiremen were censured, eleven wiremen were cautioned, and in one case the work was carried out by a wireman other than the one first reported. Fifteen reports are still under consideration. Eight Inspectors were reported to the Board for unsatisfactory inspections, and of these seven have been cautioned.

The number of reports received up to the 31st March in each year is set out in the accompanying curves. A total of 167 reports have been received up to the 30th June, 1930.

For the year ended the 30th June, 1930, there have been seventy-three reports of breaches of the Act. Thirty-six prosecutions were taken and others are pending. Of the above prosecutions, three cases were against electrical contractors for failure to give notice to supply authorities of intention to commence work, four for connecting work before inspection and test, two for failure to return registration certificates for endorsement, four for employing unregistered men, two against radio-dealers for installing all-electric radio sets, one against a builder for doing wiring work, one against a carpenter for making extension to the wiring during alterations to a building, one against a plumber for interfering with wiring when removing a petrol pump, one against a garage-proprietor for doing temporary wiring, and one for failure to supply the name of the person who carried out the work.

Fines and costs amounting to £73 were imposed in these cases. The number of reports received up to the 31st March in each year is set out in the accompanying curves. A total of 254 reports have been received up to the 30th June, 1930.

The large number of reports of defective work and breaches of the Act shows that the electrical-supply authorities are actively co-operating with the Board in an endeavour to protect the consumers from defective work and work by unskilled persons.

To the end of June, 1930, there have been registered 360 Inspectors of Electrical Wiring, 2,880 electrical wiremen with full registration, and 88 electrical wiremen with limited registration, an increase of 43 Inspectors, 101 electrical wiremen with full registration, and 28 electrical wiremen with limited registration since the 30th June, 1929. In addition to the above registrations, 671 provisional licenses have been issued, and of these 53 were issued during the year ended 30th June, 1930. Of the 2,880 electrical wiremen with full registration, 602 have been registered after passing the Board's examination, compared with 528 at the 30th June, 1929.

Of the wiremen with limited registration, 3 are registered for work in mines, 4 for work with supply authorities, 7 for work in power stations, 23 for meter-work, 26 for servicing, 1 for freezing-works, and 18 for maintenance. In connection with registration for maintenance, the Act provides that such work must be carried out only in cases of emergency due to breakdown or other accident, and that the work is to be inspected and tested by a registered or licensed electrical wireman within twenty-four hours.

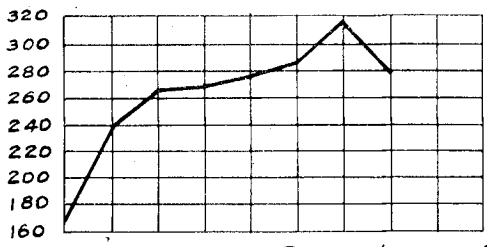
The Act has fully justified its existence and proved more successful than its sponsors expected. While it is not possible to assess the gain to the community, it is undoubtedly far in excess of the low cost of administration, which is little more than the value of property destroyed in an average fire, added to which is the immunity from danger of shock, thus making electricity the safest form of energy in use.

Registration of Electrical Wiremen.

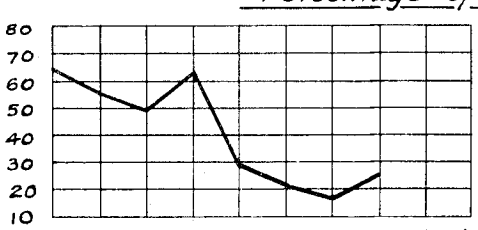
Examination Results.

Written Section.

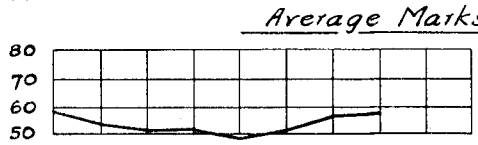
Number of Candidates Examined.



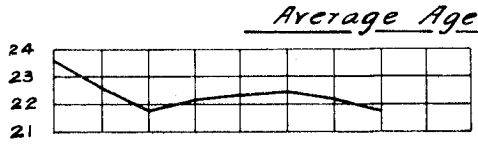
Percentage of Candidates Passed.



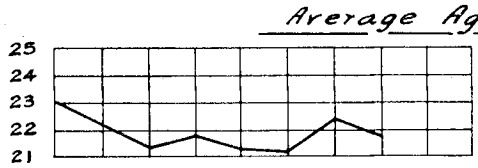
Average Marks of Candidates Passed



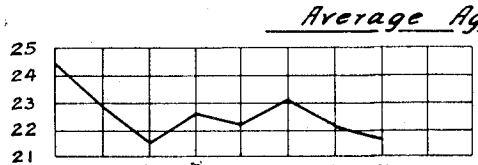
Average Age of Candidates Examined



Average Age of Candidates Passed



Average Age of Candidates Failed.

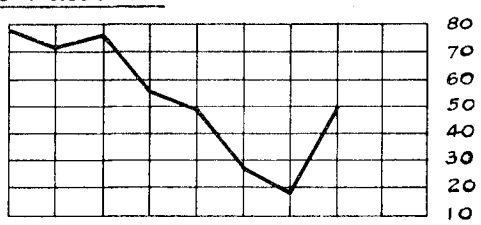


Practical Section.

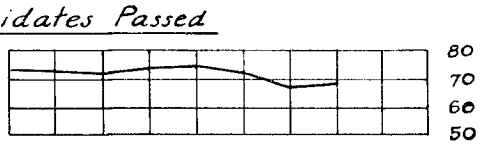
Number of Candidates Examined.



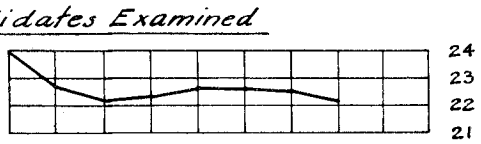
Percentage of Candidates Passed.



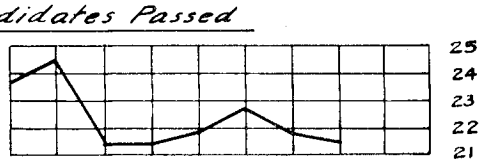
Average Marks of Candidates Passed



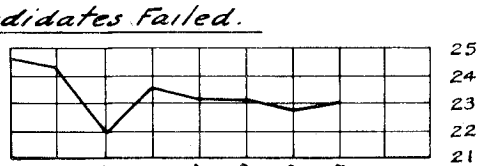
Average Age of Candidates Examined



Average Age of Candidates Passed

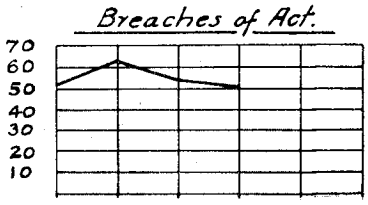


Average Age of Candidates Failed.

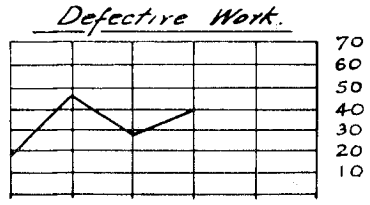


Reports of Breaches of Act and Defective Work.

Breaches of Act.



Defective Work.



Electrical Wiremen's Examination Results.

—	October, 1927.			March, 1928.			September, 1928.			March, 1929.			September, 1929.			March, 1930.		
	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.
Written Part.																		
Auckland	55	28	51	53	37	70	65	22	34	62	18	29	69	12	17	59	16	27
Christchurch	29	17	59	31	20	65	31	10	32	23	2	9	42	12	29	25	7	28
Dunedin	26	10	38	24	14	58	23	5	22	22	4	18	25	4	16	22	6	27
Gisborne	11	5	45	10	7	70	5	1	20	7	4	57	4	Nil	..	5	2	40
Greymouth	6	2	33	3	Nil	..	9	Nil	..	10	2	20	5	Nil	..	10	1	10
Hamilton	20	11	55	14	8	57	16	6	37	17	2	12	13	2	15	16	3	19
Havelock South ..	..	..	..	1	1	100	..	..	..	..	..	..	..	..	..	..	..	..
Hawera	2	Nil	..	5	2	40	..	..	..	5	Nil	..	7	Nil	..	4	3	75
Invercargill	8	3	37	10	7	70	4	2	50	8	2	25	9	Nil	..	9	5	56
Masterton	7	3	43	9	3	33	8	2	25	8	2	25	6	Nil	..	2	2	100
Napier	15	6	40	14	11	79	7	1	14	10	3	30	12	Nil	..	8	1	13
Nelson	6	1	17	4	2	50	3	Nil	..	4	1	25	4	1	25	1	Nil	..
New Plymouth ..	11	7	64	7	3	43	8	1	12	9	3	33	8	2	25	11	3	27
Oamaru	..	..	..	..	..	..	..	..	..	..	..	..	3	1	33	..	..	..
Paeroa	..	..	..	..	..	..	..	..	..	..	..	..	4	Nil	..	7	Nil	..
Palmerston North ..	15	9	60	16	10	63	11	1	9	13	2	15	17	Nil	..	17	6	35
Stratford	..	..	..	1	Nil	..	..	..	..	..	..	..	..	..	..	..	..	..
Tauranga	..	..	..	..	..	..	2	1	50	4	1	25	8	1	13	8	2	25
Timaru	4	1	25	7	6	86	4	2	50	2	Nil	..	1	Nil	..	3	Nil	..
Wanganui	9	1	11	12	2	17	13	1	7	12	1	8	9	Nil	..	9	2	22
Wellington	38	26	68	44	34	77	63	22	35	59	7	12	72	15	21	61	13	21
Westport	2	Nil	..	2	1	50	4	Nil	..	4	2	50	..	..	..	2	Nil	..
Whangarei	1	1	100	1	1	100	..	..	..	4	3	75	..	..	..	..	..	..
Total	265	131	49	268	169	63	276	77	28	283	59	21	318	50	16	279	72	26
Highest marks obtained..		80			89			79			84			87			83	
Practical Part.																		
Auckland	44	39	89	35	23	66	68	29	43	58	20	34	62	7	11	66	36	55
Christchurch	22	17	77	27	9	33	30	11	37	25	3	12	39	2	5	37	13	35
Dunedin	25	17	68	19	6	32	24	15	62	14	5	36	19	Nil	..	18	10	56
Gisborne	5	4	80	6	1	17	6	3	50	5	Nil	..	4	1	25	4	2	50
Greymouth	5	5	100	2	Nil	..	5	1	20	7	Nil	..	5	Nil	..	7	2	29
Hamilton	20	5	25	13	6	46	19	8	42	17	1	6	19	Nil	..	22	10	46
Havelock South ..	..	..	..	1	1	100	..	..	..	..	..	..	..	..	..	..	..	..
Hawera	5	5	100	3	2	67	..	..	..	2	Nil	..	4	Nil	..	3	3	100
Invercargill	8	7	87	6	3	50	4	4	100	6	3	50	8	Nil	..	7	1	14
Masterton	6	5	83	5	Nil	..	6	3	50	4	Nil	..	7	Nil	..	4	3	75
Napier	12	9	75	11	10	91	6	3	50	9	4	44	9	Nil	..	8	5	63
Nelson	4	4	100	..	..	..	2	Nil	..	2	1	50	2	Nil	..	1	1	100
New Plymouth ..	9	7	78	6	6	100	6	1	17	3	1	33	6	1	17	9	4	44
Oamaru	..	..	..	..	..	..	..	..	..	..	..	..	4	Nil	..	3	2	67
Paeroa	..	..	..	..	..	..	..	..	..	..	..	..	5	Nil	..	7	3	43
Palmerston North ..	12	11	92	10	5	50	11	7	66	7	2	28	13	Nil	..	13	9	69
Tauranga	..	..	..	..	..	..	2	1	50	4	Nil	..	12	2	17	9	4	44
Timaru	4	3	75	6	5	83	3	2	67	4	Nil	..	1	1	100	1	1	100
Wanganui	7	6	86	6	6	100	6	4	67	3	2	66	5	Nil	..	3	2	67
Wellington	37	28	76	39	26	67	68	36	53	51	20	39	54	25	46	31	12	39
Westport	2	2	100	2	1	50	4	3	75	2	Nil	..	..	..	..	2	2	100
Whangarei	1	1	100	1	1	100	..	..	..	5	Nil	..	4	Nil	..	5	2	40
Total	228	175	77	198	111	56	270	131	49	228	62	27	282	39	14	260	127	49
Highest marks obtained..		91			96			93			86			85			84	

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Chief Electrical Engineer.

TABLE I.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATION.

Results of Operation.	Twelfth Year, 1927.	Thirteenth Year, 1928.	Fourteenth Year, 1929.	Fifteenth Year, 1930.
	£	£	£	£
Capital outlay	1,538,569	1,561,081	1,581,262	1,622,199
Costs—				
Working-costs	30,728	40,054	30,130	36,808
Interest	65,094	75,630	76,612	76,354
Depreciation, 2 per cent.	28,168	29,863	29,847	15,315
Total costs	123,990	145,547	136,589	128,477
Accumulated Depreciation Fund	142,594	173,231	192,359	188,294
Accumulated surplus	..	..	..	44,388
Sinking Fund Account	35,443	62,465	115,770	144,557
Revenue—				
City Council	64,322*	68,000*	70,344*	70,169
Tramways	16,094	16,863	16,215	16,435
Wholesale consumers	67,378	83,722	97,817	107,677
Retail consumers	269	164	145	50
Miscellaneous	2,177	2,378	2,442	2,317
Total revenue	150,240	171,127	186,963	196,648
Maximum load (kilowatts)—				
Power-house	16,880	21,020	24,370	27,540
Substations—				
Addington	12,872	16,088	17,610	20,792
Timaru	1,133	1,616	2,247	2,395
Ashburton	1,040	1,306	1,402	1,370
Oamaru	269	581	869	1,061
Hororata	177	239	264	275
Point	21	19	21	37
Total substations (66 kv.)	15,512	19,313	21,772	25,574
City Council	7,978	10,102*	11,624*	12,944
Tramways	2,860	2,720	2,810	2,860
Average load (kilowatts)				
Power-house	9,000	10,710	12,370	14,210
Substations (66 kv.)	8,200	9,780	11,120	13,120
City Council	3,760	4,480*	5,140*	6,060*
Tramways	980	1,020	986	1,000
Units output—				
Power-house	78,342,797	93,853,759	108,011,955	124,375,245
Fed to village, tunnel, and intake	741,462	757,678	1,422,898	1,514,776
Fed to transmission-lines	76,941,870	93,096,081	106,589,057	122,860,469
Substations (66 kv.)	71,791,696	85,969,069	97,765,686	114,971,933
Units distributed—				
City Council (sold)	32,935,247	39,390,350*	45,058,656*	54,124,965
Tramways (sold)	8,583,270	8,993,650	8,648,400	8,764,860
Wholesale consumers and local bodies (sold)	27,829,050	34,912,744	42,195,004	49,706,308
Retail consumers (sold)	23,699	20,844	24,147	4,817
Substations and power-house local consumption unsold	1,516,395	1,453,130	2,118,757	2,569,583
Total units distributed	70,887,661	84,770,718	98,044,964	115,170,533
Losses—				
Transmission-line losses	5,150,174	7,127,012	8,823,371	7,888,536
Percentage	6·7	7·65	8·28	6·42
Distribution losses	1,645,497	1,956,029	1,143,620	1,316,176
Percentage	2·2	2·3	1·15	1·14
Average load-factor (per cent.)—				
Power-house	53·4	51·0	50·7	51·6
Substations (66 kv.)	52·9	50·6	51·2	51·4
City	47·2	44·4*	44·3*	46·7*
Working-costs—				
Per kilowatt (power-house maximum)	£1·820	£1·905	£1·236	£1·338
Per kilowatt (substations maximum)	£1·981	£2·074	£1·383	£1·441
Per unit generated	0·094d.	0·102d.	0·067d.	0·07d.
Per unit distributed	0·104d.	0·113d.	0·074d.	0·077d.
Capital charges (interest plus depreciation)—				
Per kilowatt (power-house maximum)	£5·525	£5·019	£4·368	£3·326
Per kilowatt (substation maximum)	£6·012	£5·462	£4·889	£3·582
Per unit generated	0·286d.	0·027d.	0·236d.	0·18d.
Per unit distributed	0·323d.	0·299d.	0·261d.	0·19d.
Total cost—				
Per kilowatt (power-house maximum)	£7·345	£6·924	£5·605	£4·664
Per kilowatt (substation maximum)	£7·993	£7·536	£6·273	£5·023
Per unit generated	0·379d.	0·372d.	0·303d.	0·25d.
Per unit distributed	0·419d.	0·412d.	0·334d.	0·267d.
Revenue—				
Per kilowatt (power-house maximum)	£8·900	£8·141	£7·672	£7·262
Per kilowatt (substation maximum)	£9·685	£8·860	£8·587	£7·821
Per unit generated	0·460d.	0·437d.	0·416d.	0·39d.
Per unit distributed	0·509d.	0·484d.	0·457d.	0·42d.
Per unit sold (city)	0·469d.	0·414d.	0·375d.	0·33d.
Per unit sold (trams)	0·450d.	0·450d.	0·449d.	0·45d.
Per unit sold (wholesale consumers)	0·581d.	0·575d.	0·556d.	0·52d.
Per unit sold (retail consumers)	2·724d.	1·889d.	1·441d.	2·49d.

* Excludes Woolston Borough Council.

TABLE II.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

Item.	Total Expenditure to 31st March, 1930.	Total Expenditure to 31st March, 1929.	Difference in Expenditure during Year 1929–30.
	£	£	£
Land, roading, and fencing	24,437	24,320	117
Harper diversion	23,158	23,133	25
Headworks No. 1	235,745	235,702	43
Headworks No. 2	230,479	223,263	7,216
Power-house machinery	221,608	208,210	13,398
Staff village	24,692	24,611	81
Transmission-lines	394,884	381,188	13,696
Addington Substation	83,959	84,619	*Cr.* 660
Primary distribution	47,997	49,977	*Cr.* 1,980
Secondary distribution	103,561	106,792	*Cr.* 3,231
Service transformers and meters	7,084	6,869	215
Vehicles and loose tools	28,490	27,849	641
Telephone-lines	1,891	1,903	*Cr.* 12
Office furniture	316	261	55
Surveys, preliminary expenses, &c.	128,658	119,804	8,854
Interest during construction	65,240	62,761	2,479
Total	1,622,199	1,581,262	40,937

TABLE III.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

Item.	1929.		1930.	
	Cost.	Cost per Unit Distributed.	Cost.	Cost per Unit Distributed.
	£	d.	£	d.
Harper diversion	1,201	0·003	837	0·0021
Generating	10,170	0·025	8,995	0·0186
Transmission-line	3,375	0·008	6,972	0·0146
Main distribution	3,255	0·008	3,183	0·0066
H.T. distribution	1,500	0·004	3,480	0·0073
L.T. distribution	4,564	0·011	4,680	0·0098
Standby	..	..	..	..
Management	6,066	0·015	8,661	0·0180
	30,131	0·074	36,808	0·077

Units distributed—1929, 98,044,964; 1930, 115, 170, 533.

TABLE IV.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—TOTAL CONNECTED LOAD, AND MAXIMUM DEMANDS FOR YEAR ENDED 31ST MARCH, 1930.

Consumer.	Connected Load.			Total Connected Load.	Maximum Kilowatts.	Maximum Kilovolt-amperes.
	Light.	Heat.	Power.			
Distributing authorities (15)—	Kw.	Kw.	Kw.	Kw.		
Ashburton Power Board	1,563·60	8,231·59	1,896·09	11,691·28	1,360·00	1,385·60
Banks Peninsula Board	400·15	2,601·86	337·03	3,339·04	345·00	..
Christchurch City Council	..	..	..	95,205·00*	12,760·00	..
Halswell County Council	78·33	258·14	55·66	392·13	..	144·28
Heathcote County Council	524·74	3,321·41	184·88	4,031·03	549·11	..
Lyttelton Borough Council	364·31	927·58	670·87	1,962·76	208·00	..
Malvern Power Board	318·14	1,737·59	236·53	2,292·26	244·80	265·86
North Canterbury Power Board	995·85	3,837·14	1,564·22	6,397·21	880·00	1,072·00
Riccarton Borough Council	651·60	3,123·56	486·14	4,261·30	460·80	460·80
South Canterbury Power Board	3,628·85	11,513·06	3,145·00	18,286·91	..	2,616·60
Springs-Ellesmere Power Board	916·75	3,545·91	2,001·13	6,463·79	1,120·00	..
Sumner Borough Council	339·05	1,099·05	193·62	1,631·72	..	271·20
Tai Tapu Dairy Co., Ltd.	113·63	342·16	77·20	532·99	222·86	..
Waimairi County Council (Hillmorten)	98·06	183·00	25·80	306·86	..	..
Waitaki Power Board	1,616·58	5,555·05	1,569·39	8,741·02	1,066·00	1,233·60
	11,609·64	46,277·10	12,443·56	165,535·30	..	..
Direct consumers (48)	879·46	1,842·02	12,455·59	15,177·07	..	..
Total	12,489·10	48,119·12	24,899·15	180,712·37	..	..
Substations (7)—						
Addington (condenser and local)	19·00	68·00	52·22	139·22†	..	
Point	1·08	9·50	2·24	12·82	..	..
Hororata	1·80	16·60	0·37	18·77	..	..
Ashburton	1·02	11·32	..	12·34	..	..
Timaru (condenser and local)	2·50	17·00	1·86	21·36†	..	..
Oamaru	1·50	10·00	1·49	12·99	..	..
Woolston (constr. and local)	0·30	2·00	..	2·30	..	..
Power-house	..	..	..	378·00	..	..
Grand total	12,516·30	48,253·54	24,957·33	181,310·17	..	..

* Includes Woolston Borough Council and part Waimairi Council. † Excludes synchronous condenser.

Cost per unit distributed, 0·267d.

Connected loads: 1927, 112,424; 1928, 136,364; 1929, 157,401; 1930, 181,310.

TABLE V.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY: GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR YEAR ENDED 31ST MARCH, 1930.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue.						Expenditure.							Balance.	
			From Sale of Electrical Energy.		Rates.	Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Working-costs and Management.	Interest.	Depreciation.	Sinking Fund, Reserve Fund, &c.	Other Expenditure.	Total.	Profit.	Loss.
			Retail.	Bulk (for Resale).													
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department ..	94	1,622,199	43,736	150,595	..	295	2,022	196,648	..	36,808	76,354	15,315	68.171	..	196,648	..	..
Ashburton Power Board ..	3,444	340,423	40,524	..	..	..	488	41,012	10,960	9,790	18,695	2,876	3,262	123	45,706	..	4,694
Banks Peninsula Power Board ..	955	100,285	12,663	..	3,933	189	282	17,067	2,860	5,282	6,297	..	1,076	975	16,490	577	..
Christchurch City Council ..	25,601	707,704	218,402*	7,772	..	1,318	9,633	237,125	73,541	54,883	23,026	31,813	11,076	..	194,339	42,786	..
Halswell County Council ..	243	6,923	1,879	..	..	8	13	1,900	807	475	263	..	50	..	1,595	305	..
Heathcote County Council ..	1,197	33,354	9,469	..	..	222	..	9,691	4,524	2,314	1,065	..	1,131	..	9,034	657	..
Lyttelton Borough Council ..	664	6,930	5,375	..	..	173	..	5,548	1,906	2,860	273	..	100	225	5,364	184	..
Malvern Power Board	644	61,818	6,501	..	..	286	451	7,238	2,469	1,438	3,391	..	630	340	8,268	..	1,030
North Canterbury Electric-power Board	2,265	124,745	18,706*	91	..	366	353	19,516	7,584	2,936	4,086	1,818	1,321	46	17,791	1,725	..
Riccarton Borough Council ..	1,290	20,160	10,074	..	..	361	9	10,444	3,890	2,690	583	444	554	..	8,161	2,283	..
South Canterbury Power Board ..	6,536	312,615	50,697	..	..	..	346	51,043	19,633	8,292	17,290	3,217	3,089	235	51,756	..	713
Springs-Ellesmere Power Board ..	2,004	132,346	25,257	..	..	458	101	25,816	8,744	3,598	6,749	1,838	1,121	2,670	24,720	1,096	..
Sumner Borough Council.. ..	951	15,577	6,156	..	..	..	36	6,192	2,390	1,772	430	382	81	..	5,055	1,137	..
Tai Tapu Dairy Company ..	241	10,329	3,887	..	..	78	..	3,965	1,769	1,344	411	365	..	..	3,889	76	..
Waimairi County Council ..	3,030	78,446	22,278	..	93	..	..	22,371	8,073	4,879	2,389	..	966	..	16,307	6,064	..
Waitaki Electric-power Board ..	3,066	167,981	35,717	..	..	331	875	36,923	9,217	7,424	9,550	2,100	2,190	641	31,122	5,801	..
Totals	52,225	3,741,835	511,321	158,458	4,026	4,085	14,609	692,499	158,367	146,785	170,852	60,168	94,818	5,255	636,245	62,691	6,437

* After deducting sales to other distributing bodies.

	£
Gross profit	56,254
Raised by rates	4,026
Net profit	£52,228

TABLE VI.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—MILKING-MACHINES CONNECTED AT 31ST MARCH, 1930.

Electric-power Board.	½ Horse-power.		1 Horse-power.		1½ Horse-power.		2 Horse-power.		3 Horse-power.		Total Number.	Total Horse-power.
	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.		
Ashburton Power Board	1	½	5	5	17	25½	21	42	..	..	44	73
Banks Peninsula Power Board* ..	5	2½	52	52	5	7½	70	140	3	9	177*	222*
Christchurch City Council	1	½	..	..	..	..	..	..	..	..	1	½
Halswell County Council	2	1	..	..	..	..	5	10	9	27	16	38
Heathcote County Council	..	..	..	..	..	..	2	4	1	3	3	7
Kaiapoi Borough Council	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton Borough Council ..	..	..	..	..	..	..	..	..	1	3	1	3
Malvern Power Board	..	..	..	..	..	..	5	10	..	..	5	10
North Canterbury Power Board ..	..	..	6	6	5	7½	25	50	19	57	55	120½
Rangiora Borough Council ..	..	..	..	..	..	..	..	..	..	..	..	..
Riccarton Borough Council ..	..	..	..	..	..	..	..	..	..	..	..	..
South Canterbury Power Board ..	5	2½	13	13	36	54	43	86	6	18	103	173½
Sumner Borough Council	..	..	..	..	..	..	..	..	1	3	1	3
Tai Tapu Dairy Co.	..	..	1	1	..	..	26	52	13	39	40	92
Timaru Borough	..	..	..	..	..	..	..	..	..	..	..	..
Waitaki Power Board	2	1	1	1	5	7½	13	26	..	..	21	35½
Waimairi County Council	..	..	1	1	3	4½	5	10	5	15	14	30½
Totals	16	8	79	79	71	106½	215	430	58	174	481	808½

* Includes 41 ¼ h.p., 1 ¾ h.p.; total, 11 h.p. Grand total, 222 h.p., 177 machines.

TABLE VII.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—ROUTE-MILES OF POWER BOARDS' LINES AT 31ST MARCH, 1930.

Number of Circuits	11,000 Volts.				6,600 Volts.		3,300 Volts.		400 Volts.		Total Route-miles.
	1	2	3	4	1	2	1	2	1	2	
Ashburton Power Board	54·5	19	0·7	0·62	689	2·1	..	..	86·08	..	852 (*a*)
Banks Peninsula Power Board ..	..	..	..	..	23	3·0	92	..	62	..	180 (*b*)
Christchurch City	8·07	..	..	..	..	..	5·07	..	238·58	..	286·2 (*c*)
Halswell County Council	..	..	..	..	..	..	7	..	15	..	22 (*d*)
Heathcote County Council ..	6·625	..	..	..	..	..	2·625	..	21·25	..	30·5 (*e*)
Kaiapoi Borough	..	..	..	..	..	..	0·875	..	14	..	14·875(*f*)
Lyttelton Harbour Board ..	..	..	..	..	..	..	..	..	2·7	..	2·7
Lyttelton Borough	..	..	..	..	..	..	..	..	..	9·2	9·2
Malvern Power Board	..	..	..	..	167	..	..	..	11	..	178 (*g*)
North Canterbury Power Board ..	163·75	7·8	..	..	41·1	..	24·05	..	50·6	..	287·3 (*h*)
Rangiora Borough	..	..	..	..	..	..	1·85	..	10·5	..	12·35 (*i*)
Riccarton Borough	..	..	..	..	..	..	3	0·5	16·25	0·25	20 (*j*)
South Canterbury Power Board ..	28	83·5	..	..	513·15	3·0	..	..	71·25	0·5	699·4 (*k*)
Sumner Borough	1	..	..	..	..	..	3·25	..	5·25	..	9·5 (*l*)
Tai Tapu Dairy Co.	..	..	..	..	..	..	16	..	14	..	30 (*m*)
Timaru Borough	0·875	..	..	..	..	..	4·8	2·6	44	..	52·275(*n*)
Waitaki Power Board	104	..	..	..	172·7	..	3·2	..	82·1	..	362 (*o*)
Waimairi County Council ..	..	..	..	..	27	..	28·5	..	64	..	140·5 (*p*)
Totals	366·82	110·3	0·7	0·62	1,632·95	8·1	192·22	3·1	803·56	9·95	3,188·8

(*a*) Also 0·82 miles of 6,600 volts double circuit under 11,000-volt lines; 40·68 miles of 6,600 volts single circuit under 11,000-volt lines; 18 miles of 400 volts single circuit under 11,000-volt lines; 66·03 miles of 400 volts single circuit under 6,600-volt lines.

(*b*) Also 22 miles of 33,000-volt lines; 12 miles of 3,300 volts under 33,000 volts; 11 miles of 400 volts under 6,600 volts; 27 miles of 400 volts under 3,300 volts.

(*c*) Also 4 miles 400 volts under 11,000-volt lines; 5·07 miles 400 volts under 3,300-volt lines; includes 39·5 miles 11,000-volt underground cable.

(*d*) Also 1·5 miles 400 volts under 3,300-volt lines.

(*e*) Also 4·375 miles 400 volts under 11,000 volts and 1·5 miles 400 volts under 3,300 volts.

(*f*) Also 0·25 miles 400 volts under 3,300 volts.

(*g*) Also 30 miles 400 volts under 6,600 volts.

(*h*) Also 2·5 miles 400 volts under double circuit 11,000 volts; 43·75 miles 400 volts under single circuit 11,000 volts; 17·60 miles 400 volts under single circuit 6,600 volts; 12·15 miles 400 volts under single circuit 3,300 volts.

(*i*) Also 1·85 miles 400 volts under 3,300 volts.

(*j*) Also 1·75 miles 400 volts under 3,300 volts.

(*k*) Also 16 miles of 6,600 volts under double circuit 11,000 volts; 4 miles of 400 volts under double circuit 11,000 volts; 52 miles of 6,600 volts under single circuit 11,000 volts; 18 miles of 400 volts under single circuit 11,000 volts; 202 miles of 400 volts under single circuit 6,600 volts.

(*l*) Also 2·5 miles of 400 volts under 3,300 volts.

(*m*) Also 10 miles 400 volts under 3,300 volts.

(*n*) Also 2·6 miles of 400 volts under double circuit 3,300 volts, and 4·8 miles of 400 volts under single circuit 3,300 volts.

(*o*) Also 15·5 miles of 6,600 volts under 11,000-volt lines; 22 miles of 400 volts under 11,000-volt lines; 0·4 miles of 3,300 volts under 6,600-volt lines; 44 miles of 400 volts under 6,600-volt lines; 3 miles of 400 volts under 3,300-volt lines.

(*p*) Also 23 miles of 400 or 230 volts under 6,600 volts, and 24 miles of 400 or 230 volts under 3,300 volts. Includes 21 miles of 230-volt lines.

TABLE VIII.—LAKE COLERIDGE POWER SUPPLY.—TRANSMISSION AND DISTRIBUTION LINES.

Route-miles 31st March, 1930.

Voltage.	Line. Description.	Miles.	Total Miles.
66 kv. ..	Lake Coleridge to Christchurch—		
	North—Powerhouse–Glentunnel–Hororata–Homebush–Christchurch ..	67·5	
	Middle—Powerhouse–Hororata–Christchurch	61·5	
	South—Powerhouse–Hororata–Christchurch	61·5	
	Point to Timaru	84·4	
	Hororata to Timaru	79·0	
	Timaru to Oamaru	60·2	
			414·1
33 kv. ..	Stoddart's Corner to Motukarara	8·5	
	North Canterbury Line (under 11 kv. pressure, temporarily)	22·4	
			30·9
11 kv. ..	Northern feeder	10·4	
	Southern and western feeder	18·5	
	Lyttelton feeder and branches	14·2	
	Montreal	0·8	
	Point to Phillips's Farm	1·7	
	Point to Snowdon	4·3	
	Underground—	Chains.	
	Tramway 1 and 2, and Montreal 1 and 2	5	
	Northern 1 and 2, and Fendalton 1 and 2	8	
	Southern 1 and 2, and Steelworks 1 and 2	9	
	Lyttelton 1 and 2	9	
	Colombo Street and Lincoln Road	12	
	Montreal	146	
	Armagh 1 and 2	180	
	Local 1 and 2	40	
	Armagh 4	41	
	Powerhouse	3	
	Distribution substations (various)	29	
		— 6·0	
			55·9
6·6 kv. ..	Murchison's and intake, &c.	..	5·9
3 kv. ..	Southern feeder	0·4	
	Addington–Christchurch Railway	2·1	
	Underground (railway)	0·3	
			2·8
L.T. ..	Addington	..	1·0
			510·6

—	Erected during Current Year.	Total erected to 31st March, 1930.	Sold or dismantled during Year.	Balance at 31st March, 1930.
Route-miles of lines—	Miles.	Miles.	Miles.	Miles.
(*a*) Transmission (overhead lines) ..	..	445	..	445
(*b*) Distribution (overhead lines) ..	2·5	71·4	11·8	59·6
(*c*) Underground cables	0·4	6	..	6
Total	2·9	522·4	11·8	510·6

TABLE IX.—MANGAHAO-WAIKAREMOANA ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATIONS

	1930. (First Year.) £
Capital outlay	3,426,901
Costs—	
Working-costs*	59,235
Interest	191,288
Depreciation	62,205
Total costs	312,728
Revenue†	259,461
Loss	53,267
Depreciation Fund	62,205
Maximum load (kilowatts)—	
Combined power-houses	37,880
Khandallah	20,000
Wellington City	15,424
Hutt Valley Electric-power Board	4,180
Wellington Meat Export Co.	429
Railway Department	1,440
Horowhenua Electric-power Board	2,142
Manawatu-Oroua Electric-power Board	3,465
Dannevirke Electric-power Board	617
Tararua Electric-power Board	607
Wairarapa Electric-power Board	1,044
Wanganui-Rangitikei Electric-power Board	3,441
Central Hawke's Bay Electric-power Board	694
Hawke's Bay Electric-power Board	3,048
Wairoa Electric-power Board	804
Poverty Bay Electric-power Board	1,330
Units output—	
Generated—Power-house totals	182,148,043
Purchased—	
Wellington City Council	65,040
Hastings Borough Council	1,300
Total units generated and purchased	182,214,383
Units sold—	
Wellington City Council	50,192,540
Wellington Meat Export Co.	1,673,450
Horowhenua Electric-power Board	8,468,472
Hutt Valley Electric-power Board	20,086,060
Wairarapa Electric-power Board	3,549,797
Tararua Electric-power Board	3,090,220
Dannevirke Electric-power Board	2,987,845
Central Hawke's Bay Electric-power Board	3,487,202
Hawke's Bay Electric-power Board	15,401,308
Manawatu-Oroua Electric-power Board	20,266,997
Wanganui-Rangitikei Electric-power Board	17,026,540
Railway Department	3,136,540
Wairoa Electric-power Board	3,209,344
Poverty Bay Electric-power Board	4,981,845
Retail consumers	1,454,571
Total units sold	159,012,731
Operating consumption	3,090,320
Losses—	
Total losses (units)	20,111,332
Percentage	11·04
Load-factor (per cent.)—	
System (annual)	54·9
System (average weekly)	65·2
Working-costs (less power purchased)—	
Per kilowatt (system maximum)	£1·56
Per unit generated	0·078d.
Per unit sold	0·089d.
Capital charges—	
Per kilowatt (system annual maximum)	£6·71
Per unit generated	0·333d.
Per unit sold	0·381d.
Total costs—	
Per kilowatt (system annual maximum)	£8·27
Per unit generated	0·411d.
Per unit sold	0·470d.
Revenue—	
Per kilowatt (system maximum)	£6·78
Per unit generated	0·342d.
Per unit sold	0·390d.

* Does not include £233 for power purchased. † Gross revenue, £259,668.

TABLE X.—MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

	Expenditure to 31st March, 1930. £
Land, roading, tram-lines, and fencing	150,643
Headworks	952,034
Generating-stations and machinery	609,784
Transmission-lines	675,585
Main substations	305,226
Service buildings and workmen's accommodation	104,455
Vehicles and loose construction tools	7,310
Office furniture	599
Surveys, expenses, and salaries	241,353
Construction plant and equipment	18,505
Interest during construction	289,926
Cost and expenses of raising loans	71,481
Totals	£3,426,901

TABLE XI.—MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

	1930.	
	Cost.	Per Unit sold.
	£	d.
Generating	15,933	0·024
Transmission	20,201	0·030
Substations	7,764	0·012
Management and general	15,337	0·023
Totals	£59,235	0·089

Units sold, 159,012,731.

TABLE XII.—MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1930.

	Street-lighting.	General Lighting, Heating, and Cooking.	Power.	Total.
Public Works Department	4	1,075	579	1,658
Central Hawke's Bay Electric-power Board	21	3,161	680	3,862
Dannevirke Electric-power Board	18	4,906	1,054	5,978
Hawke's Bay Electric-power Board	139	17,079*	3,704	20,922
Horowhenua Electric-power Board	37	6,789	2,834	9,660
Hutt Valley Electric-power Board	103	25,667	6,257	32,027
Manawatu-Oroua Electric-power Board	147	23,772	5,081	29,000
Poverty Bay Electric-power Board	41	8,534	2,395	10,970
Railway Department	..	1,983	3,650	5,633
Tararua Electric-power Board	12	3,758	837	4,607
Wairarapa Electric-power Board	30	10,113	2,420	12,563
Wairoa Electric-power Board	13	3,558	651	4,222
Wanganui-Rangitikei Electric-power Board	152	19,180	5,930	25,262
Wellington City Corporation	350	70,600	29,250	100,200
Wellington Meat Export Co., Ltd.	..	97	937	1,034
Totals	1,067	200,272	66,259	267,598

* Includes some power.

TABLE XIII.—MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.—GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR THE YEAR ENDING 31ST MARCH, 1930.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue.						Expenditure.							Balance.	
			From Sale of Electrical Energy.		Rates.	Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Working-costs and Management.	Interest.	Depreciation.	Sinking Fund, Reserve Fund, &c.	Other Expenditure.	Total.	Profit.	Loss.
			Retail.	Bulk (for Resale).													
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department ..	97	3,426,901	16,846*	239,497	..	..	3,351	259,694	233	59,235	191,288	62,205	..	..	312,961	..	53,267
Central Hawke's Bay Electric-power Board	1,472	133,787	20,666	..	..	..	897	21,563	6,299	1,984	8,017	2,283	501	1,229	20,313	1,250	..
Dannevirke Electric-power Board	2,186	199,880	26,400	..	..	137	543	27,080	5,550	5,444	11,018	1,988	2,340	116	26,456	624	..
Hawke's Bay Electric-power Board	2,181	221,611	25,792*	19,125	..	1,088	1,515	47,520	25,074	5,554	11,701	2,531	2,000	265	47,125	395	..
Hutt Valley Electric-power Board	9,521	370,922	97,088	..	..	..	1,515	98,603	33,829	20,671	21,835	7,083	8,473	4,702	96,593	2,010	..
Horowhenua Electric-power Board	3,301	195,472	44,278	..	..	140	1,436	45,854	18,352	6,477	11,078	2,523	1,940	2,179	42,549	3,305	..
Hastings Borough Council ..	3,263	111,316	25,062	..	..	..	52	25,114	7,275	6,541	3,866	991	1,519	380	20,572	4,542	..
Manawatu-Oroua Electric-power Board	4,368	495,347	59,750*	11,753	..	655	512	72,670	27,580	9,555	25,228	5,268	4,417	274	72,322	348	..
Mangaweka Town Board ..	94	4,784	913	..	..	301	49	1,263	300	459	108	..	21	13	901	362	..
Napier Borough Council ..	3,980	159,940	37,715	..	..	..	583	38,298	11,850	10,964	7,775	3,285	899	226	34,999	3,299	..
Palmerston North City Council	5,065	210,857	54,765	..	..	..	1,304	56,069	11,753	7,825	10,900	4,700	1,850	906	37,934	18,135	..
Poverty Bay Electric-power Board	4,266	299,301	47,629	..	..	..	1,391	49,020	10,000	13,386	16,279	3,756	3,219	305	46,945	2,075	..
Tararua Electric-power Board	1,458	157,810	20,970	..	..	147	938	22,055	5,400	4,343	7,987	2,610	1,470	171	21,981	74	..
Wairarapa Electric-power Board	3,904	349,901	47,234	..	..	1,125	1,066	49,425	6,203	10,925	20,264	2,291	3,978	2,759	46,420	3,005	..
Wairoa Borough Council ..	647	19,743	7,547	..	..	42	279	7,868	3,731	1,263	1,132	372	284	87	6,369	999	..
Wairoa Electric-power Board	490	55,595	8,399*	3,731	2,993	89	136	15,348	6,573	2,842	3,589	846	430	131	14,411	937	..
Wanganui-Rangitikei Electric-power Board	8,882	528,291	92,929*	399	..	..	3,830	97,158	27,384	19,941	29,716	14,607	5,556	845	98,049	..	891
Wellington City Corporation ..	26,700	1,078,199	355,880*	163	..	..	3,006	359,049	70,160	73,870	29,832	..	46,430	18,842	239,134	119,915	..
Totals	81,875	8,019,319	989,863	274,668	2,993	3,724	22,403	1,293,651	277,546	261,279	411,613	117,339	85,327	33,430	1,186,534	161,275	54,158

* After deducting sales to other distributing bodies.

Gross profit, £107,117; rates collected, £2,993; net profit, £104,124.

TABLE XIV.—MANGAHAO - WAIKAREMOANA ELECTRIC - POWER SUPPLY. — MILKING - MACHINES CONNECTED AT 31ST MARCH, 1930.

Power Board.	¼ Horse-power.		½ Horse-power.		¾ Horse-power.		1 Horse-power.		1½ Horse-power.		2 Horse-power.		2½ Horse-power.		3 Horse-power.		Totals.	
	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.
Central Hawke's Bay ..	..	..	..	..	..	..	..	..	2	3	66	132	..	..	..	..	68	135
Dannevirke (*a*) ..	..	..	9	4·5	..	..	26	26	115	172·5	91	182	..	..	..	..	241	385
Hawke's Bay (*b*) ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	102	173
Horowhenua ..	97	24·25	40	20	3	2·25	41	41	105	157·5	250	500	..	..	..	..	536	745
Hutt Valley ..	..	..	..	..	..	..	7	7	15	22·5	36	72	1	2·5	2	6	61	110
Manawatu-Oroua ..	4	1	12	6	..	..	61	61	18	27	733	1,466	..	..	7	21	835	1,582
Tararua	..	..	5	2·5	..	..	83	83	55	82·5	121	242	1	2·5	1	3	266	415·5
Wairarapa ..	..	..	6	3	1	0·75	24	24	3	4·5	289	578	..	..	8	24	331	634·25
Wairoa	..	..	2	1	..	..	2	2	..	..	40	80	..	..	7	21	51	104
Wanganui-Rangitikei ..	..	..	20	10	..	..	60	60	192	288	122	224	..	..	..	..	384	582
Poverty Bay	..	..	5	2·5	..	..	25	25	13	19·5	17	34	..	..	1	3	61	84
Totals	101	25·25	99	49·5	4	3·00	329	329	518	777·0	1,755	3,510	2	5	26	78	2,936	4,949·75

(*a*) 45 motors disconnected—not included in above. (*b*) Particulars not available.

TABLE XV. — MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY. — ROUTE-MILEAGE, POWER BOARD LINES, AT 31ST MARCH, 1930.

——	11,000 Volts.				6,600 Volts.		3,000 Volts.		400 Volts.	Total Route-miles.
Number of Circuits ..	4.	3	2	1	2	1	2	1	1	
Central Hawke's Bay ..	..	..	1·5	109	..	25·75	..	1	38·5	175·75 (*a*)
Dannevirke ..	..	..	4·5	22·8	0·5	196·3	..	..	76·26	300·36 (*b*)
Hawke's Bay ..	..	..	15	81·5	..	..	..	6	64	166·5 (*c*)
Horowhenua ..	..	0·625	2·875	151·6	..	..	..	..	134·14	289·24 (*d*)
Hutt Valley ..	..	..	17·5	1	21	65	..	..	174	278·5 (*e*)
Manawatu-Oroua ..	1·5	..	28·5	243	..	..	..	157	140	570 (*f*)
Poverty Bay ..	..	..	..	51·5	..	154·3	..	..	108·1	313·9
Tararua	..	..	12·25	40	..	..	..	104	43	199·25 (*g*)
Wairarapa	..	1·25	27·25	219	..	..	..	9	69·25	325·75 (*h*)
Wairoa	..	..	..	60	..	..	..	19	10	89 (*i*)
Wanganui-Rangitikei	..	..	25	154	..	190	..	4	260	633 (*j*)
Totals ..	1·5	1·875	134·375	1,133·4	21·5	631·35	..	300	1,117·25	3,341·25

(*a*) Also 27 miles of 400-volt lines on same poles as 11,000 volts, 4·25 miles of 400-volt lines on same poles as 6,600 volts, and 2·25 miles of 400-volt lines on same poles as 3,000 volts.
(*b*) Also 0·63 miles of 11,000-volt underground cable, and 19·33 miles of 6,600-volt lines on 11,000-volt poles; 12·8 miles of 400-volt lines on 11,000-volt poles, and 80·01 miles of 400-volt lines on 6,600-volt poles.
(*c*) Also 82 miles of 3,300-volt lines on 11,000-volt poles.
(*d*) Also 92·6 miles of 400/230-volt lines on 11,000-volt poles.
(*e*) Also 11 miles of 6,600-volt lines on 11,000-volt poles, and 59·5 miles of 400-volt lines on 6,600-volt poles.
(*f*) Also 310 miles of line with more than one voltage on same poles.
(*g*) Also 33 miles of 3,000-volt lines on 11,000-volt poles, and 93·4 miles of 400-volt lines on 11,000-volt and 3,000-volt poles.
(*h*) Also 2 miles of 11,000-volt underground cable, 157·5 miles of 400-volt lines on same poles as higher-voltage lines, and 53·25 miles of series on same poles as 400 volts.
(*i*) Also 15 miles of 400 volt and 9 miles 230 volt on same poles as higher voltages.
(*j*) Also 20 miles of 6,000-volt lines and 2 miles of 3,000-volt lines on 11,000-volt poles, and 171 miles of 400-volt lines on same poles as higher-voltage lines.

TABLE XVI.—MANGAHAO–WAIKAREMOANA ELECTRIC-POWER SUPPLY.—ROUTE-MILEAGE OF DEPARTMENT'S LINES IN OPERATION AT 31ST MARCH, 1930.

——	Size of Wire (S.W.G.).	Miles.
110,000-volt Lines (Double Circuit)—		
Mangaore–Khandallah	19/·092 Cu	61·10
Mangaore–Bunnythorpe	7/·167 A.C.S.R.	25·44
Tuai–Taradale	37/·072 Cu	59·76
110,000-volt Lines (Single Circuit)—		
Bunnythorpe–Wanganui	7/·167 A.C.S.R.	39·34
Bunnythorpe–Woodville	7/·167 A.C.S.R.	12·44
Woodville–Masterton	7/·167 A.C.S.R.	51·50
Woodville–Taradale	7/·167 A.C.S.R.	76·00
50,000-volt Lines (Single Circuit)—		
Midhirst–Egmont Village	7/·104 Cu	16·19
Tuai–Wairoa	19/·064 Cu	22·70
Tuai–Gisborne	7/·167 A.C.S.R.	46·47
11,000-volt Lines (Double Circuit)—		
Khandallah–Petone	19/·064 Cu	3·81
Mangaore–Shannon	19/·064 Cu	3·00
11,000-volt Lines (Single Circuit)—		
Khandallah–Wellington Meat Export Co., Ltd.	19/·064 Cu	0·63
Total route-miles in operation	..	418·38

Table XVII.—Arapuni-Horahora Electric-power Supply.

—	Seventh Year. March, 1927.	Eighth Year. March, 1928.	Ninth Year. March, 1929.	Tenth Year. March, 1930.
Capital outlay—	£	£	£	£
Horahora—Assets in operation	576,841	609,228	617,725	624,117
Arapuni—Assets in operation	268,107	363,945	524,621	2,705,894
Total assets in operation	844,948	973,173	1,142,346	3,330,011
Assets not in operation	..	..	..	330,416
Costs—				
Working-costs	28,713	46,568	76,231	62,571
Interest (capital costs)	37,989	44,190	53,044	135,622
Depreciation (capital costs)	16,481	18,646	21,527	60,258
Sinking Fund	8,448	9,732	..	..
Total costs	91,631	119,136	150,802	258,451
Revenue	108,748	125,312	135,511	225,683
Profit	17,116	6,176	*Dr.* 15,291	*Dr.* 32,768
Accumulated surplus	47,670	53,845	32,415	*Dr.* 2,618
Accumulated Depreciation Fund	63,782	84,272	103,187	165,758
Accumulated Sinking Fund	38,515	49,847	52,164	54,445
Accumulated Fire Insurance Reserve	..	..	..	132
Maximum load (kilowatts)—				
System for year	14,760	15,700	15,900	41,520
Horahora Power-station for year	12,400	12,400	10,300	10,200
Arapuni Power-station for year	..	..	..	33,900
Horahora Power-station, average weekly	11,090	11,370	9,702	7,752
Arapuni Power-station, average weekly	..	..	..	24,731
Units output—				
Horahora Power-station, total generated	79,253,160	88,703,370	79,298,740	56,648,365
Arapuni Power-station, total generated	..	..	..	121,084,986
Grand Junction, total generated	..	..	5,846,740	2,682,100
Diesel plant, total generated	..	..	7,070,912	2,608,248
Units purchased (McLaren's Falls, Auckland Power Board, and dairy factories)	7,398,942	11,372,298	12,776,370	7,706,548
Total units generated and purchased	86,652,102	100,075,668	104,992,762	190,730,247
(1) Units used for station auxiliaries, &c.	1,850,000	1,720,690	1,010,540	2,478,395
	..	424,600	337,635	
(2) Units available for outgoing lines	84,802,102	97,930,378	103,644,587	188,251,852
(3) Units sold	75,844,229	87,852,067	92,707,271	173,003,373
(4) Total losses	8,957,873	10,078,311	10,937,316	15,248,479
(5) Percentage of units not available for sale	10·55	10·29	10·58	8·1
Load-factor, annual (per cent.)—				
System	67·7	72·8	75·5	54·1
Powerhouse—				
Arapuni	..	..	..	40·8
Horahora	72·9	81·7	87·8	63·4
Load-factor, average weekly—				
Powerhouse—				
Arapuni	..	..	..	55·9
Horahora	81·6	88·2	93·2	83·5
Working-costs	(£28,713)	(£46,568)	(£76,231)	(£62,702)
Per kilowatt (system annual maximum)	£1·95	£2·96	£4·79	£1·51
Per unit generated and purchased	0·079d.	0·112d.	0·174d.	0·079d.
Per unit sold	0·091d.	0·127d.	0·197d.	0·087d.
Capital costs	(£54,470)	(£62,836)	(£74,571)*	(£195,749)*
Per kilowatt (system annual maximum)	£3·69	£4·00	£4·70	£4·71
Per unit generated and purchased	0·151d.	0·151d.	0·171d.	0·246d.
Per unit sold	0·172d.	0·172d.	0·194d.	0·261d.
Total costs on system	(£83,183)	(£109,404)	(£150,802)	(£258,451)
Per kilowatt (system annual maximum)	£5·64	£6·96	£9·49	£6·22
Per unit generated and purchased	0·230d.	0·263d.	0·345d.	0·325d.
Per unit sold	0·263d.	0·299d.	0·391d.	0·348d.
Revenue	(£108,484)	(£125,312)	(£135,511)	(£225,683)
Per kilowatt (system annual maximum)	£7·72	£7·98	£8·53	£5·42
Per kilowatt (powerhouse annual maximum)	£8·75	£10·1	£13·15	..
Per kilowatt (powerhouse average weekly maximum)	£9·79	£11·1	£13·97	..
Per unit generated and purchased	0·301d.	0·305d.	0·31d.	0·284d.
Per unit sold	0·343d.	0·342d.	0·351d.	0·313d.

* Note.—Capital costs do not include Sinking Fund.

TABLE XVIII.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

—	At 31st March, 1929.	At 31st March, 1930.	Expenditure during Year.	
			Dr.	*Cr.*
Horahora—	£	£	£	£
Land, roading, and fencing	3,208	3,208	..	..
Headworks	178,012	178,609	597	..
Generating-station, transformers, and machinery	113,612	110,928	..	2,684
Staff village	11,822	12,439	617	..
Arapuni—				
Land, roading, and fencing	..	37,002	37,002	..
Headworks	..	901,973	901,973	..
Generating-station, transformers, and machinery	..	573,049	573,049	..
Staff village	675	47,866	47,191	..
Auxiliary plants—				
Waihi Grand Junction steam plant	9,202	9,139	..	63
Diesel plant	63,657	63,330	..	327
Transmission-lines	365,269	605,417	240,148	..
Main substations	154,095	369,974	215,879	..
Distribution-lines (11,000 volts)	43,601	44,261	660	..
Distribution substations (11,000 volts)	10,913	10,913	..	..
General—				
Land, stores, and railway-siding, Ruakura	13,776	13,809	33	..
Staff residences, Ruakura	4,397	4,372	..	25
Office furniture, Hamilton	924	924	..	..
Motor-vehicles, loose tools, and equipment	8,428	15,851	7,423	..
Engineering—Office and general expenses on surveys and on construction	50,566	152,479	101,913	..
Interest during construction	66,014	353,198	287,184	..
Cost of raising loans	29,865	132,055	102,190	..
Stocks of spares at substations, &c.	14,310	19,631	5,321	..
Totals	1,142,346	3,660,427	2,518,081	..

TABLE XIX.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

—	1926–27.		1927–28.		1928–29.		1929–30.	
	Cost.	Per Unit sold.	Cost.	Per Unit sold.	Cost.	Per Unit sold.	Cost.	Per Unit sold.
	£	d.	£	d.	£	d.	£	d.
Generating	5,313	0·0168	16,446	0·0449	39,219	0·1015	27,191	0·03772
Transmission-lines	5,226	0·0165	7,757	0·0212	7,995	0·0207	11,380	0·01579
Main substations	4,434	0·014	5,466	0·0149	6,165	0·0148	8,416	0·01168
H.T. distribution	..	..	..	..	..	..	1,551	0·00215
Management and general	4,954	0·017	5,631	0·0154	6,210	0·0161	6,085	0·00867
Purchase of power	8,787	0·0278	11,268	0·0308	16,642	0·0431	7,948	0·01103
	28,714	0·0922	46,568	0·1272	76,231	0·1942	62,571	0·08704

Units sold: 1926–27, 75,844,229; 1927–28, 87,852,067; 1928–9, 92,707,271; 1929–30, 173,003,373.

TABLE XX.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1930.

—	1928.	1929.	1930.
Waihi Gold-mining Co.	4,545	4,545	4,570
Waihi Grand Junction Co.	2,528	2,528	2,528
Cambridge Co-operative Dairy Co.	411	411	307
New Zealand Co-operative Dairy Co., Frankton	828	828	828
State Farm, Ruakura	16	16	16
New Zealand Railways, Frankton	1,906	936	936
Hamilton Borough Council	6,153	6,843	7,813
Tourist Department, Rotorua	3,390	3,194	3,681
Cambridge Electric-power Board	2,211	2,461	2,694
Central Electric-power Board	6,354	7,992	9,350
Te Awamutu Electric-power Board	3,520	4,117	4,848
Thames Valley Electric-power Board	16,493	18,192	20,205
Waitomo Electric-power Board	1,428	1,790	2,334
Franklin Electric-power Board	4,085	5,808	6,917
Waitemata Electric-power Board	10,075	13,159	16,456
P.W.D., Horahora	151	151	151
P.W.D., Arapuni	110	303	557
P.W.D., Hamilton	56	56	56
P.W.D., Penrose	127	127	127
Bay of Plenty Power Board	..	3,664	5,150
Summary	64,580	77,121	89,524
Auckland Electric-power Board	..	..	171,000
Total connected load	64,580	77,121	260,524

TABLE XXI.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—ROUTE-MILES OF DEPARTMENT'S LINES IN OPERATION AT 31ST MARCH, 1930.

Line.	Supports.	Size of Wire.	Miles.
110,000-volt Double Circuit—			
Arapuni–Hamilton No. 2	Steel towers	19/13	29·21
Hamilton No. 2 – Bombay	Steel towers	19/13	46·32
Bombay–Penrose	Steel towers	19/13	24·20
110,000-volt Single Circuit—			
Arapuni–Penrose	2·68 miles steel towers; 96·56 miles wood poles	19/13	99·24
Total route-miles of 110,000-volt lines			198·97
50,000-volt Double Circuit—*			
Penrose–Henderson	17·60 miles steel towers; 1·15 miles duplicate wood-pole line	7/14	18·75
Henderson–Takapuna	2·15 miles steel towers; 7·78 miles duplicate wood-pole line	7/14	9·93
50,000-volt Single Circuit—			
Arapuni–Mamaku	Wood poles	7/14	25·13
Mamaku–Ngongotaha	Wood poles	7/14	7·36
Ngongotaha–Edgecumbe	Wood poles	7/14	38·93
Edgecumbe–Waiotahi	Wood poles	7/14	21·08
Arapuni–Horahora	Wood poles	7/12	6·71
Horahora–Matamata	Steel towers	No. 0	14·74
Matamata–Waihou	9·32 miles steel towers	No. 0	20·52
	11·20 miles wood poles	7/12	
Waihou–Waiorongomai–Waikine	5·11 miles wood poles	7/12	16·20
	5·11 miles steel towers	7/12	
	5·98 miles steel towers	No. 0	
Waihou–Paeroa	Wood poles	19/16	12·28
Bombay–Kerepeehi	Wood poles	19/16	35·23
Kerepeehi–Paeroa	Wood poles	19/16	10·12
Paeroa–Waikino	Wood poles	19/16	5·37
Waikino–Aongatete (Department's part of McLaren's Falls line)	Wood poles	7/14	17·31
Horahora – Mystery Creek	Wood poles	7/12	20·70
Mystery Creek – Hamilton No. 1	Wood poles	7/12	6·54
Hamilton No. 1 – Huntly	0·53 mile steel towers; 18·53 miles wood poles	19/16	19·06
Mystery Creek – Te Awamutu	Wood poles	7/14	9·50
Te Awamutu – Hangatiki	Wood poles	7/14	19·50
Horahora Tap on Arapuni–Penrose Line (temporary)	Wood poles	7/14	2·00
Total route-miles of 50,000-volt lines			336·96

Line.	Circuits.	Supports.	Size of Wire.	Miles.
11,000-volt Lines—				
Waikino–Waihi	Single	Steel towers	37/13	5·77
Waihi – Grand Junction	Single	Wood poles	7/12	0·75
Horahora–Leamington	Double	Wood poles	7/14	12·54
Leamington – Hamilton No. 1	Double	Wood poles	7/16	15·86
Hamilton–Frankton	2·86 miles quadruple	Wood poles	7/16	3·95
	0·72 mile triple	0·55 mile wood poles; 0·17 mile underground cables	7/16	
	0·37 mile double	Wood poles	7/16	
Bombay–Pukekohe		5·14 miles wood poles; 0·07 mile underground cables	7/14	5·21
Total route-miles of 11,000-volt lines				44·08
Grand total of all lines				580·01*

* NOTE.—The Penrose–Henderson–Takapuna 50,000-volt line contains 8·93 miles of duplicate pole line

Route-miles of Transmission-lines erected at 31st March, 1930.

	Miles.
110,000-volt steel-supported, double circuit	99·73
110,000-volt steel-supported, single circuit	2·68
110,000-volt wood-pole supported, single circuit	96·56
50,000-volt steel-supported, double circuit	20·03
50,000-volt steel-supported, single circuit	35·40
50,000-volt wood-pole supported, single circuit	290·46
11,000-volt steel-supported, single circuit	5·77
11,000-volt wood-pole supported, single circuit	0·75
11,000-volt wood-pole supported, double circuit	33·91
11,000-volt wood-pole supported, triple circuit	0·55
11,000-volt wood-pole supported, quadruple circuit	2·86
11,000-volt underground cables, 3 single circuits	0·17
11,000-volt underground cables, 2 single circuits	0·07
Total route-miles	588·94†

† The 8·93 miles in Penrose–Henderson–Takapuna line is counted as 17·86 miles of erected single-circuit line.

TABLE XXI. — ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY. — ROUTE-MILES OF DEPARTMENT'S LINES IN OPERATION AT 31ST MARCH, 1930—*continued.*

Circuit-miles of Transmission-lines erected at 31st March, 1930.

Size of wire:	7/16.	7/14.	7/12.	19/16.	19/13.	No. 0.	37/13	Underground Cable.
Miles	45·55	233·53	56·12	82·34	298·70	30·04	5·77	0·65

Total circuit mileage, 752·70. All circuits are three-phase, and all wires are of copper.

TABLE XXII.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—MILEAGE, POWER BOARD LINES, AT 31ST MARCH, 1930.

——	11,000 Volts.		3,000 Volts.		400 Volts.	Total Route-miles.	
Number of circuits	2	1	2	1	1		
Cambridge Power Board	..	..	..	103·5	70·5	174·00	(*a*)
Central Power Board	6·58	163·63	..	96·32	184	450·53	(*b*)
Te Awamutu Power Board	12	43·5	5	168	74·5	303·00	(*c*)
Thames Valley Power Board	83	386·6	..	97·9	153·4	720·90	(*d*)
Waitomo Power Board	No details		..	..	..	..	(*e*)
Franklin Power Board	7	289	..	..	105	401·00	(*f*)
Waitemata Power Board	5·45	142·03	..	0·4	258·29	406·17	(*g*)
Bay of Plenty Power Board	..	189·6	..	..	25·8	215·40	(*h*)
Hamilton Borough Council	..	3·95	..	3·25	42·25	49·45	(*i*)
Totals	114·03	1,218·31	5	469·37	913·74	2,720·45	

(*a*) Also 49 miles of 400 volts on 3,000-volt poles.
(*b*) Also 2·5 miles of 3,000 volts on 11,000-volt poles; 90·12 miles of 400 volts on 11,000-volt poles; 52·75 miles of 400 volts on 3,000-volt poles.
(*c*) Also 16·8 miles of 3,000 volts on 11,000-volt poles; 19·82 miles of 400 volts on 11,000-volt poles; 123·12 miles of 400 volts on 3,000-volt poles.
(*d*) Also 385 miles of 400 volts on 11,000-volt poles.
(*f*) Also 174 miles of 400 volts on 11,000-volt poles.
(*g*) Also 101·5 miles of 400 volts on 11,000-volt poles; 0·3 mile of 400 volts on 3,000-volt poles.
(*h*) Also 56 miles of 400 volts on 11,000-volt poles.
(*i*) Also 3·25 miles of 400 volts on 3,000-volt poles.

TABLE XXIII.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—MILKING-MACHINES CONNECTED AT 31ST MARCH, 1930.

Horse-power	¼	½	¾	1	1½	2	3	5	Total Number.	Total Horse-power.
Cambridge Power Board ..	..	1	..	19	127	128	8	..	283	490·00
Central Power Board ..	..	3	1	60	101	742	12	..	919	1,733·75
Te Awamutu Power Board ..	53	7	..	38	178	286	..	..	562	893·75
Thames Valley Power Board ..	..	..	1	24	52	1,750	60	2	1,889	3,792·75
Waitomo Power Board ..	..	3	..	4	..	114	..	..	121	233·50
Franklin Power Board ..	..	71	..	40	355	185	1	..	652	981·00
Waitemata Power Board ..	..	11	3	12	8	95	1	..	130	224·75
Bay of Plenty Power Board ..	..	..	..	8	158	256	10	..	432	787·00
Tourist Department ..	..	..	..	..	..	..	..	..	..	..
Totals	53	96	5	205	979	3,556	92	2	4,988	9,136·50

ELECTRIC RANGES.

2 kw. and not over 5 kw., 259; 5 kw. and over, 2,458: Total number, 2,807.

ELECTRIC WATER-HEATERS.

Total number, 7,088; total kilowatts, 4,760.

TABLE XXIV.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR THE YEAR ENDED 31ST MARCH, 1930.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue.					Expenditure.							Balance.	
			From Sales of Electrical Energy.		Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Working-costs and Management.	Interest.	Depreciation.	Sinking Fund and Reserve Funds.	Other Expenditure.	Total.	Profit.	Loss.
			Retail.	Bulk (for Resale).												
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department ..	19	3,692,131	21,898*	200,304	..	3,481	225,683	7,948	53,845	135,622	60,258	..	778	258,451	..	32,768
Auckland Power Board ..	44,108	2,998,854	638,174	..	..	6,888	645,062	78,164	213,182	133,131	62,390	81,794	..	568,661	76,401	..
Bay of Plenty Power Board ..	1,232	186,129	27,358	..	..	960	28,318	10,728	5,781	11,024	..	1,700	1,196	30,429	..	2,111
Cambridge Power Board ..	1,278	106,030	18,232	..	316	1,086	19,634	5,374	4,959	6,269	713	1,534	..	18,849	785	..
Central Power Board	3,708	295,104	50,054	..	217	873	51,144	12,596	9,658	17,318	3,427	2,957	2,453	48,409	2,735	..
Franklin Power Board ..	2,887	242,929	39,570	..	2,564	3,378	45,512	12,477	7,571	13,614	2,539	3,445	303	39,949	5,563	..
Hamilton Borough	3,745	69,101	37,864	..	..	105	37,969	8,515	9,615	3,254	2,130	1,645	6,578	31,737	6,232	..
Te Aroha Borough	684	23,597	7,047*	77	..	78	7,202	1,700	2,619	515	350	95	64	5,343	1,859	..
Te Awamutu Power Board ..	1,550	174,379	27,620	..	85	602	28,307	7,385	5,027	9,462	1,000	1,845	891	25,610	2,697	..
Thames Valley Power Board ..	5,570	790,532	125,978*	5,603	2,787	2,294	136,662	41,151	24,339	46,262	3,902	9,709	10,267	135,630	1,032	..
Thames Borough	1,101	33,647	11,297	..	12	91	11,400	3,903	3,178	1,059	266	209	1,988	10,603	797	..
Tourist Department	1,686	68,180	16,619	..	..	507	17,126	2,671	4,140	3,409	1,363	5,543	..	17,126	..	..
Waitemata Power Board ..	7,468	364,550	66,800	..	..	2,135	68,935	17,645	17,775	18,248	2,500	6,610	3,505	66,283	2,652	..
Waitomo Power Board ..	1,262	92,312	16,312	..	215	761	17,288	3,675	5,203	6,169	..	892	1,610	17,549	..	261
Totals	76,298	9,137,475	1,104,823	205,984	6,196	23,239	1,340,242	213,932	366,892	405,356	140,838	117,978	29,633	1,274,629	100,753	35,140

* After deducting amount of sales to other distributing authorities.

Net profit, £65,613.

TABLE XXV.—ARAPUNI-HORAHORA ELECTRIC-POWER SUPPLY.—POWER PURCHASED DURING YEARS ENDING 31ST MARCH, 1927, 1928, 1929, AND 1930.

—	1926–27.		1927–28.		1928–29.		1929–30.	
	Units.	Cost.	Units.	Cost.	Units.	Cost.	Units.	Cost.
		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Grand Junction Co. (total generated and purchased)	162,700	1,250 13 5	3,612,720	13,300 9 11	..	..	..	..
McLaren's Falls ..	7,217,830	7,489 1 6	7,379,095	7,690 7 2	10,514,730	11,022 18 9	7,664,438	8,170 18 11
Auckland Power Bd.	14,281	29 15 0	333,110	693 19 7	1,762,070	4,896 8 8	42,110	87 14 7
Waitoa Factory ..	2,357	17 15 10	5,760	24 0 0	4,580	19 1 8	..	..
Frankton Factory	..		15,303	47 16 3	6,208	19 8 0	..	..
Te Awamutu Factory	1,774		14,550	60 12 6	1,420	5 18 4	..	..
Hautapu Factory	..	..	11,760	49 0 0	..	..	..	..
Waitomo Electric-power Board	..	..	..	11 2 6	..	..	..	..
	7,398,942	8,787 5 9	11,372,298	21,877 8 1	12,289,008	15,963 15 5	7,706,548	8,258 13 6
Grand Junction Co. (generated)	..	..	2,768,220	10,608 19 6				
Net total purchased	..	..	8,604,078	11,268 8 7				
Tourist Department*	..	..	..	..	..	240 4 0	..	171 6 8
Dairy factories† ..	..	..	..	..	487,362	437 15 3	..	..
								8,430 0 2
Less—Dairy Co.‡	..	..	..	..	..	..	..	482 3 3
					12,776,370	16,641 14 8		7,947 16 11

* Payment for extra labour in running Okere plant in taking up part of own load.
† Payment for taking up part of own load.
‡ Claim for taking up own load 1929 not continued.

NOTE.—Included in the 1927–28 figure of the Grand Junction Co. are 2,768,220 units generated at a cost of £10,608 19s. 6d. thereat since 17th October, 1927, when the Department took over plant.

TABLE XXVI.—ELECTRIC-POWER BOARDS OF NEW ZEALAND AS CONSTITUTED AT 31ST MARCH, 1930.

Name of Board.	Proclamation constituting Power Board Area gazetted.	Members on Board.	Approximate Area.		Population.		Value of Rateable Property.			Valuation Basis.	Amount of Loan authorized.	Voting for Loan Poll.	
							Used as Rating Basis.	Unimproved.					
			District.	Outer Area.	District.	Outer Area.	District.	District.	Outer Area.			For.	Against.
		Number.	Sq. Miles.	Sq. Miles.	Number.	Number.	£	£	£		£	Number.	Number.
Ashburton	17/11/21	12	1,193	1,349	17,500	533	11,500,000	9,346,863	700,181	Capital	411,150	2,999	706
Auckland	1/4/22	11	300	..	200,000	..	73,537,262	50,491,865	..	Capital	2,318,000	11,004	1,367
Banks Peninsula	8/1/20	7	387	..	4,050	..	4,537,806	3,645,448	..	Capital	114,680	658	113
Bay of Plenty	20/8/25	8	460	2,615	8,600	3,100	1,769,657	1,769,657	450,000	Unimproved ..	204,000	654	153
Buller	11/5/22	5	1,987	..	9,197	..	696,374	696,374	..	Unimproved ..	Poll not yet taken.		
Cambridge	8/1/20	8	137	..	6,000	..	2,559,567	1,550,262	..	Capital	122,836	749	123
Central	8/7/20	10	817	..	18,039	..	8,091,272	4,554,703	..	Capital	307,000	1,059	78
Central Hawke's Bay ..	19/10/22	9	1,300	..	11,200	..	6,839,951	6,839,951	..	Unimproved ..	150,000	543	41
Dannevirke	11/8/21	10	578	118	12,188	426	4,275,674	4,275,674	487,019	Unimproved ..	224,000	1,584	330
Franklin	29/6/25	9	628	58	16,359	406	7,761,397	4,926,883	..	Capital	329,820	2,471	478
Golden Bay	18/6/25	5	51	..	1,200	..	479,726	248,871	..	Capital	25,000	336	96
Grey	26/10/22	9	640	810	12,220	615	1,600,000	515,700	107,000	Capital	256,000	2,083	669
Hawke's Bay	19/6/24	11	1,682	2	45,360	1,107	19,067,387	11,499,056	128,811	Capital	304,000	681	66
Horowhenua	1/12/21	9	630	..	16,430	..	6,898,987	3,403,255	..	Capital	260,000	973	26
Hurunui	31/10/29	7	..	..	5,443	537	..	1,330,629	64,421	Unimproved ..	Poll not yet taken.		
Hutt Valley	6/7/22, 11/12/24	11	530	..	40,680	..	3,119,920	3,119,920	..	Unimproved ..	390,000	2,333	343
Malvern	28/6/23	6	308	1,833	3,550	1,500	3,037,533	2,433,080	1,458,588	Capital	65,000	508	33
Manawatu-Oroua	1/12/21	12	1,301	..	40,000	..	13,846,231	13,846,231	..	Unimproved ..	500,000	1,144	96
Marlborough	25/10/23	8	3,218*	..	14,530*	..	8,658,285	5,879,884*	..	Capital	327,500	1,334	300
North Canterbury	3/3/27	8	746	312	8,651	4,614	6,052,918	5,051,124	1,903,803	Capital	160,300	430	86
North Auckland	29/3/23, 4/12/29	12	2,225	..	26,915	..	..	5,205,716	..	Unimproved ..	Poll not yet taken.		
Opunake	9/8/21, 11/3/22	7	197	5	4,250	50	1,729,168	916,111	..	Capital	92,000	292	35
Otago Central	26/10/22	9	306	2,378	3,585	1,585	742,782	296,380	727,447	Capital	87,000	430	31
Otago	18/10/23, 31/12/26, 1/11/28	7	825	1,456	13,201	10,881	3,588,713	2,198,991	2,497,457	Capital	256,000	1,358	196
Poverty Bay	12/6/24	11	1,747	..	23,670	..	16,536,848	9,356,443	..	Capital	280,000	1,203	244
Reefton	30/6/21	4	24	..	1,639	..	178,055	38,504	..	Capital	Poll not yet taken.		
South Canterbury	3/7/24	12	1,673	3,451	35,618	6,625	15,096,516	12,946,839	2,640,530	Capital	348,300	1,919	587

* Includes outer area.

TABLE XXVI.—ELECTRIC-POWER BOARDS OF NEW ZEALAND AS CONSTITUTED AT 31ST MARCH, 1930—*continued.*

Name of Board.	Proclamation constituting Power Board Area gazetted.	Members on Board.	Approximate Area.		Population.		Value of Rateable Property.			Valuation Basis.	Amount of Loan authorized.	Voting for Loan Poll.	
							Used as Rating Basis.	Unimproved.					
			District.	Outer Area.	District.	Outer Area.	District.	District.	Outer Area.			For.	Against.
		Number.	Sq. Miles.	Sq. Miles.	Number.	Number.	£	£	£		£	Number.	Number.
South Taranaki	30/4/25	8	174	306	11,500	6,000	6,312,329	3,693,420	1,506,331	Capital	187,500	1,063	208
Southland	13/11/19 19/11/19	12	7,918	3,035	68,000	30	15,101,728	15,101,728	137,513	Unimproved ..	1,650,000	6,516	415
Springs-Ellesmere	1/7/20	5	464	..	10,560	..	5,155,388	5,155,388	..	Unimproved ..	140,000	959	56
Taranaki	18/5/22 6/5/26 20/5/26	8	355	1,333	13,985	8,015	6,141,672	2,865,396	3,109,336	Capital	435,000	1,026	252
Tararua	23/3/22	10	700	565	8,458	1,770	2,833,994	2,833,994	1,149,113	Unimproved ..	154,480	714	83
Tauranga	14/6/23	7	636	3	8,450	3,640	943,371	943,371	489,164	Unimproved ..	144,500	1,192	417
Te Awamutu	8/1/20	8	270	..	7,620	..	3,699,132	2,353,948	..	Capital	178,000	757	146
Teviot	22/7/22	7	102	..	1,700	..	176,839	255,661	..	Unimproved ..	55,500	280	32
Thames Valley	8/1/19	12	2,295	6	38,500	3,500	14,785,086	7,709,621	43,047	Capital	850,000	1,236	806
Wairarapa	25/3/20	9	606	1,390	19,650	4,350	9,683,051	5,465,547	2,753,453	Capital	330,600	2,295	312
Waimea	1/5/29	7	..	..	12,280	..	..	1,624,185	..	.. ..	Poll not yet	taken.	
Wairere	9/10/24 4/11/26 21/3/29	7	382	25	2,500	200	696,621	696,621	163,379	Unimproved ..	45,850	94	8
Wairoa	29/7/20	10	1,354	..	7,678	..	3,942,089	2,567,839	..	Capital	100,000	504	31
Waitaki	9/8/23	9	520	1,853	17,029	791	6,855,282	4,406,970	358,805	Capital	145,650	1,286	124
Waitemata	18/10/23 27/11/24 26/8/26 7/3/29	12	627	..	39,205	..	12,425,267	6,104,446	..	Capital	380,000	6,676	1,834
Waitomo	6/3/24	7	160	1,100	5,000	3,000	1,066,361	1,066,361	..	Unimproved ..	117,000	557	90
Wanganui-Rangitikei ..	1/12/21	12	1,684	972	52,000	3,000	22,099,617	6,568,540	1,408,210	Capital	375,000	1,315	214
Westland†	28/10/20	9	750	..	3,272	..	196,268	196,268	..	Unimproved ..	Poll not yet	taken.	
Totals, 1929–30 ..	..	396	42,887	24,975	927,462	66,275	334,316,124	235,993,718	22,283,608	..	12,821,666	63,215	11,225
Totals, 1928–29 ..	..	377	41,394	25,475	858,651	63,813	308,440,171	230,377,936	23,655,055	..	12,309,116	55,058	9,189

† License delegated to Westland Power, Ltd.

TABLE XXVII.—ELECTRIC-POWER BOARDS.—FINANCIAL STATISTICS FOR THE YEAR ENDED 31ST MARCH, 1930.

Name of Board.	Main Supply commenced.	Capital Outlay.	Revenue.					Expenditure.				Profit.	Loss.	Rates.					
			Sale of Electricity.		Sale of Materials (Profit).	General.	Total (not including Rates).	Power.	General.	Capital Charges.[1]	Total Annual Costs.			General Rate.		Availability Rate.		Special Rates.	
			Bulk.	Retail.										Levied.	Collected.	Levied.	Collected.	Levied.	Collected.
		£	£	£	£	£	£	£	£	£	£	£	£	d.	£	d.	£	d.	£
Ashburton	1923	340,423	..	40,524	..	488	41,012	17,291	3,582	21,956	42,829	..	1,817	..	..	..	..	..	..
Auckland	1908	2,988,854	..	638,174	..	6,888	645,062	241,321	50,025	195,520	486,866	158,196	..	..	..	..	..	..	..
Banks Peninsula ..	1921	100,285	..	12,663	..	471	13,134	6,749	2,368	7,373	16,490	..	3,356	$\frac{1}{14}$	..	..	..	$\frac{1}{7}$	4,176[2]
Bay of Plenty ..	1928	186,129	1,410	25,948	..	960	28,318	14,655	3,050	12,724	30,429	..	2,111	..	..	..	..	..	..
Buller[3]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cambridge	1921	106,030	..	18,232	316	1,086	19,634	7,862	2,471	7,453	17,786	1,848	..	..	..	..	..	..	..
Central	1921	296,604	..	50,054	217	873	51,144	18,619	6,088	20,275	44,982	6,162	..	..	..	..	..	..	..
Central Hawke's Bay ..	1925	133,787	550	20,116	..	897	21,563	7,473	2,039	8,253	17,765	3,798	..	..	..	..	..	..	..
Dannevirke	1925	199,880	..	26,400	137	543	27,080	7,864	3,246	13,358	24,468	2,612	..	..	..	..	..	..	..
Franklin	1925	242,929	..	39,570	2,564	3,378	45,512	15,428	4,923	16,059	36,410	9,102	..	..	..	..	..	$\frac{1}{8}$	..
Golden Bay	1929	21,532	..	1,119	94	..	1,213	275	327	1,529	2,131	..	918	..	..	..	..	$\frac{7}{8}, \frac{7}{16}$	1,339[4]
Grey	1926	132,983	..	25,751	232	472	26,455	8,841	4,397	8,869	22,107	4,348	..	..	..	..	..	..	..
Hawke's Bay	1927	221,611	24,908	20,009	1,088	1,515	47,520	27,907	2,986	13,701	44,594	2,926	..	..	..	..	..	..	..
Horowhenua	1924	195,472	..	44,278	140	1,436	45,854	22,158	4,850	13,018	40,026	5,828	..	..	..	..	..	..	..
Hurunui[3]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hutt Valley	1925	370,922	..	97,088	..	1,515	98,603	46,462	12,740	25,558	84,760	13,843	..	..	..	..	..	..	..
Malvern	1925	61,818	..	6,501	286	451	7,238	2,879	1,368	4,021	8,268	..	1,030	$\frac{1}{4}$	..	$\frac{1}{4}$	..	$\frac{1}{8}$	..
Manawatu-Oroua ..	1924	494,695	11,753	59,750	655	512	72,670	32,302	5,107	29,645	67,054	5,616	..	..	..	..	..	..	..
Marlborough	1927	308,769	1,059	23,681	..	985	25,725	3,766	2,816	21,648	28,230	..	2,505	..	..	2	..	..	..
North Canterbury ..	1928	124,745	2,772	16,025	366	353	19,516	8,849	1,717	5,406	15,972	3,544	..	..	..	..	..	..	..
North Auckland[3] ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Opunake	1924	103,708	..	12,195	..	327	12,522	3,734	1,685	7,986	13,405	..	883	..	..	..	..	..	..
Otago Central	1925	85,859	..	8,188	210	320	8,718	1,420	1,162	6,587	9,169	..	451	..	..	..	..	..	..
Otago	1926	281,198	1,209	33,008	..	128	34,345	15,999	4,470	20,587	41,056	..	6,711	$\frac{1}{20}$	27	..	..	$\frac{1}{2}, \frac{3}{5}, \frac{4}{5}$	7,726
Poverty Bay	1912	305,301	..	47,629	..	1,391	49,020	17,697	5,994	19,498[5]	43,189	5,831	..	..	..	..	..	..	..
Reefton[3]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Canterbury ..	1925	312,615	10,434	40,263	..	346	51,043	23,685	4,475	20,379	48,539	2,504	..	..	..	..	..	..	..
South Taranaki ..	1903	143,337	..	10,801	249	180	11,230	1,585	3,092	3,961	8,638	2,592	..	..	..	..	..	$\frac{588}{1000}$	..
Southland	1925	1,654,870	19,437	88,619	270	8,965	117,291	27,756	23,707	115,500	166,963	..	49,672	1	60,700[6]	..	..	$\frac{1}{2}$	9,765[7]
Springs-Ellesmere ..	1922	132,346	..	25,257	458	101	25,816	10,705	4,307	7,870	22,882	2,934	..	..	..	..	..	..	..
Taranaki	1927	462,219	7,461	34,169	..	691	42,321	5,021	7,822	32,284	45,127	..	2,806	..	..	$1\frac{1}{2}$	9,779[8]	..	..
Tararua	1925	157,810	..	20,970	147	938	22,055	7,355	2,560	9,457	19,372	2,683	..	..	..	..	..	..	..

[1] Includes interest and sinking fund payments only. [2] Includes arrears, £143. [3] Not yet actively functioning. [4] Includes arrears, £339. [5] Includes repayments of loan, £1,168. [6] Includes arrears, £7,921. [7] Includes arrears, £3,605. [8] Includes arrears, £7,966.

TABLE XXVII.—ELECTRIC-POWER BOARDS.—FINANCIAL STATISTICS FOR THE YEAR ENDED 31ST MARCH, 1930—*continued.*

Name of Board.	Main Supply commenced.	Capital Outlay.	Revenue.					Expenditure.				Profit.	Loss.	Rates.					
			Sale of Electricity.		Sale of Materials (Profit).	General.	Total (not including Rates).	Power.	General.	Capital Charges.[1]	Total Annual Costs.			General Rate.		Availability Rate.		Special Rate.	
			Bulk.	Retail.										Levied.	Collected.	Levied.	Collected.	Levied.	Collected.
		£	£	£	£	£	£	£	£	£	£	£	£	d.	£	d.	£	d.	£
Tauranga	1926	125,565	..	20,874	18	2,120	23,012	8,780	3,999	7,889	20,668	2,344	..	..	..	..	..	..	..
Te Awamutu	1921	174,379	1,187	26,858	85	177	28,307	10,674	2,629	11,083	24,386	3,921	..	..	..	..	..	..	61[1]
Feviot	1924	55,866	1,023	4,738	71	78	5,910	606	836	3,704	5,146	764	..	$\frac{1}{4}$	193[3]	..	..	$\frac{3}{4}$	64
Thames Valley ..	1921	790,532	3,708	127,873	2,787	2,294	136,662	56,239	19,518	55,971	131,728	4,934	..	..	..	..	..	..	..
Wairarapa	1924	349,901	1,435	45,799	1,125	1,066	49,425	9,190	10,697	24,242	44,129	5,296	..	..	..	..	..	..	..
Waimea[3]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wairere	1925	38,447	..	4,482	..	98	4,580	474	1,067	2,948	4,489	91	..	..	..	..	..	..	..
Wairoa	1923	55,595	5,383	6,747	89	136	12,355	7,997	1,549	4,019	13,565	..	1,210	..	..	..	167[2]	$\frac{1}{32}, \frac{3}{8}$	2,560[4]
Waitaki	1926	167,981	1,131	34,586	331	875	36,923	14,081	3,201	11,740	29,022	7,901	..	$\frac{3}{8}, \frac{1}{32}$	..	..	..	..	..
Waitemata	1926	364,550	..	66,800	..	2,135	68,935	27,107	11,818	24,858	63,783	5,152	..	..	..	..	..	..	..
Waitomo	1926	92,312	..	16,312	215	761	17,288	5,572	5,002	7,061	17,635	..	347	..	..	..	..	$1\frac{1}{4}, \frac{1}{8}, \frac{3}{8}, \frac{3}{8}$	..
Wanganui-Rangitikei ..	1924	528,291	300	93,028	..	3,830	97,158	39,769	8,401	35,272	83,442	13,716	..	..	..	..	..	..	..
Westland[5]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals, 1929–30 ..	..	12,920,150	95,160	1,935,079	12,150	49,780	2,092,169	786,147	242,091	859,262	1,887,500	278,486	73,817	..	60,920	..	9,946	..	25,691
Totals, 1928–29 ..	..	12,009,891	90,123	1,698,596	15,298	46,436	1,850,453	735,773	217,013	797,205	1,749,991	201,443	100,981	..	46,039	..	18,068	..	12,662

[1] Arrears only. [2] Includes arrears, £19. [3] Not yet actually functioning. [4] Includes arrears, £87. [5] Licence delegated to Westland Power Ltd.

TABLE XXVIII.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1930.

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load.	Demand Factor.	Units.						Annual Load Factor.	Average Units sold (excluding Sales in Bulk) per Consumer.	Average Units sold (excluding Sales in Bulk) per Capita of Population.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated.	Purchased.	Total.	Sold (including Sales in Bulk).	Non-productive.	Percentage Non-productive.							
STEAM STATIONS.		No.	No.	Kv.a.	Kv.a.	Kw.	Kw.	Per Cent.	No.	No.	No.	No.	No.	Per Cent.	Per Cent.	No.	No.			Miles.	Ft
1. Auckland	1908	200,000	44,108	25,450	..	28,340	171,000	16·57	51,192,030	72,699,816	123,891,846	103,719,531	20,172,315	16·28	49·90	2,351	519	A.C./D.C.	400/230 A.C., 460/230 D.C.	1,026·0	.
2. Grey	1926	12,800	2,093	1,250	..	1,100	4,874	22·57	4,362,760	52,873	4,415,633	3,447,480	968,153	21·93	45·82	1,647	269	A.C.	400/230	88·0	..
3. Nelson	1923	11,500	2,200	937	624	650	5,291	12·29	2,075,520	..	2,075,520	1,559,716	515,804	24·85	36·45	675	129	A.C.	400/230	47·0	..
Totals, steam stations ..	..	224,300	48,401	27,637	624	30,090	181,165	16·61	57,630,310	72,752,689	130,382,999	108,726,727	21,656,272	16·61	49·46	2,245	484	..	..	1,161·0	..
GAS STATIONS.																					
1. Kaikoura	1922	630	146	47	..	30	106	28·37	44,420	..	44,420	30,537	13,883	31·25	27·29	209	48	A.C.	400/230	5·0	..
2. Motueka	1922	1,600	316	65	..	57	195	29·28	61,173	..	61,173	45,880	15,293	25·00	12·25	145	29	A.C.	400/230	11·7	..
Totals, gas stations ..	..	2,230	462	112	..	87	301	28·90	105,593	..	105,593	76,417	29,176	27·63	13·9	165	34	..	..	16·7	..
OIL STATIONS.																					
1. Picton	1917	1,350	356	181*	..	66	495	13·23	138,970	..	138,970	106,098	32,872	23·65	24·22	298	79	D.C.	460/230	10·0	..
2. Uawa	1925	400	99	30*	..	14	64	21·87	24,155	..	24,155	17,508	6,647	27·50	19·70	177	44	D.C.	230	3·0	..
Totals, oil stations	..	1,750	455	211	..	80	559	14·31	163,125	..	163,125	123,606	39,519	24·23	23·23	272	71	..	..	13·0	..
HYDRO STATIONS.																					
1. Coleridge	1915	..	78	40,580	..	27,540	180,712	15·24	124,375,245	..	124,375,245	112,600,950	11,774,295	9·47	51·55	..	..	A.C.	400/230	510·6	480
Ashburton	1923	17,500	3,444	..	200	(1,498)	(11,691)	12·80	11,229	6,038,810	6,050,039	(4,729,531)	1,320,508	21·83	46·10	1,373	270	A.C.	400/230	852·0	..
Banks Peninsula	1921	4,050	955	..	90	(375)	(3,339)	11·23	50,946	1,503,900	1,554,846	(1,134,663)	420,183	27·02	47·33	1,188	280	A.C.	400/230	202·0	310
Christchurch	1904	93,500	25,600	..	400*	(13,040)	(95,205)	13·70	540	54,124,965	54,125,505	(47,564,061)	6,561,444	12·12	46·32	1,671	457	A.C./D.C.	460/400/230	285·8	..
Halswell	1919	1,850	243	..	..	(122)	(392)	31·17	..	470,236	470,236	(396,000)	74,236	15·79	43·92	1,630	214	A.C.	400/230	22·0	..
Heathcote	1914	6,000	1,197	..	..	(549)	(4,031)	13·62	..	2,047,546	2,047,546	(1,805,546)	242,000	11·82	42·57	1,508	301	A.C.	400/230	31·7	..
Hurunui†	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton	1917	3,710	664	..	..	(208)	(1,963)	10·60	..	804,161	804,161	(622,666)	181,495	22·57	44·13	938	168	A.C.	400/230	9·2	..
Malvern	1925	5,050	644	..	..	(245)	(2,292)	10·68	..	893,880	893,880	(619,687)	274,193	30·67	41·68	962	123	A.C.	400/230	178·0	..
North Canterbury	1928	8,651	1,389	..	..	(880)	(6,397)	13·76	..	3,347,245	3,347,245	(3,041,018)	306,227	9·15	43·42	1,641	263	A.C.	400/230	301·3	..
Kaiapoi	1917	1,800	450	..	..	(112)	(576)	19·42	..	277,150	277,150	(232,979)	44,171	15·94	28·30	518	129	A.C.	400/230	20·0	..
Rangiora	1919	2,100	545	..	..	(140)	(1,242)	11·27	..	475,750	475,750	(389,345)	86,405	18·16	38·79	714	185	A.C.	400/230	12·5	..
Riccarton	1916	5,500	1,290	..	..	(461)	(4,261)	10·81	..	2,150,230	2,150,230	(1,952,937)	197,293	9·18	53·27	1,514	355	A.C.	400/230	18·3	..
South Canterbury	1925	41,743	3,277	40	..	(2,093)	(18,287)	11·45	112,848	10,593,164	10,706,012	(9,951,457)	754,555	7·05	58·39	1,732	136	A.C.	400/230	701·0	66
Timaru	1908	17,500	3,259	..	..	(1,375)	(8,647)	15·90	..	4,017,164	4,017,164	(3,500,997)	516,167	12·85	33·35	1,074	200	A.C.	400/230	53·6	..
Springs-Ellesmere	1922	10,560	2,004	..	..	(1,120)	(6,463)	17·33	..	4,710,700	4,710,700	(3,837,877)	872,823	18·53	48·01	1,915	363	A.C.	400/230	286·8	..
Sumner	1918	3,500	951	..	..	(217)	(1,632)	13·29	..	1,023,066	1,023,066	(819,430)	203,636	19·90	53·84	862	234	A.C.	400/230	16·5	..
Tai Tapu Dairy Co.	1915	5,700	241	..	..	(223)	(533)	41·82	..	792,488	792,488	(633,990)‡	158,498‡	20·00‡	40·08	2,631	111	A.C.	400/230	29·7	..
Waimairi	1916	13,000	3,030	..	..	(1,089)	(10,684)	10·19	..	4,879,022	4,879,022	(4,389,324)	489,698	10·04	51·14	1,453	338	A.C.	400/230	141·0	..
Waitaki	1926	17,820	3,065	150	240	(1,215)	(8,742)	13·90	170,274	5,008,829	5,179,103	(4,363,668)	815,435	15·77	48·66	1,424	245	A.C.	400/230	362·0	250

(For notes see page 134.)

TABLE XXVIII.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1930—*continued.*

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load.	Demand Factor.	Units.						Annual Load Factor.	Average Units sold (excluding Sales in Bulk) per Consumer.	Average Units sold (excluding Sales in Bulk) per Capita of Population.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated.	Purchased.	Total.	Sold (including Sales in Bulk).	Non-productive.	Percentage Non-productive.							
HYDRO STATIONS—*continued.*		No.	No.	Kv.a.	Kv.a.	Kw.	Kw.	Per Cent.	No.	No.	No.	No.	No.	Per Cent.	Per Cent.	No.	No.			Miles.	Ft.
2. Dunedin (Waipori)	1907	80,000	22,722	18,750	860*	14,341	66,608	21·53	63,274,430	..	63,274,430	50,891,022	12,383,408	19·57	50·37	2,038	579	A.C.	400/230	503·0	700
Otago	1926	17,931	3,657	..	..	(1,663)	(9,792)	16·98	..	6,592,793	6,592,793	4,900,930	1,691,863	25·66	45·26	1,340	273	A.C.	400/230	581·0	..
3. Golden Bay	1929	1,200	204	250	..	200	632	31·65	285,565	..	285,565	221,388	64,177	22·47	16·29	1,085	184	A.C.	400/230	38·3	330
4. Havelock North	1916	1,150	278	180	..	90	652	13·80	343,000	..	343,000	304,452	38,548	11·24	43·51	1,095	265	A.C.	400/230	16·5	50
5. Kanieri Electric Ltd. (Hokitika)	1921	2,500	565	700	150	600	1,251	47·96	3,691,000	..	3,691,000	2,866,700	824,300	22·33	70·22	5,074	1,147	A.C.	400/230	17·8	250
6. Kaponga	1916	1,200	353	120/45*	..	205	645	31·78	503,100	36,760	539,860	455,290	84,570	15·67	30·06	1,290	379	A.C./D.C.	400/230, 460/230	51·0	58/31
7. Mangahao-Waikaremoana	1925	..	83	65,000	..	37,880	267,598	14·16	182,148,043	66,340	182,214,383	159,012,731	23,201,652	12·73	54·91	..	..	A.C.	400/230	418·0	896/676
Central Hawke's Bay	1925	11,200	1,472	..	..	(694)	(3,862)	17·97	..	3,487,202	3,487,202	(3,001,533)	485,669	13·93	57·36	2,039	268	A.C.	400/230	222·0	..
Dannevirke	1925	12,614	2,186	..	..	(617)	(5,987)	10·32	..	2,987,845	2,987,845	(2,540,022)	447,823	14·99	55·28	1,162	201	A.C.	400/230	299·1	..
Hawke's Bay	1927	16,020	2,176	..	..	(3,048)	(20,922)	14·57	..	15,400,008	15,400,008	(14,372,647)	1,027,361	6·67	57·68	2,415	328	A.C.	400/230	248·5	..
Hastings	1912	10,660	3,263	1,175	..	(803)	(6,382)	12·58	..	3,137,800	3,137,800	(2,594,953)	542,847	17·30	44·61	795	243	A.C./D.C.	D.C. 460/230, A.C. 400/230	55·7	..
Napier	1913	18,680	3,980	..	1,330	(1,418)	(7,004)	20·25	50,230	5,979,000	6,029,230	(5,021,904)	1,007,326	16·71	48·54	1,262	269	A.C./D.C.	D.C. 460/230, A.C. 400/230	34·2	..
Horowhenua	1924	16,430	3,301	..	..	(2,142)	(9,660)	22·17	..	8,468,472	8,468,472	(7,232,714)	1,235,758	14·59	45·13	2,191	440	A.C.	400/230	498·4	..
Hutt Valley	1925	40,680	9,521	..	500	(4,320)	(32,027)	13·49	..	20,087,340	20,087,340	(14,135,301)	5,952,039	29·63	53·08	1,485	347	A.C.	400/230	279·7	..
Manawatu-Oroua	1924	39,011	4,368	..	..	(3,465)	(15,297)	22·65	..	20,266,997	20,266,997	(17,143,357)	3,123,640	15·41	66·77	2,007	225	A.C.	400/230	570·0	..
Palmerston North	1924	19,900	5,065	..	1,350	(1,886)	(13,703)	13·77	405,008	8,326,450	8,731,458	(7,685,579)	1,045,879	11·98	52·84	1,517	386	A.C.	400/230	74·5	..
Poverty Bay	1912	23,670	4,266	..	300*	(1,330)	(10,970)	12·17	153,270	4,981,845	5,135,115	(3,808,590)	1,326,525	25·83	44·08	893	161	A.C./D.C.	400/230, 460/230	214·3	..
Tararua	1925	10,255	1,458	..	..	(607)	(4,606)	13·18	..	3,090,220	3,090,220	(2,693,510)	396,710	12·84	58·10	1,847	263	A.C.	400/230	196·5	..
Wairarapa	1924	19,500	3,904	..	837	(1,190)	(12,563)	9·47	3,280,380	3,549,797	6,830,177	(5,398,596)	1,431,581	20·96	65·52	1,383	277	A.C.	400/230	475·0	429/290
Wairoa Power Board	1923	5,341	367	..	..	(804)	(4,149)	19·38	..	3,209,344	3,209,344	(2,757,658)	451,686	14·07	45·57	3,840	264	A.C.	400/230	89·0	..
Wairoa Borough Council	1913	2,410	647	..	..	(240)	(2,116)	11·34	..	1,348,380	1,348,380	(1,235,406)	112,974	8·38	64·14	1,909	513	A.C.	400/230	13·7	..
Wanganui-Rangitikei	1924	52,000	8,882	..	1,650	(3,441)	(25,050)	13·74	92,360	17,026,540	17,118,900	(13,695,120)‡	3,423,780‡	20·00‡	13·74	1,535	262	A.C.	400/230	626·0	..
Mangaweka	1913	400	102	40	..	(30)	(213)	14·14	46,423	66,732	113,155	(73,928)	39,227	34·68	43·06	725	185	A.C.	400/230	8·8	37
Wellington	1888	110,000	26,700	8,000	1,650	(15,424)	(100,200)	15·39	80,713	50,127,500	50,208,213	(41,329,434)	8,878,779	17·68	37·15	1,548	376	A.C.	400/230/105	345·0	..
8. Marlborough	1927	14,530	2,319	1,250	..	970	4,779	20·30	4,506,708	..	4,506,708	3,577,865	928,843	20·61	53·04	1,543	246	A.C.	400/230	270·0	100
9. Mataura	1913	1,300	343	75	..	72	345	20·87	103,426	..	103,426	79,160	24,266	23·46	16·40	231	61	A.C. (S.P.)	440/220	9·0	22
10. Murchison	1922	450	100	115	..	80	220	36·36	160,000	..	160,000	80,800	79,200	49·50	22·83	808	180	A.C.	400/230	14·0	105
11. New Plymouth	1905	21,000	6,060	4,125	..	2,900	17,430	16·64	13,523,031	613,791	14,136,822	11,252,881	2,883,941	20·40	55·65	1,689	487	A.C.	400/230	263·0	120/240
Inglewood	1905	1,300	416	..	..	(136)	(1,224)	11·11	..	459,968	459,968	(364,052)	95,916	20·85	38·61	875	280	A.C.	400/230	8·1	38
Waitara	1907	1,787	442	..	..	(95)	(654)	14·53	..	296,460	296,460	(255,831)	40,629	13·70	35·62	579	143	A.C.	415/240	12·1	..
12. Ohakune	1914	2,400	469	120	141	112	625	17·91	282,990	14,598	297,588	243,574	54,014	18·15	30·33	519	101	A.C.	400/230	14·0	42
13. Opunake	1924	7,000	1,250	380	..	380	1,736	21·89	1,358,300	258,560	1,616,860	1,278,993	337,867	20·90	48·57	1,023	183	A.C.	400/230	146·0	47
14. Patea	1901	1,800	335	82	80	106	389	27·25	347,500	..	347,500	311,500	36,000	10·36	37·42	930	173	A.C. (S.P.)	220/110	13·7	78
15. Queenstown	1924	800	220	60	..	75	290	25·86	181,400	..	181,400	112,990	68,410	37·71	27·61	514	141	A.C.	400/230	8·0	510
16. Raetihi	1917	4,500	384	350	120	195	800	24·37	605,000	..	605,000	453,750	151,250	25·00	35·42	1,161	99	A.C.	400/230	28·0	380
17. Reefton Electric Light and Power Co., Ltd.	1887	1,200	319	86*	..	66	264	25·00	100,400	..	100,400	90,400	10,000	9·96	17·98	283	75	D.C.	230	7·3	27
18. Southland	1925	47,000	8,742	7,050	..	6,250	39,263	15·92	23,331,520	..	23,331,520	16,762,536	6,568,984	28·15	42·61	1,223	228	A.C.	400/230	2,386·0	154
Bluff	1903	1,695	421	..	..	(232)	(1,051)	22·07	..	381,674	381,674	(312,538)	69,136	18·11	18·78	742	184	A.C.	400/230	9·6	..
Invercargill	1914	21.000	4,670	..	2,450	(1,848)	(11,700)	15·79	10,300	5,681,700	5,692,000	(5,135,462)	556,538	9·78	35·16	1,100	245	A.C.	A.C. 400/230	78·2	..

(For notes see page 134.)

TABLE XXVIII.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1930—*continued.*

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load.	Demand Factor.	Units.						Annual Load Factor.	Average Units sold (excluding Sales in Bulk) per Consumer.	Average Units sold (excluding Sales in Bulk) per Capita of Population.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated.	Purchased.	Total.	Sold (including Sales in Bulk).	Non-productive.	Percentage Non-productive.							
HYDRO STATIONS—*continued.*		No.	No.	Kv.a.	Kv.a.	Kw.	Kw.	Per Cent.	No.	No.	No.	No.	No.	Per Cent.	Per Cent.	No.	No.			Miles.	Ft.
19. South Taranaki ‖	1929	11,500	2,487	615	605	657	3,910	16·80	907,580	..	907,580	762,029	145,551	16·04	15·77	306	66	A.C.	400/230	79·3	57
20. Taranaki	1927	12,285	1,984	3,600	..	2,520	7,794	32·33	8,952,200	..	8,952,200	7,057,692	1,894,508	21·16	40·55	2,386	385	A.C.	400/230	289·0	300
Stratford	1898	3,500	975	..	..	(328)	(2,000)	16·40	..	1,796,586	1,796,586	(1,415,517)	381,069	21·21	62·53	1,452	404	A.C.	400/230	15·0	..
21. Tathape	1913	2,450	628	150*	75*	217	997	21·77	545,300	..	545,300	400,062	145,238	26·63	28·69	637	163	D.C.	460/230	10·3	30
22. Taumarunui	1924	4,000	740	500	..	460	1,598	28·79	1,125,319	..	1,125,319	794,000	331,319	29·44	27·93	1,052	195	A.C.	400/230	16·0	25
Manunui	1929	1,000	154	..	..	(16)	(116)	13·79	..	15,445	15,445	(14,047)	1,398	9·05	11·02	91	14	A.C.	400/230	4·8	..
23. Tauranga Borough Council	1915	2,700	857	4,300	..	3,576	..	..	15,546,783	..	15,546,783	13,332,518	2,214,265	14·24	49·63	2,047	650	A.C.	400/230	64·2	110/80
Tauranga Power Board	1926	8,450	870	..	..	..	(3,355)	..	..	3,058,850	3,058,850	(3,058,850)§	..	..	..	3,516	362	A.C.	400/230	297·9	..
Te Puke	1921	980	284	..	..	(124)	(606)	20·44	..	412,644	412,644	(362,150)	50,494	12·24	38·05	1,275	369	A.C.	400/230	8·9	..
24. Teviot	1924	1,700	390	750	..	645	1,280	20·87	2,781,525	..	2,781,525	2,225,220‡	556,305‡	20·00‡	49·23	1,572	361	A.C.	400/230	72·0	380
Otago Central	1925	2,537	803	..	..	(400)	(1,790)	22·35	..	1,612,155	1,612,155	(1,335,005)	277,150	17·19	46·01	1,663	526	A.C.	415/240	160·1	..
25. Horahora-Arapuni	1921	..	..	62,800	..	41,520	89,524	15·94	183,023,699	7,706,548	190,730,247	173,003,373	17,726,874	9·29	52·43	..	..	A.C.	..	580·0	27/175
Bay of Plenty	1928	8,525	1,232	..	..	(1,170)	(5,150)	22·72	..	6,088,261	6,088,261	(5,069,063)	1,019,198	16·74	59·40	4,115	595	A.C.	400/230	215·4	..
Cambridge	1921	6,000	1,278	..	..	(654)	(2,694)	24·28	..	3,976,400	3,976,400	(3,101,592)	874,808	22·00	69·41	2,427	517	A.C.	400/230	148·7	..
Central	1921	18,039	3,708	..	..	(1,512)	(9,350)	16·17	..	9,139,675	9,139,675	(7,626,926)	1,512,749	16·55	69·00	2,057	423	A.C.	400/230	451·4	..
Franklin	1925	16,765	2,887	..	295	(1,440)	(6,917)	20·82	..	7,964,207	7,964,207	(6,249,224)	1,714,983	21·53	63·14	2,165	373	A.C.	400/230	403·0	..
Hamilton	1913	15,500	3,745	..	..	(1,075)	(7,813)	13·76	..	3,811,465	3,811,465	(3,225,811)	585,654	15·37	40·47	861	208	A.C.	400/230	49·5	..
Te Awamutu	1921	7,620	1,550	..	..	(912)	(4,848)	18·81	..	5,166,686	5,166,686	(4,357,784)	808,902	15·66	64·67	2,811	572	A.C.	400/230	302·2	..
Thames Valley	1921	34,850	5,570	..	..	(4,609)	(20,205)	22·81	..	28,066,958	28,066,958	(22,889,774)	5,177,184	18·45	69·52	121	19	A.C.	415/240	721·9	..
Thames Borough Council	1914	5,000	1,101	100	105	(397)	(1,601)	24·76	70,000	1,319,100	1,389,100	(872,437)	516,663	37·19	39·99	793	175	A.C./D.C.	400/230 460/230	21·5	130
Te Aroha	1906	2,400	684	150	..	(247)	(1,520)	16·25	146,000	630,460	776,460	(705,975)	70,485	9·08	35·89	1,032	294	A.C.	400/230	15·6	600
Tourist Department (Rotorua)	1901	5,500	1,686	200	187	(551)	(3,681)	14·97	431,922	1,543,735	1,975,657	(1,416,116)	559,541	28·32	40·93	840	257	A.C.	200/115 400/230	47·8	14
Waitemata	1926	39,205	7,468	..	..	(1,340)	(16,456)	8·14	..	10,863,450	10,863,450	(8,980,657)	1,882,793	17·33	57·03	1,203	229	A.C.	400/230	406·4	..
Waitomo	1926	8,000	1,262	..	..	(465)	(2,335)	19·91	..	2,166,774	2,166,774	(1,675,023)	491,751	22·69	53·19	1,327	209	A.C.	400/230	77·0	..
26. Waimea Electric Co.	1912	4,000	672	100	40	105	930	11·29	105,774	62,396	168,170	132,545	35,625	21·18	18·28	197	33	A.C.	400/230	35·3	11/14
27. Wairua	1916	..	44	2,500	..	2,200	10,553	20·21	11,399,620	..	11,399,620	9,975,121	1,424,499	12·50	59·15	..	..	A.C.	400/230	36·8	130
Whangarei	1915	7,000	1,969	..	..	(661)	(4,637)	14·25	..	2,546,750	2,546,750	(2,267,152)	279,598	10·98	43·98	1,136	320	A.C.	400/230	32·2	..
Kamo	1923	600	108	..	..	(27)	(173)	15·61	..	30,141	30,141	(30,141)	..	..	12·74	279	50	A.C.	400/230	4·8	..
28. Wairere	1925	2,000	272	480	..	354	1,346	26·30	1,114,740	..	1,114,740	947,528	167,212	15·00	35·95	3,484	474	A.C.	400/230	91·2	65
29. Westland	1928	4,200	97	620	200	220	795	27·69	482,470	..	482,470	395,546	86,924	18·02	37·50	4,078	94	A.C.	400/230	47·3	250/105
30. Westport	1925	4,000	594	250	..	178	847	20·97	537,040	..	537,040	511,942	25,098	4·67	34·52	862	128	A.C.	400/230	21·5	430
31. Whakatane	1922	1,800	482	240	..	240	1,047	22·93	1,028,930	..	1,028,930	692,096	336,834	32·74	48·94	1,436	385	A.C.	400/230	33·5	258
Totals, Hydro Stations	..	1,142,154	234,917	226,078	13,855	144,954	704,880	16·55	651,784,081	387,081,108	1,038,865,189	891,154,139	147,711,050	23·28	51·33	1,572	484	..	..	17,937·5	..

* Kw. † Hurunui Electric-power Board not yet operating. ‡ Assessed. § Units metered on consumers' premises only, loss born by Tauranga Borough Council. ‖ Purchased the assets of Hawera Electric Supply Co. Records of company's operations since destroyed.

SUMMARY OF HYDRO STATIONS.

Units generated	651,784,081
Units sold by generating-stations	570,826,654
Units non-productive	80,957,427 = 12·4 per cent.

Table XXIX.—Summary of Returns of Operating Results for the Year ended 31st March, 1930.

Title.	Capital Outlay as at 31st March, 1930. (Total Expenditure—Depreciation not deducted.)	Value of Assets at 31st March, 1930. (Total Expenditure, less Total Allowance for Depreciation.)	Total Revenue (not including Rates).	Working-expenses.		Capital Charges, &c.		Total Annual Costs.	Net Results.		Revenue and Expenditure Comparisons.								Retail Selling-rates.		
											Average Revenue from Sale of Energy.		Working-costs.		Capital Charges.		Total Costs.				
				Total.	Per Cent. of Revenue	Total.	Per Cent. of Capital Outlay.		Profit.	Loss.	Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.	Lighting.	Heating.	Power.
	£	£	£	£		£		£	£	£	d.	£	d.	£	d.	£	d.	£	d.	d.	d.
Steam Stations.																					
1. Auckland Power Board ..	2,998,854	2,652,371	645,062	291,346	45·17	195,520	6·52	486,866	158,196	..	1·48	22·52	0·67	10·28	0·45	6·90	1·12	17·18	5 to 2	4½	2½ to $\frac{5}{6}$
																			All less 5 per cent.		
2. Grey Power Board	132,983	132,643	26,455	13,238	50·04	8,869	6·67	22,107	4,348	..	1·79	23·41	0·92	12·03	0·62	8·06	1·54	20·09	7	3 to 1½	2
3. Nelson City Council ..	102,358	88,715	26,929	13,058	48·49	4,900	4·79	17,958	8,971	..	4·06	40·55	2·01	20·09	0·75	7·54	2·76	27·63	8	4 to 2	4 to 1½
Totals, steam stations ..	3,234,195	2,873,729	698,446	317,642	45·48	209,289	6·47	526,931	171,515	..	1·52	22·94	0·70	10·60	0·46	6·95	1·16	17·55	..	..	..
Gas Stations.																					
1. Kaikoura County Council ..	9,839	9,150	1,560	1,688	108·20	746	7·58	2,434	..	874	12·00	50·90	13·27	56·27	5·86	24·87	19·13	81·14	12	12	6
2. Motueka Borough Council ..	15,931	13,098	2,311	2,023	87·54	962	6·04	2,985	..	674	11·55	38·74	10·58	35·49	5·03	16·88	15·61	52·37	12	4	4
Totals, gas stations ..	25,770	22,248	3,871	3,711	95·87	1,708	6·63	5,419	..	1,548	12·19	44·5	11·65	42·66	5·36	19·63	17·01	62·29	..	..	..
Oil Stations.																					
1. Picton Borough Council ..	19,114	16,243	3,236	2,231	68·94	1,249	6·53	3,480	..	244	7·32	49·40	5·05	34·06	2·83	19·07	7·88	53·13	10	4 to 2	4
2. Uawa County Council ..	6,252	4,634	1,325	526	39·70	638	10·20	1,164	161	..	17·14	89·28	7·21	37·57	8·75	45·57	15·96	83·14	17	11	11
Totals, oil stations ..	25,366	20,877	4,561	2,757	60·45	1,887	7·44	4,644	161	244	8·85	57·1	5·35	34·46	3·67	23·60	9·02	58·06	..	..	..
Hydro Stations.																					
1. Coleridge (Public Works Dept.)	1,737,355	1,645,064*	196,648	36,808	18·75	100,137	5·76	136,945	59,703	..	0·41	7·06	0·08	1·34	0·21	3·64	0·29	4·98	..	..	..
Ashburton Power Board ..	340,423	331,355	41,012	20,873	50·89	21,956	6·45	42,829	..	1,817	2·06	27·05	1·06	13·93	1·11	14·66	2·17	28·59	8 to 1	3 to 1	3 to $\frac{10}{9}$
Banks Peninsula Power Board	100,285	96,235	13,134	9,117	69·42	7,373	7·35	16,490	..	3,356	2·68	33·77	1·93	24·31	1·56	19·66	3·49	43·97	10 to 1½	2 to $\frac{3}{8}$	3 to 1½
Christchurch City Council ..	707,704	359,545	237,125	128,424	54·16	34,102	4·82	162,526	74,599	..	1·14	17·34	0·65	9·85	0·17	2·62	0·82	12·47	6 to 1	2 to 1	1¼ to $\frac{1}{2}$
Halswell County Council ..	6,923	4,953	1,900	1,282	67·47	313	4·52	1,595	305	..	1·14	15·37	0·78	10·49	0·19	2·56	0·97	13·05	Flat rate.		
Heathcote County Council ..	33,354	28,554	9,691	6,838	70·56	2,196	6·58	9,034	657	..	1·26	17·24	0·91	12·45	0·29	4·00	1·20	16·45	6 to 4	1½ to 1	3 to 1
Hurunui Power Board† ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton Borough Council ..	6,930	6,930	5,548	4,991	89·96	272	3·92	5,263	285	..	2·07	25·84	1·92	23·99	0·10	1·31	2·02	25·30	4½	1	3 to 1
Malvern Power Board ..	61,818	58,564	7,238	4,247	58·68	4,021	6·50	8,268	..	1,030	2·52	26·56	1·65	17·35	1·56	16·43	3·21	33·78	9 to 1	..	3 to 1
North Canterbury Power Board	124,745	120,455	19,516	10,566	54·14	5,406	4·33	15,972	3,544	..	1·48	21·36	0·83	12·01	0·43	6·14	1·26	18·15	8 to 2	3 to 1	3 to $\frac{8}{10}$
Kaiapoi Borough Council ..	12,907	10,856	3,715	2,265	60·97	894	6·93	3,159	556	..	3·12	27·08	2·33	20·26	0·92	8·00	3·25	28·26	6	1	1
Rangiora Borough Council	11,531	7,977	4,782	3,314	69·30	423	3·67	3,737	1,045	..	2·94	34·08	2·04	23·67	0·26	3·02	2·30	26·69	6 to 2	2½ to 1½	3 to 1
Riccarton Borough Council ..	20,160	16,327	10,444	6,580	63·00	1,137	5·64	7,717	2,727	..	1·24	21·86	0·81	14·28	0·14	2·47	0·95	16·75	6 to 1	1	1½
South Canterbury Power Board	312,615	294,005	51,043	28,160	55·17	20,379	6·52	48,539	2,504	..	1·22	24·22	0·68	13·45	0·49	9·74	1·17	23·19	8 to 1	3 to 1	3 to 1
Timaru Borough Council ..	124,218	89,318	32,921	16,757	50·90	9,161	7·37	25,918	7,003	..	2·23	23·62	1·15	12·19	0·63	6·66	1·78	18·85	7 to 4	3 to 1½	2½ to 1
Springs-Ellesmere Power Board	132,346	128,510	25,816	15,012	58·15	7,870	5·95	22,882	2,934	..	1·58	22·55	0·94	13·40	0·49	7·03	1·43	20·43	8 to 7	3 to 1½	3 to $\frac{1}{2}$
Sumner Borough Council ..	15,577	12,999	6,192	4,162	67·22	511	3·28	4,673	1,519	..	1·80	28·37	1·22	19·18	0·15	2·35	1·37	21·53	5	1	1 to $\frac{1}{2}$
Tai Tapu Dairy Co. ..	10,329	6,562	3,965	3,113	78·51	411	3·98	3,524	441	..	1·47	17·44	1·18	13·97	0·15	1·84	1·33	15·81	Flat rate.		
Waimairi County Council ..	78,446	77,068	22,278	12,979	58·26	3,355	4·28	16,334	5,944	..	1·22	20·46	0·71	11·92	0·18	3·08	0·89	15·00	5 to 1½	2 to 1	3 to $\frac{1}{3}$
Waitaki Power Board ..	167,981	159,869	36,923	17,282	46·81	11,740	6·99	29,022	7,901	..	1·96	29·40	0·95	14·22	0·65	9·66	1·60	23·88	8 to 2	3 to $\frac{1}{2}$	3 to $\frac{2}{3}$
2. Dunedin City Council (Waipori)	1,488,904	1,450,879	218,451	61,972	28·37	76,429	5·13	138,401	80,050	..	1·02	15·06	0·29	4·32	0·36	5·33	0·65	9·65	6 to 1	2 to $\frac{1}{2}$	2 to $\frac{1}{3}$
Otago Power Board ..	281,198	273,556	34,345	20,469	59·60	20,587	7·32	41,056	..	6,711	1·68	20·58	1 00	12 31	1·01	12·38	2·01	24·69	8	1½	1
3. Golden Bay Power Board ..	21,532	21,304	1,213	602	49·63	1,529	7·10	2,131	..	918	1·21	5·60	0·65	3·01	1·66	7·64	2·31	10·65	9	4½ to 1	4½ to 1½
4. Havelock North Town Board..	23,997	23,997	2,918	1,121	38·42	1,967	8·20	3,088	..	170	2·25	31·82	0·88	12·46	1·55	21·86	2·43	34·32	7	2	2
5. Kanieri Electric Co... ..	43,172	32,384	8,563	5,294	61·82	..	..	5,294	3,269	..	0·70	13·97	0·44	8·82	..	..	0·44	8·82	6	1½	4 to 2
6. Kaponga Town Board ..	24,507	23,052	6,023	4,051	67·26	1,670	6·81	5,721	302	..	3·07	28·43	2·14	19·76	0·88	8·15	3·02	27·91	9	4 to ¼	5 to 2
7. Mangahao-Waikaremoana (Public Works Dept.)	3,426,901	3,203,636	259,461	59,235	23·73	191,288	5·6	250,523	8,938	..	0·39	6·78	0·089	1·56	0·381	6·71	0·47	8·27	..	..	..
Central Hawke's Bay Power Board	133,787	123,139	21,563	9,512	44·10	8,253	6·17	17,765	3,798	..	1·65	29·78	9·76	13·71	0·66	11·89	1·42	25·60	10	3 to 1½	3 to 1½
Dannevirke Power Board ..	199,880	195,609	27,080	11,110	41·03	13,358	6·68	24,468	2,612	..	2·49	42·79	1·05	18·01	1·26	21·65	2·31	39·66	8	3 to 1½	3 to 1
Hawke's Bay Power Board	221,611	216,888	47,520	30,893	65·01	13,701	6·18	44,594	2,926	..	0·75	14·74	0·52	10·14	0·23	4·49	0·75	14·63	8 to 1½	8 to 1½	3 to 1½
Hastings Borough Council	111,408	103,408	25,114	14,196	56·53	5,385	4·83	19,581	5,533	..	2·32	31·21	1·31	17·68	0·50	6·71	1·81	24·39	8 to 1½	4 to 1½	3 to 1½
Napier Borough Council	159,940	158,341	38,298	23,040	60·16	8,674	5·42	31,714	6,584	..	1·80	26·60	1·10	16·22	0·41	6·12	1·51	22·34	6 to 1½	3 to 1½	3 to 1½
Horowhenua Power Board..	195,472	184,380	45,854	27,008	58·90	13,018	6·65	40,026	5,828	..	1·47	20·67	0·90	12·61	0·43	6·08	1·33	18·69	8	4 to 1½	4 to 1½
Hutt Valley Power Board ..	370,922	341,830	98,603	59,202	60·04	25,558	6·89	84,760	13,843	..	1·65	22·47	1·01	13·70	0·43	5·92	1·44	19·62	6 to 5	3 to 1	3 to 1
Manawatu-Oroua Power Bd.	494,695	479,687	72,670	37,409	51·48	29,645	5·99	67,054	5,616	..	1·00	20·64	0·52	10·80	0·42	8·56	0·94	19·36	8	3½ to 1½	4½ to 1¾
Palmerston N. City Council	213,398	200,037	56,069	20,484	36·53	12,750	5·97	33,234	22,835	..	1·71	29·03	0·64	10·86	0·40	6·76	1·04	17·62	6	1½	3 to 1¾
Poverty Bay Power Board..	305,301	290,755	49,020	23,691	48·33	19,498‡	6·39	43,189†	5,831	..	3·00	35·81	1·49	17·81	1·23	14·66	2·72	32·47	8 to 6	4 to 2½	4 to 2¼
Tararua Power Board ..	157,810	151,498	22,055	9,915	44·96	9,457	5·99	19,372	2,683	..	1·87	34·54	0·88	16·33	0·84	15·57	1·72	31·90	8	4 to $\frac{8}{10}$	4½ to $\frac{5}{8}$

(For notes see page 136.)

TABLE XXIX.—SUMMARY OF RETURNS OF OPERATING RESULTS FOR THE YEAR ENDED 31ST MARCH, 1930—*continued.*

Title.	Capital Outlay as at 31st March, 1930. (Total Expenditure—Depreciation not deducted).	Value of Assets at 31st March, 1930. (Total Expenditure, less Total Allowance for Depreciation.)	Total Revenue (not including Rates).	Working-expenses.		Capital Charges, &c.		Total Annual Costs.	Net Results.		Revenue and Expenditure Comparisons.								Retail Selling-rates.		
				Total.	Per Cent. of Revenue	Total.	Per Cent. of Capital Outlay.		Profit.	Loss.	Average Revenue from Sale of Energy.		Working-costs.		Capital Charges.		Total Costs.		Lighting.	Heating.	Power.
											Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.	Per Unit sold.	Per Kw. of Max.			
HYDRO STATIONS—*continued.*	£	£	£	£		£		£	£	£	d.	£	d.	£	d.	£	d.	£	d.	d.	d.
7. Mangahao-Waikaremoana (Public Works Dept.)—*contd.*																					
Wairarapa Power Board ..	349,901	345,602	49,425	19,887	40·24	24,242	6·93	44,129	5,296	..	2·10	39·69	0·88	16·71	1·08	20·37	1·96	37·08	7	3½ to 1¾	4½ to 2
Wairoa Power Board ..	55,595	53,236	12,355	9,546	77·26	4,019	7·23	13,565	..	1,210	1·06	15·09	0·83	11·87	0·35	5·00	1·18	16·87	10 to 1	10 to 1	10 to 1
Wairoa Borough Council	19,743	11,790	7,868	5,081	64·58	1,416	7·17	6,497	1,371	..	1·47	31·45	0·99	21·17	0·27	5·90	1·26	27·07	6	3 to 1	3 to 1½
Wanganui-Rangitikei Power Board	528,291	465,181	97,158	48,170	49·58	35,272	6·68	83,442	13,716	..	1·64	27·12	0·84	14·00	0·62	10·25	1·46	24·25	5	2½ to 1½	3 to 1
Mangaweka Town Board	5,580	5,434	1,263	772	61·12	128	2·29	900	363	..	2·96	30·44	2·51	25·74	0·42	4·27	2·93	30·01	10	3 to 2	4½
Wellington City Council ..	1,094,199	1,070,199	359,049	162,872	45·36	37,132	3·39	200,004	159,045	..	2·07	23·08	0·94	10·56	0·21	2·41	1·15	12·97	6 to 1	2 to 1	2½ to 1
8. Marlborough Power Board ..	308,769	302,186	25,725	6,582	25·59	21,648	7·01	28,230	..	2,505	1·66	25·51	0·44	6·79	1·45	22·32	1·89	29·11	9	2½ to 1½	4½ to 1½
9. Mataura Borough Council ..	4,767	4,343	1,507	1,514	100·46	234	4·91	1,748	..	241	4·07	18·67	4·59	21·03	0·71	3·25	5·30	24·28	6	2½	2½ to 1½
10. Murchison County Council§ ..	13,925	13,925	1,234	595	48·22	974	6·99	1,569	..	335	3·45	14·50	1·77	7·44	2·89	12·18	4·66	19·62	6	3	3
11. New Plymouth Borough Council	407,459	330,806	71,418	32,549	45·58	25,539	6·27	58,088	13,330	..	1·47	23·78	0·69	11·22	0·54	8·81	1·23	20·03	7 to 5	2 to 1	2 to ¾
Inglewood Borough Council	12,644	8,590	3,847	2,313	60·12	750	5·93	3,063	784	..	2·40	26·71	1·52	17·01	0·49	5·51	2·01	22·52	6	2	2 to 1¾
Waitara Borough Council ..	11,850	5,998	3,842	2,094	54·50	900	7·59	2,994	848	..	3·57	38·46	1·96	22·04	0·84	9·47	2·80	31·51	9	3 to 1	3 to 1
12. Ohakune Borough Council ..	18,176	15,551	4,790	1,767	36·89	989	5·44	2,756	2,034	..	4·65	42·14	1·74	15·78	0·97	8·83	2·71	24·61	9	3 to 1	4 to 2
13. Opunake Power Board ..	103,708	103,708	12,522	5,419	43·28	7,986	7·70	13,405	..	883	2·29	32·09	1·02	14·26	1·50	21·02	2·52	35·28	4 to 3	2	2
14. Patea Borough Council ..	12,573	12,520	4,094	2,548	62·24	605	4·81	3,153	941	..	3·12	38·17	1·96	24·03	0·47	5·71	2·43	29·74	8½ to 6½	4 to 3	3⅜ to 1
15. Queenstown Borough Council	12,437	12,437	1,499	529	35·29	816	6·56	1,345	154	..	3·02	18·99	1·42	8·89	1·73	10·88	3·15	19·77	6	6	3
16. Raetihi Borough Council ..	37,178	32,678	4,398	2,038	46·34	1,912	5·14	3,950	448	..	2·24	21·76	1·08	10·45	1·01	9·81	2·09	20·26	10 to 3	1	3 to 1½
17. Reefton Electric Co. ..	4,976	4,492	3,780	2,143	56·69	..	..	2,143	1,637	..	8·35	47·67	5·69	32·47	..	..	5·69	32·47	Flat rate.		
18. Southland Power Board ..	1,654,870	1,636,507	117,291	51,463	43·88	115,500	6·98	166,963	..	49,672	1·55	17·29	0·74	8·23	1·65	18·48	2·39	26·71	7	4 to ½	2½ to 1½
Bluff Borough Council ..	10,363	9,214	4,037	2,826	70·00	682	6·58	3,508	529	..	2·82	15·84	2·17	12·18	0·52	2·94	2·69	15·12	7 to 6	2	3 to 1 7/16
Invercargill City Council ..	165,567	164,217	50,085	27,750	55·41	10,848	6·55	38,598	11,487	..	2·17	25·13	1·30	15·01	0·51	5·87	1·81	20·88	6 3/16 to 1⅝	..	2 7/16 to 1
19. South Taranaki Power Board‖	143,337	142,091	11,230	4,677	41·65	3,961	2·76	8,638	2,592	..	3·40	16·44	1·47	7·12	1·25	6·03	2·72	13·15	7⅛	3⅜ to 1½	3⅜ to 2
20. Taranaki Power Board ..	462,219	451,774	42,321	12,843	30·35	32,284	6·98	45,127	..	2,806	1·42	20·52	0·44	5·10	1·10	12·81	1·54	17·91	6	3 to 1½	4½ to 1
Stratford Borough Council	28,351	28,101	12,512	6,318	50·50	3,426	12·08	9,744	2,768	..	2·11	38·00	1·07	19·26	0·58	10·45	1·65	29·71	8	4 to 1½	4 to 1
21. Taihape Borough Council ..	18,590	9,528	5,885	2,638	44·83	1,081	5·81	3,719	2,166	..	3·42	26·29	1·58	12·16	0·65	4·98	2·23	17·14	8	1½	2
22. Taumarunui Borough Council	60,939	60,939	9,572	2,667	27·86	4,410	7·24	7,077	2,495	..	2·76	19·84	0·81	5·80	1·33	9·59	2·14	15·39	9 to 7	3 to 1½	3 to 9/16
Manunui Town Board ..	3,266	3,266	505	361	71·49	250	7·65	611	..	106	8·62	31·56	6·17	22·56	4·27	15·63	10·44	38·19	9	4½	4½
23. Tauranga Borough Council ..	150,225	146,500	25,510	6,905	27·07	10,393	6·9	17,298	8,212	..	0·45	6·98	0·12	1·93	0·19	2·91	0·31	4·84	7	1⅛ to 1	2 to 1
Tauranga Power Board ..	125,565	120,995	23,012	12,779	55·53	7,889	6·28	20,668	2,344	..	1·64	..	1·00	..	0·62	..	1·62	..	10 to 1¼	10 to 1¼	3 to 1
Te Puke Town Board ..	11,141	6,672	2,982	1,480	49·63	562	5·04	2,042	940	..	1·92	23·50	0·98	11·95	0·37	4·54	1·35	16·49	7	2¼ to 1½	2½ to 1½
24. Teviot Power Board ..	55,866	55,599	5,910	1,442	24·40	3,704	6·63	5,146	764	..	0·62	8·93	0·16	2·24	0·40	5·74	0·56	7·98	3 to ½	3 to ½	3 to ½
Otago Central Power Board	85,859	84,570	8,718	2,582	29·62	6,587	7·67	9,169	..	451	1·47	20·47	0·46	6·46	1·18	16·47	1·64	22·93	8 to 1	8 to 2	6 to 2
25. Horahora – Arapuni (Public Works Dept.)	3,692,131	3,528,343	225,683	62,571	27·78	135,622	3·67	198,193	27,490	..	0·31	5·35	0·09	1·51	0·13	3·27	0·22	4·78	..	..	..
Bay of Plenty Power Board	186,129	183,244	28,318	17,705	62·52	12,724	6·84	30,429	..	2,111	1·30	23·38	0·84	15·13	0·60	10·87	1·44	26·00	10	4 to 1½	3 to 1½
Cambridge Power Board ..	106,030	106,030	19,634	10,333	52·63	7,453	7·03	17,786	1,848	..	1·41	27·88	0·80	15·80	0·58	11·40	1·38	27·20	7½ to 4½	3 to ¾	3 to ¾
Central Power Board ..	296,604	286,984	51,144	24,707	48·31	20,275	6·84	44,982	6,162	..	1·58	33·10	0·78	16·34	0·64	13·41	1·42	29·75	8	1½	3
Franklin Power Board ..	242,929	212,582	45,512	20,351	44·72	16,059	6·61	36,410	9,102	..	1·52	27·48	0·78	14·13	0·62	11·15	1·40	25·28	7½	1½	3 to 2
Hamilton Borough Council	74,088	55,037	37,969	24,708	65·07	4,899	6·61	29,607	8,362	..	2·82	35·22	1·84	22·98	0·36	4·56	2·20	27·54	5½ to 4	2	2 to 1
Te Awamutu Power Board	174,379	172,697	28,307	13,303	47·00	11,083	6·36	24,386	3,921	..	1·52	30·29	0·73	14·59	0·61	12·15	1·34	26·74	8 to 7	2 to 1½	3 to 1½
Thames Valley Power Board	790,532	790,532	136,662	75,757	55·43	55,971	7·08	131,728	4,934	..	1·38	28·55	0·79	16·44	0·59	12·14	1·38	28·58	8	3 to 1½	3 to 1/16
Thames Borough Council	33,647	24,463	11,400	9,023	79·15	1,268	3·77	10,291	1,109	..	3·11	28·49	2·48	22·76	0·35	3·20	2·83	25·96	8	3 to 1½	3 to ½
Te Aroha Borough Council	23,597	16,405	7,202	4,383	60·86	610	2·59	4,993	2,209	..	2·42	28·84	1·49	17·74	0·21	2·47	1·70	20·21	7 to 5	3 to ½	3 to ½
Tourist Dept. (Rotorua) ..	68,180	57,705	17,126	6,811	39·77	6,135	9·00	12,946	4,180	..	2·82	30·16	1·15	12·36	1·04	11·13	2·19	23·49	7 to 6	3 to 1½	3 to 1
Waitemata Power Board ..	364,550	357,724	68,935	38,925	56·47	24,858	6·82	63,783	5,152	..	1·78	30·31	1·04	17·66	0·66	11·28	1·70	28·94	7	3 to 1¾	3 to 1¾
																			All less 12½ per cent.		
Waitomo Power Board ..	92,312	92,312	17,288	10,574	61·16	7,061	7·65	17,635	..	347	2·34	35·08	1·51	22·74	1·01	15·18	2·52	37·92	10	3 to 1	3 to 1½
26. Waimea Electric Co. ..	20,813	18,863	4,751	2,974	62·60	363	1·74	3,337	1,414	..	8·03	42·24	5·39	28·32	0·66	3·46	6·05	31·78	11	4	4
27. Wairua (Wilson's Cement Co.)	91,164	38,201	15,904	6,188	38·91	..	..	6,188	9,716	..	0·37	7·05	0·15	2·81	..	..	0·15	2·81	5½ to 5	1½	3 to 2½
Whangarei Borough Council	58,409	58,022	22,808	15,433	67·66	2,143	3·67	17,576	5,232	..	2·39	34·20	1·63	23·35	0·23	3·25	1·86	26·60	5½ to 5	1½	3 to 2
Kamo Town Board ..	3,311	2,500	842	583	69·24	232	7·01	815	27	..	6·45	30·00	4·64	21·59	1·85	8·59	6·49	30·18	9	4	4 to 3
28. Wairere Power Board ..	38,447	37,562	4,580	1,541	33·65	2,948	7·67	4,489	91	..	1·14	12·66	0·39	4·35	0·75	8·33	1·14	12·68	9	4½	1
29. Westland Power, Ltd.¶ ..	73,871	73,871	2,108	2,563	121·58	..	..	2,563	..	455	0·97	7·29	1·55	11·65	..	..	1·55	11·65	8 to 6	2½ to 1½	2
30. Westport Borough Council ..	30,534	28,288	6,134	1,980	32·28	2,304	7·55	4,284	1,850	..	2·84	34·10	0·93	11·15	1·08	12·97	2·01	24·12	9	3 to 1	3 to 2
31. Whakatane Borough Council..	56,155	5,747	2,023	35·20	3,368	6·00	5,391	356	..	1·84	22·15	0·70	8·43	1·17	14·03	1·87	22·46	9	1½	3 to 1
Totals, hydro stations ..	24,375,823	22,845,445	3,508,109	1,547,560	44·18	1,365,939	5·64	2,913,499	669,734	75,124	**0·92	24·1	**0·42	10·69	**0·37	9·42	**0·79	20·11	..	..	..

* Includes £22,865 for stocks of material on hand and not absorbed in scheme. † Hurunui Electric-power Board not yet operating. ‡ Including £1,168 repayment of loans. § Murchison County Council plant idle for six months.
‖ South Taranaki Electric-power Board purchased Hawera Electric Company's system, and in operation for five months only. Boards of Hawera Company since destroyed. ¶ Westland Power, Ltd., figures cover period of eight months.
** Units sold by generating-stations, 570,826,654; and corresponding figures per unit are—Revenue, 1·48d.; working-costs, 0.655d.; capital, 0·575d.: total, 1·23d.

Table XXX.—Electric-supply Stations.—Appropriations for the Year ended 31st March, 1930.

Title.	Ownership.	Supply commenced.	Appropriations. (N.B.—These do not necessarily presuppose a credit balance for the year's operations.)									Accumulated Funds.				
			To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Payment of Dividends.	Capital Expenditure (out of Revenue).	Unappropriated Surplus.	Total.	Depreciation.	Renewal.	Sinking.	Reserves.	Total.
Steam Stations.			£	£	£	£	£	£	£	£	£	£	£	£	£	£
1. Auckland	Power Board	1908	62,390	..	16,530	..	..	..	74,693	4,583	158,196	..	..	408,662	..	408,662
2. Grey	Power Board	1926	1,332	..	..	..	..	..	..	3,016	4,348	..	..	11,554	..	11,554
3. Nelson	City Council	1923	2,846	..	..	..	..	..	6,125	..	8,971	..	..	9,401	..	9,401
Totals, steam stations	..	..	66,568	..	16,530	..	..	..	80,818	7,599	171,515	..	..	429,617	..	429,617
Gas Stations.																
1. Kaikoura	County Council	1922	..	..	..	..	..	..	..	..	..	..	..	798	..	798
2. Motueka	Borough Council	1922	709	..	..	..	..	..	..	..	709	..	..	1,740	..	1,740
Totals, gas stations	..	..	709	..	..	..	..	..	..	..	709	..	..	2,538	..	2,538
Oil Stations.																
1. Picton	Borough Council	1917	..	..	..	..	..	..	..	..	..	..	..	1,568	..	1,568
2. Uawa (Tolaga Bay)	County Council	1925	..	..	..	..	..	..	6	155	161	..	..	1,618	..	1,618
Totals, oil stations	..	..	..	..	..	..	..	..	6	155	161	..	..	3,186	..	3,186
Hydro Stations.																
1. Coleridge	Public Works Dept.	1915	15,315	..	44,388	..	..	..	..	..	59,703	188,294	..	144,557	44,388	377,239
Ashburton	Power Board	1923	2,876	..	..	..	..	..	..	..	2,876	..	11,388	17,031	..	28,419
Banks Peninsula	Power Board	1921	..	..	..	..	..	..	..	..	..	4,050	..	8,592	..	12,642
Christchurch	City Council	1904	31,813	..	..	..	23,475*	..	571	18,740	74,599	..	..	164,302	..	164,302
Halswell	County Council	1919	..	..	..	..	..	..	93	212	305	..	..	657	..	657
Heathcote	County Council	1914	..	..	..	..	..	..	..	657	657	..	..	5,308	..	5,308
Hurunui	Power Board†	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton	Borough Council	1917	..	..	..	..	..	..	..	285	285	..	..	205	..	205
Malvern	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	3,121	..	3,121
North Canterbury	Power Board	1928	1,818	..	..	..	..	..	..	1,726	3,544	812	..	5,366	..	6,178
Kaiapoi	Borough Council	1917	492	..	..	..	..	..	..	64	556	..	..	1,180	..	1,180
Rangiora	Borough Council	1919	407	..	..	..	..	..	235	403	1,045	..	..	1,003	..	1,003
Riccarton	Borough Council	1916	444	..	..	..	..	..	498	1,785	2,727	583	..	634	..	1,217
South Canterbury	Power Board	1925	3,216	..	..	..	..	..	..	..	3,216	4,705	..	19,647	..	24,352
Timaru	Borough Council	1908	..	..	..	..	2,276	..	3,847	880	7,003	..	..	37,544	..	37,544
Springs-Ellesmere	Power Board	1922	1,838	..	..	..	..	..	..	1,096	2,934	3,203	..	7,094	..	10,297
Sumner	Borough Council	1918	382	..	..	..	..	..	..	1,137	1,519	..	..	1,281	..	1,281
Tai Tapu Dairy Co.	Company	1915	365	..	..	..	..	..	..	76	441	1,102	..	..	..	1,102
Waimairi	County Council	1916	..	..	..	..	..	..	3,944	2,000	5,944	..	..	3,291	..	3,291
Waitaki	Power Board	1926	2,100	..	1,589	..	..	..	..	4,212	7,901	6,286	..	11,297	1,624	19,207

(For notes see page 139.)

TABLE XXX.—ELECTRIC-SUPPLY STATIONS.—APPROPRIATIONS FOR THE YEAR ENDED 31ST MARCH, 1930—*continued.*

Title.	Ownership.	Supply commenced.	Appropriations. (N.B.—These do not necessarily presuppose a credit balance for the year's operations.)									Accumulated Funds.				
			To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Payment of Dividends.	Capital Expenditure (out of Revenue).	Unappropriated Surplus.	Total.	Depreciation.	Renewal.	Sinking.	Reserves.	Total.
HYDRO STATIONS—*continued.*			£	£	£	£	£	£	£	£	£	£	£	£	£	£
2. Dunedin (Waipori) ..	City Council ..	1907	23,276	33,183	..	..	16,384	..	6,957	250	80,050	128,750	146,854	121,525	..	397,129
Otago	Power Board ..	1926	4,006	..	..	..	..	..	..	..	4,006	..	..	15,105	..	15,105
3. Golden Bay	Power Board ..	1929	229	..	..	..	..	..	..	..	229	229	..	221	..	450
4. Havelock North ..	Town Board ..	1916	..	..	..	..	..	..	..	..	..	..	..	6,421	..	6,421
5. Kanieri Electric, Ltd. (Hokitika)	Company ..	1921	1,303	..	..	..	..	..	..	1,966	3,269	..	..	..	..	..
6. Kaponga	Town Board ..	1916	..	..	..	..	..	..	..	302	302	..	..	1,856	..	1,856
7. Mangahao-Waikaremoana	Public Works Dept.	1925	62,205	..	..	..	..	..	..	..	62,205	223,257	..	..	..	223,257
Central Hawke's Bay	Power Board ..	1925	2,283	200	65	..	..	..	..	1,250	3,798	6,730	..	1,509	730	8,969
Dannevirke	Power Board ..	1925	1,988	..	..	..	..	..	..	624	2,612	..	..	8,268	100	8,368
Hawke's Bay ..	Power Board ..	1927	2,531	..	..	..	..	..	..	395	2,926	2,192	..	8,690	..	10,882
Hastings	Borough Council ..	1912	991	..	..	..	153	..	1,658	2,731	5,533	2,378	..	9,259	..	11,637
Napier	Borough Council ..	1913	3,285	..	..	..	..	..	..	3,299	6,584	14,435	..	9,920	10,486	34,841
Horowhenua ..	Power Board ..	1924	2,533	..	..	100	..	..	..	3,205	5,828	11,092	..	7,740	8,000	26,832
Hutt Valley ..	Power Board ..	1925	7,083	2,000	2,750	..	..	..	1,800	210	13,843	29,092	..	16,016	..	45,108
Manawatu-Oroua ..	Power Board ..	1924	5,268	..	..	..	..	..	..	348	5,616	3,085	..	41,543	..	44,628
Palmerston North ..	City Council ..	1924	4,700	..	..	..	2,800	..	..	15,335	22,835	4,700	4,370	15,486	..	24,556
Poverty Bay ..	Power Board ..	1912	3,756	..	..	..	..	..	..	2,075	5,831	1,708	..	10,316	..	12,024
Tararua	Power Board ..	1925	2,610	480	..	..	29	..	663	..	3,782	5,106	..	11,180	..	16,286
Wairarapa	Power Board ..	1924	2,291	..	..	..	..	..	..	3,005	5,296	..	..	13,589	..	13,589
Wairoa	Power Board ..	1923	846	..	..	..	..	..	..	..	846	2,358	..	4,911	..	7,269
Wairoa	Borough Council ..	1913	372	..	..	..	..	..	445	554	1,371	372	..	3,192	..	3,564
Wanganui-Rangitikei	Power Board ..	1924	14,607	..	1,157	..	..	..	..	..	15,764	..	..	24,940	4,000	28,940
Mangaweka ..	Town Board ..	1913	..	..	..	..	..	..	..	362	362	..	..	1,084	..	1,084
Wellington	City Council ..	1888	..	19,565	19,565	..	..	..	60,525	59,390	159,045	..	96,226	167,870	59,860	323,956
8. Marlborough	Power Board ..	1927	2,523	..	..	..	..	..	..	..	2,523	..	..	13,975	..	13,975
9. Mataura	Borough Council ..	1913	..	..	..	..	..	..	..	..	..	..	..	216	..	216
10. Murchison	County Council‡ ..	1922	..	..	..	..	..	..	1,566	..	1,566	..	..	1,570	..	1,570
11. New Plymouth ..	Borough Council ..	1905	..	..	..	..	..	..	8,316	5,014	13,330	13,541	..	56,092	29	69,662
Inglewood	Borough Council ..	1905	490	..	..	..	..	..	..	294	784	..	..	2,775	..	2,775
Waitara	Borough Council ..	1907	300	..	..	..	400	..	..	148	848	..	..	2,153	..	2,153
12. Ohakune	Borough Council ..	1914	378	..	..	..	1,000	..	525	131	2,034	..	..	2,614	..	2,614
13. Opunake	Power Board ..	1924	..	..	..	..	..	..	..	..	..	..	..	13,600	..	13,600
14. Patea	Borough Council ..	1901	53	..	..	..	817	..	71	..	941	53	..	212	..	265
15. Queenstown	Borough Council ..	1924	..	..	..	..	..	..	..	154	154	..	..	550	..	550
16. Raetihi	Borough Council ..	1917	..	..	..	..	..	..	1,032	..	1,032	..	..	3,899	..	3,899
17. Reefton Electric Light and Power Co., Ltd.	Company ..	1887	236	..	..	..	..	375	..	1,026	1,637	..	..	..	..	..
18. Southland	Power Board ..	1925	..	..	..	..	..	..	2,213	..	2,213	13,845	..	204,584	..	218,429
Bluff	Borough Council ..	1903	303	..	..	..	..	..	205	21	529	1,181	..	704	..	1,885
Invercargill	City Council ..	1914	..	..	..	..	6,159	..	4,150	1,178	11,487	..	32,223	26,791	..	59,014

(For notes see page 139.)

TABLE XXX.—ELECTRIC-SUPPLY STATIONS.—APPROPRIATIONS FOR THE YEAR ENDED 31ST MARCH, 1930—*continued.*

Title.	Ownership.	Supply commenced.	Appropriations. (N.B.—These do not necessarily presuppose a credit balance for the year's operations.)									Accumulated Funds.				
			To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Payment of Dividends.	Capital Expenditure (out of Revenue).	Unappropriated Surplus.	Total.	Depreciation.	Renewal.	Sinking.	Reserves.	Total.
HYDRO STATIONS—*continued.*			£	£	£	£	£	£	£	£	£	£	£	£	£	£
19. South Taranaki ..	Power Board§ ..	1903	150	..	200	..	..	..	1,246	996	2,592	150	..	1,086	330	1,566
20. Taranaki	Power Board ..	1927	..	..	..	..	..	..	..	..	..	..	..	16,688	..	16,688
Stratford	Borough Council ..	1898	250	..	..	..	..	..	637	1,881	2,768	250	..	5,367	..	5,617
21. Taihape	Borough Council ..	1913	508	..	..	..	1,000	..	88	570	2,166	829	..	3,469	..	4,298
22. Taumarunui	Borough Council ..	1924	800	..	..	..	1,000	..	687	8	2,495	2,111	..	1,568	..	3,679
Manunui	Town Board ..	1929	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23. Tauranga	Borough Council ..	1915	500	..	..	..	..	..	1,074	..	1,574	..	..	15,557	..	15,557
Tauranga	Power Board ..	1926	1,581	..	..	..	..	..	341	422	2,344	1,489	..	5,611	..	7,100
Te Puke	Town Board ..	1921	213	..	..	..	..	..	..	727	940	1,727	..	1,037	..	2,764
24. Teviot	Power Board ..	1924	24	..	..	..	..	..	1,385	355	1,764	267	..	3,964	..	4,231
Otago Central ..	Power Board ..	1925	..	..	..	..	..	..	..	..	..	1,289	..	3,565	..	4,854
25. Horahora-Arapuni ..	Public Works Dept.	1921	60,258	..	..	..	..	..	..	..	60,258	165,758	..	54,445	..	220,203
Bay of Plenty ..	Power Board ..	1928	..	..	..	..	..	..	..	..	..	..	..	3,959	..	3,959
Cambridge	Power Board ..	1921	713	..	350	..	..	..	..	785	1,848	825	..	10,498	..	11,323
Central	Power Board ..	1921	3,427	..	..	..	..	..	..	2,735	6,162	3,971	6,139	23,112	..	33,222
Franklin	Power Board ..	1925	7,539	..	1,000	..	..	..	..	563	9,102	13,104	..	8,221	7,634	28,959
Hamilton	Borough Council ..	1913	..	2,130	..	..	6,067	..	1,108	..	9,305	..	12,014	17,143	6,691	35,848
Te Awamutu ..	Power Board ..	1921	1,000	..	..	..	95‖	..	35	2,791	3,921	682	..	10,592	..	11,274
Thames Valley ..	Power Board ..	1921	3,902	..	..	..	..	..	..	1,032	4,934	6,508	..	79,532	..	86,040
Thames	Borough Council ..	1914	312	..	..	..	..	..	..	797	1,109	1,327	..	5,060	..	6,387
Te Aroha	Borough Council ..	1906	350	..	..	..	..	..	146	1,713	2,209	7,192	..	1,519	..	8,711
Tourist Dept. (Rotorua)	Government ..	1901	1,363	..	2,817	..	..	..	..	..	4,180	10,475	..	10,475	..	20,950
Waitemata	Power Board ..	1926	2,500	..	..	..	..	..	969	1,683	5,152	..	..	29,257	10,000	39,257
Waitomo	Power Board ..	1926	..	..	..	..	..	..	..	..	..	..	..	2,757	..	2,757
26. Waimea Electric Co. ..	Company ..	1912	1,030	..	..	..	..	..	..	384	1,414	..	..	..	..	..
27. Wairua (Wilson's Cement Co.)	Company ..	1916	..	..	..	..	..	..	..	9,716	9,716	..	..	..	..	..
Whangarei	Borough Council ..	1915	1,480	..	..	..	..	..	2,558	1,194	5,232	2,843	..	3,466	..	6,309
Kamo	Town Board ..	1923	..	..	..	..	..	..	27	..	27	..	..	474	..	474
28. Wairere	Power Board ..	1925	91	..	..	..	..	..	..	..	91	885	..	635	..	1,520
29. Westland Power, Ltd. ..	Company¶ ..	1928	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30. Westport	Borough Council ..	1925	643	..	..	..	..	..	602	605	1,850	1,608	..	3,268	..	4,876
31. Whakatane	Borough Council ..	1922	..	..	..	..	..	..	..	356	356	..	..	6,265	..	6,265
Totals, hydro stations ..	..	..	300,136	57,558	73,881	100	61,655	375	110,217	165,853	769,775	896,429	309,214	1,591,076	153,872	2,950,591

* On loan to municipal department. † Hurunui Power Board; not yet in operation. ‡ Murchison County Council; plant idle for six months. § South Taranaki Power Board; in operation for five months only.
‖ Rates and bad debts written off. ¶ Westland Power, Ltd.; figures cover a period of eight months only.

Table XXXI.—Return of Electric Ranges, Water-heaters, and Milking-machines.

Table showing the Number of Electric Ranges, Water-heaters, and Milking-machines connected to Electric-supply Systems as at 31st March, 1930.

Licensee.	Number of Consumers.	Ranges.				Water-heaters.			Milking-machines.		
		2 to 5 Kilowatts.	5 Kilowatts and over.	Total.	Percentage of Number of Consumers.	Number.	Total Kilowatts.	Percentage of Number of Consumers.	Number.	Horse-power	Not yet electrified.
Ashburton Power Board	3,444	38	621	659	19·15	398	801·0	11·57	44	77·0	60
Auckland Power Board	44,108	..	4,512	4,512	10·23	9,562	6,060·0	21·68	91	180	..
Banks Peninsula Power Board	955	27	142	169	17·69	158	228·0	16·55	176	222	..
Bluff Borough Council	421	1	..	1	0·24	..	..	..	..	..	..
Bay of Plenty Power Board	1,232	23	378	401	32·50	777	534·0	63·00	432	787	25
Cambridge Power Board	1,278	8	119	127	9·94	402	308·0	31·45	289	490	7
Central Hawke's Bay Power Board	1,472	6	140	146	9·91	227	226·0	15·40	68	133	..
Central Power Board	3,708	26	206	232	6·26	1,008	632·8	27·18	919	1,734	90
Christchurch City Council	25,600	..	3,205	3,205	11·50	3,690	3,862·0	13·50	..	..	..
Coleridge (Public Works Department)	78	31	12	43	..	36	9·0	..	..	..	..
Dannevirke Power Board	2,186	..	139	139	6·40	307	209·0	14·04	286	401	154
Dunedin City Council	22,722	..	960	960	4·22	1,419	1,415·0	6·24	154	307	..
Franklin Power Board	2,887	..	337	337	11·67	883	520·0	30·59	735	863	..
Golden Bay Power Board	204	7	12	19	9·30	15	13·0	7·30	17	27	25
Grey Power Board	2,093	4	81	85	4·06	91	95·0	4·35	5	12	..
Halswell County Council	243	18	6	24	9·88	10	8·0	4·12	15	39	1
Hamilton Borough Council	3,745	8	70	78	2·08	108	75·0	2·88	..	..	..
Hastings Borough Council	3,263	7	111	118	3·61	28	18·0	0·85	..	..	..
Havelock North Town Board	278	26	2	28	10·07	8	7·3	2·87	..	..	..
Hawke's Bay Power Board	2,176	..	332	332	15·70	343	224·0	15·76	102	173	..
Heathcote County Council	1,197	45	240	285	23·80	250	230·0	20·80	4	12	..
Horowhenua Power Board	3,301	..	445	445	13·40	769	237·0	23·20	536	745	..
Hutt Valley Power Board	9,521	81	1,072	1,153	12·10	928	1,076·0	9·74	61	108	..
Inglewood Borough Council	416	3	23	26	6·20	19	17·0	4·50	1	2·5	..
Invercargill City Council	4,670	10	102	112	2·20	1	1·0	..	3	6	..
Kaiapoi Borough Council	450	20	5	25	5·54	2	2·0	0·44	..	..	..
Kaikoura County Council	146	..	..	..	..	..	..	..	..	..	..
Kamo Town Board	108	1	..	1	1·00	..	..	..	..	..	..
Kanieri Electric Light, Ltd.	565	3	8	11	1·94	8	7·6	1·41	..	..	..
Kaponga Town Board	353	7	12	19	5·40	43	25·8	12·20	100	201	38
Lyttelton Borough Council	664	..	30	30	4·50	13	15·6	2·00	1	3	..
Malvern Power Board	644	17	110	127	19·72	63	107·5	9·78	5	10	..
Manawatu-Oroua Power Board	4,368	..	653	653	14·95	1,224	757·0	28·00	835	1,582	..
Mangahao (Public Works Department)	83	..	56	56	..	58	58·0	..	..	..	..
Mangaweka Town Board	102	1	8	9	8·80	6	2·9	5·90	3	5·75	..
Manunui Town Board	154	..	..	..	..	..	..	..	1	1·5	..
Marlborough Power Board	2,319	..	312	312	13·40	312	220·0	13·40	53	92	6
Mataura Borough Council	343	1	8	9	3·00	1	1·0	0·30	4	12	..
Motueka Borough Council	316	..	..	..	..	..	..	..	..	..	..
Murchison County Council	100	..	1	1	1·00	11	8·7	11·00	11	24	4

TABLE XXXI.—RETURN OF ELECTRIC RANGES, WATER-HEATERS, AND MILKING-MACHINES—*continued.*

Table showing the Number of Electric Ranges, Water-heaters, and Milking-machines connected to Electric-supply Systems as at 31st March, 1930—continued.

Licensee.	Number of Consumers.	Ranges.				Water-heaters.			Milking-machines.		
		2 to 5 Kilowatts.	5 Kilowatts and over.	Total.	Percentage of Number of Consumers.	Number.	Total Kilowatts.	Percentage of Number of Consumers.	Number.	Horse-power.	Not yet electrified.
Napier Borough Council	3,980	6	45	51	1·28	311	201·0	7·80	..	..	..
Nelson City Council	2,200	..	..	..	..	3	4·0	0·14	..	..	..
New Plymouth Borough Council	6,060	150	626	776	10·30	673	402·0	11·10	290	520	..
North Canterbury Power Board	1,389	..	125	125	9·00	106	182·8	7·60	55	121	..
Ohakune Borough Council	469	9	11	20	4·30	17	13·3	3·60	2	4	..
Opunake Power Board	1,250	63	..	63	5·00	128	75·0	10·00	219	400	..
Otago Central Power Board	803	79	28	107	13·30	101	115·0	12·60	13	26	..
Otago Power Board	3,657	7	314	321	8·77	283	225·0	7·70	42	72	..
Palmerston North City Council	5,065	14	419	433	8·50	816	516·0	16·10	4	8	..
Patea Borough Council	335	11	3	14	4·20	12	7·6	3·50	3	6	..
Picton Borough Council	356	..	1	1	0·28	..	..	..	..	..	..
Poverty Bay Power Board	4,266	10	380	390	9·14	251	225·0	5·90	40	59·5	..
Queenstown Borough Council	220	4	1	5	2·27	..	..	..	..	..	..
Raetihi Borough Council	384	3	7	10	2·60	21	14·9	5·40	11	29	..
Rangiora Borough Council	545	3	31	34	6·24	32	32·6	5·87	..	..	..
Reefton Electric Light and Power Co., Ltd.	319	..	..	..	..	..	..	..	..	..	..
Riccarton Borough Council	1,290	15	191	206	15·97	249	234·4	19·30	..	..	..
Rotorua (Tourist Department)	1,686	41	77	118	7·00	142	121·2	8·42	35	74	..
South Canterbury Power Board	3,277	16	494	510	15·56	355	488·6	10·86	103	173	60
South Taranaki Power Board	2,487	..	37	37	1·08	51	31·0	2·05	180	370	250
Southland Power Board	8,742	..	1,309	1,309	14·90	672	907·2	7·68	922	2,255	..
Springs-Ellesmere Power Board	2,004	5	162	167	8·30	94	95·2	4·69	62	131	..
Stratford Borough Council	975	4	116	120	12·30	108	90·0	11·18	..	..	..
Sumner Borough Council	951	22	60	82	8·60	78	73·0	8·20	1	3	..
Taihape Borough Council	628	..	9	9	1·40	13	12·2	2·07	..	..	..
Tai Tapu Dairy Co., Ltd.	241	7	16	23	9·50	19	42·0	7·88	44	109	..
Taranaki Power Board	1,984	4	207	211	10·60	677	434·4	34·12	696	1,371	..
Tararua Power Board	1,458	28	201	229	15·70	339	221·0	23·20	265	415	..
Taumarunui Borough Council	740	3	17	20	2·70	26	20·0	3·51	..	..	..
Tauranga Borough Council	857	50	133	183	21·35	286	110·0	33·37	..	..	..
Tauranga Power Board	870	26	127	153	17·58	400	245·0	45·92	361	662	45
Te Aroha Borough Council	684	2	22	24	3·50	33	22·0	4·82	7	15	..
Te Awamutu Power Board	1,550	14	152	166	10·71	554	374·0	35·74	562	894	50
Te Puke Town Board	284	7	6	13	4·50	29	20·0	10·20	4	8	..
Teviot Power Board	390	7	107	114	29·20	105	80·0	26·90	..	..	..
Thames Borough Council	1,101	1	16	17	1·50	31	17·5	2·80	..	..	..
Thames Valley Power Board	5,570	65	304	369	6·62	1,909	1,272·0	34·40	1,889	3,793	50
Timaru Borough Council	3,259	..	251	251	7·70	167	167·0	5·20	..	..	..
Uawa County Council	99	..	..	..	..	..	..	..	..	..	..
Waikato (Horahora–Arapuni)	..	..	55	55	..	66	69·0	..	..	..	..

TABLE XXXI.—RETURN OF ELECTRIC RANGES, WATER-HEATERS, AND MILKING-MACHINES—*continued.*

Table showing the Number of Electric Ranges, Water-heaters, and Milking-machines connected to Electric-supply Systems as at 31st March, 1930—continued.

Licensee.	Number of Consumers.	Ranges.				Water-heaters.			Milking-machines.		
		2 to 5 Kilowatts.	5 Kilowatts and over.	Total.	Percentage of Number of Consumers.	Number.	Total Kilowatts.	Percentage of Number of Consumers.	Number.	Horse-power.	Not yet electrified.
Waimairi County Council	3,030	22	467	489	16·14	527	544·0	17·39	14	30	..
Waimea Electric Supply Co.	672	..	..	..	..	2	2·0	..	..	..	..
Wairarapa Power Board	3,904	18	306	324	8·30	462	388·0	11·80	331	633	..
Wairere Power Board	272	3	76	79	29	116	65·0	42·65	55	79·5	..
Wairoa Borough Council	647	5	104	109	16·84	126	67·7	19·40	1	0·75	..
Wairoa Power Board	367	29	81	110	33·00	94	49·5	28·30	51	104	6
Wairua (Wilson's)	44	..	..	..	..	1	0·6	2·20	22	66	..
Waitaki Power Board	3,065	8	341	349	11·39	354	583·0	11·55	22	35·5	2
Waitara Borough Council	442	4	24	28	6·33	18	13·6	4·07	1	2	30
Waitemata Power Board	7,468	18	830	848	11·40	1,154	751·0	15·44	130	219	..
Waitomo Power Board	1,262	24	93	117	9·27	194	121·0	15·37	121	233	20
Wanganui-Rangitikei Power Board	8,882	..	873	873	9·80	1,123	836·0	12·60	384	853	..
Wellington City Council	26,700	48	794	842	3·15	802	1,105·0	3·00	..	..	..
Westland Power, Ltd.	97	..	16	16	16·50	30	41·4	30·90	16	32	..
Westport Borough Council	594	..	7	7	1·18	18	16·0	3·00	2	4	..
Whakatane Borough Council	482	3	47	50	10·37	52	31·5	10·79	5	10	..
Whangarei Borough Council	1,969	30	101	131	6·65	156	99·0	7·92	6	18	..
Totals, 1929-30	284,327	1,307	24,690	25,997	9·14	37,564	29,887·4	13·12	11,922	22,087·4	923
Totals, 1928-29	266,306	1,036	19,218	20,254	7·60	29,257	23,100·0	10·98	10,161	19,654	..
Increase	18,021	271	5,472	5,743	..	8,307	6,787·4	..	1,761	2,433·4	..

TABLE XXXII.—RETURN SHOWING AVERAGE REVENUE PER CONSUMER AND PER CAPITA FOR THE YEAR ENDING 31ST MARCH, 1930.

Licensee.	Ratio of Consumers to Population.	Average Revenue per Consumer.	Average Revenue per Capita.	Capital Outlay per Capita.
	Per Cent.	£	£	£
Ashburton Power Board	19·68	11·91	2·34	19·45
Auckland Power Board	22·05	14·62	3·23	14 99
Banks Peninsula Power Board	23·58	13·75	3·24	24·76
Bluff Borough Council	24·84	9·59	2·38	6·11
Bay of Plenty Power Board	14·45	22·99	3·32	21·83
Cambridge Power Board	21·30	15·36	3·27	17·67
Central Hawke's Bay Power Board	13·14	14·65	1·93	11·95
Central Power Board	20·56	13·79	2·84	16·44
Christchurch City Council	27·38	9·26	2·54	7·57
Coleridge (Public Works Department)	Figures not applicable.			
Dannevirke Power Board	17·33	12·39	2·15	15·85
Dunedin City Council	28·40	9·61	2·73	18 61
Franklin Power Board	17·22	15·76	2·71	14·49
Golden Bay Power Board	17·00	5·95	1·01	17·94
Grey Power Board	16·35	12·64	2·07	10·39
Halswell County Council	13·14	7·82	1·03	3·74
Hamilton Borough Council	24·16	10·14	2·45	4·78
Hastings Borough Council	30·61	7·70	2·36	10 45
Havelock North Town Board	24·17	10·50	2·54	20·87
Hawera County Electric Co., Ltd.	Taken over by South Taranaki Power Board.			
Hawke's Bay Power Board	13·58	21·84	2·97	13·83
Heathcote County Council	19·95	8·10	1·62	5·56
Horahora-Arapuni (Public Works Department)	Figures not applicable.			
Horowhenua Power Board	20·09	13·89	2·79	11 90
Hurunui Power Board	..	..	..	..
Hutt Valley Power Board	23·40	10·36	2·42	9·12
Inglewood Borough Council	32·00	9·25	2·96	9·73
Invercargill City Council	22·24	10·72	2·39	7·88
Kaiapoi Borough Council	25·00	8·26	2·06	7·17
Kaikoura County Council	23·17	10·68	2·48	15·62
Kamo Town Board	18·00	7·80	1·40	5·52
Kanieri Electric Light, Ltd.	22·60	15·16	3·43	17·27
Kaponga Town Board	29·42	17·06	5·02	20·42
Lyttelton Borough Council	17·90	8·36	1·50	1·87
Malvern Power Board	12·75	11·24	1·43	12·24
Manawatu-Oroua Power Board	11·20	16·64	1·86	12·69
Mangahao-Waikaremoana (Public Works Department)	Figures not applicable.			
Mangaweka Town Board	25·50	12·38	3·16	13·95
Manunui Town Board	15·40	3·28	0·51	3·27
Marlborough Power Board	15·96	11·09	1·77	21·25
Mataura Borough Council	26·38	4·39	1·16	3·67
Motueka Borough Council	19·75	7·31	1·44	9·96
Murchison County Council	22·22	12·34	2·74	30·94
Napier Borough Council	21·31	9·62	2·05	8·56
Nelson City Council	19·13	12·24	2·34	8·90
New Plymouth Borough Council	28·86	11·79	3·40	19·40
North Canterbury Power Board	16·06	14·05	2·26	14·42
Ohakune Borough Council	19·54	10·21	2·00	7·57
Opunake Power Board	17·86	10·02	1·79	14·82
Otago Central Power Board	31·65	10·86	3·44	33·84
Otago Power Board	20·39	9·39	1·92	15·68
Palmerston North City Council	25·45	11·07	2·82	10·72
Patea Borough Council	18·61	12·22	2·27	6·99
Picton Borough Council	26·37	9·09	2 40	14·16
Poverty Bay Power Board	18·02	11·49	2 07	12·90
Queenstown Borough Council	27·50	6·81	1·87	15·55
Raetihi Borough Council	8·53	11·45	0·98	8·26
Rangiora Borough Council	25 95	8·77	2·28	5·49
Reefton Electric Light and Power Co., Ltd.	26·58	11·85	3·15	4·15
Riccarton Borough Council	23·45	8·10	1·90	3·67
South Canterbury Power Board	7·85	15·58	1·22	7·49
South Taranaki Power Board	21·63	4·52	0·98	12·46
Southland Power Board	18·60	13·42	2·50	35·21
Springs-Ellesmere Power Board	18·98	12·88	2·44	12·53
Stratford Borough Council	27·86	12·83	3·57	8·10
Sumner Borough Council	27·17	6·51	1·77	4·45
Taihape Borough Council	25·63	9·37	2·40	7·59
Tai Tapu Dairy Co., Ltd.	4·23	16·45	0·70	1·81
Taranaki Power Board	16·15	21·33	3·44	37·62
Tararua Power Board	14·22	15·13	2·15	15·39
Taumarunui Borough Council	18·50	12·94	2·39	15·23
Tauranga Borough Council	31·74	29·77	9·45	55·64
Tauranga Power Board	10·30	26·45	2·72	14 86
Te Aroha Borough Council	28·50	10·53	3·00	9·83
Te Awamutu Power Board	20·34	18·26	3·71	22·88
Te Puke Town Board	28·98	10·50	3·04	11·37
Tevict Power Board	22·94	15·15	3·48	32·86
Thames Borough Council	22·02	10·35	2·28	6·73
Thames Valley Power Board	15·98	24·54	3·92	22·68
Timaru Borough Council	18·62	10·10	1·88	7 10
Tourist Department (Rotorua)	30·65	10·16	3·11	12·40
Uawa County Council	24·75	13·38	3·31	15·63

TABLE XXXII.—RETURN SHOWING AVERAGE REVENUE PER CONSUMER AND PER CAPITA FOR THE YEAR ENDING 31ST MARCH, 1930—*continued.*

Licensee.	Ratio of Consumers to Population.	Average Revenue per Consumer.	Average Revenue per Capita.	Capital Outlay per Capita.
	Per Cent.	£	£	£
Waimairi County Council	23·23	7·38	1·71	6·03
Waimea Electric Supply Co., Ltd.	16·80	7·07	1·19	5·20
Wairarapa Power Board	20·02	12·66	2·53	17·94
Wairere Power Board	13·60	16·84	2·29	19·22
Wairoa Borough Council	26·85	12·16	3·26	8·19
Wairoa Power Board	6·87	33·66	2·31	10·41
Wairua (Wilson's Cement Co.)	Figures not applicable.			
Waitaki Power Board	17·20	12·05	2·07	9·43
Waitara Borough Council	24·73	8·69	2·15	6·63
Waitemata Power Board	19·05	9·23	1·76	9·30
Waitomo Power Board	15·78	13·70	2·16	11·54
Wanganui-Rangitikei Power Board	17·08	10·94	1·87	10·16
Wellington City Council	24·27	13·45	3·26	9·95
Westland Power, Ltd.	2·31	21·73	0·50	17·59
Westport Borough Council	14·85	10·33	1·53	7·63
Whakatane Borough Council	26·78	11·92	3·19	31·20
Whangarei Borough Council	28·13	11·58	3·26	8·34
Average for reticulation areas in New Zealand ..	20·74	14·83	3·08	17·68
Average for 1929	19·33	14·10	2·73	17·27
,, 1928	20·4	11·5	2·36	14·8

Table XXXIII.—Condensed Financial Statistics, 31st March, 1930.

Supply Authority.	Capital Investment.		Revenue (for Year).	Working Expenses (for Year).	Capital Charges (Interest and Sinking Fund).	Credited to Depreciation Fund.	Balance for Year's Operation.		Accumulated Funds.		Rates collected, &c., during Year.	Accumulated Losses to 31st March, 1930.
	Total Outlay to Date.	Present Book Value (after making Allowance for Depreciation.					Debit.	Credit.	Sinking.	Depreciation and/or Renewal.		
	£	£	£	£	£	£	£	£	£	£	£	£
Ashburton Power Board	340,423	331,355	41,011	20,873	21,956	2,876	4,694	..	17,031	11,388	..	7,695
Auckland Power Board	2,998,854	2,652,371	645,062	291,346	195,520	62,390	..	95,806	408,662	268,454	..	..
Banks Peninsula Power Board	100,285	96,235	13,134	19,117	7,373	Nil	3,356	..	8,592	4,050	3,933	..
Bluff Borough	10,363	9,214	4,037	2,826	682	303	..	226	704	1,181	..	..
Bay of Plenty Power Board..	186,129	183,244	28,318	17,705	12,724	Nil	2,111	..	3,959	..	..	..
Cambridge Power Board	106,030	106,029	19,634	10,333	7,453	713	..	1,135	10,498	1,175¶	..	..
Central Hawke's Bay Power Board	133,787	123,139	21,563	9,512	8,253	2,283	..	1,515	1,509	7,460	..	..
Central Power Board	296,609	286,984	51,144	24,707	20,275	3,427	..	2,735	23,112	13,912	..	..
Christchurch City	707,704	359,595	237,125	128,424	34,102	31,813	..	42,786	164,302	348,159*	..	..
Dannevirke Power Board	199,880	195,609	27,080	11,111	13,358	1,988	..	623	10,018	4,271	..	..
Dunedin City	1,488,904	1,450,879	218,451	61,972	76,429	23,276	..	56,774	121,526	275,604†	..	..
Franklin Power Board	242,929	212,582	45,512	20,351	16,059	7,539	..	1,563	8,221	13,004	..	..
Grey Power Board	132,983	132,643	26,455	13,238	8,869	1,332	..	3,016	11,554	2,223	..	4,494
Golden Bay Power Board	21,532	21,304	1,213	602	1,529	229	1,147	..	221	229	1,300	..
Halswell County	6,923	4,953	1,900	1,282	313	Nil	..	305	657	..	..	..
Hamilton Borough..	74,049	55,037	37,969	24,708	4,899	2,130	..	6,232	17,143	12,014	..	..
Hastings Borough	111,408	103,408	25,114	14,196	5,385	991	..	4,542	9,259	2,378	..	..
Havelock North Town Board	23,997	23,997	2,918	1,121	1,967	Nil	170	..	6,421	..	244	..
Hawke's Bay Power Board	221,611	216,888	47,520	30,893	13,701	2,531	..	395	8,690	4,723	..	..
Heathcote County	33,359	28,554	9,691	6,838	2,196	Nil	..	657	5,308	..	..	..
Horowhenua Power Board	195,472	184,380	45,854	27,008	13,018	2,523	..	3,305	7,740	11,192‡	..	..
Hutt Valley Power Board	370,922	341,830	98,603	59,202	25,558	7,083	..	6,760	16,016	29,029	..	..
Inglewood Borough	12,644	8,590	3,847	2,313	750	490	..	294	2,775	4,054	..	..
Invercargill City	165,567	164,217	50,085	27,750	10,848	Nil	..	11,487	26,791	32,223	..	..
Kaikoura County	9,839	9,150	1,560	1,688	746	..	874	..	875	689	..	2,003
Kaiapoi Borough	12,907	10,856	3,715	2,265	894	492	..	64	1,062	2,051	..	..
Kamo Town Board	3,311	2,500	842	583	232	Nil	..	27	474	..	..	..
Kanieri Electric Co.	43,172	32,384	8,563	5,294	..	1,303	..	1,966	..	..	..	..
Kaponga Town Board	24,507	2,305	6,023	4,051	1,670	Nil	..	302	1,856	..	..	..
Lyttelton Borough	6,930	6,930	5,548	4,991	372	Nil	..	285	205	..	..	..
Malvern Power Board	61,818	58,564	7,238	4,247	4,021	Nil	1,030	..	3,121	..	..	2,588
Manawatu-Oroua Power Board	494,695	479,687	72,670	37,409	29,645	5,268	..	348	41,543	15,008	..	5,159
Mangaweka Town Board	5,580	5,434	1,263	772	128	Nil	..	363	1,084	..	153	..
Manunui Town Board	3,266	3,266	505	361	250	Nil	106	..	129	..	..	..
Marlborough Power Board	308,769	302,196	25,725	6,582	21,649	2,523	5,028	..	13,975	6,585	266	7,429
Mataura Borough	4,767	4,343	1,507	1,514	234	Nil	241	..	216	..	..	..
Motueka Borough	15,931	13,098	2,311	2,023	962	709	1,383	..	1,740	2,833	1,039	3,533
Murchison County	13,925	13,925	1,234	595	974	Nil	335	..	1,570	..	..	..
Napier Borough	159,940	158,341	38,298	23,040	8,674	3,285	..	3,299	9,920	24,921	..	..
Nelson City	102,358	88,715	26,925	13,058	4,900	Nil	..	8,967	..	..	..	..
New Plymouth Borough	407,959	330,806	71,418	32,549	25,539	..	..	13,330	56,093	15,370	..	..
North Canterbury Power Board	126,321	120,455	19,516	10,566	5,406	1,818	..	1,726	6,188	4,290	..	..
Ohakune Borough	18,176	15,551	4,790	1,767	989	378	..	1,656	2,614	..	..	..
Opunake Power Board	103,708	103,708	12,522	5,419	7,985	150	1,032	..	13,600	455	..	..
Otago Central Power Board	85,859	84,570	8,718	2,581	6,587	(406)	856	..	3,565	1,289	..	1,668
Otago Power Board	281,198	273,556	34,345	20,469	20,587	4,006	11,096‖	..	15,105	7,642	7,726	26,118
Palmerston North City	213,398	200,037	56,069	20,484	12,750	4,700	..	18,135	15,486	9,070	..	..

For notes see page 146.

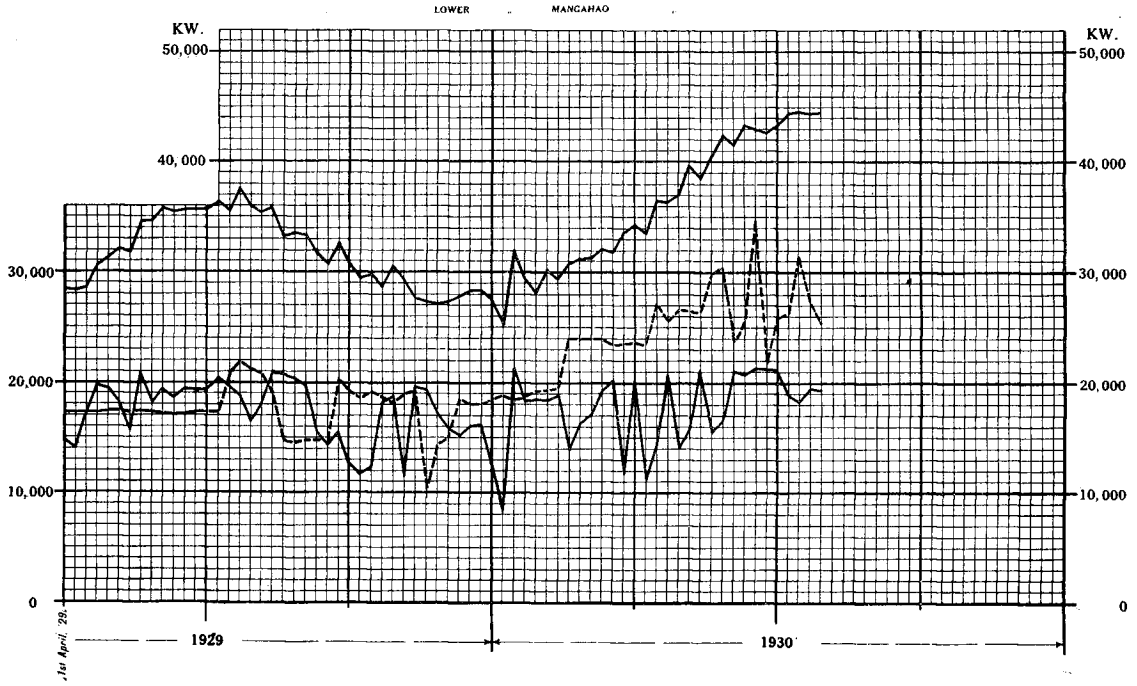
Table XXXIII.—Condensed Financial Statistics, 31st March, 1930—*continued.*

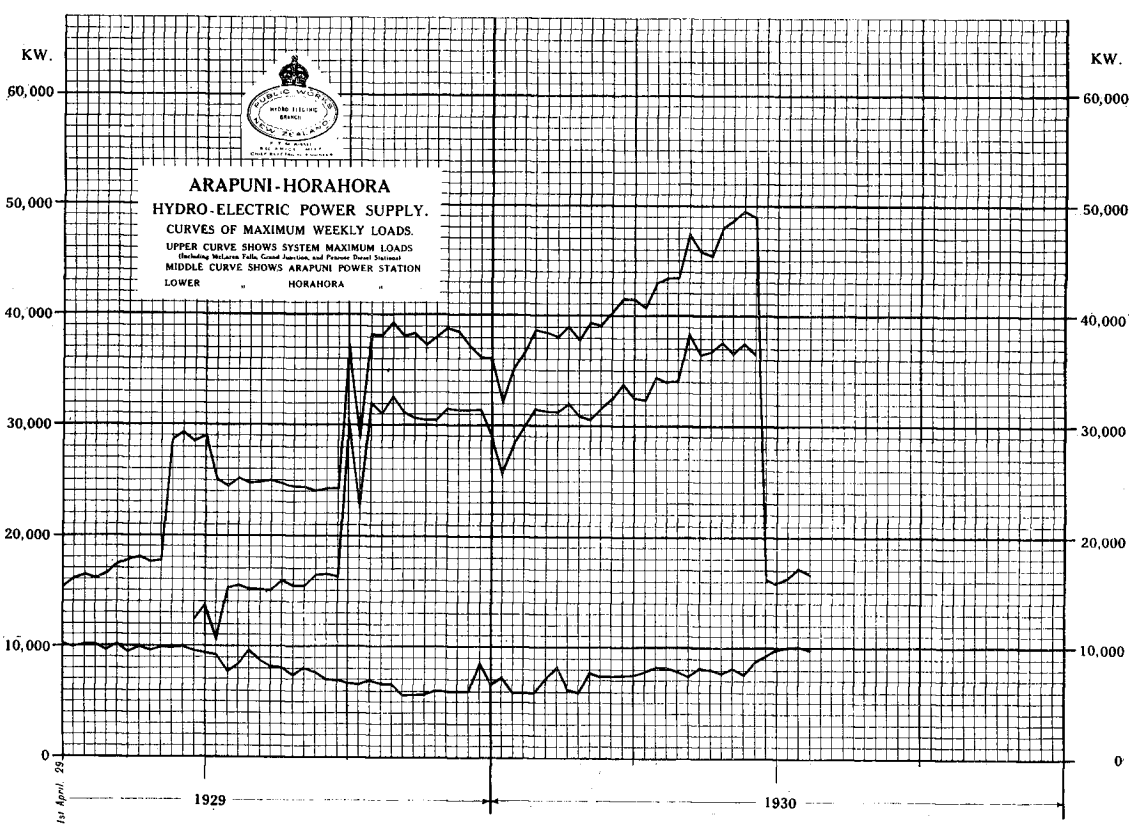
Supply Authority.	Capital Investment.		Revenue (for Year).	Working Expenses (for Year).	Capital Charges (Interest and Sinking Fund).	Credited to Depreciation Fund.	Balance for Year's Operation.		Accumulated Funds.		Rates collected, &c., during Year.	Accumulated Losses to 31st March, 1930.
	Total Outlay to Date.	Present Book Value (after making Allowance for Depreciation.					Debit.	Credit.	Sinking.	Depreciation and/or Renewal.		
	£	£	£	£	£	£	£	£	£	£	£	£
Patea Borough	12,573	12,520	4,094	2,548	605	53	..	888	212	53	..	..
Picton Borough	19,114	16,243	3,236	2,231	1,249	Nil	244	..	1,568	..	1,529	..
Poverty Bay Power Board	305,301	290,755	49,020	23,691	19,498	3,756	..	2,075	10,316	1,708	..	..
Queenstown Borough	12,437	12,437	1,499	529	816	Nil	..	154	550	..	3	..
Raetihi	37,178	32,678	4,398	2,038	1,912	Nil	..	448	3,899	..	..	..
Rangiora Borough	11,531	7,977	4,782	3,314	423	407	..	638	1,003	3,554	..	..
Reefton Electric Light Co.	4,976	49,922	3,780	2,143	Nil	(236)	..	1,401	..	..	..	..
Riccarton Borough Council	20,160	(16,327)	10,444	6,580	1,137	444	..	2,283	634	583	..	..
South Canterbury Power Board	312,615	294,005	51,043	28,160	20,379	3,216	712	..	19,647	4,706	..	..
South Taranaki Power Board	**143,337	142,091	11,230	4,677	3,961	150	..	2,442	1,086	480	..	..
Southland Power Board	1,654,870	1,637,507	117,291	51,463	115,500	Nil	49,672	..	204,584	13,845	60,200	56,759
Springs-Ellesmere Power Board	132,346	128,510	25,816	15,012	7,870	1,838	..	1,096	7,094	3,203	..	..
Stratford Borough	28,351	28,101	12,512	6,318	3,426	250	..	2,518	5,368	250	..	..
Sumner Borough	15,577	12,999	6,192	4,162	511	382	..	1,137	1,281	382	..	..
Taihape	18,590	9,528	5,885	2,638	1,081	Nil	..	2,166	3,469	829	..	..
Taranaki Power Board	462,219	451,774	42,321	12,843	32,284	2,850	5,656	..	18,159	7,188	1,835	..
Tararua Power Board	157,810	151,498	22,055	9,915	9,457	2,610	..	73	11,180	5,106	..	1,332
Taumarunui Borough	60,939	60,939	9,572	2,667	4,410	800	..	1,695	4,858	2,111	..	..
Tauranga Borough	150,225	146,500	25,510	6,905	10,393	500	..	7,712	15,557	3,725	..	..
Tauranga Power Board	125,565	120,995	23,012	12,779	7,889	1,581	..	763	5,611	1,489	..	..
Te Aroha Borough	23,597	16,405	7,202	4,383	610	350	..	1,859	1,519	7,192	..	..
Te Awamutu Power Board	174,379	172,697	28,307	13,303	11,083	1,000	..	2,921	10,592	1,682	..	..
Teviot Power Board	55,866	55,599	5,910	1,442	3,704	24	..	740	3,964	267	257	..
Te Puke Town Board	11,141	6,672	2,982	1,480	563	212	..	727	1,037	1,127	..	..
Thames Borough Council	33,647	24,462	11,400	9,023	1,268	312	..	797	5,060	1,327	..	..
Thames Valley Power Board	709,532	709,532	136,662	75,757	55,971	3,902	..	1,032	81,733	23,822	..	..
Timaru Borough	124,218	89,318	32,921	16,757	9,161	Nil	..	7,003	37,544	..	..	13,768
Tourist Department, Rotorua	68,180	57,705	17,126	6,811	6,135	1,363	..	2,817	10,475	20,950	..	..
Uawa County	6,252	4,634	1,325	526	638	Nil	..	161	1,618	..	..	..
Waimairi County	78,446	77,068	22,278	12,979	3,355	Nil	..	5,944	3,291	..	93	..
Waimea Electric Co.	20,813	18,863	4,751	2,974	363	1,030	..	384	..	..	..	..
Wairarapa Power Board	349,901	345,602	49,425	19,887	24,242	2,292	..	3,004	14,479	..	..	..
Wairere Power Board	38,447	37,562	4,580	1,541	2,948	91	..	..	635	885	..	..
Wairoa Borough	19,743	11,790	7,868	5,081	1,416	448	..	923	3,192	7,953	3	..
Wairoa Power Board	55,595	53,236	12,355	9,546	4,019	846	2,056	..	4,911	2,358	2,993	3,745
Waitaki Power Board	167,981	159,869	36,923	17,282	11,740	2,100	..	5,801	1,291	16,291§	..	..
Waitara Borough	11,850	5,998	3,842	2,094	900	309	..	539	2,153	..	543	2,542
Waitemata Power Board	364,550	357,724	68,935	38,925	24,858	2,500	..	2,652	29,257	6,826	..	..
Waitomo Power Board	92,312	92,312	17,288	10,574	7,061	Nil	347	..	2,757	1,805	..	2,170
Wanganui-Rangitikei Power Board	528,291	465,181	97,158	48,179	35,272	14,607	891	..	23,624	15,137	..	..
Wellington City	1,094,199	1,070,199	359,049	162,872	37,132	19,565	..	139,480	167,870	156,086	..	..
Westport Borough	30,534	28,288	6,134	1,980	2,304	643	..	1,207	3,268	1,608	25	..
Westland Power, Ltd.	73,871	73,871	2,108	2,563	Nil	Nil	455	(8 months	partial oper	ation only.)		
Whakatane Borough	56,155	56,155	5,747	2,023	3,368	Nil	..	356	6,265	..	337	..
Whangarei Borough	58,409	58,022	22,808	1,543	2,143	1,480	..	3,752	3,466	2,843	..	..

* Includes £33,183 Renewal Fund. † Includes £146,854 Accumulated Renewal Fund. ‡ Includes £100 Insurance Reserve Fund. § Includes £9,905 General and Reserve Fund. ‖ Includes £379 Loss on Trading Account. ¶ Includes £350 General Reserve. ** Includes 5½ months working only.

WAIKAREMOANA-MANGAHAO
HYDRO-ELECTRIC POWER SUPPLY.
CURVES OF MAXIMUM WEEKLY LOADS.

UPPER CURVE SHOWS SYSTEM MAXIMUM LOADS
DOTTED " WAIKAREMOANA STATION LOADS
LOWER " MANGAHAO "





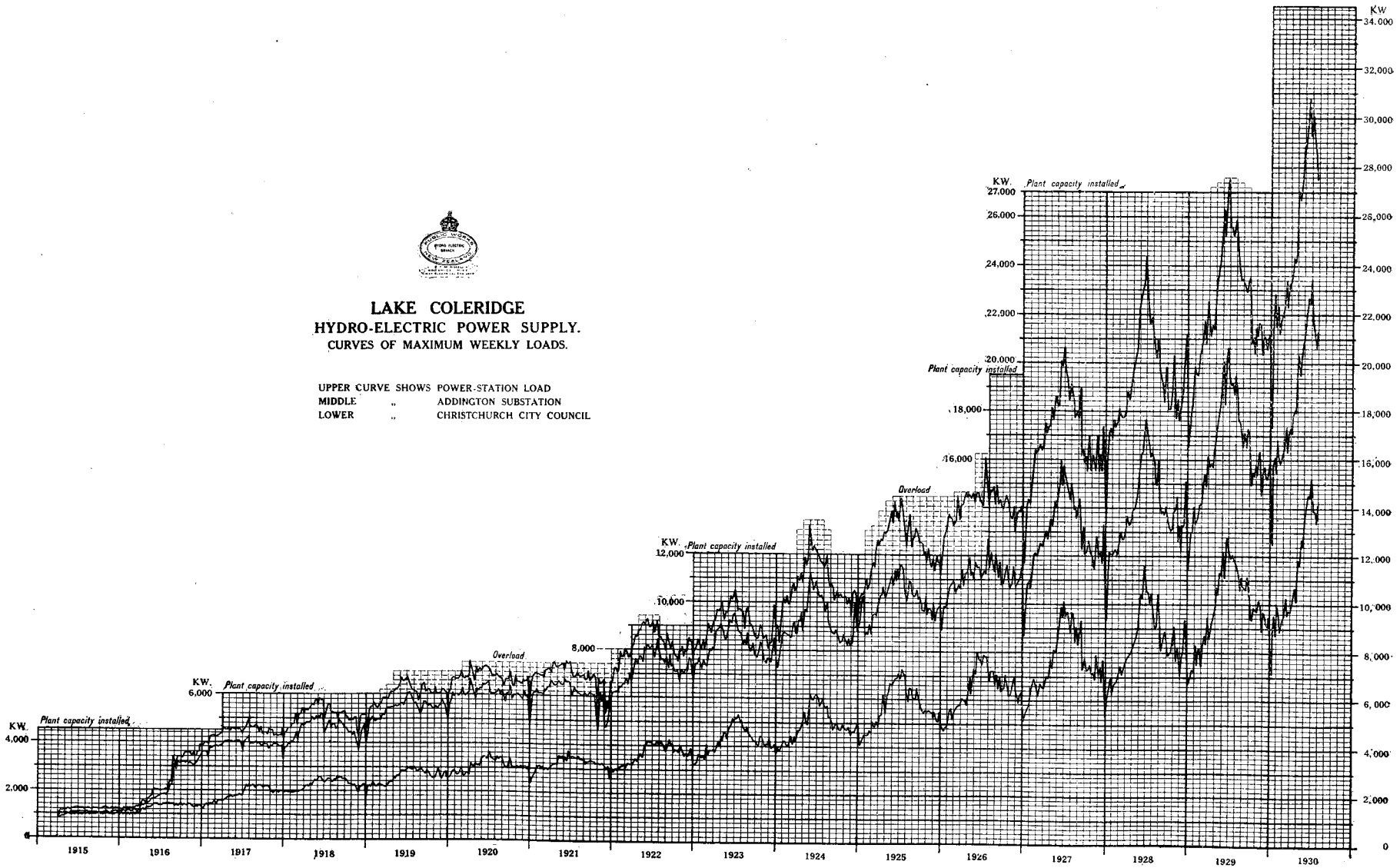
ARAPUNI-HORAHORA
HYDRO-ELECTRIC POWER SUPPLY.
CURVES OF MAXIMUM WEEKLY LOADS.

UPPER CURVE SHOWS SYSTEM MAXIMUM LOADS
(Including Wellaron Falls, Grand Junction, and Penrose Diesel Stations)
MIDDLE CURVE SHOWS ARAPUNI POWER STATION
LOWER " HORAHORA "

[To face page 146.

LAKE COLERIDGE
HYDRO-ELECTRIC POWER SUPPLY.
CURVES OF MAXIMUM WEEKLY LOADS.

UPPER CURVE SHOWS POWER-STATION LOAD
MIDDLE " ADDINGTON SUBSTATION
LOWER " CHRISTCHURCH CITY COUNCIL



NORTH ISLAND

NEW ZEALAND

SHOWING

POWER BOARD DISTRICTS

1930

Scale: 35 miles to an inch.

Reference

Cities	thus	AUCKLAND
Provincial Centres	..	O NAPIER
Boroughs	..	O FEILDING
Town Districts	..	O MANAIA
Small Centres	..	o Tokomaru
Railways	..	
Coach Routes	..	
Boundaries of Land Districts	..	

TASMAN SEA

SOUTH ISLAND

POWER BOARDS FORMED.

No.	Name.	Population.	Value of Rateable Property unimproved.
3	North Auckland	26,915	5,205,716
5	Waitemata	21,425	5,901,473
6	Auckland	175,000	43,439 850
7	Franklin ..	14,444	6,800,000
9	Wairere	2,500	872,434
10	Waitomo. ..	8,500	3,566,152
12	Taranaki	22,000	5,974,732
13	Opunake .	7,000	916,111
14	South Taranaki .	17,612	7,914,269
15	Wanganui-Rangitikei	60,000	7,976,750
16	Manawatu-Oroua	40,000	13,955,493
17	Horowhenua	12,035	3,403,255
18	Hutt Valley	27,275	3,119,920
19	Wairarapa	19,000	9,370,503
20	Tararua	10,255	3,983,107
21	Dannevirke	12,081	4,666,713
22	Central Hawke's Bay	10,056	6,839,951
33	Hawke's Bay	40,104	11,611,022
26	Wairoa	7,712	2,639,968
27	Poverty Bay	23,986	9,591,676
28	Bay of Plenty	10,900	2,562,042
29	Tauranga	8,425	1,232,100
30	Thames Valley	30,000	7,550,000
31	Te Awamutu	8,500	1,668,509
32	Cambridge	6,000	1,841,209
33	Central	20,621	5,413,224
	Totals	642,406	178,045,979

POWER BOARDS PROPOSED

1	Whangarei	4	Waihi
2	Whangaparaoa	3	Te Puke
4	Rodney	23	Waipawa-Waipukurau
8	Waikato	24	Ohakune-Raetihi
11	Taumarunui	25	Rangitaiki

Districts shown red.

ELECTRIC SUPPLY STATIONS

Steam	▼
Gas	▲
Oil	●
Hydro	■

P.W.D. transmission lines over 30,000 v. ——————

P.W.D. proposed transmission lines over 30,000 v. — — — — —

Other supply authorities . . . . . .

HORA HORA

ARAPUNI

WAIKAREMOANA

MANGAHAO

Bay of Plenty

Hawke Bay

South Latitude

North Taranaki Bight

South Taranaki Bight

Tasman Bay

Karamea Bight

Cloudy Bay

Golden Bay

Mahia Peninsula

Drawn by W. G. Harding

172° 173° 174° 175° East Longitude 176° 177° 178°

SOUTH ISLAND

NEW ZEALAND

SHOWING

POWER BOARD DISTRICTS.

1930

Scale: 35 miles to an inch.

Reference

	thus	
Cities		NELSON
Provincial Centres	..	HOKITIKA
Boroughs	..	TEMUKA
Town Districts	..	CLINTON
Small Centres	..	Lyell
Railways	..	
Coach Routes	..	
Boundaries of Land Districts	..	

TASMAN SEA

South Latitude

Stewart Island

Otago Peninsula

Banks Peninsula

LAKE COLERIDGE

WAITAKI

Karamea Bight

Canterbury Bight

Cloudy Bay

Pegasus Bay

Kaikoura Peninsula

ELECTRIC SUPPLY STATIONS.

Steam	▼
Gas	▲
Oil	●
Hydro.	■

P.W.D. transmission lines over 30,000 v.

P.W.D. proposed transmission lines over 30,000 v.

Other supply authorities

POWER BOARDS FORMED.

No.	Name.	Population.	Value of Rateable Property unimproved.
1	Buller	9,197	£96,374
2	Reefton	1,850	£4,476
3	Grey	12,000	£14,694
4	Westland	3,272	£96,268
6	Southland	66,009	£5,493,548
7	Otago	24,082	£4,696,446
8	Teviot	2,400	£83,022
9	Otago Central	5,170	£1,067,518
10	Waitaki	17,580	£4,646,292
11	South Canterbury	41,618	£5,483,654
12	Ashburton	18,001	£10,047,044
13	Malvern	5,050	£3,891,668
14	Springs-Ellesmere	11,270	£6,480,598
15	Banks Peninsula	4,000	£4,218,326
16	North Canterbury	12,868	£4,941,302
17	Hurunui	5,980	£6,529,528
19	Marlborough	20,780	£6,728,793
20	Waimea	24,000	£1,624,185
21	Golden Bay	1,200	£40,717
	Totals	303,907	£86,854,455

Districts shown red.

Drawn by Rik Harding

168° 169° 170° 171° 172° 173° 174° 170° East Longitude

PUBLIC WORKS
HYDRO-ELECTRIC BRANCH
NEW ZEALAND
P. T. M. KENNEL
ESQ. A.M.I.C.E. M.I.E.E.
CHIEF ELECTRICAL ENGINEER

MAP SHOWING

ELECTRIC SUPPLY AREAS.

31st. March 1930.

NORTH ISLAND

(TE IKA-A-MAUI)

NEW ZEALAND

10 5 0 10 20 30 40 50 Miles

REFERENCE

22,000, 50,000 and 110,000 volt Main Transmission Lines shown Blue.

11,000 volt Distribution Lines shown Red.

6,600 volt " " " Yellow.
3,300 volt " " not shown.
Government Power Stations " ▣
" Sub " " ◉

WHANGAREI
WAIRUA
HELENSVILLE
PENRUSE
KAWAKAWA
KAWAKAWA
PUKEROA
MERCER
KERIKERI
THAMES
PAEROA
WAINI
TE AROHA
WAHROU
MORRINSVILLE
TAURANGA
TE PUKE
OMANAWA
McLARENS FALLS
MATATA
WHAKATANE
EDGECUMBE
OPOTIKI
KAUTANI
KUNTLY
NGARUAWAHIA
HAMILTON
MYSTERY CREEK
TE AWAMUTU
PUTARURU
MAMARU
NGONGOTAHA
ROTORUA
KAITUNI
KOROHANGA
TEKUITI
PIO PIO
WAIRERE FALLS
MAHOENUI
ARIA
TE KARAKA
RERE
PATUTAHI
GISBORNE
WAIKAREMOANA
WAIROA
NAPIER
HASTINGS
WAITARA
NEW PLYMOUTH
OKAIKURA
NORTHWOOD
TARIKI
HOROPITO
STRATFORD
RAETIHI
OHAKUNE
ELTHAM
OPUNAKE
HAWERA DISTRICT
SUPPLY 5,500 V
WAVERLEY
MATAROA
TAIHAPE
TIKORINO
ONGARUE
WAIPAWA
WAIPUKURAU
TAKAPAU
HATUMA
WANSTEAD
WALLINGFORD
WHANGANUI
HUNTERVILLE
APITI
MARTON
CAMBERHAM
ORMONDVILLE
DANNEVIRKE
FEILDING
BUNNYTHORPE
WOODVILLE
PALMERSTON NORTH
PAHIATUA
PORANGAHAU
FOXTON
SHANNON
MANGAHAO
MANGAMAIRE
LEVIN
ROMGOMAI
OTAKI
EKETAHUNA
MAURICEVILLE
PARAPARA
PAEKAKARIKI
MASTERTON
CARTERTON
GREYTOWN
FEATHERSTON
UPPER HUTT
KOURARAU
MARTINBOROUGH
KHANDALLAH
LOWER HUTT
PETONE
WELLINGTON
MURITAI

X-13

PUBLIC WORKS HYDRO-ELECTRIC BRANCH NEW ZEALAND

P. F. M. KIBBEL
B.Sc. A.M.I.C.E., M.I.E.E.
CHIEF ELECTRICAL ENGINEER

MAP SHOWING

ELECTRIC SUPPLY AREAS.

31st. March 1930

SOUTH ISLAND

(TE WAI-POUNAMU)

NEW ZEALAND

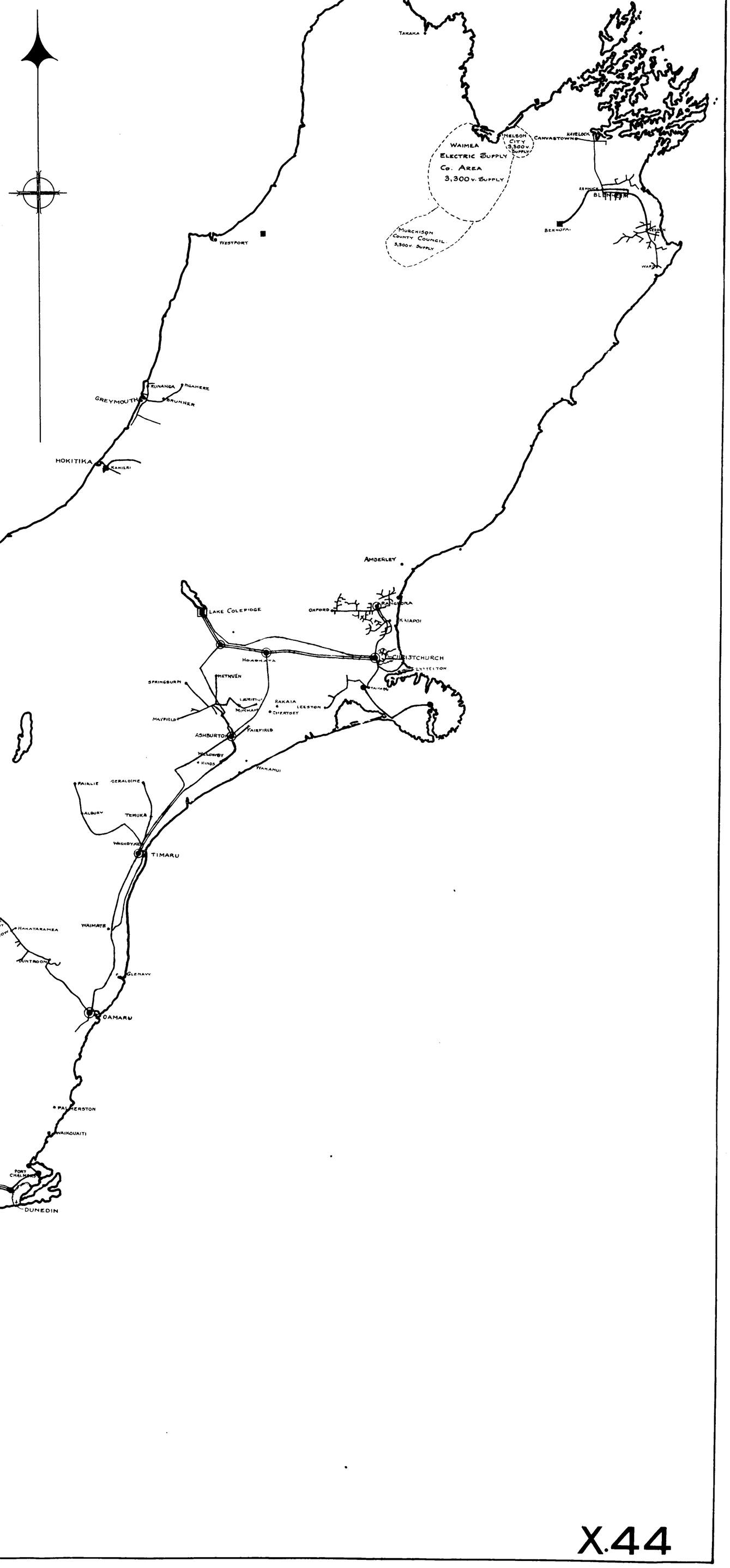
10 5 0 10 20 30 40 50 Miles.

REFERENCE

33,000, 50,000 and 110,000 volt Main Transmission Lines shown Blue.

11,000 volt Distribution Lines shown Red.

6600 volt " " " Yellow.
3,300 volt " " " not shown.
Government Power Stations " ▣
" Sub " " ◉



X.44

APPENDIX E.

SIXTH ANNUAL REPORT OF THE MAIN HIGHWAYS BOARD.

The Main Highways Board to the Minister of Public Works, Wellington.

Sir,—

In accordance with the provisions of section 24 of the Main Highways Act, 1922, the Main Highways Board has the honour to submit its sixth annual report for presentation to Parliament through the Hon. the Minister.

The report covers the period from the 1st April, 1929, to the 31st March, 1930, though a few matters referred to are carried beyond the latter date for convenience and completeness of record.

As stated, the report is the sixth annual report of the Board, but it is the first occasion on which the Board has had the pleasure of presenting such a document to Parliament through yourself.

General.

The expenditure in the case of both funds exceeded £1,000,000, the total for the year under review being £2,317,444, made up of £1,246,027 charged to the Revenue Fund and £1,071,417 to the Construction Fund. Operations under the Revenue Fund involved the payment of subsidies on the maintenance of 10,408 miles of main highway, which length includes 6,651 miles of primary highways and 3,757 miles of secondary highways, the latter being declared during the year 1928–29.

The expenditure from Construction Fund resulted in 173 miles 29 chains of highway being formed and widened, 179 miles 6 chains gravelled and metalled, and 214 miles 28 chains surfaced with bitumen and concrete. A total length of 7,547 ft. of bridges was erected, while engineering surveys were made over 238 miles 14 chains of the highway system.

The Board was able to record that the amount spent on construction in the South Island during the financial year 1928–29 was the highest figure on record. The operations for the year 1929–30 resulted in a sum of £363,879 being spent on construction works in the South Island, and this figure represents more than a 50 per cent. increase on the previous year's total of £229,820. It is not merely the expenditure by the Board alone that is showing an increase in this Island. The amounts provided by the local authorities show a substantial increase on those provided in the earlier stages of the Board's operations.

Except in the case of works opened up for the relief of unemployed, most of which are done on the co-operative-contract basis, the Board requires, as far as possible, that all work shall be carried out under the contract system. During the past year there has been a tendency towards a reduction in prices and some very favourable tenders have been received for all classes of work such as formation, surfacing, and bridges. There are now quite a number of reliable contractors in the road-construction field, and tendering is becoming fairly keen. Contract prices have shown a tendency to fall with the general deflation in prices, but the Board is satisfied that a very strong reason for the lower prices received from contractors is the fact that contractors having obtained the advantage of a considerable amount of work let by the Board in the past have been able to build up efficient organizations both as regards men and plant and thereby increase their output.

The Board as a large employer of labour has, in accordance with the policy of both the Government and local authorities, provided work for unemployed. Its endeavour in this connection is to have work done on such construction operations as do not lend themselves to the use of labour-saving machinery, such as easing curves on hillside roads and widening.

The Board itself has provided practically the whole of the money required for unemployed works, without a contribution from the local authorities, most of the works having been done on sections of main highway where it is not reasonable to expect the local authority to share the cost, though works towards which the local authorities are prepared to contribute secure preference. While, as pointed out on previous occasions, the work carried out by unemployed is in certain cases some years in advance of requirements, many very necessary improvements on main highways, in grading and alignment, have been carried out, and these works have been of great benefit to the road-users and have been generally appreciated by them.

The system of payment by results ensures that even on relief works, on which little or no machinery is in use, good value is obtained for the money spent.

A sum of £86,878 was expended on the restoration of damage caused by the severe earthquake which occurred in the Nelson and West Coast districts on the 17th June, 1929, and a detailed report of the work carried out appears below.

Annual Review of Main Highways.

Although the applications from local authorities for additional main highways totalled approximately 2,000 miles, the Board was unable to make any substantial increase to the declared mileage. The Board felt that, having just declared over 3,700 miles of secondary highway in the previous year, it could not take on additional liabilities until such time as it was able to more accurately gauge its financial liability in respect of the secondary highways.

The Board feels that its attitude in this matter has been justified by reason of the fact that the cost of maintenance of secondary highways increased by over 60 per cent. The total expenditure thereon, including overhead charges, &c., was £254,260, which is approximately £36,000 in excess of the one-quarter of the petrol-tax earmarked for maintenance of secondary highways.

Several minor adjustments only were made to the highway system during the year. They were as follow:—

No. 1 Highway District.—Whangaroa–Okaihau Main Highway: A length of 11 miles 36 chains was revoked.

No. 2 Highway District.—Hamilton–Paeroa Main Highway: An alteration in the route of this highway in the Paeroa Borough was made, the actual distance being reduced by 2 chains.

Station Road (Matamata): A distance of 10 chains was declared.

Hamilton–Raglan Main Highway: An alteration in the route of this highway was made in the Raglan Town District, such alteration involving an additional 13 chains.

Ellerslie–Panmure: The short section of road from Ellerslie to Panmure, a distance of 2 miles 24 chains, was declared. This short section links up the Great South Road with the previously declared highway from Panmure to Howick.

No. 6 Highway District.—Bruce Road: A distance of 4 miles was declared.

Auckland–Wellington Main Highway: A newly constructed deviation between Hangatiki and Otorohanga, a distance of 4 miles 56 chains, was declared as part of the Auckland–Wellington Main Highway. The present road between Hangatiki and Otorohanga will be regarded as a secondary highway in the future.

No. 12 Highway District.—A length of 2 miles 75 chains of the Inangahua Junction – Waiho Main Highway and 2 chains of the Westport – Greymouth Coast Road in the Greymouth Borough were revoked by reason of the fact that the population of the Greymouth Borough increased beyond 6,000, and the borough will in future receive an allocation from that portion of the petrol-tax which is set aside for payment to cities and boroughs with a population of more than 6,000.

No. 14 Highway District.—A length of 34 chains was added to the Christchurch–Akaroa Main Highway by reason of an alteration to the Waimairi County boundary.

No. 18 Highway District.—An alteration was made in the route of the Riverton–Orepuki Main Highway, involving a saving in distance of 1 mile 4 chains. Likewise an alteration was made in the Limehills – Centre Bush Main Highway, but in this case the alteration involved the declaration of an additional mile.

Main Highways controlled by the Board.

No variation has been made in the system under which most of the highways are controlled by the local authorities under delegation from the Board. During the year under review, however, the Board itself, per medium of the Public Works Department, expended a large percentage of the construction moneys. On the other hand, by far the greater proportion of revenue moneys was expended by the local authorities. The two main reasons for the percentage of capital expenditure by the Board exceeding that by the local authorities are, firstly, the provision of work for unemployed which in practically all cases is supervised by the Public Works Department, and, secondly, most of the paving work in the South Island is being done under the direct supervision of the Public Works Department.

Finance.

The actual contributions to the Board's Revenue Fund from external sources for the year 1929–30 amounted to £1,442,226. The tabulation below shows how this amount is made up. The income from similar sources during the previous five years is also shown.

The figures reveal a still further decrease in the revenue received from the tire-tax; in fact, the amount derived from this source during the year was less than the amount derived in 1924–25 when the number of motor-vehicles was less than half the number registered in 1929–30. At the 31st March, 1925, when the first complete record of vehicles was taken there were approximately 100,000 vehicles registered, and during the financial year ended on that date the tire-tax receipts amounted to £161,986. At 31st March, 1930, there were approximately 217,000 vehicles registered, and the tire-tax receipts for the financial year ending on that date amounted to only £155,722, truly a remarkable decrease. The tire-tax in 1924–25 represented £1 12s. 5d. per vehicle, as compared with 14s. 5d. in 1929–30.

——	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.
	£	£	£	£	£	£
Transfer from Consolidated Fund ..	35,000	35,000	35,000	35,000	35,000	35,000
Proceeds of tax on tires and tubes collected through the Customs Department	161,986	223,699	188,450	219,658	196,747	155,722
Registration and license-fees of motor-vehicles	268,178	78,038	283,963	303,861	341,017	378,135
Motor-spirits tax..	..	..	..	130,461	730,414	873,369
Totals	465,164	336,737	507,413	688,980	1,303,178	1,442,226

Eliminating from the total income of £1,442,226 the sum of £35,000 transferred from the Consolidated Fund, the total direct taxation contributed to the Board's funds by motorists was £1,407,226.

The total amount of petrol-tax collected by the Customs Department during the year was £1,028,894, and of this amount £66,946 was refunded to persons entitled to exemption under the Motor-spirits Taxation Act, making the net amount received £961,948. Charges for collection and for making refunds amounted to £12,634, and, of the balance, £873,369 was credited to the Main Highways Revenue Account and £75,945 was paid to cities and boroughs of a population of more than 6,000, the allocation being made on a population basis.

For the year ended 31st March, 1930, the appropriations and expenditure under the Revenue Fund were as follows:—

——	Available for Authorization.	Appropriated.	Expenditure.	Percentage of Expenditure to Appropriation.
	£	£	£	
North Island	821,227	632,754	653,725	103·31
South Island	489,614	377,246	395,524	104·84
Administration charges	50,000	50,000	44,991	89·98
Commission paid to Postal Department for collection of motor registration and license fees and registration of change of ownership	18,000	18,000	20,770	115·39
Miscellaneous payments, including recoupment of interest on loans to Consolidated Fund and reserve for redemption of Main Highway securities	161,186	161,186	131,017	81·28
Totals	1,540,027	1,239,186	1,246,027	100·55

An analysis of the expenditure by the Board and by local authorities on actual maintenance as distinct from interest on loans and other overhead charges is shown in the tabulation below. This tabulation has been subdivided to show, firstly, the expenditure on the original system of main highways; secondly, the expenditure on the additional main highways declared in 1928; and, thirdly, the expenditure on the whole system.

——	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage Board's Contribution to Total.	Percentage Local Authorities' Contribution to Total.
(1) Original highway system—	£	£	£		
North Island	510,334	183,465	693,799	73·56	26·44
South Island	294,434	89,598	384,032	76·67	23·33
	804,768	273,063	1,077,831	74·67	25·33
(2) Additional highways declared 1928—					
North Island	143,391	68,412	211,803	67·70	32·30
South Island	101,090	34,374	135,464	74·63	25·37
	244,481	102,786	347,267	70·40	29·60
(3) Complete system—					
North Island	653,725	251,877	905,602	72·19	27·81
South Island	395,524	123,972	519,496	76·14	23·86
	1,049,249	375,849	1,425,098	73·63	26·37

On the occasion of the last report the Board was able to record a substantial reduction in the amount which local authorities had provided towards the cost of maintenance of the primary system, the reduction representing approximately £45,000. This year, however, the local authorities contributed £273,063 to works financed out of the Revenue Fund, representing an increase on last year's figure of £48,971, and bringing the amount to almost the same as that provided in 1926–27 and 1927–28.

To a certain extent the increase in the amount provided by the local authorities on the primary system of main highways is brought about by the increasing amount of sealing-work which is charged to the Revenue Fund. As a matter of fact, new sealing-work, representing an expenditure of approximately £100,000, was carried out and charged to the Revenue Fund last year, representing a substantial increase on previous years. This work alone would mean a contribution by the local authorities of between £20,000 and £30,000.

The amount provided by the local authorities towards the cost of maintenance of the secondary system increased from £60,434 for the financial year 1928–29 to £102,786 for the financial year 1929–30, but this does not necessarily mean that the local authorities provided more for the maintenance of the secondary highways than was the case before their declaration. The amount provided by the Board for maintenance of the secondary highways was £244,481, which, together with the amount contributed

by the local authorities, represents a total of £347,267 ; and while this total figure doubtless represents a substantial increase in expenditure on secondary highways as compared with 1927 (before declaration), there must be substantial relief to the local authorities.

The following tabulation shows the amount which has been provided by the Board and the local authorities for expenditure on the construction and maintenance of main highways during the six years the Board has been in operation.

——	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	Total.
	£	£	£	£	£	£	£
Maintenance by Board	123,675	279,404	438,762	523,581	756,399	1,049,249	3,171,070
Maintenance by local authorities	110,001	185,015	276,349	269,065	284,526	375,849	1,500,805
Construction by Board	222,422	421,880	540,362	449,904	936,148	1,007,957	3,578,673
Construction by local authorities	80,000	142,761	255,860	262,538	214,155	203,148	1,158,462
Totals ..	536,098	1,029,060	1,511,333	1,505,088	2,191,228	2,636,203	9,409,010

The figures in the above tabulation do not include indirect charges such as supervision, interest, and other overhead charges.

An analysis of the actual expenditure on maintenance in each Island as compared with the number of motor-vehicles in each Island at the 31st March of each year since the inception of the main-highways scheme gives the following results, expressed in percentages of the Dominion totals :—

——	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.
North Island—						
Maintenance expenditure ..	64·49	65·27	64·86	67·51	66·13	62·30
Motor-vehicles	60·91	61·41	61·86	62·19	63·08	63·63
South Island—						
Maintenance expenditure ..	35·51	34·73	35·14	32·49	33·87	37·70
Motor-vehicles	39·10	38·59	38·14	37·81	36·92	36·37

The tabulation indicates that there has been a further increase in the percentage of motor-vehicles in the North Island, while on the other hand the percentage of maintenance expenditure shows a decrease, with a corresponding increase in the percentage of expenditure in the South Island.

In accordance with the direction contained in section 21 of the original Act, and following on the Board's resolution passed in May, 1925, an apportionment of the tire duty and license fees for the year ending 31st March, 1930, has been made between the two Islands in proportion to the number of motor-vehicles registered in each Island on that date.

As explained last year, no statutory provision exists requiring an apportionment of the proceeds from the petrol-tax between the two Islands. The Board is of opinion that the most equitable method of distribution of this tax is on the basis of the consumption of petrol in each Island. As in the previous year, the Board obtained figures from oil companies, and these figures show that during the calendar year 1929 approximately 69 per cent. of the motor-spirit imported was consumed in the North Island, and approximately 31 per cent. in the South Island, as compared with 72 per cent. and 28 per cent. respectively for the previous calendar year. No adjustment has been made on these percentages to take account of rebates, because definite information is not available, and in any case it appears probable that the rebates in each Island will bear the same proportion as the petrol consumed. Moreover, the proportion of rebates is so small that a very considerable error in their proportions would not materially affect the proportion of the totals. In making the apportionment the interest on moneys borrowed for construction work in each Island has been charged against the revenue allocation to each Island and other adjustments in connection with interest on accumulated balances have been made.

On the assumption given above, the balances to the credit of the North Island and South Island respectively on the 31st March, 1930, were £30,610 and £209,873.

The following statement shows the manner in which these balances have been obtained :—

NORTH ISLAND.

Expenditure.	£	s.	d.	*Income.*	£	s.	d.
Expenditure (general)	653,724	12	8	Balance at 1st April, 1929	209,261	7	2
Abolition of toll-gates	1,807	0	0	Interest from investments	16,999	14	0
Interest and expenses of raising loans, &c., and reserve for redemption of securities	78,972	15	0	Motor registration—Annual license fees and tire-tax	339,693	3	10
Commission on collection of motor fees	13,216	4	1	Motor-spirits tax	602,624	18	0
Miscellaneous expenditure	30,897	0	3	Transfer from Consolidated Fund ..	16,100	0	0
Finance Act, 1927 (No. 2), sec. 33, Wellington City Council	24,128	10	9	Part repayment of temporary transfer to Construction Fund	128,677	0	0
Transfer to Construction Fund ..	480,000	0	0				
Balance	30,610	0	3				
	£1,313,356	3	0		£1,313,356	3	0

SOUTH ISLAND.

Expenditure.	£	s.	d.	*Income.*	£	s.	d.
Expenditure (general)	395,524	19	11	Balance at 1st April, 1929	408,869	4	10
Interest and expenses of raising loans, &c., and reserve for redemption of securities	21,508	0	0	Interest from investments	9,153	13	8
				Motor registration—Annual license fees and tire-tax	194,163	15	7
Commission on collection of motor fees ..	7,554	3	11	Motor-spirits tax	270,744	10	3
Miscellaneous expenditure	18,693	14	1	Transfer from Consolidated Fund ..	18,900	0	0
Transfer to Construction Fund ..	270,000	0	0	Part repayment of temporary transfer to Construction Fund..	21,323	0	0
Balance	209,873	6	5				
	£923,154	4	4		£923,154	4	4

Of a sum of £300,000 temporarily transferred from the Revenue Fund to the Construction Fund in the financial year 1927-28, £150,000 was repaid to the Revenue Fund from borrowed money during the year. The balance of £150,000 is to be repaid to the Revenue Account in the financial year now current.

A permanent transfer of a sum of £750,000 was made from the Revenue Fund to the Construction Fund during the financial year 1929–30, and this transfer has been the cause of materially reducing the balance in the Revenue Fund. This amount, however, is substantially more than will be transferred in normal future years, when the transfers will vary from £200,000 to £300,000 according to the revenue. In transferring a sum of £750,000 the Board was enabled to accelerate certain paving works, which the amount borrowed for the year, under the loan authority contained in the Act of 1922, would not have permitted.

For the year ended 31st March, 1930, the appropriations and expenditure, including administration charges, &c., under the Construction Fund were as follows :—

——	Available for Authorization.	Appropriation.	Expenditure.	Percentage of Expenditure to Appropriation.
	£	£	£	
North Island	802,623	755,666	684,629	90·60
South Island	525,052	494,334	386,788	78·24
Totals	1,327,675	1,250,000	1,071,417	85·71

An analysis of the Board's expenditure, excluding overhead charges, and the expenditure by local authorities under the Construction Fund shows the following position :—

The tabulation has been subdivided to show, firstly, the net expenditure on the original system of main highways ; secondly, the net expenditure on the additional main highways declared in 1928 ; and, thirdly, the net expenditure on the whole system.

——	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	(1) *Original Highway System.*				
	£	£	£		
North Island	584,352	117,408	701,760	83·27	16·73
South Island	324,189	54,312	378,501	85·65	14·35
Totals	908,541	171,720	1,080,261	84·10	15·90
	(2) *Additional Highways declared, 1928.*				
North Island	59,726	23,591	83,317	71·68	28·32
South Island	39,690	7,837	47,527	83·51	16·49
Totals	99,416	31,428	130,844	75·98	24·02
	(3) *Complete System.*				
North Island	644,078	140,999	785,077	82·04	17·96
South Island	363,879	62,149	426,028	85·41	14·59
Totals	1,007,957	203,148	1,211,105	83·23	16·77

The amount provided by the local authorities towards the cost of construction works on the original highway system shows a reduction of £19,000 as against a reduction of £72,000 in the previous year. The local authorities found £8,000 more towards the cost of construction works on secondary highways, the work on most of which is subsidized on a £1 for £1 basis. On the whole year's operations

there was a reduction of £11,000 in the amount provided by local authorities, while the amount provided by the Board increased from £936,148 to £1,007,957. The percentage of construction costs provided by the Board has gradually increased from 70 per cent. in 1924 to 83 per cent. for the year under review.

CONSTRUCTION.

As mentioned in last year's report, the construction work carried out or subsidized by the Main Highways Board may be discussed under three headings—(1) The closing-up of unmetalled gaps in the main-highway system, a work to which the Board has consistently applied itself since it commenced to function; (2) the paving of sections of highway which carry traffic beyond the capacity of the ordinary gravelled or metalled road, which work has been given considerable impetus since the imposition of the petrol-tax; and (3) the construction and replacement of bridges.

During the year under review a number of further important all-weather connections were established. It is gratifying to record that considerable progress has been made with the construction work necessary to complete the most important link remaining in the Dominion—that between Auckland and Whangarei.

Last year an all-weather connection was established between Auckland and Waiwera, and surfacing-work has now reached the Township of Warkworth. A connection was also established between Te Hana and Topuni.

The completion of a sandstone base course between Tauhoa on the west coast and Warkworth on the east coast was achieved.

An all-weather connection was established between Whangarei and Kaikohe via the Awarua Gorge. A further connection established was that between Hokianga and Kaikohe.

On the Whangarei–Kawakawa Main Highway a short length of metalling at the county boundary near Hukerenui was completed, thus providing an all-weather connection between Whangarei and Kawakawa with the aid of a detour road between Hikurangi and Hukerenui.

On the Waitoa–Taupo Main Highway a short clay gap was surfaced in the Piako County.

Between Tauranga and Waihi metalling was completed, thus providing a further all-weather connection to Auckland from the Bay of Plenty.

On the Te Kuiti – Bulls (via Taumarunui) Highway—the main arterial route through the centre of the Island—sufficient work has been accomplished to enable light traffic to use the road throughout the whole of the year. A considerable length of this highway, however, is still pumice formation, and consequently it will be a considerable time before the road will be fit for use by heavy traffic in all weathers.

The Wanganui–Horopito Main Highway was linked up immediately after the end of last financial year, and was dealt with in detail in the last annual report.

Paving-work on the more heavily trafficked sections of main highway, principally adjacent to the main centres of population, has proceeded satisfactorily. In the South Island, in particular, excellent progress has been made compared with that made in the first four or five years of the Board's operations.

As has been mentioned on several occasions in the Board's previous annual reports, the local authorities in the South Island were somewhat loth to take advantage of the opportunities offered under the original Main Highways Act, but the imposition of the petrol-tax, which was followed by the payment of special subsidies, usually amounting to £3 for £1 on approved paving schemes adjacent to the main centres of population, combined with the judicious use of the powers given to the Board to advance money to local authorities under the Main Highways Amendment Acts of 1926 and 1928, has completely changed the situation. A large number of counties in the South Island now desire to accelerate paving schemes at a rate beyond the financial resources of the Board.

As explained in previous reports, schemes usually involving a programme of construction extending over a period of five years were prepared for paving works around all important centres of over 6,000 population. The details of these schemes were decided upon after collaboration with the local authorities and automobile associations. Less than two years has elapsed since the schemes were first launched, and the following short summary of each scheme indicates roughly the progress which has been made:—

Whangarei centre: Work completed is up to schedule.

Auckland centre: The work completed is in accordance with schedule.

Gisborne centre: Progress is satisfactory.

Napier and Hastings centres: Almost the whole programme for five years has been completed in this area in two years. The reason for such excellent progress in this locality is that the local authorities had ample finance available to enable the schemes to be prosecuted with the utmost vigour, while the Board was also in a position to find its share of the money on account of a certain amount of delay in other districts.

New Plymouth centre: The progress in this area is in accordance with schedule.

Wanganui centre: Progress made to date has been in accordance with the programme.

Palmerston North centre: Excellent progress has been made in this area, the five-year programme being almost completed in two years.

Masterton centre: Excellent progress has been made, the work accomplished being considerably ahead of programme.

Wellington centre: Progress has been satisfactory.

Nelson centre: The progress so far is behind the schedule.

Christchurch centre: Progress in this area has been very satisfactory.

Timaru centre: Excellent progress has been made in this area.

Oamaru centre: Satisfactory progress has been made.

Dunedin centre: Excellent progress has been made.

Invercargill centre: The programme is to some extent behind the schedule.

Maintenance.

The Board is able to report that the main highways have been generally well maintained. Table No. 5 appended to this report, however, shows that there has been a considerable increase in the average maintenance costs per mile on both the primary and secondary system. The average cost per mile per annum since 1924 on the primary system is as follows: 1924–25, £51·7; 1925–26, £73·2; 1926–27, £111·9; 1927–28, £119·9; 1928–29, £125·2; 1929–30, £151·2.

Apart from the general increase in maintenance costs, which is to be expected as the number of motor-vehicles increase, the increase in the average cost per mile is due to the amount of sealing-work carried out during the year, the cost of which was charged to the Revenue Account. Approximately £100,000 was expended out of the Revenue Fund on new sealing-work, and this figure represents a substantial increase on that charged in previous years for the same class of work.

With regard to secondary highways, a total length of 3,757 miles was maintained at an average cost of £88·5 per mile, which represents an increase of £33 per mile over the previous year, when the average was £55·5 per mile. From experience in the case of the original highway system this increase was not unexpected, and the average for the year more closely represents the normal maintenance costs of the secondary system.

Advances to Local Authorities.

Under section 2 of the Main Highways Amendment Act, 1926, which authorizes the Board to advance moneys by way of loan to local authorities for highway purposes, a sum of £31,802 was advanced, making the total now advanced under this section £37,402. All loans are made on the instalment repayment system, the local authority being required to make equal annual payments, which include interest on the amount for the time being outstanding and part repayment of principal. All loans which have so far been made bear interest at the rate of 5½ per cent. per annum, but the Minister of Finance has found it necessary to increase the rate on future loans to 5¾ per cent. per annum.

Traffic-control.

Following on the appointment of a Traffic Inspector to regulate traffic on the main highway between Auckland and Hamilton, and the receipt of satisfactory reports as to the results of the appointment, the Board suggested to local authorities that certain groups should combine for the purpose of administering the traffic regulations. In cases of approved joint schemes the Board indicated that it would subsidize the wages and expenses of a Traffic Inspector on a pound-for-pound basis. A number of such schemes have already been approved and are in operation, and further groups of local authorities are moving along these lines.

Earthquake Damage.

A total sum of £86,878 was spent on restoration of damage caused by the earthquake on the 17th June, 1929, the amount being made up as follows:—

	£
Nelson–Westport	51,907
Murchison–Reefton	11,652
Westport–Karamea	15,936
Various small items on other main highways	7,383
Total	£86,878

It has not yet been possible to reopen the Nelson–Westport Main Highway through the Buller Gorge, nor has it been possible to reopen the main highway between Westport and Karamea. The Murchison–Maruia–Reefton Road has served as a detour in lieu of the road through the Buller Gorge, but in the case of the Westport–Karamea Main Highway no temporary connection could be made, and a pack-track and the sea remain the only means of communication with Karamea.

The reopening of both the Westport–Nelson and the Westport–Karamea Main Highways has been prolonged by reason of the large slips which continue to come down, especially in wet weather, and completely block portions of the road which have already been cleared. It is hoped that the road through the Buller Gorge will be open for traffic about November next, but periodical blockages must subsequently take place with consequent dislocation of traffic. The Murchison–Maruia–Reefton Road has, however, been brought into such a condition that road communication between Nelson and the West Coast is ensured, although blockages may occur in the Buller Gorge.

Purchase of Plant.

The purchasing and hiring of plant to local authorities on the hire-purchase system has continued. The total value of plant purchased to 31st March, 1930, amounted to £139,816.

The following shows the plant ordered, and hired to local authorities, from 31st March, 1929, to 31st March, 1930: Power graders, 20; ordinary road-grader, 1; motor-lorries, 8; roller, 1; tractors, 4; elevator, 1; conveyer, 1; dragline-excavator, 1; oil-engine, 1; rock-drill outfit, 1; loadometers, 1 set; &c.

In addition to the above, the Board purchased the following plant for its own use, at a total cost of £10,051: Power graders, 4; ordinary road-grader, 1; road-rollers, 2; oil-engines, 3; winches, 2; pump, 1; air-receiver, 1; testing-machine, 1; motor-lorries, 8; crusher, 1; elevator, 1; air-compressors, 2; loaders, 2; sprayer, 1; tractor, 1; trailer, 1; &c.

The periodical payments being made to the Board by local authorities for plant purchased on their behalf is now sufficient to finance all new purchases under this scheme, so that it is unnecessary to utilize ordinary revenue for this purpose.

A great deal, if not most, of the plant now purchased by County Councils is obtained by this system, under which the maximum period allowed for payment by the local authorities is four years, and, although the Board has been asked on different occasions to extend this period, it considers that it would be most unwise to do so. There are a large number of local authorities a present carrying loans with periods ranging from twenty to thirty-six and a half years for plant, the true value of which to-day is indeed very low, if not in many cases nil, and this in itself is a strong reason why the period allowed for present-day purchases should be strictly limited. The Board understands that a number of local authorities have established a reserve for the purchase of plant, and the Board desires to express its complete accord with such a system.

When making purchases of plant the Board would like to see more local authorities invite quotations per medium of the public press, as it is satisfied that much better prices can be obtained by this method.

Testing of Highway Materials.

The Petrological Laboratory has continued to carry out the standard tests on roadmaking-materials. Table 6 shows the rock-tests carried out during the year. In addition, a large number of granulometric analyses of gravels and sands were undertaken. Several special geological investigations in connection with highway matters were carried out. The testing of samples of tar, road-oil, bitumen, bituminous emulsions, and bituminous concrete was efficiently undertaken as usual by the Dominion Analyst, Wellington.

Examination of Foremen and Overseers Employed on Road-construction.

The fifth examination of foremen and overseers for the purpose of issuing certificates of competency was held on the 29th July, 1930. Eighty-four candidates sat for the examination as compared with twenty-six, fifty, fifty-two, and forty-eight respectively in previous years. Nineteen candidates passed the full examination. Five candidates completed the examination, having passed in one subject previously, and twenty candidates obtained a partial pass. Although the complete passes were twenty-four in number, certificates are to be issued to only fifteen as nine of the candidates who passed the theoretical test have had insufficient practical experience to justify the issue of a certificate of competency.

Each examination reveals that candidates are taking a great deal of interest in this examination, as the standard of paper has shown an improvement on each occasion.

For the information of local authorities the following is a complete list of successful candidates since the examinations were originated: S. Annabell, G. Avery, V. L. Bagnall, D. Baldwin, F. H. Bastin, J. W. Bean, H. V. Bond, D. E. Brown, H. Chappell, W. E. Cottrell, A. H. Davis, J. G. Dennison, E. J. Ferguson, P. S. Finlayson, J. Forbes, W. I. Gardiner, G. E. Gibbs, E. Grant, W. J. Hawkes, F. Hermans, O. G. Hewison, T. J. Hickey, M. H. Houlihan, R. G. Howell, T. R. Hutton, W. J. Jenkins, W. J. E. Jenkins, J. H. Kendall, B. L. Larson, R. M. Lankshear, R. G. Lysnar, J. G. Mahood, O. R. Marshall, G. Mascull, F. F. Maynard, J. E. Mays, H. N. McDonald, J. G. McIvor, C. D. Molesworth, J. I. Monfries, F. Muggeridge, J. V. Neill, R. H. Newman, R. F. Newton, L. Oldham, W. Page, R. B. Price, E. M. B. Revill, S. G. H. Robinson, J. I. Shields, H. B. Smart, T. G. Smith, T. R. Sneddon, S. G. Stockley, J. Stringer, C. B. Thomson, R. H. Westbrook, J. A. Williams, H. J. L. Wotten.

Progress Report.

The following statement shows the more important construction work carried out under the control of the Main Highways Board during the year ended 31st March, 1930:—

Waimate–Kaeo–Mangonui.—Kahoe Bridge: Concrete piles have been fabricated for this bridge, and all material is on the ground.

Kahoe Bridge – Stoney Creek: 1 m. 69 ch. has been metalled, providing an all-weather connection between Waimate and Mangonui.

Whangaroa–Waiare.—Whangaroa – Kaeo Bridge Section: The road has been widened in rock over a length of 15 ch. where the alignment is unsatisfactory.

Waipapakauri – Victoria Valley.—Victoria Valley Bridge: The erection of this bridge 150 ft. in length and its approaches has been completed.

Te Rore Bridge: Approaches 14 ch. in length have been formed and metalled.

Pamapuria culvert: This reinforced-concrete culvert has been completed.

Mangamuka – Te Karae.—Omakura Bridge: This structure of a length of 70 ft. together with its approaches has been completed.

Waimamaku–Ohaeawai.—Kaikohe–County boundary: A contract has been let for the formation and metalling of 1 m. 14 ch., and at the end of the year the formation work was completed.

Kawakawa–Mangamuka.—Ohaeawai – Lake Omapere: 4 m. of road has been reconstructed and metalled.

Maungatapere–Kaikohe.—Kaikohe – Awarua Gorge Section: 10 ch. has been widened and 64 ch. metalled.

Kaikohe–Mangakahia Section: A length of 56 ch. of this section was formed and 1 m. of base-course metal laid. Two small bridges have been erected.

Whangarei–Kawakawa.—Kamo Town District Section: 1 m. 6 ch. of bituminous macadam was laid during the year. This completed the section.

Otonga–County boundary: 30 ch. of formation has been completed. All the concrete piles for the five bridges north of Whakapara have been fabricated, and a contract let for the erection of the structures.

Hukerenui–Waiomio: 19 ch. at the county boundary has been metalled, thus completing a metalled connection between Hukerenui and Kawakawa.

Long's Corner – Tauraroa.—The approaches to the Tauraroa Bridge have been surfaced and the side slopes of banks protected.

Dargaville–Maungaturoto.—Concrete piles have been fabricated for Anderson's, Bascombe's, and Skelton's bridges, and the materials for erection of same are on the sites.

Kaukapakapa – Port Albert.—On Putahi Flat a further 29 ch. has been metalled as well as 16 ch. between Tauhoa and Mangakura; 25 ch. of metalling at Hoteo Bridge approach is in hand.

Te Hana – Tomorata.—The metalling of 25 ch. of a deviation is in progress.

Wellsford–Whangaripo. — 2 m. 73 ch. of base course was completed and the top course metalling is in progress. The completion of the base course on this section provides an all-weather road between Pakiri Junction and Wellsford.

Warkworth–Leigh.—Meiklejohn's Bridge: This bridge, 70 ft. in length, and its approaches are complete.

Tauhoa – Kaipara Flats.—1 m. 33 ch. of sandstone base course was laid, enabling an all-weather road to be used between the East and West Coasts.

Auckland–Maungaturoto.—Birkenhead–Albany: A length of 55 ch. of bituminous macadam was laid during the year, making a total of 2 m. 70 ch. to date. An experimental length of 22 ch. of cement penetration pavement was also completed.

Silverdale–Waiwera: The completion of the approach filling at the south end of the Waiwera Bridge was practically accomplished at the end of the year.

Waiwera Bridge: At the close of the year tenders were called for the construction of this bridge, and a contract has since been let.

Puhoi–Warkworth: A considerable amount of work was carried out on this section during the year. Reinforced-concrete piles were fabricated for Langridge's Bridge. A sandstone base course was laid over a considerable length of the section, and an all-weather connection between Auckland and Warkworth was established by the end of the year. 6,000 cub. yd. of top-course metal was delivered to a dump at Puhoi. On this section it was found necessary to construct a considerable length of special spall foundations and stone drains.

Dome Hill – Wayby Junction: Formation work was continued on this section. Two sandstone quarries were opened up, and a total of 6,200 cub. yd. of stone crushed.

Wayby–Wellsford: Spall foundations and metalling work were continued on this section. Both bottom and top course metalling were completed over the whole length, except for about 30 ch.

Wellsford – Te Hana: A small amount of formation work was carried out. Spall foundations and metalling were completed on the new sections of work in such a manner as to give, with the old temporary metalled stretches, an all-weather connection.

Te Hana – Topuni: The whole of the formation on this section has been completed. Spall foundations and metalling were well advanced at the end of the year.

The following summary shows the work accomplished during the year on this highway: Earthwork, 59,577 cub. yd.; spalls, 4,487 cub. yd.; metal crushed, 44,104 cub. yd.; bridge piles, 140 lin. ft.; fencing, 169 lin. ch.; culverts, 4,769 lin. ft.

Motutara Island Quarry: A small plant is being erected on this island to supply the maintenance metal required during the winter and construction metal during next summer.

Helensville–Waiwera.—Reconstruction work over a length of 1 m. 10 ch. between Upper Waiwera and Waiwera has been finished.

Kumeu–Albany.—The surface course has been completed over a length of 2¼ miles.

Onewa Road.—Shoulders to the concrete pavement have been constructed on the Waitemata County Section.

Northcote Road.—The shoulders to the concrete pavement have been constructed on the Waitemata County Section.

Titirangi Road.—Waitemata County Section: A contract was let for necessary earthwork on this section preparatory to paving, and the work is well advanced. A commencement has also been made with a large concrete retaining-wall near Titirangi.

Auckland–Helensville.—Henderson–Huapai: For the first three months of the year, formation work was continued on this section, a total of 3,027 cub. yd. being excavated. To enable traffic to be maintained over the new formation work 1,485 cub. yd. of metal was laid.

Great South Road.—Mount Wellington Road Board Section: Bituminous shoulders to the concrete pavement were constructed.

Manukau County Section: Bituminous shoulders to the concrete pavement were completed, and the Papakura Stream Bridge was erected.

Bombay Hills Deviation: Improvements to the alignment on this deviation were put in hand.

Mercer–Ohinewai: On this section widening and formation were undertaken over a length of 10 ch. The foundation course was widened to 18 ft. over a length of 4 m. 24 ch. and a bituminous-macadam wearing-course was completed over a length of 7 m. 70 ch.

Huntly–Taupiri: 90 ch. of widening and 1 m. 39 ch. of metalling were completed.

Contracts were let for the following bridges, and construction work is in hand: Whangamarino Stream Bridge, Rangiriri Stream Bridge, Te Onetea Stream Bridge, and Kimihia Stream Bridge.

Waipa County Section: Between Ohaupo and Te Awamutu a length of 29 ch. of bituminous macadam has been carried out.

Pipiroa–Coromandel.—Thames County Section: The alignment of the eastern approach to the Kopu Bridge has been much improved.

A 20-ft.-span concrete bridge was completed over McCormick's Creek.

Coromandel County Section: A total length of 10 m. 41 ch. of this section was widened to 18 ft. Metalling was undertaken where widening work made it necessary.

Kopu–Raglan.—Kirikiri Stream: A diversion of this stream 16 ch. in length was completed.

Paeroa Borough Section: A length of 44 ch. was surface-treated with bitumen.

Raglan County Section: A length of 5 m. 62 ch. of this section was improved and widened to a width of 22 ft.

Hamilton–Rotorua (No. 2 Highway District).—Hamilton–Cambridge: A length of 8 m. 51 ch. was sealed with two coats of tar and one of bitumen.

Cambridge Borough Section: A length of 34 ch. was treated with two coats of tar.

Cambridge–Tirau: 1 m. 30 ch. of road was widened to 24 ft.; 69 ch. of rhyolite surfacing has been completed. Further formation work is in hand over a length of 4 m.

Tapapa–Mamaku: Further gravelling-work was continued on this section, and 10 m. 48 ch. of gravelling from 12 ft. to 16 ft. wide was completed.

Waitoa–Taupo.—Piako County Section: The last length of 83 ch. of the unmetalled section of this highway was surfaced.

Putaruru Town District: A contract was let for the reconstruction, metalling, and sealing of 1 m. 56 ch. of this section, and by the end of the year 58 ch. had been completed.

Matamata–Tauranga (No. 2 Highway District).—47 ch. of formation and 1 m. 18 ch. of metalling were completed on the Kaimai Hills Section.

Tahuna-Ohinewai.—A 20-ft.-span timber bridge was erected on this highway.

Orongo–Netherton.—A 20-ft.-span bridge was constructed over Ansford's drain in the Hauraki Plains County.

Kihikihi–Putaruru.—Putaruru Town District: A length of 93 ch. of reconstruction and metalling was completed.

Matamata County Section: Bituminous surface-treatment was undertaken over a length of 8 m. 61 ch.

Waipa County Section: Reconstruction and gravelling were carried out over a length of 1 m. 31 ch.

Pukekohe–Glenmurray via Tuakau.—Pukekohe Borough Section: Widening of the bituminous surface over a length of 1 m. 40 ch. was completed.

Tuakau Town District: 5¾ ch. of formation was carried out.

Papakura–Hunua.—On the Hunua Section the existing formation was widened to a minimum width of 18 ft. over a total length of 3 m. 23 ch.

Papakura–Clevedon.—Papakura Town District: This section was sealed over a length of 14 ch.

Papatoetoe–Howick.—Manukau County Section: 33 ch. of regrading and metalling was completed.

Howick–Manurewa.—Manukau County Section: Between Whitford and Brookby 20 ch. of metalling was finished.

Ngatea–Waharoa via Morrinsville.—On the Matamata County Section 1 m. of bituminous surfacing was undertaken. Two small bridges were constructed during the year on the Maukoro Deviation.

Waitoa–Maukoro.—A new bridge consisting of rolled-steel-joist spans on concrete piers has been built over the Piako River.

Pairere–Kaimai.—A length of 7 m. of this section was sealed with bitumen.

Te Aroha – Waharoa.—Matamata County Section: 88 ch. of this section was surface-treated with bitumen.

Cambridge–Morrinsville.—Cambridge Borough Section: One coat of tar was applied over a length of 50 ch.

Gisborne–Whakatane via Motu (No. 3 Highway District).—Motu–Willow Tree Crossing–Nukuhou: A number of dangerous bends on the Meremere and Papamoa Hills were widened during the year, greatly improving the visibility. A length of 1,496 lin. ft. of concrete-pipe culverts was placed.

A length of 25 ch. of road near Waiotahi Bridge was given a second sealing-coat.

At Healey's cutting 8 ch. of road was widened and straightened and the grades eased.

Nukuhou–Whakatane: A bridge 71 ft. long was completed in reinforced concrete.

Taneatua Township Section: 30 ch. of road was sealed to a width of 30 ft.

Whakatane–Tauranga.—Whakatane–Matata: A new bridge consisting of two 16 ft. and one 40 ft. rolled-steel-joist spans was erected over the Te Rahu Drain.

Matata–Otamarakau: Two reinforced-concrete bridges, each 55 ft. with 18 ft. roadway, were erected over the Mimihau and Hereperu Streams.

Te Puke Town District: An area of 7,000 sq. yd. was surface-treated with bituminous material.

Te Puke – Tauranga: A length of 4 ch. of road was raised above flood-level and widened, and one small bridge and a number of culverts have been renewed.

Tauranga–Waihi.—Tauranga County Section: By the metalling of a length of 6 m. 21 ch. an all-weather road between Tauranga and Auckland was provided. In the Hikurangi Gorge 4½ m. was reconditioned. New bridges were erected at Tahawai, Hyde's Creek, and Rereatuakahia.

Tauranga Borough Section: A length of 40 ch. of bituminous macadam 18 ft. in width has been constructed.

Hamilton–Rotorua (No. 3 Highway District).—Ngongotaha Stream Bridge: This structure, consisting of two 30 ft. reinforced-concrete spans on concrete-pile piers was completed.

Rotorua–Napier.—Rotorua–Waiotapu: On this section 3,274 cub. yd. of earth and clay were excavated in cutting back bends between 3 m. and 5 m.

Waiotapu–Taupo: Between 20 m. and 21 m. the road was widened, some 1,700 cub. yd. of earth and clay being excavated.

Tauranga–Matamata (No. 3 Highway District).—Ruahihi–County boundary: A commencement has been made with the erection of the Ruahihi Bridge, consisting of two 55 ft., one 65 ft., and one 22 ft. spans, with 18 ft. roadway.

Tauranga Borough Section: A length of 33½ ch. of bituminous-macadam surfacing, 18 ft. in width, has been completed, and 167 ch. of existing pavement has been widened.

Whakatane–Rotorua.—Whakatane–Rotoma: A length of 30 ch. of road was metalled 12 ft. in width.

The Te Rahu Bridge, consisting of two 16 ft. and one 40 ft. rolled-steel-joist spans, was renewed.

The Whakaire Bridge, consisting of one 26 ft. span, was completed in concrete.

Rotoma–Rotorua: Between 25 m. and 26 m. at Rotoma widening-work was carried out, and 12½ ch. of stone protection-wall was constructed along the shores of Rotoma Lake.

Adjacent to the Borough of Rotorua a length of 122 ch. of pumice road was treated with road-oil.

Whakatane Borough Section: 63 ch. of this section was surface-treated to widths varying from 27 ft. to 36 ft.

Rotorua-Tauranga (Direct Road).—Rotorua County Section: 37 ch. has been widened to a width of 24 ft., and 3 m. 15 ch. metalled to a width of 10 ft. with rhyolite.

Tauranga County Section: A length of 64 ch. had been metalled to a width of 10 ft. In the Mangorewa Gorge further widening over a length of 127 ch. was undertaken.

Te Puna Point–Omokoroa.—A contract has been let for the metalling of a further 80 ch. of this road.

Rotoma – Matata.—Whakatane County Section: 35 ch. of metalling has been completed to a width of 12 ft., and a number of new culverts installed.

Wainui Road.—Whakatane County Section: 40 ch. of this section was straightened and widened to 20 ft., and a number of culverts were renewed.

Gisborne–Opotiki via Coast.—Cook County Section: A further length of 64 ch. of bituminous macadam was completed to the 4 m. peg.

Waiapu County Section: A length of 3 m. of top course has been laid. Contracts were let for 15 miles of top-course metalling, but were considerably delayed by weather conditions. Bottom-course metalling was completed over a length of 3 m. between 94·9 m. and 97·9 m.

Mangahauini Bridges Nos. 1 and 2: These bridges at 61½ m. and 62½ m. were completed. They are 110 ft. and 80 ft. in length respectively, and consist of rolled-steel-joist spans with concrete superstructure and deck.

Maraehara Bridge: This bridge at 102½ m., on the boundary of the Waiapu and Matakaoa Counties, has been completed. It consists of one 80 ft. span and two 30 ft. spans.

Mangaoporo Bridge: This structure, consisting of four 80 ft. spans, is well in hand.

Matakaoa County Section: 10 ch. of metalling was completed on the deviation on the Hick's Bay Hill, and 40 ch. of metalling was finished at 106 m.

Awatere Bridge: A contract has been let for the erection of this structure. It consists of plate-girder spans with reinforced-concrete deck. A commencement has been made with the contract.

Gisborne–Wairoa via Morere (No. 4 Highway District).—Cook County Section: The formation of a deviation 96 ch. in length across the flats from the 9-mile peg has been completed. The deviation shortens the road by 40 ch.

Te Arai Bridge: This structure, 200 ft. in length and 18 ft. in width, has been completed in reinforced concrete.

Gisborne–Wairoa via Hangaroa (No. 4 Highway District).—Cook County Section: During the year 48 ch. of bituminous surface was completed, making a total length of 2 m. 42 ch. to date. Between 36 m. and 39 m. a further length of 1½ m. of metalling was completed.

Gisborne–Whakatane via Motu (No. 4 Highway District).—Waikohu County Section: On this section 4¼ m. of bottom-course metalling and 6 m. of top-course metalling were completed. The approaches to the Waihuka Bridge have been metalled. The Waikohu River Bridge at Rakauroa has been completed. It consists of one 40 ft. and two 20 ft. rolled-steel-joist spans with reinforced-concrete deck. A deviation eliminating a railway overbridge is being constructed at 20½ m.

Taurangakautuku Road.—On this highway a steep open crossing on the Tangikaka Stream has been bridged.

Tokomaru–Mata.—The whole of the widening and metalling has been completed on this road, 1 m. having been carried out during the year.

Patutahi–Rere.—Cook County Section: 1 m. of top-course metalling has been laid from the boundary at 17·4 m. towards Gisborne.

Waikohu County Section: On this length 2 m. 50 ch. of top course has been laid, completing the metalling to Rere.

Gisborne–Ormond via Waiohika.—Cook County Section: The construction of a further 1 m. 38 ch. of bituminous macadam has been commenced, and the work is well in hand.

Napier–Gisborne via Wairoa (No. 5 Highway District).—Westshore–Petane: A length of 4 m. of bituminous surface which was in hand at the end of the previous year has since been completed. A reinforced-concrete culvert has been constructed at McGregor's Crossing near Tongoio. A contract has been let for the construction of a concrete bridge and deviation at Te Ngaru Crossing.

Tutira–Waikare: The Mahiaruha Bridge, Sandy Creek Bridge, and King's Creek Bridge were completed.

Mohaka Bridge – Wairoa: Several large deviations were completed between the foot of the Mohaka and Waihua to avoid railway crossings on the Napier–Wairoa Railway.

Wairoa–Morere: The Waikatuku Bridge at Whakaki was renewed in steel and concrete. The renewal of the Tahaenui Bridge is also in hand.

Wairoa–Gisborne via Hangaroa (No. 5 Highway District).—Wairoa County Section: 2 m. of sealing from Wairoa towards Frasertown was completed.

The Mangatawa Bridge at Marumaru was renewed in concrete and steel. It consists of three spans, and has a total length of 110 ft.

Petane–Taupo.—Mohaka Bridge–Runanga Falls: The construction of the Double Crossing Bridge is well in hand.

Napier–Wellington via Wairarapa (No. 5 Highway District).—Hawke's Bay County Section: Along Hastings Borough boundary, a length of 2 m. 8 ch., and between Hastings Borough boundary and the Maraekakaho turnoff, a length of 3 m., the road is being given a bituminous surface by the three-coat method.

The Te Aute Hill deviation, 66 ch. in length and entailing 20,000 cub. yd. of cutting, has been completed. The deviation shortens the road by 20 ch.

Waipawa County Section: The length from the Hawke's Bay County boundary to the Waipawa Borough boundary received a second seal coat of bitumen during the year. On this section several defects have developed owing to springs, which have been dealt with by the construction of stone drains.

On the Takapau Plains a length of 7 m. was reconstructed during the winter, and the sealing of same with bitumen is now in progress.

Waipawa Borough Section: 1 m. 40 ch. of this section was treated with a second coat of bitumen.

Waipukurau Borough Section: A contract has been let for the sealing of 18 ch.

Waipukurau County Section: The north side of the Sanatorium Hill was considerably widened and improved.

Dannevirke County Section: 45 ch. of formation across Wood's Swamp was raised, widened, and metalled.

A length of 4 m. between Waipawa County boundary and Norsewood was sealed, likewise a length of 40 ch. on the Whakaruatapu deviation. $3\frac{3}{4}$ m. of second-coat work was completed.

Stanley Street Bridge (over the Tapuata Stream) was widened to 24 ft.

Woodville Borough Section: On Vogel Street a length of 8 ch. was reconstructed.

Mangatewai-iti Deviation: 30 ch. of protective fencing was erected.

Mangatewai-iti–Mangatewai-nui Deviation and Bridge: A contract was let for this bridge and deviation.

Orua Kiritaki Deviation and Bridge: This bridge, consisting of four 35 ft. rolled-steel-joist spans with reinforced-concrete deck, together with a deviation 16 ch. in length at the southern approach, was completed.

Dannevirke–Waipukurau via Porangahau.—Dannevirke County Section: A contract has been let for the erection of a new reinforced-concrete bridge over the Mangatera Stream. The structure comprises two 43 ft. 6 in. spans and one 48 ft. span.

Patangata County Section: A contract has been let for improving the road near Wanstead for a length of 27 ch. Boundary Bridge, of a length of 100 ft., has been completed.

Waipukurau Borough Section: A contract has been let for the surface-treatment of this section of a length of 1 m.

Woodville–Greatford via Ashhurst.—Woodville Borough Section: The second coat of sealing was applied over a length of 26 ch.

Manawatu Gorge Section: 3 m. 65 ch. of second-coat sealing-work was carried out.

Manawatu River Bridge: This large reinforced-concrete structure, 389 ft. long, consisting of four arches of 80 ft. span, and six short spans of varying lengths, has been commenced. At the end of the year the excavation for the southern approach and for one pier was well in hand.

Napier–Tukituki via Omahu.—Havelock North Town District: $77\frac{1}{4}$ ch. of two-coat sealing-work was completed during the year.

Taradale–Rissington.—Mangaone Stream Bridge: This bridge, consisting of one 120 ft. steel-truss span and one 40 ft. rolled-steel-joist span has been completed.

Hangatiki–Caves.—A commencement has been made with preparation work in anticipation of sealing.

Te Kuiti–Bulls via Taumarunui (No. 6 Highway District).—8 Mile–Kaitangaweka: 1 m. 22 ch. of formation was completed. A bottom course of rhyolite over a length of 3 m. 7 ch. was laid, and a top course of metal placed over a length of 3 m. 32 ch.

Aramatai Deviation: 38 ch. of formation was completed, the width being 20 ft. The bottom and top course of metalling was completed over a length of 1 m. 78 ch.

Kurakura Deviation: A top course of metal over a length of 1 m. 29 ch. was placed.

Kurakura Deviation–Mangaiti: 1 m. 62 ch. of formation and 1 m. of bottom-course metalling were completed.

Mangaiti–Mapiu: This length was widened to 20 ft., and gravelling carried out over a length of 3 m. 50 ch.

Ongarue Turnoff–Okahukura: Formation over a length of 4 m. 60 ch. of a width of 20 ft. was completed. Bottom-course metalling was placed over a length of 6 m. 60 ch. The Tunatahi Bridge, of a length of 56 ft. and a width of 20 ft., was also completed.

Taumarunui–Raurimu: 2 m. 32 ch. of top-course metalling was completed.

Raurimu–Kaitieke County boundary: 14 ch. of formation was carried out. The Makatote Bridge, of a length of 160 ft. and a width of 12 ft., was completed.

Horopito Deviation: The formation and metalling of this deviation was carried to completion during the year.

Raurimu – Wades Landing.—Kaitieke – Wades Landing: 8 m. 10 ch. of formation work, consisting of realigning, regrading, and widening to 18 ft., was completed. A length of 7 m. 58 ch. was metalled to a width of 10 ft. The Takapa Bridge, of a length of 30 ft., was erected.

Stratford–Taumarunui (No. 6 Highway District).—Paparata Saddle – County boundary: 1 m. 44 ch. of re-formation, 18 ft. in width, was completed.

Te Maire – Mangaohutu.—Te Maire – Kokakonui: 4 m. 32 ch. of metalling, 10 ft. in width, was completed.

Kokakonui–Mangaohutu: A length of 4 m. 8 ch. of re-formation and widening to 18 ft. was finished.

National Park – Taupo.—National Park – Tokaanu: 8 ch. of metalling was laid down. Hand-rails were erected on five motor-bridges.

Tokaanu–Taupo: 33 ch. of formation, 18 ft. in width, was completed.

Manunui–Owhango.—Owhango–Hikimutu: Metalling was carried out over a length of 1 m. 9 ch.

Pirongia Junction – Kawhia.—4 m. 58 ch. of formation and 4 m. 50 ch. of metalling were completed.

Otunui Road.—64 ch. of formation and metalling was carried out.

Auckland–Wellington via Taranaki (No. 7 Highway District).—Mahoenui–Pukearuhe: East of Awakino, 1 m. 53 ch. of road has received a first sealing-coat and 1 m. 79 ch. a second sealing-coat. South of Tongaporutu a length of 66 ch. has been surface-sealed and a second coat of bitumen has been applied over a length of 2 m. 43 ch. A further 29 ch. of bituminous macadam has been laid near Uruti, and considerable widening of the formation and pavement has been carried out at Uruti, Mount Messenger, and Awakino.

A reinforced-concrete bridge, consisting of three 30 ft. spans, with 18 ft. roadway, has been constructed over the Uruti Stream.

Clifton County Section: A further length of 2 m. 47 ch. of bituminous macadam has been laid north of Waitara. The construction of a 140 ft. concrete bridge with 18 ft. roadway over the Urenui Stream is nearing completion.

Taranaki County Section: A further 4½ m. of bituminous-macadam pavement is in hand south of Lepperton, 50 ch. having been completed at the end of the year. A deviation, which will eliminate four curves and shorten the road by 4 ch., is in hand. A reinforced-concrete culvert has been constructed over the Mangapapa Stream.

Inglewood County Section: A concrete arch culvert over the Tariki Stream has been completed.

Eltham County Section: A length of 60 ch. of sealed road has been widened with bituminous-macadam shoulders.

Hawera County Section: A bituminous-macadam wearing-course has been laid on the approaches to the railway subway at Hawera.

Lepperton Junction – Hawera via Opunake.—Taranaki County Section: The Waiwakaiho weir for the protection of the road-bridge adjacent to the Borough of New Plymouth was severely damaged by floods, and extensive repairs are in hand.

The Kaitakara Stream Bridge, 120 ft. long, has been completed in reinforced concrete. A deviation and approaches to the bridge totalling 37 ch. in length have also been formed.

The Timaru deviation, 17 ch. long, has been metalled, and is open to traffic.

A reinforced concrete bridge, 36 ft. in length, has been constructed over the Kaihihi Stream, and a 64 ft. concrete-arch bridge has been completed over the Stoney River. The deviation and approaches to the latter bridge are in hand.

Egmont County Section: A bituminous macadam wearing-course has been laid on the deviation at Rautini Stream 8½ ch. in length.

At Mangahume Stream a reinforced concrete bridge 32 ft. in length has been completed and a deviation is also in hand at the Oeo Stream.

New Plymouth – Kaimata.—Taranaki County Section: The programme of improvements to grades and curvature and widening of the bituminous pavement south of New Plymouth is well in hand, 1 m. 25 ch. of the bituminous surface has been completed.

Ohura Road.—Whangamomona County Section: Deviations 12 ch. in length have been completed and 7 m. 13 ch. of the highway improved, widened, and remetalled.

Skeet Road.—Hawera County Section: Over the Mangatoki Stream the construction of a reinforced-concrete bridge 100 ft. in length has been completed, and the deviation and approaches to same are in hand.

Waimate West County Section: A reinforced-concrete culvert 10 ft. in length has been completed at Harvey's Creek.

Egmont County Section: A length of 44 ch. has been given a first coat of road-oil and a second coat of bitumen has been applied over a length of 22 ch.

Pukearuhe Road.—Clifton County Section: A length of 1 m. 42 ch. at the northern end of this road has been re-formed and metalled.

Oxford – Saunders.—Taranaki County Section: The formation of 69 ch. of this road has been completed.

Eltham–Opunake.—Eltham County Section: 100 ch. of sealed road on this section has been widened with bituminous-macadam shoulders, the camber and super-elevation being corrected at the same time.

Eltham-Rawhitiroa.—Eltham County Section: 80 ch. of sealed road on this section has been widened with bituminous-macadam shoulders.

Normanby – Manaia – Mount Egmont.—Hawera County Section: 117 ch. of this road has been remetalled and widened to 16 ft. and a first seal-coat applied over a length of 2 m.

Auckland–Wellington via Taranaki (No. 8 Highway District).—Patea County Section: The second sealing-coat has been applied on the Waverley Racecourse Deviation, on Whenuakura Hill, and over a length of approximately 1 m. south of Patea.

Waverley Town District: 20 ch. of the bituminous surfacing has been widened from 18 ft. to 40 ft. in the business area.

Waitotara County Section: 2 m. 51 ch. of heavy reconstruction and 2 m. 77 ch. of remetalling have been completed on the Goat Valley - Kai Iwi Section. Futher contracts have been let for 33 ch. of heavy reconstruction between Kai Iwi and Maxwell. A large reinforced-concrete culvert has been constructed in the Goat Valley.

Wanganui County Section: A length of 2 m. 71 ch. of re-formation, remetalling, and bituminous surfacing by the three-coat method was completed between Marybank and Marangai.

Rangitikei County Section: Widening and reconstruction of the Kohurauponga Stream Bridge in the Turakina Township was completed. There has also been completed the reconstruction and remetalling of a length of 84 ch. in the Turakina Township. Between Wangaehu and Turakina a length of 3 m. 24 ch. of road has been re-formed and 2 m. 16 ch. was remetalled by the end of the year.

Te Kuiti - Bulls via Taumarunui (No. 8 Highway District). — Waiouru–Karioi: The reconstruction and surfacing of the unmetalled gap on this section of highway was completed, the amount of work carried out during the year being $3\frac{1}{4}$ m. of formation and 4 m. of metalling.

Tohanga Road Deviation: 2 m. of heavy clearing and 2 m. of formation were completed.

Waimarino County Section: 4 ch. of bituminous surfacing and a 5 ft. concrete arch culvert at the Orautoha Stream were completed.

Curl's Bridge - Upper Tutaenui.—Riddiford's Bridge: A small reinforced-concrete structure was completed, as well as the formation and metalling, of 7 ch. of road approaches.

Feilding–Hunterville.—Rangitikei River Bridge at Vinegar Hill was completed. This structure consists of two steel-truss spans of 90 ft. and 120 ft. with concrete deck.

Kohi Road.—Patea County Section: 62 ch. of this highway was re-formed and metalled.

Ongo Road.—A length of 1 m. of this highway in the Hunterville Town District was re-formed and metalled.

Raetihi–Ohakune.—Raetihi Borough Section: A contract was let for the construction of a reinforced-concrete bridge over the Makotuku Stream, and the work has been commenced.

Waimarino County Section: 24 ch. of bituminous surfacing near the Ohakune Borough boundary and several minor improvements to the road have been carried out.

Rangitatau East and Watershed Road.—Waitotara County Section: 9 ch. of new metalling has been completed on this road.

Wanganui–Horopito.—Wanganui County Section: Two water-tunnels have been driven between 32 m. and 33 m.

Waimarino County Section: The metalling of this section was completed in the early part of the year, the work undertaken during the period being $1\frac{3}{4}$ m. of base-course and $7\frac{3}{4}$ m. of top-course metalling.

Heavy work was undertaken at Houghton's Hill to reduce the possibility of future slips.

Between Oruakukuru–Karioi Road and Ore Ore 1 m. 70 ch. of base-course and 2 m. 20 ch. of top-course metalling were completed. 60 ch. of reconstruction and 20 ch. of remetalling were also undertaken a little south of Horopito.

Wanganui–Karioi.—Wanganui County Section: A contract was let for a length of bituminous surfacing by the three-coat method and at the end of the year 2 m. had been completed.

Wellington–Auckland via Taranaki (No. 9 Highway District).— Johnsonville - Tawa Flat: The paving of this section in bituminous concrete was completed, with the exception of about 35 ch. of road-deviations which were not sufficiently consolidated.

Tawa Flat - Porirua: On this length 60 ch. of bituminous-concrete pavement was completed during the period, and 20 ch. of second-coat sealing was also carried out.

Paremata–Waikanae: The bituminous surface on this section was completed during the year, also two large culverts at McKay's Crossing and at Horokiwi. The sealing-work comprised 8 m. 3 ch. of first-coat work and 11 m. 53 ch. of second-coat work.

Horokiwi–Paekakariki: On this length 2 m. 8 ch. of road was widened to 24 ft. and a turning-place was provided at the summit of the hill. Bituminous sealing was carried out over a length of 4 m. 12 ch. and a second coat was applied over a length of 58 ch.

Otaki Borough Section: This section of highway of a length of 40 ch. has been laid in bituminous macadam.

Horowhenua County Section: Between Otaki River Bridge and Otaki Borough boundary 40 ch. of bituminous macadam was completed and a large concrete culvert constructed. Between Otaki and Manakau two road-deviations were metalled over a length of 60 ch. and paved with bituminous macadam. Between Manakau and Levin the Waikawa River Bridge, consisting of four 30 ft. reinforced-concrete-beam spans was completed; 5 ch. of approaches have also been formed, but not yet metalled. The Kuku Stream Bridge has also been completed in reinforced concrete. At the Ohau and Waikawa Railway crossings 30 ch. of sealing has been carried out. Between Levin and the Wirokino Bridge a length of 3 m. 20 ch. of re-formation work has been completed and the bituminous-macadam pavement has been laid over a length of 3 m.

Manawatu County Section: Between Foxton and Himatangi 135 ch. of road has been widened and remetalled preparatory to bituminous-concrete paving, and a contract has been let for the construction of the bituminous pavement.

Levin - Palmerston North via Shannon.— Horowhenua County Section: Between Wirokino Riding boundary and Shannon a length of 1 m. 25 ch. of heavy widening and formation work has been carried out.

Between Tokomaru River and the northern county boundary a length of 56 ch. of bituminous macadam has been completed.

Himatangi–Ashhurst, via Palmerston North.—Manawatu County Section: Between Himatangi and Rangiotu 6 m. 55 ch. has been widened, straightened, and completely remetalled.

Kairanga County Section: Between Longburn and Rangiotu a length of 3 m. 40 ch. was paved with bituminous concrete. A further contract has been let to complete the paving to the southern county boundary, a length of 2 m. 40 ch.

The Awapuni Bridge, consisting of two 30 ft. rolled-steel-joist spans with a reinforced-concrete deck, has been completed.

Oroua County Section: The whole length of this section, 3 m. 70 ch., has been surfaced by the three-coat method.

Sanson – Palmerston North.—Manawatu County Section: Between Sanson and Mount Stewart 2 m. 77 ch. of bituminous concrete was completed. Between Mount Stewart and Awahuri 2 m. 10 ch. of three-coat-sealing work was carried out.

Kairanga County Section: Between Awahuri and Palmerston North bituminous-concrete paving was completed over a length of 2 m. 22 ch.

Greatford–Woodville, via Feilding and Ashhurst.—Oroua County Section: Between Taonui and Bunnythorpe 2 m. 20 ch. has been prepared for sealing and 40 ch. of the length has been given a first coat of road-oil. Between Ashhurst and the Manawatu Gorge 1 m. 16 ch. of the road has been completely surfaced with bitumen.

Aorangi Bridge: A contract has been let for the construction of this reinforced-concrete bridge consisting of twelve 48 ft. spans with a 20 ft. roadway and a 4 ft. footpath.

Wellington–Napier, via Wairarapa (No. 9 Highway District).—Hutt County Section: In the Taita Gorge 27 ch. of heavy widening was completed and a length of 1 m. 13 ch. of bituminous concrete pavement was laid. On this section a heavy slip, comprising approximately 10,000 cub. yd. of metal, was removed.

Between Akatarawa and the Summit of the Rimutaka Hill 1 m. 13 ch. of heavy widening to 24 ft. was carried out mostly in rock. 5 m. of this length was prepared for sealing and 2 m. of one-coat sealing and 1½ m. of two-coat sealing were completed.

Bunnythorpe–Kairanga.—Kairanga County Section: Derby Creek Bridge, consisting of one 20 ft. span, was completed.

Pahautanui–Plimmerton.—Hutt County Section: 26 ch. of this road was widened.

Upper Hutt – Waikanae.—Hutt County Section: 1 m. 28 ch. of this section was widened to 16 ft. A contract was let for the construction of the Rangiora Bridge near Reikiorangi. A commencement has been made with the work.

Wellington–Napier, via Wairarapa (No. 10 Highway District).—Featherston County Section: Between the Summit of the Rimutaka Hill and the Featherston Borough, 40 ch. of heavy widening was completed and a large slip of about 5,000 cub. yd. cleared. During the year a second coat of bitumen was applied over a length of 3 m. 33 ch.

Between Featherston Borough and the Tauherenikau Bridge a length of 1 m. 64 ch. of bituminous macadam has been completed.

Wairarapa South County Section: Between Carterton Borough and the Waiohine Bridge a length of 1 m. 20 ch. has been paved with bituminous macadam.

Masterton County Section: A length of 60 ch. of this section was widened to 24 ft.

Mauriceville County Section: On this length 3 m. 25 ch. of road was widened to 24 ft., and a further 2 m. of heavy widening was partially completed. Several large reinforced-concrete culverts were also constructed.

Eketahuna County Section: The metalling of the Eketahuna Deviation was finished during the year, 1 m. 15 ch. being carried out by contract.

Between the Eketahuna Deviation and the Eketahuna Borough approximately 40 ch. of narrow road has been widened to 24 ft.

Newman Factory Bridge, 34 ft. in length and 18 ft. in width, has been completed. Coopers Creek Bridge has also been erected.

Pahiatua County Section: Brown's and Galvin's Bridges at Hamua and two small reinforced-concrete structures have been erected.

Featherston–Martinborough.—Featherston County Section: The whole of this length has now been paved with bituminous macadam, 1 m. 40 ch. having been completed during the year under review. A large reinforced-concrete culvert was also completed.

Carterton–Longbush.—Wairarapa South County Section: A contract was let for the construction of Kokotau Bridge, comprising eight 45 ft. reinforced-concrete spans with a roadway of 18 ft. in width. During the year five spans were completed. Ross bridge, a small concrete structure, was also completed.

Masterton–Weber, via Alfredton.—Masterton County Section: The Ruamahanga River Bridge at Te Ore Ore is well under way. This structure is of reinforced concrete, and consists of eleven 40 ft. spans with a roadway 20 ft. in width.

A number of bad corners were improved, and the road widened to 24 ft. over a distance of 2¼ m.

Mauriceville County Section: The previously unmetalled portion of this section has been completed over a distance of 1 m. 60 ch. from the south boundary of the county to Dreyer's Rock Highway junction.

Eketahuna County Section: During the year a length of 1½ m. of this section was widened and a deviation 22 ch. in length was formed. A contract for surfacing the unmetalled gap of 3 m. 55 ch. is in progress, 28 ch. having been completed at the end of the year. The Waterfall's Bridge, consisting of one 36 ft. concrete span was completed.

A contract was also let for the metalling of the remaining unmetalled gap over the Summit Hill, a length of 3 m. 4 ch.

Pahiatua-Pongaroa. — Pahiatua County Section: O'Grady's Bridge, consisting of one 40 ft. reinforced-concrete span, was completed.

The Gorge End Bridge, a reinforced-concrete structure of two 35 ft. spans, was completed.

Balmoral Bridge, consisting of one 25 ft. span, was finished.

Akitio County Section: McLeod's Bridge, consisting of one 27 ft. rolled-steel-joist span, was finished.

Hennessey's Bridge, consisting of one 25 ft. span, was also completed.

Eketahuna-Alfredton.—Eketahuna County Section: Pleckville Bridge No. 1 and Pleckville Bridge No. 2 and Alfredton Township Bridge No. 2, all small reinforced-concrete structures, were completed.

Masterton-Tinui.—Masterton County Section: Bituminous surfacing has been completed over a length of 30 ch.

Kahautara Highway.—Featherston County Section: A length of 3½ m. of widening and reconstruction work was carried out in anticipation of bituminous sealing.

Picton-Bluff (No. 11 Highway District).—Marlborough County Section: Widening and improvements at Picton Swamp are in hand.

Blenheim Borough Section: The borough length of the Picton-Blenheim Section has received one coat of bitumen and the borough length of the Blenheim-Christchurch Section has been tar-sealed over a length of 12 ch.

Dashwood Deviation: Formation work on this deviation has been actively prosecuted during the year, a length of 2 m. 55 ch. having been completed, together with necessary culverts.

Nelson-Blenheim.—Marlborough County Section: Hughes Creek Bridge, comprising one 20 ft. reinforced-concrete-beam span, has been completed. The northern approach to the Wairau River Bridge has been metalled, fenced, and widened to 22 ft. over a length of 26 ch.

Waimea County Section: Between Lud Bridge and the Rai Saddle the widening works commenced during the previous year have been completed. The work carried out during this year covered a length of 1 m. 52 ch.

Nelson-Westport (No. 11 Highway District).—Tahunanui Town District: A commencement has been made with the reconstruction work on this section preparatory to the laying of the bituminous-macadam pavement.

Waimea County Section: Bituminous macadam between Stoke and Richmond has been completed, the total length carried out during the year being 2 m.

The construction of the reinforced-concrete bridge over the Wairoa River at Brightwater is well in hand, four 42 ft. spans having been completed. The bridge is to be 420 ft. in length.

At Norris Gully two bridges have been erected and a considerable amount of widening carried out.

Between Foxhill and Hope Saddle widening, culverting, and remetalling has been completed over a distance of 3 m. 32 ch.

Murchison County Section: A deviation 20 ch. in length has been formed and metalled at Crooked Bank Creek.

A contract has been let for the construction of a new bridge at Newton River. The structure will consist of one 120 ft. steel truss and two 30 ft. rolled-steel-joist spans on mass-concrete abutments and piers.

A deviation 24½ ch. in length has been completed at the Newton River Bridge.

Earthquake Restoration (No. 11 Highway District).—The Murchison County Section of the Nelson-Westport Highway suffered severe damage during the earthquake of the 17th June, 1929. Between Glenhope and Murchison numerous slips occurred, and several bridges were destroyed or badly damaged. A large number of men were employed on the restoration work, and communication with Murchison was restored in a few days. Temporary bridges were erected at Doctor's Creek and Clay Bank Creek. This length of road has now been restored to its previous standard, but several bridges yet need attention. From Murchison to Eight-mile Creek the highway was completely blocked by slips, large portions of the formation being destroyed. The Matakitaki River Bridge, White's Bridge, and Deep Creek Bridge were severely damaged. Restoration work was put in hand over the whole section, and good progress has been made. The road has been opened up over a distance of 16 m., culverts have been reinstated, repairs to bridges are in hand, and a number of minor deviations constructed. The Murchison-Reefton Highway was also severely damaged by the earthquake, and extensive repairs rendered necessary. A road deviation 71 ch. in length was the largest work undertaken. A sledge-track was first opened up to allow the passage of mails and passenger traffic to the West Coast. Restoration work entailed the removal of slips, the construction of small deviations, the lowering of the spillway of the newly-formed Matakitaki Lake, and general improvements and widening over the whole section. Satisfactory progress was made and the road was opened for motor traffic in August, this road serving as access to the West Coast in lieu of the highway through the Buller Gorge.

Richmond-Pakawau.—Waimea County Section: A large concrete culvert has been erected at Bockmann's Creek.

Appleby-Motueka, via Tasman.—Waimea County Section: A contract was let for the construction of a reinforced-concrete bridge over Watt's Creek, but work has not yet been commenced.

Renwicktown - Branch River.—Marlborough County Section: A 20 ft. reinforced-concrete bridge and 8 ch. of approach road have been constructed at Church Creek.

Wakefield-Woodstock.—Waimea County Section: The Dovedale Hill Creek Bridge has been completed.

Westport-Karamea.—Little Wanganui River Bridge: Materials are on the site for this work.

Westport-Mohikinui Section: In Granity Township a length of 60 ch. has been widened to 16 ft.

The following bridges were completed: Bridge No. 40 (Patten's Creek), Bridge No. 41, Bridge No. 42 (Chatterbox Creek), Bridge No. 46 (Rapid Creek), Brewery Creek Bridge, Bridge No. 29.

Kerr's Crossing – Ngakawau Bridge: The contract for bituminous surfacing of this section was completed during the year, the total length treated being 3 m. 76 ch.

Westport-Nelson (No. 12 Highway District).—Ten-mile Creek Bridge: This bridge, consisting of one 35 ft. rolled-steel-joist span, has been completed.

Dublin Terrace Bridge: This bridge was practically completed when the earthquake occurred and the bridge was buried in a slip.

Twelve-mile Creek Bridge: A single 25 ft. span structure has been built to obviate a ford.

Little Hawk's Crag: Wall—A 25-ft.-span reinforced-concrete half bridge has been constructed, thus completing the improvements at this dangerous point.

Stitts Bluff Wall: This work, consisting of road-widening and the construction of a heavy concrete retaining-wall, has been completed.

Waimea Creek Bridge: This bridge, comprising one 14 ft. and two 25 ft. stringer spans has been completed, and the grades and alignment of the approaches have been improved.

Whitecliffs Bridge: This structure, consisting of one 35 ft. and one 30 ft. rolled-steel-joist spans has been completed.

Bridge at 15 m. 48 ch.: Materials are on the site for this work.

Passing-places: Thirty passing-places have been constructed on narrow stretches of this highway.

Inangahua Junction – Waiho.—Big Grey – Taramakau Section: Ahaura River Bridge.—A contract has been let for the construction of this bridge, which consists of twelve 60 ft. plate-girder spans on pile piers and abutments. The work is under way.

Taramakau–Ross Section: Taramakau Bridge, South Approach Deviation.—This deviation 13 ch. in length has been completed.

Ross–Waiho Section: Vines Creek Bridge.—The construction of this bridge, consisting of one 40 ft. rolled-steel-joist span on pile abutments, has been practically completed.

McCullough's Creek Bridge: Except for a certain amount of widening of the approaches, this structure, comprising three 35 ft. rolled-steel-joist spans on pile piers and abutments, has been completed.

Butler's Creek Protection-works: 7 ch. of protection-work has been carried out.

Red Jack's Creek Bridge: This bridge, consisting of one 40 ft. rolled-steel-joist span on concrete abutments, has been completed.

McDonald's Creek Bridge: The construction of this bridge, comprising five 40 ft. rolled-steel-joist spans on pile piers and abutments, 16 ch. of approach road, and 3 ch. of groyne is nearly completed.

Widening, and Passing-places: A number of passing-places have been constructed on narrow stretches of the road and several curves have been improved. Between Paroa and Taramakau widening-work has been completed.

The following bridges have also been completed: Bridge at 10 m. 20 ch., Overflow Bridge at Maimai, Stoney Creek Bridge, Blackwater Bridge, Fitzgerald's Bridge No. 1, La Fountain Creek Bridge.

Westport–Greymouth Coast Road.—Charleston–Brighton Section: Widening of bad curves and improvements to grades have been carried out through the section. Two dry stone walls have been built, and a large culvert installed at Deep Creek. A number of minor culverts have also been renewed.

Greymouth–Punakaiki Section: Widening and improvements over a section of 22½ ch. of road have been carried out at 27¼ m. Considerable improvements have also been completed at the 9 m. and 10 m. Bluffs and also between 14 m. 27 ch. and 15 m. 20 ch.

The following minor bridges and culverts have been completed: Maher's Creek Bridge, Devery Creek Bridge, Collin's Creek Bridge, Kararoa Creek Bridge, White's and Griffith's culverts.

The following structures are in hand: Canoe Creek Bridge, Little Granite Creek Bridge, Fourteen-mile Creek Bridge, Waiwhio Creek Bridge.

Reefton–Maruia.—A temporary bridge 180 ft. in length has been constructed over the Maruia River. Deep Gully Bridge, consisting of one 30 ft. span, has also been completed.

Arthur's Pass – Kumara.—Widening and improving of Rocky Point is in hand. A number of culverts have been renewed.

Earthquake Restoration.—The Mokihinui-Karamea Section of the Westport–Karamea Main Highway was very seriously affected by the earthquake of the 17th June, 1929. Large sections of the road were totally destroyed. One 60 ft. truss span of the Little Wanganui Bridge was wrecked. Reconstruction is being carried out expeditiously, and some three hundred workmen are employed. At the end of the year a pack-track had been constructed throughout the full length of the damaged section, several large camps had been erected, and the work of restoration was being pushed ahead from both ends. Five miles of the road had been opened at the end of the period.

On the Westport–Nelson Main Highway, between Westport and Inangahua, numerous small slips occurred from Waimea Hill to the 12 m. and the eastern approach bank to the Ohika-nui Bridge settled considerably. At Fern Arch a large slip came down in rock country, and, on account of loose material higher up, was both difficult and dangerous to clear. Further large slips occurred at Whitecliffs and at 23 m. The bridges on this length suffered only minor damage.

Direct communication between Westport and Inangahua was restored after four days, but the road was later blocked on occasions by further slips.

Between Inangahua and 8 m. the road suffered very severe damage. In places whole sections practically disappeared, while on other lengths the formation was buried by huge slips.

The cylinder piers of the Inangahua Combined Road and Railway Bridge were cracked and moved out of plumb, while the southern approach subsided 4 ft. The concrete abutments of Dee Creek Bridge were cracked and one of the approaches to Flaxbush Creek Bridge subsided, and brought the sill down with it. On both abutments of the Buller River Bridge at Lyell the holding-down

bolts were sheared off, and the bridge was swung out of line. At Lyell Creek Bridge one approach span and one truss span were buried in a slip. Dublin Terrace Bridge was smothered by a slip.

The work of reconstruction on this section is being carried out energetically. A pack-track was first formed through the damaged country and camps established. An 8 ft. access road was then constructed and subsequently widened to full width. Trouble has been experienced from numerous small slips which commence running with every rain, and which will be a source of trouble for some time to come.

On the Arthur's Pass – Kumara Main Highway restoration work is practically complete. Slips totalling 47,000 cub. yd. have been shifted, and a total length of 384 lin. ft. of stone-walling constructed.

On the Granity–Stockton Road several large slips were brought down by the earthquake, and the road was completely blocked until the 2nd August.

On the Westport–Greymouth Coast Road numerous small slips occurred, but no serious damage was done. On account of the blocking of the Buller Gorge Section of the Westport–Nelson Highway, the main road traffic was diverted over the Reefton–Maruia Road, and a great deal of work was carried out on that road to fit it for carrying the additional traffic.

Picton–Bluff (No. 13 Highway District).—Clarence River Protective Works: Further work to strengthen the existing groynes has been carried out. Large concrete blocks have been placed at the end of No. 1 groyne.

Hurunui River Bridge: This structure, 480 ft. in length, on four cylinder piers, three concrete piers, and two concrete abutments, has been completed. The superstructure consists of steel-plate girders with a reinforced-concrete deck.

Middle Creek Bridge: This structure, comprising three 25 ft. timber-beam spans, was finished.

Waipara County Section: Between Omihi and Waipara River a contract was let for the preparation and bituminous sealing of 6 m. 24 ch. By the end of the year the preparation work over a length of 6 m. was completed.

Waipara–Kaikoura, via Culverden.—Waipara County Section: 1 m. 30 ch. of bituminous-sealing work has been carried out, commencing at the junction of the Waikari–Waitohi Highway and extending northwards towards Culverden.

Waikari–Waitohi.—1 m. 30 ch. of bituminous-sealing work has been completed, commencing from the junction of the Waipara–Kaikoura Main Highway, and extending through the Waikari Township.

Picton–Bluff (No. 14 Highway District).—Waimakariri River Bridge: A contract was let for the erection of this structure in March, 1929, and the work was well forward at the end of the year. The bridge will be 1,120 ft. in length, and the superstructure consists of plate-girder spans with a reinforced-concrete deck 20 ft. in width.

Rangiora County Section: Between Woodend and Ashley River a contract was let in December, 1929, for the construction of a two-course bituminous-concrete pavement 18 ft. in width with gravel shoulders 3 ft. in width. At the end of the period 2½ m. had been completed out of a total length of 3 m. 47 ch. Between Kaiapoi and Woodend a contract was let in March, 1929, for the construction of a Portland-cement-concrete pavement 18 ft. in width with 3 ft. gravel shoulders. The work extending over a length of 3 m. 5 ch. was completed, except for the shoulders, by the end of the year.

Eyre County Section: A contract was let during the year for the construction of a Portland-cement-concrete pavement 18 ft. in width with gravel shoulders 3 ft. in width. The length of the contract was 1 m. 45 ch., and the work was satisfactorily completed.

Paparua County Section: Between Sockburn and Templeton a contract for the construction of a Portland-cement-concrete pavement over a length of 3 m. 73 ch. was completed. The width of the pavement is 18 ft., with 3 ft. bituminous penetration shoulders.

Between Templeton and Rolleston a contract for the paving in Portland-cement concrete of 4 m. 14 ch. was also completed.

Christchurch – New Brighton, via Pages Road.—Heathcote County Section: A contract was let for the paving in Portland-cement concrete of 1 m. 51 ch. of this section. The pavement was laid in two 10 ft. strips, and the work has been completed.

Woodend–Rangiora.—A contract for the paving of 3 m. 55 ch. of this section with 2½ in. single-course bituminous concrete was let during the year, and the preparation work was well in hand at the end of the period.

Junction near Kaiapoi–Waddington, via Rangiora and Bennett's.—Skew Bridge: A contract was let for the construction of a reinforced-concrete bridge 120 ft. in length and 20 ft. in width across the main drain. By the end of the year all piles were driven and two of the five piers were concreted.

Upper Riccarton – Kumara.—Springfield – Arthur's Pass: Porter River Bridge—This structure, consisting of five 25 ft. spans., was completed by contract.

Bealey Road Deviation: A deviation 40 ch. in length was formed and metalled near the Bealey Hotel.

Christchurch–Akaroa.—Waimairi County Section: On Lincoln Road a contract was let for the construction in Portland-cement concrete of a section of pavement in two 10 ft. widths with gravel shoulders. The work was well advanced at the end of the period.

Picton–Bluff (No. 15 Highway District).—Geraldine County Section: Between Rangitata River and Temuka a total of 18 m. 20 ch. of tar-sealing has been completed.

Pareora River Bridge: The erection of a reinforced-concrete bridge, 660 ft. long and 18 ft. in width, has been completed. The approach banks and protection-work have also been completed.

Levels County Section: The formation and metalling of the Brookland's Hill Deviation, 19¼ ch. in length, has been completed.

Waimate County Section: A contract was let for the paving in bituminous concrete of the length between Pareora River and Deep Creek. By the end of the period 7 m. 59 ch. of paving, 18 ft. in width, had been carried out.

Waitaki County Section: The protective works at Kartigi Beach were completed during the year, approximately 2,000 tons of heavy rubble and 5,000 cub. yd. of earth filling being placed.

Timaru–Queenstown (No. 15 Highway District).—Ahuriri Deviation: A commencement was made with this deviation 46 ch. in length. By the end of the period 21 ch. had been completed.

Picton–Bluff (No. 16 Highway District).—Waikouaiti County Section: A commencement was made with the reconstruction work on this section between Waitati and the Kilmog Hill. By the end of the period 1½ m. was completed.

Waihemo County Section: The construction of a deviation at Bushey between 38 m. 70 ch. and 40 m. 40 ch. was commenced, and by the end of the year approximately 35 per cent. of the work was completed. A considerable amount of widening and improvements to curves was undertaken near Kartigi.

Palmerston–Queenstown.—Lake County Section: A commencement has been made with the construction of the Arrow River Bridge.

St. Bathan's Loop Highway.—A contract was let for the construction of a small bridge over the Three-mile Creek, and the work is well in hand.

Ida Valley Railway-station – Moa Creek.—A contract was let for a reinforced-concrete bridge over the Poolburn Creek.

Timaru–Queenstown (No. 16 Highway District).—Vincent County Section: A contract was let for the construction of two bridges on this section, one over the Clutha River at Albertown, and the other over the Hawea River, near Camp Hill. The former structure consists of six 50 ft. spans of reinforced concrete, and the work was well on towards completion at the end of the year. The second bridge will consist of three 50 ft. spans in reinforced concrete, and the work has just been commenced.

Dunedin – Port Chalmers.—Port Chalmers Borough Section: Reconstruction work over a length of 16 ch. has been completed in anticipation of sealing.

Picton–Bluff (No. 17 Highway District).—Taieri County Section: The formation work and the construction of a water-bound macadam base course were completed over the whole length of this section. A bituminous-concrete-surface course was constructed by contract over a length of 3 m. 64 ch.

Bruce County Section: Improvements to curvature and visibility were carried out between 22 m. and 23 m. immediately south of the Henley Ferry Bridge and also between Lovell's Flat and Stoney Creek.

Clutha County Section: The Waipahi Bridge at Arthurton was completed in reinforced concrete.

Dunedin–Portobello (Lower Road).—Peninsula County Section: During the year widening and improvements to visibility, curvature, and cant were carried out from 4 m. to 6 m. 30 ch., including the completion of the Company Bay deviation. A contract for paving 4 m. of this section with two courses of bituminous concrete was completed during the year.

Waikaka–Kelso.—Clutha County Section: A new superstructure was completed on the bridge over the Pomahaka River near Kelso. The length of the bridge is 250 ft.

Green Island – Taieri Mouth.—Taieri and Bruce County Sections: A number of bad corners were improved at various places on this highway, including the approach to the Taieri Mouth Traffic-bridge, and a bad corner near Brighton Township was also dealt with.

Picton–Bluff (No. 18 Highway District).—Southland County Section: On the Invercargill–Bluff Section a commencement was made with widening over a length of 162 ch.

Gore Borough Section: A short length of sealing was carried out.

Invercargill–Riverton.—Southland County Section: The bituminous surfacing of the length between Wallacetown Railway and Wallacetown was completed, 1½ m. of the final coat of bitumen being applied during the period.

Aparima Bridge at Riverton: This structure was approximately two-thirds completed at the end of the year.

Groper's Bush – Waimatuku.—Wallace County Section: A new timber bridge 650 ft. in length has been completed.

Wrey's Bush – Mossburn.—Wallace County Section: 1 m. 77 ch. of formation and gravelling was completed.

Hillside–Manapouri.—6½ ch. of gravelling was completed.

Te Anau – Manapouri.—A total length of 7¼ m. of gravelling was completed during the year, and a further 5 m. is in hand.

Signed on behalf of the Main Highways Board,

F. W. Furkert, C.M.G., M.Inst.C.E., M.I.Mech.E.,
Chairman.

TABLE 1.—MAIN HIGHWAYS ACCOUNT.

REVENUE FUND.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1930, AND TOTAL TO DATE.

EXPENDITURE.	Total for Year 1929-30.	Total since Inception of Main Highways Act, 1922, to 31/3/30.
To Net expenditure on maintenance of main highways: —		
Highway District—	£ s. d.	£ s. d.
No. 1	73,726 4 5	217,606 2 7
No. 2	122,276 7 8	363,391 8 4
No. 3	45,347 1 3	156,547 0 7
No. 4	45,141 19 4	127,309 12 8
No. 5	71,068 18 5	258,604 6 11
No. 6	58,640 5 10	136,004 18 10
No. 7	57,879 4 2	215,919 17 2
No. 8	57,613 18 4	162,502 2 9
No. 9	72,695 8 7	240,395 5 11
No. 10	49,335 4 8	169,400 3 10
Totals for North Island	653,724 12 8	2,047,680 19 7
No. 11	77,805 17 0	175,904 10 3
No. 12	121,045 2 5	304,635 5 6
No. 13	25,808 10 6	95,259 5 8
No. 14	31,579 13 2	115,790 4 5
No. 15	50,010 12 8	155,975 0 0
No. 16	25,356 1 9	69,849 18 3
No. 17	32,378 9 8	94,122 8 1
No. 18	31,540 12 9	111,823 7 11
Totals for Dominion	1,049,249 12 7	3,171,040 19 8
Abolition of toll-gates (section 20, Finance Act, 1925)	1,807 0 0	13,958 14 7
Accident compensation	772 18 4	1,652 15 6
Administration and supervision expenses, including salaries and expenses of Public Works officers, printing, stationery, postages, and miscellaneous expenses	44,990 19 5	147,262 16 6
Charges and expenses of raising loans	795 10 7	43,321 10 1
Commission on collection of motor-registration fees by Postal Department	13,940 13 6	57,353 2 0
Commission on registration of change of ownership	6,829 14 6	16,534 17 6
Depreciation of furniture, fittings, &c.	64 11 1	243 4 9
Depreciation of plant not in service	16 0 0	34 0 0
Expenses of District Councillors attending District Council meetings and annual conference	134 3 2	531 12 10
Fees and travelling-expenses of members of the Main Highways Board, other than Government members	1,116 9 6	8,447 6 6
Carried forward	1,119,717 12 8	3,460,380 19 11

INCOME.		Total for Year 1929-30.	Total since Inception of Main Highways Act, 1922, to 31/3/30.
By Income from—			
Interest from investments of—	£ s. d.	£ s. d.	£ s. d.
Construction Fund	2,556 12 2		
Revenue Fund	18,714 6 11		
		21,270 19 1	171,367 15 2
Interest from local authorities on plant purchased on their behalf		3,718 5 1	11,288 17 1
Interest on advances to local authorities		962 3 5	1,131 2 0
Miscellaneous receipts		202 0 1	240 6 5
Motor-registration licenses, fees, and fines (section 24, Moror-vehicles Act, 1924)		378,134 10 1	1,653,192 14 5
Motor-spirits tax (section 9, Motor-spirits Taxation Act, 1927)		873,369 8 3	1,734,244 12 0
Rent of and tolls from ferries		..	2,081 10 6
Tire-tax (sections 13 and 14, Main Highways Act, 1922)		155,722 9 4	1,396,170 9 4
Transfer from Consolidated Fund (section 14, Main Highways Act, 1922)		35,000 0 0	210,000 0 0
Balance, being excess of expenditure over income, carried to general balance-sheet		527,647 5 4	..
Carried forward		1,996,027 0 8	5,179,717 6 11

TABLE 1.—MAIN HIGHWAYS ACCOUNT—*continued.*

REVENUE FUND—*continued.*

EXPENDITURE.	Total for Year 1929–30.	Total since Inception of Main Highways Act, 1922, to 31/3/30.	INCOME.	Total for Year 1929–30.	Total since Inception of Main Highways Act, 1922 to 31/3/30,
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Brought forward	1,119,717 12 8	3,460,380 19 11	Brought forward	1,996,027 0 8	5,179,717 6 11
To Net expenditure on maintenance of main highways—*continued.*					
Hutt Road annual charges—Finance Act, 1927 (No. 2), section 33 ..	24,128 10 9	39,197 1 6			
Interest on loans, recoupment to Consolidated Fund (section 4, Finance Act, 1919)	59,012 1 3	171,417 16 9			
Level crossings, alarm-signals at	598 6 10	598 6 10			
Management charges of consolidated stock on account of Construction Fund	165 3 2	686 0 1			
Miscellaneous expenses—					
Advertising, maps, rent of halls, traffic tallies, transport of samples, &c.	200 7 7	1,524 12 1			
Compensation under section 3, Public Works Amendment Act, 1925..	500 0 0	815 1 6			
Reserve for redemption of main highways securities	40,508 0 0	100,456 0 0			
Signposts, erection of	657 17 7	2,003 0 9			
Traffic inspection	539 0 10	539 0 10			
	1,246,027 0 8	3,777,618 0 3			
Transfers to Construction Fund	750,000 0 0	1,100,000 0 0			
	1,996,027 0 8	4,877,618 0 3			
Balance, being excess of income over expenditure, carried to general balance-sheet	..	302,099 6 8			
	1,996,027 0 8	5,179,717 6 11		1,996,027 0 8	5,179,717 6 11

TABLE 1—MAIN HIGHWAYS ACCOUNT—*continued.*

CONSTRUCTION FUND.

INCOME AND EXPENDITURE ON CAPITAL ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1930, AND TOTAL TO DATE.

EXPENDITURE.	Total for Year 1929–30.	Total since Declaration of Main Highways (9/6/24).
To Net expenditure on construction and improvement of main highways, including cost of administration by Public Works Department and accident compensation :—		
Highway District—	£ s. d.	£ s. d.
No. 1	126,042 2 4	464,221 15 3
No. 2	131,898 14 10	520,842 8 10
No. 3	29,604 0 4	146,421 10 9
No. 4	38,601 9 7	262,282 15 7
No. 5	35,289 4 11	164,968 3 5
No. 6	76,878 11 9	258,102 2 6
No. 7	47,243 4 5	295,147 10 3
No. 8	59,091 14 1	149,727 6 11
No. 9	94,739 1 5	414,483 7 5
No. 10	46,538 19 4	136,871 6 11
Totals for North Island	685,927 3 0	2,813,068 7 10
No. 11	20,172 5 8	64,766 14 5
No. 12	22,427 10 7	105,775 4 3
No. 13	51,688 15 2	130,644 7 6
No. 14	92,285 14 4	188,990 14 6
No. 15	44,930 5 11	64,716 17 1
No. 16	15,744 18 7	76,258 16 3
No. 17	109,206 5 9	266,734 8 10
No. 18	29,033 11 10	75,908 7 1
Totals for Dominion	1,071,416 10 10	3,786,863 17 9
Balance, being excess of income over expenditure, carried to general balance-sheet	328,208 9 2	..
	1,399,625 0 0	3,786,863 17 9

INCOME.	Total for Year 1929–30.	Total since Declaration of Main Highways (9/6/24).
By Receipts under section 15, Finance Act, 1923, from Public Works Fund,	£ s. d.	£ s. d.
General Purposes Account*	200,000 0 0	1,226,000 0 0
Loans raised under Main Highways Act, 1922—		
Consolidated stock	..	542,004 10 10
Debentures	139,800 0 0	323,250 0 0
Inscribed stock	359,825 0 0	556,375 0 0
Temporary transfers from other accounts	*Dr.*50,000 0 0	..
Transfer from Revenue Fund	750,000 0 0	1,100,000 0 0
Charges and expenses of raising loans (adjustment)	..	3 3 2
Balance, being excess of expenditure over income, carried to general balance-sheet	..	39,231 3 9
	1,399,625 0 0	3,786,863 17 9

* Interest on these amounts is paid from Consolidated Fund.

TABLE 1.—MAIN HIGHWAYS ACCOUNT—*continued.*

GENERAL BALANCE-SHEET AS AT 31ST MARCH, 1930.

LIABILITIES.	Revenue Fund.	Construction Fund.	Total.
	£ s. d.	£ s. d.	£ s. d.
Accumulated Revenue Fund—			
Balance at 31/3/29	829,746 12 0	..	829,746 12 0
Less excess of expenditure over income for 1929–30	527,647 5 4	..	527,647 5 4
	302,099 6 8	..	302,099 6 8
Sundry creditors—			
Public Works Department	22,465 10 7	26,239 11 5	48,705 2 0
Other Government Departments	1,316 13 9	718 13 8	2,035 7 5
Non-departmental	91,656 11 5	85,594 15 4	177,251 6 9
Interest accrued on loans	9,591 7 6	..	9,591 7 6
Motor-registration fees paid in advance	69,726 0 0	..	69,726 0 0
Writings-off in Suspense	155 14 5	198 14 10	354 9 3
Temporary transfer from Revenue Fund	..	150,000 0 0	150,000 0 0
Reserve for redemption of securities	102,817 17 8	..	102,817 17 8
	599,829 2 0	262,751 15 3	862,580 17 3

ASSETS.		Revenue Fund.	Construction Fund.	Total.
		£ s. d.	£ s. d.	£ s. d.
Cash in Public Account—				
At call		120,552 13 6	160,567 6 3	281,119 19 9
Invested temporarily until required		15,900 0 0	..	15,900 0 0
		136,452 13 6	160,567 6 3	297,019 19 9
Sundry debtors—				
Public Works Department		1,401 12 10	1,709 4 6	3,110 17 4
Other Government Departments		2,870 1 1	1,224 16 7	4,094 17 8
Non-departmental		1,511 1 11	19,889 16 2	21,400 18 1
Motor-registration fees in hands of Postal Department		2,437 5 2	..	2,437 5 2
Interest due and accrued		6,025 11 3	..	6,025 11 3
Stocks of material, tools, &c.		12,739 15 4	31,161 14 5	43,901 9 9
Stocks, deficits account		155 14 5	198 14 10	354 9 3
Roadmen's cottages, huts, and road buildings generally		6,154 10 0	8,768 18 9	14,923 8 9
Furniture, fittings, &c.—	£ s. d.			
Expenditure to 31/3/30	870 14 8			
Less depreciation to 31/3/30	247 2 2			
		623 12 6	..	623 12 6
Plant and equipment—				
For Main Highways Board—				
Expenditure to 31/3/30	83,657 14 6			
Less depreciation charged to works	11,986 5 0			
		71,671 9 6	..	71,671 9 6
Purchased for local authorities—				
Expenditure to 31/3/30	139,815 15 6			
Less repayments of principal	72,249 10 5			
		67,566 5 1	..	67,566 5 1
Amount in Loans Redemption Account		102,817 17 8	..	102,817 17 8
Construction Fund—	£ s. d.			
Balance at 31/3/29	367,439 12 11			
Less excess of income over expenditure, 1929–30	328,208 9 2			
		..	39,231 3 9	39,231 3 9
Temporary transfer to Construction Fund		150,000 0 0	..	150,000 0 0
Advances to local authorities (Main Highways Amendment Act, 1926, section 2)		37,401 11 9	..	37,401 11 9
		599,829 2 0	262,751 15 3	862,580 17 3

J. J. GIBSON, Accountant, Public Works Department.

F. W. FURKERT, C.M.G., Chairman, Main Highways Board.

I hereby certify that the Income and Expenditure Accounts and Balance-sheet have been duly examined and compared with the relative books and documents submitted for audit, and correctly state the position as disclosed thereby, subject to the above departmental notes. The following comment is appended: A reserve of £102,817 17s. 8d. for redemption of securities has been set up and paid over to the Loans Redemption Account, but the amount has not yet been applied to the redemption of securities.—G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE 2.—LENGTHS OF MAIN HIGHWAYS AT 31ST MARCH, 1930.

Number and Name of Highway District.	Original Main Highways.	Additional Main Highways.	Total.
	M. ch.	M. ch.	M. ch.
1. Auckland North	576 5	331 30	907 35
2. Auckland South	487 45	334 32	821 77
3. Tauranga	447 15	170 18	617 33
4. Gisborne	249 72	91 8	341 0
5. Napier	455 71	235 29	691 20
6. King-country	334 6	297 23	631 29
7. Taranaki	313 72	123 6	436 78
8. Wanganui	327 48	147 15	474 63
9. Wellington West	315 40	122 40	438 0
10. Wellington East	338 48	114 2	452 50
Totals, North Island ..	3,846 22	1,966 43	5,812 65
11. Nelson	305 3	193 10	498 13
12. West Coast	345 46	145 8	490 54
13. Canterbury North	307 40	89 20	396 60
14. Canterbury Central	399 66	242 65	642 51
15. Canterbury South	425 45	415 35	841 0
16. Otago Central	258 54	223 34	482 8
17. Otago South	299 37	145 60	445 17
18. Southland	463 52	335 12	798 64
Totals, South Island ..	2,805 23	1,790 4	4,595 27
Totals for Dominion ..	6,651 45	3,756 47	10,408 12

TABLE 3.—CONSTRUCTION WORK COMPLETED DURING YEAR 1929-30.

Number and Name of Highway District.	Formation and Widening.	Gravelling and Metalling.	Tar and Bituminous Sealing.	Bituminous Macadam (Penetration).	Bituminous Concrete.	Portland Cement Concrete.	Bridges.	Engineering Surveys.	
								Surveys completed.	Plans completed.
	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	Ft.	M. ch.	M. ch.
1. North Auckland	15 45	26 53	..	1 61	..	0 22	493	40 60	26 76
2. Auckland South	28 16	23 17	30 47	16 70	..	..	283	30 0	16 0
3. Tauranga	5 16	10 33	4 60	3 0	..	..	529	..	..
4. Gisborne	2 56	22 30	13 6	..	..	..	733	..	..
5. Napier	4 63	5 3	22 76	..	..	..	738	3 64	3 64
6. King-country	28 73	47 58	..	..	..	..	246	28 8	28 8
7. Taranaki	1 41	1 74	5 51	5 14	..	..	470	11 24	11 24
8. Wanganui	19 46	11 1	5 15	..	..	..	220	38 61	17 13
9. Wellington West ..	20 32	0 60	24 9	5 46	11 64	..	291	11 12	11 12
10. Wellington East	13 47	3 23	0 30	4 44	..	..	649	1 0	1 0
11. Nelson	9 73	0 60	0 71	2 0	..	..	236	13 15	12 71
12. West Coast	0 55	0 48	3 76	..	..	..	348	..	..
13. Canterbury North ..	..	..	2 60	..	..	..	555	..	..
14. Canterbury Central ..	0 40	0 40	4 52	..	2 40	11 37	125	11 20	11 20
15. Canterbury South ..	0 40	0 19	11 10	..	8 72	..	660	8 25	8 25
16. Otago Central	3 56	1 66	0 35	..	..	..	..	25 44	25 44
17. Otago South	13 50	7 4	..	..	7 64	..	305	13 61	13 61
18. Southland	4 0	15 57	2 16	..	..	..	666	1 20	1 20
Totals	173 29	179 6	132 54	38 75	31 0	11 59	7,547	238 14	188 38

TABLE 4.—APPROPRIATIONS AND EXPENDITURE FOR THE YEAR ENDING 31ST MARCH, 1930.

Number and Name of Highway District.	Construction.		Maintenance.	
	Available for Authorization.	Expenditure.	Available for Authorization.	Expenditure.
	£	£	£	
1. Auckland North	142,492	117,716	99,973	73,726
2. Auckland South	128,150	123,342	168,041	122,277
3. Tauranga	31,957	28,071	52,613	45,347
4. Gisborne	62,328	35,652	61,530	45,142
5. Napier	49,754	33,250	103,474	71,069
6. King-country	63,762	72,492	53,700	58,641
7. Taranaki	59,375	45,071	68,085	57,879
8. Wanganui	64,184	56,288	54,521	57,614
9. Wellington West ..	119,572	88,439	103,817	72,695
10. Wellington East ..	48,404	43,757	55,473	49,335
11. Nelson	35,756	18,882	91,507	77,806
12. West Coast	35,760	21,403	112,828	121,045
13. Canterbury North ..	36,341	49,002	38,924	25,808
14. Canterbury Central ..	136,255	87,158	44,042	31,580
15. Canterbury South ..	75,708	42,843	69,154	50,010
16. Otago Central	30,770	14,613	39,292	25,356
17. Otago South	105,944	102,522	42,529	32,378
18. Southland	47,163	27,456	51,338	31,541
Totals for Dominion ..	1,273,675	1,007,957	1,310,841	1,049,249
Totals for North Island	769,978	644,078	821,227	653,725
Totals for South Island	503,697	363,879	489,614	395,524

TABLE 5.—MAINTENANCE OF MAIN HIGHWAYS (INCLUDING BRIDGES).

Number and Name of Highway District.	Length Maintained.	Expenditure.								
		Board.	Local Authorities.	Total.	Average per Mile per Annum.					
					1929–30.	1928–29.	1927–28.	1926–27.	1925–26.	1924–25.
Primary System.										
	M. ch.	£	£	£	£	£	£	£	£	£
1. Auckland North ..	576 5	51,201	21,001	72,202	125·34	102·28	103·6	65·6	56·1	77·0
2. Auckland South ..	487 45	75,673	31,040	106,713	218·87	233·82	203·3	181·0	85·1	53·5
3. Tauranga ..	447 15	40,261	9,142	49,403	110·47	90·59	80·3	69·1	48·6	28·1
4. Gisborne ..	249 72	39,281	15,373	54,654	218·70	146·40	104·3	152·7	93·9	59·5
5. Napier	455 71	59,621	25,646	85,267	187·03	158·72	170·0	169·4	104·5	73·4
6. King-country ..	334 6	47,594	9,408	57,002	170·63	90·18	56·2	69·8	55·4	58·5
7. Taranaki ..	313 72	46,966	12,622	59,588	189·83	182·93	195·7	198·8	105·0	67·1
8. Wanganui ..	327 48	43,999	19,509	63,508	193·86	96·12	145·3	167·6	88·9	54·4
9. Wellington West ..	315 40	64,246	21,123	85,369	270·58	228·91	228·9	166·3	120·2	91·7
10. Wellington East ..	338 48	41,492	18,601	60,093	177·48	158·02	138·8	138·0	104·7	77·7
Totals, North Island	3,846 22	510,334	183,465	693,799	180·38	147·29	141·2	131·6	82·9	62·9
11. Nelson	305 3	59,487	13,751	73,238	153·18	121·31	102·1	119·9	63·9	48·1
12. West Coast ..	345 46	94,899	3,932	98,831	154·06	158·56	118·3	114·2	94·6	61·6
13. Canterbury North	307 40	22,632	11,695	34,327	111·63	94·06	90·1	79·5	47·7	37·7
14. Canterbury Central	399 66	19,218	11,863	31,081	77·74	77·85	87·3	81·4	46·1	52·2
15. Canterbury South..	425 45	35,130	19,525	54,655	128·43	95·69	105·0	79·5	73·9	39·7
16. Otago Central ..	258 54	15,987	5,965	21,952	84·86	61·25	77·2	49·3	26·1	12·6
17. Otago South ..	299 37	25,014	12,192	37,206	124·24	88·96	90·5	81·7	54·2	22·5
18. Southland ..	463 52	22,067	10,675	32,742	70·62	67·13	63·4	76·0	56·6	24·6
Totals, South Island	2,805 23	294,434	89,598	384,032	111·19	94·96	91·4	85·4	59·6	38·5
Totals for Dominion	6,651 45	804,768	273,063	1,077,831	151·20	125·19	119·9	111·9	73·2	51·7

TABLE 5.—MAINTENANCE OF MAIN HIGHWAYS (INCLUDING BRIDGES)—*continued.*

Number and Name of Highway District.	Length Maintained.	Expenditure.				
		Board.	Local Authorities.	Total.	Average per Mile.	
					1929–30.	1928–29.
		Secondary System.				
	M. ch.	£	£	£	£	£
1. Auckland North	331 30	22,525	10,228	32,753	98·84	68·85
2. Auckland South	334 32	46,604	22,826	69,430	207·63	109·12
3. Tauranga	170 18	5,086	1,531	6,617	38·87	32·23
4. Gisborne	91 8	5,861	4,110	9,971	109·45	67·79
5. Napier	235 29	11,448	4,709	16,157	68·65	45·97
6. King-country	297 23	11,047	5,033	16,080	54·09	29·17
7. Taranaki	123 6	10,913	5,029	15,942	129·53	87·91
8. Wanganui	147 15	13,615	6,502	20,117	136·68	71·64
9. Wellington West ..	122 40	8,449	4,428	12,877	105·12	74·18
10. Wellington East	114 2	7,843	4,016	11,859	104·00	80·04
Totals, North Island ..	1,966 43	143,391	68,412	211,803	107·70	66·20
11. Nelson	193 10	18,319	3,236	21,555	49·08	37·14
12. West Coast	145 8	26,146	5,138	31,284	196·99	111·98
13. Canterbury North ..	89 20	3,176	2,049	5,225	58·54	36·31
14. Canterbury Central ..	242 65	12,362	6,232	18,594	76·58	54·05
15. Canterbury South ..	415 35	14,880	5,802	20,682	49·78	36·23
16. Otago Central	223 34	9,369	4,303	13,672	61·19	31·95
17. Otago South	145 60	7,364	3,580	10,944	75·09	52·62
18. Southland	335 12	9,474	4,034	13,508	40·30	26·07
Totals, South Island ..	1,790 4	101,090	34,374	135,464	67·42	43·79
Totals for Dominion ..	3,756 47	244,481	102,786	347,267	88·51	55·51
		Complete Highway System.				
1. Auckland North	907 35	73,726	31,229	104,955	115·66	90·26
2. Auckland South	821 77	122,277	53,866	176,143	214·30	182·99
3. Tauranga	617 33	45,347	10,673	56,020	90·73	74·50
4. Gisborne	341 0	45,142	19,483	64,625	189·52	124·91
5. Napier	691 20	71,069	30,355	101,424	146·72	120·35
6. King-country	631 29	58,641	14,441	73,082	115·75	61·44
7. Taranaki	436 78	57,879	17,651	75,530	172·85	155·92
8. Wanganui	474 63	57,614	26,011	83,625	176·13	88·53
9. Wellington West ..	438 0	72,695	25,551	98,246	224·31	185·63
10. Wellington East	452 50	49,335	22,617	71,952	158·96	138·38
Totals, North Island ..	5,812 65	653,725	251,877	905,602	155·78	119·87
11. Nelson	498 13	77,806	16,987	94,793	112·83	88·69
12. West Coast	490 54	121,045	9,070	130,115	166·76	144·87
13. Canterbury North ..	396 60	25,808	13,744	39,552	99·69	81·07
14. Canterbury Central ..	642 51	31,580	18,095	49,675	77·29	68·85
15. Canterbury South ..	841 0	50,010	25,327	75,337	89·58	66·32
16. Otago Central	482 8	25,356	10,268	35,624	73·89	47·67
17. Otago South	445 17	32,378	15,772	48,150	108·15	77·06
18. Southland	798 64	31,541	14,709	46,250	57·90	49·90
Totals, South Island ..	4,595 27	395,524	123,972	519,496	94·12	75·04
Totals for Dominion ..	10,408 12	1,049,249	375,849	1,425,098	128·57	100·06

For the purpose of computing the average costs per mile in the above tables the expenditure on the restoration of earthquake damage in the Nos. 11 and 12 Highway Districts has been excluded.

TABLE 6.—(*a*) TESTS OF STONE COMPLETED DURING THE YEAR ENDING 31ST MARCH, 1930.

No.	Locality.	Weight in Pounds per Cubic Foot.	Absorption of Water in Pounds per Cubic Foot.	Abrasion.		Hardness.	Toughness.	Geological Classification.
				Percentage of Wear.	French Coefficient.			
146	Wainui Road, Hutt County ..	164	0·86	4·88	8·2	18·9	22·5	Greywacke.
147	Hick's Bay, East Cape ..	173	0·29	2·88	13·8	18·5	24·5	Basalt.
148	Hick's Bay, East Cape ..	171	0·59	..	..	16·9	20·5	Basalt (slightly weathered).
149	Hick's Bay, East Cape ..	151	1·03	..	..	15·9	16·0	Basalt (weathered).
150	Huntly Town Board Quarry ..	167	0·36	2·6	15·4	18·4	38·0	Greywacke.
151	Ngaruawahia	154	1·19	4·48	8·93	..	..	Greywacke.
152	Horokiwi Quarry, Hutt River Shingle Co.	166	0·55	2·88	13·89	18·0	13·5	Greywacke.
153	Excelsior Quarry, Hutt River Shingle Co.	163	0·70	5·9	6·78	..	..	Greywacke (weathered).
154	Tokatoka, Section 4, Block XI, Whangarei—Donovan's	149	5·40	28·92	1·38	..	..	Decayed andesite.
155	Tauraroa, Whangarei.. ..	169	1·26	4·54	8·81	17·3	11·5	Basalt.
156	Piako: Borough Quarry, Block IX, Aroha	168	1·50	3·48	11·49	17·5	24·0	Altered andesite.
157	Glass Bros. Quarry, Waikato River, Mercer	165	1·22	2·24	17·9	19·1	30·0	Basalt.
158	Waerenga: South End, Rotoma	137	2·98	14·54	2·75	18·1	6·0	Dense spherulitic rhyolite.
159	Waerenga: North End, Rotoma	152	1·99	7·00	5·71	17·8	7·5	Dense spherulitic rhyolite.
160	Trig. K, East Taupo	178	1·43	2·04	19·60	19·2	41·5	Basalt.
161	Kaimanawa Mount, East Taupo	148	0·94	44·02	0·91	10·3	3·0	Glassy rhyolite.
162	Rotoma–Taupo Road—11-mile peg	149	3·40	17·62	2·27	17·4	4·5	Dense spherulitic rhyolite.
163	Rotoma–Taupo Road.—32-mile peg	107	15·37	28·32	1·42	9·2	3·5	Volcanic tuff.
164	Rotoma–Taupo Road.—21-mile peg	151	5·44	24·68	1·62	17·7	4·5	Crystalline spherulitic rhyolite.
165	Butler and Carrol, Ltd., Pokeno	187	1·66	3·12	12·82	18·9	34·0	Basalt.
166	Tehiki River, Toketaruna: Block XII, Purua	176	0·62	4·22	9·48	18·1	18·0	Basalt.
167	Maketu Quarry, Runciman ..	180	1·65	2·86	13·98	19·1	34·5	Basalt.
168	McPeake Quarry, Otorohanga ..	162	0·57	4·42	9·05	17·9	9·0	Argillaceous limestone.
169	Matapara Quarry, Otorohanga County	169	0·38	4·16	9·61	..	..	Greywacke.

(*b*) ABRASION TESTS OF GRAVELS COMPLETED DURING THE YEAR ENDING 31ST MARCH, 1930.

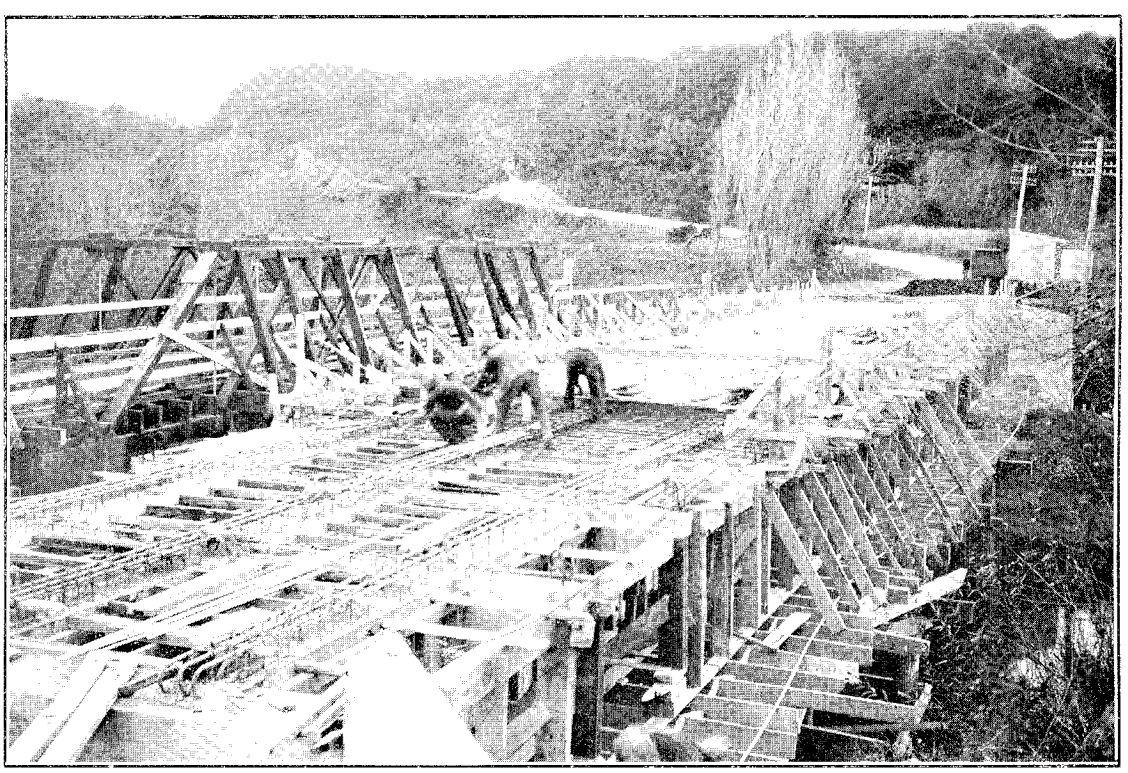
Locality.	Percentage of Wear.	French Coefficient.
Hawke's Quarry, Waitemata County	7·28	5·50
King's Quarry, Waitemata County	10·08	3·96
Motutara, Whangarei	6·98	5·70
Taringamotu Stream, Stratford	6·26	6·39
Manunui	5·88	6·80
Waiomio Stream, Whangarei	14·68	2·72
Takatu, Whangarei	4·58	8·73
Taumerere, Whangarei	8·88	4·50
Victoria Valley, Whangarei	12·18	3·28
Mangamuku, Whangarei	14·94	2·68
Takahue, Whangarei	13·02	3·07
Broadwood, Whangarei	14·72	2·72
Tauranga: Taupo Stream	4·88	8·19
Tongariro River at bridge	5·30	7·55
Oporo, Oreti Road, Invercargill	2·26	17·80

By Authority: W. A. G. SKINNER, Government Printer, Wellington.—1930.



Road-oil Work at Mourea after Fifteen Months Wear.

TE NGAE–PAENGAROA MAIN HIGHWAY. LOOKING WEST TOWARDS MOUREA.



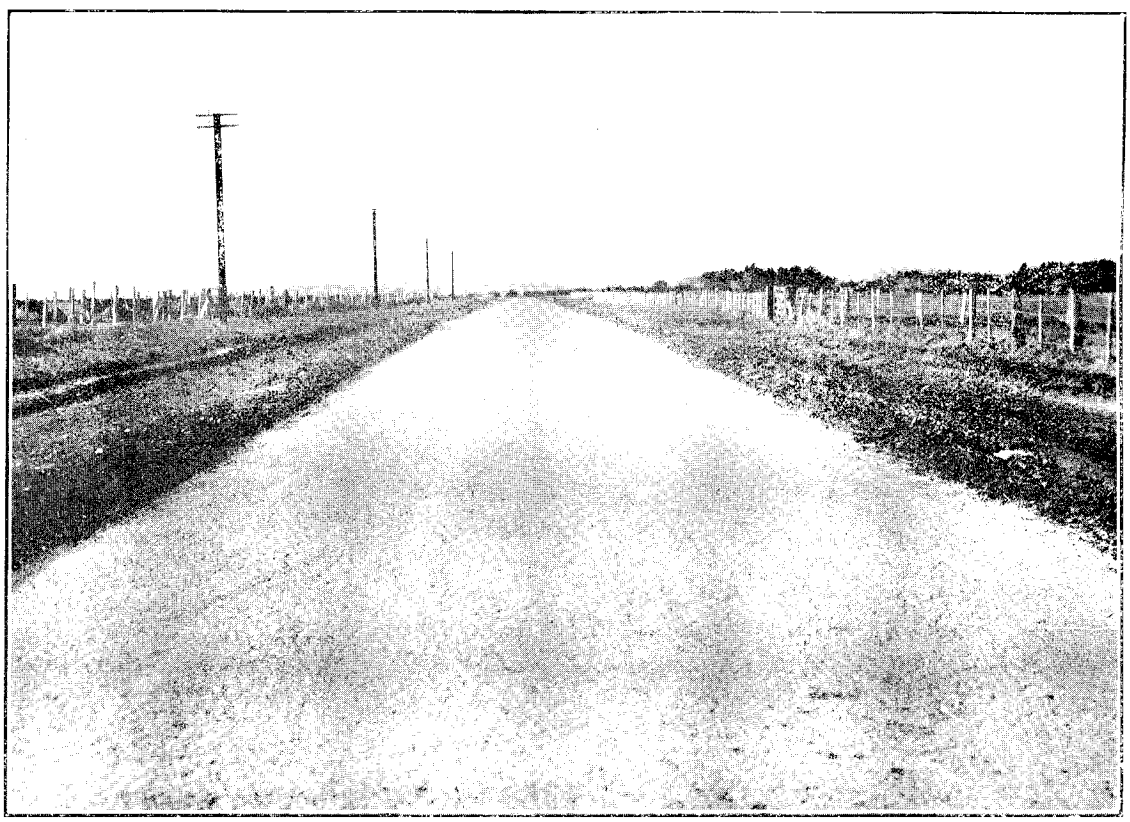
Urenui Stream Bridge.

One 60-ft. span, and two 40-ft. spans. Reinforced-concrete deck; 18-ft. roadway. Old bridge in background.

No. 1 MAIN HIGHWAY. AUCKLAND–WELLINGTON VIA TARANAKI.

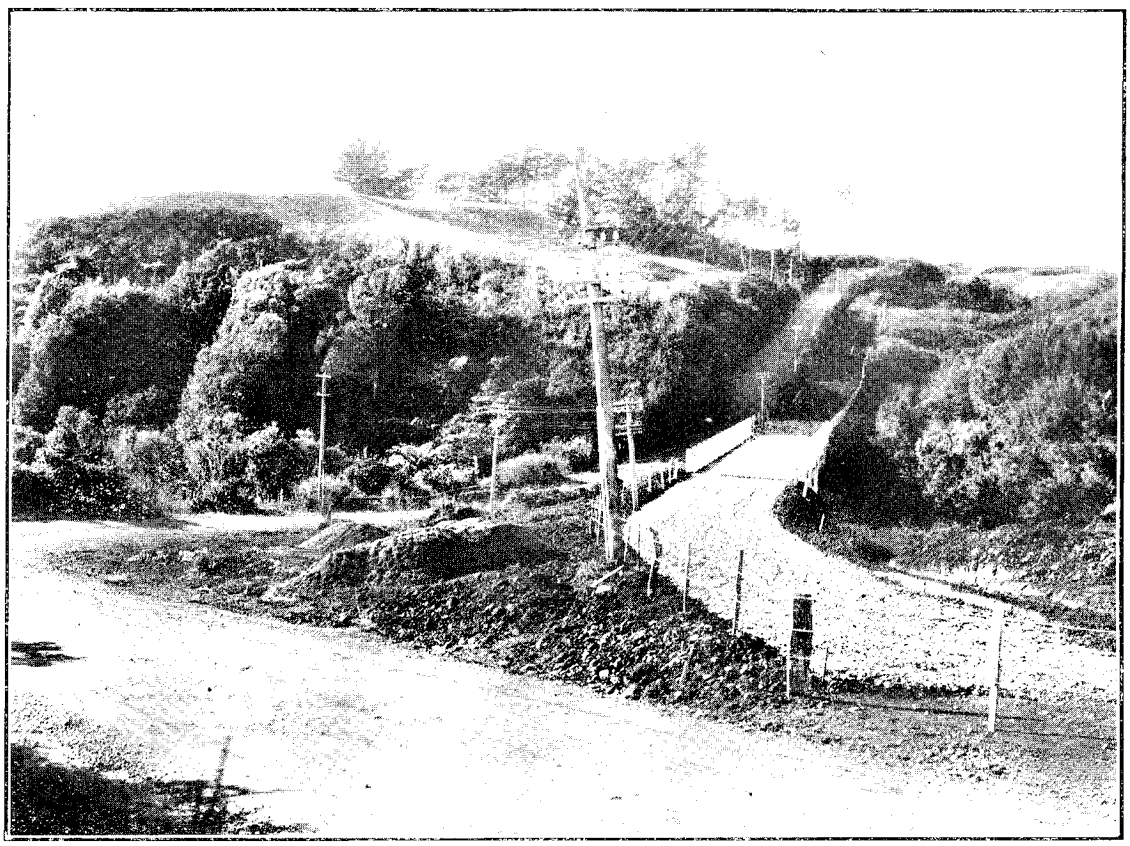


Subway near Hawera, eliminating Railway Level Crossing.



Bituminous Macadam Pavement, Waitara Pukearuhe Section.

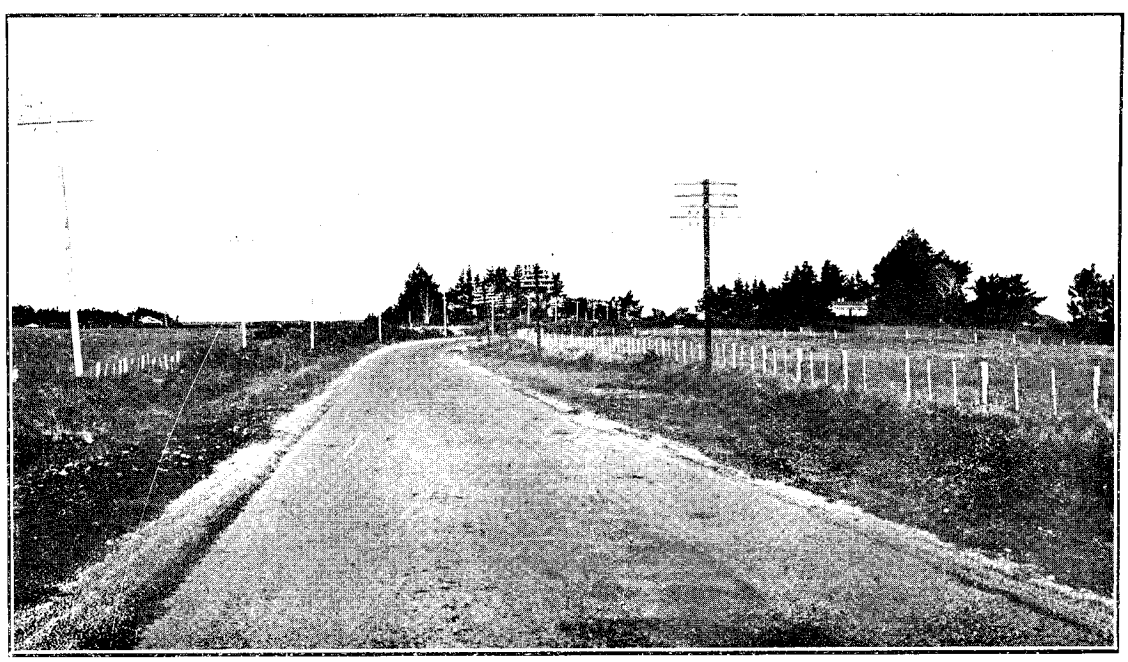
No. 1 Main Highway, Auckland Wellington via Taranaki.



Katikara Deviation and Bridge.

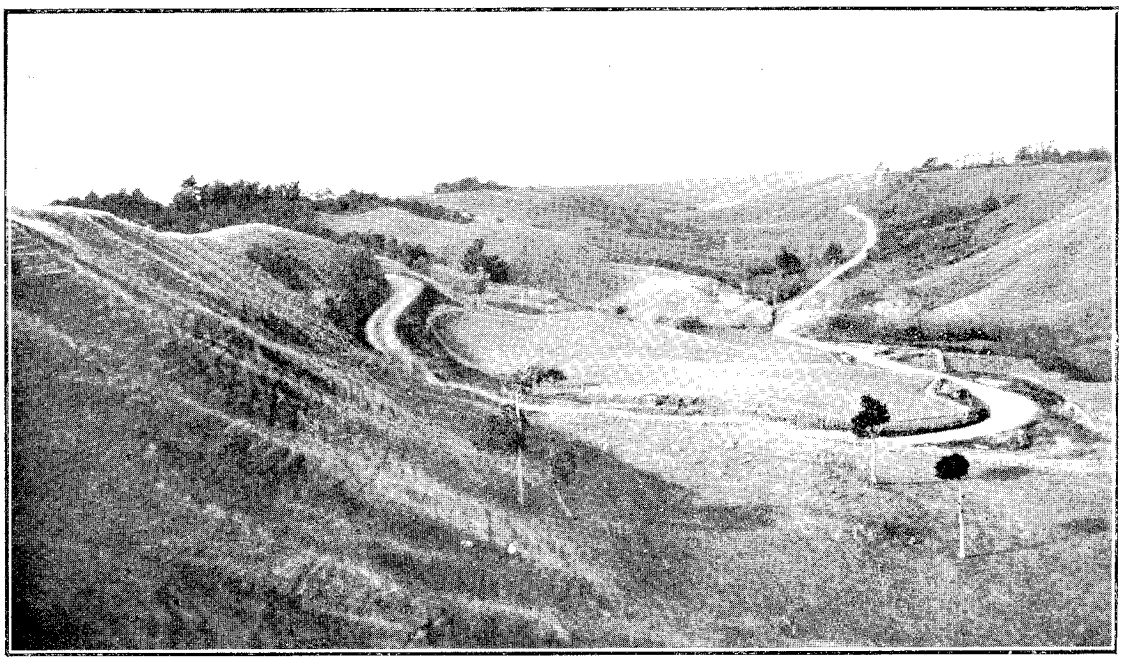
Three 40 ft. spans; 18 ft. roadway.

No. 36 MAIN HIGHWAY.—LEPPERTON JUNCTION–HAWERA VIA OPUNAKE.

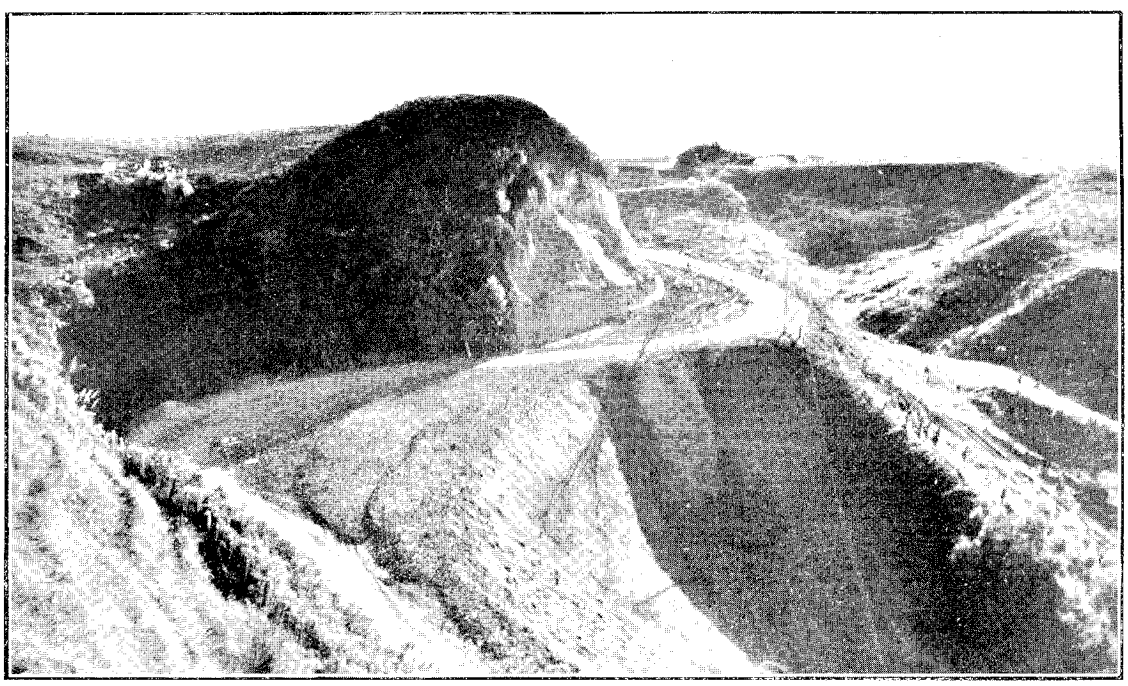


Old Sealed Surface widened and improved.

No. 37 MAIN HIGHWAY.—NEW PLYMOUTH–KAIMATA.

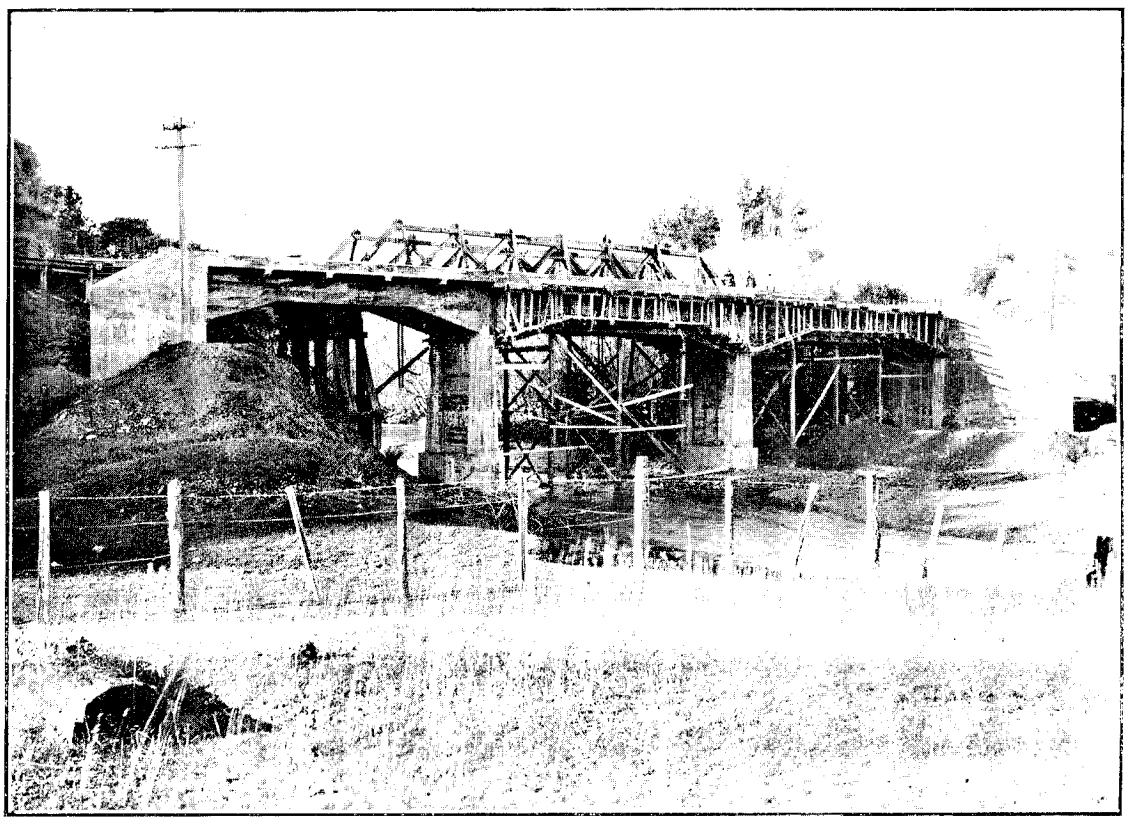


Goat Valley Section improved in Alignment and Widened.



Improvements in Alignment near Kai-iwi.

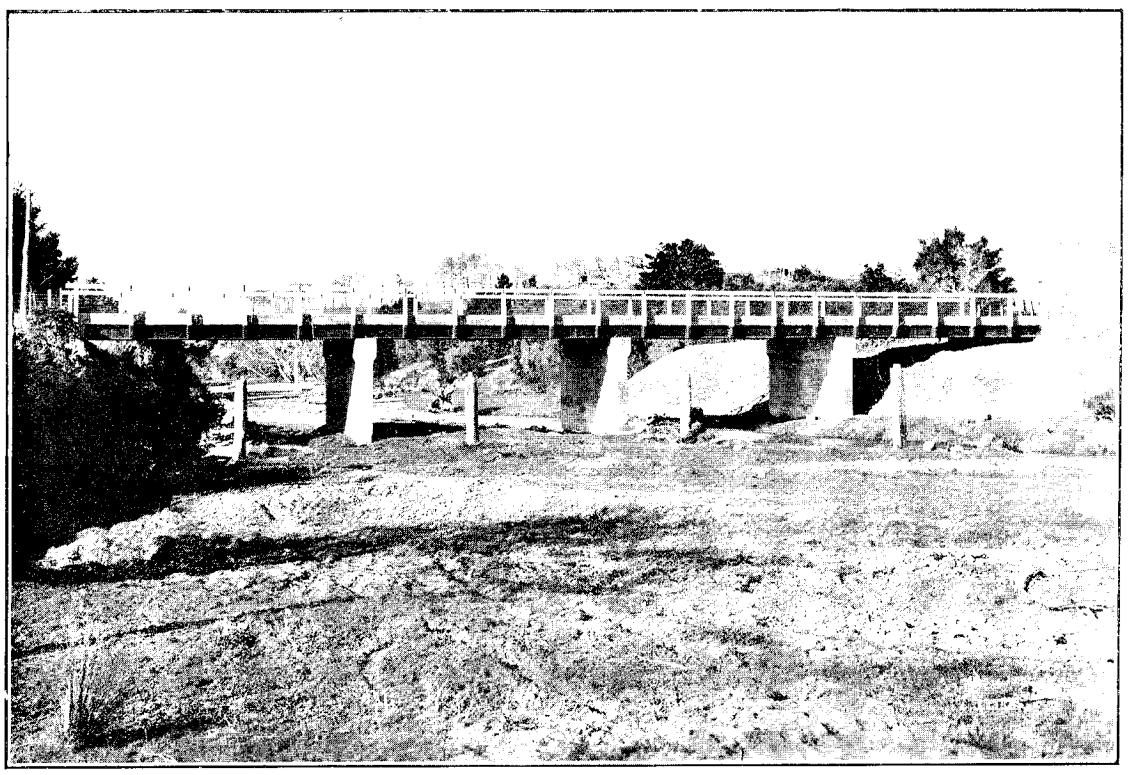
No. 1 MAIN HIGHWAY, AUCKLAND WELLINGTON VIA TARANAKI.



MANGATERA BRIDGE.

Reinforced concrete: three 40 ft. spans: 18 ft. roadway. Old bridge in background.

DANNEVIRKE WAIPUKURAU VIA PORANGAHAU MAIN HIGHWAY.



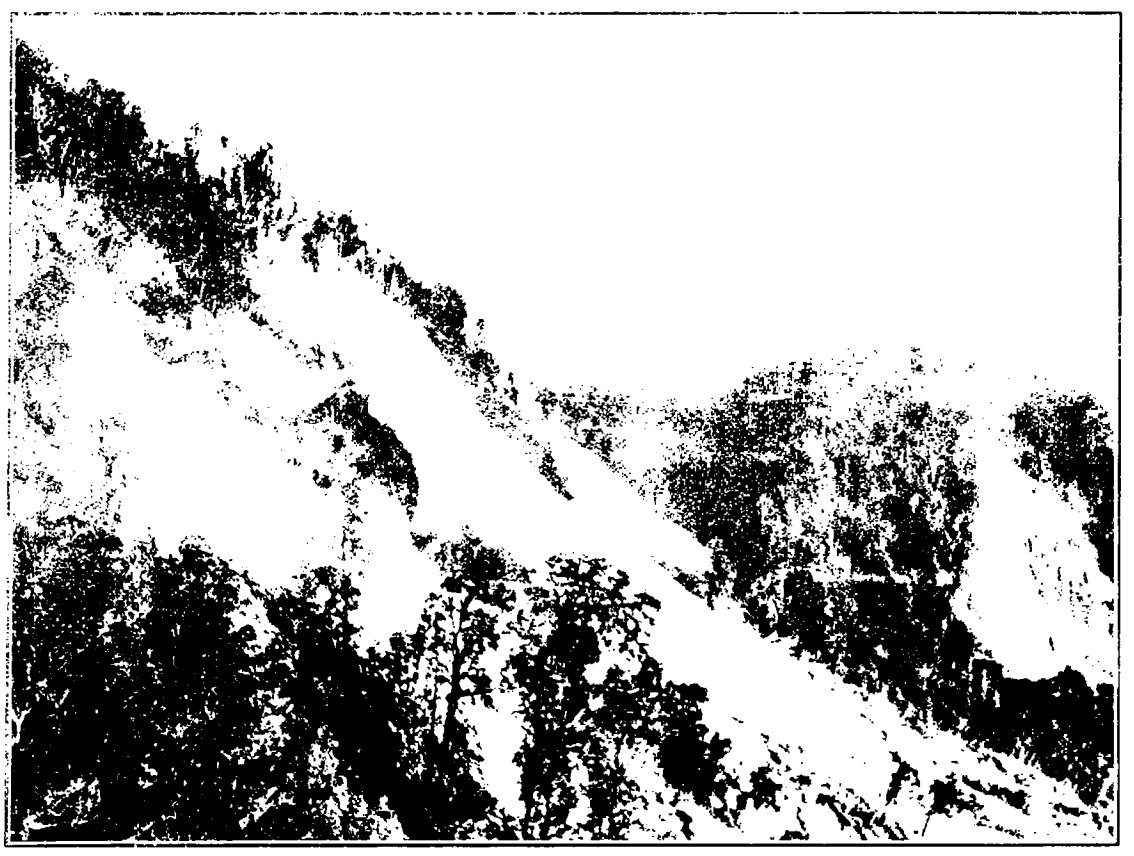
ORUA KIRITAKI STREAM BRIDGE.

Four 35 ft. rolled-steel-joist spans: reinforced-concrete deck: 18 ft. roadway.

NAPIER WELLINGTON MAIN HIGHWAY.

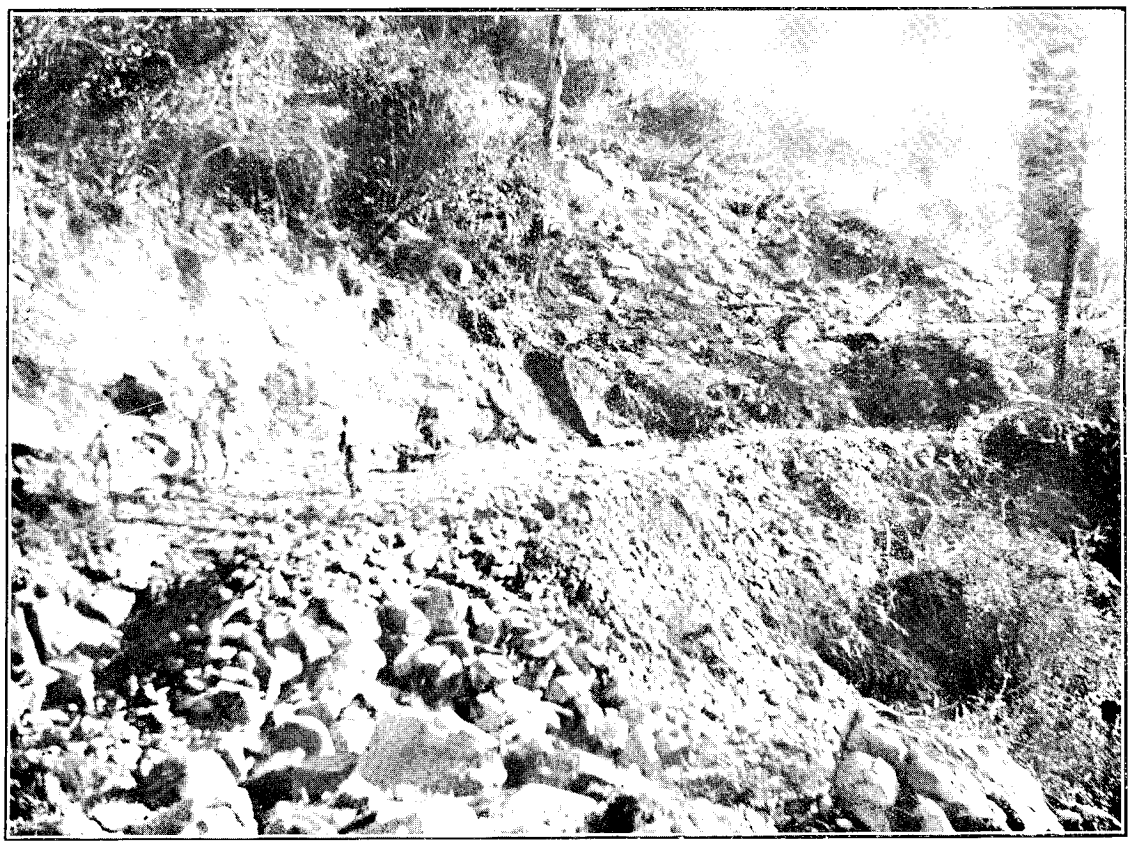


Earthquake Damage. Reconstruction of Road around Limestone Bluffs above Mokihinui.



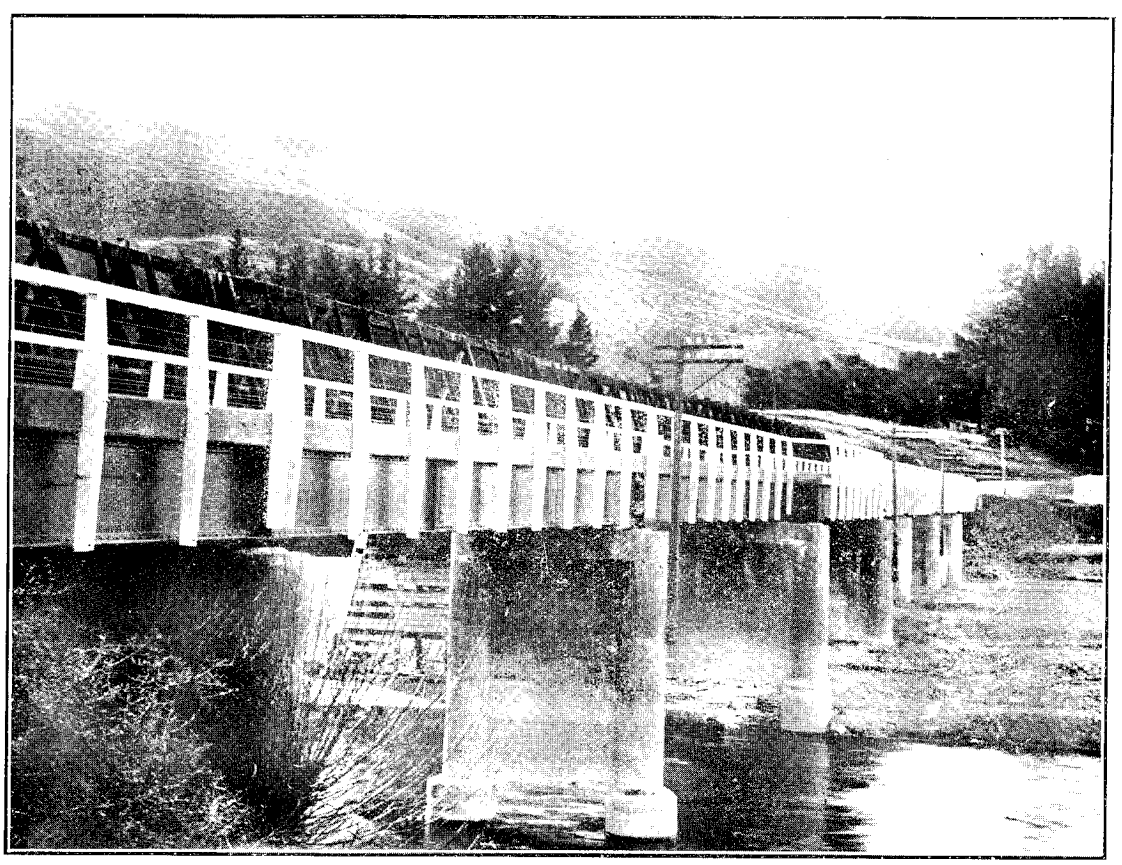
Earthquake Damage. Reconstruction of Road around Limestone Bluffs above Mokihinui.

WESTPORT KARAMEA MAIN HIGHWAY. MOKIHINUI KARAMEA SECTION.



Reconstruction of Road damaged by Earthquake.

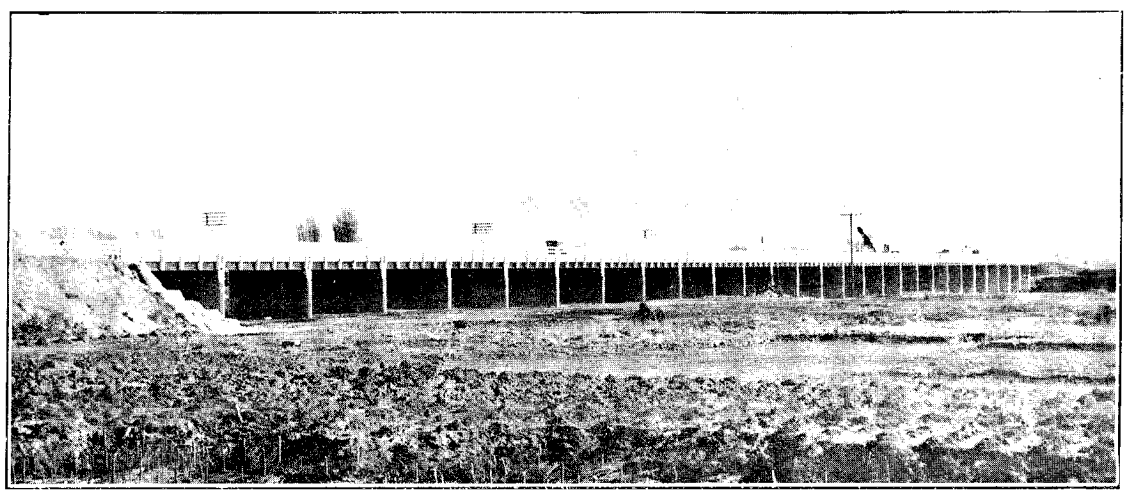
WESTPORT-KARAMEA MAIN HIGHWAY. MOKIHINUI-KARAMEA SECTION.



Hurunui River Bridge.

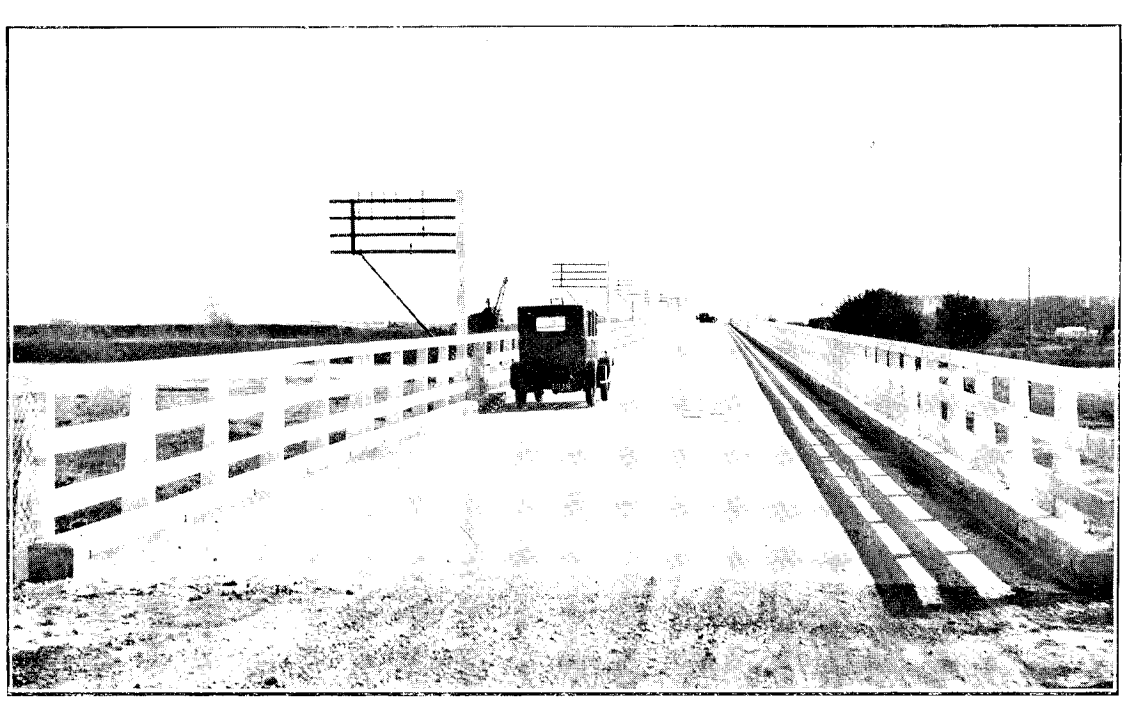
Eight 60 ft. steel-plate-girder spans; reinforced-concrete deck; 12 ft. roadway, with passing span in centre 19 ft. roadway; cylinder piers.

CHRISTCHURCH BLENHEIM VIA PARNASSUS MAIN HIGHWAY.



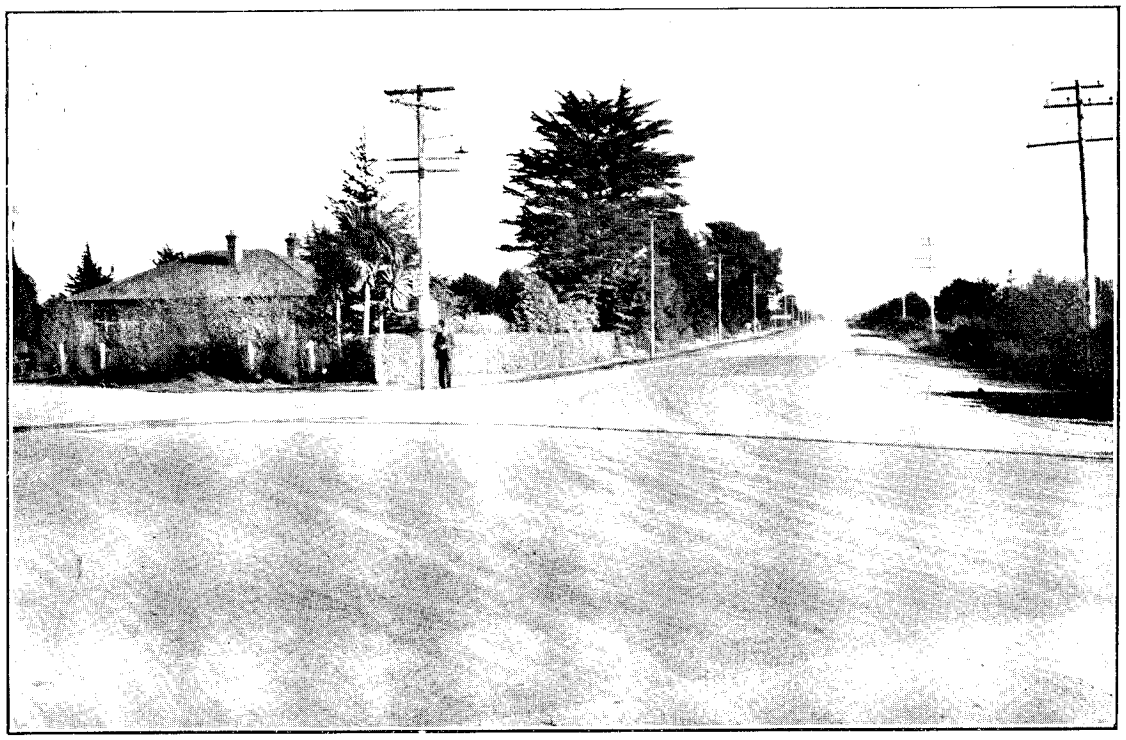
Waimakariri River Road-bridge.

Twenty-nine 40 ft. rolled-steel-joist spans: reinforced-concrete deck: 20 ft. roadway.

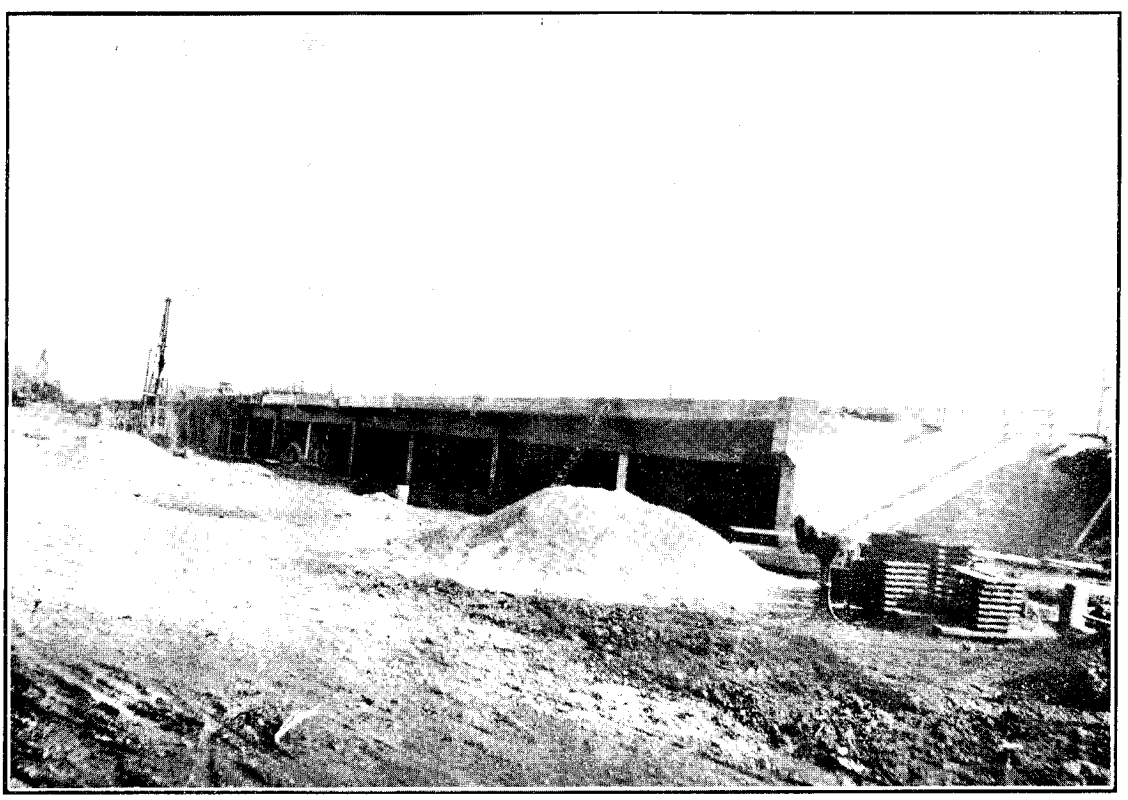


Waimakariri River Road-bridge: View showing Bituminous-concrete Surfacing of Deck.

CHRISTCHURCH–BLENHEIM MAIN HIGHWAY.

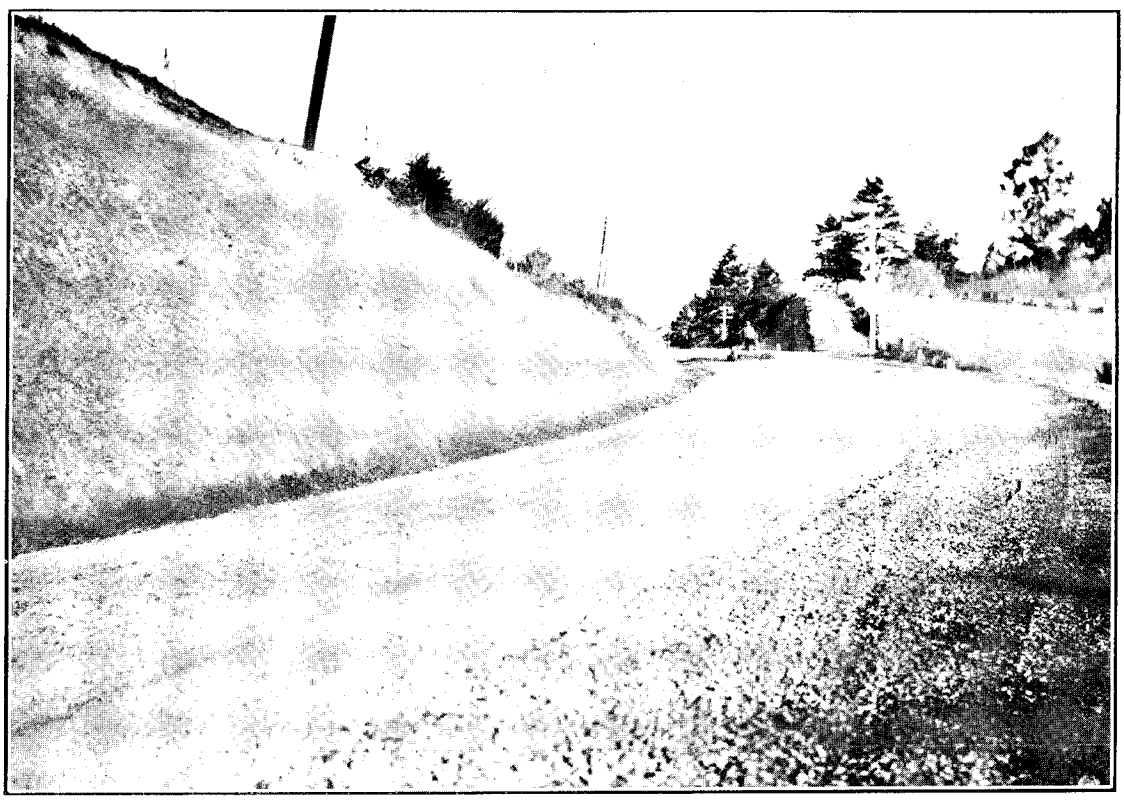


Bitumen Paving at Corner of Main South Highway and Sockburn-Ellesmere Highway, joining Concrete Road with Bitumen Road.



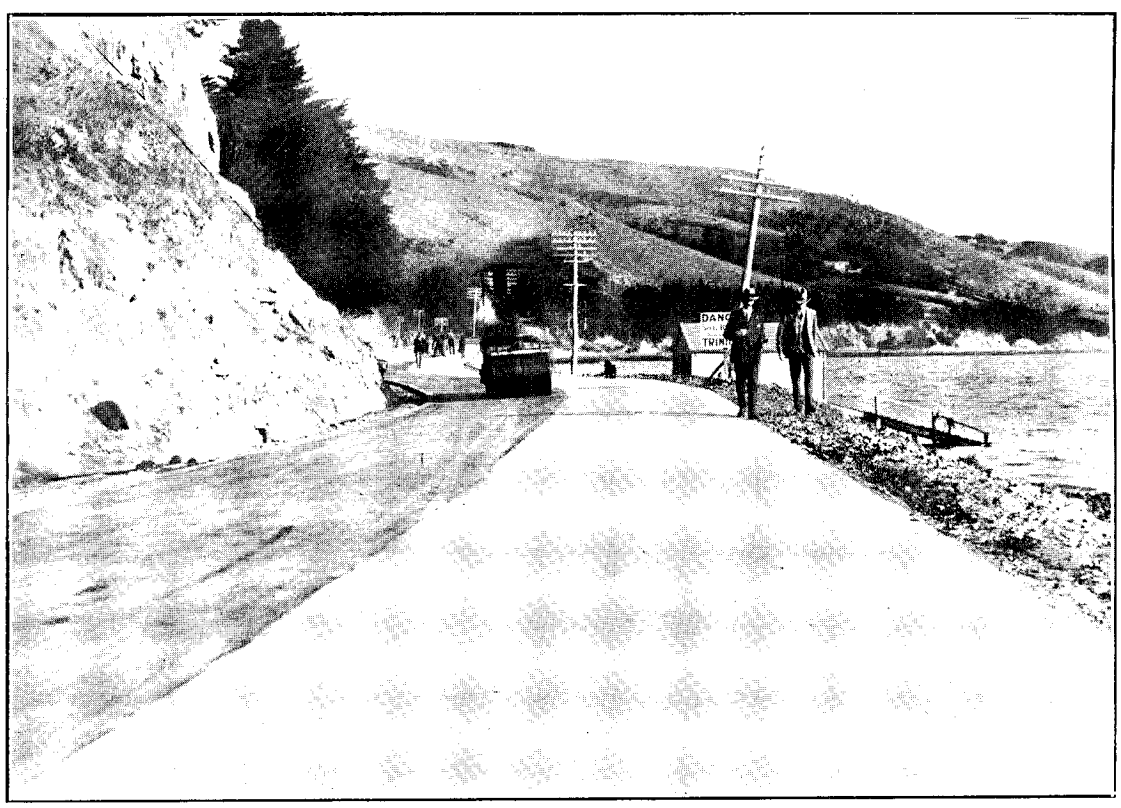
Christchurch–Dunedin Main Highway.—Ashburton River Bridge under Construction.

Thirty-two 35 ft. reinforced-concrete spans, 22 ft. roadway and 6 ft. footway.



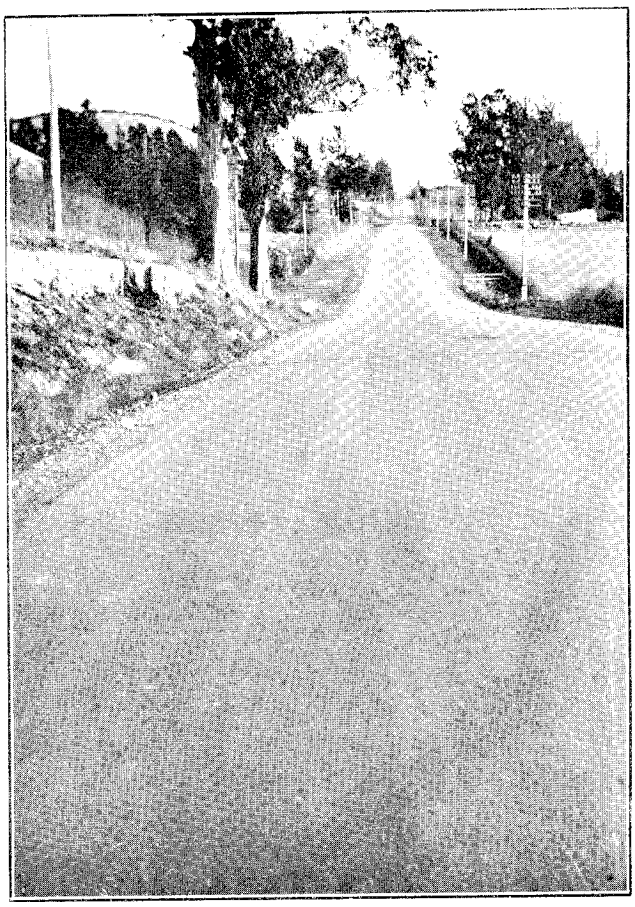
Constructing Macadam Foundation between Waitati and Evansdale.

DUNEDIN CHRISTCHURCH MAIN HIGHWAY.

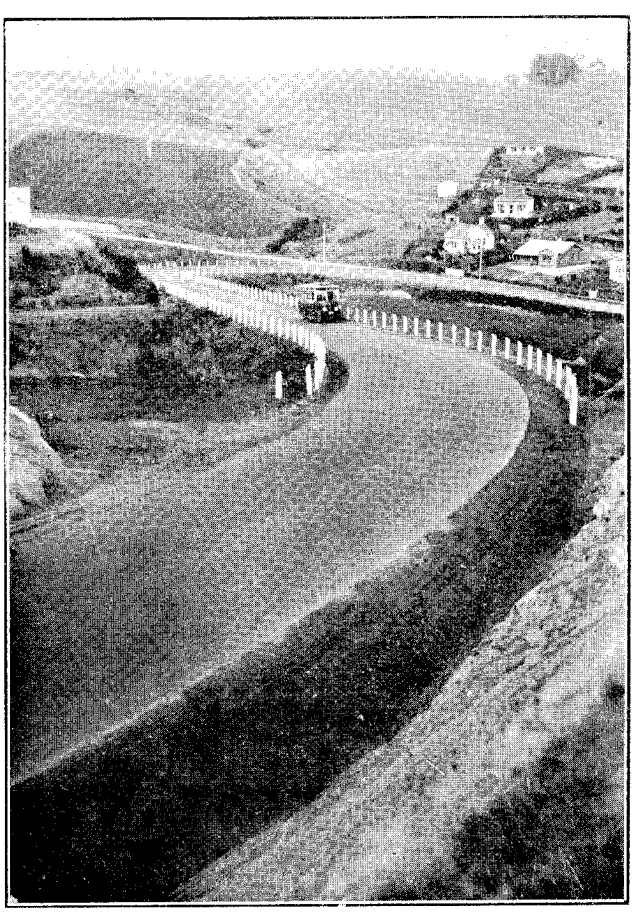


Bituminous-concrete Paving.

DUNEDIN PORTOBELLO MAIN HIGHWAY.

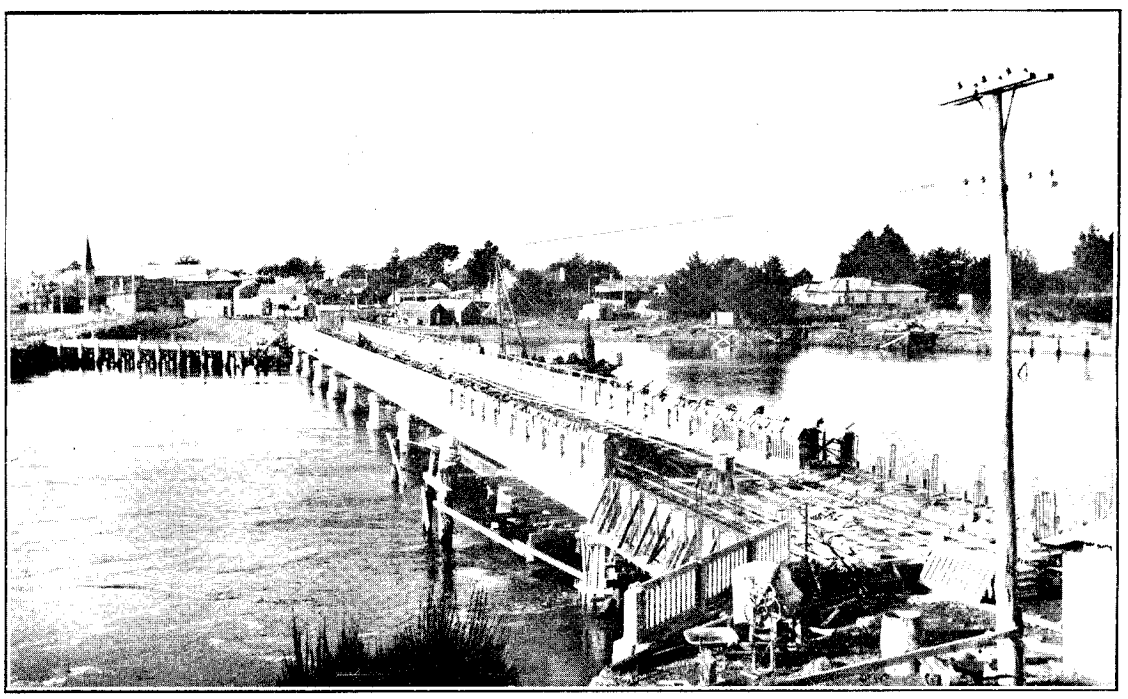


Bituminous-concrete Pavement.

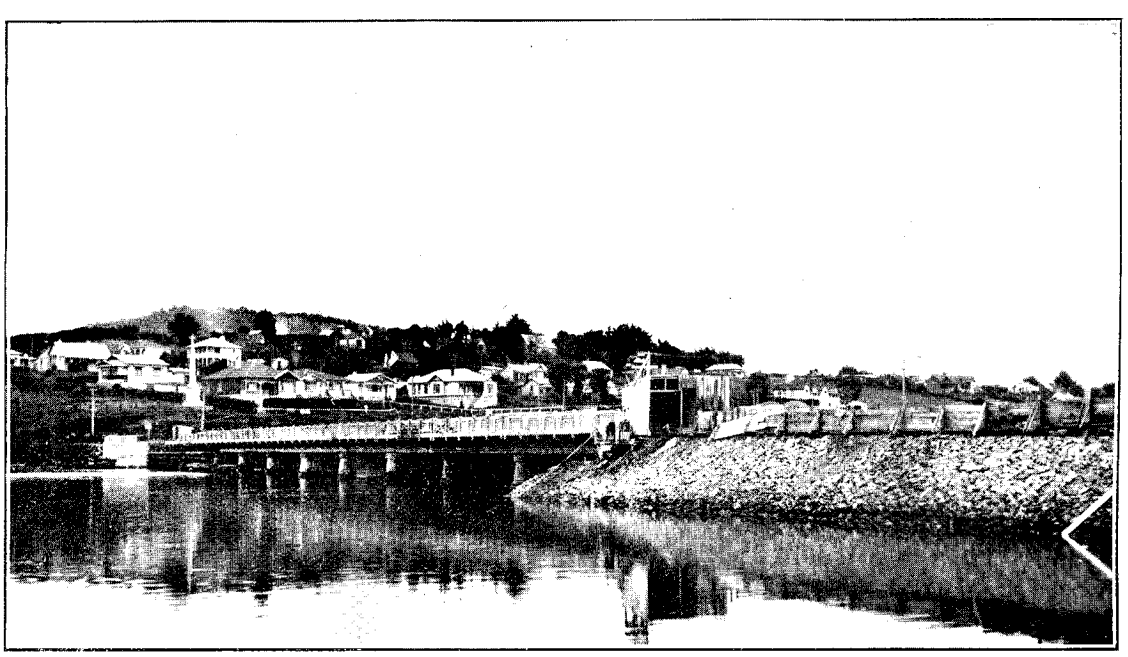


Burnside Deviation and Bituminous-concrete Pavement.

DUNEDIN INVERCARGILL MAIN HIGHWAY.



Aparima River Road Bridge: Looking towards Riverton.



Aparima River Road Bridge: View from Riverton Side, showing Stone-protected Approach Bank.

Reinforced concrete; eleven 40 ft. spans; 18 ft. roadway; 4 ft. 4 in. footway; reinforced-concrete pile piers and one reinforced-concrete cylinder pier.

RIVERTON OREPUKI MAIN HIGHWAY.