1928.

NEW ZEALAND.

PUBLIC WORKS STATEMENT

(BY THE HON. K. S. WILLIAMS, MINISTER OF PUBLIC WORKS).

MR. SPEAKER,—

This is the third occasion it has been my privilege to present to you the annual Statement of the Public Works Department, and I think I can now claim to have fairly attained the intimate knowledge that the many ramifications of this Department necessitate in order that I, as Minister, may keep my finger on the many activities which my Department carries out.

The preceding year has been one of much activity in the various public works conducted by my Department, and I again wish to acknowledge my indebtedness to the members of my staff for the willing and efficient service they have rendered. Railway-construction and hydro-electric development expecially have been on a large scale, and much good work has been accomplished. During the year I continued extending my knowledge of the various works in hand by making personal investigations of the progress being made in as many cases as I was able.

The public works now being undertaken must prove to be of much benefit in the development of the country's natural resources. The extending of hydro-electric services to our primary producers, especially in the dairying districts, and the access to markets given to outlying districts by railway and road construction, all tend to increase the Dominion's export trade. The prospects of the coming season are bright, the markets being steady for our chief exports, and it is hoped that the service given by the Government, both in transport and power, will be availed of to the utmost by the primary producers.

During the year the most noteworthy progress has been evidenced by the completion and handing over to the Working Railways Department of 118 miles 29 chains of railway. It is true that for some years past a considerable portion of this mileage has been almost completed, and the public have had a modified use of the same. Progress of works further on has been so interlocked with the completed portion, involving the running of construction trains continuously over the completed portion, that it was not deemed advisable to hand over some, which might have been handed over, until my Department was in a position to transfer to the control of the Railways Department a considerable length, and could do so without prejudicing the progress of other works. This more particularly refers to the East Coast Main Trunk Railway in the Bay of Plenty district, where until a through connection was made to Auckland it would not have been possible for the full value of the work to be obtained. Now that the connection between Tauranga and Waihi has been completed and that a halt has been called in extension eastward, it has been possible to open the railway from Taneatua on the eastward, right through to Auckland.

The extension of the rail-head to the northern side of the Northern Wairoa River at Kirikopuni marks another step forward in the removal of the isolation of the far North, and has been instrumental in developing and bringing a large fertile part of the Dominion into close touch with its principal markets and centres of social intercourse. There is an opinion in the minds of many people—I might almost say a great many people—that railways are no longer required, and that further

expenditure on them is unwarranted. With this view I do not agree. It is true that many places where a railway would have been the natural means of development in the past can now be developed without the expense of laying down a railway, but where long distances have to be traversed or heavy merchandise moved the railway is still the most economical form of transport, provided, of course, that there is sufficient business to prevent the enterprise being overburdened with capital charges. Speaking of capital charges, I do not know whether honourable members have ever looked into the question of the capital charges in connection with motor transport; but, if so, they will have found that the capital invested in motor transport, including the track on which it is operated, in New Zealand is greater than that invested in the railways, the roads being, of course, an essential part of motor transport. If rolling-stock and running-expenses alone are taken, the cost of motor transport is several times that of railways, while I do not think anyone would be found who would argue that even double the motor transport which we have in the country could do anything like the work which is being done by the railways at present. There are localities which in order that they may be developed to their fullest must be provided with cheap transport, particularly in the case of manures, and if a method of cheaply transporting fertilizers is not provided, then without doubt the districts requiring such facilities will never be developed. It is, of course, necessary to be reasonably assured that when the development has been brought about there will then be sufficient business to justify the losses in the early stages.

Bearing in mind the foregoing, the question of commencing the railway from Rotorua into the centre of the North Island, into what is now the largest area of undeveloped country in New Zealand which is capable of development, was considered by the Government. The question of development of this country by railway connection was investigated by two Royal Commissions in the past, and the evidence which they collected was of very considerable value to the Government in coming to its decision.

The exotic forests which have been established by the operations of the Government's forestry policy in and around Waiotapu have grown to such a stage that within a very few years it will be necessary to have rail transport in order that the produce therefrom may be economically brought to market. When the Royal Commissions previously referred to went into this aspect of the problem they had in mind an expansion of 8,000 or even perhaps 10,000 acres per year on to an already existing area of 27,568 acres, while actually there is at the present time 84,000 acres, 27,000 acres of which was planted last year, while the forestry programme of the next few years contemplates the planting of 30,000 acres per year. If railway connection was considered at all in 1922, how much more has its necessity been emphasized by this tremendous expansion.

Apart from the necessity for a cheap method of transporting the timber, referred to above, from the area to be served by the Rotorua–Taupo Railway, there is also the question of providing the most economical method of developing the immense area, estimated at well over a million acres of land, which lies in the valley of the Waikato River. The wonderful development of the land east of Hamilton which followed the construction of the railway from there to Rotorua inspires the hope that the providing of cheap transit facilities to bring in the much-needed manures and to take away the produce will result in a similar development south of Rotorua. The progress that has been made by the few progressive pioneers who attacked the problem even without railway transit has demonstrated what can be done with this land, but a full measure of development could never be obtained without rail transport. It is not claimed that the whole million and a quarter acres said by the Royal Commission of 1922 to be served by this line is capable of a high state of development, but a very considerable portion of that area certainly is.

The almost total absence of good road-metal or other material suitable for concrete creates conditions under which the construction of a concrete road would be almost as expensive as a railway, and to attempt to carry out the timber already referred to by road would necessitate the road being constructed with a concrete foundation. Taking all these points into consideration, the Government decided to commence the construction of the railway, making Reporoa in the meantime the objective.

Making a short review of the railways actually under construction, it can be said that the North Auckland Main Trunk Railway is now making good progress, and will soon reach Rangiahua, on the Hokianga River. On investigating the position, I considered it wise to continue the North Auckland Main Trunk line so as to connect with the existing Dargaville - Kaihu Valley Railway, an isolated section of twenty-four miles. This will have the effect of bringing a large area of country on the west coast beyond Dargaville in touch with the main railway system. Work will be proceeded with at a pace which will give the best results considering the physical obstacles to be overcome, and it is hoped to complete this connection within two and a half years.

The extension of the East Coast Main Trunk Railway has been discontinued at Taneatua, and I propose to await the results of the constructed portion, and to ascertain to what extent the local population patronize the railway facilities in preference to other methods of transport running in opposition thereto, before coming to a conclusion as to what further extension is warranted.

The Napier–Gisborne Railway will be carried on to Wairoa, which will take some years yet, and before that length is completed a definite decision will have been made concerning the route to be followed on the further connection from Wairoa to Gisborne, and the governing points on that length will be put in hand, so that when the time comes for a forward push from Wairoa the time for making the connection to the existing railway at Gisborne will be reduced as much as possible.

The Stratford Main Trunk Railway is now located definitely, and a programme of works entered upon, as a result of which it is hoped to have a through connection completed in from four to five years. Of course, the actual rate of progress will be governed by the amount of money which Parliament makes available; but even without this restriction I do not think it would be economically possible to complete within four years.

In the South Island the only railway on which at present it is proposed to proceed vigorously is the connection between the Westport Section of railway and the Midland Railway system at Inangahua Junction, by which connection the rich bituminous coalfields of the Buller district will be brought in touch with the greater part of the South Island by direct rail connection. When that connection is well under way a forward movement to connect with the Midland system can be taken up. At the present time the railway works in the North Island are proceeding in accordance with a programme, but indications point to the possibility of releasing a certain number of men and money fairly soon, and immediately it becomes possible, without unduly inflating the Railway Vote, more money can be devoted to this end. Although good service has been rendered to the community by the action of the Railway Department in extending its service by car and lorry as far as Murchison, there is no doubt that it is difficult for any isolated section of railway to show a good financial result, the tendency under modern conditions being undoubtedly for the motor to take the short hauls and the railway the long and heavy work.

A total vote of £984,000 is proposed for railway-construction, as against £1,007,000 last year.

The three important railway deviations—namely, (1) at Westfield, near Auckland, which is being constructed to avoid the heavy grades immediately after leaving Auckland, and also to provide the increased station facilities which the growth of business absolutely demands; (2) the Palmerston North Deviation, which will take the business of the Main Trunk line outside the fast-growing town of Palmerston North, and provide the extra station facilities which could not be provided at the present station-yard location within the city limits for this, one of the most important junctions in New Zealand; and (3) the Tawa Flat Deviation, immediately outside Wellington, which is being constructed for much the same reason as the Westfield Deviation at Auckland—which form a substantial part of the works included in the scheme of the Railways Improvement Act, will all be vigorously pushed to completion.

The most noteworthy fact in connection with hydro-electric development has been the decision of the Government to proceed with the development of power

on the Waitaki River, in order to be ready for the time when the increasing demand of the east-coast district exceeds the capacity of Coleridge. What is regarded as the last unit for Lake Coleridge Station is being obtained. It would be possible to still increase this station by the diversion of other streams, but it is considered that another station in South Canterbury, dividing the distance between Coleridge and Waipori, best fits in with the general scheme of development.

As honourable members know, the Government has taken over the Arapuni works from the contractors; good progress is being made, and I am confident that when I present my next Statement, I will be able to state that the northern part of the North Island is being supplied by the generators of Arapuni, and also that the southern part of the North Island has been put beyond the power of being effected by the vagaries of the weather, owing to the connection on to the present transmission system of the station now approaching completion at Waikaremoana.

It is expected that the total expenditure this year will be £1,260,000.

Roadwork, both on ordinary roads and on highways, has been pushed on in an endeavour to absorb a large number of men who were unable to find work in civil avenues of employment, and, though this has resulted in works being undertaken which would not otherwise have been undertaken this year, no work has been done which could be criticized as wasteful. Every work is a work which will be an advantage to the Dominion as years roll on, and I am of the opinion that it is better to employ men on useful work, even though that useful work is not immediately necessary, rather than to face the alternative of having to pay what is commonly known as a "dole." I hoped when making my last Statement that it would not have been necessary to make such large provision for relief workers this year as was necessary last year. Unfortunately, the reverse has been the case, because the local labour-market always lags to a certain extent behind the returns from produce sent abroad; in other words, when there is a slump in receipts works then in hand are not stopped immediately, and, conversely, when, owing to better prices and crops, a larger amount of money flows into the country new enterprises are not started immediately; but I am quite confident that, with the many millions of additional wealth which has flowed into the country in the last few months, as the winter passes away avenues of employment will be opened up which will enable all the relief workers to be absorbed. Already there are indications in that direction. To give one specific instance: where one of my Engineers was authorized to place 120 relief workers on a fairly convenient work, only thirty-six men could be obtained.

Many genuine cases of hardship were met with and relieved by the employment offered by my Department and other Departments, notably the Forestry. My Department, however, must not be looked upon as a dumping-ground for unemployed. The large body of loyal and efficient workers who now follow public works as a permanent occupation must be protected from being flooded out at certain periods of the year when work at other callings is short. A policy of throwing open work on public works to all unemployed would be to the disadvantage of the State for the reason that it would mean a shortage of work for the regular Public Works employees, and build up in the minds of outside casual workers the idea that work in the Department would readily be available, and that there was little need to either hold down a job or make preparation for possible forced idleness.

One of the very extensive activities that has been thrown upon my Department during the year has been brought about by the passing of the Local Bodies' Loans Act. Under that Act it is necessary for the Board to obtain expert reports on almost all the projects for which local authorities wish to borrow money, and, while all Departments of State are at the disposal of the Loans Board for its purposes, the greater weight of the work falls naturally upon the Public Works Department, because the greater number of the loans of local bodies are for the construction of works. It is necessary, therefore, for my officers to investigate all local bodies' proposals, not only looking into the engineering soundness of the proposals technically, but also going into the question of probable life of the asset to be created and its necessity or otherwise for the community at large. Naturally, the sinking fund which it is necessary to set aside must be governed by the probable life of the asset, and not, as has been the case in the past, by the ideas of the local authority as to their ability to pay, or the willingness of the money-lender to wait for his money.

The Local Bodies' Loans Act was long overdue, and will probably in the future be looked upon as one of the most important Acts ever passed in this country. Most of us know of instances of loans that have been raised and spent on works that have never produced any beneficial result for the ratepayers. The provision of a sinking fund is the great feature; but this in some cases presses hardly on the backblocks, where the estimated life of the loan, coupled with the sinking-fund rate, prohibits the raising of a loan. It might be remarked that what may to-day appear a sound proposition as a metalling loan may in a few years, with the rapidly changing methods of and increased desire to travel, assume a very different aspect and become a burden rather than an asset.

From the point of view of the local authorities, one of the events of paramount importance was the passing of the Motor-spirits Taxation Act of last session, providing, as this new source of revenue did, a fund from which the construction and maintenance of the principal roads of the Dominion could be financed without further increasing the already severe load which the local authorities were carrying in the way of local rates.

The increase of motor-cars, and particularly of heavy motor-lorries, in New Zealand, with its resultant wear-and-tear on the roads, had made it evident that further income must be derived from some source other than the pockets of the ratepayers, and the decision of the Government that the user of the road should pay a larger proportion than had previously been contributed by him has, I am sure, met with universal satisfaction, even those who have to pay not maintaining that any unfairness exists.

In considering the question of road finance, it must not be forgotten that for many years before the motor-vehicle was taxed for the upkeep of the roads local authorities and the Government had been forced to spend large and constantly increasing sums for the upkeep of the roads. To such an extent did this apply that from 1917 to 1927 more was spent annually per motor-car than was received in the whole period, and, as I stated when the Motor-spirits Taxation Bill was before the House, something had to be done to give relief to rates. Naturally, this relief cannot be expected to manifest itself immediately. Quite a long period was necessary in which to examine into the comparative merits of various roads before they could be declared highways, and consequently the full benefit could not be realized this year; and, in any case, the revenue from the motor-spirits taxation only began to flow into the coffers of the Treasury at the beginning of 1928.

Since the highways system was inaugurated local authorities have been spending an undue proportion of their rates on the main highways, and as a result their less important roads—particularly those carrying in some cases little less traffic than the main highways—had fallen into a bad state of repair, and it will take some time for this leeway to be made up. I wish it to be clearly understood that the whole of the money derived from the motor-spirits taxation was not intended for further road-improvement, but a considerable proportion of it was intended for, and must be devoted to, the relief of the county ratepayers. That it will have this effect is quite clear if we consider the case of any road where, for instance, the annual cost of maintenance was £50 per annum. Prior to the recent declaration of additional highways, this £50 would all fall on the local authority; since declaration as a highway, only £20 would fall on the local authority, and relief to that extent or in that proportion must have a beneficial effect on rural districts.

Perhaps this would be an appropriate place for me to make a few general remarks on roads and road transport, which have become in recent years a most important factor in the life of the community. The number of motor-vehicles in New Zealand has risen at a phenomenal rate, so that there is now only one country in the world which per head of population has more motor-vehicles, this being the United States. Canada and New Zealand are practically on the same footing when vehicles are compared with population, but when we come to commercial motors in particular we find that Canada has only one to every ninety-eight of population, while New Zealand has one to sixty-two. No other country approaches New Zealand's ratio any closer, and highly industralized countries like Germany and Italy have only one to 700 and one to 794 respectively—in other words, less than one-tenth of New Zealand's proportion. The result of this exceptional number of commercial motor-vehicles is a very keen competition between the owners of same, resulting in extremely low freights—low from the point of

view of motor transport—being charged. Frequently the rate charged is unremunerative, and it is well known that on this account many owners have been forced to go out of business.

An analysis of all the figures obtainable not only in this country, but abroad, shows that the average price per ton for transport by motor-vehicles is very much more than the lowest prices which are charged by any considerable motor organization operating in New Zealand. The result of the cheap freights quoted in some cases has been to create an impression in the minds of the public that motor transport is more economical than railway transport. This, however, is an entire fallacy. A return of 3d. a ton-mile on the average on the goods hauled on the railways would enable them to make a handsome profit, but the average figures from over one thousand vehicles operating in New Zealand seem to show that 1s. 6d. a ton-mile is nearer their cost, and even in the most favourable cases, where long hauls with full loads are operated, it is in the region of 6d. per ton-mile or over.

When considering the economy or otherwise of motor transport, the individual consignor is very prone to look only at his freight bill, and to think only of the convenience of having the motor-vehicles calling at his door; but if he pauses to think of what motor transport viewed as a whole is costing New Zealand this would probably change his ideas. Last year the cost of upkeep of the roads of New Zealand approached the £3,000,000 mark, an enormous increase on what was necessary before the motor became a serious user of the roads. Towards this the motor-vehicle contributed less than £1,000,000, and when converted into cost per motor-vehicle per year, the maintenance expenditure amounts to £18, without making any allowance for the interest and fixed charges on capital expenditure, and the above average cost is obtained by regarding the motor-bicycles (numbering nearly thirty-four thousand) as motor-vehicles. If the latter were ignored, and only the motor-cars and commercial vehicles taken into account, the figure would be in the vicinity of £23. In 1914 the gross annual expenditure on roads, capital expenditure included, was just under two and a half millions; in 1927 it was considerably over five and a half millions. Viewed in another way, in the past eleven years there has been spent in maintaining the roads £255 per motor-vehicle, during which time there has been received £24 in taxation per motor-vehicle. The amount of money found in the way of rates by the rural portions of New Zealand has trebled since 1911.

When factors like the foregoing are taken in conjunction with the higher rate per ton-mile charged by the motor-vehicles it becomes a question for very serious inquiry as to whether we are not paying too high a price for the convenience of having the long-distance motor carrier calling at our doors. The total expenditure on motor transport is estimated to be nearly three times that spent on railway transport, being about eight and a half millions for railways and over twenty-nine millions for road transport.

Another matter which warrants very serious consideration from those utilizing commercial road transport where the State railways are available is that by depriving the railways of the high-class freight they leave the Railway Department in a position that it is unable to operate except at a loss, unless the rates on the cheaper and more bulky classes of goods, which provide the greater part of the tonnage to be hauled, are raised. As frequently the margin on which these goods are carried is so narrow that an increase even of a fraction of a penny per ton will divert or kill the traffic altogether, the inevitable result is a deficit on the operation of the railway system. This deficit must be made good by the general taxpayer, and thus many people, while congratulating themselves on obtaining a convenience and imagining even an economy by using road transport, are actually being involved in a loss; and even if no individual can show from his own books that he is suffering a loss, nevertheless the country as a whole is undoubtedly doing so. The motor-transport bill for every man, woman, and child in New Zealand is £20 per head per year.

It is not possible to ascertain definitely how many more tons of goods there are to haul about the line of communication of New Zealand than there were, say, in 1914, before which the motor was not a dominating factor, but if we take the tonnage of overseas vessels entered and cleared we find that between 1914 and 1927 there has been an increase of less than half a million tons.

It is well known that the shipping which trades here is not fully utilized. For instance, the tonnage of ships cleared in 1922 was 1,782,987, but the actual cargo outwards was only 701,560 tons. Similarly, for 1927 the tonnage of vessels cleared was 2,200,763, while the cargo was only 804,619. The contrast between the increase of exportable goods and the bill for motor transport is startling.

Between 1914 and 1927 over sixty millions of money was sent out of New Zealand for the purchase of motor-vehicles, tires, spares, and petrol. When to this sum is added the road expenditure during the same period, we arrive at the stupendous figure of £106,905,577. If the figures up to the 31st March of this year were available they would undoubtedly swell the previous total by well over twelve millions, and from this we see that there has been spent in providing for motor transport in New Zealand since 1914, when it may be fairly considered that the motor began to be an important factor of the life in the Dominion, in round figures the sum of £119,000,000. It should be noted that the immediately preceding figures are not the whole cost of motor transport, but only what is spent on the roads, plus what actually goes out of New Zealand for the purchase of motors and their fuel from overseas.

This is not the whole story either, because during the same period—from 1914 to 1927—the loan indebtedness of the harbour authorities of New Zealand increased by two and three-quarter millions, over one and a half millions of which was spent on the minor harbours, the goods from and to which could quite well have been carried on the railways. The fixed charges on this extra indebtedness and all the working-expenses connected with the new facilities are a still further charge on the increased tonnage referred to above.

It is estimated that all the goods and passengers carried by motor transport on routes where railways are available could have been carried on the railways with almost no additional expense, while the estimated revenue from this business—some £630,000 per annum—would have made the railways practically self-supporting. The significance of this fact from a community point of view cannot be overlooked. Looking at the matter broadly from the point of view of the country as a whole, it is undoubtedly uneconomical to transport goods by road which can be transported by railway, unless the circumstances are exceptional.

If the railways are placed in the position that as a result of their higher-tariffed goods being carried by another agency they are unable to be self-supporting, then, naturally, the Dominion cannot expect the overseas investors to supply loan-money for any further railway development, either in the way of extensions, improvement of present lines, electrification, or other works to increase and cheapen facilities.

There is no doubt that there is a legitimate field for the motor-vehicle, particularly the commercial motor-vehicle, but the foregoing facts are simply put forward to impress on the public that in this matter there is something more to be considered than just the price at which some lorry-owner will agree to carry goods from the warehouse to a customer up the country.

Increased expenditure on roads with the advent of mechanical traction was inevitable, but the roading bill, not only from a *maintenance* point of view but more especially from the point of view of *capital* expenditure, has been immensely increased by the necessity for providing for the relatively few heavy vehicles.

In connection with roading, I propose this year to provide the sum of £908,500, an increase of £60,250 on last year; while the Main Highways Board proposes a vote of £940,000 for construction, as against £675,000 last year, and £975,000 for maintenance, as against £725,000 last year.

The Main Highways Board, as in the past, has co-operated cordially with the local bodies, with which it has such intimate contact, and, conversely, has received loyal co-operation not only from the County Councils, with which it has always had to deal, but also with the Borough Councils, which now come into the scheme of highway administration. By its system of providing free advice to local authorities concerning the quality of the materials which go to the make-up of road-surfacing, it has, wherever the local bodies have been far-sighted enough to seek its co-operation, been able to ensure that their money is spent in the most economical manner. It is hoped that more local bodies will avail themselves of this service. The Main Highways Board, having access to the accounts and keeping a close watch on the methods used and results obtained by every local body of importance throughout New Zealand, is in a unique position to advise any local

authority or association of local authorities which desires to have the benefit of its knowledge. The far-reaching effect of the new finances provided by the Motor-spirits Taxation Act is just beginning to make itself felt, and during the coming paving season extensive works in high-class paving will be in progress around a great many of the main centres of population, and, in addition the County Councils and smaller boroughs will be able to improve their maintenance and at the same time lessen the actual expenditure from their own funds.

EXPENDITURE.

The total net expenditure under all votes and accounts appearing on the public-works estimates for the financial year ended 31st March, 1928, was £7,061,201. Of this sum £3,200,664 was expended out of General Purposes Account, and the balance, £3,860,537, 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, 1928.	Total Expenditure to 31st March, 1928.
	£	£
Railways—		
New construction	908,669	35,166,168
Additions to open lines	233,153	15,790,234
Payment to Midland Railway bondholders	..	150,000
Roads	705,805	16,966,026*
Public buildings	223,540	10,136,524
Immigration	67,157	3,184,565
Purchase of Native lands	..	2,061,148
Lighthouses, harbour-works, and harbour defences	23,870	1,249,214
Tourist and health resorts	36,673	460,766
Telegraph extension	625,540	9,291,948
Development of mining	..	881,845
Defence works (general)	39,986	1,280,916
Departmental	130,951	2,490,564
Irrigation and water-supply	49,735	781,282
Lands-improvement	72,898	426,607
Minor works and services	..	312,607
Plant, material, and stores	*Cr.* 1,288	348,219
Quarries (acquisition and operating)	*Cr.* 9,325	11,143
Timber-supply and sawmills for Public Works Department	*Cr.* 6,997	5,689
Motor-transport services	..	33,635
Cost and discount, raising loans, &c.	100,297	2,596,622
Total General Purposes Account	3,200,664†	103,625,722
Aid to Water-power Works and Electric Supply Account	1,389,341‡	7,235,205
Waihou and Ohinemuri Rivers Improvement Account	59,644‡	607,989
Total Public Works Fund	4,649,649	111,468,916
Wellington–Hutt Railway, &c.—		
Railway	..	228,374
Road	..	101,658
Railways Improvement Account	.	641,275
Railways Improvement Authorization Act, 1914 Account	1,488,739§	4,458,793
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	6,337	590,025
National Endowment Account	..	53,401
Education Loans Account	368,479§	3,371,426
Main Highways Account Construction Fund	547,997§	1,745,436
	7,061,201	123,563,338

* Includes £4,500 expended under section 16, subsection (1), Native Land Amendment and Native Claims Adjustment Act, 1923. † Does not include expenditure under the Ellesmere Land Drainage Act, 1905.
‡ Excludes interest during construction. § Includes proportionate cost of loan raised under these accounts.

WAYS AND MEANS.

	£
On the 1st April, 1927, the available ways and means for public-works purposes were	839,387
Additional funds were received as follows :—	
(*a*) Transferred from Consolidated Fund in terms of section 12 of the Appropriation Act, 1927	250,000
(*b*) Under Finance Act, 1926, section 2 (public works)	3,599,001
(*c*) Recoveries on account of expenditure of previous years ..	40,026
(*d*) Ellesmere and Forsyth Reclamation and Akaroa Railway Trust Account receipts	1,615
	£4,730,029

	£
The net expenditure on works and services against the General Purposes Account for the year was—	
(*a*) Under appropriations	3,300,369
(*b*) Under Lake Ellesmere Land Drainage Act, 1905 ..	439
(*c*) Under Lake Ellesmere and Akaroa Railway Trust Account	121
(*d*) Charges and expenses of raising loans	100,297
Making a total of	£3,401,226

	£
This left a credit balance in the account for general purposes at 31st March, 1928, of	1,328,803
Legislative authority exists for raising a further	5,561,050
It is proposed to ask for further legislative authority to borrow, when required	3,000,000
Thus making available for public works, general purposes, a total of ..	£9,889,853

	£
The estimated expenditure under the account for the current financial year, including the transfer of £200,000 to Main Highways Construction Fund, is	4,047,500

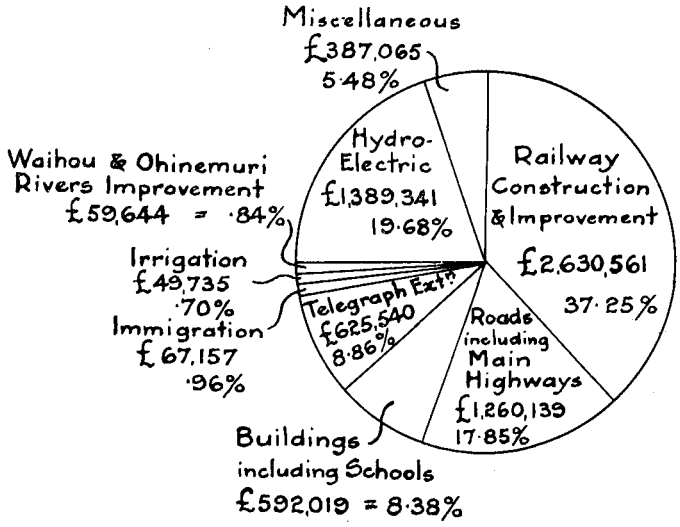
In addition to the requirements for general purposes, there are a number of special accounts for public works with separate ways and means. The most important of these are :—

Name of Account.	Balance available at 31st March, 1928.	Unexhausted Borrowing Authority at 31st March, 1928.	Additional Borrowing Authority to be sought during year.	Total available Ways and Means.
	£	£	£	£
Electric-supply Account	72,701	3,418,990	..	3,491,691
Waihou and Ohinemuri Rivers Improvement Account	12,078	90,000	..	102,078
Railways Improvement Authorization Act, 1914 Account	676,769	2,350,000	2,000,000	5,026,769
Main Highways Construction Fund	72,571	2,350,000	..	2,422,571
Totals for these special accounts ..	834,119	8,208,990	2,000,000	11,043,109

	£
From the foregoing figures it will be observed that at the end of last financial year the unexpended balance of the Public Works Fund for general purposes, plus existing and proposed authorities for raising further moneys, amounted to	9,889,853
While the balance at the same date in respect to some of the more important public works, under special accounts, plus existing and proposed legislative authority to raise additional loans, amounted to	11,043,109
Or a total of	£20,932,962

RATIO OF EXPENDITURE 1927–28.

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



RAILWAY-CONSTRUCTION.

The expenditure for the last financial year on new railway-construction, as given in the foregoing table, is an indication of the importance that is attached to the completion of the important trunk lines on which work is in hand. The amount of new work carried out during the past year is closely up to the volume for the previous year.

The most noteworthy achievement for the year is the practical completion of the East Coast Main Trunk Railway between Tahawai and Taneatua, and the connection thus of the Bay of Plenty district with the general railway system. Though a length of only 14 miles of this line was handed over to the Railway Department during last financial year, a full passenger and goods service co-ordinated with existing services on the opened line has been established to the end of the constructed line at Taneatua, a distance of 84 miles.

The total length on all lines under construction over which goods and passenger traffic has been run during the year is 161 miles, and these services have undoubtedly been of great service and benefit to the districts and settlers served.

The schedule attached gives a complete statement of the work on railways now in progress, and the extent to which it is anticipated the railways can be completed during the next two years, assuming that sufficient financial provision will be available. The work done 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 Island Lines.

North Auckland Main Trunk Railway.—On this railway, work is being continued on two widely-separated sections. On the Rangihua Section, between Okaihau and the upper waters of Hokianga Harbour, earthwork operations are being continued in particularly difficult country—difficult owing to the treacherous and unstable nature of the hillside on which the line has to be built. By the extensive use of mechanical plant these difficulties are being overcome, and progress for the year has been substantial.

On the Kirikopuni Section, 13½ miles in length, construction work was completed, and the line placed in order for handing over to the Railway Department. The works required to complete were very substantial in character. Cuttings that had slipped badly had to be cleaned up, bridges were completed, and at the several station-yards much building and other work was done. Traffic was run by the Public Works Department until May last, when the line was taken over by the Railway Department.

Dargaville Branch Railway.—The purpose of this branch railway is to give Dargaville and the Kaihu Valley, so far served by an isolated section of railway, a connection with the trunk system at Kirikopuni. Plant off the recently completed Kirikopuni Section of the North Auckland Main Trunk Railway has been moved forward on to the Tangowahine Section of the branch, and earthwork, culverting, and other construction work is in hand over a length of 7 miles.

Auckland-Westfield Deviation.—Substantial progress has again been made during the past year on this work. The earthwork, which has been particularly heavy, has progressed so far that it has been possible to lay a service track from Campbell's Point to Westfield, and this track will facilitate transport and the completion of the formation. The construction of the Auckland Waterfront Road by my Department on behalf of the Auckland City Council is being carried out in conjunction with the railway-deviation works, and these two works have fitted in well together, to the advantage of both.

The Purewa Tunnel, nearly 2,000 ft. in length, is now complete. In a double-track tunnel such as this the quantity of work is approximately three times the amount of work in a similar length standard single-track tunnel. The work was successfully carried through to programme.

The extensive bridge programme, including railway-bridges across openings in the embankments across the harbour, and many overhead road-bridges of substantial design, is well advanced, and the work done is of first-class standard.

East Coast Main Trunk Railway: Waihi Eastwards.—This important section of railway, as far as Taneatua (distant 59 miles from Tauranga), was complete by the end of June last, with the exception of some minor works between Tauranga and Taneatua.

Messrs. Sir W. G. Armstrong, Whitworth, and Co., completed their contract for the construction of 19 miles of the railway in March last. The work required under the contract, involving heavy railway-construction, was satisfactorily completed, and the section of railway was taken over by the Department at the end of the maintenance period without hitch.

The Department has carried out a substantial programme of works required to complete the balance of the railway between Tahawai and Taneatua, including formation, ballasting, completion of bridges, and station buildings, and at the same time maintained a suitable passenger and goods service. The big increase in goods traffic that took place as soon as through railway traffic was inaugurated affords ample indication of the importance of this railway connection to the whole of the Bay of Plenty district.

Gisborne–Napier Railway.—Work on this railway was, as last year, vigorously pushed on between Eskdale, the present terminus of the opened line, and Wairoa. A feature of the work at the southern end is the building of the Waikoau and Matahoura Viaducts. The former, of total length of 490 ft., with a main span of 250 ft., is complete, while at the latter the concrete piers and abutments are complete and the building of the scaffolding for the erection of the main span is in hand.

The associated works at the south end, including earthwork, platelaying, and ballasting, have been pushed energetically on, so as to afford facilities for the transport of steel to the viaduct-sites.

At the northern end, on the Wairoa Section, the Wairoa Bridge, 458 ft. in length, is in hand. A start has been made with the concrete-cylinder piers, and the steel trusses are now on site ready for erection on completion of piers. On this section a very important feature is the tunnelling programme. It is necessary to push on with the driving of these tunnels to give access to three important viaduct-sites, to which the steel, when fabricated, will have to be transported by rail. Work has been carried on in four of these tunnels, in which satisfactory progress has been made.

At the Waikare, Mohaka, and Maungaturanga Viaduct sites preliminary investigations and borings to test foundations have been made with the object of commencing foundation and pier work during the current year.

Stratford Main Trunk Railway.—On the eastern end a daily goods and passenger service has been maintained between Okahukura and Ohura, and this

has been of great service to the district. Construction work on this length, 19 miles long, is now practically complete. Earthwork on the following (Tokirima) section has made good progress, and tunnelling is in hand, the Mangatatawa Tunnel, $7\frac{3}{4}$ chains long, being complete, and a start made with bottom heading of the Mahorahora Tunnel.

On the western end of this railway most of the work has been concentrated on the Heao Section. No. 1 Tunnel, $30\frac{1}{2}$ chains long, was completed last March, and at No. 2 Tunnel, $54\frac{1}{2}$ chains long, a total length of 25 chains is complete. A substantial start has also been made at No. 3 Tunnel. Very good progress has also been made with the earthwork on the west end of this railway, and the work generally has been much facilitated, in what is really difficult country, by the provision of power-operated inclines over the rough ridges, and by the provision of electric energy derived from a steam electric-power station.

Palmerston North Railway Deviation.—This work, which had been started on a small scale in the preceding year, made good progress last year. The deviation, $6\frac{3}{4}$ miles long, involves heavy earthwork, for, though the country is very easy undulating in character, the areas required for passenger and goods yards are very extensive, involving heavy cut and fill. This earthwork is now one-fourth complete. The overbridge-construction necessary to carry road-crossings over the railway-deviation is on an elaborate scale, and of these bridges that on Milson's line, making provision for crossing eleven tracks, is complete.

Wellington – Tawa Flat Railway Deviation.—This railway, of total length of $7\frac{1}{2}$ miles, is being constructed for through traffic to avoid the very excessive and unfavourable grades on the existing line through Khandallah and Johnsonville. The maximum grades on the deviation will be 1 in 110 against traffic out of Wellington, and 1 in 100 against traffic into Wellington, compared with grades of 1 in 40 on the existing line. In addition, the new line will reduce the through distance by $2\frac{1}{2}$ miles, and will cut out a great deal of unfavourable curvature. The 1924 report of the Hon. the Minister for Railways on the programme of improvements and new works shows that this deviation would pay interest and show a profit immediately it is constructed.

The work of constructing the Tawa Flat Deviation was put in hand during the past year. Its most important feature is the $3\frac{1}{2}$ miles of double-track railway-tunnel required. Tenders were called for this work in New Zealand and abroad. The tenders received were unfavourable and much in excess of the Department's estimate, and it was thereon decided that the work would be carried out by the Department. Special tunnelling plant has been ordered, and most of it should be to hand by the end of October. In the meantime No. 1 Tunnel is being opened up by a bottom heading at each end, and enlargement and lining is proceeding at the south end, all under the co-operative system. At the No. 2 Tunnel, 2 miles 54 chains long, preliminary work is being pushed on with a view to commencing work underground.

Considerable bridge-work has been done, including the completion of piers for the Hutt Road Bridge, while the railway-bridge across the Ngahauranga Gorge is partially erected and in service.

South Island Lines.

Midland Railway.—Work on the Kawatiri–Murchison Section of the railway has been confined to the length of 5 miles between Kawatiri Station and the Gowan Station. Formation is nearly complete, and it is intended to at once proceed with the platelaying, ballasting, and completion of the Gowan Station buildings, with a view to handing this section over to the Working Railways.

Westport–Inangahua Railway.—On the Cascade–Hawk's Craig Section fair progress has been made with the advance work, including bushfelling and formation. Considerable accommodation for workmen has been provided in two camps on the main road, and access to the railway-works on the other side of the Buller River is being provided by the construction of a light suspension bridge.

Lawrence-Roxburgh Railway.—A certain amount of platelaying, ballasting, bridge-erection, and station-building erection had to be completed on the Miller's Flat – Roxburgh Section to complete this railway to its terminus at Roxburgh. This was successfully done, and after goods traffic was run by the Public Works Department for a few months the section was taken over by the Working Railways in April last.

RAILWAYS.

Additions to Open Lines.

The expenditure out of the Public Works Fund amounted to £233,153 1s. 7d., for the provision of additional rolling-stock, motor-vehicles for road services, improvements and additions to station buildings, extension of sidings, water-services, cranes, weighbridges, capstans, and turntables, train-control lines and instruments, additional dwellings, and purchase of land.

Railways Improvement Authorization Act, 1914.

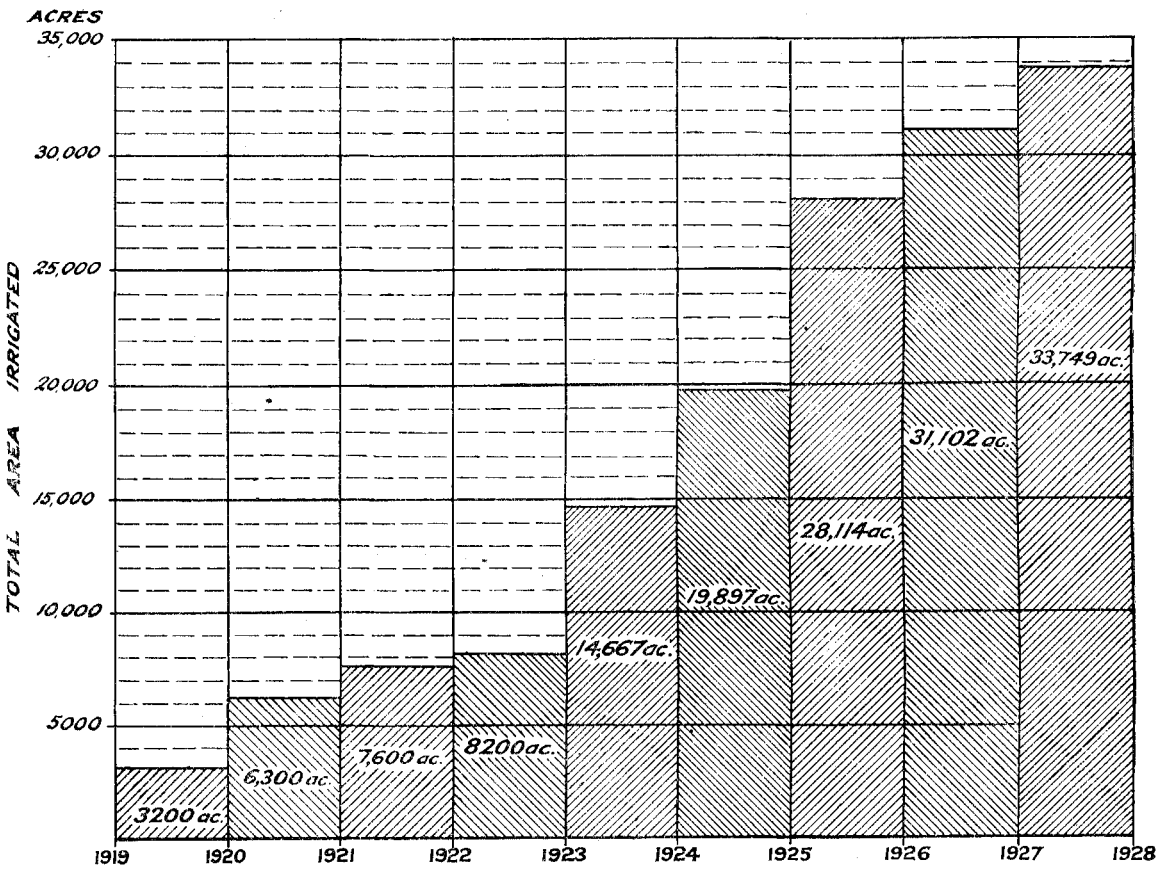
The expenditure under the Railways Improvement Authorization Act, 1914, amounted to £1,135,393, including the sum of £44,222, proportion of the cost of raising the loan. The works included in this expenditure were new stations and yards, goods-sheds, and terminal facilities at Auckland and Wellington; Addington-Middleton marshalling-yards; duplication, Penrose-Papakura; grade-easements Frankton Junction - Te Kuiti; new lines, Hutt Valley, Auckland-Westfield, and Auckland-Morningside; new locomotive-depot at Greymouth; deviations, Ravensbourne-Burke's, Pelichet Bay, Palmerston North, and Tawa Flat; workshops and locomotive workshops equipment; bridge-strengthening; electrification of railway between Lyttelton and Middleton; signalling, interlocking, telegraph and telephones, safety appliances, and electric-lighting.

IRRIGATION AND WATER-SUPPLY.

In respect to new works, activities have been confined to the pushing-on with the Hawkdun and Arrow schemes, and to the commencement of a small extension to the Teviot River scheme. On the Hawkdun scheme work has mainly consisted of race-construction, and it is anticipated that most of the area will be supplied with water during the coming season. On the Arrow scheme contracts have been let for the supply of pipes and fittings for the long pipe-line and extensive siphons required for the completion of the scheme. It is anticipated that water will be supplied to the district in the 1929-30 season.

The irrigation season just passed was a record dry one, and all streams and rivers were exceptionally low, and in respect to some of the schemes that have no water-storage the supply was for a while below requirements. However, taking the season as a whole, all irrigators were supplied with a full complement of water, and that fact, viewed in the light of the record dry season, is regarded as an indication that the basis of the design of these schemes is sound, in that the greatest possible use of the water available is being made. It, of course, would be possible to restrict the area to be irrigated under any scheme to such an extent that there would be a full supply available at all times in the record dry season. The disadvantage of this would be that in all other seasons there would be water flowing to waste that otherwise could be used to great advantage. The loss under this latter condition would many times outweigh any inconvenience under the former condition.

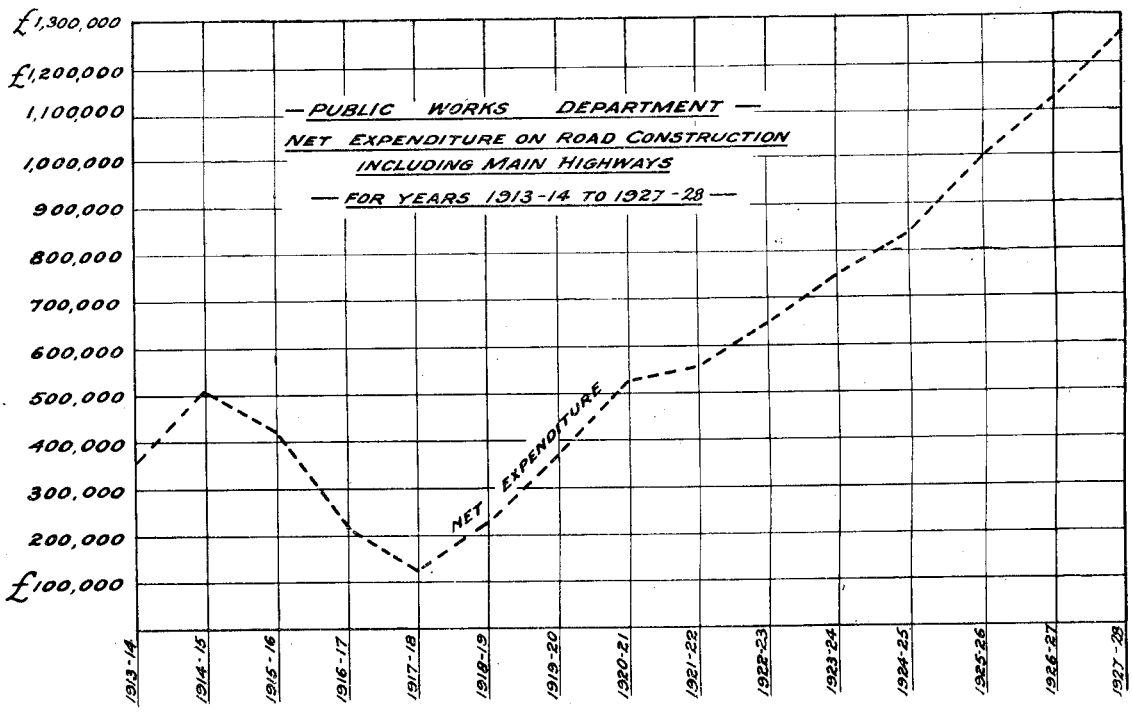
During the year the existing schemes were maintained in good order, and a supply of water given to all lands requiring it. The total area irrigated under all Government schemes was 32,949 acres, the number of irrigators being 288. The graph appearing below shows the growth of irrigation under the Government schemes during the past nine years.



During last irrigation season very strong representations were made to the Government as to certain features of irrigation administration, it being alleged that the supply of water provided by some of the irrigation agreements was insufficient for certain lands, and that there was urgent need for classifying irrigation lands. After an examination of the district by the Prime Minister and Ministers of Public Works and Lands, the Government decided to set up an investigating committee, under the chairmanship of the Assistant Engineer-in-Chief of the Public Works Department, to report to the Government. The order of reference of this committee included an examination into the questions of the duty of irrigation-water, of the question of the rates of payment therefor, and of the future administration of irrigation undertakings. This committee has now completed an exhaustive investigation and is preparing its report, and I have no doubt that when this comes before the Government for consideration it will be found that the report is a most valuable and constructive one.

ROAD-CONSTRUCTION.

The past year again saw very great progress made with the roading schemes whereby access is being provided for those settlers in the back districts, and also on the improvements, by way of widening and surfacing, to the many uncompleted roads. Each year the extension and improvement of the roads throughout the Dominion is assisting more settlers with the better working of their lands, and the record expenditure by the Government of £1,253,801 on roadworks, including main highways, during last year will show the great strides which are being made in this direction. The figure quoted, as was the case last year, shows a very considerable advance on the amount expended on roadworks during the preceding year.



Wherever possible, consideration in the way of improved access was given to the backblock settlers, and the setting-aside of a substantial sum under the new vote, "Roads to provide access to outlying districts," resulted in more attention being paid to those roads than would have been possible from the general allocation under the ordinary Roads vote. The extension of the Main South Road of Westland with a view to its ultimate connection with the general roading system of Otago is one of the works which I have particularly in mind in this connection. In my Statement last year I mentioned the fact that the new vote was being created, and the results obtained have, I think, amply justified the decision to earmark a specified amount for the purpose of opening up and improving the roads in the sparsely populated districts.

In addition to the road-construction which was undertaken by the various local bodies and the Department out of the usual funds provided from the Roads and Outlying Districts votes, a large number of new works in various parts of the country were put in hand for the purpose of giving relief to the unemployed. Many of these were completed, while others are approaching that stage, and a considerable number of roads the construction of which under ordinary circumstances would have had to remain over for possibly several years have in this way received attention.

It is the policy of the Government, where circumstances warrant such treatment, to assist the local bodies with the renewal of bridges, the state of the finance of the county, the nature of the materials used in the old structure, and the fact as to whether the Government or the local ratepayers bore the cost of the original bridge all being taken into consideration when arriving at the rate of assistance to be granted. In the course of the year under review several bridges, some of which were built of soft timber and had been in use for upwards of twenty years, were replaced by modern and more substantial structures. This replacement of old bridges has in some cases been the final work in the general improvement of a road.

The expenditure on the restoration of flood damages was approximately the same as the previous year, but a considerable portion of it was accounted for by the cost of completing works necessitated by floods which occurred just before the beginning of the financial year.

No very disastrous floods were experienced during the year, but the usual slips and washouts, with more extensive damage in some cases, had to be attended to, thus resulting in a fairly substantial expenditure of Government funds.

Regarding the maintenance of roads, this is generally acknowledged to be the responsibility of the local authorities, but in a few cases, where great lengths of main roads pass through little-settled portions of counties, and rates collected have been insufficient to provide for proper maintenance, it has been necessary for the State to assist.

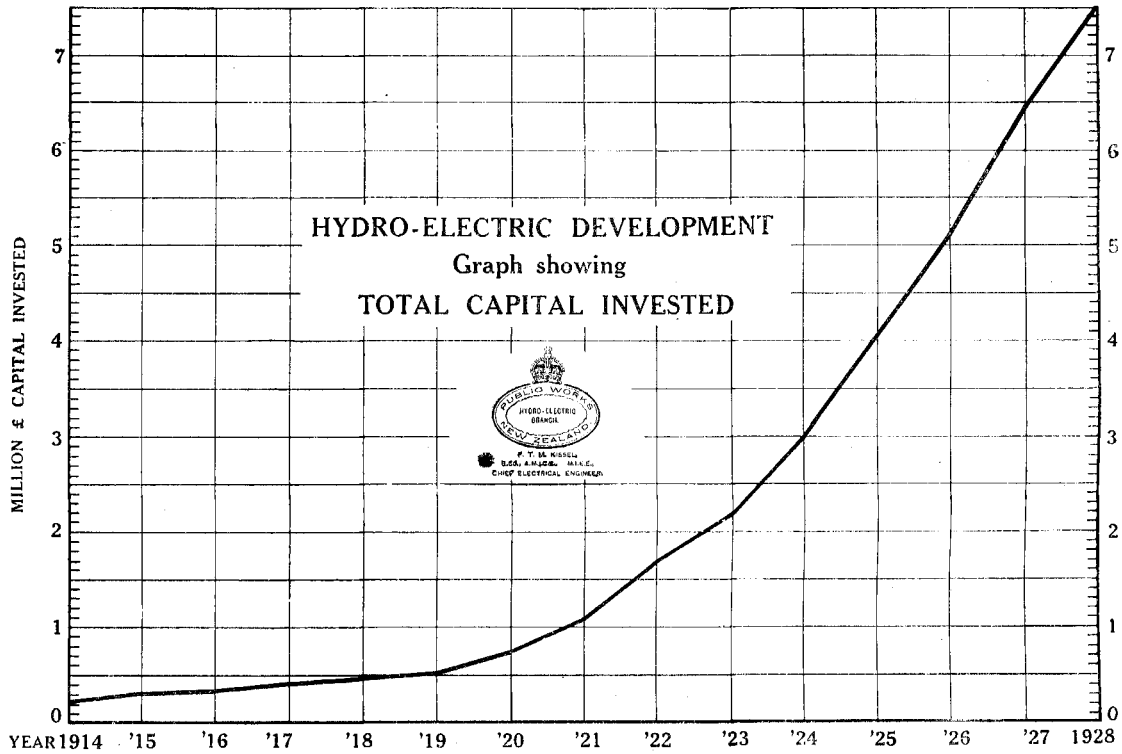
Every care is taken by the Department to ensure that such assistance is recommended only in cases where it is definitely proved that the finances of the controlling authority are inadequate, and where, in the event of maintenance being neglected, capital outlay by the State on the construction of the roads would be wasted. Although the funds available for the purpose last year were administered with the utmost care, the expenditure showed a considerable increase. This, however, is mainly the result of increased assistance having been granted for roads in the deteriorated-land areas, where lack of reasonable access would probably have resulted in properties being abandoned. In most of these cases the assistance was based on a pound-for-pound subsidy on the amount of rates actually expended by the local authority on the maintenance of the particular road.

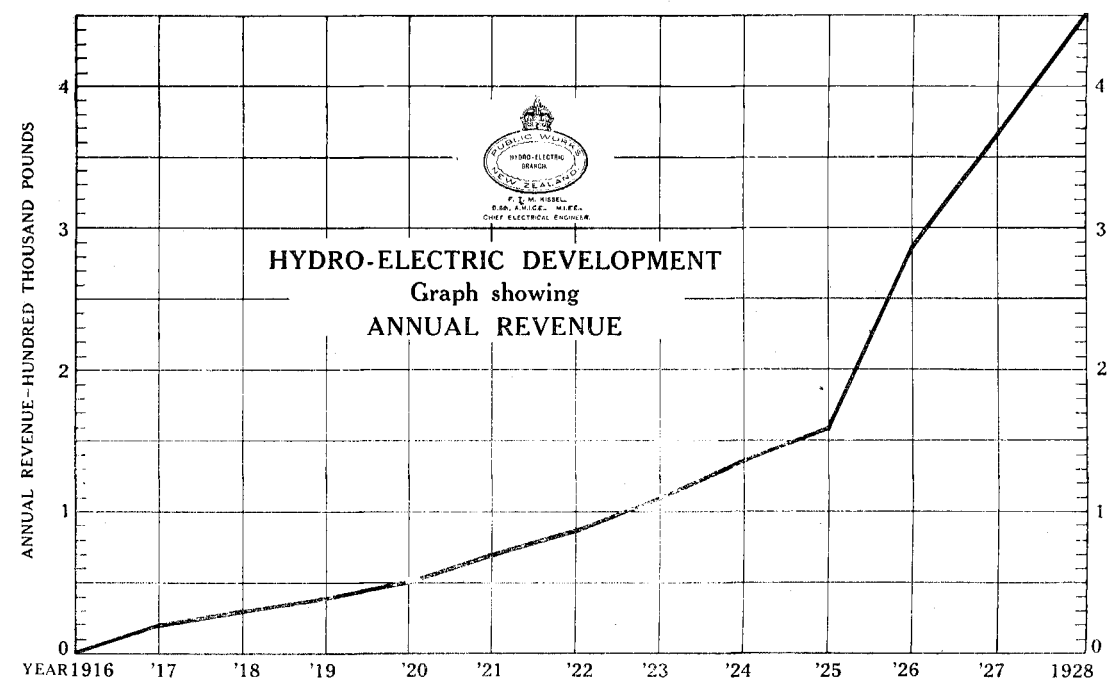
Representations have from time to time been made to the Government pressing for a reduction in the fees charged under the Heavy Traffic Regulations. The question is one which covers a wide economic field very far reaching in its effect, particularly on the finances of the local authorities which collect the fees and utilize them on road construction and maintenance, and while a great amount of thought has been given to the matter, the Government feels that before coming to a conclusion regarding the representations concerning the matter which have been made to it, further time is necessary before giving a final decision.

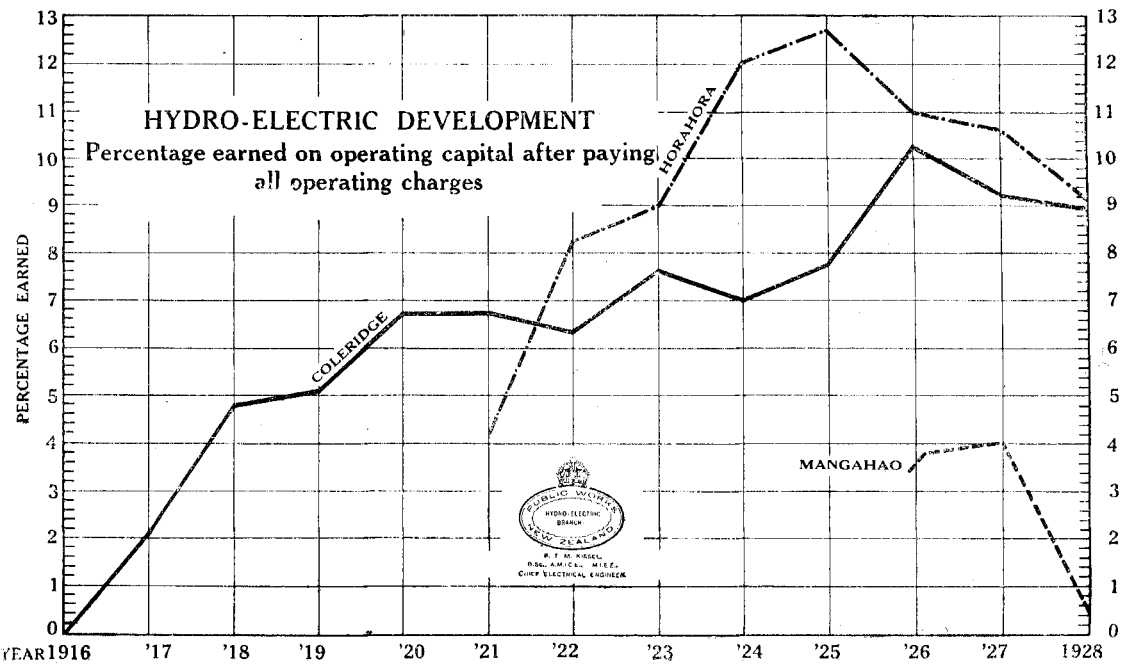
HYDRO-ELECTRIC DEVELOPMENT.

The year just completed, the seventeenth since construction works were first commenced by the Department, has been marked by continued activity throughout its period. The expenditure has been £1,095,993, increasing the total capital spent on hydro-electric works from £6,427,935 to £7,523,928. A considerable portion of this capital—about £3,000,000—is represented in works, mainly at Arapuni and Waikaremoana, which have not yet come into operation.

The year has been a particularly difficult one from an operating point of view, especially on account of the severe drought experienced in the Mangahao district, and on account of the operating difficulties at Horahora consequent on the diversion of the river into its new channel at Arapuni. Nevertheless, the annual revenue shows a substantial increase, being now £457,369, as against £364,412 last year, an increase of £92,957, or 25·5 per cent. Even though both Mangahao and Horahora plants were operating at their limit last year, the total load supplied by all schemes shows an increase from 50,150 kw. to 54,502 kw. during the year just completed. Mainly on account of the excessive amount of power that had to be purchased from outside stations on the Mangahao system, and due to the increased operating-costs at Horahora, the percentage return on the whole operating capital in hydro-electric development has decreased from 6·95 per cent. last year to 4·99 per cent. this year.


HYDRO-ELECTRIC DEVELOPMENT
Graph showing
TOTAL CAPITAL INVESTED
MILLION £ CAPITAL INVESTED
YEAR 1914 '15 '16 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26 '27 1928
0 1 2 3 4 5 6 7


HYDRO-ELECTRIC DEVELOPMENT
Graph showing
ANNUAL REVENUE
ANNUAL REVENUE—HUNDRED THOUSAND POUNDS
YEAR 1916 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26 '27 1928
0 1 2 3 4


HYDRO-ELECTRIC DEVELOPMENT
Percentage earned on operating capital after paying all operating charges
HORAHORA
COLERIDGE
MANGAHAO
PERCENTAGE EARNED
YEAR 1916 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26 '27 1928
0 1 2 3 4 5 6 7 8 9 10 11 12 13

Lake Coleridge.

The financial position of this scheme can be summarized as follows:—

	£
Capital investment	1,561,081
Revenue	171,127
Operating expenses	40,054
Balance	£131,073

This balance has been used in paying interest charges and a 2-per-cent. depreciation charge, leaving a profit on the year's working of £25,580. This has been paid into the Sinking Fund. The scheme now has a depreciation reserve of £173,231, and a sinking fund of £62,465.

There has not been a great deal of construction work in connection with this scheme during the year. Work at the power-station was confined to final adjustments to the two new units which were put into commission during the previous year. Alterations have been made to the Harper intake works and the outlet weir to ensure a minimum of interruption with the water-supply, which it is anticipated will be getting towards its limit during the next two years. To enable these works to be carried out, water from the Harper was cut off for several months during the summer, and consequently the low level during the winter has been considerably below normal. This, however, will be made up with the increased stream-flow which always occurs in the spring months of the year. A new substation is being built at Woolston to supply power for the Lyttelton–Christchurch Railway electrification.

The operation of the system has been free from any very serious interruptions, the only ones of any serious consequence being one of 15½ minutes' duration on the Christchurch lines, and one of 31 minutes on the South Canterbury lines.

Horahora.

The financial results of this plant may again be considered satisfactory, although the operating-cost has been considerably increased owing to trouble with sand, pumice, and vegetation coming down the river, following the diversion at Arapuni. There has also been considerable additional cost consequent on the increased extent to which the fuel-driven plants connected with the system had to be utilized to meet the increasing demand for power.

	£
Capital investment	973,173
Revenue	125,312
Operating expenses	46,568
Balance	£78,744

The balance has been used in paying interest and 2 per cent. depreciation, and has left a profit of £15,908 for the year's operation. This has been utilized in paying £9,732 to the Sinking Fund and £6,176 into a Reserve Fund. This scheme now has a depreciation reserve of £84,272, a sinking fund of £49,847, and a reserve of £53,845. The capital investment shown above includes £363,945 used on lines and substations forming part of the Arapuni scheme but at present operated from Horahora. Following the diversion of the river at the Arapuni power works, very considerable expense was necessitated at Horahora in keeping the screens sufficiently clean to maintain supply. The position is, however, gradually improving, and the station is now generating its normal full-load capacity.

The steam plant which was purchased from the Grand Junction Mining Co. last year has been operated during the year, and one of the units there which was out of commission when purchased has been repaired and put on load. In addition, power has been obtained under contract from the Tauranga Borough Council's plant at McLaren's Falls, and from the Tourist Department's plant at Okere.

The three Diesel-engine-driven generating-sets which were ordered towards the end of last year were erected and put into operation at Penrose in June of this year.

Construction work on various lines which, though ultimately forming part of the Arapuni scheme will be operated meanwhile from Horahora, was continued.

A 50,000-volt line from Rotorua to Opotiki, in the Bay of Plenty, was completed, and has gone into operation, with substations at Rangitaiki and Opotiki. In addition, a new 50,000-volt line is being built from Hamilton to Huntly, and new substations at Huntly, Matamata, and Kerepehi.

Waikaremoana.

This plant, of a total capacity of 2,000 horse-power, which was originally installed partly to supply power for construction purposes and partly to supply the Wairoa Power Board, was operated by that Board under lease until December, 1927, and since that date has been operated by the Department itself. The capital expenditure on all works has been increased from £185,703 to £613,893. Operating charges, including interest and depreciation on the plant in operation, amounted to £8,780. The revenue received has been £5,073, showing a loss of £3,707 on the years' operation. The accumulated loss on this plant now amounts to £18,757, against which there is an accumulated depreciation reserve of £8,925.

Construction of the main plant at Waikaremoana has been pushed on very energetically to endeavour to relieve the overload conditions at Mangahao. Contracts for supply from this main plant were made by which we were to give supply in June, 1929; but we confidently anticipate that power should be available somewhat before this date. There has been some delay with the delivery of plant from England, but good progress has been made with the headworks and pipe-line, and, should all material come to hand at the dates now promised, power should be available early in the new year.

The transmission-line from Waikaremoana to Napier, where it will connect with the Mangahao system, is almost completed, and another line from Waikaremoana to Gisborne will be finished before the end of the year.

Mangahao.

The past year at Mangahao has been a critical one owing to the severe drought which was experienced in all the western districts of New Zealand during last summer. The financial position can be summarized as follows:—

	£
Capital	2,373,921
Revenue	155,857
Operating expenses	145,659
Balance	£10,198

The balance has been sufficient to pay only 0·49 per cent. towards the interest charges for the year. The operating expenses are particularly heavy because of the purchase of power from other plants connected to the system, amounting to £111,745.

The Department was faced, when the drought commenced, with the problem of deciding whether it should endeavour to supply all the demands made on the plant, or whether it should restrict its bulk supply consumers to the actual amounts of power which they had guaranteed to take when contracts for supply were

originally made. It was decided that, although these amounts had been very considerably exceeded in practically all cases, it would be better to make every endeavour to supply the needs of the community, even at considerable expense, rather than curtail supply in an attempt to make a better appearance in this year's balance-sheet. The financial difficulties of the scheme during the past year are an index of the actual success of electric supply in the district, rather than an indication of any failure on its part, in that the excessive cost of operation was due very largely to the rapid rate at which the demand for power has grown.

The following table shows the actual demand of the various supply authorities during the year, as compared with the load equivalent of the amount they were prepared to guarantee for this year when the contracts were originally made :—

Power Board.	Originally-guaranteed Load. Kv.a.	Maximum Load for the Year. Kv.a.
Horowhenua	720	2,333
Wellington City Council ..	6,370	10,496
Hutt Valley	1,200	2,372
Manawatu-Oroua	1,100	2,093
Dannevirke	270	470
Tararua	400	468
Wairarapa	282	465
Wanganui	875	2,088
Central Hawke's Bay ..	240	476
Hawke's Bay	800	2,136

The difficulties were accentuated by the fact that the upper dam on the Mangahao, which was completed and available for storing water in January, 1928, could not be filled until after the drought had broken in April. Even with this additional storage, however, difficulties would have been experienced, as the plant has always been rated as being able to supply 1,600,000 units per week, whereas immediately before the drought and immediately after it the output has been between 2,000,000 and 2,400,000 units per week.

The main item of construction during the year has been the completion of the upper dam on the Mangahao River. In anticipation of supply being obtained at an early date from Waikaremoana, condensers and additional switch-gear are being installed in some of the main substations to secure better service. The operation of the plant has given very little trouble during the year, and the number of interruptions on the main transmission-line has been very considerably reduced as compared with the previous year.

Arapuni.

An expenditure of £801,932 has been made on this scheme, of which £483,821 represents payments to the contractors for the headworks and power-station, and the balance is mainly for various transmission-lines and substations which have been built by the Department to transmit and distribute the power to various supply authorities.

Fair progress was made with the construction of the main dam, which was completed towards the end of December. Water was finally turned over the new spillway on the 1st January of this year. The diversion of this water into the new channel caused considerable erosion in the Waitete Stream, and on the banks of the Waikato River between Arapuni and Horahora. Large quantities of sand, pumice, and debris of all kinds were carried down the river, and interfered considerably with the Horahora Power-station. The difficulty has been gradually decreasing.

As indicated in my Statement of last year, progress on the power-house section had not been altogether satisfactory for some time. After protracted negotiations with the contractors, it was decided to take over this section of the work from them, and to carry it on under the direction of the Department's own staff. An agreement was made with the contractors by which they were to be paid at schedule rates for the actual quantities of work done and material supplied, and where material was supplied and not actually erected they were to be paid at their schedule rates, less

their estimated erection costs. The contractors were allowed the benefit of the reduction they made on this section of the work when both sections were let to them at the commencement of the contract. Construction plant and material belonging to the contractors which was of use to the Department was taken over from them at a valuation. It is hoped that under this agreement the work will be completed by the Department at a cost not very much in excess of that contemplated in the original contract. Work was actually taken over at the end of December, 1927, and since that date the excavations for the power-house have been completed, the concrete foundations for the three units in the original installation completed, and the erection of one unit and the steel frame of the building is well in hand. There have been various statements that there were grave difficulties in connection with the construction at Arapuni, and that the Department was taking undue risks in proceeding with the power-house at the site originally selected. Up to date the work carried on has demonstrated quite clearly that the Department was quite right in insisting that the work should be carried out as originally planned, and that it was well advised in taking over the work from the contractors. If the Department had insisted on the contractors carrying on, there is no doubt that very serious delays would have occurred pending and during litigation, and also because the contractors' representatives indicated that for them to complete the work would have taken considerably longer than was estimated by the Department's own officers as being necessary.

It is to be regretted that delays have occurred in the completion of this power-station, which is so important to the industries of the Auckland District, and the Department is making every effort to have at least a section of it in operation at the earliest possible moment. I hope that by the time the next Public Works Statement is produced power from this important plant will be available in Auckland.

Apart from the main generating plant, the main transmission-lines to Auckland have been completed, and the main substation at Penrose is ready for receiving power as soon as available.

Waitaki.

I indicated in last year's Statement that the Waitaki River had been selected as the next source of power for supply to the South Island system. At that time the actual site was not definitely located, but as a result of surveys and investigations made during the year a site for the dam, about $3\frac{3}{4}$ miles above Kurow, has been selected and construction work has commenced. Tenders have been invited for the main items of plant, and every effort is being made to have power available from this source in three years from the present time.

LOCAL ELECTRIC-SUPPLY AUTHORITIES.

The Department controls only a portion of the electric-supply business of the country, but is more or less vitally interested in all the supply and distribution throughout the country. Many of the supply authorities purchase power in bulk from the Department for distribution and sale to the actual users. Over all supply authorities also, whether customers of the Department or not, a certain amount of control and general regulation has to be exercised. The Government itself now has an investment of £7,523,928 in its hydro-electric development, whilst local authorities drawing their supplies wholly or in part from the Government have an investment of £10,251,940, and other supply authorities who are generating their own power independent of Government supply an investment of £5,927,384.

Generally speaking, most of these supply authorities have been successful during the year, and, although possessed of rating-powers, these powers have been used only to a limited extent. Of the twenty-four Power Boards purchasing power from the Government only four collected rates during the past year, the total amount so collected being £8,333. Of the eleven Boards not using Government supply, three collected rates to a total value of £61,621 during the same period.

SURVEYS, ETC.

The surveys between Lakes Manapouri, Te Anau, and the Western Sounds, which have been going on for some time, were completed during the past summer. It will be remembered that a concession was granted to a syndicate to develop one of the large water-powers in this area for large chemical or metallurgical works. Representatives of this syndicate and of another one which is also desirous of developing works of this nature are at present in England with a view to interesting the necessary capital and manufacturing concerns in the proposals.

RAILWAY ELECTRIFICATION.

Work on the electrification of the Christchurch railway has been proceeding on the lines indicated in my last year's Statement. The main substation at Woolston and the line to supply that point are being constructed by the Public Works Department.

The Chief Electrical Engineer of the Public Works Department has also been associated with the Railway Department as chairman of a committee of railway experts to advise on a complete scheme of electrification of various sections of the railway system radiating from Wellington, and also in connection with the electrical equipment of the various railway workshops.

MAIN HIGHWAYS.

In my last report I pointed to the fact that additional revenue should be made available to the Main Highways Board for four main reasons: Firstly, to enable an additional mileage of roads to be declared main highways, primarily for the purpose of giving relief to County Councils in the matter of maintenance; secondly, to enable the Board to continue to pay substantially towards the cost of maintenance of the original highway system, notwithstanding the increased mileage of highways referred to above; thirdly, to assist in a much greater proportion than heretofore in the paving of roads in the vicinity of the large centres of population; and, fourthly, to help boroughs, more particularly the smaller ones, in the construction and upkeep of the main highways.

To provide money for the foregoing, a petrol-tax of 4d. per gallon was approved by the House during the session of 1927, and as a result of this County Councils are now being relieved to a much greater extent of the heavy charges involved in maintaining the roads up to the standard necessitated by the continuous and heavy motor traffic. In addition, the construction programme of the Board is being greatly accelerated, and, fortunately, I am able to say that although the expenditure on construction will be considerably increased it is not necessary, at least in the meantime, to extend the borrowing-powers conferred on the Minister of Finance by the Main Highways Act, 1922.

Since the close of the last financial year the Board has recommended that the general maintenance subsidy, which is at present £1 10s. for £1, be increased to £2 for £1, and legislation will be introduced for the consideration of the House giving effect to the Board's recommendation. The power vested in the Board enabling it in special cases to pay more than the usual rate of subsidy has been exercised in a number of cases during the year under review, and I hope that the Board will give special consideration to those cases where local rating is proving a hardship on the ratepayers.

The Board, recognizing that bridge finance, more particularly in the case of large bridges, often presents difficulties to local authorities, has since 1926 been subsidizing the cost of erection of bridges on a scale ranging from £1 for £1 to £2 for £1, according to the cost of the work. The Board has now suggested that bridges costing up to £10,000 be subsidized on the basis of £2 for £1, and that it (the Board) be given authority to pay such subsidy as it in its discretion thinks justified in the cases of bridges costing more than this figure. The Board in fixing the rate of subsidy will require to go thoroughly into special traffic features and the ability of the ratepayers to find their proportion of the cost. The House will be asked to consider legislation to give effect to this proposal also.

PUBLIC BUILDINGS.

Additions have been made to Departmental Buildings at Wellington, Auckland, and Napier, and at the Government Printing Office. New departmental buildings were acquired at Wanganui.

Courthouses.

In Wellington a new Arbitration Court has been erected. The building is of two stories, in brick and concrete. This is the only new building erected during the year, but repairs and renovations have been carried out to a large number of Courthouses.

Prison Buildings and Works.

The general policy of utilizing prison labour on capital works, including prison buildings, road-construction, and farm development, has been pursued with satisfactory results during the year. Last year the monetary provision for farm development at Hautu and Rangipo was transferred from the Public Works Fund to the Prisons vote, but there has been no curtailment of activities in this connection, and splendid results have been achieved in bringing these waste lands into productivity.

Among the principal works in which prison labour was used was the conversion of the crushers at the prison quarry at Mount Eden. An up-to-date plant has now been installed, enabling the Department to produce graded metal products suitable to modern-day roading requirements. A quarry-workshop has been constructed and equipped, which enables repairs to be done on the spot economically and with a minimum of delay, and at the same time providing facilities for training prisoners in this line of work. A baker's oven was also installed at Mount Eden. This provides another avenue of employment, besides enabling cheaper bread to be supplied to the institution.

At the Waikeria Borstal Institution an additional dairy was constructed, making a third on the farm. This is in pursuance of the extensive farming programme for the training of Borstal lads detained at this institution.

Splendid work has been done in road-construction in the Waimarino area. In addition to considerable maintenance-work, prisoners have been engaged in the formation of portion of the Taumarunui–Ohakune section of the main highway.

Good progress has been maintained in the building programme at the Wellington, Paparua, and Invercargill institutions. At the Invercargill Borstal Institution a building for the conducting of a wool-classing school was erected by the inmates. At Addington a well-equipped laundry was constructed, enabling women prisoners to undertake laundry-work for several State Departments. Fifty hutments were constructed from surplus timber from the Department's mill stocks for the housing of prisoners at the roadwork camps and at the prisons farms.

Police-stations.

The expenditure on police-stations amounted to £5,589. A new station was erected at Tokanui, and the station at Phillipstown (Christchurch) was completed. The old post-office dwelling at Paeroa was converted into a constable's residence, and an office and lock-up were built at Ongaonga. A residence was purchased for the Inspector at Invercargill, and additional land for police purposes was acquired at Lumsden.

Post and Telegraph Buildings.

The progress of the Dominion is indicated by the necessity for providing at many places additional accommodation for the conduct of post and telegraph business. During the year practically all of the Department's buildings were inspected, and arrangements were made for additions and alterations to be carried out to many of the structures. There is, however, a considerable number of places at which the need for additional accommodation is pressing, but, owing to the expenditure involved, these requirements can be dealt with only in their order of urgency.

Preliminary work has been commenced in connection with the erection of new chief post-office buildings at Dunedin and Napier; also, it is intended to proceed as soon as possible with the erection of new buildings at Courtenay Place (Wellington), High Street (Christchurch), and Taumarunui, and with extensive additions to the existing buildings at Greymouth, Masterton, Nelson, and Waipukurau.

The growth of the Department's motor transport continually demands the provision of suitable facilities for the storage of petrol. The modern method of providing storage in a tank placed underground and delivering by means of a pump has been adopted at a number of places.

During the year new post-offices were erected at Castlecliff, Leigh, Portobello, Te Mata, Uruti, Waimiha, Waiuta, and Miramar (automatic telephone exchange); residences for Postmasters at Porangahau, Te Karaka, and Waiuku; workshop-store-garage buildings at Frankton Junction and Timaru; and garages at Clyde, Foxton, Newmarket, Pukekohe, Putaruru (purchased), Ruawai, Tolaga Bay, and Warkworth.

Increased accommodation was also provided at Courtenay Place (automatic telephone exchange), Frankton Junction Railway, Hastings, Levin, Lower Hutt, Palmerston North, Putaruru, Richmond, Wellesley Street, and the erection of a new post-office building at Waverley is under construction.

The following additions and alterations have been authorized: Cromwell (addition and alterations); Gore (addition); Hawera (addition); Matamata (alterations); Milton (alterations); Mokauiti (addition); Papakura (alterations); Pembroke (addition and alterations); Radio-Wellington (addition); Te Teko (addition); Waipukurau (addition and alterations); Walton (addition and alterations).

Sites for storage purposes were purchased at Blenheim and Napier; the area of the post-office site at Carterton has been increased by the acquisition of additional land; and at Palmerston North an area of land adjoining the post-office site was taken over from the Department of Agriculture.

Mental Hospitals.

Avondale: Alterations have been carried out to the kitchen, men's lavatories, and Nurses' Home; and, in the main building, necessary alterations have been made to provide quarters for the Matron. A new veranda has been completed for No. 8 Ward, and various repairs and renovations carried out as required.

Puhitahi (Men's Quarters): The erection of a dormitory, dining-hall, kitchen, bathroom, and lavatories was completed during the year. All buildings are of wood on concrete foundations. Electric light has been laid on to the new site and installed in the various buildings. A windmill has been provided and tanks erected for a temporary supply of water pending the bringing in of a gravitation scheme, the headworks of which are now being proceeded with.

Tokanui: A contract was let for the erection of three villas for female patients, and the work is in hand. A mortuary building, in concrete blocks, has been completed. A 14 ft. road, 18 chains in length, has been formed and metalled, to give access to the projected buildings. A 20 ft. bridge has been constructed, and general maintenance-works carried out as required.

Porirua: A new Nurses' Home, a two-storied brick building containing over one hundred rooms, is being erected by contract, the roof now being on. A new six-roomed residence, in wood, for the Assistant Medical Officer has been erected by contract, and road, &c., formed. The whole of the buildings have been rewired for the 230 voltage, and extensive repairs, renovations, and additions carried out. The water-supply has been augmented by the installation of new mains, pressure-reducing tank, and by the raising of height of the dams.

Nelson and Stoke: General maintenance-work has been carried out.

Sunnyside: Alterations are being made to the boiler-house and a new chimney being erected. General maintenance-work was carried out as required.

Hornby: A residence has been erected for the Assistant Medical Officer.

Templeton: The new villa unit, commenced the previous year, has been completed, and an addition made to the day-room. A water-tank to supply this building is in course of erection.

Seacliff: A large and important work, comprising a new kitchen, laundry, and stores block, is in hand, and good progress is being made. Modern equipment for both kitchen, laundry, and store is being installed, and will greatly facilitate the working of the institution. Additions have been made to the Nurses' Home, and a residence erected for the Assistant Medical Officer.

Hospital Institutions.

The following works were carried out to institutions administered by this Department:—

St. Helen's, Auckland: Hot-water service renewed.

Queen Mary Hospital, Hanmer: The old electric power-house was dismantled and re-erected elsewhere as storerooms. A new boiler-house and coal-dump are nearing completion, and the machinery, &c., is being assembled. A start was made with the new Nurses' Home, a two-story building, to accommodate upwards of sixty nurses. The stables were removed and re-erected on a new site.

Extensive maintenance works, repairs, and renovations were carried out to various institutions as required.

Agricultural Buildings.

The amount expended last year was £2,863, a sum considerably less than usual. The principal works carried out were a new residence for the Manager at Ruakura Farm, further work on the plant and machinery at the Green Island (Dunedin) poison-mixing depot, and additional buildings at the experimental farms at Galloway (Otago), Puwera (Auckland), and Waimaunga (West Coast), and at the poultry-station at Wallaceville.

Education.

Considerable progress was made during the year in providing for increase of school population and the continual movement manifested between district and district. The Department is still pursuing its policy of replacing rented accommodation by permanent buildings, with the result that the allocation for rent is steadily decreasing. Further, the policy of making special provision for small country districts has been continued.

Among the larger primary schools completed during the year may be mentioned Turu Turu Road, near Hawera, and Linwood Avenue Fresh-air School, Christchurch. The Terrace End School, Palmerston North, has been partially rebuilt; also the Kakaramea School, Wanganui district. Secondary departments were provided at Foxton, Ohakune, and Te Aroha. The Rongotai Boys' College, Wellington, and the Marlborough Junior High School were completed. A hostel for the Girls' High School at New Plymouth was also erected.

Some of the more important of additions to existing schools were Point Chevalier and the new Normal School, Auckland City; New Brighton, Christchurch; Timaru Boys' High School; Hutt Valley High School; and Waitaki High School. The Memorial Hall at Wellington College, towards which a substantial grant was provided by the Old Boys' Association, was also completed.

A heavy building programme is at present being undertaken, including the Massey Agricultural College, Palmerston North; a new infant department and remodelling of the main building at Hawera; additions to Wanganui East; a new school at Fry's Lane, Hutt Valley; additions to Somerfield, Christchurch; remodelling of Tokomairiro, Otago; rebuilding of infant department, Rangiora, Canterbury; new workshops at the Auckland Technical School; and additions to Hamilton and Palmerston North Technical Schools.

The Department is giving careful consideration to the open-air type of school —*i.e.*, a building one side of which can practically be thrown open if weather conditions are suitable. Arrangements have been made to note from time to time the effect of this type of school on the health of the pupils as against the Department's normal type of fresh-air building.

The greater part of the secondary- and technical-school building work was carried out by the Architectural Branch of the Public Works Department.

The following table shows for the year ended 31st March, 1927, the amount expended by the Department on new buildings, additions, sites, and teachers' residences :—

	£
Primary schools	190,940
Secondary schools	93,878
Technical schools	30,060
Training colleges	6,349
Universities	23,208
Native schools	11,430
Special schools	3,510
Free kindergartens	Nil
Massey Agricultural College	9,104
Total	£368,479

LIGHTHOUSES.

The policy of gradually improving the lighting of the coast-line and adding to the efficiency of the existing lights has been steadily pursued during the past year.

A new automatic light of considerable power has been installed at Kaikoura to give an additional aid between Cape Campbell and Godley Head, and to mark the Kaikoura Peninsula and adjoining foul ground.

A smaller light was erected at Sail Point in Kaipara Harbour, and the beacon at the mouth of the Piako River was completed.

The apparatus has been procured and a start made with the erection of a powerful automatic light at the North Cape. The preliminary excavation has been completed, and it is anticipated that the light will be in operation very shortly.

The apparatus for the conversion of Manakau South Head to automatic operation has been received, and will be installed as soon as the North Cape is completed.

Provision has been made for the erection of a new powerful revolving light for Cape Egmont and a flashing light for Kahu Rock during the ensuing year, and orders have been placed for the necessary outfit.

It has also been decided to erect an automatic light on the West Head at the entrance to Tory Channel, and to replace the existing oil-burning leading-lights by range light of a more modern pattern.

At Dog Island two new and up-to-date cottages have been erected for the keepers, and the buildings, &c., at other stations have been well maintained.

A new diaphone fog-signal has been erected at Godley Head with satisfactory results.

HARBOURS.

At Westport considerable expenditure has been involved in the protection and conservation works between the Buller River Railway Bridge and the overflow above Organ's Island. The quarry has been fully manned during the year. Extensive service lines and bridging have been carried out, and a large quantity of heavy stone

transported to the work. Two dredges have been in operation most of the year on the entrance and in the harbour, and arrangements have been made to put the "Ruby Seddon" into commission, and thus enlarge the scope of dredging on the bar as much as possible.

At Karamea the work of reconstructing in stone the existing training-wall is being steadily pushed ahead. The opening-up of the quarry and the laying of the railway from the quarry to the wall is practically completed. The necessary cranes, compressors, air-drills, &c., are being installed in the quarry, and the locomotive and trucks are on the ground. This coming year should see a large quantity of stone deposited.

Additions were made to the Waikokopu Wharf, and a 30-ton crane built to handle the heavy machinery for the Waikaremoana hydro-electric work. A contract has been let for the construction of a stone breakwater, which will improve very considerably the conditions at this port.

A new reinforced-concrete wharf is being constructed at Whangaroa, and also additions to the existing wharf at Half-moon Bay. In addition, several small wharves have been built at minor ports.

TOURIST AND HEALTH RESORTS.

The expenditure for the year was £36,673, as against £31,981 for the previous year. The main works carried out were additions to the Waitomo Caves Hostel; improvements to the water-supply at the Hermitage, Mount Cook; extensions to the Rotorua electrical, water, and drainage systems; erection of a slipway at Lake Te Anau; and the formation of the road to Lake House, Waikaremoana. During the year a contract was let for the erection of an up-to-date hostel at Milford Sound.

TELEGRAPH EXTENSION.

It is the general policy of the Government to provide a telephone service which will enable any one, anywhere, to pick up a telephone and talk to any one anywhere else in the Dominion. During the past year a further step towards this goal has been achieved by the installation of modern telephone-repeaters at Wellington and Seddon, and the completion of a new telephone toll circuit between Seddon and Christchurch. When used in conjunction with the new telephone-cable across Cook Strait, these additional facilities not only provide an efficient means of communication between Wellington and Christchurch, but permit telephone communication between such widely divergent places as Auckland and Dunedin, Auckland and Christchurch, Hamilton and Dunedin, Wellington and Dunedin, Christchurch and Gisborne, Wanganui and Greymouth, Dunedin and Rotorua, Dunedin and New Plymouth, Dunedin and Napier, as well as between a great number of the intervening exchanges. In order to extend further the range of intercommunication between exchanges and at the same time to increase the traffic-carrying capacity of the existing circuits, it is proposed to introduce in the near future one of the most interesting developments of modern telephone and telegraph practice, which is known as "carrier current" telephony. By the application of carrier-current principles to a circuit as many as three telephone-channels or ten telegraph-channels may be provided without increasing the actual wire plant. As the carrier-current system possesses great flexibility and has a wide range of application to a variety of differing conditions, it is especially suitable for New Zealand.

The speed of toll service and the traffic-carrying capacity of the existing circuits to certain automatic exchanges have been increased by the installation at certain automatic exchanges of apparatus enabling toll operators at distant exchanges to call subscribers at the automatic exchanges without the assistance of toll operators at the automatic exchanges. Another proposal for improving the toll service and for meeting the steady increase in toll business is the adoption of a method enabling subscribers making toll calls to be placed in direct communication with the toll-line

operator. Thus in many cases subscribers will have their calls completed immediately without the necessity of hanging up the receiver. The convenience of being able to place calls direct with the toll-line operator and the increased speed which should result will, it is anticipated, have a stimulating effect on the use of the toll service generally. The new method will be tried at a number of exchanges as soon as the necessary changes in equipment can be effected.

The policy of introducing modern types of exchange switching equipment is being proceeded with as it becomes necessary to replace existing systems. Action will be taken shortly to provide certain new exchanges in replacement of those which are now becoming obsolete and which are incapable of further extension. In this connection the needs of the rural communities as well as of the cities are being carefully studied in order that the telephone requirements of the different sections of the community shall be fully met.

In consequence of various extensions to the exchange systems in the matter of switching facilities and cable accommodation, the waiting-list of prospective telephone subscribers has practically disappeared, and considerable progress has been made in reducing the interval between the time of acceptance of an application and the time of providing service. The number of new subscribers connected during the year was 12,159, a total that has been exceeded on but two previous occasions.

An important development in radio-telephone operations was the inception on the 30th August, 1927, of commercial short-wave signalling between the Dominion and Samoa. This new service, for which Wellington and Apia are the present terminal stations, has effected several marked improvements over the previous service. Consideration is now being given to the inclusion in the scheme of other Pacific islands in which New Zealand is interested both commercially and politically. The work, when completed, should ensure a quick and reliable means of communication with the islands.

Of the works upon which capital expenditure was incurred during the year the following were the more important: The erection of new metallic circuits between Wellington and Seddon, Wellington and Palmerston North, Wanganui and Hawera, New Plymouth and Hawera, Marton and Taihape, Kaikohe and Rawene, Murchison and Inangahua, Lumsden and Kingston, Balclutha and Owaka; the improvement and extension generally of toll facilities; the installation of short-wave apparatus at Radio-Wellington; the conversion to automatic working of the magneto exchanges at Dunedin, Napier, Dannevirke, and Stratford; the opening of a new automatic branch exchange at Miramar; the installation of a multiple lamp-signalling switchboard at Greymouth; the opening of new magneto exchanges at Katikati, Leigh, Paihia, and Te Mata; the installation of 113 new public call offices (coin-in-the-slot telephones); the extension of the switching equipment at five automatic exchanges and twenty-eight manual exchanges; the erection of 2,513 miles of toll and telegraph wire, and 8,305 miles of aerial wire for telephone-exchange subscribers' circuits; the laying or erecting of 169 miles of lead-covered cable, containing 39,991 miles of wire, for subscribers' circuits; and the connection of 12,159 new subscribers' stations. In addition, 1,916 new extension telephones were installed; while 8,093 telephones were installed in new locations on account of subscribers' removals. The total number of telephone stations in the Dominion at the 31st March, 1928, was 144,552. This represents approximately ten telephones for every 100 of population, a density exceeded only by the United States of America and Canada.

RIVER-IMPROVEMENT AND LAND-PROTECTION WORKS.

Under this head work has been continued on three schemes of river-improvement and land-protection. Brief particulars of work done during the year are as follows:—

Wairoa River: The work of protecting the foreshore alongside the Tokatoka stop-banks by the laying of a rock-spall carpet was continued, 32,000 cubic yards of spalls being spread during the year.

Waihou and Ohinemuri Rivers: Important progress on the Lower Waihou River was made with the works of stop-bank construction, clearing of the river-banks, and of improving the river itself by dredging, a complete and efficient mechanical plant being utilized on the work. A fine bridge over the Ohinemuri River at Paeroa has been completed in concrete and steel. Construction work on this scheme is drawing to a conclusion.

Taieri River: The greater part of the stop-bank system on this scheme for protection of the Taieri Plain against floods is now complete, and good progress has also been made with the construction of the pumping-station, the function of this latter being to dewater the plain, if subjected to flooding, and to provide for getting rid of ordinary drainage-water. It is anticipated that in a few months time the main stop-bank and the pumping-station will be complete, leaving only some minor works to complete the scheme.

DEFENCE WORKS.

Training Establishments.

Very satisfactory progress has been made with the development of the mobilization base and training-camp at Waikato Camp, Ngaruawahia. The large Ordnance Store building, Ordnance Office, oil-store, vehicle-shed, loading-bank, forage-store, two high-explosive magazines, two married quarters, extensions to railway-siding, permanent latrines, and septic tanks have been completed and are in use. The S.A.A. magazine is in course of erection. Drainage, roading, and noxious weeds have received attention, and the camp generally maintained. The erection of drying-room, shower-baths, three high-explosive magazines, and laboratory, which are now in hand, together with provision of up-to-date fire-fighting facilities and hutment for hospital, will complete this camp.

Trentham and Burnham Camps have been maintained, and a hut for camp equipment erected at the latter.

New drill-halls at Hamilton and Ponsonby have been erected and are in use.

Numerous additions and improvements to drill-halls, offices, and storerooms throughout the Dominion have been made, and the buildings generally maintained.

The development of Hobsonville Aerodrome for land-planes and sea-planes is now in hand. The engineering survey has been completed, and the plans and estimates for the various works are receiving attention.

This major work, together with the completion of Waikato Camp, prevents much progress being made with the additional drill-hall accommodation required in various localities. A new drill-hall at Petone to serve the populous Hutt Valley is the only work in this category which it is proposed to complete during the present financial year.

MOTOR-VEHICLE LAW.

The most important developments in the law affecting motor-vehicles since the last Statement are (1) the imposition of a Customs duty of 4d. per gallon on motor-spirits, and (2) the issue of the Motor-vehicle Regulations.

The administration of these measures is proceeding smoothly, although the work involved in the system of refunds of the duty on motor-spirits is, as anticipated, fairly considerable. Certain anomalies in connection with the refunds have been discovered, as was almost inevitable, and it is proposed to bring forward amendments to the law during the present session with a view to rectification in certain cases.

The steps taken by the local bodies and the police to enforce the Motor-vehicle Regulations have so far not been very active, but now that motorists have had time to become conversant with the requirements more stringent enforcement may be anticipated shortly.

The report of the Commission set up to investigate the transport position in the Auckland district has now been received by the Government. Although the problems placed before the Commission were, in general, local, it is noteworthy

that the Commissioners agree with the policy of the Motor-omnibus Traffic Act, 1926, and find the majority of its provisions, and the provisions of the regulations issued under it, reasonable and satisfactory. The Government is giving consideration to the suggestions made by the Commission for amendments to this law, and also to the question of bringing forward other amendments which experience has shown might be desirable.

PLANT AND MECHANICAL.

If the order of reference under the heading "Plant and Mechanical" were to be in keeping with the relative importance of the wide variety of work undertaken by the mechanical staff, first place would be given to plant-maintenance in its many phases. However capable an operator may be in the control of an efficient machine, that machine frequently controls the entire local situation—it has, in fact, complete "job control"—hence requests from the field for renewable parts or for the repair of some worn or over-strained part belonging to a hard-worked plant article are immediately dealt with, and are given preference over current general business.

During the year certain districts have benefited by the appointment of Plant Overseers, men who by training and experience are competent to correctly diagnose plant-ailments, who immediately counteract threatened defects, and who are capable of undertaking the practical and other work incidental to the inspection of motor-omnibuses, also contracts for manufactured ironwork.

As was expected, the regulation of motor-omnibus design and construction for the safety of the public, and for the control of motor-vehicles in general throughout the Dominion, has sent much additional work to the Mechanical Engineers' office, and it is opportune to here add that my Department endeavours to keep abreast of the times in the fast-travelling and progressive motor world.

The comparatively large undertaking in the Wellington – Tawa Flat Railway Deviation has occasioned more than the ordinary amount of time in the preparation of specifications for the supply by tender of labour-aiding plant and machinery, but the new plant required for this work is not included in the following schedule of plant which has been purchased and delivered for general purposes during the year: Four air-compressors, one air-hoist, one air-lock, two air-receivers, two bitumen-boilers, six concrete-mixers, five electric motors, one electric winch, two fans, five light locomotives, ten machine tools, nineteen motor-cars, seven motor-trucks, one motor-velocipede, one oil-engine, one pump, two road-graders, one steam-crane, three tractors, two trailers, and one welding plant.

STAFF.

It is with sincere regret that I have to record the fact that a number of officers of the Department died, as one might say, in harness. Mr. J. F. Simpson, Assistant Engineer, was accidentally shot while at work. Mr. C. H. Lawn, Office Engineer, after a long and valuable service, died, having worked until 5 o'clock on the very day of his death. Assistant Engineer A. A. Quartermain died from appendicitis, contracted while on his Christmas holidays. S. Fittall, Storekeeper, and A. Ross, Overseer, died after comparatively short illnesses.

Mr. H. Dickson, Office Engineer at Auckland, retired on superannuation, and Messrs. F. N. Thompson, District Engineer, E. R. McKillop, Assistant Engineer, and G. I. B. Thomas, Assistant Engineer, resigned in order to take up positions with the Wellington City Corporation.

During the year a number of retired Public Works officers passed away, notable amongst these being Mr. W. S. Short, I.S.O., for many years Under-Secretary of the Department, and who since his retirement on superannuation has rendered valuable assistance to the Department, extending almost up to the time of his death, by acting as a Commissioner in investigating such questions as the allocation of costs of road and bridge construction and maintenance between different mutually interested bodies.

CONCLUSION.

Shortly, to summarize, I have endeavoured to instil into my staff, from whom I have had the most loyal co-operation, the fundamental principle that the taxpayer must receive the very best value for the money spent, that all projects must be considered on an economic basis, and that in that consideration not only the requirements of the day are to be considered, but the ever expanding wants of this vigorous young country. Also, while seeing that only good work is done, and done economically, I have endeavoured to avoid any possibility of it being suggested that low-priced work was to be obtained at the expense of fair and reasonable treatment of the employees. I have always found the staff eager to assist me, and in all cases anxious to carry out the policy defined for their guidance by the Government. I am satisfied that the works which have been brought into being during this year will serve a useful purpose long after those responsible for their conception and construction have passed away.

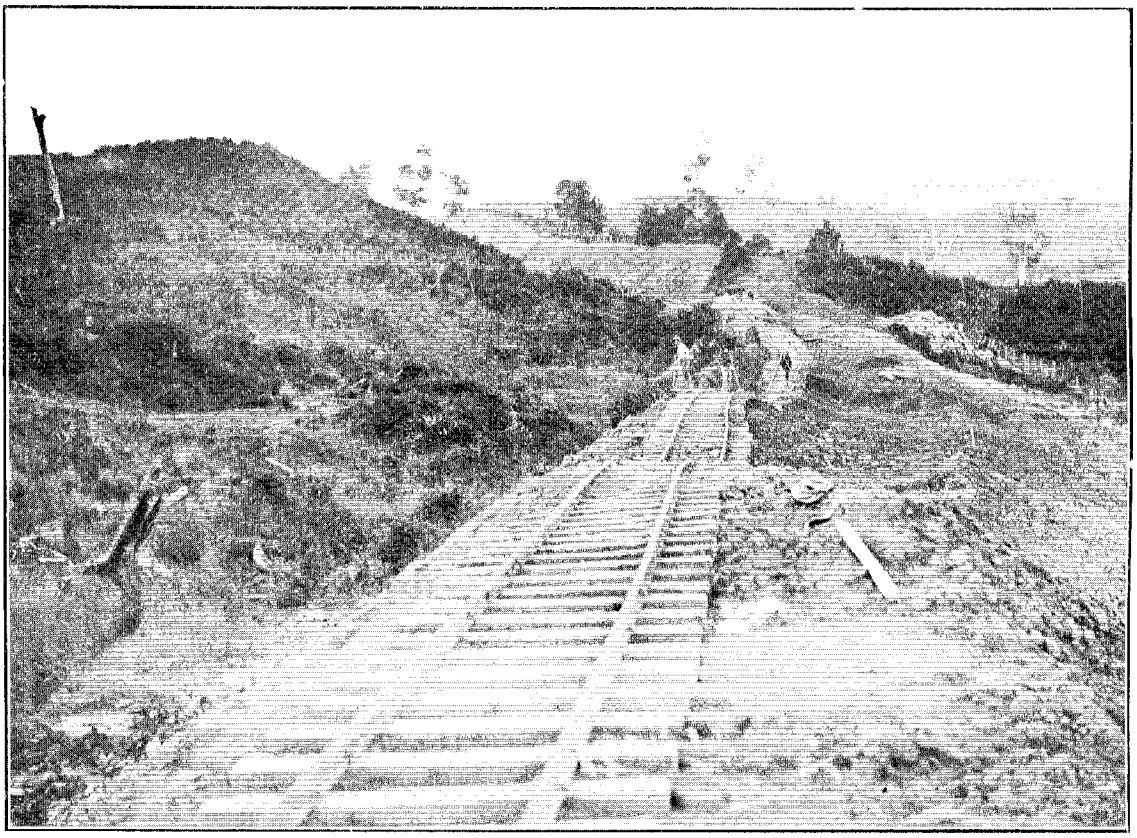
As appendices to this Statement honourable members will find full details of the principal works carried out by the Department in the reports of the Engineer-in-Chief, Government Architect, Chief Electrical Engineer, and Main Highways Board respectively.

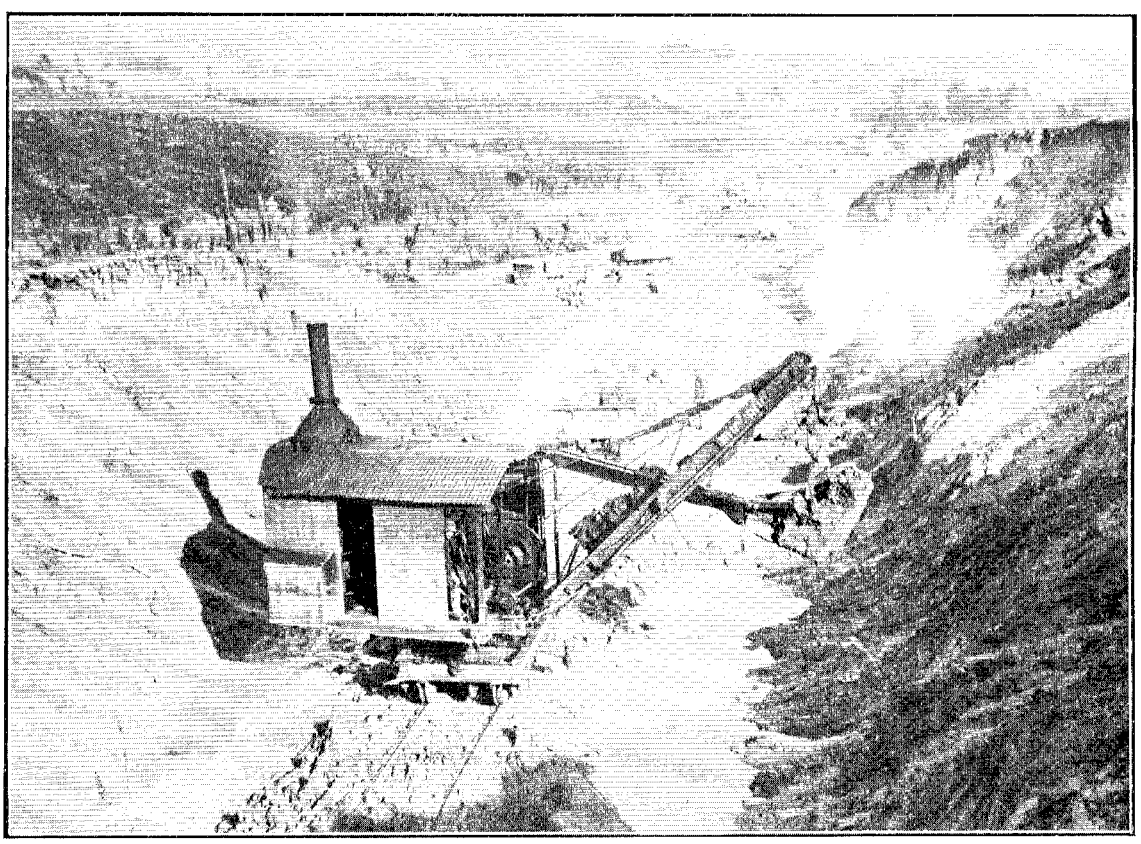
Schedule showing Particulars of Railway-lines under Construction at 1st April, 1928.

Railway.	Length of Section.	Length under Construction.	Handed over to Railway Department during Year ended 31st March, 1928.	Rails laid during Year.	Length over which Traffic is being run.	Length over which Goods Traffic only is being run.	Length ready for handing over to Railway Department.	Ready for handing over to Railway Department within One Year.	Ready for handing over to Railway Department within Two Years.	Amount spent to Date.	Estimated Amount to Complete.
	M. CH.	M. CH.	M. CH.	M. CH.	M. CH.	M. CH.	M. CH.	M. CH.	M. CH.	£	£
North Auckland Main Trunk and Branches—											
Okaihau–Mangamuka	30 0	11 0	..	3 40	..	..	..	..	..	284,522	1,100,000
Waiotira–Kirikopuni	13 56	13 56	..	..	13 56	..	13 56	..	..	1,082,340	15,000
Kirikopuni–Dargaville	17 40	5 0	..	..	..	..	..	..	..	23,921	342,000
Auckland–Westfield Deviation	9 67	9 67	..	..	..	..	..	9 67	..	445,965	..
Paeroa–Pokeno	42 0	..	..	..	..	..	..	..	..	22,406	1,018,518
East Coast Main Trunk and Branches—											
Waihi–Tauranga	38 33	38 33	14 0	6 0	24 33	..	..	24 33	..	1,010,963	90,000
Tauranga–Taneatua (including Mount Branch)	63 36	63 36	..	..	63 36	..	..	63 36	..	1,459,360	
Taneatua–Opotiki	26 26	..	..	..	..	..	..	..	..	3,799	600,000
Gisborne–Wairoa	65 12	..	..	..	..	..	..	..	..	147,241	1,200,000
Wairoa–Eskdale	60 21	60 21	..	2 40	13 0	5 0	..	..	18 0	1,136,460	900,000
Waikokopu Branch	24 58	24 58	..	..	24 58	..	..	24 58	..	566,656	20,000
Stratford–Main Trunk—											
Tahora–Ohura	22 40	8 40	..	..	..	..	..	..	..	364,291	950,000
Ohura–Okahukura	19 10	19 10	..	..	19 10	..	..	19 10	..	660,209	
Palmerston North Deviation	7 0	7 0	..	..	..	..	..	..	..	56,719	..
Rimutaka Deviation	13 24	..	..	..	..	..	..	..	..	6,500	970,000
Wellington–Tawa Flat Deviation	8 0	4 0	..	..	..	..	..	..	..	60,323	1,100,000
Hutt Valley Railway	2 64	..	2 64*	..	..	..	..	..	..	278,335	..
Midland—											
Kawatiri–Inangahua	46 43	4 0	..	..	..	..	..	4 0	..	57,209	1,600,000
Westport–Inangahua	26 0	5 0	..	..	3 0	..	3 0	..	..	175,030	630,000
South Island Main Trunk—											
Wharanui–Parnassus	76 0	..	..	..	..	..	..	..	..	44,691	2,300,000
Lawrence–Roxburgh—											
Miller's Flat–Roxburgh	9 10	9 10	..	..	..	..	9 10	..	..	135,246	10,000
Totals	..	283 11	16 64	12 0	161 33	5 0	25 66	145 44	18 0	8,022,186	12,845,518

* Double track.

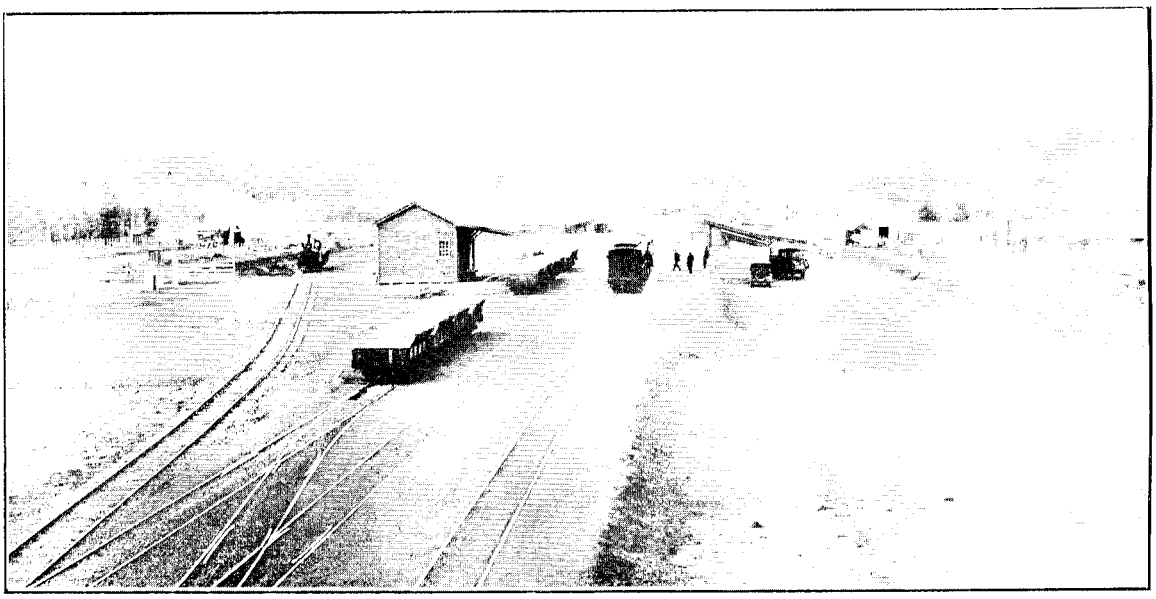
NOTE.—Estimates to complete include amounts required for maintenance and running traffic where traffic is being run.



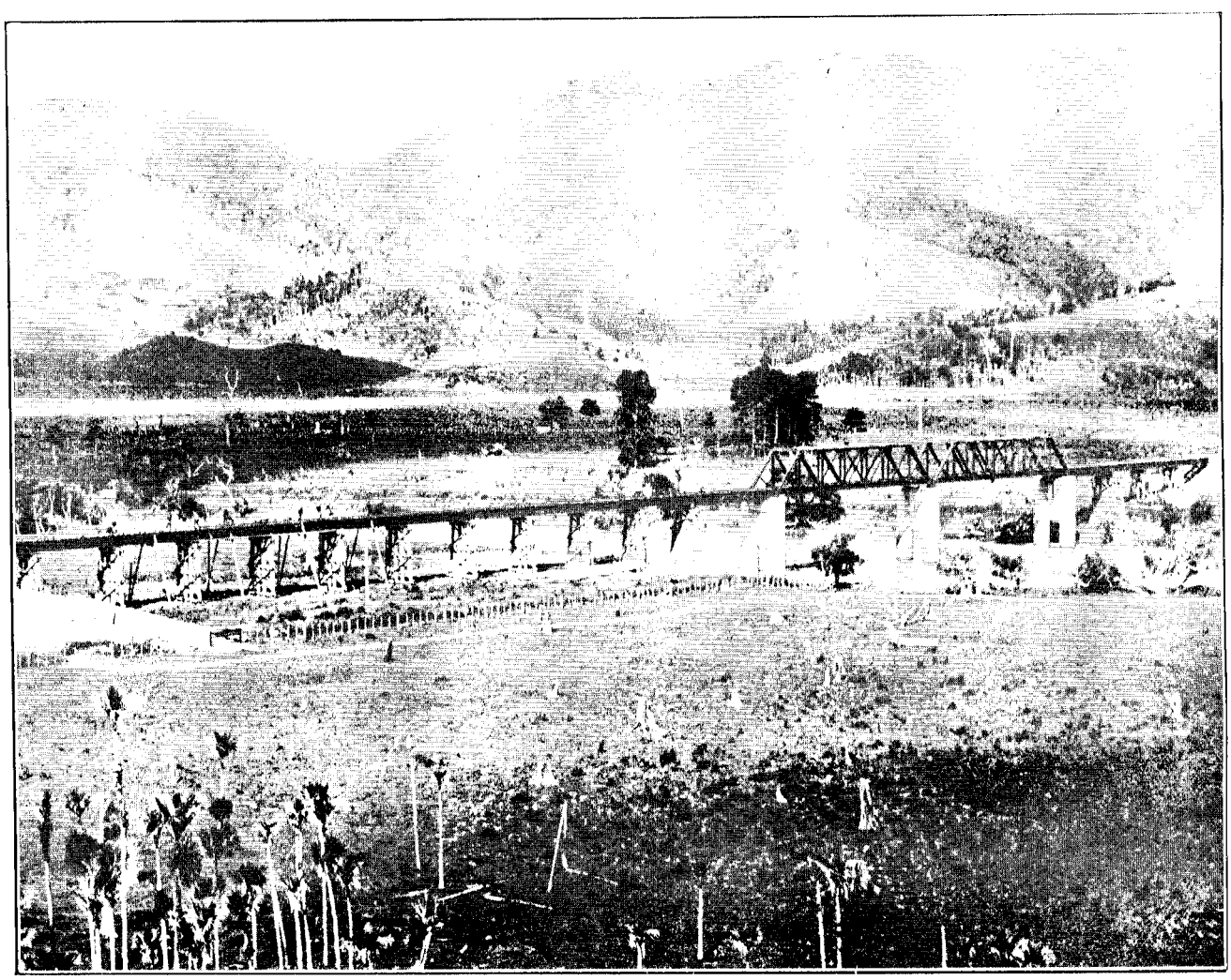


VIEWS SHOWING SLIP COUNTRY JUST BEYOND OKAIHAU.

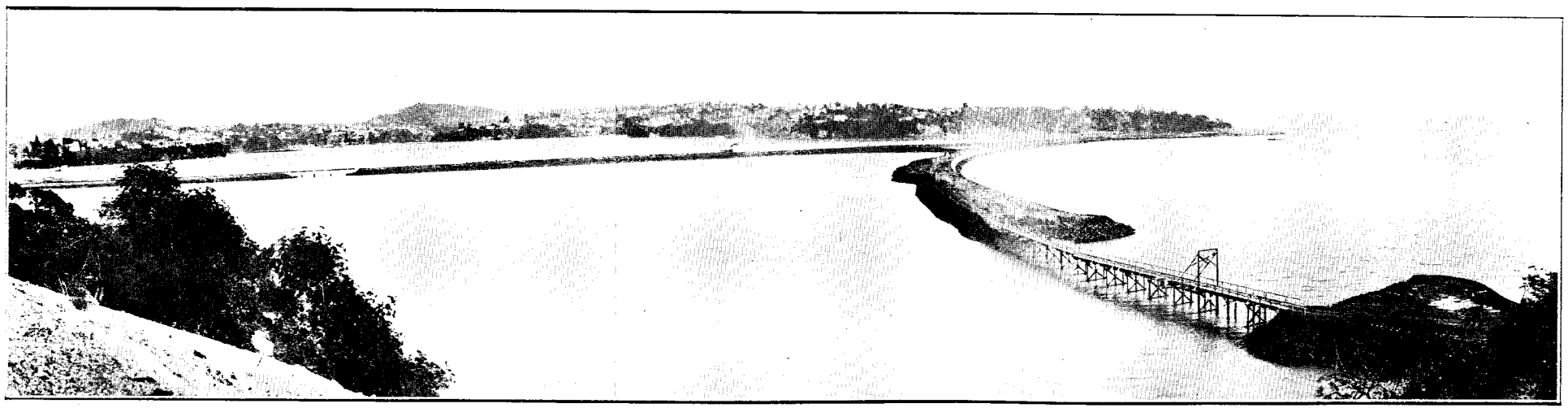
NORTH AUCKLAND MAIN TRUNK RAILWAY. RANGIAHUA SECTION.



Kirikopuni Station yard.

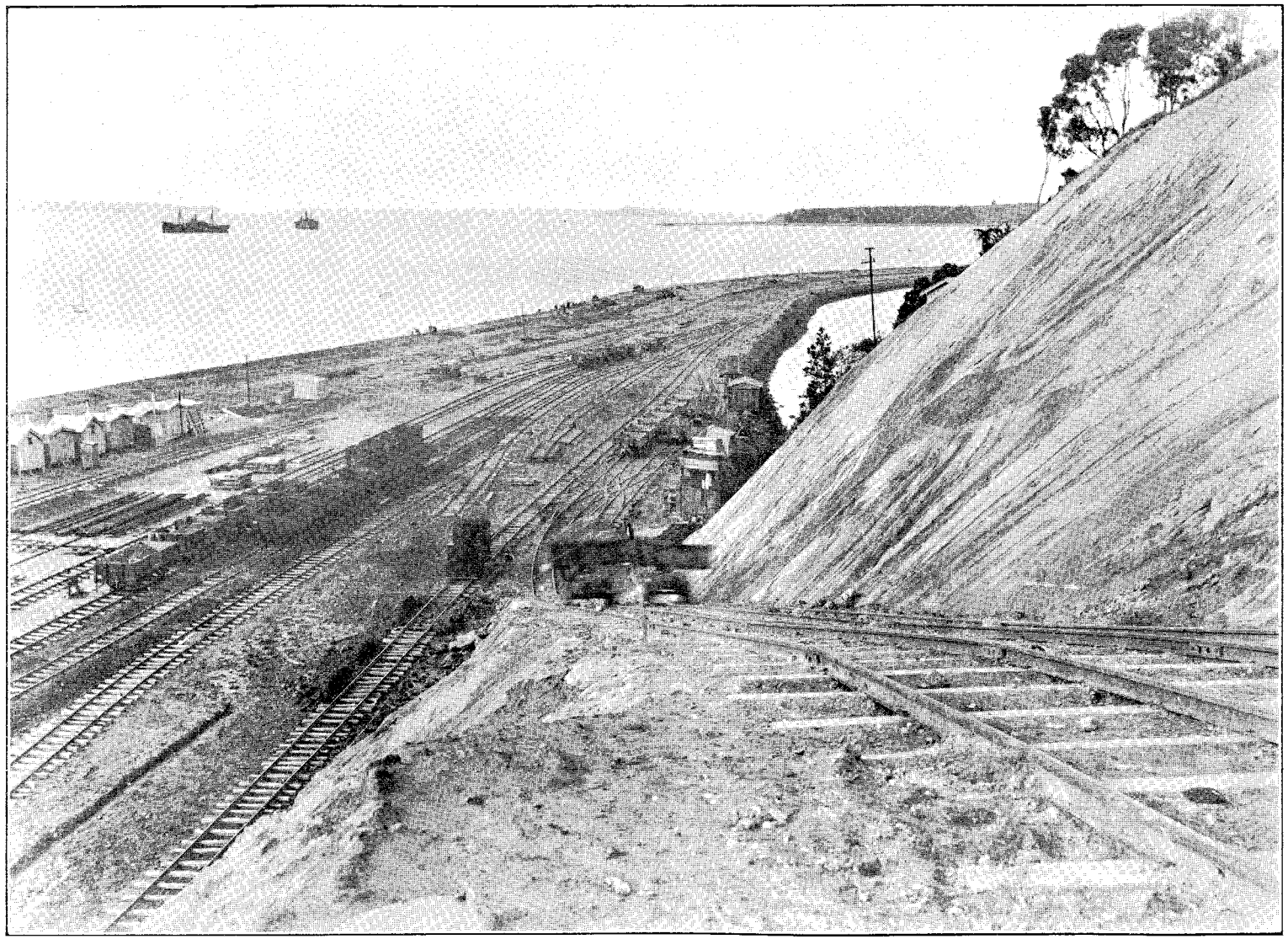


Northern Wairoa River Bridge, Pukehuia.
Two 105 ft. steel truss spans, two 45 ft. and fifteen 30 ft. steel plate girder spans.



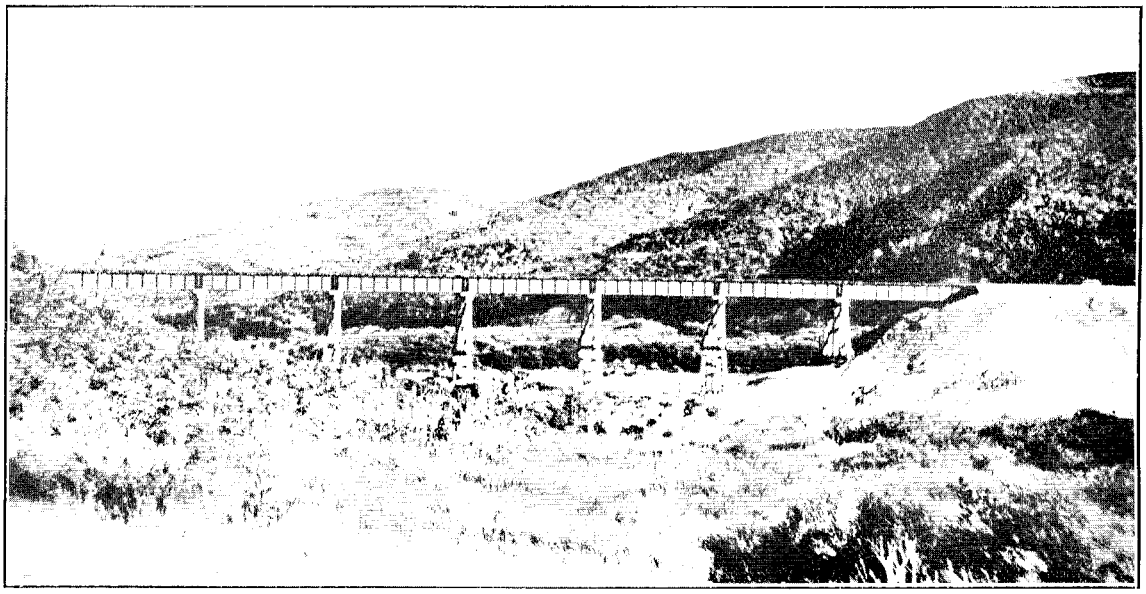
General View showing Embankment across Hobson Bay.
New waterfront road in foreground.

AUCKLAND–WESTFIELD DEVIATION.



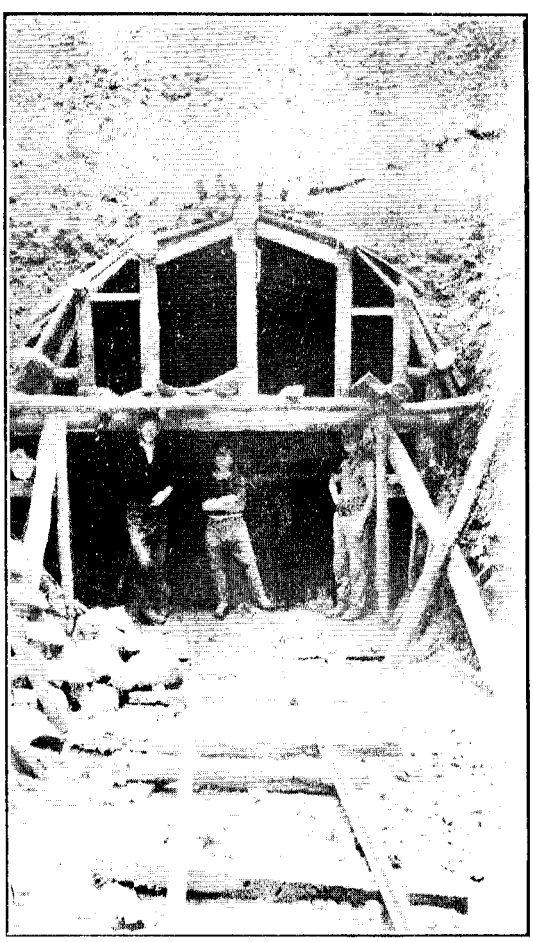
View from Campbell's Point, showing Excavation and Embankment at Southern End of New Auckland Station-yard. Embankment for new waterfront road on left.

AUCKLAND–WESTFIELD DEVIATION.

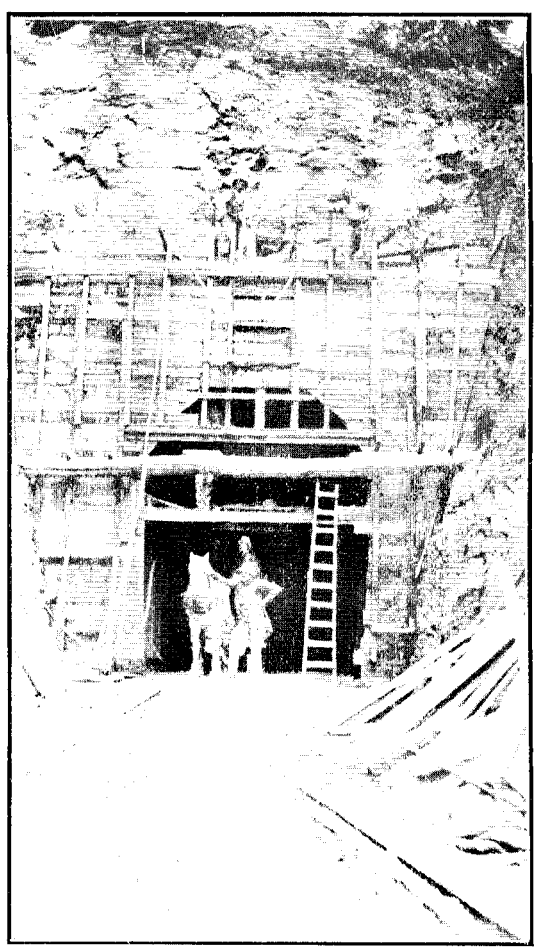


Waiaua River Bridge.
Seven 35 ft. steel plate girder spans.

EAST COAST MAIN TRUNK RAILWAY.—APATA SECTION.

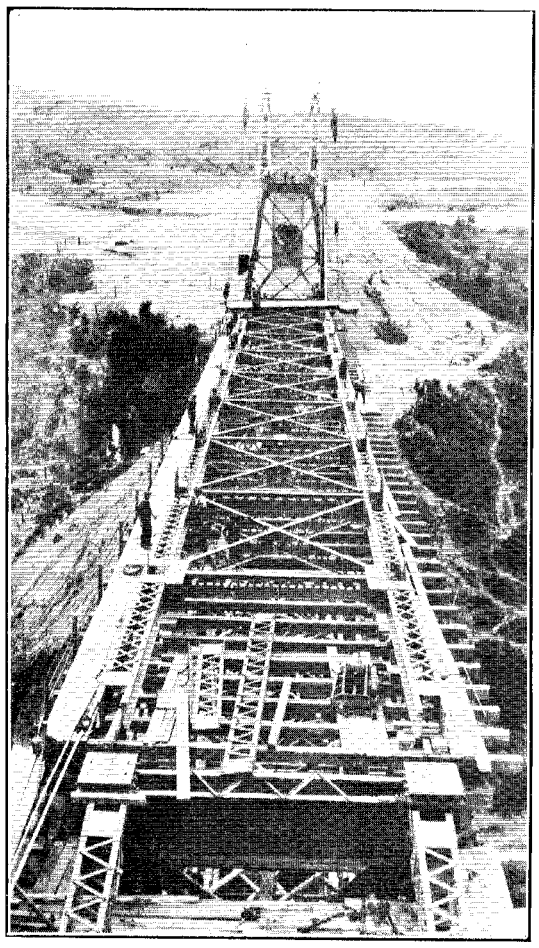


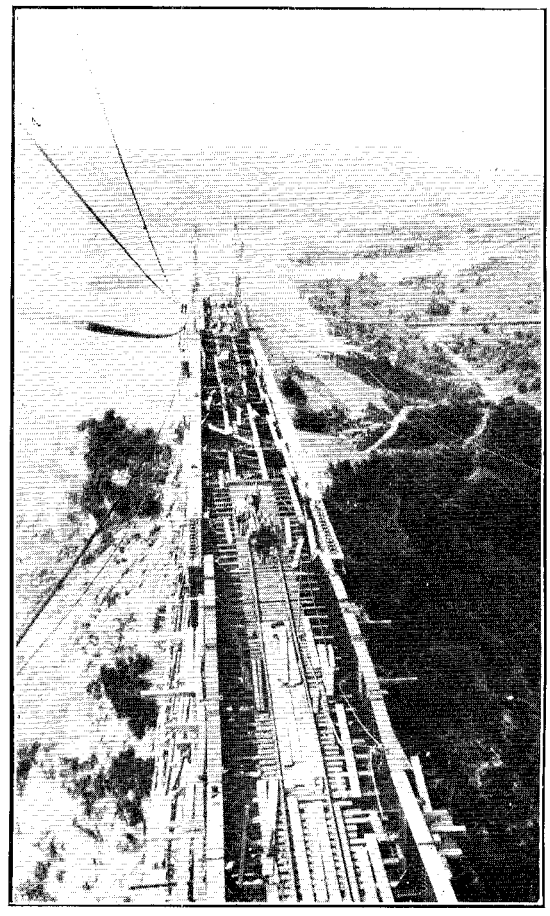
Creek diversion Tunnel at 53 m. 25 ch.



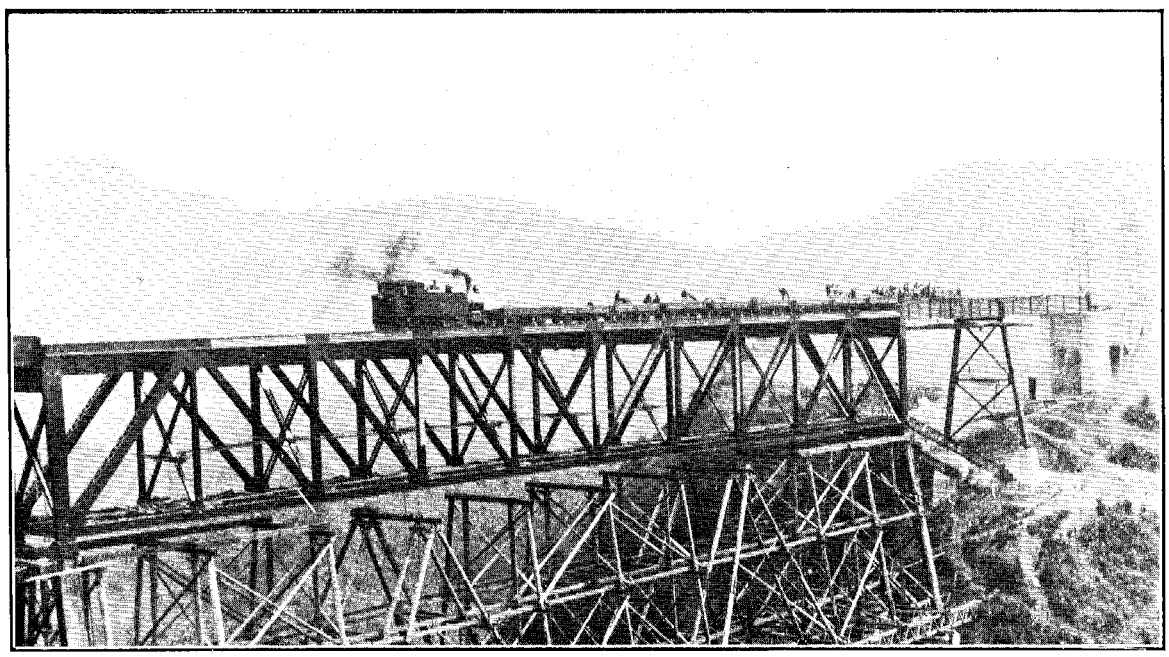
No. 2 Railway Tunnel, Eastern End.

STRATFORD MAIN TRUNK RAILWAY, WESTERN END.—HEAO SECTION.



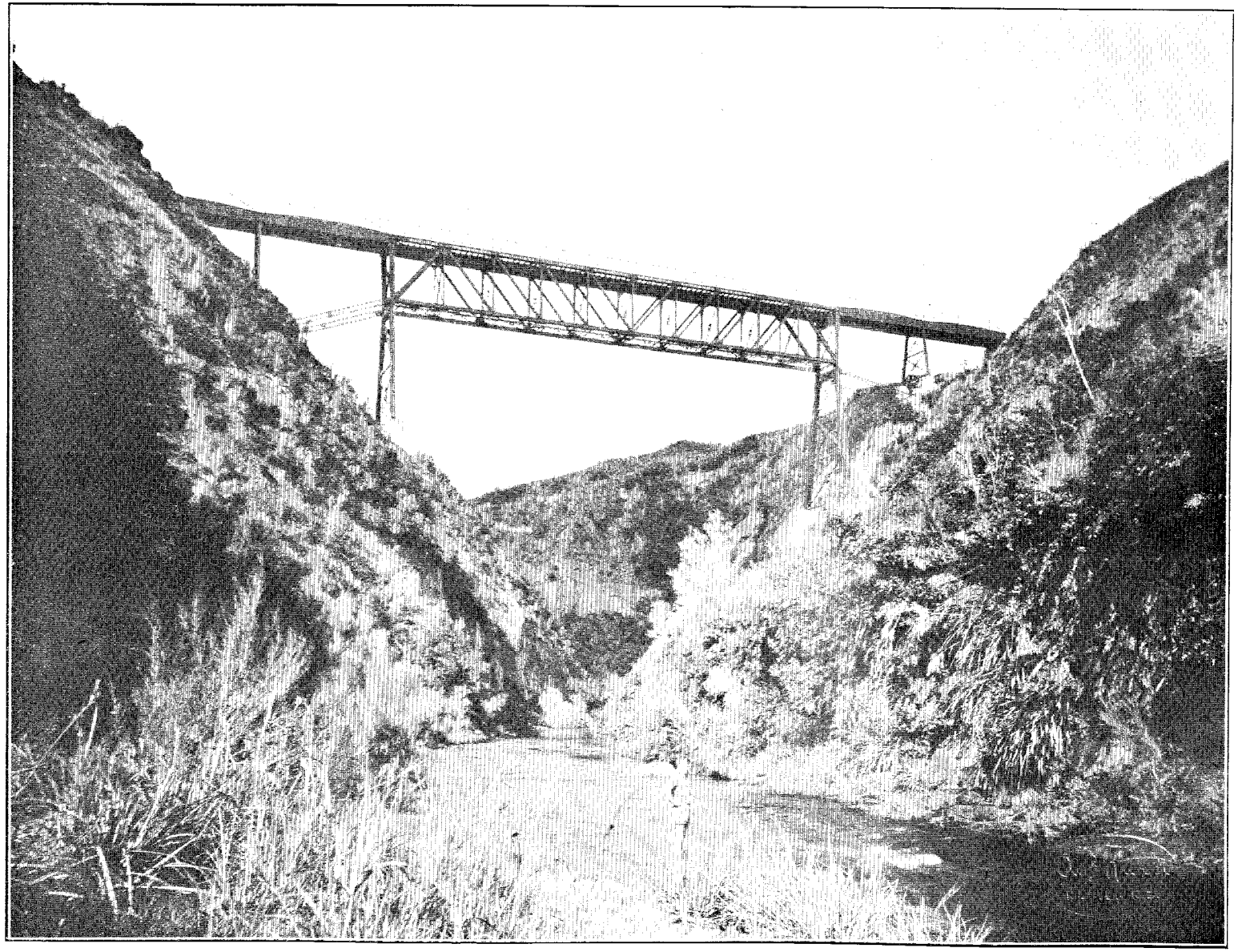


VIEWS SHOWING 250 FT. SPAN IN COURSE OF ERECTION.



FIRST TRAIN CROSSING.

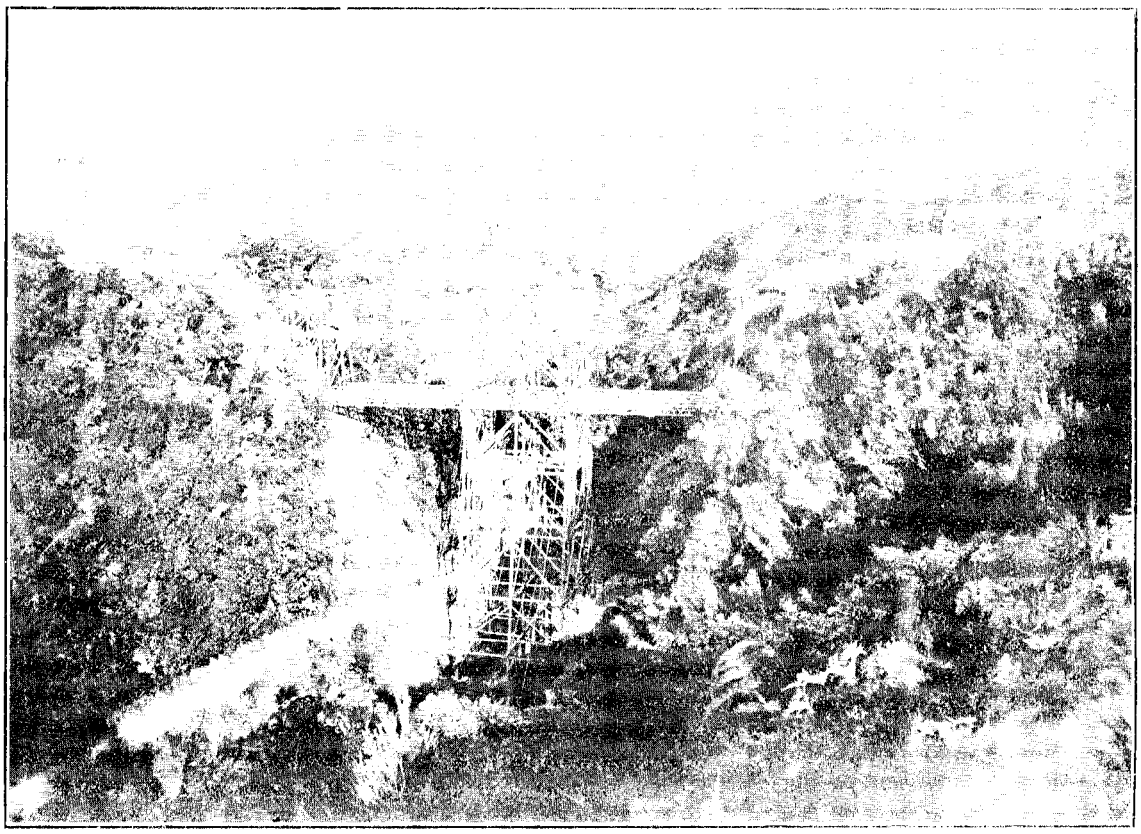
NAPIER WAIROA RAILWAY. PUTORINO SECTION: WAIKOAU VIADUCT.



WAIKOAU VIADUCT.

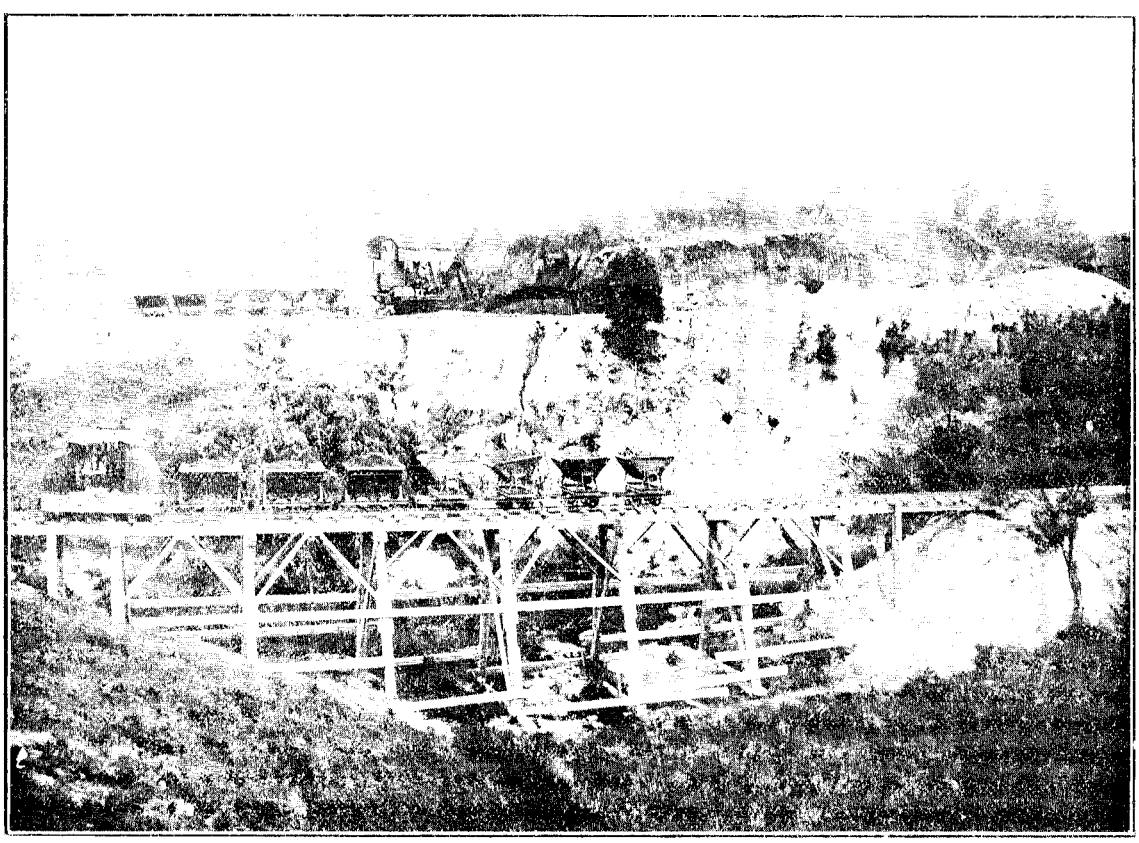
One 250 ft. steel deck truss span, four 60 ft. through steel plate girder spans. Height of rail-level above water-level, 235 ft.

NAPIER–WAIROA RAILWAY.—PUTORINO SECTION.



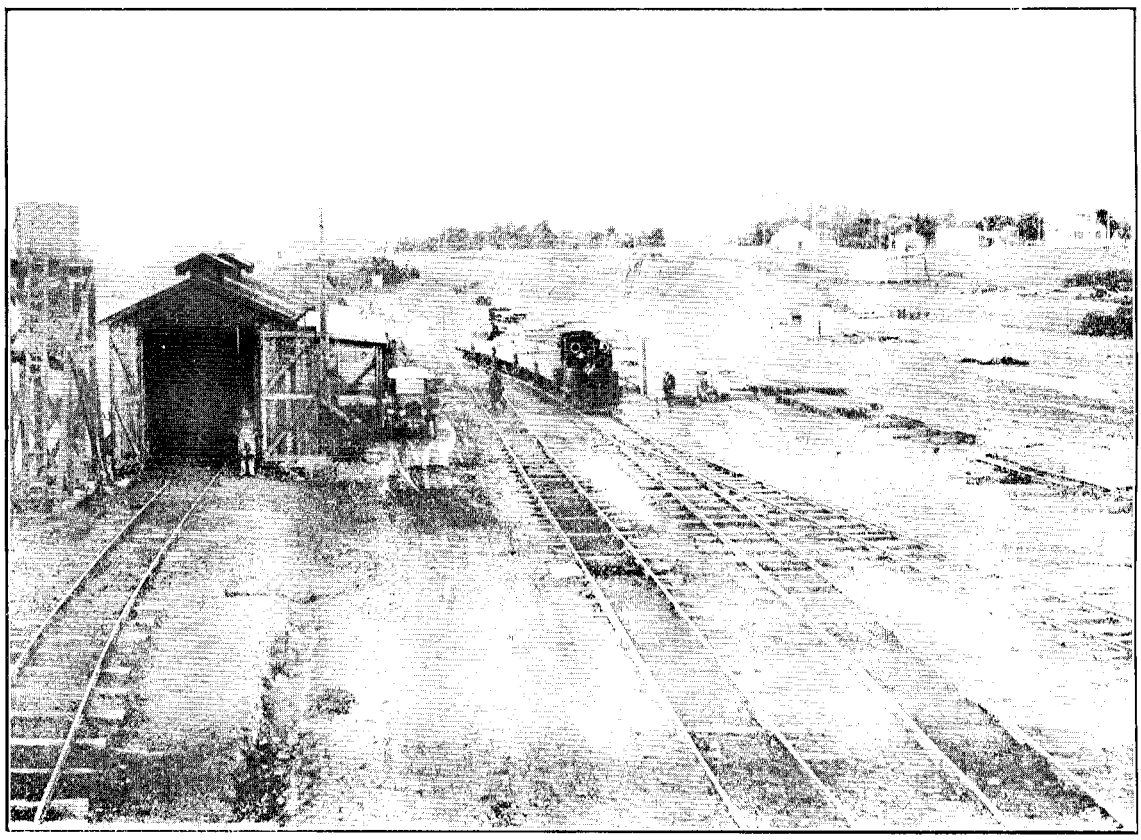
MAKAHOUKA VIADUCT
View showing trestling and cableways for erection of 240 ft. span

NAPIER WAIROA RAILWAY—PUTORINO SECTION

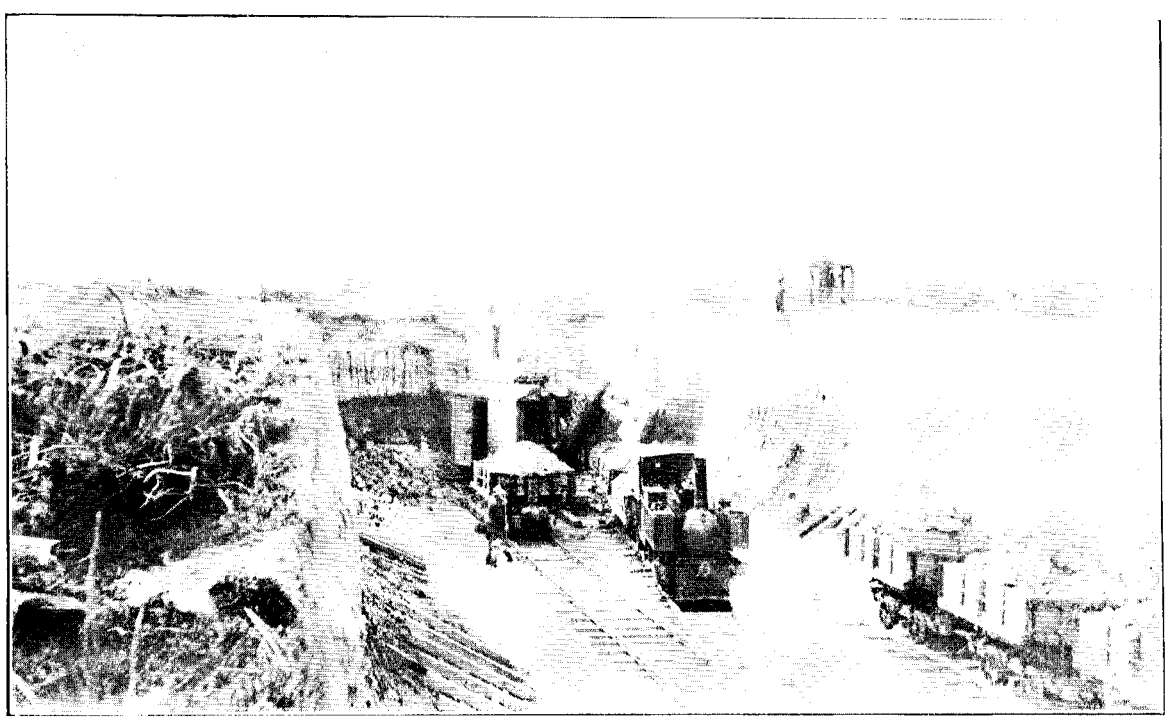


TOP LIFT OF CUTTING AT 31 M.

NORTH AUCKLAND MAIN TRUNK RAILWAY—RANGIAHUA SECTION

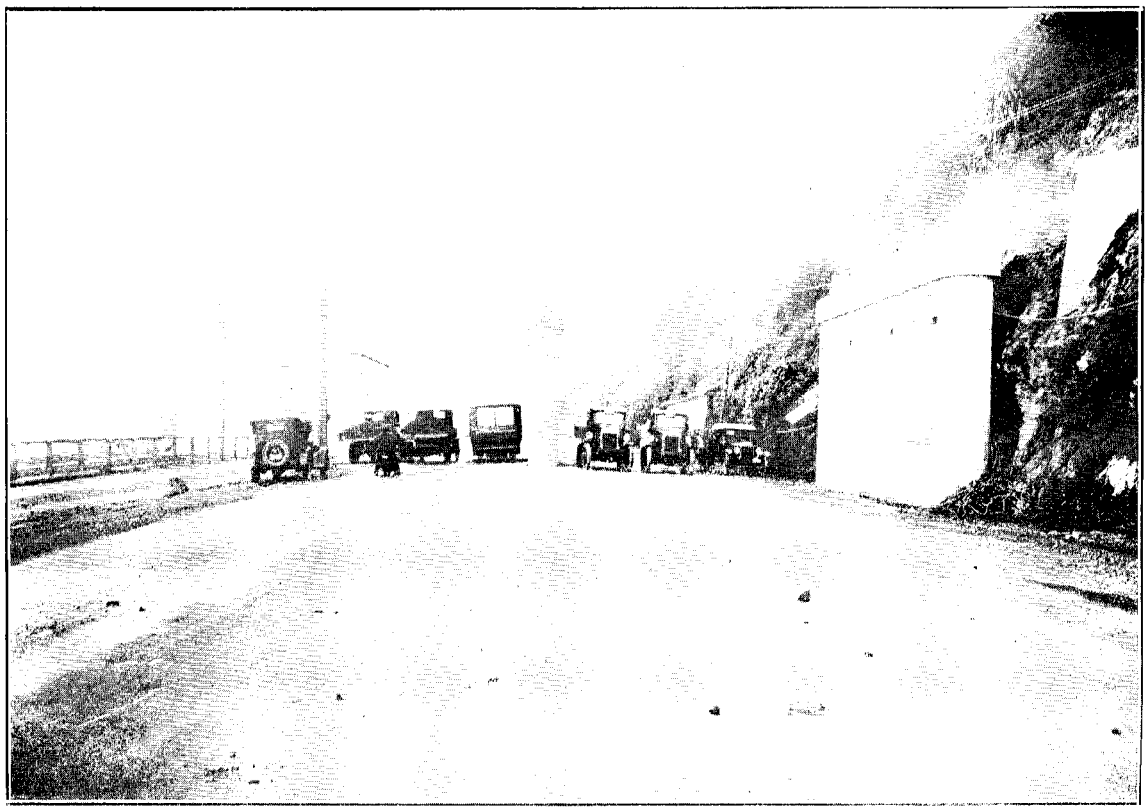


General View of Excavation for Goods yard.

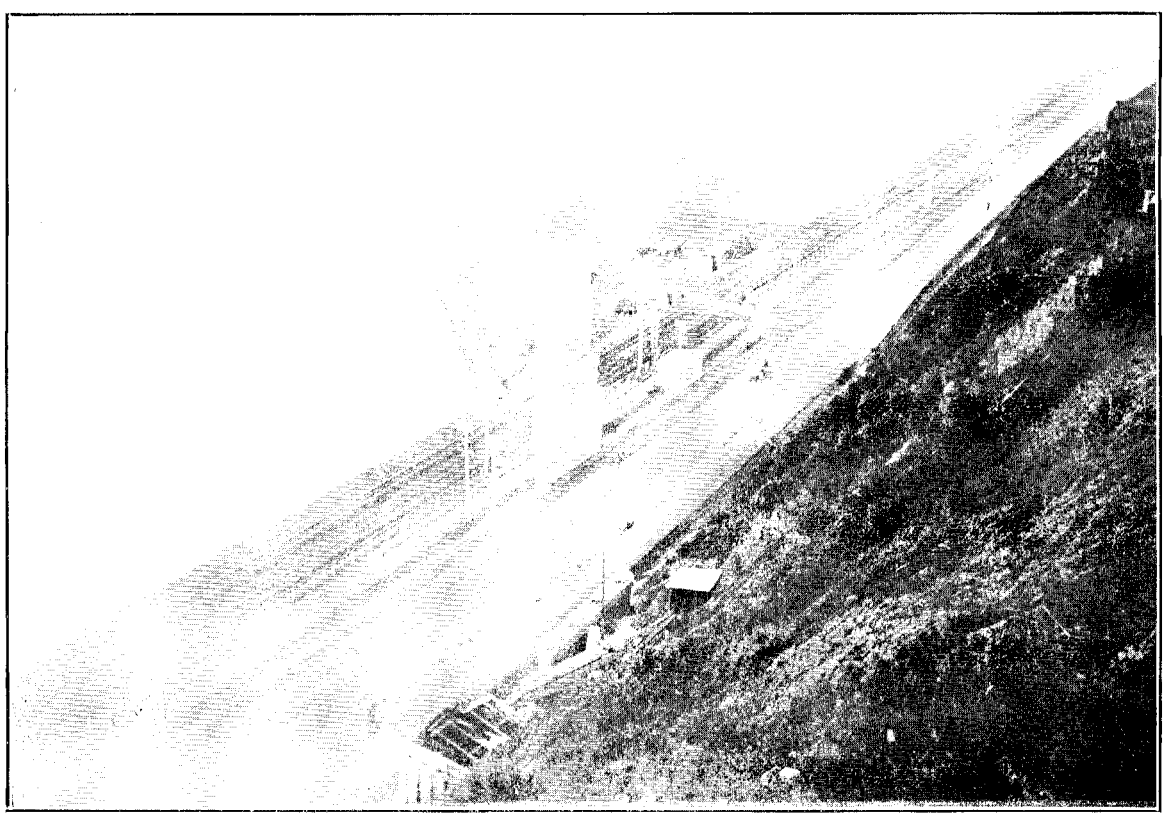


Steam-shovel excavating for Goods yard.

PALMERSTON NORTH DEVIATION.

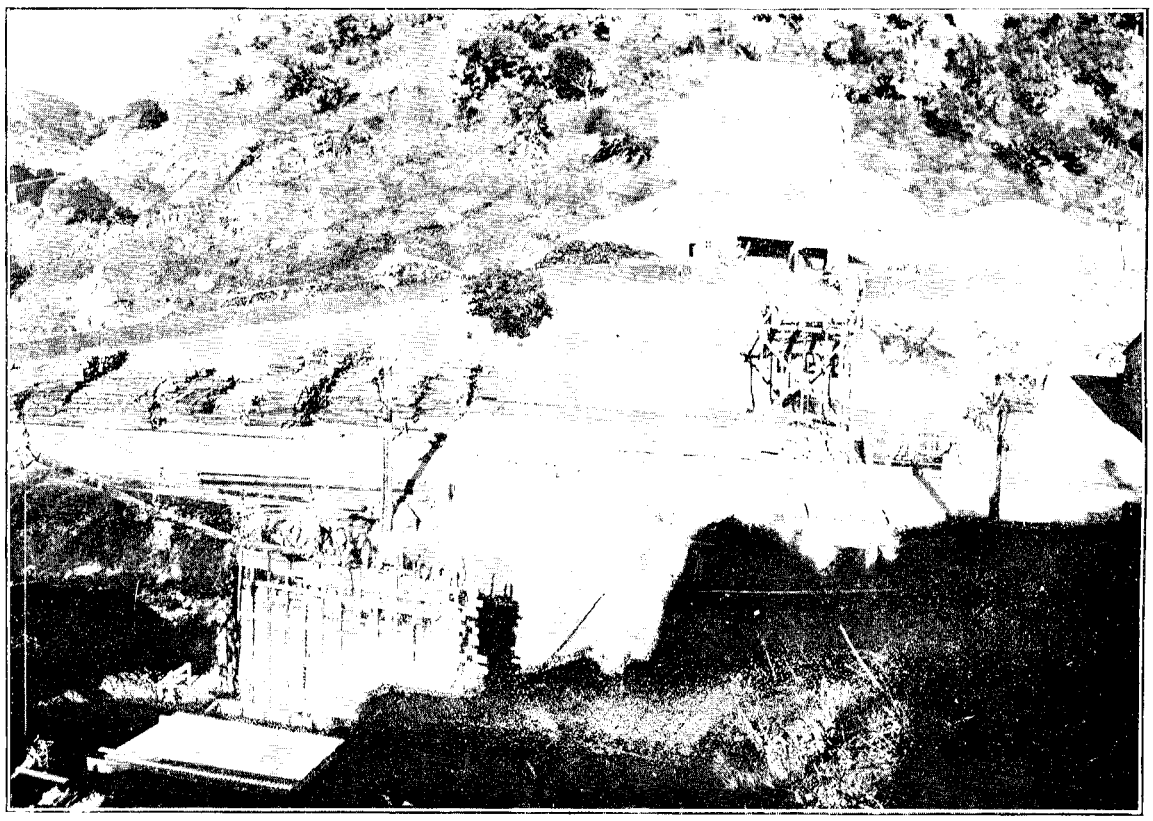


View showing Piers for Bridge over Hutt Road and Railway.
Note three lines of traffic through each span.

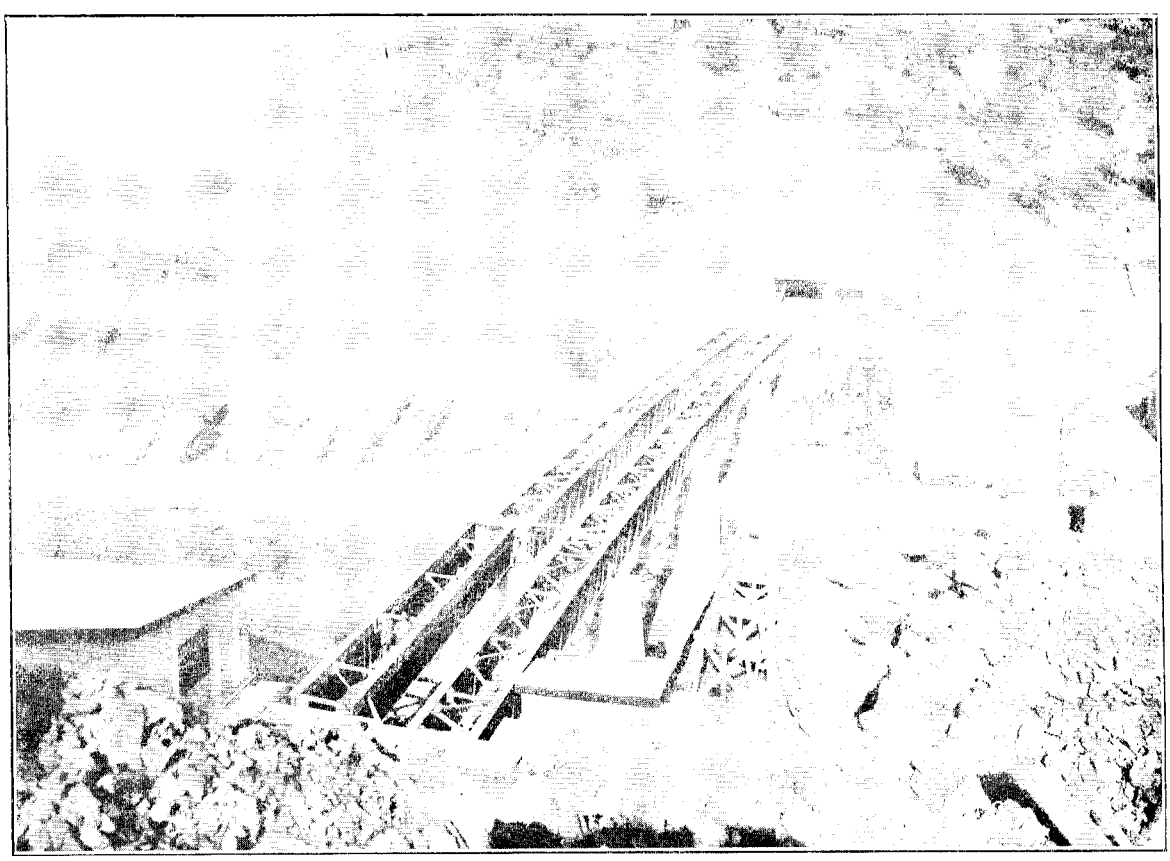


View from above Portal of No. 1 Tunnel.
This view gives a good idea of the angle of skew of the crossing of road and railway, which is 60.

WELLINGTON NEW PLYMOUTH RAILWAY. TAWA FLAT DEVIATION.



NGAHAURANGA STREAM BRIDGE.
View showing piers under construction.

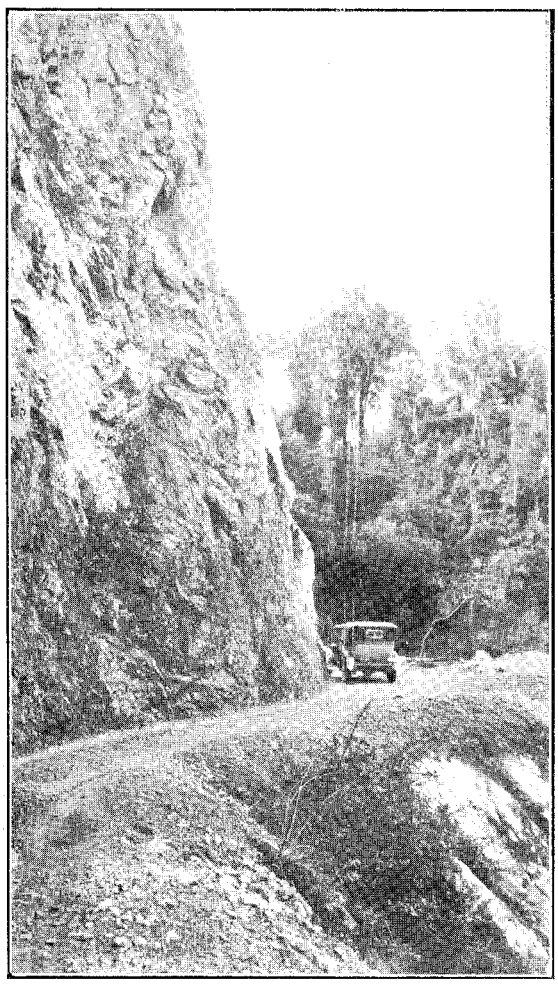


NGAHAURANGA STREAM BRIDGE.

View showing piers completed and erection of steel plate girder spans almost completed. No. 1 Tunnel in background. Bridge consists of two 60 ft. and two 50 ft. steel plate girder spans. Double track railway.

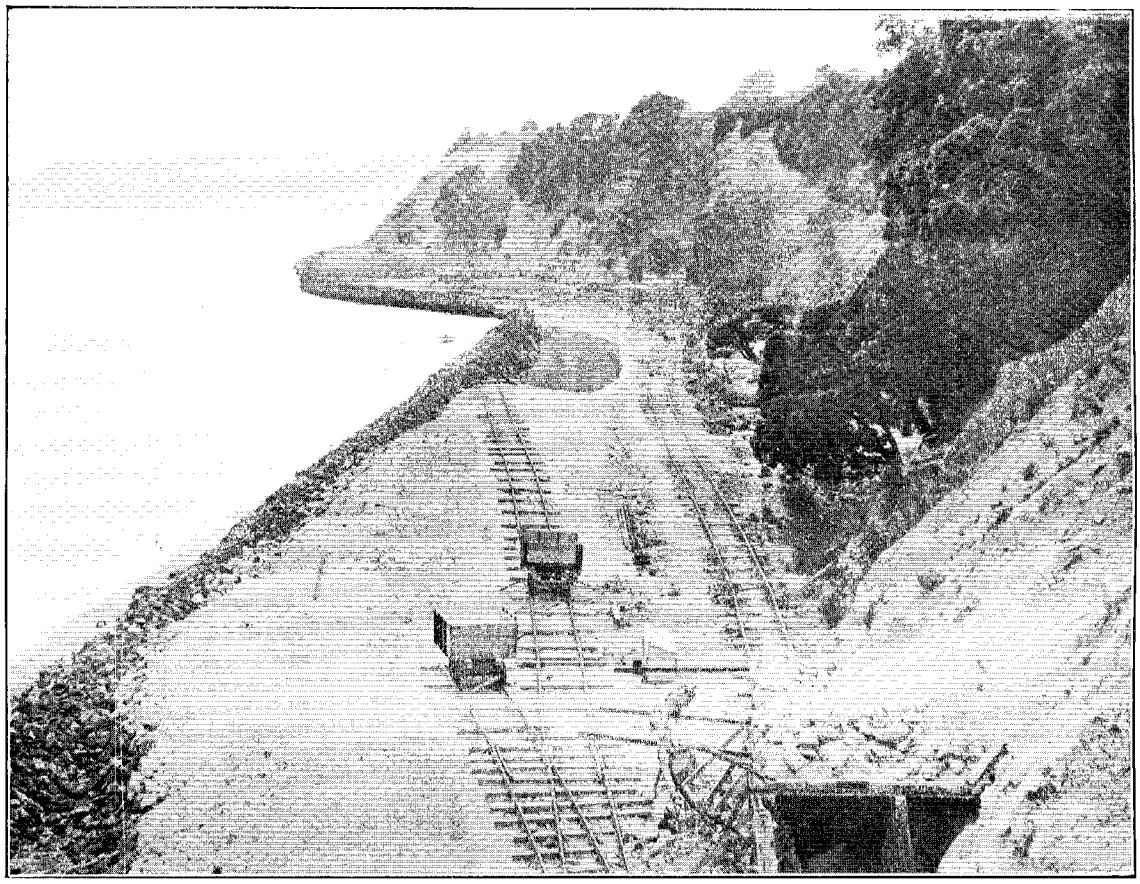


Te Karae–Mangamuka Road.
Limestone cutting.

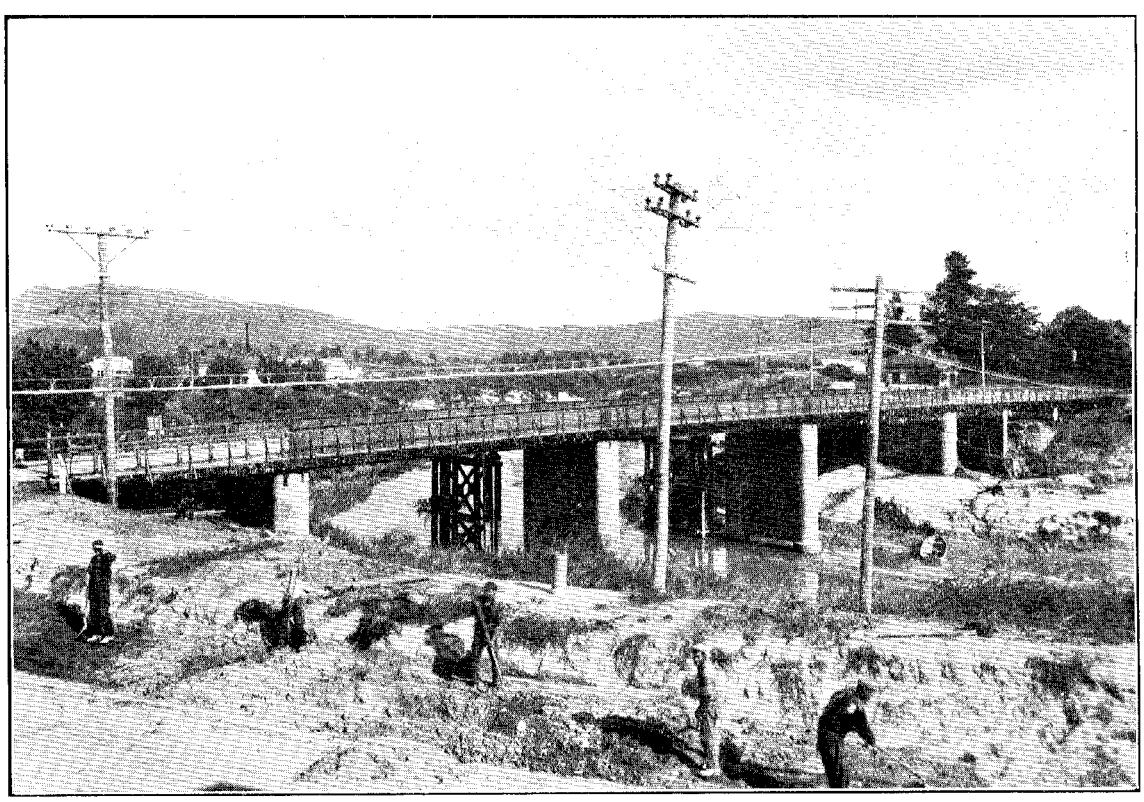




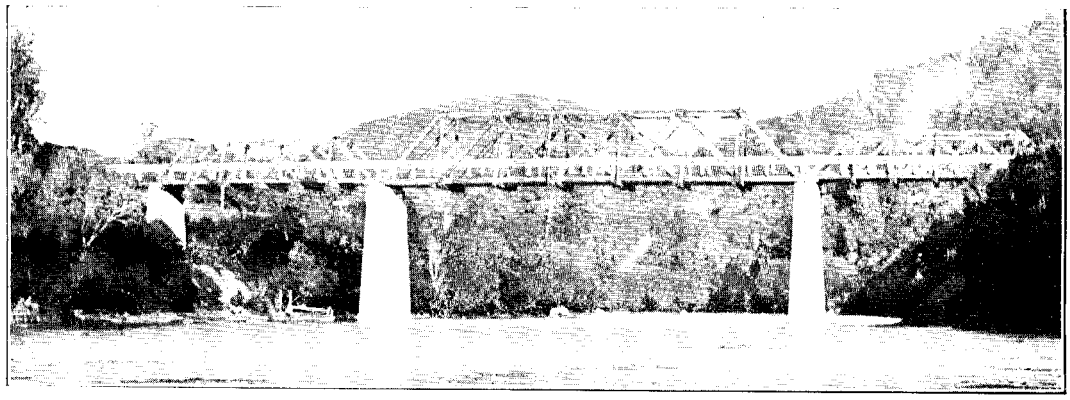
Waioeka Road, Bay of Plenty.
Views showing construction in rock country.



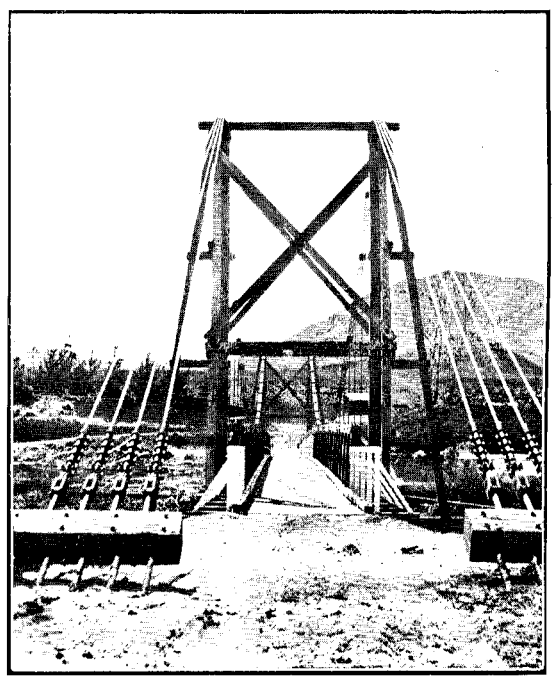
Auckland Orakei Waterfront Road.
View from Hobson Point, looking towards Orakei Point.



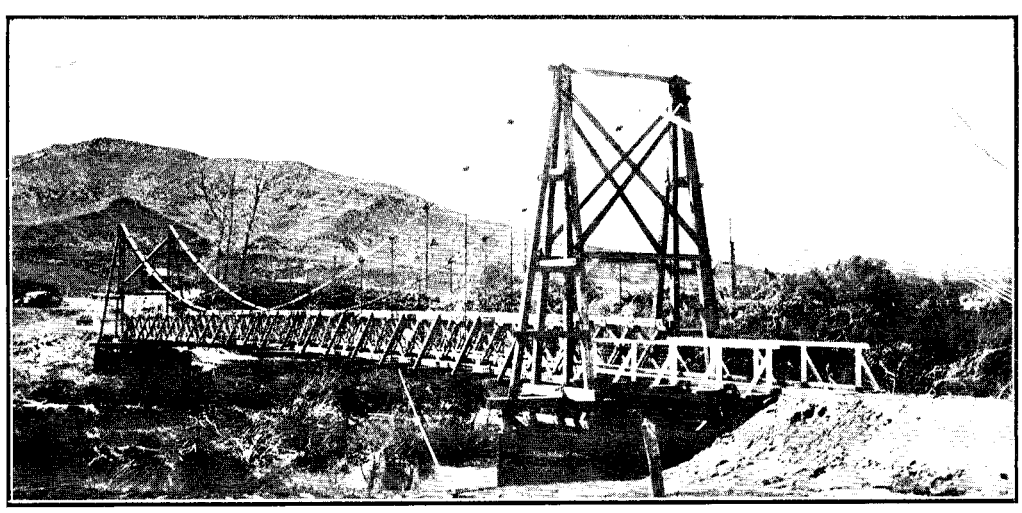
Ohinemuri River Road-bridge, Paeroa.
Three 60 ft. through steel plate girder spans and four 30 ft. rolled steel joist spans. Concrete deck, 18 ft. roadway with footway on one side.



WANGANUI RIVER ROAD-BRIDGE, TE MAIRE.
One 110 ft. and two 60 ft. timber truss spans, and two 25 ft. stringer spans.

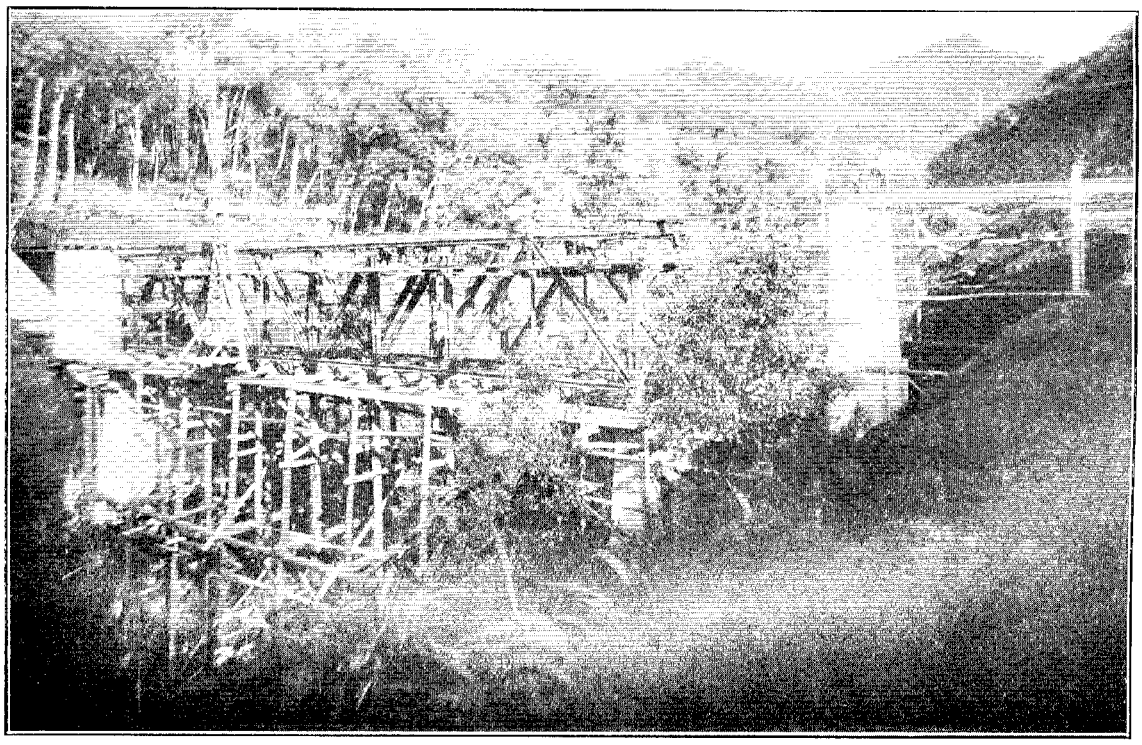


END VIEW, SHOWING ANCHORAGES.



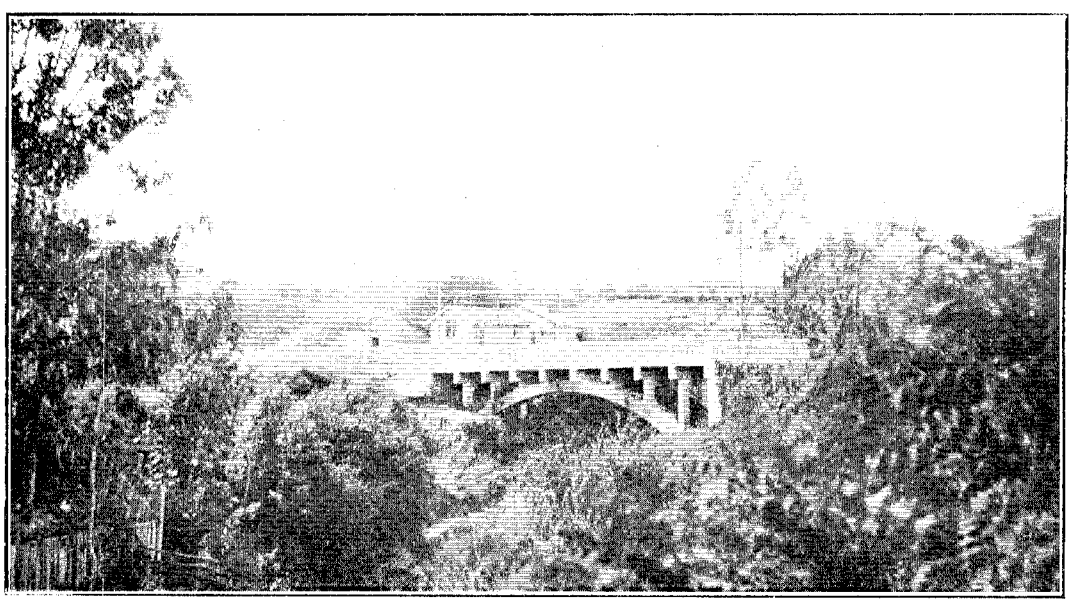
SIDE VIEW.
One 264 ft. cable suspension span with timber stiffening-truss and two 30 ft. end spans.

WAIAU STREAM ROAD-BRIDGE, TUTAEKURI BLOCK.



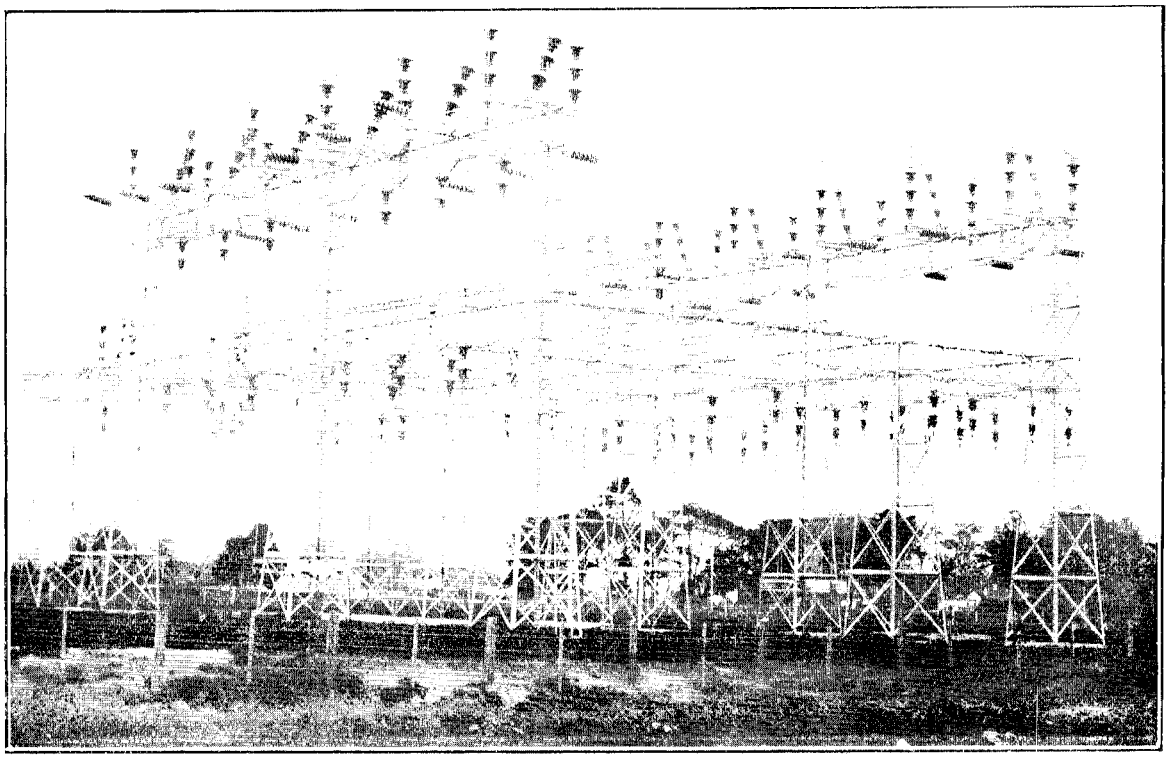
Mangatipa Bridge under Construction.
One 120 ft. steel deck truss and four 25 ft. timber spans.

KIRIKOPUNI PARAKAO ROAD.

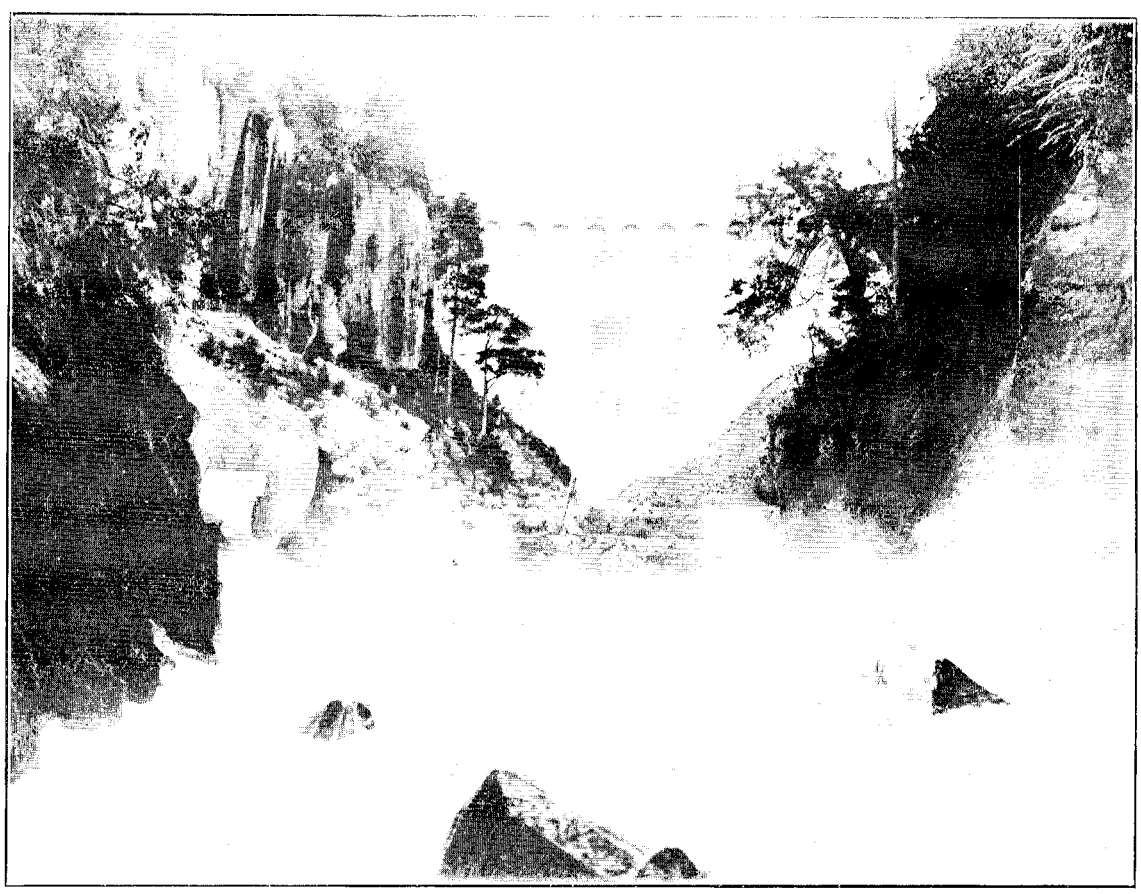


Waituna Stream Bridge.
60 ft. arched reinforced concrete span, 20 ft. roadway.

WAITUNA VALLEY ROAD, KIWITEA COUNTY.

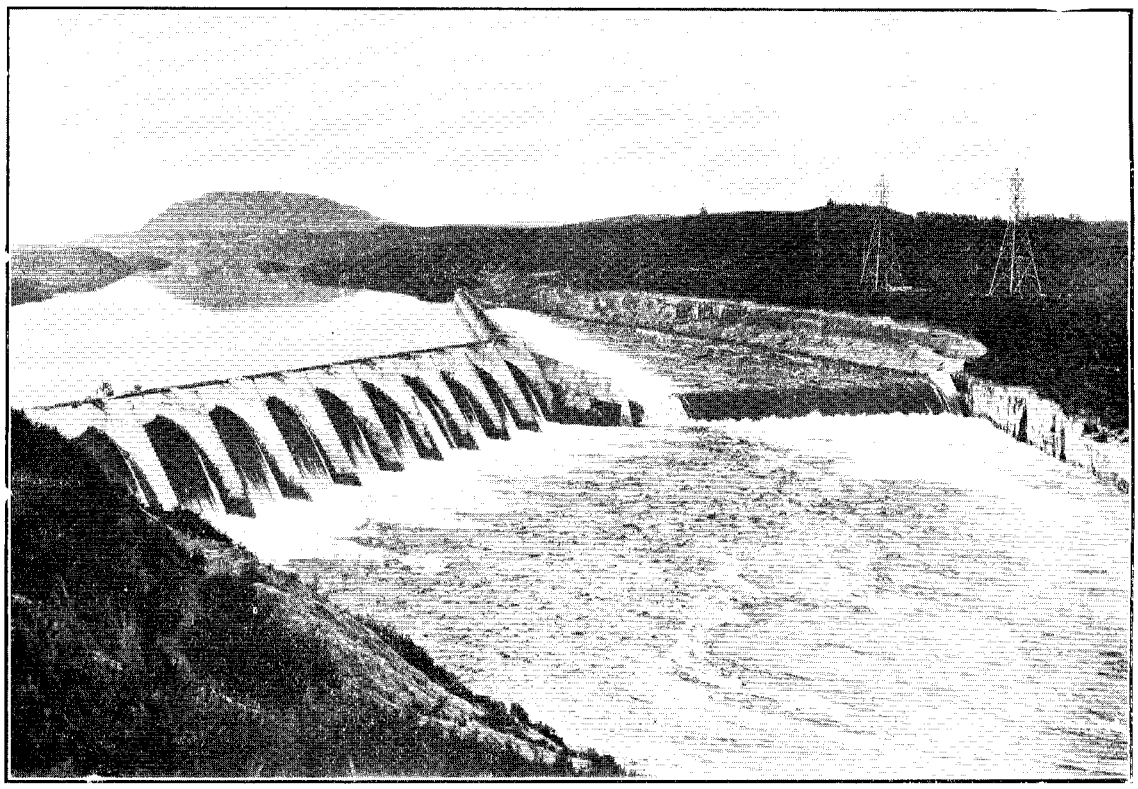


No. 2 Substation, Hamilton.

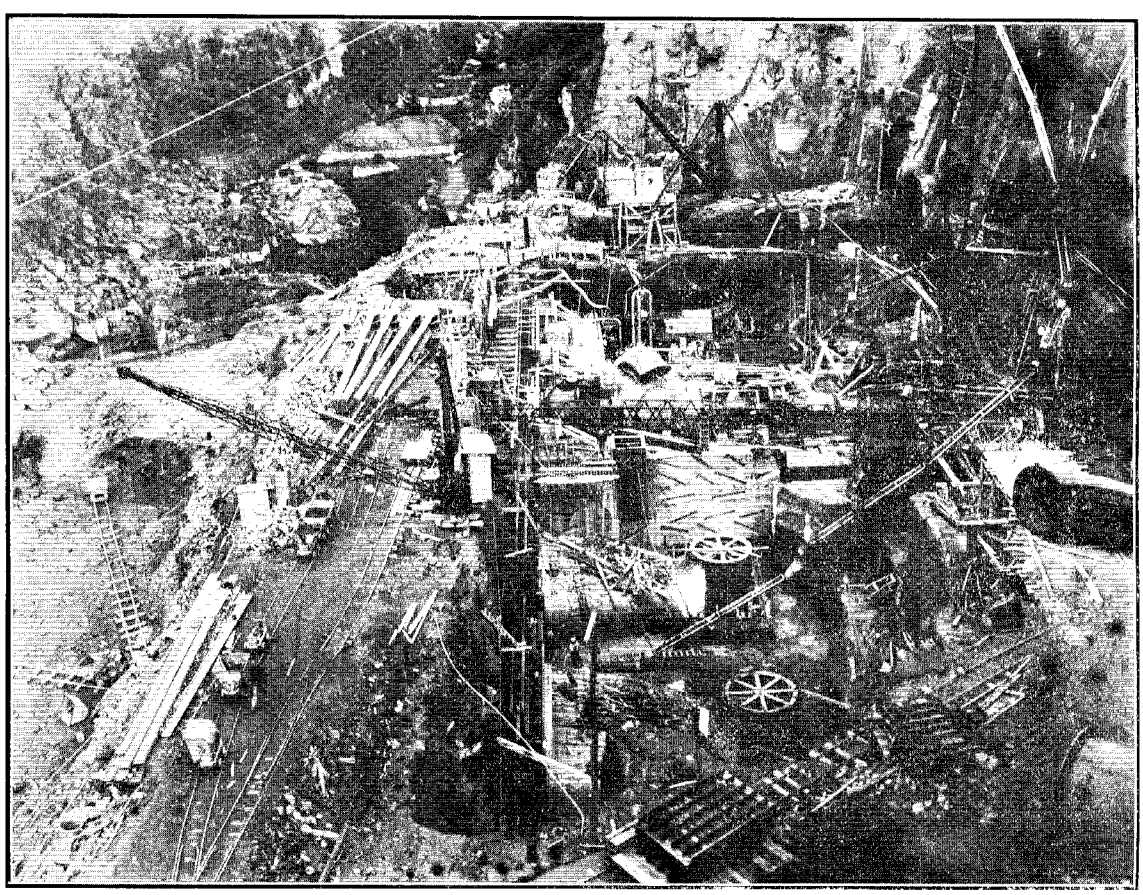


Arapuni Dam.
Water discharging from diversion tunnel under high head.

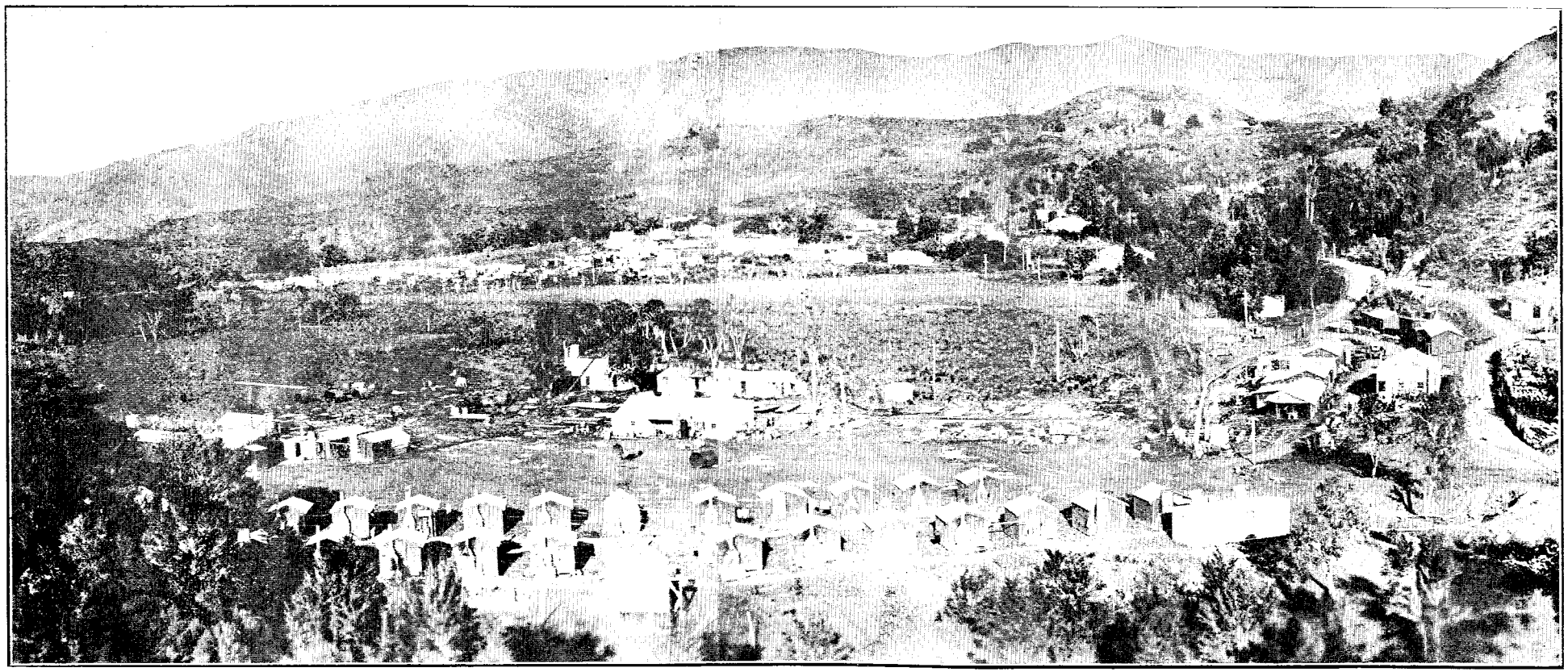
ARAPUNI HYDRO ELECTRIC SCHEME



View showing Head-race and Spillway.

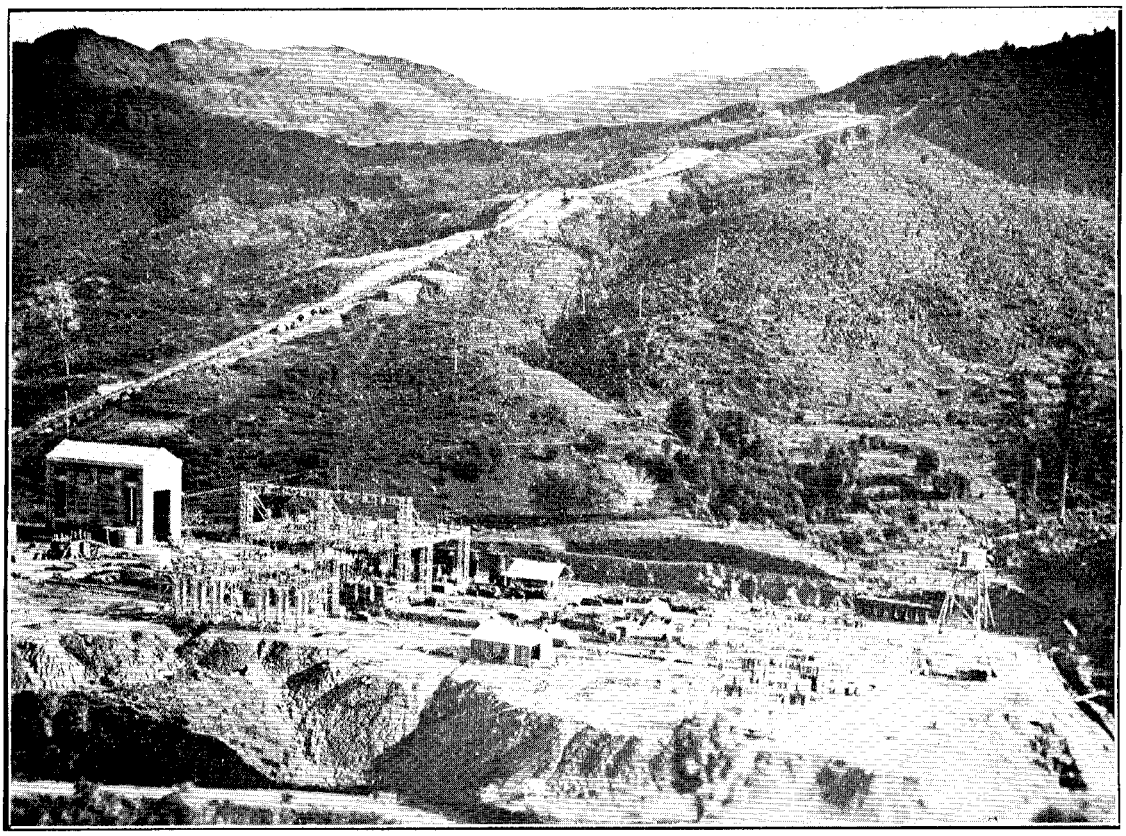


View showing Excavation at Power-house Site and Lower Concrete Foundations in Place.

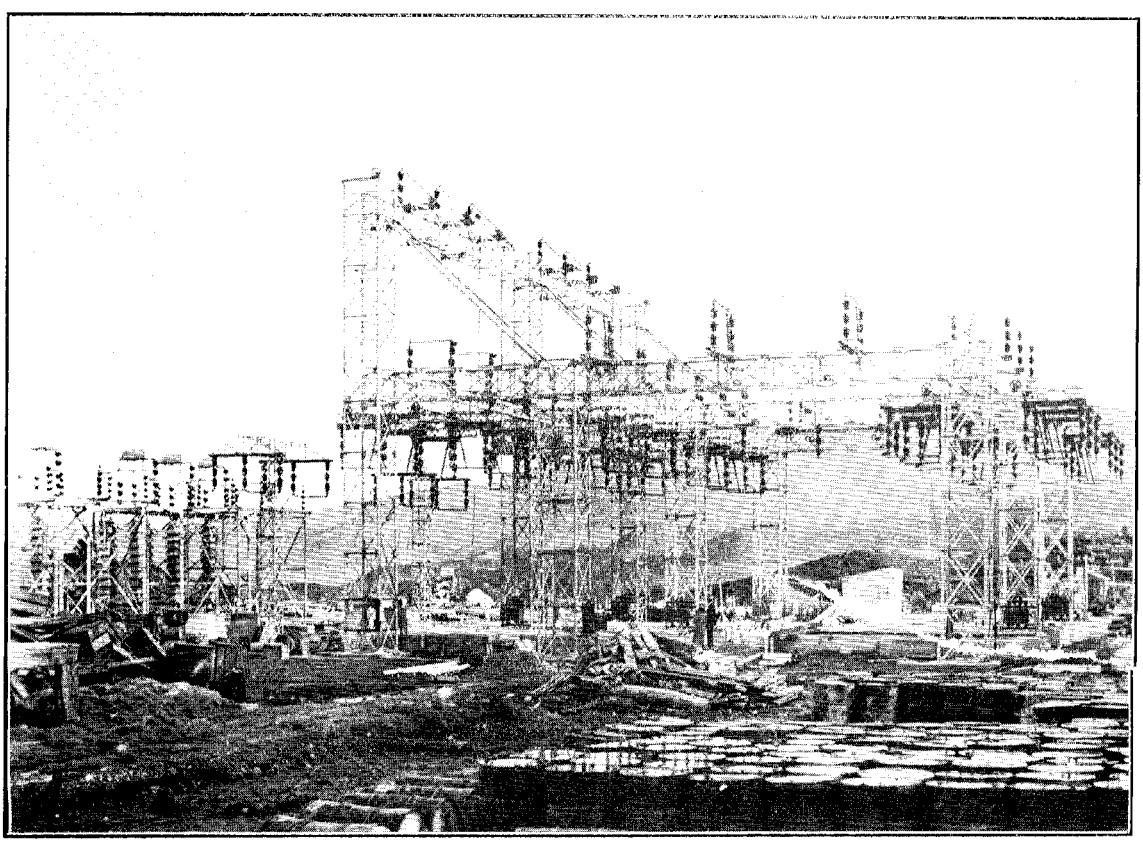


General View of Workmen's Camp and Village Settlement.

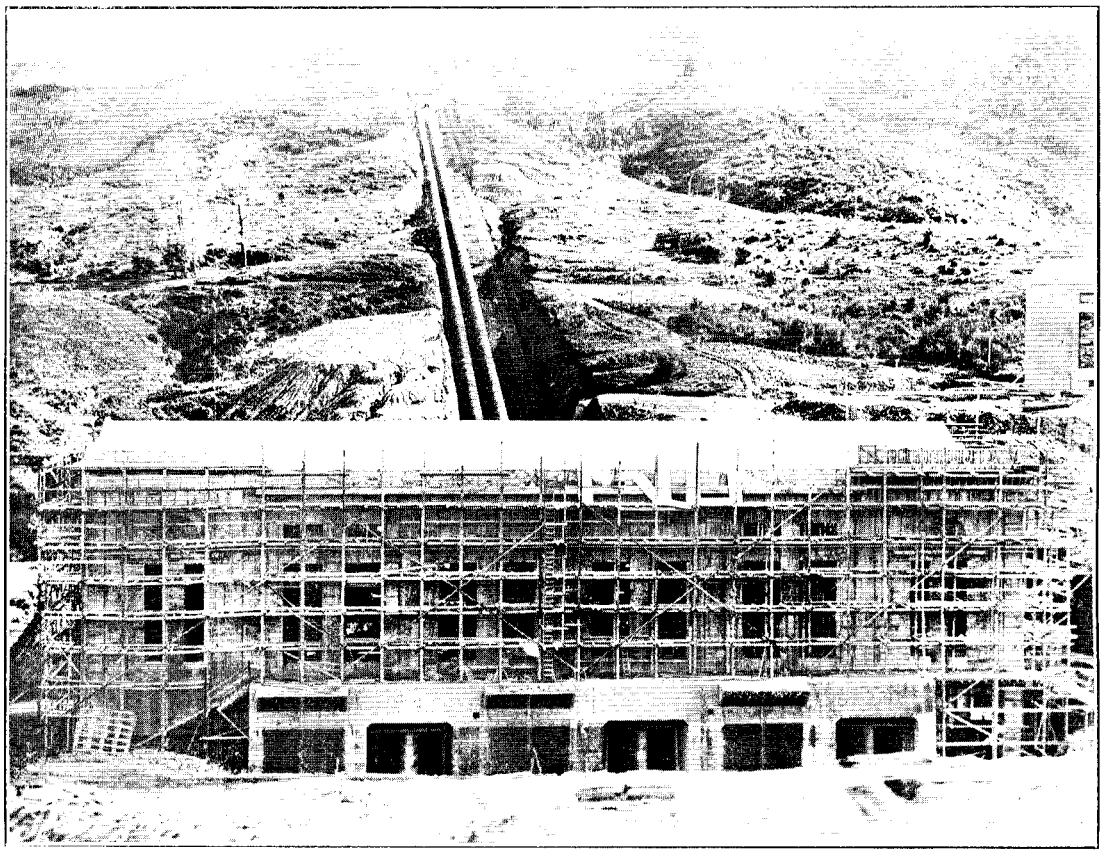
WAIKAREMOANA HYDRO-ELECTRIC SCHEME.



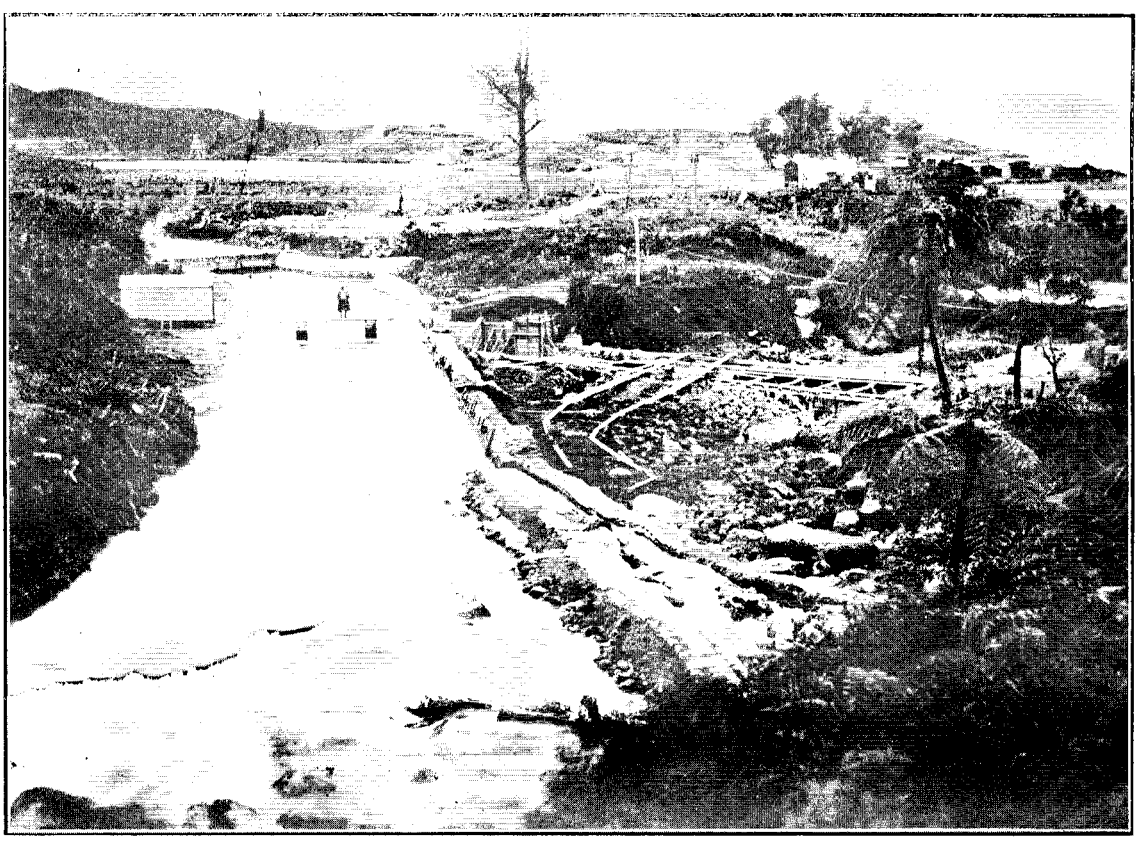
General View of Outdoor Switching-station, under Construction.
Pipe-line to power-house in background.



Outdoor Switching station, under Construction.

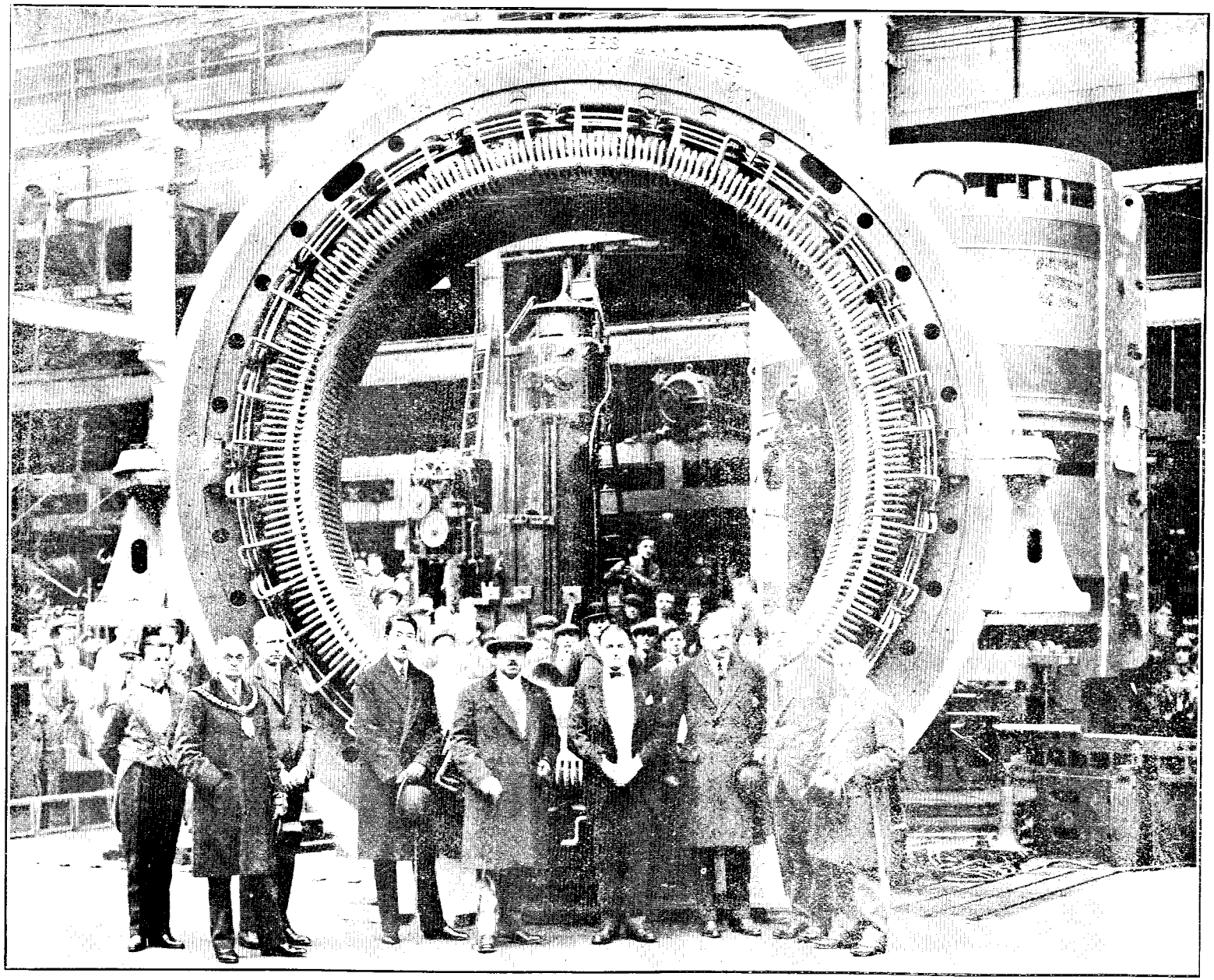


Power house under Construction.



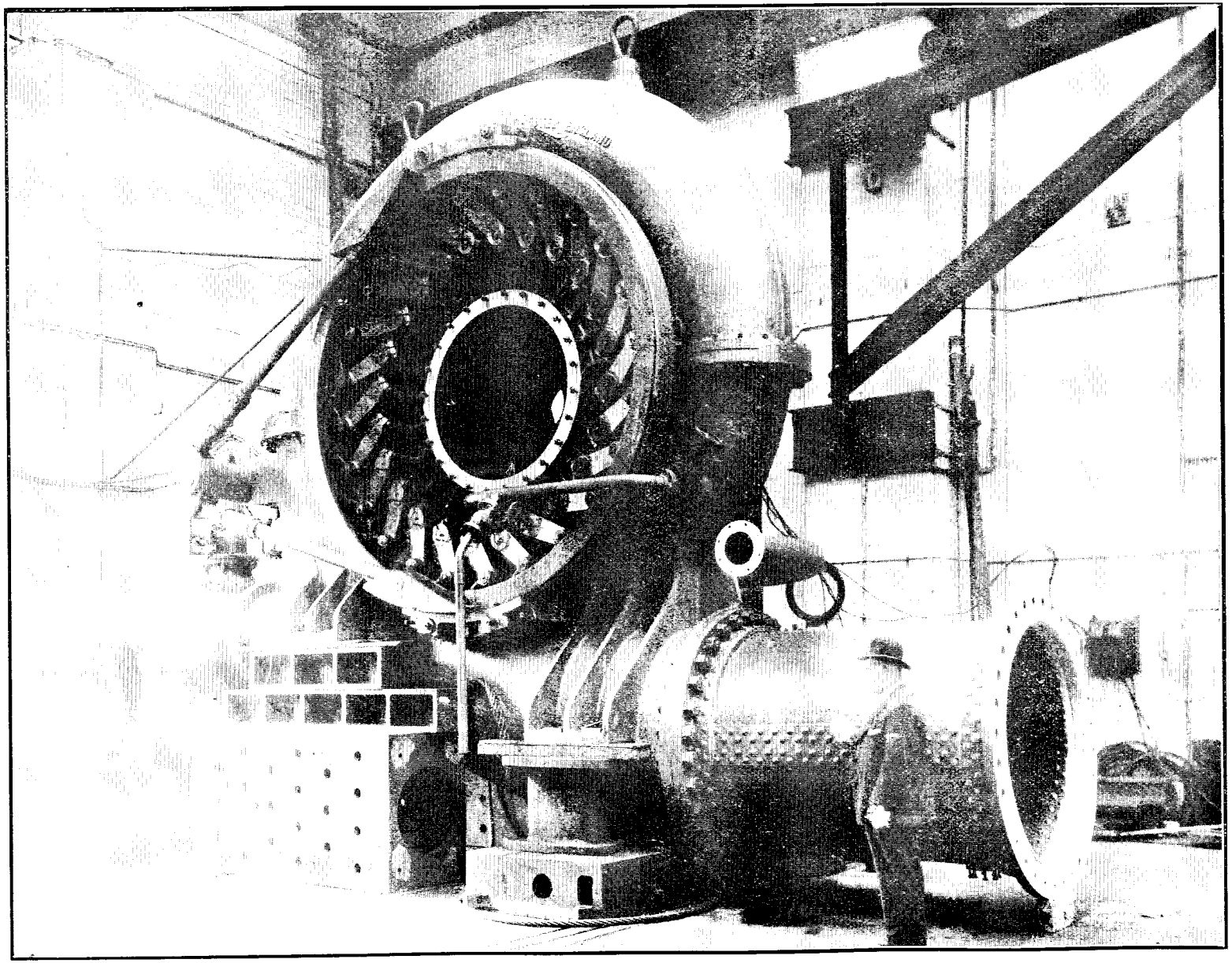
Weir and River-diversion Race.

WAIKAREMOANA HYDRO-ELECTRIC SCHEME.



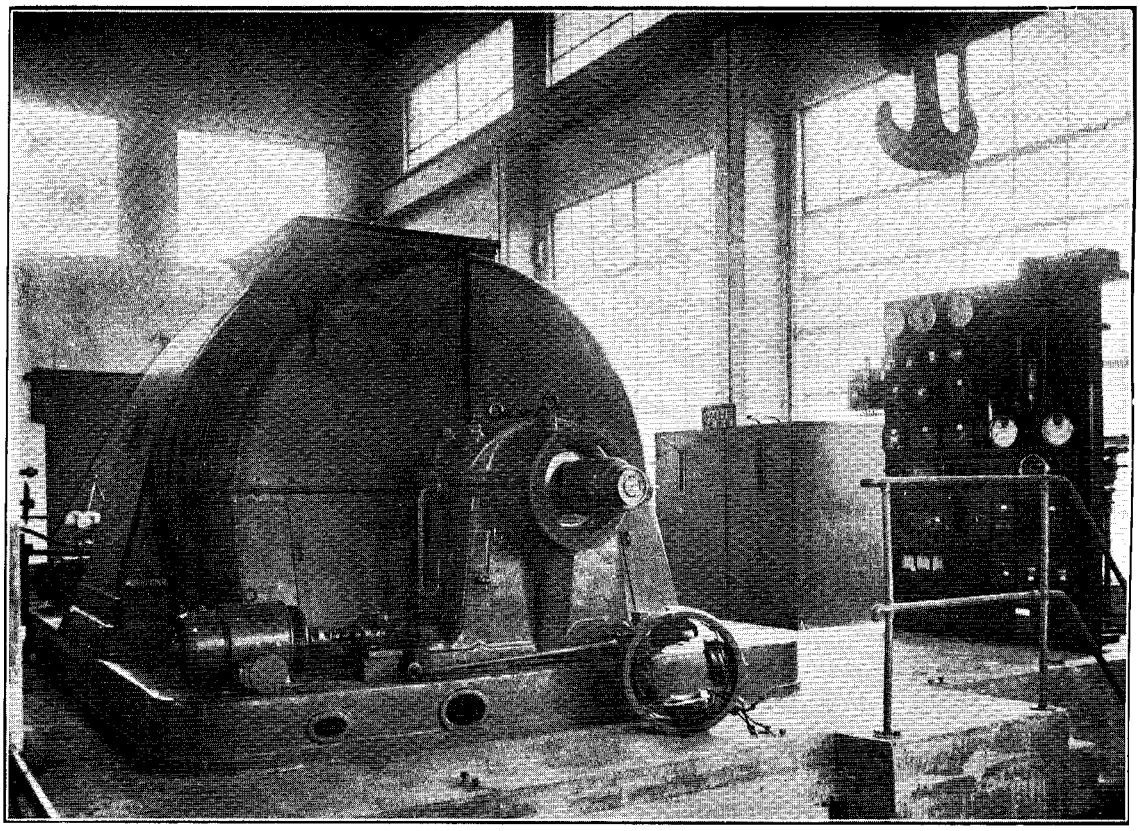
2,500 K.V.A. Generator erected in Maker's Workshops.

WAIKAREMOANA HYDRO-ELECTRIC SCHEME

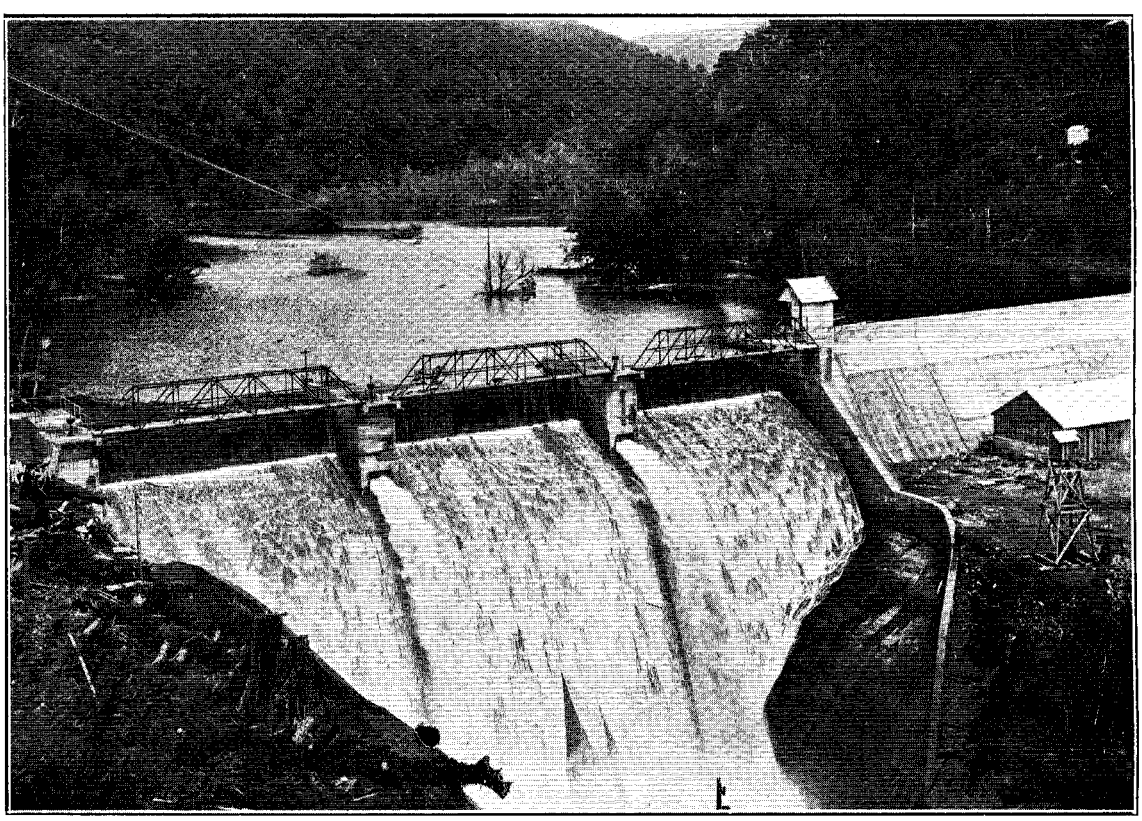


28,000 H.P. Turbine erected in Maker's Workshops.

WAIKAREMOANA HYDRO-ELECTRIC SCHEME.

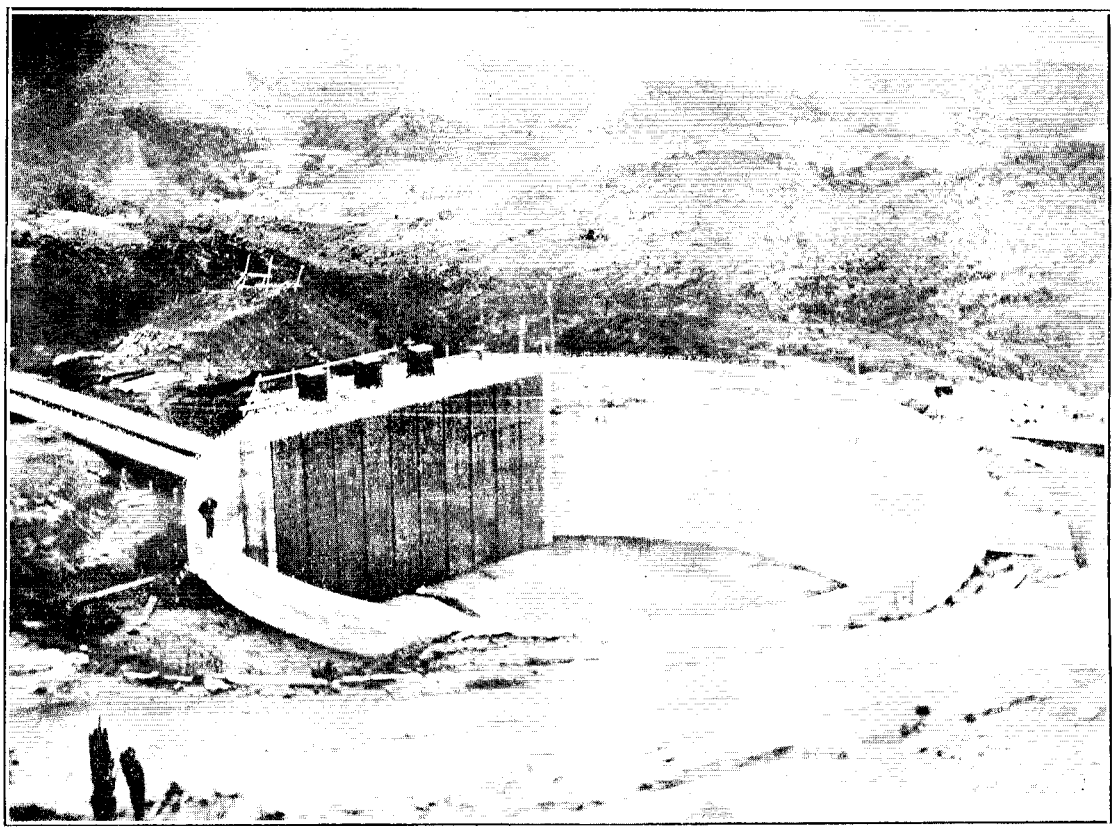


10,000 KV.A. SYNCHRONOUS CONDENSER, KHANDALLAH SUBSTATION.



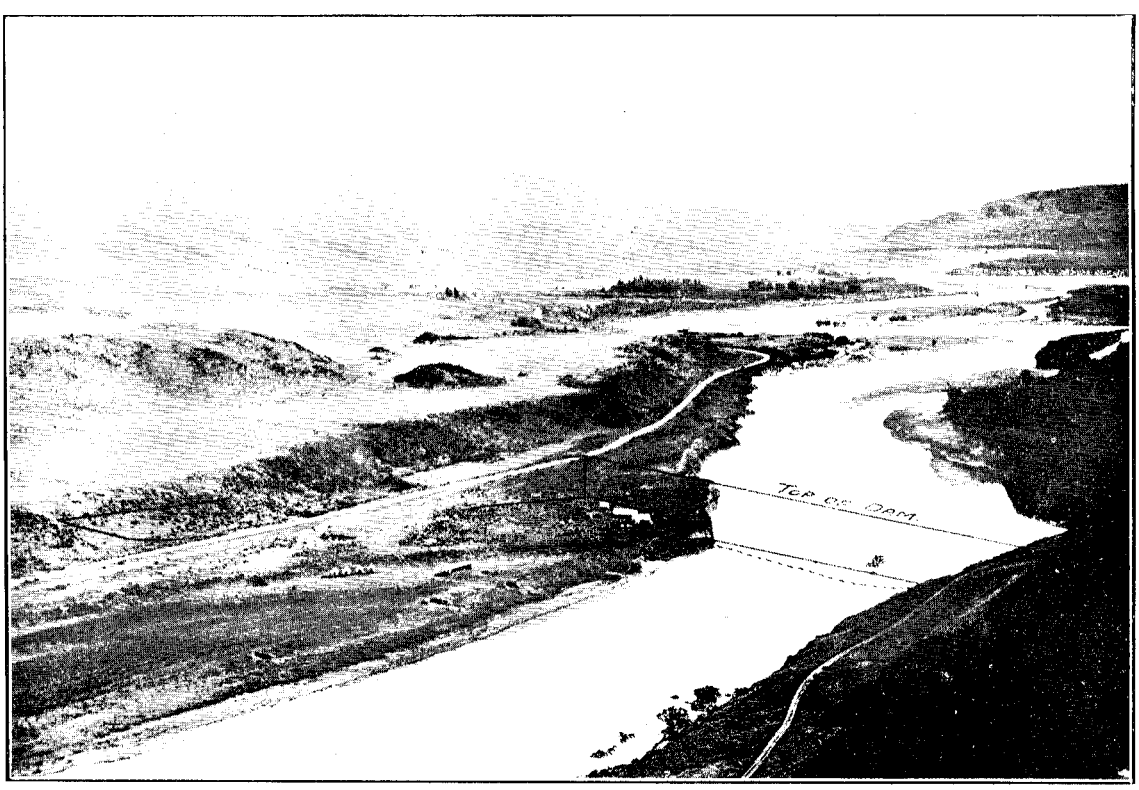
UPPER DAM, MANGAHAO RIVER.

MANGAHAO HYDRO-ELECTRIC SCHEME.



View showing Surge-chamber with Screens in Position.

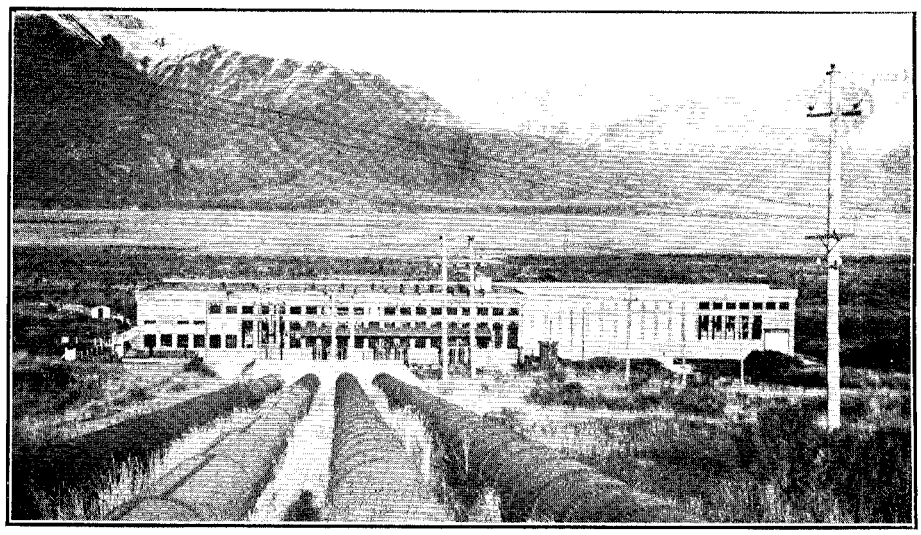
WAIKAREMOANA HYDRO ELECTRIC SCHEME.



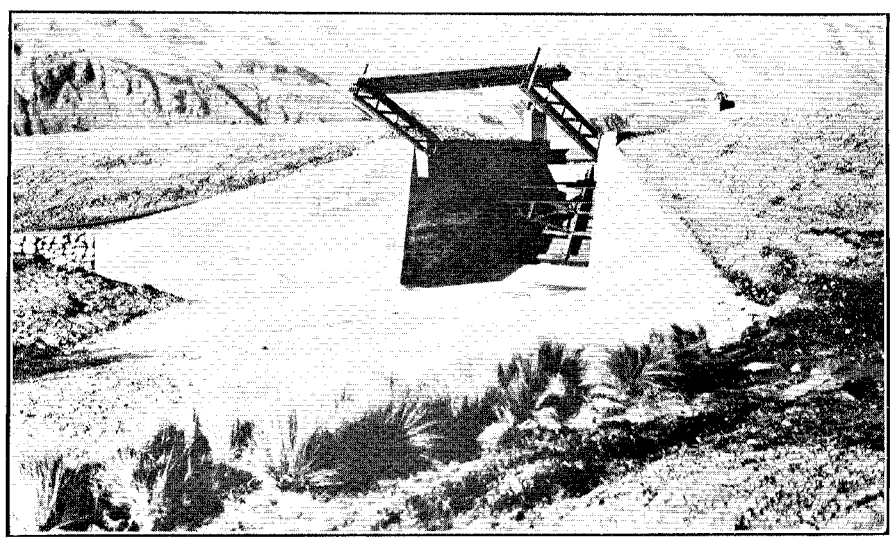
Adopted Dam-site. *Photo. D. H. Gilmour, Oamaru.*

Approximate line of dam is shown on photograph.

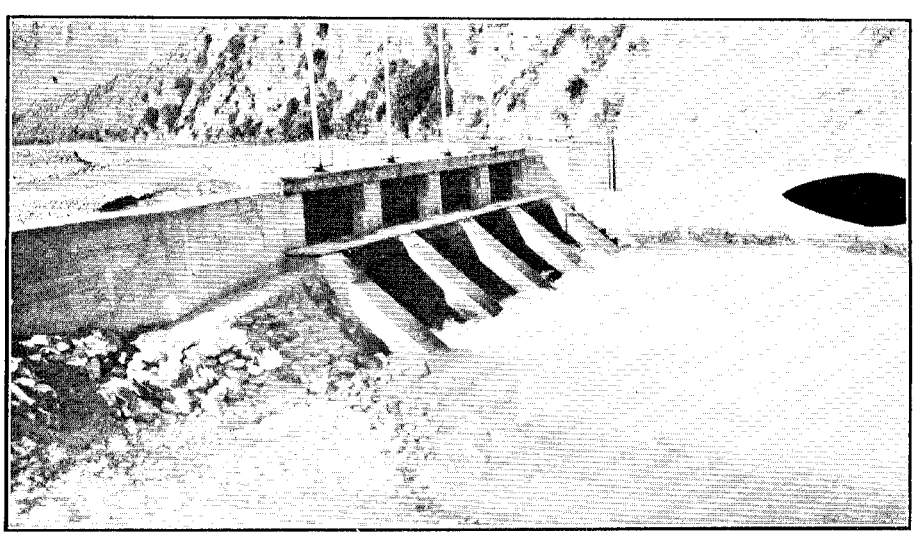
WAITAKI HYDRO ELECTRIC SCHEME.



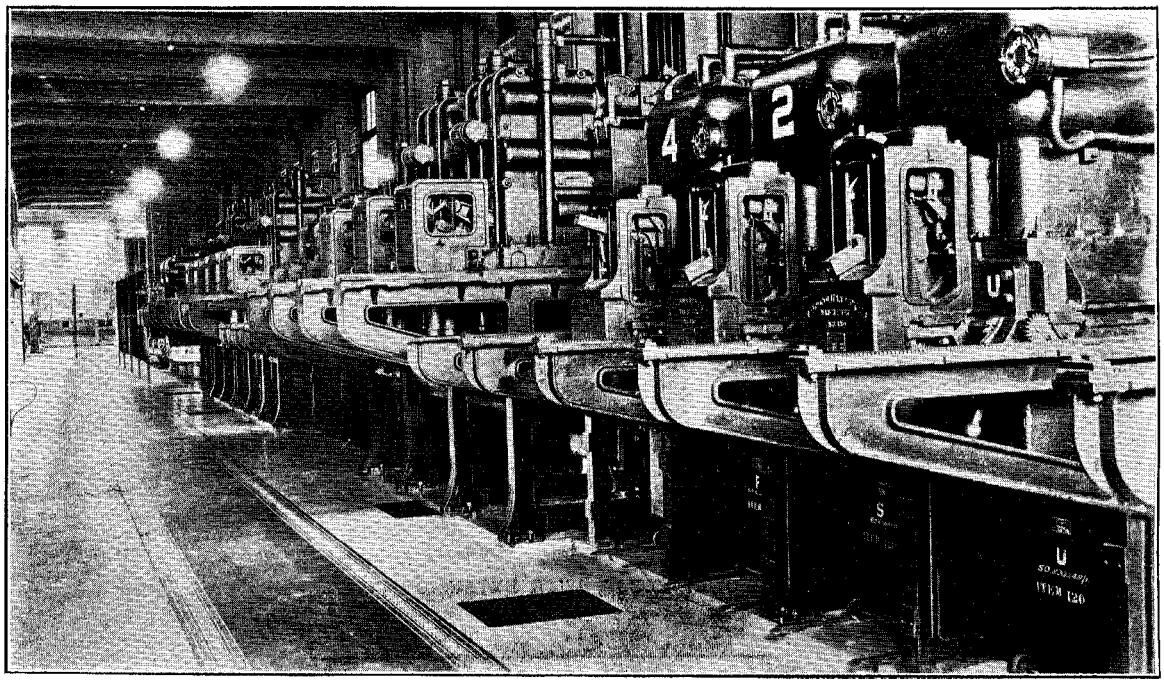
View showing Power-house, with extension completed.



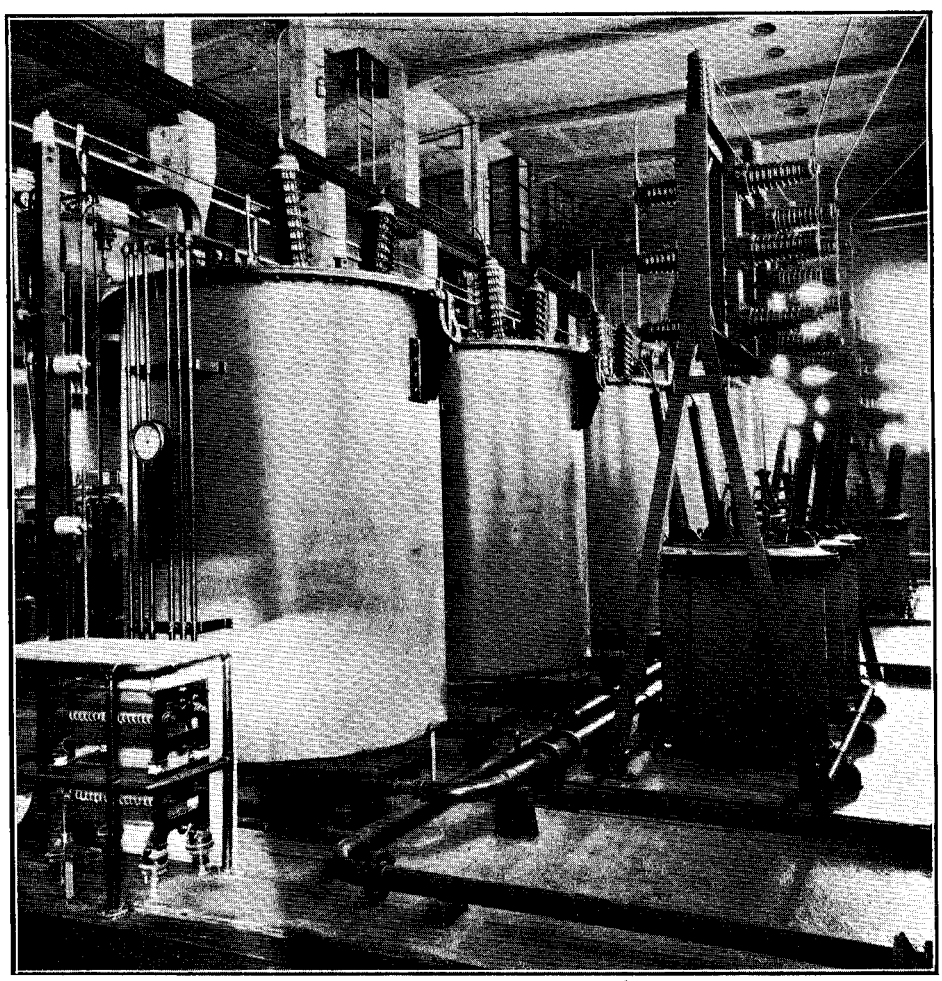
Control-gate for Lake Overflow.



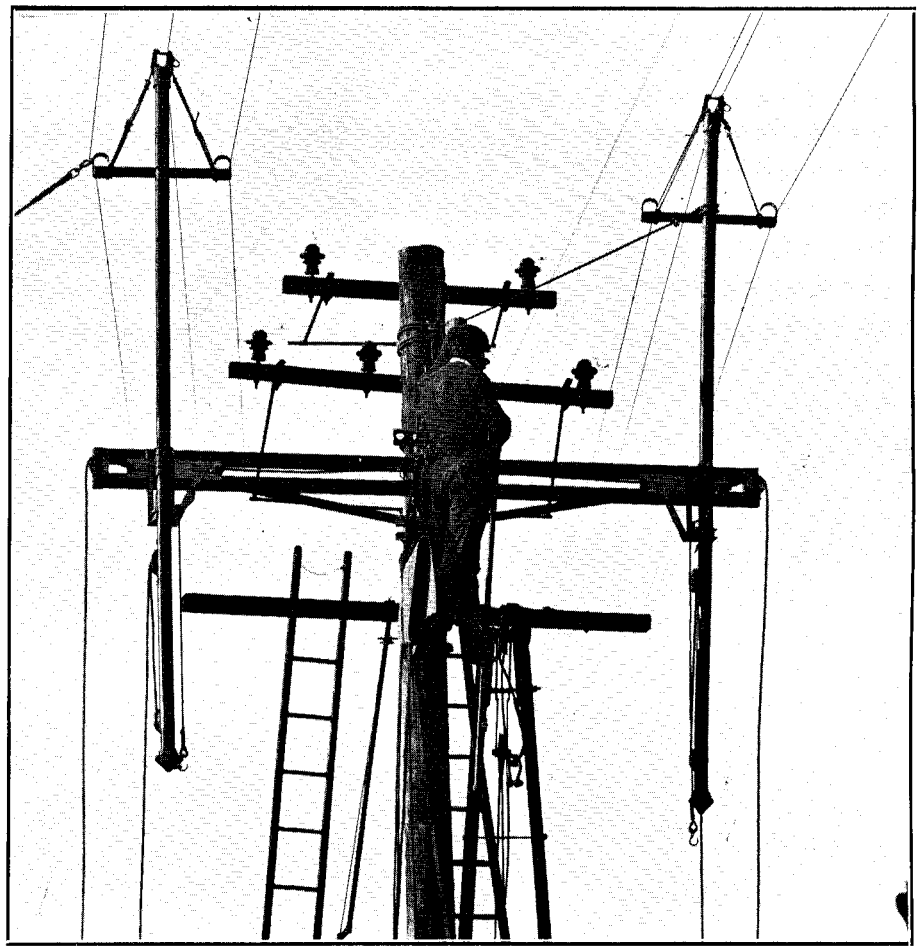
Control-gates, Harper River Diversion.



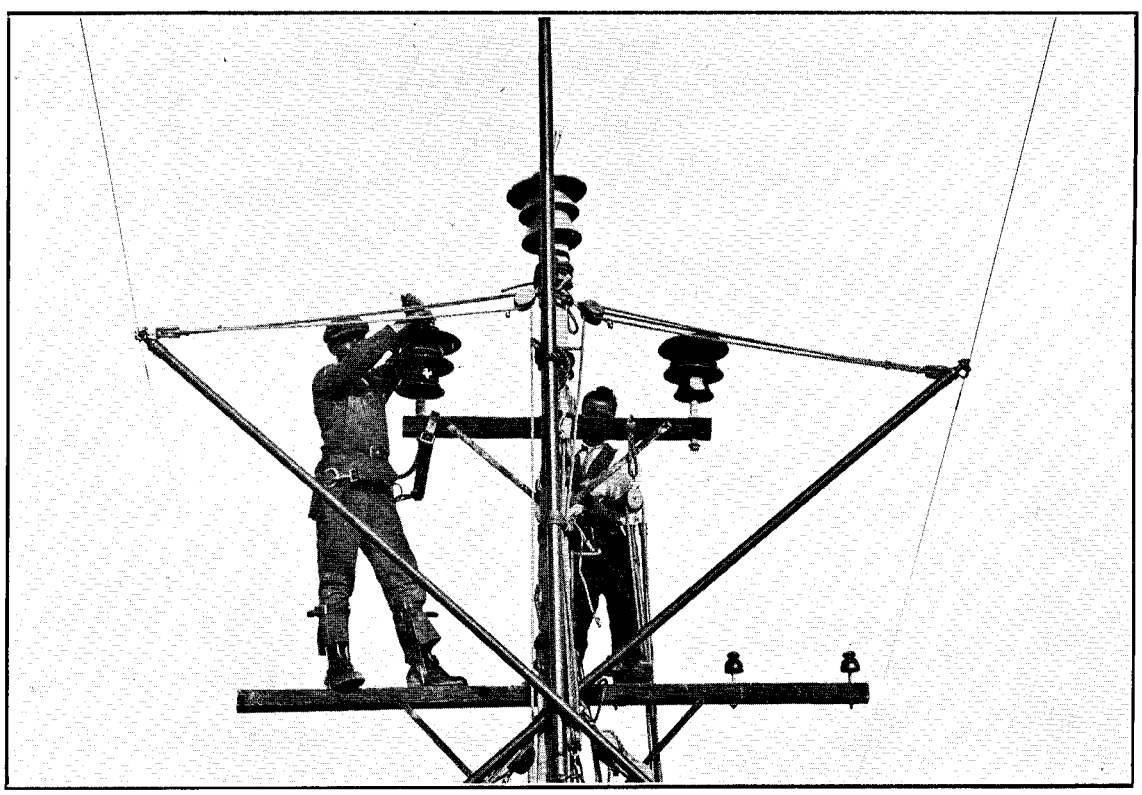
SWITCH-GEAR, LAKE COLERIDGE POWER-STATION.



ADDINGTON SUBSTATION.
66,000-volt transformers and switch-gear.



11,000-volt Live-line changing.

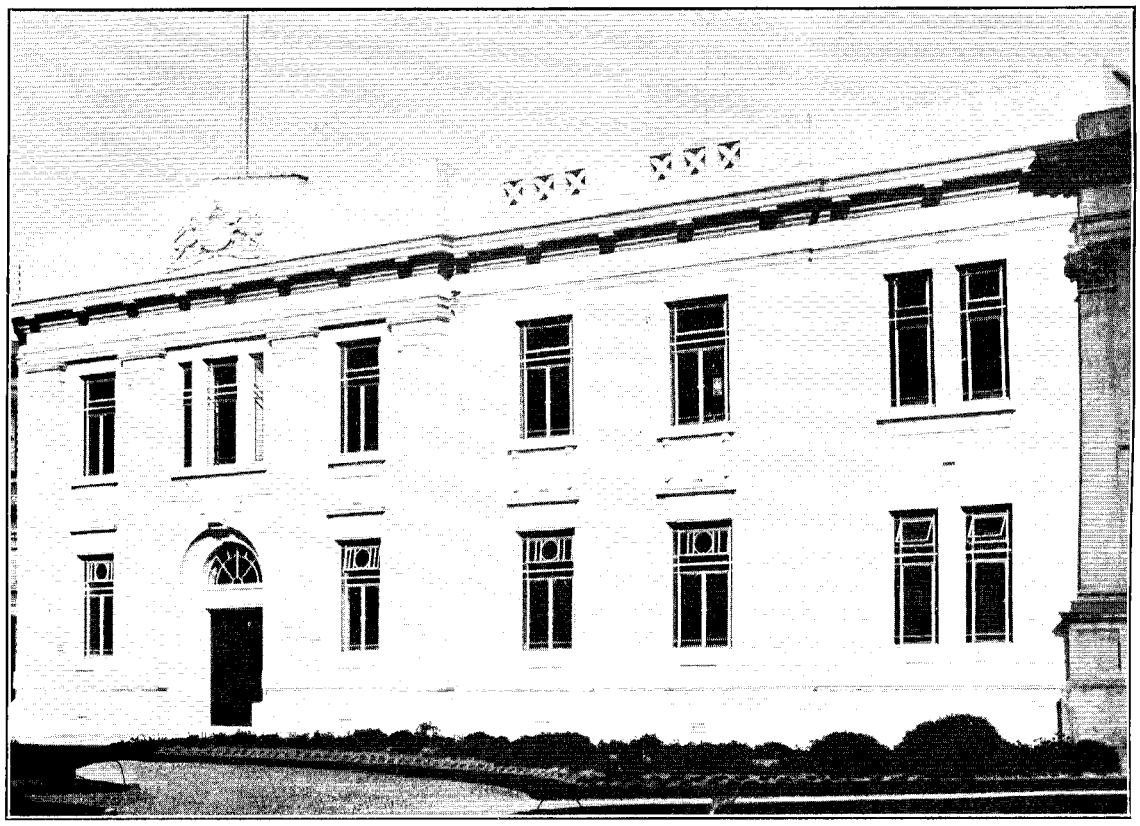


66,000-volt Live-line changing.

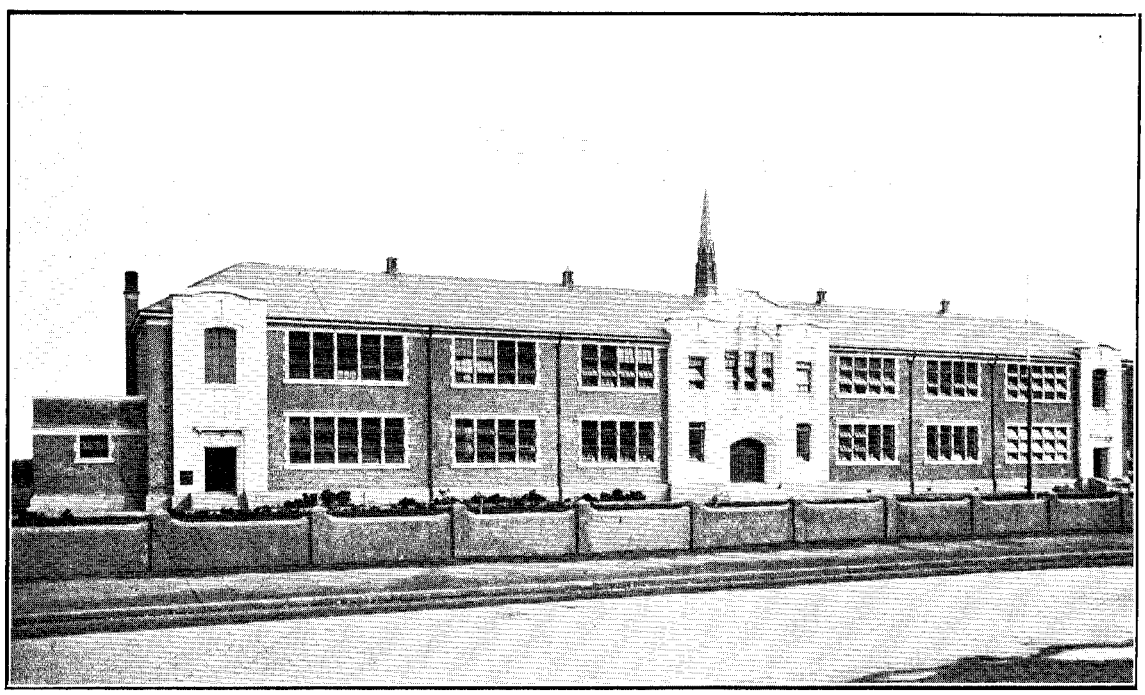
LAKE COLERIDGE HYDRO-ELECTRIC SCHEME.



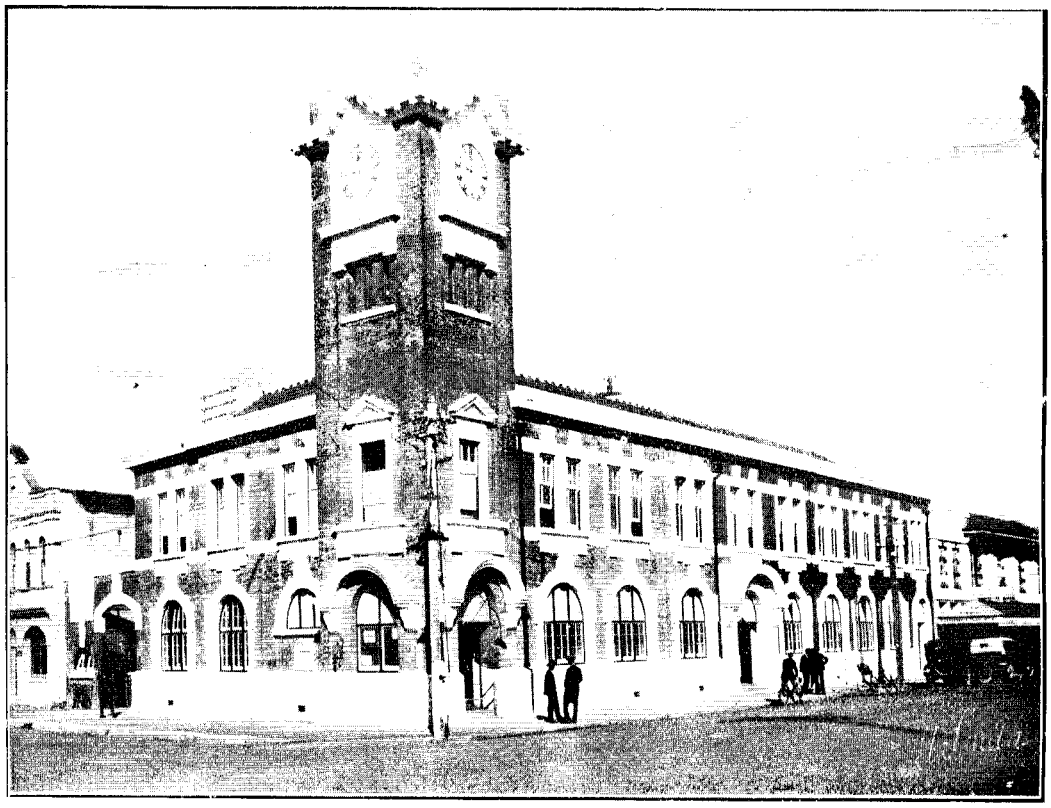
HAWKE'S BAY FALLEN SOLDIERS MEMORIAL HOSPITAL, HASTINGS.



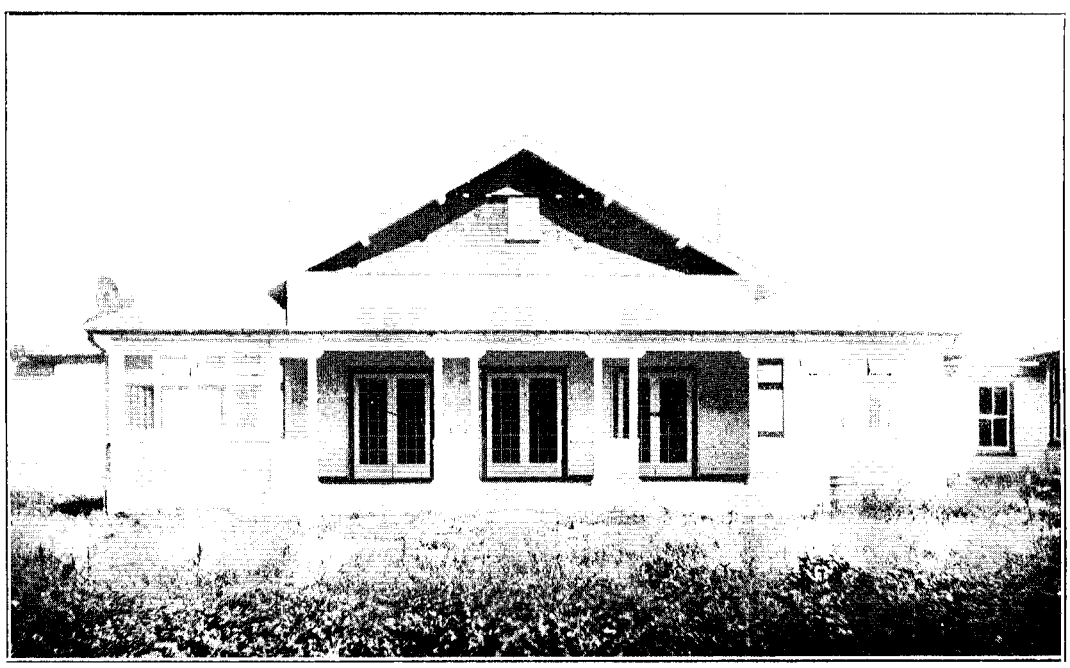
Arbitration Court, Wellington.



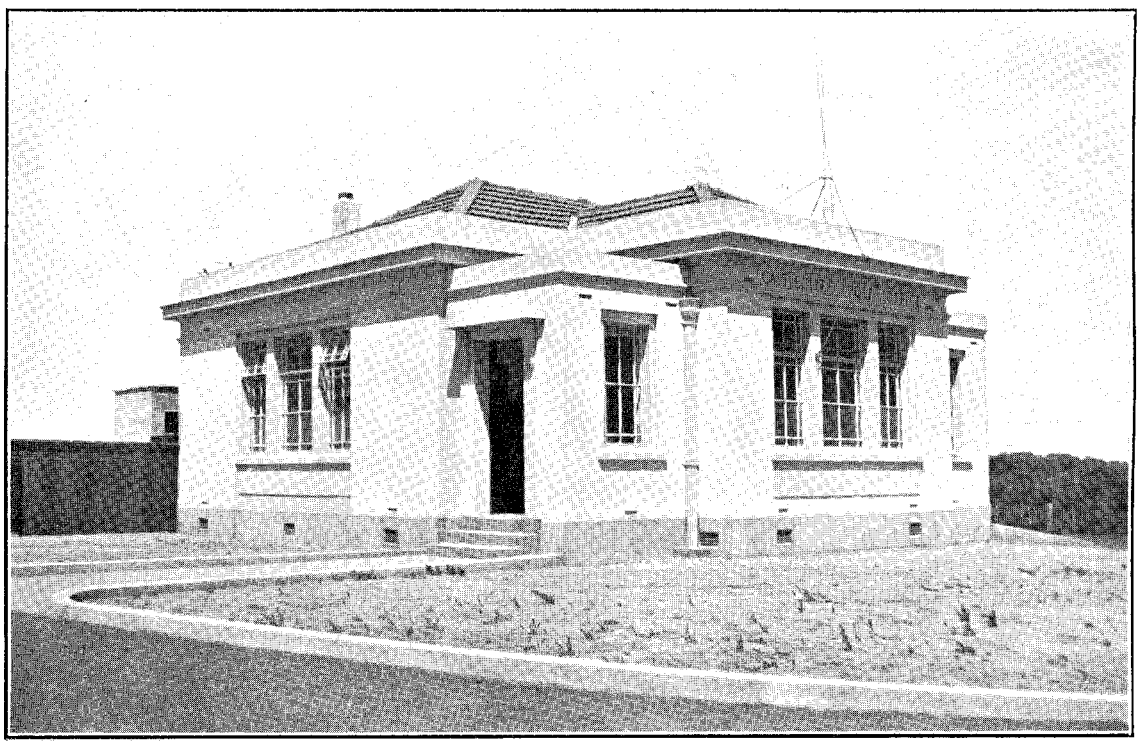
Hutt Valley High School.



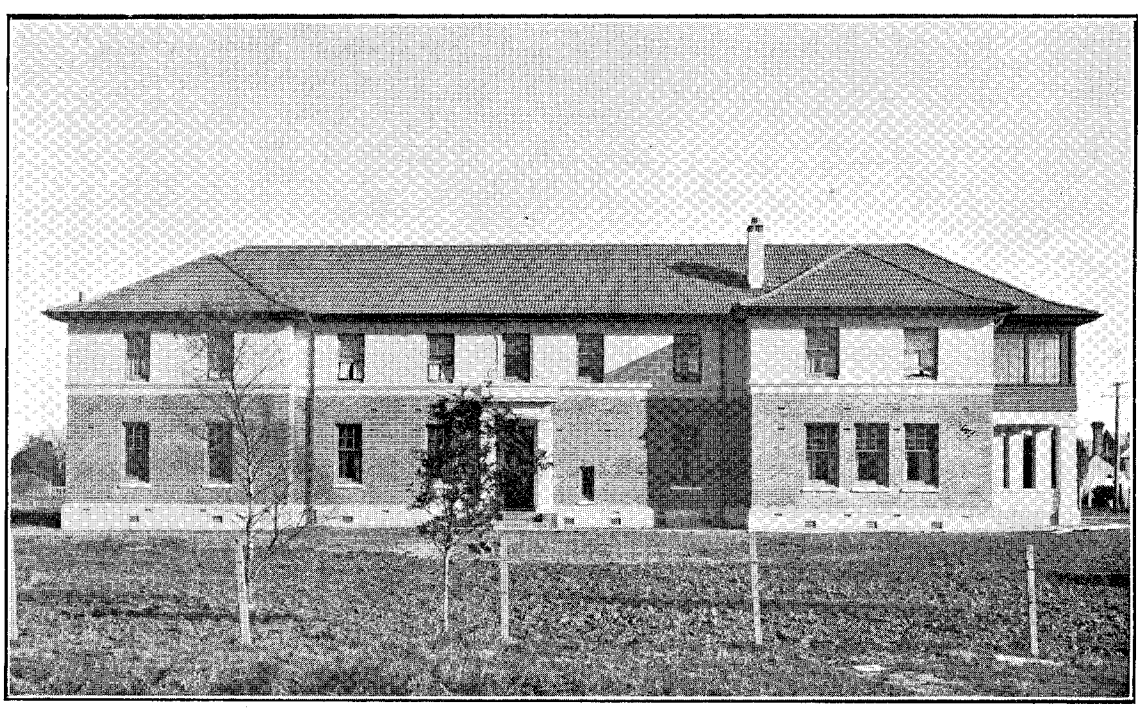
Hastings Post office.
View showing building with additions completed.



Templeton Mental Hospital.
Recreation room of villa for forty eight patients.



Castlecliff Post-office.



Gore Hospital—Nurses' Home.

PUBLIC WORKS STATEMENT, 1928.

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TABLE No. 1.

SUMMARY SHOWING THE TOTAL EXPENDITURE ON PUBLIC WORKS AND OTHER SERVICES OUT OF PUBLIC WORKS FUND TO 31ST MARCH, 1928, AND THE LIABILITIES ON THAT DATE.

Number of Table containing Details.	Works.	Total Net Expenditure to 31st March, 1927.	Expenditure during Twelve Months ended 31st March, 1928.	Recoveries on Account of Services of Previous Years.	Total Net Expenditure to 31st March, 1928.	Liabilities on 31st March, 1928.	Total Net Expenditure and Liabilities.	Works.
		£	£	£	£	£	£	
3	Railways*..	49,816,279	1,141,822	1,699	50,956,402	114,964	51,071,366	Railways.*
..	Roads†	16,261,228	705,805	1,007	16,966,026	94,445	17,060,471	Roads.†
..	Development of mining	832,975	..	1,130	831,845	..	831,845	Development of mining.
..	Telegraphs	8,666,408	625,540	..	9,291,948	227,018	9,518,966	Telegraphs.
..	Public buildings	9,920,287	223,540	7,303	10,136,524	15,277	10,151,801	Public buildings.
..	Lighthouses, harbour-works, and harbour-defences	1,225,509	23,870	165	1,249,214	1,423	1,250,637	Lighthouses, harbour-works, and harbour-defences.
..	Departmental	2,372,941	130,951	13,328	2,490,564	2,475	2,493,039	Departmental.
18 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	3,117,408	67,157	..	3,184,565	13,126	3,197,691	Immigration.
..	Purchase of Native lands	2,061,204	..	56	2,061,148	..	2,061,148	Purchase of Native lands.
..	Defence	1,241,395	39,986	465	1,280,916	..	1,280,916	Defence.
..	Charges and expenses of raising loans ..	2,496,325	100,297	..	2,596,622	..	2,596,622	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	424,609	36,673	516	460,766	4,590	465,356	Tourist and health resorts.
..	Lands improvement‡	356,283	72,898	2,574	426,607	3,170	429,777	Lands improvement.‡
..	Payment to Midland Railway bondholders	150,000	..	..	150,000	..	150,000	Payment to Midland Railway bondholders.
..	Irrigation and water-supply§ ..	734,345	49,735	2,798	781,282	2,215	783,497	Irrigation and water-supply.§
..	Plant, material, and stores	358,492	*Cr.* 1,288	8,985	348,219	7,376	355,595	Plant, material, and stores.
..	Quarries (acquisition and operation) ..	20,468	*Cr.* 9,325	..	11,143	1,997	13,140	Quarries (acquisition and operation).
..	Timber-supply and sawmills for Public Works Department	12,686	*Cr.* 6,997	..	5,689	552	6,241	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	626,000	200,000	..	826,000	..	826,000	Transfer to Main Highways Account, Construction Fund.
	Totals	101,091,084	3,400,664	40,026	104,451,722	488,628	104,940,350	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. ‡ £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, 1906–1907 to 1927–28.

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, 1906.	Expenditure.										
		1906–7.	1907–8.	1908–9.	1909–10.	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	1915–16.	1916–17.
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	2,163,227	14,353	9,132	15,075	17,003	9,441	11,681	14,694	33,914	33,219	10,010 *Cr. 10*	6,533
Public Works, Departmental	533,455	16,710	18,219	24,512	41,176	42,733	49,864	57,426	66,650	100,719	111,489	131,701
Irrigation and Water-supply	..	..	..	..	..	1,562	2,794	14,689	40,329	32,090	29,874	20,794
Railways	21,891,578	1,227,880	1,093,535	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*
Payment to Midland Railway Bondholders	150,000	..	..	..	..	..	..	..	..	..	..	..
Roads:—												
Miscellaneous Roads and Bridges	6,169,316	308,500	285,248	422,174	297,932	229,537	383,511	337,584	353,836 *Cr. 515*	484,365	400,062	203,746
Roads on Goldfields	703,987	38,970	38,494	47,375	40,830	25,626	41,067	36,761	24,143	30,065	24,432	17,099
Development of Thermal Springs and Natural Scenery ..	16,023	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account*	300,930	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	7,190,256	347,470	323,742	469,549	338,762	255,163	424,578	374,345	377,464	514,430	424,494	220,845
Development of Mining	766,961	11,064	8,633	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
Purchase of Native Lands	1,532,443	9,135	2,190	2,099	30,567	2,976 *Cr. 2,286*	*Cr. 2,466*	*Cr. 917*	*Cr. 857*	*Cr. 1,060*	*Cr. 972*	*Cr. 868*
Native Lands Purchase Account	491,980	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	2,024,423	9,135	2,190	2,099	30,567	690	*Cr. 2,466*	*Cr. 917*	*Cr. 857*	*Cr. 1,060*	*Cr. 972*	*Cr. 868*
Telegraph Extension	1,210,177	114,068	155,491	163,032	123,423	111,867	147,692	251,375	392,648	288,395	249,554	203,311
Public Buildings:—												
General (including Miscellaneous)	287,683	14,216	16,260	39,635	41,964	44,044	34,721	44,719	43,199	52,239	22,050	12,648
Parliamentary	62,323	1,047	4,119	5,172	3,157	237	2,004	18,806	23,612	31,478	17,133	22,586
Judicial { Courthouses	527,039	9,580	5,788	14,473	11,119	5,759	14,556	20,097	9,423	5,171	4,902	299
Judicial { Prisons		3,146	4,164	5,008	4,231	7,506	9,760	6,911	4,928	14,515	17,786	15,685
Judicial { Police-stations		22,466	18,986	17,730	16,256	9,030	19,817	18,423	14,094	19,122	25,484	21,147

* 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, 1906–1907 to 1927–28—*continued.*

Description of Services.	Total Net Expenditure to 31st March, 1906.	Expenditure. 1906–7.	1907–8.	1908–9.	1909–10.	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.	1915–16.	1916–17.
Public Buildings—*continued.*	£	£	£	£	£	£	£	£	£	£	£	£
Post and Telegraph	440,717	43,918	43,724	62,262	68,574	117,815	130,815	122,999	78,815	60,838	35,258	22,744
Customs	46,238	414	47	2,507	233	..	..	..	..	..	..	..
Quarantine Stations	6,865	..	..	..	..	..	..	..	..	..	..	..
Mental Hospitals	533,758	8,049	7,987	15,296	19,839	12,707	8,809	46,181	26,001	53,996	54,898	44,602
											Cr. 15	
Public Health	18,506	1,765	7,497	4,402	319	..	..	376	..	..	..	..
Health and Hospital Institutions	69,505	10,259	15,576	11,153	7,259	1,484	12,745	8,750	1,435	998	1,426	7,570
School Buildings	1,344,790	109,459	100,197	102,340	98,103	124,926	90,535	105,000	121,954	122,940	97,972	70,367
Agricultural	14,111	2,707	1,690	5,543	6,103	1,160	3,684	6,475	4,398	2,428	2,972	3,046
										Cr. 34		
Workers' Dwellings	..	..	..	..	..	..	22,644	46,455	41,741	68,275	55,893	35,437
Total, Public Buildings	3,351,535	227,026	226,035	285,521	277,157	324,668	350,090	445,192	369,600	431,966	335,759	256,131
Lighthouses, Harbour-works, and Harbour-defences:—												
Lighthouses	162,855	..	1,417	7,481	6,762	1,470	5,428	9,031	5,174	3,887	1,415	449
Harbour-works	330,293	2,963	2,867	4,439	4,548	4,092	6,004	7,415	3,346	12,563	9,355	2,280
									Cr. 1,462			
Harbour-defences	520,005	1,541	2,579	7,297	5,372	2,865	1,144	339	539	681	2,903	1,038
									Cr. 300			
Total, Lighthouses, &c.	1,013,153	4,504	6,863	19,217	16,682	8,427	12,576	16,785	7,297	17,131	13,673	3,767
Rates on Native Lands	67,113	695	837	27	..	..	..	..	..	..	..	..
Contingent Defence	854,720	14,874	18,574	10,766	4,977	6,071	10,437	23,790	30,186	15,221	37,619	9,742
Tourist and Health Resorts	71,248	42,271	45,048	24,286	14,507	5,912	13,361	12,906	14,989	8,232	5,167	1,094
										Cr. 12	*Cr. 500*	
Lands Improvement*	9,409	5,605	9,561	19,542	6,910	11,125	20,394	22,550	10,269	13,810	5,936	*Cr.* 2,731
								Cr. 383	*Cr. 432*	*Cr. 522*		
Charges and Expenses of raising Loans	1,249,304	*Cr. 5,175*	*Cr. 8,487*	575	17,715	66,367	67,470	72,950	105,449	35,495	5,037	35
					Cr. 12,000	*Cr. 66,392*	*Cr. 66,954*	*Cr. 71,681*	*Cr. 96,741*	*Cr. 34,865*	*Cr. 5,030*	..
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
Total Ways and Means Credits	..	*5,175*	*8,487*	..	..	..	*10,530*	*103,524*	*105,792*	*43,400*	*11,160*	*5,713*
Grand Total—Net Expenditure	42,790,494	2,035,144	1,909,688	2,183,245	2,022,876	1,891,918	2,190,731	2,347,965	2,455,066	2,597,109	2,363,658	5 2 588

* 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, 1906–1907 to 1927–28—*continued.*

Description of Services.	Expenditure. 1917–18.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	Total Net Expenditure to 31st March, 1928.
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	3,856	*Cr. 12,018*	*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	3,184,565
Public Works, Departmental	127,962 *Cr. 2,662*	115,419 *Cr. 4,119*	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*	2,490,564
Irrigation and Water-supply*	11,650	13,665	34,115	55,344	82,713	58,131	95,467	127,995	56,227 *Cr. 31*	56,937	49,735 *Cr. 2,798*	781,282
Railways	495,771 *Cr. 110*	387,923 *Cr. 4,924*	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*	50,956,402
Payment to Midland Railway Bondholders	..	..	..	..	..	..	..	..	..	..	..	150,000
Roads :—												
Miscellaneous Roads and Bridges	128,730 *Cr. 600*	221,887 *Cr. 997*	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*	..
Roads to give access to Outlying Districts	..	..	..	..	..	..	..	..	..	..	33,642	..
Roads on Goldfields	6,912	4,186	12,465	11,050	11,264	4,850	2,867	2,755	3,934	2,230	*Cr. 2,330*	..
											467	..
Development of Thermal Springs and Natural Scenery	..	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account	..	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	135,042	225,076	387,959	538,823	563,962	647,762	754,049	606,492	563,818	577,147	704,798	16,966,026
Development of Mining	27 *Cr. 6,545*	518 *Cr. 1,000*	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*	881,845
Purchase of Native Lands	*Cr. 57*	..	*Cr. 57*	*Cr. 57*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*	..
Native Lands Purchase Account	..	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	*Cr. 57*	..	*Cr. 57*	*Cr. 57*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*	2,061,148
Telegraph Extension	213,955	198,611	249,379	336,468	590,981	512,657 *Cr. 11,082*	717,409	957,294	931,661	558,042	625,540	9,291,948
Public Buildings :—												
General (including Miscellaneous)	11,646 *Cr. 15,067*	43,168	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*	..
Parliamentary	37,233	..	..	..	..	..	..	..	..	..	..	..
Judicial — Courthouses	21	..	868	1,400	4,358	2,018 *Cr. 13*	2,448	5,363 *Cr. 19*	7,209	1,261 *Cr. 13*	7,531	..
Judicial — Prisons	13,195	16,299	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*	..
Judicial — Police-stations	18,814	6,157	24,944	36,843	22,544	6,298	12,838	18,553	16,594 *Cr. 102*	7,411 *Cr. 13*	5,561 *Cr. 970*	..

* £6,727 previously included under Lands Improvement, now transferred to Irrigation and Water-supply.

[*Continued on page 6.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1906–1907 to 1927–28—*continued.*

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1928.
	1917–18.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	
	£	£	£	£	£	£	£	£	£	£	£	£
Public Buildings—*continued.*												
Post and Telegraph	33,525	26,072	66,543	93,364	112,906	77,211	108,395	65,917	89,865	86,052	77,194	..
				Cr. 560	*Cr. 675*	*Cr. 69*		*Cr. 210*	*Cr. 453*	*Cr. 1,114*	*Cr.* 834	
Customs	..	..	..	..	..	..	..	..	..	..	..	..
Quarantine Stations	..	..	35,490	15,529	4,581	154	171	284	..	..	..	..
Mental Hospitals	26,502	14,640	18,277	27,368	41,838	13,852	26,541	68,438	77,835	68,635	51,119	..
									Cr. 283		*Cr.* 3,600	
Public Health	..	..	..	..	..	..	..	..	..	..	..	..
Health and Hospital Institutions	4,080	2,332	8,484	4,099	26,131	20,981	7,420	27,951	31,177	15,840	14,361	..
						Cr. 1,399			*Cr. 300*		*Cr.* 310	
School Buildings	63,082	115,656	195,500	244,722	2,469	..	..	..	..	..	..	..
					Cr. 9,255	*Cr. 367*	*Cr. 1,090*	*Cr. 905*	*Cr. 1,050*	*Cr. 7,953*	..	
Agricultural	5,685	4,229	7,227	9,345	1,115	514	282	3,242	7,932	4,164	2,863	..
						Cr. 27	*Cr. 171*	*Cr. 686*	*Cr. 865*	*Cr. 310*	..	
Workers' Dwellings	15,505	7,293	26,674	..	..	..	..	..	..	..	..	..
Total, Public Buildings	214,221	235,846	469,195	500,851	334,809	255,818	188,910	243,877	280,780	315,299	216,237	10,136,524
Lighthouses, Harbour-works, and Harbour-defences :—												
Lighthouses	561	1,663	253	758	16,350	3,260	4,473	2,850	5,690	5,758	7,979	..
									Cr. 750		..	
Harbour-works	2,359	3,729	3,245	4,080	2,424	6,524	6,334	423	3,717	13,263	15,891	..
									Cr. 131	*Cr. 204*	*Cr.* 165	
Harbour-defences	56	..	..	..	..	..	..	..	..	..	..	..
						Cr. 1,235	*Cr. 16*					
Total, Lighthouses, &c.	2,976	5,392	3,498	4,838	18,774	8,549	10,791	3,273	8,526	18,817	23,705	1,249.214
Rates on Native Lands	..	..	..	..	..	..	..	..	..	..	..	68,672
Contingent Defence	6,714	8,809	10,187	8,701	15,586	1,702	4,931	27,133	89,670	34,014	39,986	1,280,916
		Cr. 922				*Cr. 463*	*Cr. 280*	*Cr. 580*	*Cr. 33*	*Cr. 751*	*Cr.* 465	
Tourist and Health Resorts	931	1,620	6,194	19,041	17,996	5,435	27,264	12,343	43,486	31,981	36,673	460,766
					Cr. 110			*Cr. 81*			*Cr.* 516	
Lands Improvement*	1,838	*Cr. 4,268*	2,964	2,064	17,478	26,204	18,182	34,172	70,493	56,267	72,898	426,607
									Cr. 19	*Cr. 135*	*Cr.* 2,574	
Charges and Expenses of raising Loans	1	..	..	184	174,280	62,399	311,905	241,930	297,180	155,373	100,297	2,596,622
Interest and Sinking Funds	..	..	..	..	..	..	..	..	..	..	..	218,500
Coal-exploration and Mine-development	..	..	..	..	..	..	..	..	..	..	..	10,835
Thermal Springs	..	..	..	..	..	..	..	..	..	..	..	14,600
Plant, Material, and Stores	6,811	20,638	47,682	169,910	106,432	*Cr. 19,708*	*Cr. 52,788*	..	34,471	*Cr. 24,148*	*Cr.* 1,288	348,219
		Cr. 31						*Cr. 12,230*	*Cr. 751*	*Cr. 1,992*	*Cr.* 8,985	
Quarries (acquisition and operation)	..	..	..	..	..	..	..	1,815	12,351	6,302	*Cr.* 9,325	11,143
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	5,689
									Cr. 104			
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	826,000
Total Ways and Means Credits	*43,492*	*11,993*	*112,864*	*19,627*	*11,616*	*20,127*	*61,914*	*73,559*	*27,474*	*146,933*	*40,026*	..
Grand Total—Net Expenditure	1,237,422	1,207,482	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	104,451,722

* 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.

TABLE No 3.

Expenditure on Railways to 31st March, 1928.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1927.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1927-28: New Works.		Expenditure under Special Acts during Year 1927-28.*	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines	Total Expenditure by General Government to 31st March, 1928.	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	179,067 17 0	..	..	..	..	..	179,067 17 0	..
Opua Wharf to Whangarei and Onerahi	607,558 8 3	..	..	10,181 1 7	*Cr.* 7,239 19 0	..	610,499 10 10	..
Otiria to Ngapuhi	125,987 0 0	..	..	..	..	..	125,987 0 0	..
Whangarei Branch (Kioreroa to Waiotira)	418,755 19 0	..	1,707 18 2	..	..	..	420,463 17 2	..
North Auckland Main Trunk—								
Ngapuhi Northwards	389,363 6 4	1 1 8	118,358 9 7	..	..	1,240 9 7	508,961 3 10	..
Helensville Northwards	2,839,632 16 8	8 9 11	160,167 14 8	609 5 3	2,392 4 0	..	3,002,793 10 8	..
North Auckland Main Trunk to Dargaville	11,623 0 3	..	12,297 18 7	..	..	..	23,920 18 10	..
Helensville to Te Awamutu	4,039,619 19 6	..	..	20,955 17 9	589,039 0 9	..	4,649,614 18 0	..
Waiuku Branch (Paerata to Waiuku)	207,735 9 10	..	..	749 10 10	401 1 10	..	208,886 2 6	..
Huntly to Awaroa	182,751 3 8	200 0 0	23 0 0	770 14 10	..	..	183,344 18 6	..
Waikokowai Branch	3,442 0 0	..	..	..	..	..	3,442 0 0	..
Frankton to Thames	487,496 6 4	..	..	191 12 2	1,614 16 6	..	489,302 15 0	..
Cambridge Branch (Ruakura Junction to Cambridge)	59,304 3 1	..	..	1,399 11 6	465 19 11	..	61,169 14 6	..
Morrinsville to Rotorua	421,985 2 5	..	32 7 2	257 16 8	1 13 6	..	422,276 19 9	..
Marton to Te Awamutu	3,013,010 9 3	..	..	7,541 9 1	4,855 3 0	..	3,025,407 1 4	..
Waipa Gravel Access Branch	114 0 0	..	..	..	..	..	114 0 0	..
Raetihi Branch	88,705 8 2	..	..	..	19 2 7	..	88,724 10 9	..
Paeroa to Pokeno	19,996 16 5	..	718 0 0	..	..	1,691 0 0	22,405 16 5	..
Paeroa to Waihi and Tauranga	1,046,322 6 8	27 10 0	108,094 4 8	1,279 18 10	*Cr.* 154 13 6	..	1,155,514 6 8	..
Tauranga to Taneatua, including Te Maunga to Maunganui Branch	1,407,081 6 0	..	55,223 16 1	..	..	854 0 0	1,463,159 2 1	..
Gisborne to Motu	623,379 7 2	..	..	..	551 15 4	..	623,931 2 6	..
Gisborne to Ormond Tramway	4,975 1 7	..	..	..	..	..	4,975 1 7	..
Napier to Gisborne—								
Gisborne Southwards	285,634 4 10	53 0 0	*Cr.* 1,295 18 3	..	..	..	284,285 6 7	..
Wairoa Northwards	24,929 5 7	..	4,956 15 0	..	..	..	29,886 0 7	..
Napier Northwards	973,281 14 4	..	333,286 14 6	..	..	4,589 0 0	1,311,157 8 10	..
Waikokopu Branch	573,315 15 5	..	*Cr.* 6,659 10 1	..	..	..	566,656 5 4	..
Wellington to Napier—								
Napier to Woodville and Palmerston North	1,043,895 6 0	20 0 0	..	14,532 17 5	8,643 6 2	..	1,067,051 9 7	..
Wellington to Woodville, including Te Aro Extension	2,168,633 7 4	..	..	52,760 0 11	302,373 8 11	..	2,523,766 17 2	..
Featherston to Martinborough	399 0 0	..	..	..	..	..	399 0 0	..
Wellington to Waitara—								
Wellington to Longburn	1,388,850 19 1	50 0 0	..	48,044 14 0	110,878 0 10	..	1,547,723 13 11	..
Foxton to Waitara and Moturoa	1,793,751 11 8	25 0 0	..	5,776 8 2	93,955 14 10	..	1,893,458 14 8	..
Mount Egmont Branch	70,686 1 6	..	..	..	..	..	70,686 1 6	..
Moturoa to Opunake	759 0 0	..	..	..	..	2,346 0 0	3,105 0 0	..
Opunake Branch (Te Roti to Opunake)	447,620 4 10	..	4,078 0 4	..	..	..	451,698 5 2	..
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, 1928—*continued.*

Lines of Railway.	Total Expenditure by General Government to 31st March, 1927.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1927-28: New Works.		Expenditure under Special Acts during Year 1927-28.*	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1928.	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)	643,393 2 6	95 0 0	76,812 2 8	..	..	..	720,110 5 2	..
Stratford to Okahukura (West End)	940,013 10 7	..	128,352 14 5	..	..	..	1,068,366 5 0	..
Nelson to Greymouth—								
Nelson to Inangahua	510,765 2 2	..	22,817 13 11	..	360 13 5	..	533,943 9 6	78,307 0 0
Stillwater to Inangahua	227,498 0 4	..	..	672 3 4	*Cr.* 4,392 16 1	..	223,777 7 7	279,685 0 0
Ngahere to Blackball	147,547 5 10	..	..	..	314 4 6	..	147,861 10 4	..
Westport to Ngakawau	193,883 5 9	..	..	9 7 5	614 12 3	..	194,507 5 5	..
Westport to Inangahua	208,750 17 5	..	23,037 6 6	..	39 6 9	..	231,827 10 8	..
Greymouth to Rewanui	255,733 4 8	..	..	6 17 4	10 16 6	..	255,750 18 6	..
Point Elizabeth Branch	74,165 3 1	30 0 0	4 0 0	..	..	..	74,139 3 1	..
Greymouth to Ross and Mikonui	356,505 18 11	..	..	6,796 5 0	39,918 4 11	..	403,220 8 10	..
Picton to Waipara—								
Picton Southwards	656,092 9 7	54 7 7	..	..	913 13 3	..	656,951 15 3	..
Waipara Northwards	380,533 0 7	..	466 8 1	2 12 6	618 13 11	..	381,620 15 1	..
Christchurch to Greymouth—								
Rolleston to Bealey	1,003,477 11 3	..	2,051 12 9	269 10 4	*Cr.* 232 0 3	..	1,005,566 14 1	61,579 0 0
Whitecliffs Branch	25,021 0 0	..	..	..	..	..	25,021 0 0	..
Greymouth to Bealey	2,050,760 13 0	368 5 6	*Cr.* 1,997 3 1	0 3 6	1,653 6 9	..	2,050,048 14 8	263,889 0 0
Hurunui to Waitaki—								
Main Line (Waiau to Waitaki)	2,274,346 8 4	..	..	7,966 7 11	141,263 0 8	..	2,423,575 16 11	316,135 0 0
Oxford Branch (Rangiora to Oxford West)	53,072 8 2	..	..	..	..	..	53,072 8 2	..
Fyreton Branch (Kaiapoi to Bennett's)	44,277 0 0	..	..	..	..	..	44,277 0 0	..
Lyttelton Branch	91,484 16 0	..	..	..	9,711 13 3	..	101,196 9 3	340,500 0 0
Southbridge Branch (Hornby to Southbridge)	91,441 0 0	..	..	..	297 12 5	..	91,738 12 5	..
Little River Branch (Lincoln to Little River)	110,846 11 9	..	..	..	..	..	110,846 11 9	..
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)	70,194 7 1	..	..	..	..	..	70,194 7 1	75,124 0 0
Waimate Branch	80,765 12 10	109 16 0	5 0 0	..	..	..	80,660 16 10	..
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	3,507,222 17 1	..	..	2,960 13 0	167,702 3 3	..	3,677,885 13 4	82,259 0 0
Duntroon Branch (Pukeuri to Kurow)	97,683 6 11	..	..	..	..	..	97,683 6 11	37,500 0 0
Ngapara Branch (Waiareka Junction to Ngapara)	26,090 0 0	..	..	..	..	..	26,090 0 0	58,009 0 0

* Railways Improvement Authorization Act 1914 Account.

TABLE No. 3—*continued.*

EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1928—*continued.*

Lines of Railway.	Total Expenditure by General Government to 31st March, 1927.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1927-28: New Works.		Expenditure under Special Acts during Year 1927-28 *	Amounts previously charged to "Surveys of New Lines" now charged to Individual Lines	Total Expenditure by General Government to 31st March, 1928.	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) ..	83,585 0 0	..	..	..	..	..	83,585 0 0	..
Waihemo Branch (Palmerston to Dunback) ..	33,515 18 3	..	..	..	..	..	33,515 18 3	..
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	680,227 0 5	465 18 0	33,900 19 7	559 3 5	..	..	714,221 5 5	..
Balclutha to Tuapeka Mouth	2,489 0 0	..	..	..	..	..	2,489 0 0	..
Catlin's River Branch (Balclutha to Tahakopa) ..	463,162 13 6	..	*Cr.* 4 0 0	..	..	..	463,158 13 6	..
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	112,143 0 0	..	..	..	..	..	112,143 0 0	..
Edendale to Glenham	53,328 0 0	..	..	139 11 6	..	..	53,467 11 6	..
Riversdale to Switzers	82,304 0 0	..	..	..	..	..	82,304 0 0	..
Seaward Bush to Catlin's (Appleby to Tokanui) ..	185,356 0 0	24 14 0	4 0 0	..	..	..	185,335 6 0	..
Otago Central (Wingatui to Cromwell)	1,438,541 7 9	..	139 19 4	..	462 10 7	..	1,439,143 17 8	..
Invercargill to Kingston—								
Main Line	366,953 9 8	..	..	..	392 14 3	..	367,346 3 11	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	357,923 14 2	165 8 10	614 0 0	..	876 0 11	..	359,248 6 3	37,097 0 0
Thornbury to Wairio	91,047 8 2	..	..	235 12 9	1,677 18 3	..	92,960 19 2	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	40,337 2 5	..	64 5 0	..	..	*Cr.* 10,720 9 7	29,680 17 10	..
Middle Island	5,763 0 0	..	..	..	..	..	5,763 0 0	..
Rolling-stock	10,184,804 19 10	..	..	12,703 4 10	6,986 6 4	..	10,204,494 11 0	..
General	7,575 1 3	..	..	601 18 1	4,012 0 6	..	12,188 19 10	..
Miscellaneous works, R.I.A.	..	..	..	..	7,741 17 0	..	7,741 17 0	..
Suspense Account, being proportion of cost of raising loans for Railways Authorization Improvement Act 1914 Account	..	..	..	..	15,874 13 3	..	15,874 13 3	..
Stock of Permanent-way Materials, 31st March, 1927 .. .. £ s. d. 10,729 14 6	10,729 14 6							
	53,756,885 7 10							
Stock of Permanent-way increased by 6,213 7 9	6,213 7 9							
Stock of Permanent-way Materials, 31st March, 1928 .. .. £16,943 2 3	..	..	..	..	..	..	16,943 2 3	..
Total	53,763,098 15 7	1,698 11 6	1,077,258 9 7	197,974 9 11	1,504,614 2 3	..	56,541,247 5 10	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
	697,408	206,626	165,679	53,401	424,346	607,989

* 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, 1928, AND THE LIABILITIES ON THAT DATE.

—	Total Expenditure to 31st March, 1927.	Expenditure for Year ended 31st March, 1928.	Total Expenditure to 31st March, 1928.	Liabilities on Authorities, Contracts, &c., 31st March, 1928.	Total Expenditure and Liabilities.
	£	£	£	£	£
Judicial*	1,359,958	33,957	1,393,915	2,758	1,396,673
Postal and telegraph	2,000,247	76,359	2,076,606	6,335	2,082,941
Customs	49,441	..	49,441	..	49,441
Offices for public Departments	762,859	41,488	804,347	531	804,878
Mental hospitals	1,215,749	47,519	1,263,268	3,952	1,267,220
Alexandra Depot, Wellington†	8,084	..	8,084	..	8,084
School buildings	3,089,393	..	3,089,393	..	3,089,393
Health and Hospitals Institutions‡	328,429	14,051	342,480	1,479	343,959
Quarantine-stations	62,464	..	62,464	..	62,464
Parliament Buildings (old buildings) ..	76,553	..	76,553	..	76,553
Parliament Buildings (new buildings) ..	393,590	..	393,590	..	393,590
Parliament Buildings (alterations to streets surrounding grounds, and purchase of land)	14,187	..	14,187	..	14,187
Government House, Wellington (land and new building)	72,645	..	72,645	..	72,645
Agricultural	95,959	2,863	98,822	221	99,043
Workers' dwellings	319,916	..	319,916	..	319,916
Miscellaneous	70,813	..	70,813	..	70,813
Totals	9,920,287	216,237	10,136,524	15,276	10,151,800

* Includes Courthouses, prisons, and police-stations. † 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, 1928.

GENERAL BALANCE-SHEET AT 31st MARCH, 1928, COMPARED WITH POSITION AT 31st MARCH, 1927.

1926–27.	*Liabilities.*	1927–28.		1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
	Aid to Water-power Works and Electric Supply Accounts—			1,608,880 17 10	Lake Coleridge scheme—		
	Debentures issued—			9,192 14 2	Assets as per separate balance-sheet ..	1,644,140 3 11	
274,000 0 0	At 4 per cent. interest	274,000 0 0			Investments, Sinking Fund	36,884 14 0	
225,000 0 0	At 4½ per cent. interest	225,000 0 0		1,618,073 12 0			1,681,024 17 11
50,550 0 0	At 5 per cent. interest	53,550 0 0					
108,450 0 0	At 5½ per cent. interest	103,900 0 0		191,664 15 7	Lake Waikaremoana scheme—		
	N.Z. inscribed stock—			15,050 4 7	Assets as per separate balance-sheet ..	652,454 5 3	
805,560 0 0	At 5 per cent. interest (due 1930) ..	806,560 0 0			Profit and Loss Account—Loss to date ..	18,756 14 2	
..	At 5¼ per cent.	160,000 0 0		206,715 0 2			671,210 19 5
293,550 0 0	At 5½ per cent. (due 1936)	294,100 0 0					
	N.Z. Consolidated Stock—				Waikato River schemes—		
542,004 10 10	At 4½ per cent. (due 1945)	542,004 10 10			Horahora—		
1,652,640 11 2	At 5 per cent. (due 1935–46)	2,577,652 19 6		883,938 15 7	Assets as per separate balance-sheet ..	1,010,006 16 5	
1,884,642 6 3	At 6 per cent. interest (due 1936–51) ..	1,884,642 6 3		30,067 1 9	Investments, Sinking Fund	40,115 8 11	
	Temporary transfer, section 40, Public Revenues Act, 1926	100,000 0 0		914,005 17 4			1,050,122 5 4
..			7,021,409 16 7				
5,836,397 8 3				1,216,032 5 4	Arapuni— Assets as per separate balance-sheet ..	..	1,997,795 13 10
	Waihi Gold-mining Company (Limited)— Purchase of Horahora works—Deed of			2,325,264 7 6	Mangahao scheme— Assets as per separate balance-sheet ..	2,450,455 1 4	
212,500 0 0	security at 5 per cent. interest ..	..	212,500 0 0	124,193 2 1	Profit and Loss Account—Loss to date ..	255,737 4 9	
				2,449,457 9 7			2,706,192 6 1
	Consolidated Fund—						
	Interest accrued on loans to 31st March,				Other schemes, surveys, &c.—		
60,640 7 3	1926	73,089 17 7		6,044 17 5	North Island	6,051 16 0	
324 11 3	Sundry creditors for interest unclaimed ..	137 13 4		11,965 10 11	South Island	27,191 13 5	
			73,227 10 11	4,622 19 10	General surveys and investigations ..	..	
60,964 18 6				22,633 8 2		33,243 9 5	
	Amount set aside as reserve to cover difference between interest payable on loans raised and interest earned from their			374 9 7		£ s. d.	
				229 4 7	Material on hand ..	558 7 7	
30,261 11 2	temporary investment pending use ..	..	31,531 18 8		Sundry debtors	5 11 10	
				23,237 2 4		563 19 5	
							33,807 8 10
6,140,123 17 11	Carried forward	..	7,338,669 6 2	6,427,521 6 9	Carried forward	..	8,140,153 11 5

TABLE No. 6—*continued.*

GENERAL BALANCE-SHEET AT 31ST MARCH, 1928, AS COMPARED WITH POSITION AT 31ST MARCH, 1927—*continued.*

1926–27.	*Liabilities.*	1927–28.		1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
6,140,123 17 11	Brought forward	..	7,338,669 6 2	6,427,521 6 9	Brought forward	..	8,140,153 11 5
	Sundry Creditors—				Charges and expenses of raising loans not distributed to schemes	..	..
106,206 11 10	Arapuni scheme	182,112 9 6		875 15 0			
7,048 16 9	Horahora scheme	15,191 2 6			Balance in Electric Supply Account at the end of the year—		
13,258 9 7	Lake Coleridge scheme	15,247 7 2					
28,023 17 3	Mangahao scheme	75,601 7 1					
14,686 3 5	Waikaremoana scheme	51,307 2 1		44,866 5 8	Cash in Public Account	30,803 17 2	
577 2 9	South Island surveys	2,632 10 11			In hands of Government officers in New Zealand	185 0 11	
169,801 1 7			342,091 19 3	2 0 0			
				79,322 4 9	In hands of Government officers in London	41,711 13 10	
							72,700 11 11
	Depreciation Reserves—			124,190 10 5			
63,782 3 2	Horahora scheme	84,271 11 6					
142,594 2 0	Lake Coleridge scheme	173,231 5 10					
64,255 5 0	Mangahao scheme	101,817 2 7					
6,326 1 0	Waikaremoana scheme	8,924 11 7					
276,957 11 2			368,244 11 6	150,000 0 0	Investment Account (funds invested until actually required for use) ..	..	..
	Sinking Fund Reserves—						
38,515 1 9	Horahora scheme	49,847 8 11					
35,442 19 5	Lake Coleridge scheme	62,465 1 10					
73,958 1 2			112,312 10 9	5,573 18 1	Interest accrued on investments to 31st March, 1926	994 18 8	
				421 7 0	Sundry debtors for interest due but unpaid	1,317 0 5	
				5,995 5 1			2,311 19 1
47,669 10 0	Reserve Fund— Horahora scheme	..	53,845 2 5				
72 15 5	Writings-off in Suspense— Lake Coleridge scheme	..	2 12 4				
6,708,582 17 3	Total	..	£8,215,166 2 5	6,708,582 17 3	Total	..	£8,215,166 2 5

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.

H. ARTHUR,
Acting-Accountant, Public Works Department.

TABLE NO. 6—*continued.*

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927.

Gross Revenue Account.

1926–27.		1927–28.			1926–27.		1927–28.		
£ s. d.	To Generating expenses, headworks, and power-house—	£ s. d.	£ s. d.		£ s. d.	By Sale of energy—	£ s. d.	£ s. d.	
2,886 4 6	Salaries	3,226 14 10			147,794 6 6	Wholesale	168,584 15 9		
1,116 9 3	Wages	1,241 0 7			269 4 8	Retail	164 5 2		
104 5 3	Supplies	57 4 1			148,063 11 2			168,749 0 11	
422 10 7	Transport of stores, &c.	251 11 7							
	Maintenance and repairs—								
2,488 16 5	Harper diversion	2,813 3 11							
267 6 10	Headworks	4,371 11 3							
582 8 11	Power-house building	559 18 8							
1,822 8 3	Power-house machinery	1,599 13 1				Rents—			
641 15 6	Roads and fences	377 0 10			1,058 18 3	Land and buildings	1,210 15 1		
640 6 5	Staff residences, &c.	651 4 4			210 3 0	Electric lines	223 5 1		
			15,149 3 2		465 13 7	Electric plant	411 9 4		
10,972 11 11					1,734 14 10			1,845 9 6	
	Transmission-lines—								
540 0 0	Salaries	529 13 11							
	Transport, including upkeep of horses,								
567 6 2	traps, cars, and cycles	532 16 3				Fees for testing and repairing electrical ap-			
3,130 9 2	Repairs to power-lines	2,562 10 1			317 3 5	pliances	..	386 12 11	
..	Live-line testing	558 13 5							
			4,183 13 8						
4,237 15 4									
	Substation, Addington—								
1,323 12 6	Salaries	1,457 15 8							
543 0 9	Wages	584 10 6							
121 12 4	Supplies	119 10 10							
	Maintenance and repairs—								
458 6 8	Buildings and yards	379 5 8				Interest from local bodies in respect of			
311 17 7	Machinery	815 1 11			7 9 4	reticulations sold on deferred payment ..	..		
			3,356 4 7		116 15 1	Earnings, motor-vehicles	145 17 7		
2,758 9 10					124 4 5			145 17 7	
	Distribution—								
212 10 0	Salaries	220 0 0							
	Transport, including upkeep of motor-								
91 9 5	vehicles	68 19 7							
	Maintenance of feeder cables, transformer								
3,138 11 9	stations, and tools	3,275 12 8							
2,017 19 1	Maintenance of secondary distribution ..	4,021 10 3							
213 18 4	Maintenance of and testing meters ..	319 13 11							
97 15 2	Earth-testing	100 17 9							
			8,006 14 2						
5,772 3 9									
23,741 0 10	Carried forward	..	30,695 15 7		150,239 13 10	Carried forward	..	171,127 0 11	

TABLE No. 6—*continued.*

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

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927—*continued.*

Gross Revenue Account—continued.

1926–27.		1927–28.		1926–27.		1927–28.	
£ s. d.	——	£ s. d.	£ s. d.	£ s. d.	——	£ s. d.	£ s. d.
23,741 0 10	Brought forward	..	30,695 15 7	150,239 13 10	Brought forward	..	171,127 0 11
	To Stand-by provision—						
1,483 9 5	Payment to Christchurch Tramway Board for energy supplied	..	..				
1,483 9 5							
	Management and general expenses—						
2,522 11 2	Salaries	5,358 6 6					
301 12 4	Sick and holiday pay to workmen ..	532 11 10					
142 17 8	Travelling-expenses	629 18 4					
379 0 0	Office-rent	336 0 0					
65 10 0	Rent of other buildings	65 10 0					
95 13 3	Postages and telegrams	104 18 2					
153 13 9	Telephone subscriptions	161 16 2					
65 3 10	Printing and stationery	47 1 1					
14 2 6	Advertising	12 8 9					
59 9 2	Accident pay	319 12 6					
125 3 0	Fire insurance	139 15 8					
163 2 6	Audit fees	95 10 6					
218 3 1	Meter-reading and line-inspection ..	266 12 6					
212 4 3	Electrical testing	238 15 3					
9 13 6	Miscellaneous trade expenses	26 11 7					
90 15 5	Duplication works opening ceremony ..	..					
72 15 5	Bad debts suspense account	2 12 4					
	Proportion of salaries, rents, and expenses, Head Office and High Commissioner's						
812 0 0	Staff	1,020 0 0					
5,503 10 10			9,358 1 2				
			40,053 16 9				
30,728 1 1							
119,511 12 9	Balance to Net Revenue Account ..	..	131,073 4 2				
£150,239 13 10			£171,127 0 11	£150,239 13 10			£171,127 0 11

Net Revenue Account.

£ s. d.		£ s. d.	£ s. d.			£ s. d.
28,167 17 2	To Depreciation at 2 per cent. per annum on completed work ..	29,862 19 7	119,511 12 9	By Balance from Gross Revenue Account ..	..	131,073 4 2
65,093 10 4	Interest for year ended 31st March	75,629 16 9				
26,250 5 3	Balance to Profit and Loss Appropriation Account ..	25,580 7 10				
£119,511 12 9		£131,073 4 2	£119,511 12 9			£131,073 4 2

TABLE No. 6—*continued.*

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

Profit and Loss Appropriation Account.

1926–27.		1927–28.	1926–27.		1927–28.
£ s. d.	——	£ s. d.	£ s. d.	——	£ s. d.
..	To Balance from previous year's statement	..	26,250 5 3	By Balance from Net Revenue Account	25,580 7 10
26,250 5 3	Sinking Fund Reserve	25,580 7 10			
£26,250 5 3		£25,580 7 10	£26,250 5 3		£25,580 7 10

Depreciation Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
	To Amounts written off—				
1,561 3 2	Motor-vehicles, tools, plant, &c.	4,929 11 0	111,526 8 0	By Balance from previous year's statement..	142,594 2 0
142,594 2 0	Balance	173,231 5 10	4,461 0 0	Interest at 4 per cent. per annum	5,703 15 3
			28,167 17 2	Amount set aside as per Net Revenue Account	29,862 19 7
£144,155 5 2		£178,160 16 10	£144,155 5 2		£178,160 16 10

Sinking Fund Reserve Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
35,442 19 5	To Balance	62,465 1 10	8,906 15 11	By Balance at close of previous year	35,442 19 5
			26,250 5 3	Amount set aside as per Profit and Loss Appropriation Account	25,580 7 10
			285 18 3	Interest	1,441 14 7
£35,442 19 5		£62,465 1 10	£35,442 19 5		£62,465 1 10
Arrears of Sinking Fund contributions at 31st March, 1928		£42,122 0 0			

TABLE No. 6—*continued.*

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

BALANCE-SHEET AT 31ST MARCH, 1928.

1926–27.	*Liabilities.*	1927–28.		1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
142,594 2 0	Depreciation Reserve Account	..	173,231 5 10	4,661 7 8	Works at Lake Coleridge—		
				10,946 6 4	Land, including fencing and planting ..	5,270 13 8	
				7,566 3 8	Coalgate Gorge Road	10,977 19 5	
				310 8 5	Service roads	7,566 3 8	
35,442 19 5	Sinking Fund Reserve	..	62,465 1 10		Service telephones	310 8 5	
				23,484 6 1			24,125 5 2
	Sundry creditors—						
10,224 13 9	On open accounts	12,339 6 7			Headworks—		
2,717 0 7	On contracts	2,596 6 2			First tunnel, including inlet and outlet		
316 15 3	For current paid in advance	311 14 5		80,728 2 10	works	80,743 2 10	
			15,247 7 2		Second tunnel, including inlet and outlet		
13,258 9 7				237,698 8 2	works	237,310 10 0	
				121,514 8 9	Pipe-lines	121,524 12 0	
				3,970 7 10	Tram-lines	3,905 7 10	
72 15 5	Writings-off in suspense	..	2 12 4	3,473 19 5	Weir at lake outlet, gauges, and fencing ..	5,173 2 0	
				23,007 6 9	Harper River diversion works	23,007 6 9	
	Balance carried to general balance-sheet—						471,664 1 5
1,618,073 12 0	Total assets as *per contra*	1,681,024 17 11		470,392 13 9			
191,368 6 5	*Less* total liabilities as above	250,946 7 2			Power-house—		
			1,430,078 10 9	53,522 12 5	Buildings, &c.	53,552 6 8	
1,426,705 5 7				151,073 9 0	Machinery, &c.	151,867 8 9	
				231 2 1	Office furniture, fittings, &c.	238 2 1	
				204,827 3 6			205,657 17 6
					Accommodation for staff and workmen—		
				24,062 18 5	Buildings, fencing, &c.	..	24,571 9 7
					Transmission-lines—		
				4,982 19 4	Land	3,924 19 2	
				178,968 15 5	Power-lines to Christchurch	182,665 4 11	
				116,253 10 11	Power-lines to South Canterbury ..	113,845 18 6	
				42,617 11 0	Power-lines, Timaru–Oamaru	42,784 16 3	
				2,480 7 8	Telephone-system	2,480 7 8	
				3,244 17 3	Linemen's cottages, depots, tools, and equipment	3,244 17 3	
				6,588 12 4	Alterations to public telegraph-lines ..	6,588 12 4	
				11,439 7 10	Point Switching Station	10,212 13 0	
				366,576 1 9			365,747 9 1
					Addington Substation—		
				3,643 0 5	Land, including cottages	3,643 0 5	
				8,835 6 10	Substation buildings	9,573 10 5	
				55,732 11 10	Machinery, &c.	60,812 12 11	
				5,865 14 3	Store buildings and workshops	5,991 16 3	
				74,076 13 4			80,021 0 0
1,618,073 12 0	Carried forward	..	1,681,024 17 11	1,163,419 16 10	Carried forward	..	1,171,787 2 9

TABLE No. 6—*continued.*

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

BALANCE SHEET AT 31ST MARCH, 1928—*continued.*

1926-27.	*Liabilities.*	1927-28.		1926-27.	*Assets.*	1927-28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
1,618,073 12 0	Brought forward	..	1,681,024 17 11	1,163,419 16 10	Brought forward	..	1,171,787 2 9
					Primary distribution—		
				7,258 16 6	Supply cables—Christchurch City ..	8,353 17 1	
				5,171 13 2	Christchurch Tramways ..	5,204 0 4	
				7,624 4 2	Lyttelton	7,868 8 1	
				26,161 4 9	Northern	26,522 17 2	
				14,016 14 0	Southern	13,406 3 4	
				4,064 7 7	Motukarara	4,064 7 7	
				10,101 12 6	Substations—Hororata	11,009 19 3	
				17,930 4 0	Ashburton..	14,097 6 6	
				25,599 17 5	Timaru	26,256 10 7	
				2,623 8 9	Oamaru	7,544 8 1	
				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	
				122,991 9 8			126,767 4 10
					Secondary distribution—		
				15,502 10 6	Supply cables and reticulation	17,001 5 3	
				30,253 17 3	Local substations	30,824 1 2	
				45,756 7 9			47,825 6 5
				6,000 11 5	Service transformers and meters	..	8,008 2 8
				8,475 1 2	Motor-cars, lorries, and cycles, &c.	..	10,568 10 8
				109 2 7	Test room equipment	..	92 12 7
				15,147 17 9	Loose tools, plant, and equipment	..	17,814 10 6
				1,729 3 9	Public telephones to the lake	..	1,729 3 9
				173 19 1	Telephones to Christchurch City Council and Tramway Board and local offices	..	173 19 1
				255 1 0	Christchurch office—Furniture and fittings ..	..	255 1 0
				53,637 12 2	Engineering, office, and general expenses on preliminary surveys and during construction	..	57,419 12 10
				38,437 8 4	Salaries of Engineers and others on preliminary surveys and during construction	..	38,737 14 3
				21,396 0 0	Cost of raising loans	..	18,469 0 0
				61,039 0 4	Interest during construction	..	61,432 11 6
				1,538,568 11 10			1,561,080 12 10
				33,222 16 9	Stocks of material, &c., on hand at date ..	..	41,793 15 5
				88 18 7	Telephone subscriptions, fire insurance, &c., paid in advance	..	167 7 2
				37,000 10 8	Sundry debtors— For current rent, work carried out, &c. ..	..	41,098 8 6
				9,055 7 5	Sinking Fund— Investment and cash in hands of Treasury	36,264 9 2	
				20 13 3	Interest accrued	620 4 10	
				116 13 6	Interest due and unpaid	..	
				9,192 14 2			36,884 14 0
£1,618,073 12 0			£1,681,024 17 11	£1,618,073 12 0			£1,681,024 17 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. 6—*continued.*

MANGAHAO ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927.

Gross Revenue Account.

1926–27.	——	1927–28.		1926–27.	——	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
	To Generating-expenses, headworks, and power-house—			118,665 15 5	By Sale of energy— Wholesale	150,727 10 7	
3,867 16 8	Salaries, wages, and allowances ..	4,133 15 5		4,505 7 8	Retail (staff cottages and construction works)	3,501 17 2	
610 13 10	Maintenance headworks, dams, and pipe-lines	626 19 7		123,171 3 1		154,229 7 9	
816 7 4	Maintenance power-house building and machinery	1,266 2 11		22,553 12 11	Less stand-by, &c.	111,744 14 11	
742 1 3	Maintenance staff-village and roads, transport and general	762 4 11		100,617 10 2			42,484 12 10
6,036 19 1			6,789 2 10				
	Transmission-lines, patrol maintenance, &c.—				Rents—		
3,368 19 10	Mangaore–Khandallah	2,952 12 7		1,266 4 6	Cottages, &c.	1,522 0 2	
2,700 9 4	Mangaore–Wanganui	3,273 14 9		8 13 0	Poles	96 7 0	
1,605 6 4	Bunnythorpe–Dannevirke	2,218 13 2		1,274 17 6			1,618 7 2
1,700 3 3	Woodville–Masterton	2,407 8 5					
1,080 6 6	Dannevirke–Napier	2,634 4 11		4 13 8	Tests and inspections	..	8 12 0
42 0 1	Miscellaneous 11,000-volt lines ..	56 18 3		..	Penalty interest	..	0 3 2
10,497 5 4			13,543 12 1				
	Substations — Operating, maintenance, &c.—						
1,941 2 0	Khandallah	2,013 7 8					
9 1 4	Otaki	3 19 6					
431 16 4	Bunnythorpe	401 7 3					
240 0 6	Dannevirke	405 7 3					
248 10 2	Waipukurau	381 15 2					
188 12 7	Woodville	422 4 4					
187 6 1	Mangamaire	402 14 0					
195 7 2	Masterton	294 3 0					
250 3 0	Wanganui	204 6 10					
..	Napier	583 1 1					
3,691 19 2			5,112 6 1				
	Management and general expenses—						
2,744 4 2	Management and office salaries, &c. ..	4,041 12 0					
1,970 14 10	Distribution salaries and expenses and transport	2,667 18 6					
275 0 1	Postages, telephones, &c.	437 6 1					
4,989 19 1	Carried forward	7,146 16 7	25,445 1 0	101,897 1 4	Carried forward	..	44,111 15 2

TABLE No. 6—*continued.*

MANGAHAO ELECTRIC-POWER SUPPLY—*continued.*

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927—*continued.*

Gross Revenue Account—continued.

1926–27.	——	1927–28.		1926–27.	——	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
4,989 19 1	Brought forward	7,146 16 7	25,445 1 0	101,897 1 4	Brought forward	..	44,111 15 2
	To Management and general—*continued.*						
116 7 6	Printing, stationery, and advertising..	302 10 10					
487 13 7	Motor-cars and general travelling-expenses	277 18 6					
453 18 9	Accident, sick, and holiday pay ..	42 15 1					
12 4 2	Fire insurance	42 12 3					
133 16 1	Audit fees	..					
20 4 2	Legal expenses	93 17 0					
480 11 9	Miscellaneous expenses	563 0 11					
			8,469 11 2				
6,694 15 1							
26,920 18 8							
74,976 2 8	Balance to Net Revenue Account ..	..	10,197 3 0				
£101,897 1 4			£44,111 15 2	£101,897 1 4			£44,111 15 2

Net Revenue Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
	To Depreciation at 2 per cent. per annum on completed works		74,976 2 8	By Balance from Gross Revenue Account..	10,197 3 0
32,997 0 0	at 31st March, 1928	35,300 13 4	56,902 9 4	Loss for year	131,544 2 8
98,881 12 0	Interest for year ended 31st March, 1928	106,440 12 4			
£131,878 12 0		£141,741 5 8	£131,878 12 0		£141,741 5 8

Profit and Loss Appropriation Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
..	To Balance from previous year	124,193 2 1	..	By Balance	255,737 4 9
..	Balance from Net Revenue Account	131,544 2 8			
..		£255,737 4 9	..		£255,737 4 9

Arrears of Sinking Fund contributions to 31st March, 1928: £66,393.

TABLE No. 6—*continued.*

MANGAHAO ELECTRIC-POWER SUPPLY—*continued.*

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927—*continued.*

Depreciation Reserve Account.

1926–27.	——	1927–28.	1926–27.	——	1927–28.
£ s. d.		£ s. d.	£ s. d.		£ s. d.
64,255 5 0	To Motor-vehicles	308 19 11	30,056 0 0	By Balance at close of previous year	64,255 5 0
	Balance	101,817 2 7	1,202 5 0	Interest at 4 per cent. per annum	2,570 4 2
			32,997 0 0	Amount set aside as per Net Revenue Account.. ..	35,300 13 4
£64,255 5 0		102,126 2 6	£64,255 5 0		£102,126 2 6

BALANCE-SHEET AS AT 31ST MARCH, 1928.

1926–27.	*Liabilities.*		1927–28.	1926–27.	*Assets.*		1927–28.
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
64,255 5 0	Depreciation Reserve	..	101,817 2 7	9,993 18 11	Headworks—		
				70,017 19 6	Land, headworks, &c.	9,990 4 7	
28,023 17 3	Sundry creditors	..	75,601 7 1	11,230 16 3	Roads, tram-lines, &c.	73,065 5 8	
				379,512 16 6	Local electric line	11,666 15 2	
	Balance carried to General Balance-sheet—			150,058 1 4	Dams 1, 2, and 3	476,658 16 0	
2,449,457 9 7	Total assets as *per contra*	2,706,192 6 1		108,469 13 2	Tunnels 1 and 2	152,300 19 10	
92,279 2 3	Less total liabilities as above ..	177,418 9 8		14,882 5 2	Pipe-line, &c.	108,788 11 3	
			2,528,773 16 5		Surge-chamber	15,045 7 10	847,516 0 4
2,357,178 7 4				744,165 10 10			
					Power-house—		
				63,347 4 6	Buildings, &c.	63,864 4 4	
				204,496 12 2	Machinery, &c.	205,852 12 2	
				8,690 17 9	Tail-race	12,870 8 8	
				2,440 0 6	Village water-supply..	18,619 11 0	
				278,974 14 11			301,206 16 2
					Accommodation for staff—Buildings, fences,		
				15,936 6 0	&c.	..	..
					Transmission-lines (110,000-volt)—		
				8,523 17 8	Lands, lines, and substations	..	
				142,423 17 5	Shannon–Khandallah	147,122 1 2	
				96,724 16 1	Shannon–Wanganui	97,742 19 4	
				45,161 6 10	Bunnythorpe–Dannevirke	45,582 5 7	
				68,086 10 0	Woodville–Masterton	68,717 13 9	
				76,577 12 6	Dannevirke–Napier	76,235 4 0	
				437,498 0 6			435,400 3 10
2,449,457 9 7	Carried forward	..	2,706,192 6 1	1,476,574 12 3	Carried forward	..	1,584,123 0 4

TABLE No. 6—*continued.*

MANGAHAO ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AS AT 31ST MARCH, 1928—*continued.*

1926–27	*Liabilities.*	1927–28.		1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
2,449,457 9 7	Brought forward	..	2,706,192 6 1	1,476,574 12 3	Brought forward	..	1,584,123 0 4
					Transmission-lines (11,000-volt)—		
				3,004 10 11	Mangaore–Shannon	3,004 10 11	
				7,344 12 11	Khandallah–Petone	4,556 10 0	
				10,349 3 10			7,561 0 11
					Substations—		
				73,473 11 4	Khandallah	78,126 6 9	
				1,666 12 8	Otaki	1,973 12 11	
				31,082 11 7	Bunnythorpe	32,621 8 1	
				20,762 16 2	Wanganui	21,312 18 7	
				13,520 12 2	Dannevirke	19,368 13 7	
				21,445 8 0	Waipukurau	21,871 17 5	
				25,052 7 4	Napier	34,409 11 10	
				12,159 17 10	Woodville	12,394 15 4	
				17,745 15 5	Mangamaire	23,584 7 1	
				12,790 7 4	Masterton	12,636 10 10	
				..	Marton	130 0 0	
				229,699 19 10			258,430 2 5
				4,602 13 3	Motor-cars, lorries, &c...	..	3,738 11 1
				961 10 10	Office furniture	..	963 19 10
				14,641 4 7	Service buildings	..	14,472 18 1
				117,515 11 9	Salaries and expenses, &c., of engineers and others on preliminary surveys and during construction	..	130,306 15 6
				75,806 18 6	Construction-tools, plant, and equipment, &c.	..	56,303 18 7
				60,059 3 7	Housing workmen, &c...	..	58,692 19 10
				217,068 13 2	Interest during construction	..	236,993 9 8
				35,591 0 0	Cost of raising loans	..	22,333 19 6
				2,242,870 11 7			2,373,920 15 9
				45,597 3 7	Stocks on hand, 31st March, 1928 (including 10 per cent. to cover administration, &c.)	39,088 16 11	
				15,714 4 2	Stocks issued but not used	7,793 4 5	
				61,311 7 9			46,882 1 4
				21,029 5 0	Sundry debtors for current, rents, &c. ..	..	29,640 9 9
				53 3 2	Telephone subscriptions, &c., paid in advance	..	11 14 6
				124,193 2 1	Net loss	..	255,737 4 9
£2,449,457 9 7			£2,706,192 6 1	£2,449,457 9 7			£2,706,192 6 1

I hereby certify that the Profit and Loss Account and Balance-sheet of the above-named electric-power scheme has 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.*

WAIKATO ELECTRIC-POWER SUPPLY—HORAHORA SCHEME.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927.

Gross Revenue Account.

1926–27.		1927–28.		1926–27.		1927–28.	
£ 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.
3,222 0 4	Salaries and wages	3,379 5 6		106,421 8 10		123,017 19 8	
84 5 8	Supplies	103 16 5		205 8 11	Less discounts and rebates	347 2 1	
50 1 1	Transport	50 12 6		106,215 19 11			122,670 17 7
	Maintenance and repairs—						
547 12 5	Headworks and buildings	761 2 3					
1,280 4 7	Power-house machinery	1,310 2 1					
128 16 9	Staff village	231 13 5					
			5,836 12 2	6 7 6	Hire of plant	9 10 0	
5,313 0 10				783 0 9	Rent of lines	780 4 11	
				1,402 14 0	Miscellaneous rents	1,490 14 2	
	Operation and maintenance of Waihi Grand Junction steam-plant		10,608 19 6	2,192 2 3			2,280 9 1
..		..					
8,787 5 9	Power purchased in bulk	..	11,268 8 7				
	Operation and maintenance of main transmission-lines (50,000-volt)—			264 1 0	Testing, oil-drying, and repairs for consumers	..	297 7 7
1,541 14 7	Horahora–Waikino	1,431 19 8					
571 18 11	Horahora–Hamilton	280 18 10		75 11 0	Fees for inspection of lines and testing of instruments, &c.	..	63 0 0
167 2 4	Mystery Creek – Te Awamutu	180 13 1					
60 2 11	Te Awamutu–Hangatiki	66 11 4		339 12 0			
10 16 8	Wairongomai–Waihou	50 6 5					
107 15 8	Horahora–Arapuni	56 12 10					
131 17 11	Arapuni–Ngongotaha	99 3 6					
48 5 2	Arapuni–Hamilton	145 5 1					
1,144 8 5	Hamilton–Penrose	3,928 7 1					
21 9 7	Penrose–Waitemata	64 19 5					
328 3 0	Katikati–Waikino	369 9 3					
..	Bombay–Waikino	58 9 11					
			6,732 16 5				
4,133 15 2							
	Operation and maintenance of main substations (50,000-volt)—						
632 7 4	Waikino	771 5 1					
470 13 0	Hamilton	593 15 0					
361 2 0	Te Awamutu	273 8 2					
87 2 4	Hangatiki	265 18 1					
309 9 3	Waihou	334 17 4					
27 9 1	Arapuni	24 3 11					
272 12 6	Ngongotaha	287 10 8					
20 3 5	Bombay	22 1 1					
943 2 3	Penrose	913 0 0					
30 7 1	Henderson	213 17 8					
11 13 7	Takapuna	272 7 10					
..	Kerepeehi	0 11 11					
..	Mamaku	5 7 2					
			3,978 3 11				
3,166 1 10							
21,400 3 7	Carried forward	..	38,425 0 7	108,747 14 2	Carried forward	..	125,311 14 3

TABLE No. 6—*continued.*

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

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927—*continued.*

Gross Revenue Account—continued.

1926–27.	——	1927–28.		1926–27.	——	1927–28.	
£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
21,400 3 7	Brought forward	..	38,425 0 7	108,747 14 2	Brought forward	..	125,311 14 3
31 5 1	Operation and maintenance of distribution substations (11,000 volt)	..	202 15 3				
	Operation and maintenance of distribution lines (11,000 volt)—						
468 11 10	Horahora–Hamilton–Frankton	367 10 0					
4 17 3	Waikino–Waihi	14 9 8					
473 9 1			381 19 8				
1,855 4 1	General supervision and management of transmission distribution systems	..	1,927 3 9				
	Management and general—						
2,918 15 8	Salaries, wages, and audit fees	3,678 12 5					
216 18 3	Accident insurance, sick and holiday pay ..	339 9 0					
330 5 8	Travelling-expenses and motor-cars ..	353 8 4					
291 3 4	Postages, telegrams, and telephones ..	295 15 2					
55 16 8	Fire insurance	65 12 6					
259 17 7	Printing, stationery, and advertising ..	160 5 6					
278 2 0	Office rent, cleaning, and lighting ..	265 16 0					
360 2 0	Experimental testing and miscellaneous expenses	197 5 8					
4,711 1 2							
23,760 1 10	Carried forward	5,356 4 7	40,936 19 3	108,747 14 2	Carried forward	..	125,311 14 3

TABLE No. 6—*continued.*

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

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927—*continued.*

Gross Revenue Account—continued.

1926–27.		1927 28.		1926-27.		1927–28.
£ s. d.	——	£ s. d.	£ s. d.	£ s. d.	——	£ s. d.
4,711 1 2	Brought forward	5,356 4 7	40,936 19 3	108,747 14 2	Brought forward	125,311 14 3
	To Management and general—*continued.*					
242 4 8	Testing, oil-drying, repairs, &c., for consumers	269 12 11				
..	Legal expenses..	5 5 0				
			5,631 2 6			
4,953 5 10						
			46,568 1 9			
28,713 7 8						
80,034 6 6	Balance to Net Revenue Account ..	..	78,743 12 6			
£108,747 14 2			£125,311 14 3	£108,747 14 2		£125,311 14 3

Net Revenue Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
			80,034 6 6	By Balance from Gross Revenue Account	78,743 12 6
	To Interest on purchase-money for plant purchased from Waihi				
37,989 7 6	Gold-mining Company, and on advances from Treasury ..	44,189 14 1			
16,481 7 0	Depreciation on completed works (2 per cent.) and on stocks	18,646 6 0			
54,470 14 6		62,836 0 1			
25,563 12 0	Balance to Profit and Loss Appropriation Account ..	15,907 12 5			
£80,034 6 6		£78,743 12 6	£80,034 6 6		£78,743 12 6

PROFIT AND LOSS APPROPRIATION ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
	Sinking Fund contributions to date, as required by section 12		25,563 12 0	By Balance from Net Revenue Account	15,907 12 5
8,448 0 0	of the State Supply of Electrical Energy Act, 1917 ..	9,732 0 0			
17,115 12 0	Reserve Fund	6,175 12 5			
£25,563 12 0		£15,907 12 5	£25,563 12 0		£15,907 12 5

TABLE No. 6 —*continued.*

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

Depreciation Reserve Account.

1926–27.		1927–28.	1926–27.		1927–28.
£ s. d.	—	£ s. d.	£ s. d.	—	£ s. d.
	To Cost of replacing—		46,443 18 4	By Balance at close of previous year	63,782 3 2
	Horahora – Waikino Line—six towers and telephone line and		1,857 15 0	Interest for year	2,551 5 9
1,059 0 2	hut..	385 6 5		Adjustment of amount incorrectly written off in 1925–26	
46 17 0	Horahora Station Oil-store floor	..	105 0 0	accounts	..
..	Amount written off for plant sold and replaced	322 17 0	16,481 7 0	Amount set aside as per Net Revenue Account	18,646 6 0
63,782 3 2	Balance	84,271 11 6			
£64,888 0 4		£84,979 14 11	£64,888 0 4		£84,979 14 11

Sinking Fund Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
38,515 1 9	To Balance	49,847 8 11	28,938 11 3	By Balance at close of previous year	38,515 1 9
				Amount set aside as per Profit and Loss Appropriation	
			8,448 0 0	Account	9,732 0 0
			1,128 10 6	Interest	1,600 7 2
£38,515 1 9		£49,847 8 11	£38,515 1 9		£49,847 8 11

Reserve Fund Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
47,669 10 0	To Balance	53,845 2 5	30,553 18 0	By Balance at close of previous year	47,669 10 0
				Amount set aside as per Profit and Loss Appropriation	
			17,115 12 0	Account	6,175 12 5
£47,669 10 0		£53,845 2 5	£47,669 10 0		£53,845 2 5

TABLE No. 6—*continued.*

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

BALANCE-SHEET AT 31ST MARCH, 1928.

1926–27.	*Liabilities.*	1927–28.		1926–27.	*Assets.*	1927–28.	
£ s. d.	Electric Supply Account—	£ s. d.	£ s. d.	£ s. d.	Works, &c., at Horahora—	£ s. d.	£ s. d.
756,990 5 8	Balance carried to general balance-sheet ..	846,967 0 0		2,168 5 9	Roads and bridges	2,168 5 9	
7,048 16 9	Sundry creditors	15,191 2 6		1,039 15 3	Land and fencing	1,039 15 3	
63,782 3 2	Depreciation reserve	84,271 11 6		11,491 11 6	Accommodation for staff and workmen ..	11,491 11 6	
38,515 1 9	Sinking Fund	49,847 8 11		175,751 9 7	Headworks	177,934 2 7	
47,669 10 0	Reserve Fund	53,845 2 5		74,123 18 0	Generating-station	73,750 6 2	
			1,050,122 5 4	40,203 2 0	Transformer building and machinery ..	40,626 9 8	
914,005 17 4				1,632 8 11	Tools and equipment	1,639 18 7	
				306,410 11 0			308,650 9 6
				..	Auxiliary plant (Waihi Grand Junction steam-plant)	..	10,298 19 1
					Transmission-lines (50,000-volt)—		
				38,460 1 3	Horahora–Waikino	38,660 1 3	
				11,001 19 2	Waikino–Katikati	11,048 13 5	
				4,561 6 6	Wairongomai–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	
				12,079 4 4	Te Awamutu – Hangatiki	12,116 18 5	
				4,875 8 7	Horahora–Arapuni	4,873 0 0	
				18,895 19 3	Arapuni–Ngongotaha	18,903 2 0	
				148 15 9	Arapuni–Te Kuiti	148 15 9	
				34,765 7 2	Arapuni–Hamilton	34,921 4 5	
				99,591 11 8	Hamilton–Penrose	100,491 0 10	
				44,979 11 0	Penrose–Takapuna	45,878 12 8	
				1,495 6 7	Linemen's cottages	1,543 0 7	
				..	Bombay–Waikino	31,727 15 8	
				301,128 19 6			335,147 19 9
					Main substations (50,000-volt)—		
				21,094 10 3	Waikino	34,432 0 6	
				8,495 12 11	Hamilton	10,311 2 0	
				6,691 0 4	Te Awamutu	6,964 5 7	
				9,351 12 6	Waihou	12,140 2 5	
				5,317 19 11	Hangatiki	6,885 13 4	
				2,318 3 3	Arapuni	2,318 19 5	
				3,627 13 7	Ngongotaha	4,183 2 2	
				2,474 18 3	Bombay	3,452 10 3	
				29,903 3 2	Penrose	35,770 19 11	
				6,156 14 5	Henderson	13,966 14 2	
				5,368 11 10	Takapuna	12,588 13 0	
				..	Mamaku	1,614 6 9	
				..	Kerepeehi	604 3 11	
				100,800 0 5			145,232 13 5
914,005 17 4	Carried forward	..	1,050,122 5 4	708,339 10 11	Carried forward	..	799,330 1 9

TABLE No. 6—*continued.*

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

BALANCE-SHEET AT 31ST MARCH, 1928—*continued.*

1926–27.	*Liabilities.*	1927–28.	1926–27.	*Assets.*	1927–28.
£ s. d.		£ s. d.	£ s. d.		£ s. d. £ s. d.
914,005 17 4	Brought forward	1,050,122 5 4	708,339 10 11	Brought forward	.. 799,330 1 9
				Distribution-lines (11,000 volt)—	
			33,162 10 5	Horahora–Frankton	33,581 10 5
			704 11 11	Waihi Grand Junction Company line ..	704 11 11
			6,000 0 0	Waikino–Waihi	6,000 0 0
			3,323 19 7	Bombay–Pukekohe	3,314 14 3
			43,191 1 11		43,600 16 7
			7,408 3 10	Distribution substations (11,000 volt)—	
				Waihi Grand Junction Co.	6,450 14 0
				Taps for consumers	2,278 0 1
					8,728 14 1
				Hamilton Area—	
			3,997 14 6	Land at Ruakura	3,997 14 6
			7,679 15 1	Stores buildings and fittings and railway-siding, Ruakura	8,127 7 1
			4,270 5 11	Staff residences, Ruakura	4,380 5 11
			3,230 17 7	Loose tools and equipment	3,678 16 6
			4,434 15 0	Motor lorries, cars, and cycles	4,101 18 0
			892 1 9	Office furniture, Hamilton	924 0 5
			227 9 6	Office accommodation	227 9 6
			7,524 17 2	Engineering, office, and general expenses on surveys and on construction	11,683 19 5
			14,513 18 2	Salaries of officers on surveys and on construction	22,619 14 5
			32,013 11 5	Interest during construction	49,568 5 5
			6,548 0 0	Cost of raising loans	11,528 0 0
			85,333 6 1		120,837 11 2
				Arapuni Area—	
			675 10 9	Electric lines and distribution	.. 675 10 9
			844,947 13 6		973,172 14 4
			11,596 2 3	General stocks of material on hand ..	.. 8,710 9 6
				Debtors—	
			27,394 19 10	For electricity and sales of material ..	28,011 14 11
			..	For payments in advance	111 17 8
					28,123 12 7
				Sinking Fund—	
			29,607 5 7	Investment and cash in hands of Treasury	39,451 5 10
			69 3 11	Interest accrued	664 3 1
			390 12 3	Interest due and unpaid	..
			30,067 1 9		40,115 8 11
£914,005 17 4		£1,050,122 5 4	£914,005 17 4		£1,050,122 5 4

NOTE.—The sum of £363,944 14s. 5d. (excluding proportion of cost of raising loans), representing various assets which form part of the permanent works of the Arapuni scheme but which are in the meantime operated in production of Horahora revenue, is included in the above figures. In connection therewith, maintenance (£17,171 7s.), interest (£17,880 15s. 10d.), depreciation (£7,278 17s. 9d.), and sinking fund (£3,639) are charged against the Horahora scheme.

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.*

WAIKATO ELECTRIC-POWER SUPPLY.—ARAPUNI SCHEME.

BALANCE-SHEET AT 31ST MARCH, 1928.

1926–27.	*Liabilities.*	1927–28.	1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
1,109,825 13 6	Electric Supply Account—Balance carried to general balance-sheet	1,815,683 4 4	4,832 5 9	Works, &c., at Arapuni— Land and fencing	9,108 15 11	
			26,549 4 8	Roads and bridges	25,893 0 9	
106,206 11 10	Sundry creditors	182,112 9 6	5,579 13 2	Houses	5,408 9 9	
			6,168 10 10	Offices and temporary buildings ..	6,206 7 10	
			43,129 14 5			46,616 14 3
				Headworks—		
			16,614 7 0	Engineering and preliminary works ..	19,649 14 7	
			710,930 8 3	Dam and other headworks under Armstrong-Whitworth's contract ..	1,194,751 5 8	
			..	Tailrace	17,816 0 6	
			727,544 15 3			1,232,217 0 9
				50,000-volt lines—		
			29,515 9 5	Waikino–Bombay	..	
			783 19 8	Ngongotaha–Opotiki	25,488 6 10	
			..	Penrose–Takapuna	..	
			..	Hamilton–Huntly	4,654 19 0	
			..	Henderson–North Auckland ..	0 9 11	
			30,299 9 1			30,143 15 9
				110,000-volt lines—		
			132,028 1 0	Arapuni–Penrose (tower) No. 1 ..	196,629 18 9	
			521 16 5	Tamaki deviation	..	
			..	Arapuni–Penrose (tower) No. 2 ..	2 9 1	
			132,549 17 5			196,632 7 10
				50,000-volt substations—		
			8,956 18 0	Bombay	30,178 17 3	
			6,254 4 4	Takapuna	..	
			3,821 12 10	Henderson	..	
			30 5 10	Huntly	42 13 10	
			70 11 5	Kerepeehi	6,989 0 0	
			929 19 0	Mamaku	..	
			2 13 0	Rangitaiki	1,126 7 0	
			1 8 3	Waiotahi	1,052 6 2	
			..	Matamata	2,530 11 5	
			20,067 12 8			41,919 15 8
				110,000-volt substations—		
			39,524 14 11	Penrose	82,633 3 1	
			438 5 11	Hamilton	3,701 15 6	
			39,963 0 10			86,334 18 7
			..	Penrose Auxiliary Station Diesel plant ..	..	45,802 3 11
1,216,032 5 4	Carried forward	1,997,795 13 10	993,554 9 8	Carried forward	..	1,679,666 16 9

TABLE No. 6—*continued.*

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

BALANCE-SHEET AT 31ST MARCH, 1928—*continued.*

1926-27.	*Liabilities.*	1927-28.	1926-27.	*Assets.*	1927-28.	
£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
1,216,032 5 4	Brought forward	1,997,795 13 10	993,554 9 8	Brought forward	..	1,679,666 16 9
				Works, &c., at Arapuni—*continued.*		
			4,088 3 11	Motor-vehicles	4,088 3 11	
			6,758 3 11	Loose tools, plant, and equipment ..	6,729 10 4	
			45,375 13 10	Engineering, office, and general expenses on preliminary survey and during construction	52,702 14 0	
			10,503 14 5	Supervision and office expenses on transmission-lines and substations during construction	25,482 13 9	
			87,985 19 1	Interest during construction	151,940 17 4	
			18,420 0 0	Cost of raising loans	48,007 0 0	
			173,131 15 2			288,950 19 4
			1,166,686 4 10			1,968,617 16 1
			48,364 10 2	Stocks of material on hand	..	28,218 16 11
			981 10 4	Sundry debtors	..	959 0 10
£1,216,032 5 4		£1,997,795 13 10	£1,216,032 5 4			£1,997,795 13 10

NOTE.—The sum of £363,944 14s. 5d. (excluding proportion of cost of raising loans), representing various assets which form part of the permanent works of the Arapuni Scheme but which are in the meantime operated in production of revenue by the Horahora Scheme, has been transferred to the accounts of the latter scheme. In connection therewith maintenance (£17,171 7s.), interest (£17,880 15s. 10d.), depreciation (£7,278 17s. 9d.), and sinking fund (£3,639) are charged against the Horahora Scheme.

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.

WAIKAREMOANA ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1928, COMPARED WITH YEAR ENDED 31ST MARCH, 1927.

Gross Revenue Account.

1926–27.		1927–28.			1926–27.		1927–28.		
£ s. d.	To Generating-expenses, headworks, and power-house (temporary development)—	£ s. d.	£ s. d.		£ s. d.	By Sale of electricity—	£ s. d.	£ s. d.	
	Operating salaries and wages	253 13 9				Wholesale consumers	2,100 0 0		
	Operating supplies	7 13 2				Retail consumers	128 10 8		
	Maintenance—							2,228 10 8	
	Pipe-lines	78 0 7				Rents—			
	Power-house building	1 15 2				Staff cottages	111 11 9		
	Turbines and generators	2 9 11				Land	33 0 0		
	Transformers	2 0 0			2,404 2 2	Plant and land leased to Wairoa Power Board	2,700 0 0		
	Switch-gear, meters, &c.	6 18 11						2,844 11 9	
	Staff houses	4 15 6							
			357 7 0						
	Management and general—								
	Salaries	15 0 0							
	Fire insurance	10 8 6							
	Printing and stationery	2 0 0							
	Postages and telephone subscriptions ..	8 0 0							
	Audit fees	5 0 0							
15 0 0	Head Office expenses	15 0 0							
			55 8 6						
2,389 2 2	Balance to Net Revenue Account	..	4,660 6 11						
£2,404 2 2			£5,073 2 5		£2,404 2 2			£5,073 2 5	

Net Revenue Account.

1926–27.		1927–28.	1926–27.		1927–28.
£ s. d.		£ s. d.	£ s. d.		£ s. d.
	To Depreciation at 2 per cent. per annum on completed works		2,389 2 2	By Balance from Gross Revenue Account	4,660 6 11
1,717 16 0	at 31st March, 1928..	2,345 9 9		Loss for year	3,706 9 7
5,038 12 0	Interest for year ended 31st March, 1928	6,021 6 9	4,367 5 10		
£6,756 8 0		£8,366 16 6	£6,756 8 0		£8,366 16 6

WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

Profit and Loss Appropriation Account.

£ s. d.		£ s. d.	£ s. d.		£ s. d.
10,682 18 9	To Balance from previous year	15,050 4 7	15,050 4 7	By Balance	18,756 14 2
4,367 5 10	Balance from Net Revenue Account	3,706 9 7			
£15,050 4 7		£18,756 14 2	£15,050 4 7		£18,756 14 2

Depreciation Reserve Account.

1926–27.	——	1927–28.	1926–27.	——	1927–28.
£ s. d.		£ s. d.	£ s. d.		£ s. d.
6,326 1 0	To Balance	8,924 11 7	4,431 0 0	By Balance at close of previous year	6,326 1 0
			177 5 0	Interest on £6,326 1s.	253 0 10
			1,717 16 0	Amount reserved for year	2,345 9 9
£6,326 1 0		£8,924 11 7	£6,326 1 0		£8,924 11 7

Balance-sheet at 31st March, 1928.

1926–27.	*Liabilities.*	1927–28.	1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.	Temporary development—	£ s. d.	£ s. d.
6,326 1 0	Depreciation reserve	8.924 11 7	34 17 11	Supervision	34 17 11	
14,686 3 5	Sundry creditors	51,307 2 1*	972 7 7	Headworks	741 1 6	
185,702 15 9	Balance carried to general balance-sheet	610,979 5 9	25,855 11 3	Pipe-lines	25,962 10 10	
			26,119 0 5	Power-house and machinery	26,348 12 9	
			3,747 1 9	Turbines and generators	3,625 14 2	
			889 13 8	Transformers and lightning-arrestors ..	901 15 7	
			75 15 6	Switch-gear	79 15 4	
			442 11 4	Workshop and equipment	442 11 4	
						58,136 19 5
206,715 0 2	Carried forward	671,210 19 5	58,136 19 5	Carried forward	..	58,136 19 5

* Excludes miscellaneous suspense charges, £702 10s. 5d.

WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1928—*continued.*

1926–27.	*Liabilities.*	1927–28.	1926–27.	*Assets.*	1927–28.	
£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
206,715 0 2	Brought forward	671,210 19 5	58,136 19 5	Brought forward		58,136 19 5
			..	Lower development—		
				Kahutangaroa Dam	..	313 16 5
				Main development—		
				Headworks—		
			816 7 11	Supervision	2,530 7 1	
			14 12 10	River-diversion weir	1,941 6 5	
			4,234 14 1	River-diversion race	6,347 3 1	
			409 14 8	Earth dam, Kaitawa	5,034 12 1	
			505 9 5	Approach canal to tunnel	4,304 17 10	
			3,496 1 4	Tunnel	16,928 18 3	
			2,226 15 8	Surge-chamber	17,269 1 5	
			5,013 6 10	Pipe-lines	59,754 3 11	
			402 17 3	Tram-line	1,533 8 5	
			2,740 2 3	Access roads	3,035 6 9	
			19,860 2 3			118,679 5 3
				Main power-station—		
			191 9 2	Supervision	1,118 8 7	
			8,856 0 5	Power-house building	44,388 6 1	
			..	Power-house cranes	4,360 13 2	
			..	Turbines, piping and valves	1 10 10	
			..	Generators	10 5 10	
			..	11 kv. switchgear, metering and control equipment	213 19 6	
			..	Battery and booster	3,489 0 5	
			..	Local service transformer	417 4 5	
			..	Electric wiring and lighting	172 11 10	
			1,402 14 7	Access road to power-house	1,318 11 11	
			..	Power-house workshop equipment ..	1,324 0 2	
			..	Station earths	109 1 10	
			10,450 4 2			56,923 14 7
			534 17 7	Outdoor station	..	58,645 14 9
			11,460 0 10	Staff village	..	21,459 19 5
				Transmission-lines—		
			2,678 3 7	Waikaremoana-Napier (110,000 volts) ..	93,307 7 10	
			1,489 1 6	Waikaremoana–Gisborne (50,000 volts) ..	9,589 4 9	
			..	Waikaremoana–Wairoa (50,000 volts) ..	22,748 12 8	
			4,167 5 1			125,645 5 3
				Substations—		
			36 7 5	Gisborne	5,339 0 5	
			..	Wairoa	2,659 18 1	
			36 7 5			7,998 18 6
206,715 0 2	Carried forward	671,210 19 5	104,645 16 9	Carried forward	..	447,803 13 7

WAIKAREMOANA ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1928—*continued.*

1926–27.	*Liabilities.*	1927–28.	1926–27.	*Assets.*	1927–28.
£ s. d.		£ s. d.	£ s. d.		£ s. d. £ s. d.
206,715 0 2	Brought forward	671,210 19 5	104,645 16 9	Brought forward	.. 447,803 13 7
				Management and general—	
			479 4 8	Exploration, preliminary survey, &c. ..	479 4 8
			7,581 5 4	Engineering and office expenses	19,947 11 11
			3,913 15 11	Salaries (office, &c.)	8,736 14 2
			887 1 11	Travelling and transfer expenses	1,712 10 5
			12,861 7 10		30,876 1 2
			13,030 3 1	Workers' accommodation	.. 15,798 18 11
			54 6 0	Accident appliances	.. 81 19 5
				Temporary service buildings—	
			3,563 5 9	Tuai and Kaitawa	4,791 8 8
			1,220 0 1	Wairoa and Napier	4,640 3 4
			4,783 5 10		9,431 12 0
			..	Harbour facilities—Waikokopu	.. 3,734 2 4
			17,109 13 4	Main roads and bridges	.. 39,801 17 3
			6,627 6 7	Land and fencing	.. 11,641 12 1
			1,064 10 4	Telephone-line to Wairoa	.. 1,064 10 4
			174 3 6	Works telephone-lines	.. 205 11 8
			3,326 2 1	Temporary power-lines	.. 3,659 2 2
			621 18 2	Temporary water-supply	.. 958 3 0
			1,484 1 3	Installation of major plant	.. 183 14 9
			5,354 17 5	Construction plant	.. 10,366 0 0
			55 4 0	Office fittings	.. 70 18 10
			129 12 7	Holiday pay to workmen	.. 1,489 9 3
			123 2 0	Accident compensation	.. 698 11 1
			7,782 18 5	Interest during construction	.. 22,623 17 3
			2,842 0 0	Cost of raising loans	.. 13,403 0 0
			46,695 9 8		613,892 15 1
			1,660 7 10	Sundry debtors	.. 3,735 6 5
			..	Plant and material transferred	.. 3,486 10 7
			7,933 18 7	Stocks of materials, tools, &c.	.. 31,339 13 2
			15,050 4 7	Profit and Loss Account—Accumulated loss to date	.. 18,756 14 2
£206,715 0 2		£671,210 19 5	£206,715 0 2		£671,210 19 5

I hereby certify that the Profit and Loss Account and Balance-sheet of the above-named electric-power scheme 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 note.—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, 1927.	Area commanded (Gross).	Area irrigated at Present.	Works authorized.		Works completed.		Expenditure to 31st March, 1928.	Remarks.
			As per Design.	During 1927–28.					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	..	20·78 (Steward Settlement)	22·88	18,000	..	14 60	50 31	14 60	50 31	12,115	Completed.
Otekaike ..	Otekaike River ..	9	15	..	22·26 (Duntroon)	20·11	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	105	16·07 (Moa Creek)	15·92	28,918	11,248	73 0	54 0	73 0	29 50	170,701	Completed.
Galloway ..	Manorburn Dam ..	..	30	26	13·99 (Galloway)	12·11	3,456	2,396	10 50	10 7	10 50	10 7	23,351	Completed.
Manuherikia – Alexandra-Clyde No. 1	Manuherikia River	77	100	84	15·54 (Alexandra, Ophir, and Clyde)	13·27	11,000	5,635	23 0	46 20	23 0	46 20	223,366	Completed.
Ardgour	Lindis River ..	35	20	..	18·99 (Tarras)	17·67	2,000	1,494	13 0	2 40	13 0	2 40	34,371	Completed.
Arrow River ..	Arrow River	40	50	..	23·50 (Arrowtown and Frankton)	21·40	6,536	..	..	..	7 51	18 77	55,809	Construction is nearing completion.
Hawkdun (formerly Mount Ida)	Tributaries of Manuherikia River and Eweburn Reservoir	..	60	..	24·37 (Naseby and Naseby Plantation)	21·99	10,000	..	66 0	101 0	66 0	30 39	41,802	Construction is well in hand.
Earnscleugh (Fraser River)	Fraser River ..	10	47 (all races)	47	14·26 (Earnscleugh)	12·32	2,743	1,900	11 30	17 60	11 30	17 60	12,670	Extension has been completed, and whole scheme is in working order.
Last Chance (Fruitlands and Earnscleugh Tops)	Shingle, Coal, Gorge, and Butcher's Creek	8	20	14	14·42 (Earnscleugh and Roxburgh East)	13·89	4,300	2,960	22 0	5 70	20 78	5 70	28,872	Completed.
Tarras	Lindis River ..	35	70	..	18·99 (Tarras)	17·67	7,000	4,373	21 70	17 55	21 70	17 55	133,099	Completed.
Bengerburn ..	Bengerburn ..	1	4	4	..	..	1,000	144	2 6	..	2 6	..	770	Completed.
Teviot River ..	Teviot River and Lake Onslow dam	40	80	45	14·58 (Roxburgh East)	15·47	3,300	2,799	16 51	10 55	16 51	10 55	44,844	Completed and serving all land requiring water.
Teviot River Extension	Ditto	40	80	45	14·58 (Roxburgh East)	15·47	2,000	..	..	..	3 76	2 5		Construction is well in hand.

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, 1927.	Area commanded (Gross).	Length of Main Canal.	Length of Distributaries.	Expenditure to 31st March, 1928.	Remarks.
		Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Miles.	Miles.	£	
Maniototo (Upper Taieri)	Taieri River and storage dam	25	500	17·56 (Waipiata)	16·45	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	21·19 (Luggate)	17·01	15,000	10	30	3,174	Development would be costly.
Upper Manuherikia ..	Manuherikia and Dunstan Rivers, and storage dam in Manuherikia River at Falls	77	500	20·30 (Clyde, Ophir, and Blackstone Hill)	22·66	96,000	130	..	5,259	Further investigations into water requirements and areas available, and revised estimates have been made.
Hawea Flats (first alternative)	Timaru Creek (gravity)	20	30	25·85 (Hawea Flat)	23·92	4,000	11	20	49	To irrigate lower flat only.
Hawea Flats (later alternative)	Hawea River (pumping)	..	..	25·85 (Hawea Flat)	23·92	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	..	..	14·65 (Alexandra)	11·23	100	..	..	16	..
Bendigo Flat	Lindis River and storage dam	35	30	18·99 (Tarras)	17·67	3,000	7	..	..	The greater portion of this area is now served.
* Teviot River Extension	Teviot River and Lake Onslow dam	40	80	14·43 (Roxburgh East)	16·81	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 ..	6 (after existing rights)	12	21·19 (Luggate)	17·01	1,200	..	..	273	To supply water to part of Mount Pisa settlement lands.
Scandinavian	Tributaries of Manuherikia River	..	20	30·57 (St. Bathan's)	39·37	4,000	..	..	..	For lands about St. Bathan's. Includes £12,000 towards cost of Falls dam. Upper Manuherikia scheme.
Soil Survey (Central Otago)	..	..	..	..	..	..	..	..	2,534	This soil survey in the irrigation districts is now complete, and plans are being prepared. 250,000 acres were surveyed this year.
Investigation of proposed schemes	..	..	..	..	..	..	..	..	120	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, 1928.

APPENDIX A.

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1927–28.

Prepared in compliance with Section 8 of the Public Works Act, 1908.

SIR,— Public Works Department, Wellington, 6th July, 1928.

In compliance with the 8th section of the Public Works Act, 1908, 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.,

K. S. WILLIAMS,
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 1927–28.

Vote.	Summary.	Appropriation.	Gross Expenditure.	Credits-in-Aid.	Net Expenditure.
	General Purposes Account—	£	£ s. d.	£ s. d.	£ s. d.
42	Public Works, Departmental	141,397	237,502 7 1	106,814 10 7	130,687 16 6
43, 44	Railways	1,507,000	1,418,645 1 10	276,823 2 11	1,141,821 18 11
45–52	Public Buildings	329,600	238,593 1 4	15,052 13 5	223,540 7 11
53	Timber-supply and Sawmills, &c., for Public Works Department	15,000	16,937 0 10	23,934 3 6	*Cr.* 6,997 2 8
54	Acquisition and Operation of Quarries for Public Works Department	25,000	25,276 2 8	34,601 0 1	*Cr.* 9,324 17 5
55, 56	Lighthouses and Harbour-works	25,250	25,175 10 11	1,305 3 7	23,870 7 4
57	Development of Tourist Resorts	50,000	36,838 7 1	165 0 4	36,673 6 9
58	Department of Immigration	125,000	177,617 9 4	110,460 5 11	67,157 3 5
59–61	Roads, Bridges, and other Public Works ..	848,250	808,572 12 9	102,767 12 2	705,805 0 7
62	Telegraph Extension	750,000	684,546 10 5	59,006 15 3	625,539 15 2
63	Contingent Defence	50,000	40,127 18 7	141 10 6	39,986 8 1
64	Lands, Miscellaneous	119,100	76,908 3 6	4,010 2 1	72,898 1 5
65	Irrigation, Water-supply, and Drainage ..	83,320	54,997 3 3	5,262 1 2	49,735 2 1
66	Plant, Material, and Stores	40,000	73,226 0 5	74,514 2 10	*Cr.* 1,288 2 5
67	Transfer to Main Highways Account, Construction Fund	200,000	200,000 0 0	..	200,000 0 0
..	Unauthorized—Services not provided for ..	..	691 17 6	428 2 6	263 15 0
	Totals, General Purposes Account ..	4,308,917	4,115,655 7 6	815,286 6 10	3,300,369 0 8
68	*Electric Supply Account*	1,340,000	1,418,273 10 10	28,932 18 11	1,389,340 11 11
..	*Waihou and Ohinemuri Rivers Improvement Account*	..	66,921 18 5	7,277 10 9	59,644 7 8
	Totals, Public Works Fund	5,648,917	5,600,850 16 9	851,496 16 6	4,749,354 0 3

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	141,397	237,502	7	1	106,814	10	7	130,687	16	6
	Railways—										
43	Railway-construction	1,007,000	1,016,696	6	10	108,027	9	6	908,668	17	4
44	Additions to Open Lines	500,000	401,948	15	0	168,795	13	5	233,153	1	7
	Public Buildings—										
45	General	61,000	42,828	7	3	274	17	11	42,553	9	4
46	Courthouses	12,500	7,532	10	2	1	10	0	7,531	0	2
47	Prison Buildings and Works	25,000	23,621	12	9	1,262	17	5	22,358	15	4
48	Police-stations	10,000	5,589	6	4	28	0	11	5,561	5	5
49	Postal and Telegraph	100,000	77,319	7	5	125	17	0	77,193	10	5
50	Agricultural	4,600	2,862	12	7	..			2,862	12	7
51	Mental Hospital Buildings	90,000	51,305	12	7	187	1	0	51,118	11	7
52	Health and Hospital Institutions	26,500	27,533	12	3	13,172	9	2	14,361	3	1
53	Timber-supply and Sawmills, &c., for Public Works Department	15,000	16,937	0	10	23,934	3	6	*Cr.* 6,997	2	8
54	Acquisition and Operation of Quarries for Public Works Department	25,000	25,276	2	8	34,601	0	1	*Cr.* 9,324	17	5
	Lighthouses and Harbour-works—										
55	Lighthouses	8,000	8,090	9	8	111	7	7	7,979	2	1
56	Harbour-works	17,250	17,085	1	3	1,193	16	0	15,891	5	3
57	Development of Tourist Resorts	50,000	36,838	7	1	165	0	4	36,673	6	9
58	Department of Immigration	125,000	177,617	9	4	110,460	5	11	67,157	3	5
	Construction and Maintenance of Roads, Bridges, and other Public Works—										
59	Roads, &c.	793,500	768,335	18	4	98,503	11	3	669,832	7	1
60	Roads to give access to Outlying Districts	50,000	37,882	8	9	4,240	4	2	33,642	4	7
61	Roads, &c., on Goldfields	4,750	2,354	5	8	23	16	9	2,330	8	11
62	Telegraph Extension	750,000	684,546	10	5	59,006	15	3	625,539	15	2
63	Contingent Defence	50,000	40,127	18	7	141	10	6	39,986	8	1
64	Lands, Miscellaneous	119,100	76,908	3	6	4,010	2	1	72,898	1	5
65	Irrigation, Water-supply, and Drainage	83,320	54,997	3	3	5,262	1	2	49,735	2	1
66	Plant, Material, and Stores	40,000	73,226	0	5	74,514	2	10	*Cr.* 1,288	2	5
67	Transfer to Main Highways Account, Construction Fund	200,000	200,000	0	0	..			200,000	0	0
..	Unauthorized—Services not provided for	..	691	17	6	428	2	6	263	15	0
	Totals, General Purposes Account	4,308,917	4,115,655	7	6	815,286	6	10	3,300,369	0	8
68	*Electric Supply Account*	1,340,000	1,418,273	10	10	28,932	18	11	1,389,340	11	11
..	*Waihou and Ohinemuri Rivers Improvement Account*	..	66,921	18	5	7,277	10	9	59,644	7	8
	Totals, Public Works Fund	5,648,917	5,600,850	16	9	851,496	16	6	4,749,354	0	3

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

H. ARTHUR,
Acting-Accountant.

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

Examined and found correct.

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, 1927, to the 30th June, 1928.

RAILWAYS.

Abstract.

The following table shows the expenditure on Government railways in New Zealand up to the 31st March, 1928:—

Name of Railway.	Total Length of Railway or Section.	Open for Traffic.	Expenditure to 31st March, 1928.
	M. ch.	M. ch.	£
Kaihu Valley	24 32	24 32	179,068
Otiria–Ngapuhi	13 45	13 45	125,987
Opua Wharf – Onerahi	58 6	58 6	610,500
Kioreroa–Waiotira	19 79	19 79	420,464
North Auckland Main Trunk Railway (from Helensville)	189 75	80 63	3,535,675
Helensville – Te Awamutu, with Branches (including Auckland–Westfield Deviation)	215 35	160 63	5,045,288
Frankton Junction – Thames, with Branches	127 35	101 20	1,728,393
Thames Valley – Rotorua	69 33	69 33	422,277
Tauranga–Opotiki, with Branches	145 32	..	1,463,159
Gisborne–Opotiki	93 44	49 32	623,931
Napier–Gisborne (including Waikokopu Branch)	231 44	23 44	2,191,985
Wellington – Napier and Palmerston North (including Te Aro Extension, Greytown and Martinborough Branches, and Hutt Valley Railway)	258 62	235 76	3,591,217
Wellington–Waitara, with Branches	350 11	308 42	3,976,526
Stratford–Okahukura	112 47	47 40	1,788,476
North Island Main Trunk (Marton – Te Awamutu), including Raetihi Branch and Waipa Gravel-access Branch	225 79	218 39	3,114,246
Picton–Waipara (South Island Main Trunk Railway)—			
Picton southwards	92 38	56 6	656,952
Waipara northwards	90 45	44 14	381,621
Nelson–Greymouth	177 51	129 50	757,721
Stillwater – Arthur's Pass	51 41	50 41	2,050,049
Rolleston – Arthur's Pass (including Whitecliffs Branch)	92 59	84 45	1,030,588
Westport–Ngakawau	19 56	19 56	194,507
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	231,827
Ngahere–Blackball	3 40	3 40	147,862
Greymouth–Rewanui and Branches	11 34	11 34	329,890
Greymouth–Waitaha	50 32	38 68	403,220
Waipara–Waitaki, with Branches	459 34	413 70	3,117,142
Canterbury Interior Main Line—Oxford–Temuka	83 0	11 44	59,942
Waitaki–Bluff, with Branches	600 21	561 2	5,745,050
Otago Central	182 51	147 27	1,439,144
Invercargill–Kingston, with Mararoa Branch	117 4	97 44	394,994
Forest Hill Railway—Winton–Hedgehope§	12 40	12 40	23,337
Western Railways	94 8	78 49	452,209
Preliminary surveys	..	..	35,444
General charges not yet apportioned	..	..	19,931
Miscellaneous	..	..	10,337
Stock of permanent-way on hand	..	..	16,943
Rolling-stock	..	..	10,204,495
Suspense Account, being proportion of cost of raising loan for Railways Improvement Authorization Act 1914 Account	..	..	15,875
Total	4,319 14	3,196 39	‖56,536,272
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	4,319 14	3,196 39	58,328,988

* 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.

Rangihua Section (24 m. 45 ch. to 38 m. 34 ch.; length, 13 m. 69 ch.).—The first eight miles of this section traverse hilly country, which has proved to be of a very unstable and treacherous nature. The batters of every cutting in this length have slipped, partially filling the cuttings with a loose water-soaked mass of clay, which has had to be removed by means of steam-shovels. Five shovels have been employed on the section, and without them the cost of removing the slips by hand would have been prohibitive. Where there have been fillings of over 10 ft. the weight has been too much for the country underneath, which, though apparently solid, is actually incapable of bearing much weight. To get over these difficulties it has been necessary either to deviate the line or put in drainage-drives under the bank-foundations.

The remaining seven miles of the section traverses the floor of the Waihou Valley. This country is more stable, but the cuttings, when opened up, have been found to consist of soft pug, in which it has been found necessary to revert to the old-fashioned hand methods of cutting out this tenacious material by means of a piano-wire with handles attached, which is used to cut through the material and separate it into blocks, similarly to the methods used for cutting soap.

The formation has been completed from 28 m. 30 ch. to 32 m. 0 ch., a distance of 3 m. 50 ch., thus giving a total completed distance of 7 m. 60 ch. beyond Okaihau. A further length of 4 m. is in hand.

Fences have been erected on both sides of the railway reserve from 32 m. 30 ch. to 34 m. 35 ch., a total length of 330 ch. of fence. Twenty concrete culverts have been built, varying from 2 ft. to 8 ft. in diameter and seven concrete-pipe culverts.

33 m. 37 ch. of permanent-way have been laid, from 26 m. 44 ch. to 30 m. 1 ch., and $1\frac{1}{4}$ m. of rails for a tram-line to ballast-pit at Okaihau. This ballast-pit is being opened up, and ballasting will be put in hand during the coming year.

Three workmen's camps have been built along the route of the railway and one at the quarry. These have been equipped with bathhouses, cookhouses, and other conveniences, and a standard Y.M.C.A. hut has been erected at Okaihau and is well patronized by workmen and settlers.

Kirikopuni Section (107 m. 0 ch. to 121 m. 0 ch.).—The principal work during the year on this section has been the general cleaning-up of the whole section, the clearing of slips, and completion of bridges, station-yards, and buildings.

At the end of last winter considerable trouble was caused by slips in the cuttings generally and subsidence of banks, but by the end of the summer the work was well consolidated and in first-class order for handing over to the Railway Department in May last. Six steam-shovels were fully occupied in removing slips.

Both the Omana and Tokatoka Tunnels have been strengthened in places to resist the very heavy pressures which developed since they were completed.

At Waiotira the platform was converted to an "island" type, points and crossings were laid at the north and south ends, and a double siding constructed on the west side of platform. At Pikiwahine Station a goods-shed was erected and the yard cleaned up and completed. Three standard 16 ft. gates were erected at Omana, and the metalling of access roads has been completed. All buildings, gates, cattle-stops, and fences were completed at Pukehuia, and metalling laid. At Kirikopuni Station all buildings, with the exception of one platelayer's cottage, which is in hand, were erected, and a sheep-drafting race and yards have been constructed at the south end of the yard, having access from the stockyard approach road.

The metal for the Parakao Road is still being unloaded at Kirikopuni Station, and for this a temporary siding has been laid and hopper erected; this will remain until the metalling is completed.

All bridges on the section, of which there are fourteen railway and four overbridges, have been erected.

At 113 m. 66 ch. it was found necessary, owing to the erosion of the banks, to construct stone bases between centre piers to a width of about 80 ft. and a depth of 5 ft. 6 in. The most important bridge, that over the Wairoa River at 118 m. 77 ch., is 765 ft. long, and consists of two 106 ft., two 45 ft., and fifteen 30 ft. steel spans on three concrete cylinder piers and seventeen timber piers. This was completed during the period.

At 120 m. 1 ch. considerable difficulty was experienced with the piles owing to the subsidence of the banks and ground-movements, and to counteract this raker piles were driven and stone packing placed under the full length of bridge to a width of 21 ft. and a depth of from 3 ft. to 15 ft., with twin 2 ft. concrete pipes embedded to take the normal flow of the creek.

All culverts on the section have been completed, the wing walls and parapets between 111 m. and 121 m., which had been left over until aggregate could be brought in by train, being the main construction items under this heading for the period.

Platelaying was completed from 118 m. 77 ch. to 121 m. 0 ch., and three lifts of ballast were placed between 107 m. 25 ch. and 121 m. 0 ch.

In order to provide a water-supply for the Kirikopuni Station a concrete dam and reservoir were erected, and connections were made to platelayers' cottages, 6,000-gallon vat, latrines, station buildings, and water-troughs in the stockyards. A metered connection was also made to the new butter-factory at the north end of the station. The necessary land was taken and fenced at intake, and reservoir and 25 links right-of-way surveyed along pipe-end.

Approximately 6 acres of silver-poplar cuttings and young gum-trees have been planted in reserves at Pikiwahine, Omana, and Pukehuia station-yards, and at the bottoms of various slips.

A 40-acre reserve between Waiotira and Tauraroa was fenced and planted in mixed trees. This planting was carried out mainly to stabilize the slopes adjoining the railway, but it is anticipated that the timber will also have a future value.

During the year all temporary accommodation at Waiotira, workers' dwellings, &c., was dismantled and re-erected at Pukehuia, Kirikopuni, and the Devil's Elbow, on the Dargaville Branch Railway.

Special goods and passenger services were run over the section up to the time of handing over to the Railway Department.

Dargaville Branch Railway.

Tangowahine Section (0 m. to 10 m.; length, 10 m.).—The permanent-line survey over this section was completed early in the year, and a considerable amount of work has been done on the section. As the Main Trunk line neared completion the necessary materials were transferred from time to time and a good start has been made with the work. The formation is of a much lighter character than on the Main Trunk, and every endeavour is being made, by means of fairly steep momentum grades, to keep the earthwork in the large cuttings to a minimum, in order to reduce the risk of slips, which are liable to occur in deep cuttings.

Where the line passes through the Tangowahine Swamp the Bucyrus drag-line is being used to carry forward canals from the Wairoa River and complete the light-railway formation. At the same time it is proposed to complete a certain length of road-formation for the Lands Department in connection with the Tangowahine Settlement. It is anticipated that several miles of line should shortly be ready for rails and ballasting, the object being to get the line to Tangowahine as soon as possible, so that temporary services may be run for the benefit of settlers in that part of the district and farther afield.

Four steam-shovels and one drag-line have been employed on the formation of the first seven miles, and scoops and co-operative hand gangs are employed on the same length in cuttings that are too light for steam-shovel operation.

The barrels of all minor culverts to 6 m. 23 ch. have been completed, and excavations are complete and pile-driving in hand for the foundations of a 4 ft. arch culvert at 3 m. 12 ch.

Fencing has been completed on both sides to 3 m. 66 ch., on the right from 6 m. 10 ch. to 6 m. 42 ch., and on the left from 6 m. 15 ch. to 6 m. 31 ch. and 6 m. 35 ch. to 6 m. 40 ch. Cattle-stops have been installed at 0 m. 40 ch.

Approximately half a mile of rails have been laid and ballasted with one lift.

Several single huts and a married man's cottage have been erected at the Devil's Elbow, and temporary accommodation at Tangowahine; but generally in the construction of the work to the Devil's Elbow, at Tangowahine Flats, men are transported to the work morning and evening by launches, as it is cheaper to keep the men camped at Pukehuia at present, and save the very great expense of transferring houses for the accommodation of workmen in a locality where they will only be required for a short time.

Auckland-Westfield Deviation.

Substantial progress has again been made this year with the construction of that portion (8 m. 70 ch. in length) of this deviation which is being constructed by the Public Works Department.

Formation.—The marked progress made has resulted in the formation work approaching completion, the portion still remaining to be done consisting mainly of trimming-work, the widening of cuttings, and the borrowing of some 30,000 cub. yd. required to complete the banks in the vicinity of Purewa and Westfield.

In the early part of the year, trouble was experienced with the embankment being made across the Orakei basin, where the bottom is soft mud of considerable depth. The difficulty was overcome, and the subsidence checked by the construction of banquettes, or low extensions of the bank, on either side. This has the effect of further distributing the weight of the bank and overcoming the tendency for the bottom to be pushed up at the sides of the fill. The embankment between Point Resolution and Orakei has stood fairly well, and a subsidence of 18 in. has been made good by top-filling and corresponding widening.

A service track now extends from Campbell's Point to Westfield, and during the next few weeks a connection will be made with the Westfield Freezing Co.'s siding in the vicinity of the existing main line. It is anticipated that the remaining earthwork between Purewa Tunnel and Westfield will be sufficiently far ahead during the next four or five weeks to allow of the systematic transportation of some 25,000 yards of stone being commenced for the stone pitching of banks in Hobson Bay and Orakei basin. Approximately 3,000 yards of this stone is located in the Sylvia Park station-yard, and arrangements have been made with the Railway Department for railage via Westfield over their main line to Campbell's Point, thus expediting the work and making a considerable saving in haulage.

During the year about 70 ch. of station approach roads and overbridge approach roads have been completed, with gravelling and footpaths.

The total earthwork done during the year under review amounts to 430,000 cub. yd., including hard lava rock, clay, and papa. This progress was only rendered possible by the efficient organization of the available excavating machinery, consisting of six steam-shovels, and of the associated earthwork-trains. The employment of this plant has been very effective in reducing direct and overhead costs, as well as being instrumental in speeding up the work. It is anticipated that the formation will be far enough advanced to enable platelaying of one complete through track to be commenced very shortly.

Purewa Tunnel.—This tunnel, of a total length of 1,954 ft., is now complete, with the exception of the portals, which are in hand, that at the north end being almost complete. The lining of the tunnel was completed on the 27th March, 1928, and the service track and its temporary foundation is being removed preparatory to the laying of the tile drain and the rock-spall foundation for the permanent track. The total quantities of excavation and concrete lining in the tunnel have amounted to—excavation in papa and tuff, 48,687 cub. yd.; concrete lining, 15,632 cub. yd.

Bridges.—The bridge-construction programme on this deviation is a large one, the most important structures being three bridges over openings left in the embankment across Hobson Bay, and seven concrete and steel road-overbridges of heavy construction, and two bridges to carry the railway over roads. The concrete piers, nineteen in number—concrete on piled foundations—for the Hobson Bay bridges are all complete, ready for the superstructure. Of the heavy road-overbridges, four, being those at 2 m. 70 ch., 7 m. 14 ch., 8 m. 3 ch., and 8 m. 77 ch., are complete, and that at 6 m. 60 ch. is almost complete. In addition, work is in hand at several of the other bridges.

EAST COAST MAIN TRUNK RAILWAY.—WAIHI EASTWARDS.

During the year this line has been completed, except for a few minor details, between Tahawai and Taneatua—a total distance of 84 m. 26 ch. Messrs. Sir W. G. Armstrong, Whitworth, and Co. completed their contract, nineteen miles in length, between the 14 m. and Te Puna, on the 19th March last, and handed over that part of the line to the Public Works Department on the 30th May.

The line between Tahawai and Tauranga was declared officially open by the Right Hon. the Prime Minister on the 28th March, and a tri-weekly through passenger service was inaugurated between Taneatua and Auckland as from that date. The portion of the line between Tahawai and Tauranga was handed over to the Working Railways on the 18th June, and a daily passenger and goods service was at once established. Pending the handing over to the Railway Department of the Tauranga–Taneatua length, the service thereon is being run by the Public Works Department. It is anticipated that this latter section will be complete and ready for handing over towards the end of the month of August. A description of the work done on the various sections of the line is as follows :—

Katikati Section (14 m. to 16 m. 28 ch. ; length, 2 m. 28 ch.).—The Tahawai bank, which gave considerable trouble through subsidence, was completed. Platelaying and ballasting on the whole section, including Katikati station-yard, was completed, and station buildings, goods-shed, and cattleyards at Katikati erected. The Tahawai Bridge at 15 m. 2 ch., consisting of five 40 ft. spans, was completed, and all bridges painted. A start has been made with the erection of a Stationmaster's house at Katikati. Flood-gates have been erected where necessary.

Aongatete Section (16 m. 28 ch. to 21 m. 5 ch. ; length, 4 m. 57 ch.).—One girder was placed on the Waitekohe Bridge, completing the bridge. The Uretara, Rereatuakahia, Te Mania, Waitekohe, and Aongatete Bridges were painted. Platelaying was completed from 20 m. 51 ch. to 21 m. 5 ch., and the whole of the section ballasted. The banks at the Rereatuakahia and Aongatete Streams were stone-pitched with spalls from Te Puke quarry. Private crossings at 17 m. 30 ch. and 20 m. 40 ch. were metalled. Goods-shed, latrines, and stockyards at Aongatete station-yard were completed. Flood-gates have been erected where necessary.

Apata Section (21 m. 5 ch. to 27 m. 50 ch. ; length, 4 m. 12 ch.).—(Short length is due to deviations from original line.) All fencing on the section was completed. The old piers of the first Wainui Bridge (23 m. 2 ch.) were removed, and a new bridge of seven 35 ft. spans erected. The stability of the original bridge had been destroyed by ground-subsidences that took place as the heavy filling was being placed. This was referred to in my report for last year under heading " Apata Section." The Watakao and Wainui Bridges were painted. 1 m. 12 ch. of platelaying was done, and the ballasting of the whole section completed. A wash-out occurred at 23 m. 28 ch., taking away 1,000 cub. yd. out of the bank. This damage was repaired. Apata station-yard was widened, and a platform and cattleyards constructed. The approach-road fence to the overbridge at 26 m. 49·50 ch. and the gates at Apata station-yard were painted. Flood-gates were erected along section.

Te Puna Section (27 m. 70 ch. to 34 m. 78 ch. ; length, 7 m. 2 ch.).—The fencing, culverting, formation, and ballasting of this section were completed. Cattleyards were erected at Omokoroa and Te Puna Stations. Stone-pitching with spalls from Te Puke quarry was done at overbridges at 30 m. 15·75 ch. and 31 m. 43 ch., at Te Puna Bridge, and along the Mangawhai bank, 30 m. 60 ch. to 31 m. 7 ch. The overbridge at 31 m. 43 ch. was completed, and a new abutment and one new pier put in the Waipapa Bridge. All bridges and station buildings were painted. Flood-gates were erected where necessary. A considerable yardage of slips was removed from the Mangawhai cut.

Tauranga Section (34 m. 78 ch. to 41 m. 5 ch. ; length, 6 m. 7 ch.).—This section was open for traffic throughout the year, and usual maintenance-work carried out. Considerable ballasting was done between Tauranga and Te Puna. Spalls were placed around the piers of the Wairoa Bridge, along the banks in the Wairoa section, and along the Tauranga Wharf approach. A platform, cart-dock, and station building were erected at the Strand. The Wairoa and Waikareao Bridges were painted.

Te Maunga, Te Puke, Paengaroa, Pongakawa, Otaramakau, and Matata Sections (41 m. 5 ch. to 79 m. 16 ch. ; total length, 38 m. 11 ch.).—This length has carried regular goods and passenger traffic, and adequate maintenance has been carried out. Most of the line between Tauranga and Paengaroa has been regraded and ballasted. Shelter-sheds have been erected at Te Maunga and Matapehi. The Tauranga, Otaimatua, Kopuroa, Kaituna, Otamarakau, and several smaller bridges have been painted. A number of small bridges have been close-sleepered and straightened. A siding has been put in at Te Maunga, and a 4 ft. arched culvert at 67 m. 60 ch. The Te Puke quarry output included 28,670 cub. yd. crushed metal and 14,645 cub yd. spalls, as well as a quantity of screenings. The Matata pit output included 26,750 cub. yd. metal for ballast and 16,850 cub. yd. stripping, the latter being mostly used for widening banks.

Rangitaiki and Awakeri Sections (79 m. 16 ch. to 91 m. 40 ch. ; length, 12 m. 24 ch.).—This length has carried regular goods and passenger service, and has been well maintained. Considerable ballasting-work has been done on this section. The Tarawera, Rangitaiki, and a number of smaller bridges have been painted. Two extra spans have been erected on bridge at 88 m. 35 ch. Level crossings have been formed and metalled at 89 m. 45 ch. and 90 m. 26 ch.

Taneatua Section (91 m. 40 ch. to 100 m. 5 ch.; length, 8 m. 45 ch.).—This length has carried goods and passenger traffic, and has been well maintained. A considerable quantity of ballast has been put on this section. A large slip came down at 97 m. 50 ch. and blocked the line, 11,190 cub. yd. being removed by steam-shovel. Gates and cattle-stops were erected throughout the section. A 6,000-gallon water-vat was erected at Kiwinui, and an engine-shed and 70 ft. turntable at Taneatua. Filling was placed on cottage-sites at Taneatua to bring them up above flood-level. Additions to the Whakatane Railway-bridge to convert it to a combined road and railway bridge are substantially finished. The road-decking is almost complete, and the approach road has been formed and metalled and two bridges have been erected thereon. The girders of the Waioho and Whakatane Bridges have been painted.

Waimana Section (100 m. 6 ch. to 100 m. 16 ch.; length, 10 ch.).—The platelaying and ballasting of this section were completed.

Mount Workshops.—628 tons of steel were fabricated into girders during the year, mostly for bridge-work outside the Tauranga district. An additional 140 tons is drilled ready for riveting. Girders were manufactured for the Whakaruatapu Bridge, Dannevirke; Makatote River Road-bridge, Mangatipa Stream Bridge, Waihou River Bridge; Ohinemuri River Bridge, Wairoa River Railway-bridge, Kirikopuni; and bridges on Auckland-Westfield Railway deviation, Lawrence-Roxburgh Railway, and the Napier Wairoa Railway. An air-lock was manufactured for the Motu River Bridge, and a crane for Waikokopu Wharf. Maintenance-work has been done to the Department's construction plant and to the railway rolling-stock. The latter includes work done on eleven locomotives, eight passenger-cars, and 261 wagons.

Traffic.—A regular passenger and goods traffic has been maintained throughout the year between Taneatua and Tauranga, and since March between Taneatua and Tahawai. The total revenue for the nine months up to 27th March was £14,614 11s. 11d. Since then the Railway Department has been doing the accounting.

Gisborne-Napier Railway.

Putorino Section (10 m. 56 ch. to 37 m. 35 ch.; length, 26 m. 59 ch.).—The two most important works on this section are the erection of the Waikoau and Matahoura Viaducts, and consequently the year's programme was so arranged as to enable the construction of these viaducts to be pushed ahead as speedily as possible.

With the exception of the approach filling to the Matahoura Viaduct, the cutting at 35 m., a small portion of Maori Creek filling, and the Putorino station-yard, the whole of the earthwork on this section has been completed. Two steam-shovels were employed for the first part of the year, and, in addition to these, hand gangs and scoops shifted approximately 80,000 cub. yd.

The road-deviation at 34 m. 10 ch. has been formed, and that at 35 m. 10 ch. has been formed, metalled, and incorporated in the main highway, while the approaches to overbridges at 18 m. 69 ch., 23 m. 31 ch., 26 m. 22 ch., and 28 m. 33 ch. have been completed. The access road to Putorino Station has been formed for 60 ch. The permanent telephone-line has been constructed throughout the section.

The fencing of the railway reserve for the whole section is now practically completed, 7 m. 33 ch. having been erected during the year. Two 16 ft. gates have been put in at the Waikoau station-yard, and others made for Waipunga, Tutira, and Matahoura Stations.

Between Eskdale and Tutira the culverting of the line has been completed, with the exception of a few portals, forty-two pipe culverts being installed during the year. From Tutira to Putorino four 2 ft. diameter pipe culverts, three 3 ft. arched concrete culverts, one 4 ft. arched culvert, and the 9 ft. by 8 ft. 7 in. water-drive at Maori Creek were completed.

On the access-road to Putorino Station three pipe culverts were placed. Overbridges have been built at 23 m. 31 ch., 26 m. 22 ch., and 28 m. 33 ch., and a concrete subway at 17 m. 20 ch. in the form of an 8 ft. flat-topped culvert has also been provided.

The Waikoau Viaduct, consisting of four 60 ft. approach spans and one 250 ft. main span with rail-level 236 ft. above the creek-bed has, with the exception of a small portion of the wind-screen and an inspection-platform, been completed, the first train crossing the bridge on the 15th February last. The temporary trestle used in the erection of the 250 ft. span has been dismantled and railed ahead, as have also all buildings and accommodation for workmen.

The concrete piers for Sandy Creek Bridge at 29 m. 10 ch. have been built, and a temporary trestle has been erected to carry the traffic ahead pending the arrival of the steel for the permanent structure, which consists of three 60 ft. spans on steel trestles.

The subway at 30 m. 19 ch., consisting of two 20 ft. spans and one 30 ft. span on timber pile abutments and concrete piers has been completed.

Good progress has been made with the Matahoura Viaduct at 33 m. 42 ch., all concrete piers and abutments having been completed. The cableway, with head and tail towers for landing the steel, has been erected, and the steel trestle at pier B, with the 40 ft. approach span has also been erected. The temporary trestle for the erection of the main 250 ft. span has been completed to a height of 40 ft. above the creek-bed, and 75 per cent. of the steel for the viaduct has been railed to the site.

All accommodation required for workmen has been transferred from the Waikoau Viaduct and re-erected, as well as the store, office, rivet-shed, blacksmith's shop, and engine-shed.

At 34 m. 10 ch. the excavations for the abutments of a subway, consisting of one 40 ft. span on concrete abutments, are in hand, and all aggregate, reinforcing-steel, and cement have been delivered to the site.

The rail-head has been brought forward to 33 m. 42 ch. in order that the steel and timber for the Matahoura Viaduct could be railed to the site at the earliest possible date.

All sidings and crossings at Tutira station-yard have been laid, while a temporary dead-end siding has also been put in at the Matahoura Viaduct to facilitate the handling of the steel.

During the period ballasting has been pushed on continuously, and the final lift and boxing-in has been completed from Eskdale to Waikoau, with the exception of 5 m. which still require boxing in. From Waikoau to Tutira the first lift only has been completed.

At 24 m. 56 ch. a new ballast-pit is being opened up, and special ballast-wagons are being hired from the Railway Department with the object of vigorously pushing ahead with the ballasting of the track from Waikoau to Putorino.

At Waipunga Station a shelter-shed has been erected, and the stockyards which had been dismantled at Westshore were re-erected here, together with holding paddocks and gates complete. At Waikoau Station shelter-shed, stockyards, 6,000-gallon vat, and permanent water-supply have been completed. At Tutira Station a goods-shed, stockyards, and three platelayers' cottages have been built during the period.

A regular passenger and goods service has been maintained between Waikoau and Eskdale, connecting with the railway service at the latter station, and as soon as the Waikoau Viaduct was completed a service was instituted from Tutira.

The Department's sawmill has proved invaluable in connection with the construction wo generally. During the year 826,767 sup. ft. of timber was cut, supplying all timber for accommodation, bridges, concrete-work, &c., as well as that for the permanent station buildings and cottages.

In May last the main office, together with the engineering and clerical staff, was shifted to Tutira, but the store and store's staff are still at Waikoau, where it is proposed to leave them until the section is completed.

Wairoa Section (37 m. 35 ch. to 70 m. 67 ch.; length, 33 m. 32 ch.).—This section consists of two subsections—Kotemaori (37 m. 35 ch. to 53 m. 15 ch. and Wairoa subsection (53 m. 15 ch. to 70 m. 67 ch.). The work on the Kotemaori subsection consists mainly of driving and lining tunnels and the excavation with steam-shovels of approach cuttings to tunnels. During the first half of the period the section was fully manned, but for the latter half activities were confined solely to steam-shovel excavations and portion of the Mohaka Tunnel. At present six steam-shovels are in operation on this section. The tunnel approaches generally are now well in hand and as the shovels become available they are placed in the larger block cuttings, several of which involve very heavy excavation.

Preliminary investigations have been made on the site of the Waikare, Mohaka, and Maungaturanga Viaducts, and during the coming year it is anticipated that the foundations for the Waikare Viaduct and, possibly, the Mohaka Viaduct will be in hand.

Chimney Creek No. 1 tunnel, at 46 m. 25 ch., was proceeded with from the north end until about 6½ ch. of the whole tunnel was completed. The bottom heading is now being pierced from both ends to solve the ventilation problem. When the heading is through, excavated material from tunnel will be hauled to bank at 45 m. 55 ch., and this tunnel should be completed in nine months. Chimney Creek No. 2 tunnel, at 47 m. 9 ch., was also worked from the north end. The work was then finished back to 47 m. 4 ch. A total of 12½ ch. of tunnel was completed when work was discontinued for a few months. Work has just been restarted with a single shift, and tunnel should be completed in seven months.

Road-deviation at 47 m. 67 ch. to 48 m. 8 ch. is being formed with scoops. Cutting at 47 m. 79 ch. was taken out to 47 m. 18 ch., and the material used to form bank at 48 m. 3 ch.

The Mohaka Tunnel, at 53 m. 2 ch., has been in progress throughout the year. This is the wettest tunnel on the Wairoa section. Just after Christmas a bad fall occurred in this tunnel and stopped progress for some months. Completed work is now at 53 m. 9·50 ch., and just over 10 ch. of the tunnel is complete.

Extensive investigations were made during the summer to ascertain the nature of the foundations for the Mohaka Viaduct. Six bores were put down and the solid papa found to be at a depth of from 45 ft. to 60 ft. below low water.

Practically all culverts, side drains, and water-drives on this length are now complete.

Fencing has been completed between the following points: On the right, 38 m. 31·50 ch. to 39 m. 18 ch., 42 m. 53 ch. to 43 m. 0 ch.; on the left, 38 m. 50 ch. to 38 m. 62 ch., 42 m. 53 ch. to 43 m. 12.50 ch., and 47 m. 16 ch. to 47 m. 65 ch.

On the Wairoa subsection there have been four steam-shovels engaged on formation, in addition to a number of hand gangs and scooping teams, the formation work being spread over approximately 11 m. between 53 m. and 64 m.

208 ch. of fencing were erected on railway reserve between 55 m. 28 ch. and 62 m. 10 ch.; 45 ch. were erected on road-deviation 57 m. 71 ch. to 58 m. 36 ch.

The excavation and lining of the Waihua Tunnel was completed from 60 m. 72·75 ch. to 60 m. 66·25 ch., and the bottom heading driven right through. This leaves a balance of 3¼ ch. to be completed, exclusive of botton heading. This tunnel has been closed down since December, but it is expected to have it in hand again by the beginning of next month.

The road-deviations at 59 m. 7 ch. and 60 m. 7 ch. were completed and handed over to the Wairoa County.

Good progress is being made with the Wairoa River Bridge at 68 m. 59 ch., consisting of two 107 ft. 6 in., two 106 ft. 3 in., and two 15 ft. 2 in. spans. 180 lin. ft. of temporary pile staging has been erected and 50 ft. of concrete cylinder has been cast and placed in position. Twenty-four 40 ft. reinforced-concrete piles have been cast, and all reinforcing-steel bent. The steel trusses for the four 100 ft. spans have been delivered at Wairoa and are being scraped and painted ready for erection, and 1,000 yards of shingle has been delivered on the bank near the bridge site.

All culverts, water-drives, &c., between 53 m. 45 ch. and 62 m. 0 ch., with the exception of the 3 ft. arched culvert at 54 m. 15 ch. and several small pipes, have been completed.

STRATFORD MAIN TRUNK RAILWAY—EAST END.

Matiere Section (0 m. to 10 m. 23 ch.; length, 10 m. 23 ch.).—All work on this section is now complete, and the only work carried out during the period has been the general maintenance and ballast for fettling, repairs, &c., 2,600 cub. yd. of ballast being used for that purpose during the period.

Ohura Section (10 m. 23 ch. to 19 m. 10 ch.; length, 8 m. 67 ch.).—The formation, platelaying, and ballasting on this section have now been completed. All bridges and culverts, with the exception of three overbridges at 13 m. 46 ch., 15 m. 32 ch., and 17 m. 69 ch. have been built.

At Niho Niho (13 m. 10 ch.) and Kopuha (15 m. 78 ch.) the station buildings are practically completed, and at Ohura (18 m. 73 ch.) the goods-shed, stockyard, platform, and one platelayer's cottage have been built, and four cottages and the turntable are well in hand.

Road-deviations at 12 m. 67 ch., 16 m. 0 ch., and 17 m. 25 ch. have been completed, and also the Hihi Street deviation at the Ohura Station.

7,941 cub. yd. of ballast were distributed on the section during the year, and a daily train service for passengers and goods has been maintained throughout the year between Okahukura and Ohura. This service is of great assistance to the settlers and has been well patronized by them, the total earnings for the period being £6,893.

A depot has been provided and sidings laid adjoining the Ohura Station, the bulk of the stores and construction material transferred to Ohura, and the whole organization will be also transferred as soon as the Ohura cottages are ready for occupation.

Tokirima Section (19 m. 10 ch. to 30 m. 0 ch.; length, 10 m. 70 ch.).—From 19 m. 10 ch. to 21 m. the formation is practically complete; 75 per cent. of the work has been done between 20 m. and 21 m., whilst approximately 20 ch. of formation work are in hand between 21 m. and 22 m. Work has not yet been commenced between 22 m. and 23 m., but about 10 ch. of earthwork is in hand at the approach to No. 3 (Mangaparo) tunnel, and between this tunnel and the Tokirima Tunnel, at 24 m. 64 ch. approximately 20 ch. of formation are in an advanced condition. The total excavation on the formation work for the period was 64,000 cub. yd.

The No. 1 tunnel (Mangatawa), at 19 m. 45 ch. (7¾ ch. long), has been lined throughout, only the portals remaining to complete the work. At the No. 2 tunnel (Mahorahora), 20 m. 50 ch., work was commenced at the end of May, and the bottom heading has been driven a distance of 3¼ ch.

All culverts have been completed as far as the 21 m. peg. A 3 ft. concrete arch culvert is nearing completion at 21 m. 35 ch., while a 4 ft. water-drive at 23 m. 43 ch. and a 5 ft. arch culvert at 24 m. 45 ch. is in hand.

The formation for private level crossings at 21 m. 1·5 ch. and 21 m. 39 ch. is complete, and 25 ch. of road-deviations from 20 m. onwards have been formed and metalled, while a further 6 ch. is ready for metalling.

Approximately 60 ch. of metalling has been done on the Turoto and Tokirima Roads, which are in use as service roads; and Kereru Road and a portion of Ruru Street, Ohura, have been formed and metalled for the same purpose. Stream-diversions have been completed at 19 m. 41 ch., 57 ch., 77·5 ch., 23 m. 74 ch., 24·1 ch., and are in hand at 23 m. 0 ch. and 24 m. 56 ch. 3¾ m. of fencing have been erected, and approximately 70 ch. of side drains have been excavated.

The permanent-line surveys to 32 m. 40 ch. have been finished, and the plans are well in hand.

STRATFORD MAIN TRUNK RAILWAY—WEST END.

Raekohua Section (47 m. 40 ch. to 50 m. 60 ch.; length, 3 m. 20 ch.).—This section has not been so vigorously prosecuted as the Heao section, further ahead, owing to the fact that the tunnels on the latter section are the determining factor in the final time of completion. 78 ch. of formation have been completed, however, and a start made with the tunnel at 50 m., 1¼ ch. of tunnel having been lined and completed. Between Taharoa and Raekohua the line follows down the Raekohua Valley, and, as this is a very narrow valley, it was necessary to divert the stream at 48 m. 5 ch., 48 m. 24 ch., 49 m. 30 ch., and 49 m. 60 ch., in order to build the road and railway.

The concrete piers for the railway-bridges at 48 m. 15 ch., 48 m. 24 ch., 49 m. 16 ch., and 49 m. 63 ch. have been completed, and are ready to receive the girders, which are expected to arrive shortly. On the Raekohua Road, from 47 m. 40 ch. to 50 m. 40 ch., all bridges, totalling 255 lin. ft., and their approaches, have been completed.

A regular passenger and goods service connecting with the railway service at Tahora has been run over the service tramway from Tahora three times a week.

Heao Section (50 m. 60 ch. to 57 m. 0 ch.; length, 6 m. 20 ch.).—This section is through very rough country, necessitating heavy construction work, including four tunnels, 2,013 ft., 3,597 ft., 4,191 ft. and 3,300 ft. in length respectively.

No. 1 tunnel (51 m. 15 ch. to 51 m. 45·50 ch.) was successfully completed in March last, the alignment and level from either end meeting very accurately, the alignment being within ⅜ in., the chainage correct to $\frac{1}{10}$ link, and the levels exactly correct.

At No. 2 tunnel (52 m. 10·50 ch. to 52 m. 65 ch.) good progress has been made, 17 ch. having been completed at the west end and 8¼ ch. at the east end.

Work was commenced at the west end of No. 3 tunnel in January last, and 5½ ch. of tunnel has been completed, a start not yet having been made with the east end. A 6 ft. concrete culvert, 64 ft. long, was built at 50 m. 65 ch., and a water-drive 6 ft. long at 52 m. 9 ch. has been lined and completed.

An 8 ft. by 6 ft. water-drive has been excavated at 53 m. and the concrete lining is in hand, while a 12 ft. by 10 ft. water-drive at 53 m. 25 ch. through heavy ground is in hand, 1½ ch. being complete with concrete lining.

The large filling at 51 m. 50 ch. has been brought up to formation-level for a width of 9 ft., and is being completed with spoil from the adjacent cutting at 51 m. 60 ch. This filling, containing 70,000 cub. yd., was built from a large trestle, the formation-level being 90 ft. above the bottom of the ravine, and the stream has been by-passed through a large water-drive.

The formation between No. 1 and No. 2 tunnel and between No. 2 and No. 3 is, with the exception of a few points, practically completed.

A good outcrop of rock was discovered in the Mangaone Valley a short distance from the centre-line at 53 m. 40 ch., and a quarry has been opened up there, with a connecting tram to crushing plant, which is electrically driven. Bins have been provided, and the crushed metal obtained is being used for tunnel-lining and other concrete-works in the valley. This plant saves the heavy transport costs of bringing metal in from the Te Wera quarry and haulage by motor-lorry over the Mangaone Saddle.

The difficulties of transport from one part of the section to another are much increased by the fact that the line traverses a number of huge ridges which have to be pierced by tunnels, and in order to enable work to be prosecuted ahead construction material has to be hauled over these ridges. Now that the No. 1 tunnel has been completed, material for works ahead can go through the tunnel. Previously everything had to be hauled over the top of this tunnel by means of an electrically operated jig-line, and a total of 9,408 tons of construction material has been hauled over this jig-line.

To reach the eastern face of No. 2 tunnel and the western end of No. 3 it has been necessary to form a service road on a very steep grade over the ridge pierced by the No. 2 tunnel, between the Mangatatoko and Mangaone Valleys. Haulage over this road was at first carried out by tractors, but later a light coat of metal was laid down on corduroy and the service is being adequately carried on by means of motor-lorries.

Power for all activities has been supplied by the steam power-house at Tangarakau, and this met all demands satisfactorily during the year, supplying electric power to all tunnels for lighting, haulage, and operation of plant generally. It also supplied compressed air for the pneumatic plant in all tunnels. In order to generate the necessary power at a reasonable figure, the Department some time ago acquired rights over a coal area in the Tangarakau Gorge, and made arrangements with a local syndicate to take up and mine these areas on the condition that they supplied a specified amount of coal per annum for our purposes at a reasonable figure. During the period, 1,161 tons of coal were supplied under this arrangement. This coal has proved to be a very fair steam coal, and it is anticipated that its use will reduce the generating-costs at the power-station, in addition to assisting in the development of a coal area which should, owing to its proximity, be of benefit to the Taranaki consumer.

Te Wera Quarry. (21 m. 60 ch.).—This quarry has been in operation throughout the year, 14,449 cub. yd. of stone being quarried and crushed during the period. 8,263 cub. yd. of this was used for railway-construction and 6,186 cub. yd. was supplied to various local bodies for roadwork and other purposes.

The Department's ballast-train maintained a tri-weekly service running crushed metal from Te Wera to Tahora for railway-construction until April last. It has since been running a daily service between Te Wera and Pohokura with road-metal for the Ohura Main Highway.

Palmerston North Railway Deviation.

It has been possible to carry on this work on a considerably larger scale than during the previous year, and steady progress has been made on its construction, which includes the building of $6\frac{3}{4}$ m. of double-track railway and of a large up-to-date goods-yard, and passenger-station.

The clearing of the railway reserve is practically complete, this work involving the removal of a number of houses and large farm buildings. Nine miles of fencing has been erected. The drainage and culverting work completed has been of a substantial character, and has comprised the cutting of 350 ch. of drains, and the building of the following concrete culverts: One 6 ft. arched, 200 ft. long; three flat-topped culverts, 4 ft., 3 ft. 6 in., and 3 ft. square in section, totalling 1,347 lin. ft.; one 3 ft. arched, 95 ft. long; one 24 in. circular, 180 ft. long, and one 18 in. circular, 120 ft. long.

A feature of this railway-deviation will be the extensive road-overbridge construction. These structures, seven in number, will be of heavy concrete and steel construction, and necessarily involve expensive earthwork approaches, as the country is flat. The largest of these, that on Milson's Line, is in hand and nearing completion. It makes provision for eleven railway-tracks passing under it. The approach ramps are nearing completion. Several temporary bridges over streams have been erected for service purposes. The formation work is well suited to power-shovel and earthwork-train operations. Three steam-shovels and six construction locomotives are in use, and the earthwork on the deviation is now one-fourth completed, the excavation done amounting to 125,000 cub. yd. Formation is almost complete from Longburn Railway-station for a distance of $3\frac{1}{2}$ m., and the goods-yard formation is also well advanced. A heavy service track connecting with the main line at Longburn has been laid into the goods-yard site, involving $5\frac{1}{2}$ m. of track. This greatly facilitates transport and construction work generally. The average number of men employed on this work for the year has been 147.

Wellington – Tawa Flat Railway Deviation.

(1 m. 70 ch., to 9 m. 30 ch.; total length, 7 m. 40 ch.)

Work was commenced on this railway during the year. Tenders were called, in the first place, for stone for a sea-wall to protect a reclamation for the line from 1 m. 70 ch., to 2 m. 39 ch. All tenders were considered too high, and were declined. The Department decided to do the work itself. Great difficulty was experienced in obtaining a suitable quarry, but eventually good stone was located on the Horokiwi Road, about a mile off the Hutt Road. A big blast was fired, and the stone was

broken into fairly good blocks for protective purposes. A 3-ton electric crane was installed at the quarry for loading the stone on to motor-lorries. 5 ch. of sea-wall have now been completed with this stone.

The bridge over the Hutt Road at 2 m. 40 ch., giving access from the first tunnel to the reclamation, was put in hand at an early stage, and the whole of the concrete piers have now been completed. For some of these, cylinder piers founded below sea-level were required. Steel-plate girders are under order for this bridge. The bridge at 3 m. 29 ch. over the Ngahauranga Gorge Road was also put in hand. All piers are completed, and two 50 ft.-span plate girders have been placed in position.

There are two tunnels on the railway-deviation. No. 1 tunnel, commencing at 2 m. 41 ch. and ending at 3 m. 26 ch., is 66 ch. in length; No. 2 tunnel, commencing at 3 m. 40 ch. and ending at 6 m. 14 ch., is 2 m. 54 ch. in length. A contract was let to drive a bottom heading through No. 1 tunnel last October. When the contractor had driven 212 ft. at the south end the Department took over the work at this end in order that the enlargement and lining should be commenced immediately. A co-operative contract has been let for this work. From the north end the contractors have driven the heading back to 3 m. 8·64 ch., a distance of 17·36 ch. In No. 2 tunnel no work has yet actually been done at the south end, but 10,000 cub. yd. have been excavated from the approach cutting and filled into the reclamation behind the sea-wall. Preparations have been made to sink a shaft to No. 2 tunnel at 5 m. 41 ch., and a start will be made immediately on the sinking. At the north end of No. 2 tunnel the approach cutting is complete, and the driving of a 10 ft. by 8 ft. heading is in hand. Plant for the whole of the tunnel-work has been ordered, and most of it should be on the ground by the end of October.

Excavation for the abutments to a small bridge at 6 m. 18 ch. is in hand, and preparatory work has been done for the piers and abutments to another small bridge at 6 m. 38 ch.

Accommodation is being provided for all the shift-men at both ends of the tunnel. A contract has been let for thirty married men's huts at Khandallah, and thirty-seven single huts have been erected. At Tawa Flat, fifty single huts have been completed, and tenders are being called for fifteen married men's huts. A good many huts for married men will be available in three or four months' time from the Auckland–Westfield Railway Deviation, and these will be transferred to Tawa Flat.

All the necessary workshops, stores, dining-rooms, bathhouses, &c., have been erected.

Midland Railway.

Murchison Section (63 m. 10 ch. to 86 m.; length, 22 m. 70 ch.).—Work on this section has been vigorously prosecuted as far as 67 m. 5 ch., the end of the Gowan station-yard. The formation has been completed with the exception of cuttings at 64 m. 79 ch., 66 m. 0 ch., and 66 m. 12 ch. Every effort is being made to complete these cuttings, double shifts being worked on two of them, and it is anticipated that they will be finished in about four months. All culverts have been built from 64 m. 58 ch. to 67 m. 5 ch., and 15 ch. of road-deviation completed. The formation of the Gowan station-yard and access road has been completed, and contracts let for the erection of the station buildings. The concrete fronts to station platform and loading-ramp have been completed. The permanent-way material is on the ground, and the completion of platelaying and ballasting will be put in hand shortly. It is anticipated that all work will be completed and the section ready to hand over to the Railway Department by the end of the ensuing year.

Westport–Inangahua Railway.

Cascade Section (5 m. 70 ch. to 8 m. 78 ch.; length, 3 m. 8 ch.).—The principal work on this section has been the completion of ballasting and bridge-work, so that the Railway Department might take over and run a goods service from the Cascade Co.'s coal-bins as soon as the company were in a position to operate. Ballasting was completed, 1,195 cub. yd. being placed on the length, and the line boxed in and brought into first-class running-order. A retaining-wall was erected at 6 m. 13 ch., and the bridge at 8 m. 7 ch., consisting of two 40 ft., two 30 ft., and two 20 ft. span steel girders on concrete piers was completed. A siding was put into the coal company's bins early in the year, and a regular output has been maintained. An engine-shed and blacksmith's shop was erected at Te Kuha, while the accommodation was increased by a new cottage and several single huts.

Hawk's Craig Section (8 m. 78 ch. to 14 m. 0 ch.; length, 5 m. 2 ch.).—Bushfelling and clearing was completed from 10 m. 40 ch. to 13 m. 0 ch. Good progress is being made with the formation, and during the early portion of the period the work was carried on by parties of relief workers, but as soon as it was definitely decided to prosecute the work vigorously the relief parties were merged into regular co-operative gangs and the number of workmen gradually increased. The section is manned from the 9 m. to 11 m. 0 ch., and further development is in hand beyond that. At 9 m. 0 ch., test pits were sunk to ascertain the depth of foundations necessary for the Cascade Creek Bridge, this work being considerably hampered by floods. At 9 m. 50 ch. a light temporary bridge was erected for the transport of materials, and the foundations for the permanent bridges investigated. A temporary bridge is also in hand at 11 m. 45 ch., and a concrete culvert at 9 m. 59 ch.

The preliminary work necessary to the start of a large undertaking such as the active prosecution of this line has involved a great deal of work. Two main camps have been established alongside the main road at Ohika, opposite 10 m. 40 ch., on the railway, and the other at Tiroroa, opposite 12 m. 0 ch. At the former, five married men's cottages, forty-seven single huts, with cookhouse and bathhouse, have been completed; while at the latter there are nine married men's cottages, sixty-three single huts, cookhouse, and bathhouse. A school with provision for thirty children, a store, and office have also been erected as well as the necessary sanitary equipment for camps of this size.

In order to give access from the main road and camps to the work, it has been necessary to erect a mechanically operated cableway for the transport of material and three boat ferries on cables for the purpose of conveying workmen, the country on the railway side of the river being so precipitous that it is impossible to establish camps there. The erection of a light suspension bridge situated centrally in regard to the work is in hand at present, so that communication will not be cut off at any time of floods.

Lawrence–Roxburgh Railway.

Roxburgh Section (49 m. 59 ch. to 58 m. 69 ch.; length, 9 m. 10 ch.).—When my last report was written all work on this section had progressed substantially towards completion. During this year the following work was done: The concrete piers on the Timaburn Bridge were finished, and the steel girders, fabricated at the Department's workshop at Tauranga, were placed in position on the three bridges on the section, which total 270 ft. in length. Platelaying, ballasting, and fencing were completed.

Station buildings: At Teviot station-yard the goods-shed, shelter-shed, and stockyards were completed by contract. At Roxburgh station-yard one cottage, the latrines, stockyards, and a 6,000-gallon vat were erected by contract. The platform, loading-bank, engine-pits, turntable, and buffer-stops were erected by the Department. The station-yard buildings were completed by the removal from Beaumont or Miller's Flat and their re-erection at Roxburgh of three cottages and station buildings, goods-shed, engine-shed, and coal-store, this work being carried out by the Railway Department's staff.

From the 26th December, 1927, a daily goods service was run on this section, and considerable freight, mostly fruit, was carried. The section was handed over to the Working Railways on the 19th April last.

All plant, stores, and buildings are being transferred or otherwise disposed of, as there is no longer any need for such in this locality.

SURVEYS OF NEW LINES UNDER CONSTRUCTION, NEW RAILWAYS, ETC.

Gisborne–Wairoa Survey.

Two parties have been engaged on the survey of the coastal route for the major part of the year, and on the north end the trial line was surveyed to 18 m. 40 ch., while the permanent line was pegged to 17 m. 53 ch. On the south end the permanent pegging was completed to 33 m.

During the latter part of the period work was commenced on the inland route, and on the north end the old line was investigated up to 32 m. On the south end approximately 15 m. of trial survey was completed.

Stratford Main Trunk (East End).

The survey of the permanent line to 32 m. 40 ch. has been completed, and the plans are well in hand. The location survey for an approach road from Tatu, on the Stratford-Taumarunui Main Highway, has also been completed.

Dargaville Branch Railway.

The survey of the permanent line to Dargaville has been completed after several trial lines had been run to determine the most suitable position for the terminal point of the branch railway at Dargaville.

CONSTRUCTION AND MAINTENANCE OF ROADS AND BRIDGES.

Okaihau–Kerikeri Road (Bay of Islands County).—This road was formed 20 ft. wide over a length of 520 ch.

Opua–Waimate Road (Bay of Islands County).—3 m. 20 ch. of formation 14 ft. wide was completed.

Ruapekapeka–Tapuhi Road (Bay of Islands County).—Formed to a width of 14 ft. for 4 m. 3 ch.

Donnelly's Crossing–Tutamoe Road (Hobson County).—44 ch. of metalling was completed and 700 cub. yd. of slips were removed.

Kirikopuni–Parakao Road (Hobson and Whangarei Counties).—Considerable progress was made on this important road during the year, a further length of approximately 7 m. having been metalled, and the base course was laid as far as the Mangatika Viaduct, a distance of 3 m. The concrete piers and abutments for this viaduct were built, and a great deal of the steel truss span was in position at the end of the year. In addition to the foregoing, several very heavy slips were removed from the formation.

Waimamaku–Donnelly's Crossing Road (Hobson and Hokianga Counties).—The old roads between Waimamaku and Donnelly's Crossing were connected up by the completion of 6 m. of 18 ft. formation to the 16 m. 24 ch. peg. 5 m. were metalled with good blue-metal or hard conglomerate, and 4 m. were covered with rubble and inferior shingle. One hundred and twenty culverts were placed and seven temporary bridges erected, so that the road is now available for through traffic except in mid-winter. It is anticipated that a metalled connection will be made through the forest this summer.

Broadwood–Takahue Road (Hokianga County).—This road was widened to 12 ft. for 146 ch., and 1,826 cub. yd. of slips were removed.

Iwitaua Road (Hokianga County).—This road was widened to 16 ft., with 20 ft. on corners, for a distance of 619 ch. The formation is through limestone country, and 2,290 cub. yd. of stone was stacked ready for metalling. Mander's Bridge, 42 ft. long, was erected, and 216 cub. yd. of approach filling completed; one 16 ft. bridge was erected and 60 ch. of metalling done.

Whangape – Rotokakahi Road (Hokianga County).—Widened from 10 ft. to 14 ft. for 79 ch., 10 ft. to 16 ft. for 82 ch.; 1,608 cub. yd. of filling were placed in banks 16 ft. wide; 4 m. 21 ch. metalled; one 14 ft. bridge erected; and 420 cub. yd. slips cleared.

Diggers' Valley Road (Mangonui County).—Widened from 10 ft. to 14 ft. over a length of 188 ch., 928 cub. yd. of slips were cleared, and 86 ch. metalled.

Oruru – Fern Flat – Mangamuka Road (Mangonui County).—155 ch. of this road were widened from 12 ft. to 16 ft., slips were cleared over a length of 40 ch., 16 ch. were metalled, and one 40 ft. bridge consisting of two 20 ft. spans with approaches 16 ft. wide was completed. The materials for three other bridges were delivered on to the sites.

Waipapakauri – Tangoake Road (Mangonui County).—214 ch. were formed to a width of 14 ft. and 68 ch. to a width of 22 ft.; 92 ch. of drains were cut.

Marereteu – Waikiekie Road (Keay's Deviation) (Otamatea County).—No. 1 bridge, consisting of four 30 ft. spans, was commenced and is well in hand; the approaches to three other bridges were formed up, and a considerable amount of clearing of slips and cleaning out of water-tables was done.

Carter's Valley Road (Whangarei County).—128 ch. of metalling were completed.

Ruakaka Bridge (Whangarei County).—This bridge of three 40 ft. spans, on the One Tree Point Road, was erected, and the approaches were formed and metalled.

Waiotira – Ararua Road (Whangarei County).—Formation 16 ft. wide, with necessary culverts, was completed from 0 m. 44 ch. to 2 m. 44 ch.; the approaches to two bridges were formed up, and slips cleared over 2 m. A temporary bridge across the Mangonui River was commenced.

Kaeo River Bridge (Kaeo Village Road) (Whangaroa County).—This bridge of three 40 ft. spans was completed, and 8 ch. of approaches were formed and metalled.

Oakleigh – Waipu Road (Whangarei County).—Substitution of road for railway: Slips were cleared from heavy cuttings, the banks near the 9½ m. and 10 m. pegs were widened, and additional drainage was completed between the 8½ m. and 9½ m. pegs. The road was further improved by the cants on curves being made up between 11 m. and 13 m. A start was made with the bitumen surfacing, the first coat of "Resmex" having been placed on the first 7 m., and four experimental strips 35 ch. long were put down in "Resmex" and bitumen. The remaining 9 m. of the road was maintained with a loose top by the application of ⅜ in. metal chips to the extent of 120 cub. yd. per mile and by frequent grading.

Colville – Port Charles Road (Coromandel County).—The construction of this road was completed during the year, 8 m. 24 ch. of formation having been carried out.

Tapu – Coroglen Road (Coromandel County).—3 m. 60 ch. were metalled, and 21 ch. of that length were blinded with sand. In addition, a bridge of one 30 ft. rolled-steel-joist span, concrete abutments, and hardwood decking was erected.

Taurangaruru Main Road (Franklin County).—3 m. of dray-road 18 ft. wide were formed.

Port Fitzroy – Nagle Cove Road (Great Barrier County).—A 6 ft. bridle-track was formed for 1¼ m.

Ngararahi Stop-Bank Road (Hauraki Plains County).—110 ch. were metalled 10 ft. wide by 9 in. deep.

Te Maika Road (Kawhia County).—113½ ch. of bridle-track were widened to 12 ft. and the whole length of road was handed over to the local body.

Buckland's Road (Manukau County).—65 ch. of penetration completed to a width of 20 ft.

Waikopua Creek – Maraetai (Manukau County).—3 m. of metalling 10 ft. wide completed.

Horahora Special Area Roads (Matamata County).—3 m. 65 ch. metalled.

Matamata – Gordon Road (Matamata County).—Proposals were approved for double-sealing 1 m. 68 ch. to a width of 15 ft., 2 m. 48 ch. to a width of 12 ft., and 3 m. 72 ch. to a width of 10 ft., and 4 m. 36 ch. were completed.

Putaruru – Waotu Road (Matamata County).—2 m. 24 ch. were metalled 12 ft. by 10 in.

Ohinemuri River Bridge (Paeroa).—This bridge, which consists of three 60 ft. and four 30 ft. steel-girder spans, concrete piles and piers, concrete deck 18 ft. wide, and cantilever footway 4 ft. 6 in. wide, was erected and the old bridge dismantled.

Waihi – Whangamata Road (Ohinemuri County).—The formation of this road was completed over a length of 9 m., this including the harbour section and Ross's and Bjerring's deviations. This road provides an outlet to Waihi for Whangamata settlers, and the work was done by relief workers.

Otorohanga – Pirongia Road (Otorohanga County).—212½ ch. were metalled during the year, and proposals for a further 2½ ch. were approved.

Owawenga Valley Road (Otorohanga County).—Relief workers formed 5 m. 10 ch. of this road to a width of 14 ft., and placed necessary culverts. This length was handed over to the local body, and a further section of 2 m. 10 ch. is in hand.

Kuranui Road (Piako County).—2 m. 47½ ch. were metalled.

Pakarau Soldiers Settlement Road (Piako County).—242 ch. were metalled 10 ft. wide by 6 in. deep.

Waihou River Bridge (Te Aroha) (Piako County).—This reinforced-concrete bridge of ten 40 ft. spans, 18 ft. roadway, and footpaths 4 ft. 6 in. wide on both sides was completed by the Te Aroha Borough Council.

Waikaretu – Port Waikato Road (Raglan County).—9 m. 74 ch. of formation 14 ft. wide completed.

Waingaro – Waingaro Landing Road (Raglan County).—2 m. 15 ch. were metalled with rubble rock and 2 m. 17 ch. were surfaced.

Te Hana – Tomorata Road (Rodney County).—A total length of 3 m. 26 ch. was metalled.

Omahu–Otamakite Road (Thames County).—Relief workers completed the formation of 3 m. 40 ch. of this road.

Tamahere–Tauwhare via Matangi (Waikato County).—During the year 2 m. 51 ch. of this road were sealed.

Owairaka Valley Road (Waipa County.)—3 m. 67 ch. were metalled 9 ft. wide by 6 in. deep.

Te Awamutu – Arapuni (Pukeatua End) (Waipa County).—A length of 2 m. 24 ch. of this road was metalled 12 ft. wide by 8 in. deep.

Great North Road, Silverdale–Redvale (Waitemata County).—60 ch. were metalled.

Orakei Waterfront Road (Eden County).—This road, which is being constructed at the joint expense of the Tamaki West Road Board, the Auckland City Council, and the Government, is to give improved access to the new suburbs in the locality. The work is being carried out by the Public Works Department, the activities being co-ordinated with those of the construction of the Auckland–Westfield Railway deviation not only in respect to supervision, but also in respect to use of plant and the disposal of earthwork and rockwork. Good progress was made during the year with the construction of the sea-walls and road-formation. From Campbell's Point, the low-level sea-wall of dumped rubble rock was continued to 2 m. 60 ch., and the facing of hand-placed rock and mortar-grouted face-joints was completed from 1 m. 0·04 ch. to 1 m. 30 ch. and from 1 m. 72 ch. to 2 m. 14 ch. The full-width formation now extends as far as 1 m. 41·80 ch. and from 1 m. 55 ch. to 1 m. 70 ch., while from there on to 2 m. 14 ch. it has been completed to approximately three-quarter width. The cuttings at 2 m. 24 ch. and 2 m. 42 ch. were completed, and the spoil was used to fill in the adjacent embankments. A spall foundation for metalling was laid for full width from 1 m. 0·02 ch. to 1 m. 13 ch., and for half-width from 1 m. 13 ch. to 1 m. 18 ch. and from 1 m. 58 ch. to 1 m. 70 ch. The spoil was practically all excavated by four steam shovels, and during the year some 300,000 cub. yd. were tipped into the embankments. Temporary bridges were erected at 1 m. 40 ch. and 2 m. 15 ch., and the road was opened to traffic.

Mission Bay Extension: Beyond 3 m. 20 ch. the low-level stone protection wall was continued to 3 m. 45 ch., and a relief party working in the cutting at 3 m. 30 ch. extended a half-width formation for about 13 ch.

Whakatakataka Bay Road: This road, which gives access to the Orakei Garden Suburb from opposite 2 m. 22 ch., was constructed to approximately one-third width for its full length of 26 ch. A good surface was maintained, and the constructed portion was thrown open to traffic.

Purewa Stream Bridge: This bridge, which is to be erected in reinforced concrete, will consist of four 40 ft. and two 30 ft. spans, with a roadway 30 ft. wide, and two footways each 6 ft. wide. During the year some preliminary stone protection work was placed, the cutting on the south side was opened up, and as far as possible both approach banks were built. The steelwork was ordered, and a party is engaged making the 18 in. square concrete piles.

Orakei Garden Suburb (Eden County).—The various works in this block were pushed ahead vigorously during the year, an average of one hundred men having been continuously employed. Some 6 m. of roads are being dealt with, of which 3 m. 15 ch. have been completed and are in readiness for handing over to the local authority. The following is a brief summary of the works completed during the year: Street-formation, 2 m. 7 ch.; kerbing and channelling, 19,729 lin. ft.; kerbing only, 18,763 lin. ft.; foundation course, 313 ch. full width and 38 ch. half width; footpaths (scoria), 478 ch. 22,000 cub. yd. of scoria were used for foundation purposes and footpaths. 412 ch. were metalled, rolled, and blinded with waste, a total quantity of 14,500 cub. yd. of metal and 5,750 cub. yd. of waste being used. Water-mains—349·02 ch. of pipes were laid complete with hydrants, valves, &c. Sewerage—12,917 lin. ft. of pipes laid, 58 manholes and 26 lamp-holes completed, and 164 building allotments were linked up with the city sewerage system. Storm-water drainage—9,300 lin. ft. of field tiles and 5,899 lin. ft. of pipes were laid complete with manholes, &c., and 69 cesspits were completed.

Opotiki – East Cape Road (Motu River – Te Kaha Section) (Opotiki County).—One 61 ft. standard truss bridge in hardwood on concrete abutments was erected at Waiorori; 3 m. 8 ch. were formed 14 ft. wide; 16 ft. of pipe culverts and 230 ft. of concrete-pipe culverts were placed in position.

Opotiki – East Cape Road (Motu River Bridge) (Opotiki County).—The contractor is making good progress with this bridge of four 110 ft. and one 81 ft. truss spans in timber on concrete abutments and concrete cylinder piers. The whole of the plant is on the site, one abutment is completed, 84 lin. ft. of concrete cylinders have been cast, and the sinking of cylinders to foundation has been commenced.

Opotiki–Matawai via Waioeka Road (Opotiki County).—2 m. 70 ch. of 16 ft. formation were completed, 62,907 cub. yd. of hard rock, 7,155 cub. yd. rubble rock, 5,163 cub. yd. loose rock, 1,696 cub. yd. loose rubble, 14,321 cub. yd. of clay and boulders, and 3,137 cub. yd. clay having been excavated, and 14,548 cub. yd. of slips removed. In addition, 100 lin. ft. of timber box culverts and 856 lin. ft. of Hume pipes were placed in position.

Maraeroa Road (Rotorua County).—2½ m. metalled 12 ft. wide, and 147 ft. of 12 in. and 36 ft. of 9 in. concrete-pipe culverts placed.

Okere–Hamurana Road (Rotorua County).—4¾ m. of formation 14 ft. wide and 1½ m. of metalling were completed, and 947 ft. of culverts were placed.

Tauranga–Rotorua Direct Road (Tauranga County).—This road was re-formed and graded over a length of 10 m., and 30 ch. were formed 18 ft. wide.

Williams Mount Road (Tauranga County).—2½ m. of 16 ft. formation and 75 ch. of metalling were completed, and 21 ft. of concrete-pipe culverts were placed.

Awaiti Road (Whakatane County).—2½ m. metalled and two dray-bridges 10 ft. long by 18 ft. wide were erected.

Waioho Valley Road (Whakatane County).—80 ch. metalling, 30½ ch. of formation, and 70 ch. of regrading were done, and 100 ft. concrete-pipe culverts were placed.

Hangaroa–Tahora Road (Cook County).—This important settlement road was metalled for 4 m. 10 ch., and a further length of ½ m. was formed.

Main East Coast Road (Hicks Bay to Whangaparaoa) (Matakaoa County).—This road is important in that it will provide access for a large portion of the county to the port at Hicks Bay. A length of 6 m. was put in hand and 3½ m. were completed during the year.

Tolaga Bay to Tauwhareparae Road (Uawa County).—This also is an important settlement road, of which 66 ch. were metalled.

Ihungia River Bridge (Waiapu County).—This bridge, consisting of four 36 ft. rolled-steel-joist spans and timber substructure was completed.

Motu Valley Road (Waikohu County).—During the year 3 m. were metalled, 1¾ m. formed, and a bridge 105 ft. long was erected. The road gives access to the Motu Railway at Matawai for a considerable area.

Kouturoa Road (Kaitieke County).—1 m. 48 ch. of formation and thirty culverts totalling 459 ft. were completed.

Wanganui River Bridge (Te Maire) (Kaitieke County).—This bridge, of one 110 ft. central span, two 61 ft. spans, and two 25 ft. landing-spans on mass concrete piers was completed.

Haparua Road (Ohura County).—2 m. 10 ch. of surfacing and 1 m. 48 ch. of formation completed.

Tongaporutu Road (Ohura County).—3 m. 20 ch. of formation, 1 m. of metalling, and twenty-three culverts totalling 708 ft. were completed.

Ongarue–Waimiha Road (Ohura County).—The formation of this road was extended by relief workers for a further 6 m. 24 ch., and sixty-six culverts totalling 1,992 ft. were placed.

Kururau Road (Taumarunui County).—1 m. 45 ch. of formation and 448 ft. of culverting were completed.

Takiri–Mokauiti Road (Waitomo County).—A length of 2 m. 18 ch. was surfaced.

Kiritihere Road (Waitomo County).—A section of 2 m. 55 ch. was formed and handed over to the local body.

Okahu and Wiremu Roads (Egmont County).—Relief workers were engaged on this road and during the year completed 4 m. 67 ch. of formation.

Maben Road (Patea County).—3 m. 73 ch. of 6 ft. track and 70 ch. of dray-road formed.

Raetihi–Ohura (Manganui-o-te-ao to Retaruke) (Waimarino County).—This road was extended for 1 m. 30 ch. and 3 m. were maintained.

Watershed Road (Waitotara County).—Formation extended 2 m. 33 ch., and 6½ m. maintained.

Field's Track – Rangiwaea (Wanganui County).—2 m. 65½ ch. of formation completed.

Wanganui River Road (Left Bank), Upokongaro to Jerusalem (Wanganui County).—A further length of 1 m. 68 ch. of formation was completed, and 2 m. 6 ch. maintained.

Mangangarara Block Access Road (Dannevirke County).—A contract for 2 m. of fencing is nearing completion.

Tutira–Pohokura Road (Hawke's Bay County).—With the completion of a further 1 m. 65 ch. this road is now open over a length of 12 m. 22 ch. An engineering survey of a deviation of 1¼ m. was carried out and the deviation approved. This will shorten the road by 1¼ m., and better grades will be obtainable.

Kahotea Block Access Road (Wairoa County).—2 m. 75 ch. of second-class formation and thirty-eight culverts of a total length of 808 ft. were completed.

Mangaone – Mangapoike Valley Road (McGee's Access) (Wairoa County).—3 m. 70 ch. of second-class formation was done, a water-drive of 105 ft. was completed, and seventy-one culverts totalling 1,404 ft. were laid.

Ruakituri–Waimana Road (Wairoa County).—The formation of this road was continued for 1½ m., eleven culverts totalling 229 ft., were placed, and a water-drive of 100 ft. was put in.

Pongaroa–Akitio Road (Akitio County).—Waiotiaki deviation, 2 m. 57 ch. in length, was formed and culverted, and 93 ch. of Akitio Hill were metalled.

Heckler's Loan Block Road (Eketahuna County).—This road was resurfaced over a length of 100 ch.

Cape River Road (Featherston County).—60 ch. of metalling completed.

Hutt River Bridge.—The new reinforced-concrete bridge, consisting of eight 45 ft. spans, with roadway 40 ft. wide, in Lower Hutt Borough was commenced. All the piles were driven: the piers, one abutment, and six spans were completed. This bridge is being erected by the Lower Hutt Borough Council at the joint expense of that body, the Wellington City Council, Petone and Upper Hutt Borough Councils, the Hutt County Council, and the Government.

Wairere Road (Masterton County).—1 m. 10 ch. were metalled.

Reu Reu Road (Oroua County).—110 ch. formed and culverted, and 70 ch. metalled.

Palmerston North – Pahiatua Track (Pahiatua County).—The points were taken off and the track was widened to 18 ft. over the whole length of the Pahiatua County side.

Hawai Railway-station – Cape Road (Awatere County).—1 m. 48 ch. metalled.

Mangles River Bridge (Longford) (Murchison County).—This bridge, consisting of one 100 ft. truss span and one 25 ft. end span in M.A.H. on concrete piers and adutments, with 6 ft. roadway, was erected.

Rangahanock Bridge (Murchison County).—One 81 ft. truss span in birch timbers on pile abutments, with 9 ft. roadway, was erected and 4·45 ch. of approaches were completed.

Blenheim – Hope Junction via Tophouse (Murchison and Waimea Counties).—This very important road has proceeded steadily during the year, an average of 152 men having been employed. A total length of 17 m. 26 ch. has been formed, 1,196 ft. of culverts placed (all the concrete pipes having been made on the works), 7½ m. metalled, and 3½ m. of bush was felled and 4 m. of general clearing done. In addition, a total length of 5 m. of fencing was erected, and 4,000 posts, 8,000 droppers, and 200 strainers were split on the work.

Traverse – Branch River Road (Marlborough County).—78 ch. were formed and metalled and two 40 ft. culverts completed.

East Takaka Main Road (Takaka County).—1 m. 13 ch. metalled.

Little Wanganui – Wangapeka Road (Buller County).—2 m. 60 ch. of road widened to dray-width, 3 m. 57 ch. gravelled, 63 ch. track formed, and 100 lin. ft. of culverts laid.

Westport – Greymouth Coast Road (Buller County).—Work on this road proceeded during the year, and with the exception of the section of 9 m. between Fox's River and Punakaiki has now been declared a secondary highway. During the year, 1 m. 32 ch. of formation and 2 m. 65 ch. of metalling were done, and 759 lin. ft. of culverts were laid. The plans for the Punakaiki and Pororari River bridges have been approved, and arrangements are being made for purchase of materials.

Brunner – Blackball Road (Grey County).—1 m. 35 ch. of engineering surveys were carried out, 1 m. 6 ch. constructed, 12½ ch. gravelled, and 136 lin. ft. of culverts were laid.

Kotuku – Bell Hill Road (Grey County).—51 ch. dray-road formed, 1 m. 72 ch. gravelled, and 426 lin. ft. of culverts placed. This road is now completed, and forms a connecting link between Greymouth and Inchbonnie.

Matakitaki – Springlands Junction (Inangahua County).—An additional 4 m. 40 ch. of engineering surveys were carried out, 3 m. 11 ch. were formed 17 ft. wide, 2 m. 69 ch. gravelled, three bridges erected, and 356 lin. ft. of culverts laid. When completed, this road will form an alternative route between Nelson and Greymouth.

Dorothy Falls Track (Westland County).—This road will eventually give tourists access by car to Dorothy Falls via the newly gazetted Lake Kanieri secondary highway. During the year 1 m. 40 ch. of engineering surveys were completed, 1 m. 17 ch. of track widened to 14 ft., 74 ch. gravelled, and 42 lin. ft. of culverts laid.

Menzies Bay – Little Akaloa (Akaroa County).—170 ch. of road were formed 12 ft. wide in heavy side-cutting, mostly in rock, and the same length was metalled. The work was carried out by unemployed, and the road is now completed.

Coskerie's Road (Ashburton County).—This road was completed with the metalling of 2 m. 25 ch.

Valetta – Cavendish Road (Ashburton County).—4 m. 25 ch. of formation completed.

Ball Hut Road (Mackenzie County).—5¼ m. of road have been formed in heavy side-cutting, mostly in rock, and a bridge 40 ft. long was erected over Blue Lake Stream. The completion of this work permits of all traffic getting to within 4 m. of the Ball Hut.

Beach Road (Waipara County).—Relief workers completed 10 m. of formation in side-cutting, partly in rock, and placed all necessary culverts.

Kinloch Settlement Roads (Wairewa County).—2 m. metalled.

Longpoint Road (Clutha County).—2 m. 39 ch. were widened and 35 ch. metalled.

Little Valley Road (Vincent County).—6 m. 20 ch. were formed and 1 m. 40 ch. gravelled.

Tussocky Road (Waitaki County).—3 m. 40 ch. were gravelled.

Evansdale – Karitane Road (Waikouaiti County).—Widened to 20 ft. for approximately 12 m., improvements being made to curvature, visibility, and drainage.

Otara – Haldane Road (Southland County).—4 m. 75 ch. of engineering surveys were carried out, and relief workers formed 4 m. 75 ch. In addition, 32 ch. were surfaced and forty-nine culverts placed.

Waikawa – Chaslands Road (Southland County).—7 m. of engineering surveys were carried out and the same distance formed by relief workers; 4 m. 10 ch. were surfaced, one bridge was erected, and sixty-four culverts were placed.

Manapouri – Te Anau Road (Wallace County).—Relief workers were placed on this road and completed 6 m. of formation.

Naturally it cannot be expected that the same mileage of roading can be done for the same amount of money as was the case a few years ago. At one time preliminary metalling could be carried out to a very moderate standard, but nowadays, with the certainty that motor-lorries will use a road as soon as it is surfaced, it is necessary to spend far more per mile than used to be the case; also, better curves, wider formation, and stronger culverts are now required.

HYDRO ELECTRIC WORKS.

ARAPUNI.

No. 1 Section of Contract.—Messrs. Sir W. G. Armstrong, Whitworth, and Co. continued to make good progress on No. 1 section of their contract, this section including all the headworks up to the penstock intakes. By the end of November, 1927, the concreting of the dam was completed, with the exception of the parapets and roadway in bays Nos. 1 and 2.

The total quantity of material excavated for the dam and cut-off walls was 95,950 cub. yd., and the total quantity of concrete placed was 59,950 cub. yd. Of these quantities, 5,300 cub. yd. were excavated, and 48,850 cub. yd. of concrete were placed during the period under review.

The hydraulic pump and cylinders for operating the diversion-tunnel gates were erected and tested before the end of November, and proved satisfactory.

At the penstock intakes the concreting of intakes 5, 6, 7, and 8, which was commenced during the period covered by my last report, was completed, as was also the concreting of intakes 1, 2, 3, and 4. This work, together with the placing of screens on intakes 1, 2, and 3, was finished just prior to the water

entering the headrace in December of last year, as the lake was being filled. The gates for intakes Nos. 1, 2, 3, and 4 have been erected, and the automatic screen-cleaner has been placed in position. The spillway was completed by the concreting-up of the 20 ft. gap, which had been left open for the purpose of access to works, and by the erection of the inspection bridge across the spillway.

In anticipation of trouble with the screens at Horahora, following the diversion of the river, all scrub and vegetation in the headrace and overflow-channel, and on the Waiteti Flat, was cut and burned, and logs were removed and two constrictions in the Waiteti Channel were reduced.

The diversion-tunnel gates were closed on the 2nd December last, so that the lake commenced to fill, and by 11.30 p.m. on the 31st December water commenced to flow over the spillway, and since then the river has flowed by its new channel over the Waiteti Flat.

No. 2 Section of Contract.—My report of last year indicated that the contractors had made no progress at the power-house site. That condition remained unchanged as far as the contractors were concerned during the year under review, no work being done by them on the excavation for the power-house foundations. In December last an agreement was reached between the Government and the contractors under which the latter were relieved from further work on No. 2 section of the contract.

At the end of January the Department commenced work on No. 2 section with its workmen and staff. Efforts were specially concentrated on the power-house construction. It had been hoped that the diversion of the Waikato River would so lower the water-level in the old channel at the power-house site that difficulties due to the inflow of water into the foundations would largely disappear. Owing, however, to the raising of the Waikato River bed at the Waiteti Stream junction by the deposit of material eroded by the diverted river, these anticipations were realized to a comparatively small extent only, in that the water-level was only lowered 7 ft., and there was substantially as much trouble with inflow of water as before. To overcome this, very extensive use was made of cement grout, this being pumped in under pressure, through a series of drilled holes, into the coffer-dam which had been built by the contractors. This proved effective in so reducing the inflow of water, and in strengthening the coffer-dam, so that work could be prosecuted with vigour. No departure from the power-house site or scheme of works as required by the contract was found necessary.

Concentrating on the foundations for Nos. 3 and 4 units, the concreting for these was commenced on the 22nd April, and concreting at units 1 and 2 begun on the 8th June. During June a commencement was made with the erection of No. 3 turbine; and the steel draft-tube, with foundation ring, has been assembled, riveted, and placed on the concrete foundation. A commencement has also been made with the assembling and riveting of steel columns, roof-trusses, and bracing for the power-house.

It is, I think, clear from the foregoing that the difficulties that confronted the Department at the power-house site in January last were satisfactorily and quickly overcome, and that the work is now proceeding with vigour.

At the penstock-tunnels the riveting and placing of the steel linings and the placing of the concrete behind the steel linings were completed last December. The cable-tunnel is complete except for 14 ft. at the lower end. The outdoor station is complete except for the erection of fence, and the pump-house is complete except for floor and window-glazing.

The tail-race excavation presented difficulty by reason of the high water-level, due to the raised condition of the Waikato River bed already referred to. However, as a bank of sand and pumice had been created at the lower end of the tail-race by the river on diversion, it was considered possible, by installing a pumping plant, to dewater the old river-bed and deal with the normal flow of 12 cub. ft. per second therefrom. A pumping plant has been installed and water-level was reduced by the end of June by a depth of 10·5 ft. Excavation work is now being successfully carried out, 3,700 cub. yd. having been moved by the end of June.

The dewatering of the tail-race disclosed that the work of clearing and enlarging it has been greatly increased by the very large quantity of rhyolite rock excavated by the contractors from above the power-house site and dumped into the river. A large proportion of this had not been carried away by the current, and now must be moved by the Department.

Erection of Electrical Equipment.—Practically the whole of the permanent equipment required by the contract as part of the installation of three 15,000 kw. units is on the site, and the position in respect to the erection is shortly summarized as follows:—

50 kv. switching-station: The erection of this equipment is complete as required for the present installation—namely, for 14,000 kv.a., 50 kv. to 110 kv., Horahora tie transformer-bank, Rotorua line; and 750 kv.a., 50 kv. to 11 kv. transformer-bank; but no operating-cables have been installed.

110 kv. switching-station: The erection of the 110 kv. and 11kv. outdoor switch-gear for transformer-banks Nos. 1, 2, and 3, and the Horahora tie bank is complete, but no operating-cables have been installed.

Main transformers: The erection work on the main transformers is complete. Painting of transformers and oil-switches still to be done.

Oil circulating, pumping, and testing system: This is complete, save for some piping connections.

Transformer water-cooling system: The installation of this system is well advanced.

Minor items: Pumping for village water-supply is complete and in service. For the operating-gear for penstock-gates, the automatic screen-cleaning machine, and the water-rheostat the electrical installation is practically completely erected. In the cable-tunnel seventy-eight angle-iron cable-racks have been erected. A grounding-system at outdoor station, consisting of a ground bus of 19/·083 bare copper cable, has been run round the station and connections made to transformer-tanks, oil-switches, and steel structures. A commencement has been made with the erection of the permanent lighting equipment at outdoor station building, steel structures, &c.

Adequate attention has been given to the temporary storage, the unpacking, and care of such items of permanent equipment as required it.

Waikaremoana Power Development.

Work on the first stage of this power development has progressed at a substantial rate during the year. The intake race between the Waikaretaheke River and Lake Kaitawa, which was commenced in July, 1926, was completed in September, 1927, except for a temporary by-pass opening in the right wall, and the Waikaretaheke River turned into the race early in October. To bring the water into the race fourteen holes, 12 ft. to 16 ft. in depth, were drilled in the face of the excavation under the river-bed. The drilling of these holes was completed on the 3rd October, and charges were placed and fired the following morning. The soft rock at the intake was thoroughly shattered, and by using drags sufficient material was removed to permit of some 380 cusecs flowing through the race that evening. Dragging operations and the shooting of obstructions were continued to give the water a clear channel. At the same time a sand-bag wall was carried across the old bed of the river to completely divert the stream. In the main race the normal flow is about 600 cusecs, while leakage down the old river-bed amounts to about 2 cusecs. A temporary timber dam was erected near the Kaitawa end of the race and the water diverted temporarily to its normal channel through the by-pass opening.

When the above work was completed a commencement was made on the permanent diversion weir, which extends across the original river-bed to a length of 100 ft. The cut-off wall was taken down 5 ft. to a bed of tight pug. The weir was completed in April, 1928, 308 cub. yd. of concrete being placed at this point. Automatic water-level indicators and measuring-devices are being installed at the weir. These instruments will record graphically in the power-house the water-level at the weir and the volume of water passing over the weir, thus enabling future possibilities of this development to be gauged. To reduce the velocity of approach of the stream at the weir, and to reduce turbulence, the river-bed is being deepened and obstructions removed. Excavation for this purpose totalled 1,678 cub. yd. at the end of June, 1928.

As the design provides for the raising of the level of Lake Kaitawa 10 ft. above the original level, it was necessary to construct an earth dam at the south end of the lake. To achieve this a stratum of porous pumice at the dam-site was removed and a pug-core wall carried down to reach as nearly as possible an impervious layer. There is no solid-rock base available. The earth dam was completed in February, 1928, except for a spillway which was left to maintain the lake at a fixed level while the temporary power plant is in operation.

Material placed in the dam totalled 15,904 cub. yd. of clay and crushed rock. The dam has been stone-pitched on the lake side to prevent erosion, while the opposite face has been sown in grass.

Excavation of the approach canal from Lake Kaitawa to the tunnel-portal was completed in May, 1928, a temporary barrier being left at the lake end to exclude water until work at the tunnel-portal is completed. On the lake side of the barrier the bed of the lake has been deepened to provide an adequate waterway at periods of low lake-level, and vegetation growing there has been removed by dragging. The total excavation for the approach canal was 12,603 cub. yd. The sides of the canal have been stone-pitched and a stone toe placed at the foot of the batter to prevent scour.

Excavation of the main tunnel was carried on from both ends, the two headings meeting in January, 1928. Owing to the tendency of the country to slip and the consequent difficulty of maintaining a batter to the canal, it was deemed advisable to extend the tunnel approximately 70 ft. nearer to Lake Kaitawa than was originally intended. The tunnel proper, 773 ft. in length, was completed in May, 1928, and work commenced immediately on the portal, which is now almost complete. The adit opening was closed in June, and back-filling of the adit completed. Grouting of the tunnel was commenced in April and completed in June, cement mortar being forced under pressure into any open ground that existed behind the concrete lining of the tunnel.

Concreting of the surge-chamber was completed in March, 1928, a total of 1,803 cub. yd. of concrete being placed. Surge-chamber screens and gates and gate-operating gear have been erected, and the latter tested for hand operation. A water-level recorder will be installed to record graphically in the power-house the water-level at the surge-chamber.

The contractors for the pipe-line completed the installation of their plant in July, 1927, and immediately commenced the drilling and rolling of plates. Anchor-blocks were concreted to invert level, angle-pieces set in position, and blocks completed. In addition, three pipes were set at the surge-chamber and concreted into the gate-chamber wall. At the end of June, 1928, the south line was complete between No. 3 anchor-block at the power-house and the surge-chamber, except for expansion joints. In the north line 2,303 ft. of pipe were completed. The erection of pedestals was completed in February, 1928.

Steady progress has been maintained on the erection of the power-house. The shell of the building was almost completed by the end of June, and at the south end a portion of the roof over the machine-room is in place. The foundation for No. 1 machine has been concreted, while No. 2 foundation is nearing completion. Foundations for the two exciter sets now in operation in the temporary power-house were completed in February, 1928. To date 7,468 cub. yd. of concrete and 139 tons of steel have been placed in the building. Work is now proceeding on the erection of the 80-ton crane in readiness for handling the heavy plant which is expected at an early date.

At the outdoor transformer and switching station the transformer-house was completed, except for windows, in April. The erection of a 50-ton crane for the handling of transformers and oil circuit-breakers is now in hand. At the point where the access road meets the outdoor station site a 30-ton unloading-crab, electrically operated, has been erected, and thence heavy plant is moved into position on a 30-ton truck running on 6 ft. gauge traverser-tracks. The main traverser-track from the unloading-crab to the transformer-house has been laid, and the turntable at the entrance to the transformer house erected. Track C, giving access to the 50 kv. transformers and switch-gear, has been partly laid, and the turntable connecting it to track D is now in course of erection.

Erection of the outdoor switch-gear was commenced early in January, and at the end of June substantial progress had been made.

The 110 kv. and 50 kv. lightning-arresters were complete, the 50 kv. oil circuit-breakers assembled and the 50 kv. air-break switch-gear nearing completion. Of the 110 kv. air-break switch-gear the steelwork and all switches have been erected and bus-bars strained up. Final connections are now being made. The erection of the 110 kv. oil circuit-breakers is now in hand.

The seven 110 kv. transformers have been transported to site and placed in position on their foundation pads. Drying out of these transformers will be put in hand as soon as they can be handled by the 50-ton crane in the transformer-house. The 50 kv. transformers are also on site, being stored near the unloading-crab until they can be dried out and placed in position on their foundation pads.

Five oil-storage tanks have been erected on a pad outside the transformer-house, and oil bus-pipes and oil-level indicators connected to them. An oil-filter house has been erected, a 12 in. oil-filter press set in place, and oil-pipes run from same to the oil-storage tanks.

From the main generating-station to the outdoor station a cable-tunnel is now in course of construction, a double tunnel being run from the power-house to the 110 kv. transformers, and a single tunnel from that point to a point opposite the 50 kv. switch-gear. At the end of June the single tunnel, 129 ft. in length, and 312 ft. of double tunnel had been completed.

To provide a storage area for the subsequent lower development an earth dam is to be constructed across the Kahutangaroa Stream, which will serve as a tail-race from the station now under construction. Excavation for the earth dam has been taken down to an impervious layer of clay, 1,660 cub. yd. being removed. Concreting of the culvert through the dam is now being put in hand.

Provision has been made for the accommodation of the permanent operating staff. In addition to the two cottages erected when the temporary scheme was installed, twelve five-roomed and six three-roomed cottages have been erected. Quarters for single men containing seven bedrooms, besides conveniences, have been built. A staff hostel, containing dining-room, recreation-room, visitors' bedrooms, and cook's quarters, has also beeen erected. All these buildings have been connected to the permanent sewerage, drainage, and water systems.

At Wairoa the unloading-store has been completed and equipped with 30-ton and 10-ton cranes. At present stored there are the first generator and parts of the first turbine, 11 kv. switch-gear and control gear, 500 kv.a. service transformer, transformer-oil, storage battery and booster, and various small items for the main generating-station, in addition to transformers for the Wairoa Substation.

At the Gisborne and Wairoa Substations a start has been made with the concreting of foundations for transformers and switch-gear.

Timber required for the many operations connected with the scheme has been cut at the Department's sawmill. For the year ending 30th June approximately one million feet were cut, making the total since the Department took over the mill of $2\frac{1}{2}$ million feet.

The temporary generating plant, which was leased to the Wairoa Electric-power Board, was taken over by the Department on the 1st January, on the expiration of the Power Board's lease. This plant has operated very satisfactorily throughout the year, coping with all demands made on it.

Mangahao.

Mangaone Section.—The principal work carried out on this section during the period has been the general maintenance of road-surfaces, repairs to bridges, and culvert replacement on the length of road between Shannon and the No. 3 dam, and the regulation and enlargement of the Mangaone Stream to enable it to carry the additional tail-water from the power-house without causing erosion or flooding. On the lower section of this stream, which acts as a main drain for the adjoining properties, it was found that the power-house tail-water caused a rise in water-level, resulting in the submergence of the outlets from several of the private drains where they entered the main stream. In order to remedy this difficulty, the lower channel has been straightened and deepened, 31,000 cub. yd. of material having been excavated by means of a floating dredge with successful results. In the upper portion of the stream a number of stone groynes were built and other protective measures adopted to cope with the erosion which has taken place recently. It is not considered that this erosion is wholly due to the increased flood flow, but it was, however, anticipated that there would be enlargement of the normal channel, and stability under the new conditions should be obtained very shortly.

Mangahao Section.—At No. 1 dam the lifting-mechanism controlling the siphon-tower port-gates and the new type of lateral gate-tighteners have been fitted and have proved fairly satisfactory. Two 60 ft. steel truss foot bridges between the towers have been erected and the temporary suspension bridge dismantled.

The shaft-control houses at Arapeti and No. 1 dams, together with the footbridges, have been painted. At No. 3 dam all construction work has been satisfactorily completed. The major portion of the concrete-work at the dam proper was carried out prior to Christmas, 12,006 cub. yd. of concrete being placed, which, in addition to that placed during last period, gave a total of 37,589 cub. yd. The rock excavation and trimming involved 28,385 cub. yd., of which 6,014 was taken out during the current period.

As it was desired to bring the dam into operation at the earliest possible date, three shifts were worked regularly until December. In order to enable the permanent gates to be placed on the diversion-tunnel it was necessary to fit temporary wooden gates, behind which the excavation and concreting of the tapered section and the installation of the permanent gates was carried out. The 4 ft. steel culvert and Johnston control-valve was fitted and concreted in the bottom of the dam, a section at the centre having been left open to take care of floods in excess of the capacity of the diversion-tunnel. After the placing of the steel culvert this section of the dam was successfully concreted without any difficulty.

The erection of the 50 ft. 4 in. automatic spillway-gates, involving careful work in fitting the steel rubbing strip, the construction of the gates themselves, as well as the concreting of siphon-towers and the fitting and adjusting of all mechanical controls, screens, &c., was successfully carried out, the automatic action being entirely satisfactory.

The spillways have been concreted and plastered, and the filling on the extreme ends of core-walls on both banks has been completed and faced with spalls or rough concrete. The shaft-control house has been built, and the three 50 ft. steel truss footbridges between towers have been erected and painted.

The installation of the necessary motors for mechanical control, the permanent wiring and lighting of the shaft and towers, and the water-level indicator have all been satisfactorily completed. All construction plant, machinery, tramways, water-supply, and electric light and power fittings have been dismantled, overhauled and transported to Mangahao for transfer. All service buildings and accommodation, with the exception of a caretaker's cottage, two buildings for the use of visitors, and several that have been purchased by private individuals, have been either dismantled or sold for removal.

In spite of the fact that the dam was ready to hold water in December, it did not fill until early in April owing to the very dry summer experienced.

Generally speaking, in spite of the hazardous nature of the undertaking and the number of floods experienced during erection, only a comparatively small amount of time and material was lost.

Waitaki River.

Following extended and careful investigations, a decision was made to develop, as the next source of supply of power for the South Island, a hydro-electric station on the Waitaki River at a point situated four miles above Kurow. At the end of May last a commencement was made to set up the construction organization of staff and workmen for the building of this important station. The erection of workmen's housing and of accommodation for staff and offices was at once begun. Surveys were made for a service railway connecting the existing railway-line to Kurow with the works, and construction of this line will be at once put in hand, so that all material for construction purposes will be transported thereon without need for transhipping at Kurow. Construction plant is being assembled and the work planned with a view to concentrating on the difficult foundation work in the Waitaki River. By the end of June seventy workmen were employed on the preliminary works.

RIVER IMPROVEMENT AND PROTECTIVE WORKS.

Wairoa River.

Tokatoka Stop-banks.—During the year the work of protecting the foreshore of the Wairoa River against tidal and wave erosion, with consequent destruction of the stop-banks, was continued. Approximately 32,000 cub. yd. of rock spalls were laid as a carpet along the foreshore between Ruawa. and Awaroa River, including a distance of 15 ch. up the latter stream from its junction with the Wairoa. Stop-banks were also strengthened where necessary, and two 3 ft. culverts were placed.

Waihou and Ohinemuri Rivers.

The works involved in this scheme for rivers improvement and the protection of adjoining lands from flooding has again made substantial progress this year, and are now approaching the stage when completion is in sight. The main work has been done this year on the Lower Waihou River, and a summary of the work carried out is as follows: Stop-bank construction by suction dredges, 6 m. 62 ch.; soiling stop-banks by use of Ruston drag-line excavators, 6 m. 23 ch.; clearing and trimming berms by use of Ruston drag-lines, 4 m. 9 ch.; clearing willow growths by log-haulers and stump-extractors, 7 m. The stop-bank and clearing-work on the Komata, Hikutaia, and Omahu streams that flow into the Lower Waihou River has been completed.

During the year five culverts of 3 ft. and 4 ft. diameter, with flood-gates, have been constructed. For drain improvement and maintenance work a light type of drag-line has been purchased and is now completing the improvement of drain H.

The Ohinemuri River Bridge, Paeroa, with concrete piles and piers, steel-plate girders, and concrete deck, of total length of 300 ft., is complete. The old bridge, which had about reached the end of its life, and of which the superstructure came below maximum flood-level, has been removed. This work constitutes a noteworthy improvement to the Borough of Paeroa.

The important dredging and associated plant in use on this work has been maintained in good condition.

Taieri River.

This work, designed to protect the Taieri Plains from flooding by the Taieri and Waipori Rivers, has again made substantial progress during the year. A number of incomplete sections of the main bank have been made good by drag-line or suction-dredge operations, and the only portion of the main bank not constructed is a section of some 20 ch. fronting Waipori Lake and adjoining the new pumping-station. This section of bank is in hand, but the gap cannot be finally closed till the new pumping-station is complete and in operation.

The erection of the pumping-station for the three low-head pumping-units is progressing very well. The foundation work, including inlet and outlet culverts, draft-tubes, and machine-foundations, is of substantial character, in concrete, and this part of the work is complete. The placing of the pump units is proceeding with the concrete-work, and the erection of the timber-work for the housing of the plant has commenced. It is anticipated that this station should be complete and available for operation by the end of this year.

Work is in hand cutting the main drainage-canal from Maori Lake to the pumping-station, and in addition a main internal drain from Momona to connect with the Maori Lake canal is being excavated.

The contour-channel deviation to allow this channel to discharge direct into Waipori River instead of Maori Lake has been cut, and the deviation stop-banked to the same standard as the main defensive bank. On the Henley–Berwick Road, across the contour-channel deviation, a traffic-bridge, in hardwood timber, of eight 25 ft. spans is in hand to first-class standard and will shortly be complete. Provision for draining the area between the contour channel and Berwick was necessary, and this has been furnished by the construction of a 20 ft. bridge span with flap gates discharging into the Waipori River and by the construction of a 2 ft. steel-pipe culvert 290 ft. long under the contour channel.

MARINE.

Lighthouses.

North Cape Lighthouse.—The apparatus for this lighthouse, which is to be of the automatic flashing type with an optical range of sixteen miles has come to hand, and the site has been prepared for its erection. Unfortunately, the weather was too rough to land the material on the last trip of the lighthouse tender, but it is anticipated that the light should be in operation by the end of the current year.

Kaipara Harbour (Sail Point).—A small automatic flashing light operated by compressed acetyline gas has been purchased and is at present being installed. It will have an average range of seven miles, and should be of great assistance to shipping in this locality, the definition of the main channel being very necessary on account of the large amount of shoaling taking place.

Piako Beacon.—The original oil-burning leading-lights have been replaced by single automatic flashing light fitted with sectors to define the channel at the entrance to the river.

Manakau South Head.—It was decided to convert this lighthouse to automatic operation; at present it is a third-order watched light, and the necessary flasher and automatic controlling-mechanism has been procured for installation in the existing lens and tower.

Tiritiri Lighthouse.—Painting and repairs carried out.

Cape Brett Lighthouse.—The keepers' residences were repaired and renovated.

Godley Head Fog-signal.—The complete apparatus for a large diaphone fog-signal similar in every respect to that recently installed at Pencarrow was procured and erected, with the necessary building. The signal has been in operation for some time and is giving satisfactory service. In addition to the assembly proper, it was necessary to construct an incline and track to enable the materials to be lowered to the site of the fog-signal.

Godley Head Access Road.—A road four miles in length giving access to the lighthouse was also formed from Evans Pass to the lighthouse.

Kaikoura Lighthouse.—This is a new light, which has been erected to fill the comparatively long gap between Cape Campbell and Godley Head. The light itself, which consists of an open-flame automatically-operated flasher in a 500 m.m. catadioptic lens, was procured and erected during the past year. The lens is mounted on a small iron tower containing the gas-holders.

Kahau Rocks.—The proposals to install a light at this point were investigated carefully last year, and following that investigation a final survey was made and plans prepared for an automatic light with an optical range of sixteen miles. This light will be of the new automatic Dalen type, and, as the cost of placing it on the rock itself would be very high, it has been arranged to place it on the foreshore immediately adjacent, and cover the rock itself with a red sector. To have placed the light on the actual rocks, which are very low and difficult of approach, would have involved an expense running probably into many thousands. The prominent position selected will compensate for the fact that the light is inshore of the danger. The order for the apparatus has been placed and the erection will be proceeded with as soon as it arrives.

Cape Egmont.—The existing watched light on this point is a fixed light and has been in use for many years, being one of the earliest provided. Owing to the multiplication of powerful electric lights in the locality and the confusion caused by the headlights of motor-cars on the main road between New Plymouth and Opunake, it has been decided to provide a new and up-to-date light with a definite characteristic. An order has therefore been placed for a powerful new revolving light. This light will be the most modern yet installed on the New Zealand coast. It will be fitted with triple lenses, giving, when revolved, three flashes at definite intervals. The whole of the apparatus, both the lighting and revolving parts, will be automatically operated and governed by the pressure of the gas, the whole process in turn being controlled by a daylight valve which automatically starts the mechanism as the daylight fades and stops it again at daybreak. Thus, in addition to increased efficiency, there will be decreased expense.

Cape Foulwind.—A new type of burner was provided at this light, and has resulted in a considerable and satisfactory increase in the optical range.

Cow Rock, Coromandel.—A small automatic light has been erected.

Dog Island.—Two new six-roomed dwellings were erected for the light-keepers. The old stone residences dated back to 1868, were inconvenient, and were falling into disrepair.

Waipapa Point Light.—Fairly extensive repairs were carried out to the residences here.

HARBOURS.

Westport Harbour.—The past year has been a fairly active one as far as construction and maintenance has been concerned. There has been a great deal of work carried out. The "Eileen Ward" has been kept steadily employed wherever conditions were favourable, and handled a total of 380,000 cub. yd. During the latter half of the period considerable shoaling took place, and opportunity was taken to push on with dredging on every possible day (including Sundays) when the state of the bar allowed. Arrangements have also been made to put the "Rubi Seddon" into commission to supplement the work of the "Eileen Ward." In addition to dredging on the bar, the bucket dredge "Maui" was hired from the Gisborne Harbour Board and utilized to deepen the berthages and increase the swinging-area. This dredge excavated 66,324 cub. yd. during the period. The breakwaters are in excellent order. No work has been found necessary on the eastern breakwater, but 2,400 tons of selected 15- to 20-ton stone was placed on the western breakwater and a further 600 tons has been reserved for use here if required. The erosion which was taking place immediately above the Railway Bridge has been arrested by the construction of a short stone training-wall, approximately 4 ch. long. This wall contains some 8,200 tons of stone and has already performed good work, the main current of the river having been forced further out into the channel. In addition to this, some 10 ch. of river-bank between the down-stream end of the erosion and the Railway Bridge, where previous stone facing was collapsing, has been rebuilt with some 5,000 tons of stone. In order to cope with the situation at what is termed Organ's Island, adjacent to the relief channel, extensive stonework has been carried out in facing the river-bank. Ten chains of work have been completed, and there is 40 ch. yet to do, which it is hoped to complete during the coming year. In order to carry out this work it has been necessary to construct one mile and a half of railway-track, including a bridge 450 ft. long across the old river-bed near the Orowaiti overflow-channel. Erosion has also been taking place on the right bank of the river some distance above the Buller Bridge, adjacent to properties owned by Messrs. Hannah, Organ, and Howey. This erosion covers a considerable length of the bank, but, as the stream has beached considerably at this point, it was decided to try and deal with the problem by planting willows. A strip of land 2 ch. wide and the whole length of the erosion was therefore acquired and extensive willow-planting carried out. In spite of the very dry summer, the majority of the trees seem to have taken well, and it is hoped that they will soon be successfully established. A great deal of snagging was carried out above the Cape Foulwind Railway Bridge, especially towards the end of the period. A large number of snags, some of very large proportions, were removed, and many others were loosened for removal by floods. The quarry at Cape Foulwind is now in good working-order, and an ample supply of good stone is in sight. The shifting of a 25-ton crane, compressor, boiler, and other plant from Tauranga Bay quarry was completed, and the railway-track thereto has been picked up and used on other parts of the work. One 25-ton and one 10-ton crane are in full operation, and the provision of a 5-ton crane is in hand. Two locomotives are in constant use transporting the stone to the various protective works, the output from the quarry to all works during the year being 22,000 tons. A great deal of survey-work was carried out during the year, including soundings in the roadstead, swinging-basin, and berthage area, traverses of various shingle beaches, lagoons, &c., and investigations at the Orowaiti overflow. All plant has been well maintained during the year, and all buildings were completely renovated and painted.

Karamea Harbour.—The erection of the new wharf-shed was completed early in the year. This is a substantially built building, 30 ft. by 20 ft., and its provision has considerably facilitated the work at the port. In connection with the development work which was necessary in order to enable the permanent stonework at the training-walls to proceed, 3 m. 50 ch. of tram-line from the training-wall to the quarry-site at the Oparara quarry has been completed and the track laid throughout. Two miles of ballasting has been completed, 300 lin. ft. of trestling erected, and a further length of 280 ft. from the end of the tram-line to the beginning of the training-wall is in hand. A considerable amount of work has been involved in the stripping and general opening-up of the quarry-site. Blacksmith's shop and benzine-store have been erected, together with one cottage and eight huts for workers' accommodation. Four end-tip and four side-tip stone-wagons have been delivered, whilst a petrol-locomotive, air-compressor, and 5-ton crane have been procured and are awaiting shipment.

Okoriti Harbour.—A thorough engineering survey of this locality was made, covering the harbour lagoon and roadstead, the final plans and report being in course of preparation.

Russell.—The new ferro-concrete wharf has been completed during the period and is now in use.

Whangaroa.—It is proposed to erect two new wharves here—one at Whangaroa in reinforced concrete, which is almost complete, and one at Totara North, for which a contract has been let for the erection in timber.

Waikopu Wharf.—An addition was made to the main wharf to strenghten it and enable a 30-ton crane to be mounted on it. This crane, which was designed by the Department and constructed in New Zealand, was provided to enable the transformers and other heavy lifts for the Waikaremoana power-station to be handled. The plans for a stone breakwater at this port were also prepared, and a contract has been let for its construction.

Waitangi Harbour, Chatham Islands.—Extensive harbour surveys were carried out, plans prepared, and a very full examination made of the above harbour to determine the possibilities of erecting a wharf there, and of the economic position generally.

Karaka Point Wharf.—Practically all timber for the above wharf has been received, and a contract is being arranged for the erection.

Half-moon Bay Wharf.—Amended plans were prepared for this wharf, all material was ordered, and the work is well in hand.

Matakana Wharf.—The erection of a wharf, shed, and approach was completed during the year. The work was carried out by the Rodney County Council and subsidized by the Department.

Marlborough Sounds.—The wharf at Manaroa has been repaired and extended, and the whole position regarding wharves in the Sounds has been investigated and reported on.

A number of minor works have been carried out among which were: Nugget Bay fishing-station —repairs to breakwater; Tahakopa Bay—improvement, surveys, and reports; Waikawa Harbour—fishermen's wharf; Raupo Ferry slip—plans, &c.; Rawene car and launch landing—plans, &c.

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.—Jetties: Bob's Cove, Lake Wakatipu; Devonport, Auckland; Kawarau Rapids, Frankton Avon, Lake Wakatipu; Victoria Wharf, Otago Harbour; Rangitoto Island, Auckland Harbour; No. 3 Jetty, Lyttelton Harbour; Naumai, Kaipara Harbour; Oyster Wharf, Bluff Harbour; Horeke, Hokianga River; Kaiti Wharf, Gisborne Harbour; Kawakawa Bay; Mechanics Bay, Auckland Harbour; Moturoa Wharf, New Plymouth; Polloc Wharf, Manakau Harbour; Cornwallis Wharf, Manakau Harbour; Thorndon Breastwork, Wellington.

Miscellaneous Works.—Sewage-outfall, St. Leonard's, Takapuna.

Boat Sheds and Landings.—Rat Island, Avon River; Railway Wharf, Tauranga.

Transmission-line.—Tauranga Harbour.

Foreshore Licenses and Buildings.—Happy Valley, Cook Straits; Horeke, Hokianga Harbour; Whangarei Harbour; Riverhead, Auckland; Bob's Cove, Lake Wakatipu; Rangaunu; Rawene, Hokianga Harbour; Wharekawa; Horeke, Hokianga; Point Chevalier, Auckland; Tewharanui Peninsula; Tawa Tawe, Whangaroa Harbour; Awakino; Kawarau Rapids, Lake Wakatipu; Rawene; Rangitoto Island, Auckland Harbour; Admiralty Bay; Horeke, Hokianga River; Mahurangi River; Kawerua, Hokianga; Picton; Half-moon Bay, Stewart Island; Totara North, Whangaroa Harbour; Whau Creek, Auckland Harbour; Wairoa River, Kaipara; Oparau River; Kaitawa, Awanui River.

Harbour-works.—New Plymouth; Nelson; Greymouth; Wanganui; Gisborne; Wellington; Auckland.

Boat Slips and Sheds.—Karaka Bay, Wellington; Freeman's Bay, Auckland.

Reclamations.—Devonport, Auckland Harbour.

Bridges, &c.—Aparima River, Riverton; St. Heliers Bay; railway-bridges, Otago Harbour, Avon River, New Brighton.

DEFENCE WORKS.

Admiralty Naval Base and Fuel-oil Depot, Devonport.

The fuel-oil installation, with associated pumping plant and fire-fighting plant, was maintained in satisfactory service and then handed over to the control of the Naval authorities. Maintenance painting of the fuel-oil tanks has been done.

New Zealand Air Force Base, Auckland.

Preliminary work has been carried out on the Hobsonville site for the New Zealand Air Force base. Engineering surveys of the grounds have been made; proposals prepared for approach road, drainage, slipway, apron, and airplane-hangar. Clearing has been done and earthwork commenced. Repairs have been carried out to two cottages.

Waikato Camp, Ngaruawahia.

Steady progress has again been made in the past year with the buildings required to complete the Waikato Camp establishment. The works that were in hand at the end of last year, including Nos. 6 and 7 Magazines, three cottages, the Ordnance Offices, and the Ordnance Depot are all complete. This latter building, 320 ft. by 100 ft., is in reinforced concrete, and has been provided with extensive fittings for the housing of stores. The Ordnance Workshops, 60 ft. by 48 ft., in concrete, are practically complete; the Magazines Nos. 8, 9, and 10 are in hand; and the Small-arms-ammunition Magazine, 74 ft. by 30 ft., is almost complete. A vehicle-shed, 100 ft. by 26 ft.; forage-store, 60 ft. by 40 ft.; and other smaller buildings have been built. Permanent latrines and sewage system have been installed, a roading-system laid down, loading-bank provided, and considerable work has been done clearing grounds of blackberries and laying down in grass. The whole of the buildings and other works that are being provided at this establishment are of a permanent and up-to-date character, so that as soon as works now authorized and in hand are complete the training-camp and Ordnance Depot should be very well provided and complete.

IRRIGATION—CENTRAL OTAGO.

Operation of Completed Schemes.

During the past year the several completed schemes have been maintained in good condition, and all lands requiring water have been supplied. The season was a record dry one, and all rivers and streams were exceptionally low. In respect to some of the schemes that have no water-storage the supply was for a while below requirements, but, taking the season as a whole, all irrigators were supplied with their full complement of water. Of the schemes in operation, Ida Valley, Galloway, Teviot River, and Bengerburn are being operated on a trading basis, the results for the year being as follows: Revenue, £8,233; working-expenses, £4,123; profit on working, £4,110; or an increase for the year of £530 on the previous year's results.

The number of irrigators and the total area irrigated on all Government schemes for the past year is as follows:—

Scheme.	Number of Irrigators.	Area under Irrigation.	Remarks.
		Acres.	
Ida Valley ..	48	11,248	..
Galloway ..	21	2,396	The enlargement of main race was completed.
Manuherikia ..	73	5,635	Maintenance-work was heavy owing to breaks in main race.
Earnscleugh ..	54	1,900	Maintenance includes recoating Earnscleugh Extension pipe-line.
Ardgour ..	12	1,494	20 ch. of race were lined in concrete.
Tarras	17	4,373	60 ch. of race were enlarged.
Last Chance ..	26	2,960	..
Teviot River ..	41	2,799	59 ch. of top race replaced by steel pipe and fluming.
Bengerburn ..	14	144	..
Totals ..	306	32,949	

These totals compare with figures for the previous year of 288 irrigators and 31,102 acres under irrigation.

The several demonstration plots that have been laid down on the border-dyke method have been maintained and kept in operation, and have demonstrated the efficiency of the method with its resultant economy in the use of water.

New Schemes under Construction.

Hawkdun Scheme.—Steady progress has been made during the year. 27½ m. of the main race have been enlarged and renovated, 60 m. of distributory races have been constructed, 15 ch. of siphons and flumes have been erected, and the remainder of the work on road-crossings, culverts, &c., is in hand. A telephone-line has been constructed along portion of the main race, commanding 40 m. of its length. Most of the area will be supplied with water next spring.

Arrow River Scheme.—With the exception of the pipe-lines and siphons, this scheme is practically complete. 2 m. 70 ch. of race were constructed and 80 road and private crossings of various types and two measuring-weirs were built. Contracts totalling £32,000 have been let for the steel pipes required for the pipe-lines and siphons, and erection of these will commence as soon as deliveries begin.

Teviot River Extension.—This extension is to command a further irrigable area of 2,066 acres on the east bank of the Clutha River between Roxburgh and Miller's Flat, and work was commenced during the current year. 6 m. 24 ch. of race have been cut, and the construction of culverts, weirs, &c., is in hand. A contract for the supply of steel pipes for the siphons has been let. Most of the area to be irrigated under this extension will be supplied with water next spring.

Surveys and Investigations.

Surveys and reports on a further extension of Teviot scheme, on the Miller's Flat scheme, and on dam-sites in the Lindis Valley have been made.

Soil surveys which had been in hand during the two previous years were completed last season by the Geological Survey Branch of the Department of Scientific and Industrial Research. The survey last season included the Arrow and Upper Clutha Valley areas. Plans showing results of these surveys are in hand.

TRAMWAYS.

Wellington.—23 ch. of duplication at Rongotai, Seatoun, 5 ch. of loop at Pitt Street, Wadestown, and 3½ ch. at Wellington Road, Miramar, were inspected and passed. Twelve new cars were examined, tested, and passed for traffic.

Wanganui.—One of the existing trams was satisfactorily converted to one-man control, and is now in operation.

Christchurch.—3 ch. of line for a trailer-siding on the Opawa line, 67 ch. of double line between Bealey Avenue and Leicester Road, and 48 ch. of double line on the Exford Terrace were built by the tramway authorities. The plans were examined and approved, and the work inspected and passed when finally completed. A siding was also laid at Moorhouse Avenue near the workshops. One new car was completed and passed for traffic during the year.

Dunedin.—24 ch. of duplication and 5 ch. of extension from the former terminus were laid on the Anderson's Bay line; 44 ch. of duplication from Calder's Crossing to the terminus on the North-east Valley line were completed, and both works were inspected and passed for traffic.

Invercargill.—During the year four of the regular cars were converted to one-man operation, and the usual inspection carried out.

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.

F. W. FURKERT, C.M.G.,
M.Inst.C.E., A.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, 1928.

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, 1904–23.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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	..	..	..	..	..	27 2
			Hukerenui-Kamo ..	16 0	3 29	19 29	..	..	..	..	..	..	..	..	..	
	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	..	..	..	..	8 20
			Okaihau-Hokianga ..	23 73	2 06	25 79	13 73	6 00	4 00	..	..	..	..	..	..	..
Kaihu Valley	Kaihu Valley ..	24 32	Dargaville-Booms ..	17 21	0 75	18 16	..	..	..	..	..	..	..	..	..	19 58
			Booms-Tarawhati ..	2 37	0 25	2 62	..	..	..	1 June, 1914	..	..	..	..	..	
			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 40	Kirikopuni–Dargaville	17 40	..	17 40	12 40	5 00	..	..	..	..	..	..	..	..
	Kaipara Northwards	83 39	Kirikopuni–Waiotira	13 56	1 44	15 20	..	..	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, 1928—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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 10	10 78	..	8 48	1 20	..	..	..	..	..	..	..
	Auckland City Branch—Kingsland Station to Auckland Station via Western Park and Freeman's Bay	2 60	Auckland City Branch	2 60	..	2 60	2 60	Prelim.	..	..	..	..	..	..	..	..
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	..	1 55	..	..	..	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-Tauranga ..	38 33	4 42	42 75	..	..	24 33	1 May, 1927	..	..	..	..	14 0	14 0
			Tauranga-Te Maunga Junction	3 75	0 17	4 12	..	..	3 75	..	..	..	..	..	..	..
			Te Maunga Junction-Te Puke	9 0	1 38	10 38	..	..	9 0	..	..	..	..	..	..	..
			Te Puke-Paengaroa..	5 67	1 16	7 3	..	..	5 67	..	..	..	..	..	..	..
			Paengaroa - Pongakawa	4 28	0 56	5 4	..	..	4 28	..	..	..	..	..	..	..
			Pongakawa-Otamarakau	6 70	0 52	7 42	..	..	6 70	..	..	..	..	..	..	..
			Otamarakau-Matata	8 11	0 46	8 57	..	..	8 11	..	..	..	..	..	..	..

* Double track.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued*.

NORTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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.*	Waihi-Opotiki—*ctd.* ..	..	Matata-Rangitaiki ..	8 29	2 04	10 33	..	..	8 29	..	..	..	..	..	..	..
			Rangitaiki-Awakeri	4 2	0 65	4 67	..	..	4 2	..	..	..	..	..	..	..
			Awakeri-Taneatua ..	8 47	1 67	10 34	..	..	8 47	..	..	..	..	..	..	..
			Taneatua-Opotiki ..	26 26	..	26 26	26 26	..	..	..	..	..	..	..	..	..
	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	..	..	..	..	11 73
			Eskdale-Putorino ..	26 69	1 38	28 27	..	10 67	16 02	..	..	..	..	..	..	..
			Putorino-Wairoa ..	33 32	2 50	36 02	..	31 60	1 52	..	..	..	..	..	..	..
	Gisborne-Wairoa .. (Inland Route)	72 42	Gisborne Station-Makaraka	3 5	..	3 5	..	..	..	..	..	..	..	..	..	..
			Makaraka-Ngatapa ..	11 51	1 29	13 0	..	..	11 51	15 Dec., 1924	..	11 51	..	..	..	11 51
			Ngatapa-Wharekopae	4 69	..	4 69	0 19	3 0	1 50§	..	..	..	..	..	..	..
			Wharekopae-Waikura	5 40	..	5 40	5 40	..	..	..	..	..	..	..	..	..

* Trial survey. † Preliminary survey. ‡ Permanent survey. § Rails taken up.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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.*		Waikura-Waterfall ..	6 66	..	6 66	5 6	Perm.	..	..	..	..	..	..	..	..
							1 60	Prelim.	..	..	..	..	..	..	..	..
			Waterfall-Hangaroa	4 0	..	4 0	4 0	"	..	..	..	..	..	..	..	..
			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)	65 12	Wairoa-Nuhaka ..	18 24	1 18	19 42	..	..	18 24	..	..	..	..	..	..	..
			Nuhaka-Waikokopu	6 11	0 49	6 60	..	..	6 11	..	..	..	..	..	..	..
			Waikokopu-Patutahi	34 0	..	34 0	28 40	Perm.	..	..	..	..	..	..	..	..
							5 40	Trial	..	..	..	..	..	..	..	..
			Patutahi Gisborne ..	6 57	..	6 57	..	..	..	..	..	..	..	..	..	..
			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-Manawatu	83 37	Wellington-Longburn	83 37	15 76	99 33	..	..	..	7 Dec., 1908*	..	..	..	..	..	83 37
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.	..	..	..	..	..	..	..	..

* Date of purchase. † Double track.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued*.

NORTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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.
Foxton-New Plymouth —*contd.*	Patea Waitara and New Plymouth	72 29	Patea-New Plymouth Breakwater	72 29	11 52	84 1	..	..	..	..	..	..	..	..	..	72 29
	Bull's 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 10	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	..	5 14	..	..	..	
			Tahora-Raekohua ..	3 20	..	3 20	..	3 20	..	..	..	..	..	..	..	..
			Raekohua-Heao ..	8 20	..	8 20	2 0† 3 0‡	3 20	..	..	..	..	..	..	..	..
			Heao-Ohura ..	11 0	..	11 0	8 10†	2 70	..	..	..	..	..	..	..	..
			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 02	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	..	..	..	..	..	..	..	..	..
	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	..	..	..	..	..	..	..

† Permanent survey. ‡ Preliminary survey

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued.*

NORTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28	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
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			..	..	..	30 June, 1908	..	..	..	..	..	
			Waiouru-Erua ..	30 63	12 50	97 28	..	..	..	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 ..	2783 63	..	2783 63	235 73	3019 56	1098 06	80 48	187 62	..	20 13	18 40	30 12	22 63	16 64	1411 54

NOTE.—Taonui and Lichfield Branches not mentioned above, as the rails have been taken up.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*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, 1904–23.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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 00	Trial	..	..	..	..	..	..	..	..
							16 53	Prelim.	..	..	..	..	..	..	..	..
			Murchison-Kawatiri	22 70	0 33	23 23	13 00	..	..	..	..	..	..	..	..	..
							5 75*	3 75	..	..	..	..	..	..	..	..
			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	..	8 14	..	..	..	
			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 00	Westport-Cape Foulwind	7 0	0 60	7 60	..	..	..	..	..	..	..	..	..	7 00
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	15 6	2 00	3 0	..	..	..	..	..	..	..

* Permanent.

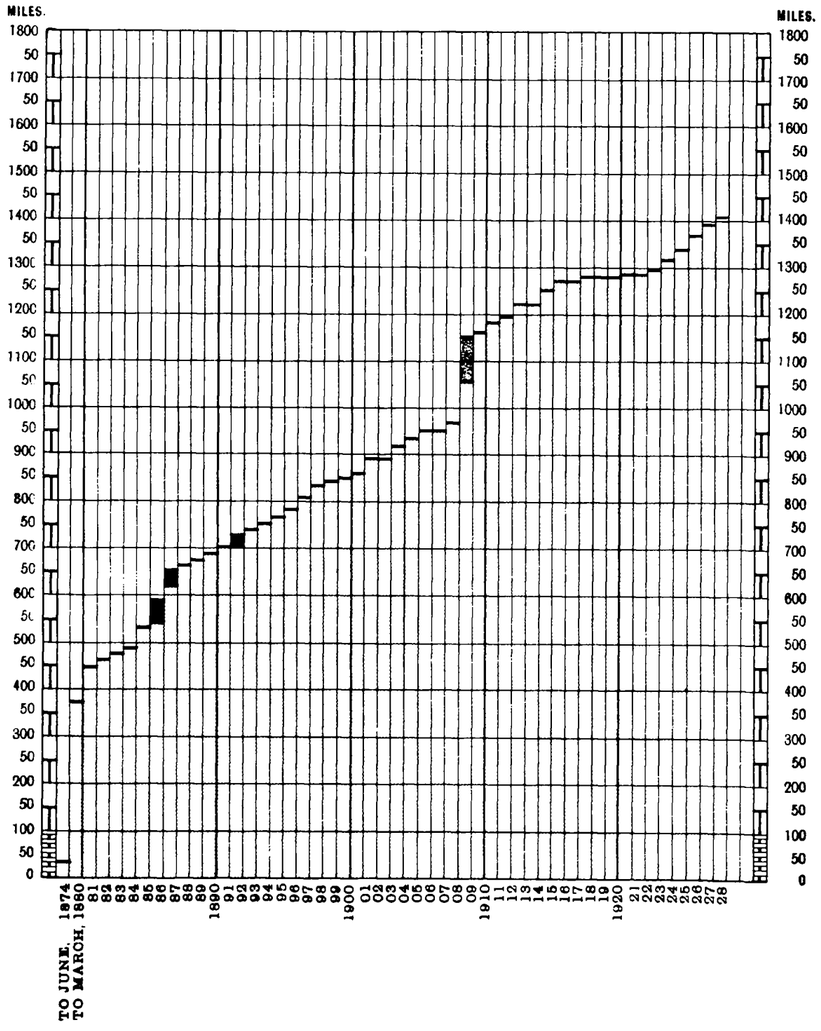
TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.										
							Surveyed.	Under Formation.	Under Platelaying.	Opened.							
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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	..	..	2 44	3 Sept., 1923	2 44	..	..	..	..	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 - Kaikoura ..	92 38	Picton-Seddon ..	33 45	3 26	36 71	..	..	..	..	..	..	..	..	..	
			Seddon-Kaparu ..	6 30	0 76	7 26	..	..	..		..	..	..	..	..	
			Kaparu-Ward ..	8 15	1 20	9 35	..	..	..	13 April, 1911	..	..	..	..	..	56
			Ward-Mirza ..	3 38	0 30	3 68	..	..	..		..	..	..	..	..	
			Mirza-Wharanui ..	4 38	0 34	4 72	..	..	..	4 Dec., 1915	..	..	..	..	..	
			Wharanui-Kekerangu	7 0	..	7 0	2 42	1 18	3 20	..	..	..	..	..	..	..
			Kekerangu - Hapuka River	29 32	..	29 32	29 32	..	..	..	..	..	..	..	..	..
	Hapuka River-Mendip Hills	40 50	Hapuka River - Limestone Creek	23 0	..	23 0	23 0	Prelim.	..	..	..	..	..	..	..	..
			Limestone Creek-Conway River	7 0	..	7 0	7 0	Prelim.	..	..	..	..	..	..	..	..
			Conway River - Mendip Hills	10 50	..	10 50	10 50	Prelim.	..	..	..	..	..	..	..	..
	Mendip Hills - Parnassus	5 61	Mendip Hills ..	5 61	..	5 61	2 0	3 61	..	..	..	..	..	..	..	..
	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	..	..	..		..	..	..	..	..	

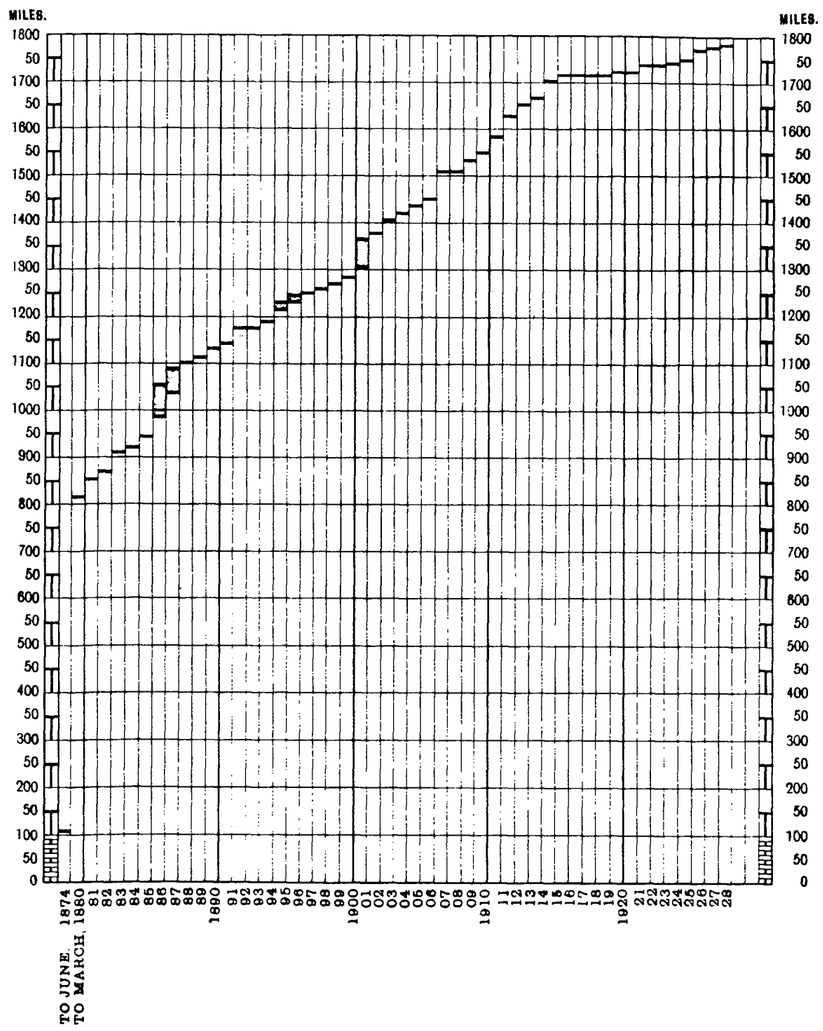
NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

NORTH ISLAND.



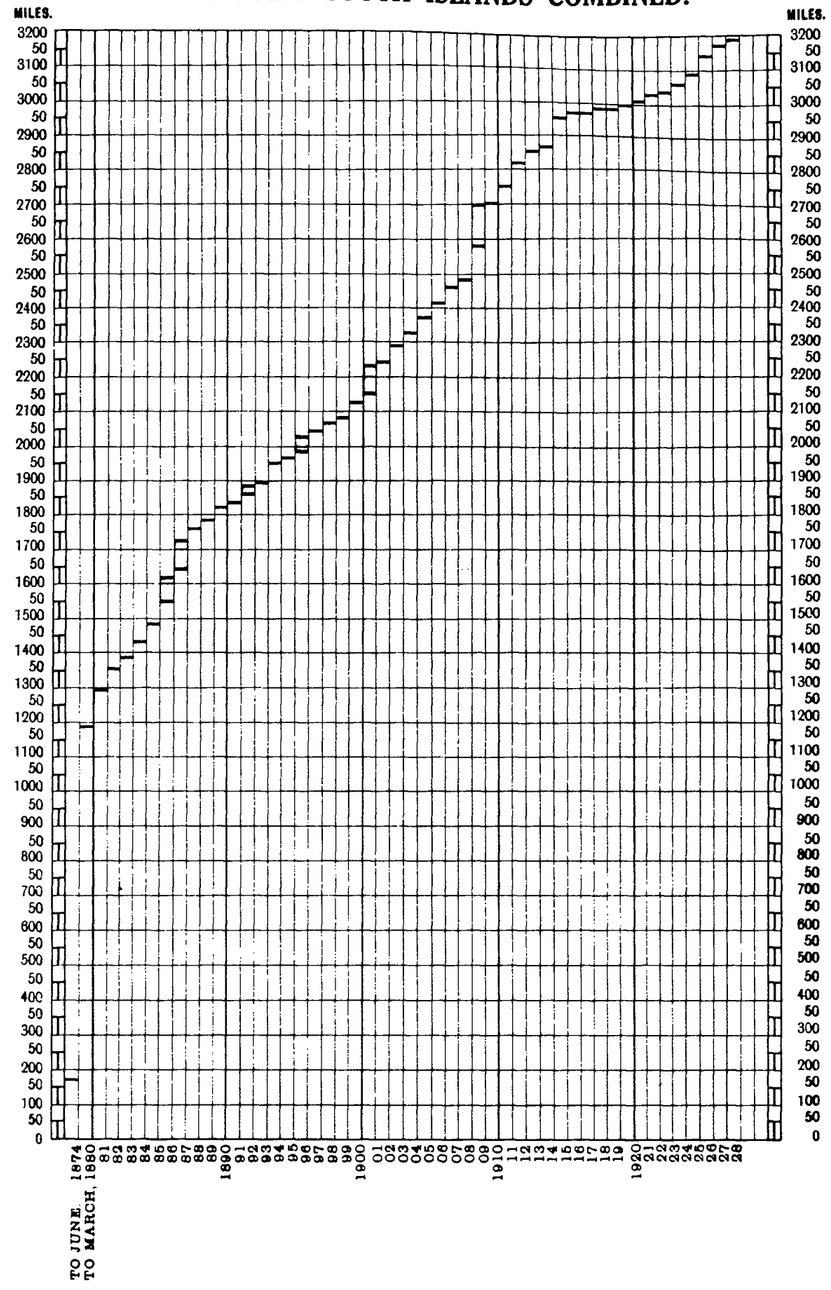
NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

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
SOUTH ISLAND
OF
NEW ZEALAND
1928

— Scale of Miles —

10 0 10 20 30 40 50 60 70 80

— REFERENCE —

GOVERNMENT RAILWAYS.

Opened - -
Under construction
Proposed - -
Explored - -

PRIVATE RAILWAYS.

Opened - -

168° 169° 170° 171° 172° 173° 174°

C. Farewell
GOLDEN BAY
D'Urville Id
French Pass
COOK STRAIT
TASMAN BAY
Karamea R.
KARAMEA BIGHT
SEA
Mokikinui R.
C. Foulwind
Buller River
Arahura R.
HOKITIKA
Pt Elizabeth
GREYMOUTH
Abut Hd
OKARITO
L. Mapourika
Mt Cook 12349ft
Mt Sefton 10959ft
Mt Harper
WELD
HERMITAGE 8725ft
Haast R.
JACKSON'S BAY
L. Tekapo
TEKAPO
Pukaki L.
L. Ohau
L. Wanaka
L. Hawea
OMARAMA
Milford Sound
Ada L.
L. Wakatipu
QUEENSTOWN
CLYDE
ALEXANDRA
L. Te Anau
Manapori L.
Monowai L.
Hauroto L.
Waitaki R.
Clutha R.
Taieri R.
Rakaia R.
Ashburton R.
Hinds R.
Rangitata R.
Ashley R.
Waimakariri R.
Waiau River
Awatere River
Clarence River
Hurunui R.
Waiau-ua R.
Conway R.
Kahautara R.
Kaikoura Peninsula
Banks Peninsula
C. Campbell
Shag Point
C. Saunders
PEGASUS BAY
CANTERBURY BIGHT
PACIFIC OCEAN
TASMAN SEA
FOVEAUX STRAIT
SOUTH
SOLANDER Id
RUAPUKE Id
STEWART Id
The Bluff
Port William
Last Head
Port Pegasus
S.W. Cape
MASON BAY
OBAN
Mataura R.
Oreti R.
Aparima R.
Waiau R.
Hollyford R.
Arawata R.
Makarora R.
Hunter R.
Matukituki R.
Dart R.
Rees R.
Shotover R.
Kawarau R.
Nevis R.
Clutha R.
Pomahaka R.
Waipahi R.
Mataura R.
Oreti R.
Waikato R.
Waimea R.
Wairau R.
Awatere R.
Clarence River
Hurunui R.
Waiau-ua R.
Conway R.
Kahautara R.
Waitaki R.
Ashburton R.
Rangitata R.
Hinds R.
Rakaia R.
Waimakariri R.
Ashley R.
Waiau River
Awatere River
Clarence River
Hurunui R.
Waiau-ua R.
Conway R.
Kahautara R.
Kaikoura Peninsula
Banks Peninsula
C. Campbell
Shag Point
C. Saunders
PEGASUS BAY
CANTERBURY BIGHT
PACIFIC OCEAN
TASMAN SEA
FOVEAUX STRAIT
SOUTH
SOLANDER Id
RUAPUKE Id
STEWART Id
The Bluff
Port William
Last Head
Port Pegasus
S.W. Cape
MASON BAY
OBAN
Mataura R.
Oreti R.
Aparima R.
Waiau R.
Hollyford R.
Arawata R.
Makarora R.
Hunter R.
Matukituki R.
Dart R.
Rees R.
Shotover R.
Kawarau R.
Nevis R.
Clutha R.
Pomahaka R.
Waipahi R.
Mataura R.
Oreti R.
Waikato R.
Waimea R.
Wairau R.
Awatere R.

COLLINGWOOD, Aorere R., Waingaro R., CLIFDEN, Takaka, MOTUEKA, TASMAN BAY, NELSON, STOKE, RICHMOND, Motueka R., Pelorus R., HAVELOCK, PICTON, Ferry Channel, WELLINGTON, WHITE'S BAY, CLOUDY BAY, TUANARINA, Karamea R., KARAMEA BIGHT, WAKEFIELD, BELGROVE, WANGAPEKA, TADMOR, TUPIKO, WAIMANGA, BLENHEIM, RIVERLANDS, DUNCREEK, SEDDONVILLE, NGAKAWAU, WAIMANGAROA Jn, WESTPORT, TE KUHA, CHARLESTON, BRIGHTON, TAWAI, REEFTON, CROHADUN, INANGAHUA Jn, INANGAHUA LANDING, MURCHISON, Roto-iti L., Rotoroa L., TOP HOUSE, Owen R., Buller River, Matiri R., Motueka R., Wairau River, Wairau R., Wairoa R., Awatere River, Clarence River, Kawatiri R., Gowan R., Inangahua R., Grey R., Teremakau R., Arnold R., Hurunui R., Waiau-ua R., Conway R., Kahautara R., Kaikoura Peninsula, Banks Peninsula, C. Campbell, Shag Point, C. Saunders, PEGASUS BAY, CANTERBURY BIGHT, PACIFIC OCEAN, TASMAN SEA, FOVEAUX STRAIT, SOUTH, SOLANDER Id, RUAPUKE Id, STEWART Id, The Bluff, Port William, Last Head, Port Pegasus, S.W. Cape, MASON BAY, OBAN, Mataura R., Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

COLLINGWOOD, GOLDEN BAY, Aorere R., Waingaro R., CLIFDEN, TASMAN BAY, Takaka, MOTUEKA, NELSON, STOKE, RICHMOND, Motueka R., Pelorus R., HAVELOCK, PICTON, Ferry Channel, WELLINGTON, WHITE'S BAY, CLOUDY BAY, TUANARINA, Karamea R., KARAMEA BIGHT, WAKEFIELD, BELGROVE, WANGAPEKA, TADMOR, TUPIKO, WAIMANGA, BLENHEIM, RIVERLANDS, DUNCREEK, SEDDONVILLE, NGAKAWAU, WAIMANGAROA Jn, WESTPORT, TE KUHA, CHARLESTON, BRIGHTON, TAWAI, REEFTON, CROHADUN, INANGAHUA Jn, INANGAHUA LANDING, MURCHISON, Roto-iti L., Rotoroa L., TOP HOUSE, Owen R., Buller River, Matiri R., Motueka R., Wairau River, Wairau R., Wairoa R., Awatere River, Clarence River, Kawatiri R., Gowan R., Inangahua R., Grey R., Teremakau R., Arnold R., Hurunui R., Waiau-ua R., Conway R., Kahautara R., Kaikoura Peninsula, Banks Peninsula, C. Campbell, Shag Point, C. Saunders, PEGASUS BAY, CANTERBURY BIGHT, PACIFIC OCEAN, TASMAN SEA, FOVEAUX STRAIT, SOUTH, SOLANDER Id, RUAPUKE Id, STEWART Id, The Bluff, Port William, Last Head, Port Pegasus, S.W. Cape, MASON BAY, OBAN, Mataura R., Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

GREYMOUTH, COBDEN, STILLWATER, BRUNNER, TOTARA FLAT, BLACKBALL, GREWANUI, VII MILE, DUNOLLY, GREY R., ANAURA, NGAHERE, Hochstetter, Amuri Pass, CANNIBAL GORGE, Waiau-ua R., Hanmer Sanatorium, Jollie Pass, Hope R., R. Hanmer, WAIAU, PARNASSUS, Conway R., Waiau-ua R., Hurunui R., PAROA, TARAMAKAU, KOTUKU, L. Brunner, KUMARA, JACKSONS, L. Sumner, CULVERDEN, MINA, DOMETT, ETHELTON, TORMORE, GRETA, SCARGILL, HAWARDEN, WAIKARI, OMIHI, WAIPARA, AMBERLEY, Hurunui R., Araiura R., HOKITIKA, KANIERI, RUATAPU, ROSS, L. Kaniere, Arthur's Pass, OTIRA, Poulter R., Esk R., Waimakariri R., ARTHUR'S PASS, Harper R., Broken R., CRAIGIEBURN, AVOCA, BROKEN RIVER, STALEYBRIDGE, Ashley R., ASHLEY, RANGIORA, Ashley R., PEGASUS BAY, OXFORD, GRAMA, BENNETTS, KAIAPOI, Waimakariri R., SPRINGFIELD, RHEFFIELD, WHITE CLIFFS, GLENTUNNEL, DARFIELD, CHRISTCHURCH, HORNBY, ADDINGTON, LITTELTON HAR., LYTTELTON, ROLLESTON Jn, LINCOLN, LITTLE RIVER, Banks Peninsula, L. Ellesmere, SOUTHBRIDGE, METHVEN, SPRINGBURN, Mt SOMERS, RAKAIA, ASHBURTON, Rakaia R., Ashburton R., Hinds R., Rangitata R., CANTERBURY BIGHT, PACIFIC OCEAN, TASMAN SEA, FOVEAUX STRAIT, SOUTH, SOLANDER Id, RUAPUKE Id, STEWART Id, The Bluff, Port William, Last Head, Port Pegasus, S.W. Cape, MASON BAY, OBAN, Mataura R., Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

OMARAMA, KUROW, Tekapo R., STUDHOLME Jn, WAINATEO, SERPENTINE, WAIHAO DOWNS, DUNTROON, Waitaki R., TOKARAHI, NGAPARA, WINDSOR Jn, PUKEURI Jn, OAMARU, MAHENO, KYEBURN, KOKONGA, RANFURLY, WEDDERBURN, OMAKAU, CROMWELL, Spottis Ck, Lindis Pass, Lindis R., Ida Valley, Dunstan Mts, Manuherikia R., Ophir, Roxburgh Gorge, Roxburgh Dam, Teviot R., Taieri R., HYDE, WAIHEMO, HAMPDEN, DURBACK, INCH VALLEY, Shag Point, PALMERSTON, MIDDLEMARCH, WAIKOUAITI, OTAGO HAR., HINDON, PORT CHALMERS, WINGATUI, DUNEDIN, C. Saunders, OUTRAM, MOSGIEL, Green Is, ROXBURGH, MILLERS FLAT, EDIEVALE, BEAUMONT, HERIOT, BIG HILL, EVANS FLAT, LAWRENCE, L. Waihola, Taieri R., WESTHERSTONE, Tuapeka R., Tuapeka Mouth, Pomahaka R., MILTON, WAIPAHI, GORE, CLINTON, BALCLUTHA, Cl. Kaitangata, KAITANGATA, Clutha R., WAIKAKA, KELSO, RIVERSDALE, Waikaka R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

LUMSDEN, WENDONSIDE, Wallace R., Waikaka R., MOSSBURN, WAIKAIA, Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

KINGSTON, ATHOLL, Mokomiel R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

ROXBURGH, MILLERS FLAT, EDIEVALE, BEAUMONT, HERIOT, BIG HILL, EVANS FLAT, LAWRENCE, L. Waihola, Taieri R., WESTHERSTONE, Tuapeka R., Tuapeka Mouth, Pomahaka R., MILTON, WAIPAHI, GORE, CLINTON, BALCLUTHA, Cl. Kaitangata, KAITANGATA, Clutha R., WAIKAKA, KELSO, RIVERSDALE, Waikaka R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

JAMESTOWN, L. McKerrow, Dart R., GLENORCHY, Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

GLADSTONE, NEWCASTLE, PEMBROKE, Cardrona R., Lindis Pass, Lindis R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

Ada I., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

KINGSTON, ATHOLL, Mokomiel R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

ROXBURGH, MILLERS FLAT, EDIEVALE, BEAUMONT, HERIOT, BIG HILL, EVANS FLAT, LAWRENCE, L. Waihola, Taieri R., WESTHERSTONE, Tuapeka R., Tuapeka Mouth, Pomahaka R., MILTON, WAIPAHI, GORE, CLINTON, BALCLUTHA, Cl. Kaitangata, KAITANGATA, Clutha R., WAIKAKA, KELSO, RIVERSDALE, Waikaka R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

Manapori L., TE ANAU, Mararoa R., Oreti R., MANAPOURI, MOSSBURN, WAIKAIA, Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

Monowai L., Hauroto L., NIGHTCAPS, WAIRIO, OHAI, Oreti R., Aparima R., Waiau R., Hollyford R., Arawata R., Makarora R., Hunter R., Matukituki R., Dart R., Rees R., Shotover R., Kawarau R., Nevis R., Clutha R., Pomahaka R., Waipahi R., Mataura R., Oreti R., Waikato R., Waimea R., Wairau R., Awatere R.

CLIFDEN, ORAWIA, OTAUTAU, TUATAPERE, TETUA, WAIHOAKA, THORNBURY, RIVERTON, OREPUKI, Waiau R., Aparima R., Oreti R., Mataura R., Waipahi R., Pomahaka R., Clutha R., Nevis R., Kawarau R., Shotover R., Rees R., Dart R., Hunter R., Makarora R., Arawata R., Waiau R., Hollyford R., Wairau R., Awatere R., Waikato R., Waimea R.

WINTON, HEDGEHOPE, EDENDALE, WYNDHAM, GLENHAM, MATAURA, CLINTON, BALCLUTHA, Cl. Kaitangata, KAITANGATA, Clutha R., MAKAREWA Jn, MONOTUA, PAPATUPU, HOUIPAPA, CATLINS, GLENOMARU, OWAKA, RATANUI, PAPATOWAI, TAHAKOPA, STUARTS, WAIMAHAKA, TOKANUI, WAIKAWA, FORTROSE, Mataura R., INVERCARGILL, OREPUKI, RIVERTON, THORNBURY, WAIHOAKA, TETUA, TUATAPERE, OTAUTAU, ORAWIA, CLIFDEN, Waiau R., Aparima R., Oreti R., Mataura R., Waipahi R., Pomahaka R., Clutha R., Nevis R., Kawarau R., Shotover R., Rees R., Dart R., Hunter R., Makarora R., Arawata R., Waiau R., Hollyford R., Wairau R., Awatere R., Waikato R., Waimea R.

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 Miller's Flat		52
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.

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
1928

— Scale of Miles —

10 0 10 20 30 40 50 60 70 80

— REFERENCE —

GOVERNMENT RAILWAYS.

Opened - -
Under construction
Proposed - -
Explored - -

PRIVATE RAILWAYS.

Opened - -

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 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

By Authority: W. A. G. SKINNER, Government Printer, Wellington.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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 08	..	6 08	6 08	..	..	..	..	..	..	..	..	..
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 55
		0 65	Surveyed ..	0 65	..	0 65	0 65	..	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued*.

SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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	..	..	..	..	..	49 55
			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	..	..	
			Miller's Flat - Roxburgh	9 12	0 68	10 00	..	..	10 00	..	..	..	..	..	..	..
	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.	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1928—*continued.*

SOUTH ISLAND—*continued.*

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.									
							Surveyed.	Under Formation.	Under Platelaying.	Opened.						
										Date.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	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	..	..	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 ..	2368 07	..	2368 07	267 52	2635 59	487 47	15 59	27 2	..	2 44	8 14	23 8	3 73	..	1784 65

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, 1928:—

During the period plans were prepared for seventy-eight new works, of a total estimated value of £751,060, of which thirty-three contracts, to the amount of £96,699, have been let. In addition, thirty-three contracts, to the amount of £172,570, for buildings designed prior to the 30th June, 1927, have also been let, making the total of works completed or under construction £269,269.

The latter total includes £48,719 for secondary-school buildings, and £51,602 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 maintenance has been carried out and a new hot-water service provided.

Wellington District.—General maintenance has been carried out and the cottages have been renovated.

Post-offices.

Whangarei District.—Repairs and renovations have been carried out to thirty post-offices.

Auckland District.—Extensive additions in brick were completed at Wellesley Street, and renovations carried out to the old portion. New post-offices in wood were erected at Leigh and Te Mata, and additions carried out at Putaruru, Ohinewai, Papakura, and Warkworth. A new residence was completed at Waiuku, and a contract let for additions at Walton. At Frankton the erection of new offices, store, motor-garage, and workshop was completed, and renovations and repairs carried out to a number of post-offices in the district.

Taumarunui District.—Renovations and repairs were carried out to thirteen post-offices.

Tauranga District.—Renovations and repairs were carried out to nine post-offices.

Gisborne District.—A Postmaster's residence in wood has been erected at Te Karaka. A storeroom and garage are being built at Tokomaru Bay. Repairs and renovations have been carried out to eight post-offices.

Stratford District.—At Waverley a new two-storey post-office in brick and concrete is in course of erection, and a new office in brick and concrete was completed at Castlecliff. At Hawera a contract has been let for very extensive additions to the Post-office. A new post-office in wood has been erected at Uruti. Considerable alterations and renovations were carried out to Wanganui Chief Post-office, and general maintenance-works carried out to other post-offices as required.

Napier District.—Extensive additions in brick have been made to Hastings Post-office, the old portion being remodelled. A garage and store have been erected. Renovations and repairs have been carried out to fourteen post-offices.

Wellington District.—A new automatic telephone exchange has been erected in brick at Miramar, and a new wing added to the Courtenay Place Exchange. A large addition in brick has been made to Palmerston North Post-office; a new garage erected at Foxton; the electrical change-over to the 230 voltage completed in the Wellington City and suburban post-offices, and repairs and renovations carried out to same. In addition, repairs, &c., have been carried out to four post-offices in the district.

Nelson District.—Repairs and renovations have been carried out to nine post-offices.

Christchurch District.—Renovations and repairs have been carried out to sixteen post-offices in the district, and the electrical installations have been overhauled in eleven offices.

Dunedin District.—Repairs and renovations have been carried out to thirty post-offices.

Greymouth District.—Repairs and renovations have been carried out to fourteen post-offices.

Courthouses.

Whangarei District.—Repairs have been carried out at Dargaville and Kawakawa.

Auckland District.—Renovations have been carried out at Hamilton, and new furniture supplied.

Gisborne District.—A number of maintenance-works were carried out.

Napier District.—Renovations and repairs have been carried out at Napier and Hastings.

Wellington District.—The new Arbitration Court, a two-storied brick building, is practically completed, the electrical, painting, and drainage works have been carried out by the Public Works staff. The Supreme and Magistrate's Courts have been changed over to the 230 voltage, and repairs, &c., carried out to several courthouses.

Nelson District.—Repairs have been carried out to four Courthouses.

Christchurch District.—Repairs, &c., have been carried out to five Courthouses.

Greymouth District.—Repairs have been carried out to five Courthouses.

Dunedin District.—Repairs, &c., to four Courthouses.

Police-stations and Gaols.

Whangarei District.—Repairs and renovations have been carried out to nine police-stations and residences.

Auckland District.—Repairs and renovations have been carried out to eleven police-stations. At Mount Eden Prison electric-light has been installed in eight cottages, extensive additions made to the stone-crushing plant, and the old bath-house has been converted into a bakehouse and baker's oven installed. At the Waikeria Borstal Institute, in addition to general maintenance-work, a new building has been erected, and various additions and repairs carried out.

Taumarunui District.—Repairs and renovations have been carried out to six police-stations.

Tauranga District.—Repairs and renovations have been carried out to two police-stations.

Gisborne District.—Repairs and renovations were carried out to seven police-stations.

Stratford District.—Repairs and renovations were carried out to Wanganui Gaol.

Napier District.—Repairs and renovations have been carried out to five police-stations.

Wellington District.—At the Central Police-station accommodation has been provided for the detective staff; several stations have been changed over to the 230 voltage, and repairs and renovations carried out in nine others.

Nelson District.—Repairs and renovations have been carried out to seven stations.

Christchurch District.—Repairs and renovations have been carried out to eight stations.

Greymouth District.—Repairs and renovations have been carried out to sixteen stations.

Dunedin District.—At Tokanui a new police-station and residence in wood has been erected, and at Lumsden a similar building is in course of erection. Repairs and renovations have been carried out to fifteen stations.

Mental Hospitals.

Avondale.—Extensive alterations have been carried out to the kitchen, men's lavatories, Nurses' Home, and in main building, to provide quarters for the Matron. A new veranda for No. 8 Ward has been completed, and various repairs and renovations carried out.

Puhitahi.—Men's quarters. The erection of a dormitory, dining-hall, kitchen, bathroom, &c., in wood was completed during the year. Electric light was installed in several buildings, and a windmill and tanks provided.

Tokanui.—A mortuary chapel, in concrete blocks, was completed; a contract for three villas for female patients was let and the work is in hand; 18 ch. of new road was completed; a 20 ft. bridge was contructed; and general maintenance-works carried out.

Porirua.—A new Nurses' Home, a two-storied brick building containing over 100 rooms, is being erected by contract, the roof now being on. A new six-roomed residence, in wood, for the Assistant Medical Officer has been erected by contract, and roads, &c., formed. The whole of the buildings have been rewired for the 230 voltage, and extensive repairs, renovations, and additions carried out. The water-supply has been augmented by the installation of new mains, pressure-reducing tanks, and by the raising of height of the dams.

Nelson and Stoke.—Extensive repairs and renovations have been carried out.

Sunnyside.—Alterations are being made to the boiler-house and a new chimney being erected. General maintenance-work was carried out as required.

Hornby.—A residence has been erected for the Assistant Medical Officer.

Templeton.—The new villa unit, commenced the previous year, has been completed, and an addition made to the day-room. A water-tank to supply this building is in course of erection.

Seacliff.—A large and important work, comprising a new kitchen, laundry, and stores block, is in hand, and good progress is being made. Modern equipment for both kitchen and laundry is being installed, and will greatly facilitate the working of the institution. Additions have been made to the Nurses' Home, and a residence erected for the Assistant Medical Officer. A contract has been let for steel racks for the stores.

Education Department.

Whangarei District.—New Native schools were erected at Oruawharo and Te Pupuke, and additions, repairs, and renovations carried out to six other schools.

Auckland District.—A contract was let for, and work started on, additions to the Hamilton Technical School. A new assembly-hall is nearing completion for Seddon Memorial College. Alterations and maintenance-work have been carried out at Ponsonby and Rukaumanga.

Tauranga District.—At Maraenui a new Native school and a residence have been completed. Extensive additions have been made to the Native school and residence at Te Paroa. Repairs and renovations have been carried out to eight schools.

Gisborne District.—A new Native school and teacher's residence has been erected at Te Araroa; two class-rooms have been added to the Gisborne High School; a new Native school and residence erected at Tokata; and various repairs, renovations, and additions carried out to a number of other schools.

Stratford District.—An addition, in concrete, was made to Hawera Technical High School, and extensive additions are being made to Wanganui Technical College. At Parinui a new Native school and residence in wood have been erected, and at Otoko Pa a Native school has been erected.

Napier District.—The Napier Technical School was completed during the year: also a large new cooking-room and a dormitory for Dannevirke High School. An extra class-room was provided at Tongoio Native School, and repairs and maintenance carried out to four schools.

Wellington District.—A new Technical School workshops has been erected in concrete at Palmerston North. A large addition, consisting of seven class-rooms, headmaster's and clerk's rooms, has been made to the Hutt Valley High School. Two class-rooms have been added to Palmerston North Technical School and to Wairarapa High School, and various additions and repairs carried out to other schools as required.

Nelson District.—Repairs and renovations were carried out to several schools.

Christchurch District.—A new home-science and cookery room has been erected and fitted up at Timaru Girls' High School, and a chemical laboratory fitted up at the Timaru Boys' High School. At the Timaru Girls' Hostel the dining-room has been extended and a new dormitory, &c., erected.

Greymouth District.—A new two-storied hostel in wood has been erected at Greymouth. General repairs were carried out at Westport.

Dunedin District.—At Otekaike a large dormitory block and assembly-hall have been erected, and extensive alterations and repairs carried out. Renovations, &c., have been carried out as required at various schools. At Invercargill Technical College a new home-science building in brick has been completed.

Health Department.

Auckland District.—The hot-water service was renewed at St. Helens Hospital and general maintenance-work carried out.

Gisborne District.—Minor repairs and maintenance were carried out at St. Helens Hospital, Gisborne.

Stratford District.—Extensive repairs and renovations have been carried out to St. Helens Hospital, Wanganui.

Wellington District.—Extensive alterations and renovations were carried out in the old library wing of Parliament Buildings, to provide new offices for the Department, and a store was fitted up in the Sydney Street offices. A new vaccine station in concrete and timber was erected in Wellington Hospital grounds. Repairs and renovations were carried out to St. Helens Hospital and to Otaki Sanatorium, and several farm buildings were erected at the latter place.

Nelson District.—Rooms were subdivided and renovated in the Education Board's building to provide accommodation for the Health Department.

Christchurch District.—At Queen Mary Hospital, Hanmer, the old electric power-house has been dismantled and re-erected elsewhere as storerooms. The new boiler-house and coal-dump are nearing completion, and the entensive plant for the boiler-house, &c., is being assembled. A start has been made with the new Nurses' Home, a two-storey building in brick, concrete, and wood. This will accommodate upwards of sixty nurses. The stables have been removed and re-erected to make room for the Nurses' Home. Various maintenance works have been carried out.

Dunedin District.—Various repairs and renovations have been carried out to St. Helens Hospital at Dunedin and Invercargill.

Hospital Boards.

Gisborne District.—A new hospital is in course of erection for the Matakaoa Hospital Board at Te Araroa.

Stratford District.—Repairs and renovations have been carried out at New Plymouth and Wanganui St. Helens Hospitals.

Napier District.—Extensive additions to the women's ward, and a new kitchen block, in brick and concrete, were completed for the Waipawa Hospital Board at Waipukurau; also a new administration block. At Hastings, the new Hawke's Bay Fallen Soldiers' Memorial Hospital and Nurses' Home, in brick and concrete, were completed. At Napier a brick disinfector building, and the new special-services block, a three-storey structure in brick and concrete, were completed during the year. A large new ward in brick and concrete, known as the Coleman Ward, is nearing completion.

Wellington District.—The Wellington Hospital Board having purchased the old Bryant and May's match-factory, at the back of the main hospital buildings, requested this Department to convert the buildings into a laundry, boiler-house, &c. This very extensive work was completed during the year, the old building being entirely remodelled to form a laundry, kitchen block and stores, diet, and staff dining-rooms, &c. A new boiler-house, engine-room, coal-bunkers, &c., were erected in brick and reinforced concrete, and a reinforced concrete chimney-stack, 140 ft. high was built. The contract provides all the engineering services for the whole of the hospital, and comprises boilers and machinery for the supply of the hot-water, heating, and sterilizing services, complete laundry machinery, &c.

Nelson District.—A site-plan and sketch-plan were prepared for a new residence for the Medical Superintendent at Nelson Hospital.

Greymouth District.—Extensive alterations and additions were carried out at the Grey River Hospital, Greymouth, comprising additions in brick to two wards, and provision of laboratory, diet and laboratory kitchens, staff quarters, &c. Additions and renovations were carried out to a house for the Medical Superintendent. Plans, &c., were prepared and a contract let for a new administration block and additions to operating-room, &c.

Dunedin District.—A new Nurses' Home, a two-storey building in brick, has been completed at Gore for the Southland Hospital Board. Tenders were recently accepted for a porter's cottage and additions to the kitchen block at the same institution.

Defence Department.

Auckland District.—A new drill-hall and rifle range were completed at Ponsonby, and extensive alterations, repairs, and renovations carried out to other drill-halls, barracks, &c. At the Waikato Camp, Ngaruawahia, the following works started the previous year were completed: Magazines Nos. 6 and 7; three cottages for married men; Ordnance Depot, and offices and fittings for same. New works completed comprise: Roading access; erection of fences; ploughing, harrowing, and sowing of swamp land; oil and forage stores; sheds, latrines, septic tank, cookhouse, reel-shed, pipe-line, concrete paths, &c. The single men's quarters were converted into a hospital. The following works are in hand: Magazines Nos. 8, 9, and 10; roading; railway back-shunt; S.D.A. magazine, Ordnance workshops, butcher's shop, and coal-store. Electric lighting has been installed in all buildings. In addition to the above, general maintenance-works have been carried out, and assistance has been given to the Defence Department on many occasions as required.

Wellington District.—At Trentham Camp the whole of the buildings have been changed over to the 230 voltage, and four 25 h.p. motors installed. Extensive repairs and renovations were carried out; also at Defence Headquarters, Buckle Street, this building also being changed over to the 230 voltage. At Palmerston North a gun-shed, store, and office were erected. Repairs and renovations were carried out to other Defence buildings as required.

Nelson District.—Repairs and renovations were carried out at the drill-hall, &c.

Christchurch District.—A portion of the Crown Brewery has been fitted up as a drill-hall for Naval cadets. Various maintenance-works have been carried out.

Dunedin District.—Various repairs and renovations have been carried out to a number of drill-halls, barracks, &c.

Tourist Department.

Taumarunui District.—The contract for the extensive additions to the Waitomo Hostel is being satisfactorily carried out and is practically completed. This is virtually a new hostel, the old portion being a comparatively small wood building. The "addition" is of reinforced concrete, with tiled roof, and is fitted with the most modern equipment for the comfort of tourists. The building has electric light, an electrically equipped kitchen, central heating, modern cold-store appliances, refrigerator, &c., and an up-to-date steam-laundry. At Tokaanu Fish-hatcheries the garage has been enlarged, alterations and renovations carried out to the office and men's quarters, and a kitchen and maids' quarters provided. New fluming and weir-gates have been installed, and roads and fences attended to.

Napier District.—At the Morere Baths extensive improvements and renovations have been carried out.

Nelson District.—A hut has been erected at Mount Hora and cleaning-work completed.

Dunedin District.—Huts for tourists have been erected at Glade House, McKinnon Pass, and on Ben Lomond, and tool-shed at Queenstown Park. At Lake Te Anau a new slipway has been constructed for the Department's steamer. A contract was let for a large new hostel at Milford Sound, and the work is in hand, the framework for the laundry having been erected.

Department of Agriculture.

Auckland District.—At Ruakura Farm a six-roomed residence has been erected for the Farm Manager, and electric light installed. Electric lighting in other building has been overhauled. Renovations were carried out at Te Kauwhata.

Napier District.—Renovations were carried out at Woodville and Port Ahuriri.

Wellington District.—Considerable alterations and renovations were carried out in the Dominion Farmers' Building to provide new offices for the Department. Repairs, &c., were done at Wallaceville Laboratory; new laboratory, Sydney Street; the fumigation-shed, Bunny Street; and the Biological Laboratory. At the Massey Memorial Agricultural College, Palmerston North, a cowman's cottage was erected.

Nelson District.—Renovations, &c., were carried out for the Department at Motueka and Blenheim.

Greymouth District.—At Waimaunga Experimental Farm a workman's hut was erected, and an office was fitted up for the Field Instructor at Greymouth.

Dunedin District.—Repairs and renovations have been carried out to six buildings.

General.

Renovations and repairs have been carried out to various departmental buildings, and furniture and fittings were made and supplied as required.

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. the 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, 1928, represents the thirteenth year of operation of the Lake Coleridge scheme, and the results of the year's working must again be considered very satisfactory.

The attached tables (A, C, and E) give the analysis of results obtained for the year's operations, connected load details appearing in Table D.

Financial Results.

The capital outlay at the end of the year was £1,561,081, as against £1,538,569 for the previous year, showing an increase of £22,512, and is analysed in Table B. The total revenue for the year was £171,127, as compared with £150,240 for the year ending 31st March, 1927, and after payment of all charges, including interest and depreciation, but not sinking fund, a surplus of £25,580 was shown. This amount has been credited to the Sinking Fund Account, bringing that fund to a total of £61,023, to which, however, must be added accrued interest earned of £1,442, bringing the total amount to the credit of the sinking fund to £62,465. The arrears of sinking-fund contributions as at 31st March, 1928, are now reduced to £42,122, and it is hoped that these arrears will be wiped out completely in the next few years. Table A shows particulars of financial results and load records.

The total cost per unit generated was 0·372d., being a decrease of 0·007d., due to increased output with little increase in capital charges. Total operating-costs have increased by £9,326, due to increased proportions of generating and management costs chargeable to operation consequent on small amount of capital expenditure during the year. Particulars will be found in Table C.

Connected Load.

The total connected load at the end of the year was 136,364 kw., being an increase of approximately 21·5 per cent. on that of the previous year. Details of connected load are given in Table D.

Power-house Load and Operation.

The maximum output from the power-house for the year was 21,020 kw., representing an increase of 24·5 per cent. over the previous year's output. This increase is abnormal in that unlimited supply was not available during 1926 until July, and also that a general reduction in heating and cooking rates was made at the same time by the Christchurch City Council. The effect of these two factors was not felt until the winter of 1927. Units output from the power-house totalled 93,853,759, as against 78,342,797 for the previous year, an increase of nearly 20 per cent. The maximum units generated in any one day was 318,540, and the maximum weekly output exceeded for the first time the two-million mark, being 2,023,495. The annual load-factor was 51 per cent., or 2·4 per cent. lower than that of the previous year.

With the full capacity of the plant (27,000 kw.) available, there was no overload experienced, and no calls were made on the tramway stand-by plant for this reason, or due to any interruption to supply.

During the period from 31st March to 30th June, 1928, the maximum demand on the power-house reached 24,370 kw.—viz., on 21st June. This figure is unlikely to be exceeded during the year ending 31st March, 1929, and the percentage increase—viz., 16 per cent.—is considered more normal.

Transmission-lines.

With the object of changing all lines between Lake Coleridge and Addington from 7/·135 aluminium to 19/13 S.W.G. copper, work was commenced on the remaining ten miles of the north line between the power-house and Hororata. This when completed will complete the change-over on all three lines between the power-house and Hororata. There will remain a section of twenty-four miles of the north line between Hororata and Christchurch, and the work of converting this portion from aluminium to copper will be put in hand during the ensuing year. The automatic sectionalizing of lines by means of relay-controlled oil circuit-breakers is proceeding, and when completed will add considerably to the continuity of supply at all points.

Excellent progress has been made in live-line insulator-testing and operation. During the year the whole of the insulators on the transmission-lines and substations were tested under live-line conditions; 317 insulators were located as faulty on the 66 kv. lines by this means and seventy-one

were replaced under live-line conditions. In addition, one 66 kv. pole was changed without interruption to supply.

On the 33 kv. lines similar work has been carried out with good results.

On the 11 kv. lines location of faulty insulators has been carried out on the live lines by means of special telephone-receiver method for some time, and this year 544 insulators, mostly the original type, were located as faulty. Replacing of poles on these feeders has been successfully accomplished with conductors alive, even with duplicate circuits.

The adoption of the live-line methods has resulted in a distinct reduction in interruptions due to insulator failures and to repair work.

66 kv. Substations.

The following table shows the installed capacity of each substation, together with the maximum demand and units output:—

Substation.	Installed Capacity.	Maximum Demand.	Units Supplied.
	Kw.		
Addington	22,000	16,088	70,796,553
Timaru	5,000	1,616	6,853,176
Ashburton	5,000	1,306	4,848,543
Oamaru	750	581	2,574,966
Hororata	295	239	821,142

Addington Substation.

A 12,000 kv.a. bank of transformers was received from the makers and installed in May, finally being put into operation on the 3rd June. Considerable trouble has been experienced with leakage of oil on these transformers, and it was found necessary to take each unit out of service and reweld the joints. Pressure-relief valves were installed during the work. Since the above repairs the bank has operated quite satisfactorily.

The 6,000 kv.a. condenser was shut down in July owing to trouble with the field spool insulation becoming loose. The makers sent out new insulation, and work is still proceeding on the repairs.

The erection of the final section of the ironclad switch-gear was completed and put into operation at the end of August. Considerable trouble was experienced with faulty switch-bushings, and large numbers have been replaced. Regular tests are carried out on all bushings in order to note any deterioration in their insulation value.

The completion of the ironclad switch-gear enabled the original open-type switch-gear to be dismantled, thus decreasing the electrical hazard and providing additional space.

A new storage battery for operation of oil circuit-breakers, 20-ton crane, and general lighting was installed and put into operation in December.

The telephone system has been rearranged, and all transmission- and distribution-line telephone circuits are now brought on to an annunciator-board in the operator's sound-proof cabinet.

A contract was let on the 24th November, 1927, for an additional 12,000 kv.a. bank of transformers to replace one of the original 5,000 kv.a. banks. This bank will be installed during the ensuing year, and will bring the transformer-capacity of Addington Substation up to 29,000 kv.a.

Interruptions to Supply.

Christchurch Lines.

The total number of interruptions to supply during the year exceeding 1 minute was seven, and the total time of same was 29 minutes. The longest period occurred on the 2nd March, of 15½ minutes' duration, and was due to the governor on one of the new machines going out of action. It is only fair to the operating staff at the power-house to state that the governors of both new machines were still in the hands of the makers' representative. Of the remaining six interruptions, totalling 13½ minutes, four were due to trouble with the power-station voltage regulator—one owing to a horse opening an air-break switch under load at the Point, and one due to a magpie causing a flash-over. There were no interruptions during the year due to defective insulators.

Timaru–Oamaru Lines.

The total number of interruptions on these lines, excluding those prearranged, was sixteen, and the total time of same was 1 hour 57 minutes. The longest period occurred on the 11th March, of 31 minutes, due to operating-rod on one phase of the oil circuit-breaker at Hororata breaking and the difficulty in discovering the fault. As the seven interruptions on the Christchurch lines also affected the Timaru lines, the actual number of outages on the Timaru-Oamaru section only was nine. Of these, five were due to direct overload, two were due to breakdown in Waitaki Power Board's cables, and two to causes unknown. No fault was actually traceable to defective insulators.

Lake Coleridge Duplication.

This work was practically completed last year, but there still remained the completion of the cross-drive between the old and new tunnels at the intake end. This was undertaken in October,

and at the same time opportunity was taken to repair the old tunnel. For this purpose a bulkhead was built at the outlet of the tunnel at the surge-chamber, in order that the original pipe-lines and turbines could be kept in operation. This work was completed in January.

During the year the operation of the new units has not been altogether satisfactory, considerable trouble having been experienced with the turbines of both No. 2 and No. 3 units. Lubricating troubles were successfully overcome, but the erratic governing was a serious matter and was not overcome until considerable alterations were made. The effect on supply was serious, and there were numerous complaints regarding frequency and voltage, particularly during December and early January, when the new units were on occasions supplying the total load. The longest period of interruption during the year—viz., 15½ minutes—was due to failure of the governor on one of these units. These troubles were rectified in May, 1928, and up to the 30th June the sets have operated satisfactorily.

In order to tide over the period between the time when it may be possible that the present installation at Lake Coleridge is fully loaded and the bringing into operation of the Waitaki development, contracts have been entered into for the supply and erection of an additional pipe-line and turbo-generating set. This set will be of 7,500 kw. capacity, and will then bring the total capacity of Lake Coleridge up to 34,500 kw. Contracts were let for both pipe-line and generating-set in May, 1928.

General.

A 3,000-volt line was erected in August on behalf of the Railway Department to supply the Middleton marshalling-yards, and also the signalling-system between Addington and Rolleston.

To cope with the increased demand at Addington Workshops, a new bank of transformers of 1,500 kv.a. capacity has been installed on behalf of the Railway Department.

In order to supply power for the electrification of the railway between Lyttelton and Christchurch, arrangements were made to erect a special duplicate 11 kv. line between Addington and Woolston, and the erection of a concrete substation to house the necessary switch-gear and machinery to supply the Railway Department with direct current at 1,500 volts. The contract for the conversion machinery was let in August, 1927, and the building contract was let in April, 1928.

At the same time opportunity will be taken to remove the old Woolston Substation and instal ironclad switch-gear of the self-closing type on all the Department's outgoing feeders. The present 3,000-volt and 400-volt supply will be changed to 11,000 volt, and work has already commenced on the change-over. The contract for the ironclad switch-gear was let in April, 1928.

The work of erecting the 33 kv. line between Addington and Southbrook to supply the North Canterbury Power Board was postponed, but the route has been pegged out, and the work will be commenced at the beginning of July, 1928.

The North Canterbury Power Board, which was formed in March, 1927, was granted its license in June, 1928, and will take supply from the Department as from the 1st July, 1928.

Rainfall.

The rainfall at the power-house for the year was 37·64 in. For the three months ended 31st March the weather was the driest on record, only 2·43 in. of rain falling.

MANGAHAO ELECTRIC-POWER SYSTEM.

Financial Results.

The capital outlay at the close of the year was £2,373,921, as against £2,242,871 for the previous year, an increase of £131,050, which is analysed in Table G. The net revenue for the year was £44,111 15s. 2d., as against £101,897 1s. 4d. for the previous year, a decrease of £57,785 6s. 2d., or 56·79 per cent., the decrease being due solely to the large amount—viz., £111,744 14s. 11d.—paid for power purchased. Working-expenses were £33,914, an increase of £6,993, mainly due to the coming into operation of Napier substation and maintenance work on transmission-lines.

Operation and Maintenance.

Headworks and Power-house.

Towards the end of the year No. 3 dam was completed and ready for storage of water, but owing to the light rainfall experienced very little water has been available for storage. During the year the water-level indicators at Nos. 1 and 3 dams were overhauled, and are now working satisfactorily. The water-level indicator at the surge-chamber has been put into commission. Further work has been done to reduce the leakage from the automatic gates on Mangahao No. 1 dam, and new operating hand-gear was installed. Painting has been carried out on the pipe-line and the power-house roof steelwork as weather permitted. One of the transformers on the headworks 3,000-volt line broke down during the year and repairs were carried out on same. The turbines have operated well during the year, practically all trouble being due to cracked and broken buckets. Twenty-three buckets have been replaced during the year, repairs to the damaged buckets being done by the electric welding plant at Mangahao. A complete new equipment of bronze buckets has been ordered for No. 5 turbine. Also, in order to cope with the increase in load on the station, a new set of nozzles, slightly larger than the originals, has been ordered. These are expected to increase the capacity of the machines by 5 per cent. The oil in the bearings and governors was filtered during the year, and oil-pipes cleaned and painted.

The running-times of the various units in the power-station during the year, including 1st April, 1928, have been as follows :—

Unit.	On Load. Hrs.	min.	Idle. Hrs.	min.
No. 1	6,868	55	1,939	05
No. 2	6,973	55	1,834	05
No. 3	6,880	11	1,927	49
No. 4	6,875	14	1,932	46
No. 5	6,310	24	2,497	36

Transmission Lines—110,000-volt Lines.

Mangaore–Khandallah Section.—During the year there has been only one total interruption to supply over these lines. This was of 10 minutes duration and was due to an operating mistake in the power-house whereby all lines were put out of commission. The line has been brought up to standard by hanging weights, as per revised schedule, lengthening jumpers, &c.

Mangaore–Bunnythorpe Section.—West Line : This line has been in operation through the year, supplying power to Manawatu-Oroua and Wanganui-Rangitikei Power Boards. There have been five interruptions to service, totalling 5 hours 48 minutes, of which one, of 5 hours 8 minutes' duration, was arranged for work at Bunnythorpe and Wanganui Substations ; one, of 12 minutes, was due to power-house operating mistake ; one, of 4 minutes, to lightning ; one of 22 minutes, to a broken earth-wire fouling one of the cables ; and one, of 2 minutes, to some unknown cause. On this section jumpers have been lengthened and weights hung to revised schedule from Bunnythorpe to Albert Road, leaving about five miles still to complete. The earth-wire has been removed from Manawatu River to one mile from Bunnythorpe.

East Line.—Over this line power has been delivered through the year to Wairarapa and Hawke's Bay districts. Apart from three prearranged shutdowns at convenient levels, eleven interruptions have been recorded during the year, totalling 7 hours 32 minutes. One interruption, of 6 hours 45 minutes, was due to a break in one of the cables on the Bunnythorpe-Woodville section, due to vibration ; one, of 12 minutes, was due to a switching mistake at the power-house ; one, of 9 minutes, was due to the surge caused by a flash-over on the Mangaore - Khandallah line ; one, of 5 minutes, was due to the failure of a rotating insulator at Mangamaire Substation ; and one, of 3 minutes, to a similar cause at Dannevirke. The remaining six interruptions, of 18 minutes, were probably due to surges caused by troubles on Power Board lines and improper functioning of the Department's oil circuit-breakers. On this line, about five miles still require weights to be hung as per revised schedule.

A piled groyne was built at the Manawatu River crossing, and the banks revetted with willows and wire netting as a protection against erosion in case of floods.

Bunnythorpe-Wanganui Line.—This line is in series with the Mangaore-Bunnythorpe west line. Apart from shutdowns by arrangement at convenient times interruptions during the year numbered 23, of a total duration of 3 hours 52 minutes. Of these, four interruptions, of 54 minutes, were for the same reasons as on the Bunnythorpe west line, the longer time being required for switching at Bunnythorpe. Ten interruptions, totalling 1 hour 36 minutes, were due to troubles on Wanganui-Rangitikei Power Board's lines bringing out the oil circuit-breaker at Bunnythorpe. One interruption, of 34 minutes, was due to a fire in a gorse hedge setting a pole alight, and the line was cut out to extinguish the fire. One, of 3 minutes, was probably caused by a gorse fire under the line. No cause has been found for the remaining seven interruptions of 45 minutes' duration.

During the year two special towers were erected on the banks of the Rangitikei River, and a special crossing made of this river in stranded copper-weld cable to prevent damage by floods, most of the arranged shutdowns on this line being for this purpose. Four poles were also replaced during the year as being under specification for their respective positions when the sap had rotted.

Bunnythorpe–Woodville Section.—Apart from prearranged shutdowns 17 interruptions were experienced on this line during the year, totalling 8 hours 16 minutes. Of these, eleven, of 7 hours 52 minutes, were as for Mangaore-Bunnythorpe east section, with which this line is in series, the extra time being for switching operations at Bunnythorpe ; two interruptions, of 6 minutes, were caused by the failure of a rotating insulator on an air-break switch at Mangamaire Substation ; two interruptions, of 9 minutes, were probably caused by troubles on 11,000-volt Power Board lines ; and the remaining two, of 9 minutes, were probably caused by a heavy gale blowing jumpers or cables close enough to poles to enable them to arc over to the pole-steps.

At one tower on the Ruahines a piece of ground has been acquired round the tower and planted with willows and poplars to prevent slipping.

Woodville–Mangamaire Section.—Apart from prearranged shutdowns on this section a total of twenty-three interruptions, amounting to 10 hours 53 minutes, were experienced during the year. Seventeen of these were from causes as for Bunnythorpe-Woodville Section, except for the longer time delay necessitated by switching operations at Woodville, these interruptions totalling 10 hours 34 minutes. Of the remainder, one, of 3 minutes, was due to a severe lightning-storm which blew the arrester-fuses at Mangamaire ; two, of 6 minutes total duration, were due to troubles originating on 11,000-volt feeders ; one, of 2 minutes, was due to a switching error at Woodville. The cause of the remaining two, of 8 minutes' duration, was not ascertained.

On this section weights have been completed to revised schedule, all defective insulators replaced, and the line generally put in first-class order.

Mangamaire–Masterton Section.—Apart from shutdowns at convenient times arranged for work on the lines and substations this section experienced twenty-nine interruptions for the year, of a total duration of 11 hours 44 minutes. Of these, twenty-three were from the same causes as those on the Woodville–Mangamaire section, and accounted for 11 hours 23 minutes, leaving six interruptions, of 21 minutes' duration, due to other causes. Of these, one, of 1 minute, was due to a surge originating on the Waipukurau–Napier section causing the oil circuit-breaker at Mangamaire to open; one, of 1 minute, was due to a switching mistake at Mangamaire; and the remaining four, of 19 minutes, had their origin in troubles on Power Board systems.

This section has also been brought up to standard during the year in the matter of weights, clearances, &c.

Woodville – Dannevirke Section.—Apart from shutdowns, arranged at convenient times, this section sustained forty-three interruptions during the year, of 12 hours 37 minutes duration. Seventeen of these were as for the Bunnythorpe–Woodville line, those accounting for 10 hours 59 minutes, as against 8 hours 16 minutes for the same interruptions on that section, most of the extra time being required to remove a broken rotating insulator at Dannevirke and to resume service at and beyond that point. Of the remainder, one, of 3 minutes, was due to a broken jumper on the Dannevirke–Waipukurau section; eleven of 50 minutes, were due to troubles originating on the 11,000-volt Power Board systems. The remaining fourteen interruptions, of 45 minutes, were due to some unknown transient trouble between Woodville and Napier, ten of these occurring in one day during a violent gale.

From a study of conditions, it has been thought that in sullen squalls, the cables have blown close enough to pole steps to arc over to earth, so insulator-strings have been shortened and pole-steps removed where these tended to lessen clearances of cables to earth. Since this work has been carried out no further troubles of this nature have occurred, but, possibly the wind has not reached the same velocity since as when the interruptions occurred.

Dannevirke – Waipukurau Section.—The forty-three interruptions recorded for the section above accounted for a total interruption time of 17 hours 34 minutes on this section. The extra time was taken in patrolling the line and repairing a broken jumper, and also by holding this section out during a violent storm when the interruptions occurred on the Woodville–Napier section while endeavouring to locate the fault. A further five interruptions, of 49 minutes, probably had their origin on the 11,000-volt Power Board lines.

Waipukurau – Napier Section.—A total of forty-eight interruptions of 26 hours 41 minutes duration were from the same causes as those on Dannevirke–Waipukurau section, with which this line is in series, the difference in time being mainly due to this line being held out of service for 8 hours while being patrolled in an endeavour to find a fault, which ultimately proved to be in the overload relays at Dannevirke, a coil on one phase being burnt out. Of a further three interruptions, one, of 19 minutes, was probably due to a surge caused by trouble on Bunnythorpe–Wanganui section. The other two, of 12 minutes duration, were probably due to Power Board troubles.

Transmission-lines—11,000-volt Lines.

Mangaore – Shannon Section.—The number of interruptions to supply over this line during the year was two. Of these, one, of 13 minutes, was due to faulty switching at the power-house, and the other, of 1 minute, was due to a faulty relay opening the oil circuit-breaker.

Supply is now taken over two feeders in parallel, the load being too great for one line.

Khandallah – Hutt Power Board Section.—Supply is taken by the Hutt Power Board over two feeders, Nos. 1 and 2.

Apart from trouble on the Power Board's own main lines there were twenty-nine interruptions to supply, amounting in all to 6 hours 36 minutes, during the year. One, of 12 minutes, was due to a switching mistake at the power-house, four, of 12 minutes, were due to Mangaore–Khandallah section being out of commission, seven, of 28 minutes, were due to faulty relays at Khandallah. Nine interruptions, amounting to 5 hours 20 minutes, were necessary to extinguish three fires on poles and to effect repairs, one, of 15 minutes, was due to the breakdown of a trifurcating-box at Khandallah end of line; three, of 3 minutes, were due to flash-overs of a L.T. air-break switch; two of 3 minutes, to linemen switching in the good line to a faulty line when trouble had been experienced on one feeder; while two, of 3 minutes, were due to some unknown causes.

Leakage-relays have been installed on these feeders in an endeavour to prevent sustained short circuits to earth setting fire to the poles and cross-arms in the event of failure of insulators, broken tie-wires, &c.

Khandallah – Petone Railway Line.—Six interruptions to supply have occurred during the year, lasting 2 hours 40 minutes. Two of these, lasting 6 minutes, were due to interruptions on the Mangaore–Khandallah 110 kv. line. The cause of the remaining four interruptions have not been located. On one of these occasions the Khandallah switch came out under such a heavy overload that it was deemed advisable to patrol the line before attempting to put it back into service. In addition to these, a good number of shut-downs were arranged on this section at times when no power was required by the Railway Department.

Khandallah – Wellington Meat Export Co. Section.—Three interruptions to service occurred on this line, all due to power being cut off from Khandallah on 110 kv. lines.

Transmission-lines—General.

The first testing of insulators by the buzz-stick method was completed over the whole system during the year. All units reported defective were replaced and forwarded to Khandallah for tests on the oscillator set.

Good progress has been made with the second year's tests, the power-house, the Mangaore–Bunnythorpe, Bunnythorpe–Wanganui, Bunnythorpe–Woodville, Woodville–Mangamaire–Masterton, and Woodville–Dannevirke sections being completed, and Mangaore–Khandallah section completed except for about seven miles of line. A start has also been made on Dannevirke–Waipukurau section.

The work of replacing defective units has also been commenced, and is being carried out as opportunity offers.

Generally, the transmission-lines have operated exceedingly well during the past year, few troubles due to the lines themselves having been experienced.

All lines have now been brought up to standard with regard to jumpers, weights, clearances, &c., except for about five miles north of the power-house on the Bunnythorpe line, which still needed revised weights.

A large proportion of the interruptions to supply have had their origin in troubles on Power Board feeders. Due to the short time delay on relays at remote substations, necessary to provide discrimination to the relays on different sections of the Bunnythorpe east line, a fault on a Power Board feeder—say, Hawke's Bay Power Board—has often produced enough short-circuit current to bring out oil circuit-breakers on other parts of the system as far back as Dannevirke, Woodville, Bunnythorpe, or even the power-house. Further investigations are now being made to try and overcome this difficulty.

Earth-leakage relays have now been set up at the power-house with a time delay of 1·8 seconds, with a time difference of 0·4 seconds between relays at consecutive substations.

Sap-testing has now been completed on the poles of the whole system, and a few poles have been replaced on the Bunnythorpe–Wanganui and Waipukurau–Napier sections. Generally, poles have proved to be quite up to standard, but there are a few which will require to be replaced or strengthened owing to a proportion of sap being found much larger than allowed for in designing the lines.

As lightning is one of the worst factors that is met with on transmission systems, a check is being kept on all such storms in the area traversed by the Mangahao lines. A total of fifteen lightning-storms was reported during the year, but only one very severe storm caused trouble on the system. Fuses were blown on the lightning-arresters at Wanganui, Bunnythorpe, Mangamaire, and Masterton, the worst of the storm centring round Bunnythorpe and Mangamaire.

Substations.

The apparatus at the various substations operated very satisfactorily throughout the year. The main 11,000-volt oil-switch at Masterton Substation gave trouble, so a new oil-tank, 1½ in. deeper than the original, was made and fitted, and no further trouble has been experienced.

A large amount of work has been done at all substations, levelling and draining the grounds.

All metering-apparatus has been checked up during the year.

Two rotating insulators on air-break switches at Mangamaire and one at Dannevirke failed during the year and were replaced. The insulators that have failed have all been of the hollow type, and new insulators of the solid type have been ordered as spares.

New metering equipment has been ordered for Khandallah, Bunnythorpe, Mangamaire, Dannevirke, and Waipukurau Substations. This has now mostly come to hand and is in process of being installed.

Spare transformers (1,000 kv.a. three-phase) ordered for Dannevirke and Mangamaire Substations, have now arrived.

GENERAL.

Due to the Waikaremoana scheme being due for operation shortly, new remote-controlled oil circuit-breakers have been ordered for Napier, Waipukurau, Dannevirke, and Bunnythorpe Substations, with necessary isolating switches and steel framework.

Also due to the Waikaremoana scheme being expected to come into operation before the end of the year, synchronous condensers are being erected at Khandallah, Mangamaire, Dannevirke, and Napier to obtain proper voltage-regulation when both schemes are in parallel operation.

With the whole system of transmission-lines and substations in operation throughout the year, the operation of the system has been very satisfactory. The oil circuit-breakers have reduced the time of interruptions to a very marked extent, owing to the ease with which sections can now be cut out and in, also owing to the automatic cutting-out of troublesome sections by means of the O.C.B. relays.

The buzz-stick method of testing insulators on live lines has been persevered with, and the second series of tests over the whole of the live insulators is well under way.

This system is fortunate in its linemen, for, in selecting men for training in live-line testing, only two were found who, owing to very slight deafness, could not be trained. This work demands a rather keen sense of hearing as well as a natural inclination, and not every man can be suitable.

With these exceptions, every lineman on the system has been trained in this work, which enables the testing to be done with much less disorganization of the ordinary routine than was the case last year, the men going out testing on suitable days on their own sections of line and carrying on their ordinary duties when the weather was unsuitable for testing.

The results so far this year confirm the results obtained last year, except that one make of insulator has proved much better this year than last. One make shows deterioration much above the average, as was also the case last year.

Generally the insulation of the lines proves to be of a very high standard, and no trouble has been experienced due to failure of insulators since the inception of the scheme.

A flash-over of one string of insulators occurred during the year, but, apart from a pitting of one unit, the insulators were not damaged, proving quite good when sent to Khandallah for test.

Another four linemen have been trained in live-line changing of insulators, but up to the present no need has been found for doing work on live lines, apart from testing of insulators, as in cases where a spare line is not available the Power Boards concerned were in agreement with having a shut-down on the lines between certain hours.

Trouble has been experienced during the year on failure of A.C.S.R. cables, which is almost certainly due to vibration, the affected portion of the line being between Bunnythorpe and Ashhurst. Five failures have occurred on a short section of about one mile, although in only one case did the steel core fail, causing a shut-down till the break was repaired.

Also, probably due to the same cause, the earth-wire on the system is showing a decided tendency to fail at the points of support, particularly on the section between Manawatu River and Bunnythorpe. On this section the steel cable was in such a bad state that it was necessary to remove it altogether, which has been done, except for about one mile south of Bunnythorpe Substation, which has been left as a protection to the substation apparatus.

Construction.

During the year the Mangahao No. 3 dam has been completed, and the spillway-gates erected. On 9th April, 1928, this dam was full for the first time, and revealed some minor defects, which have since been removed.

Further work has been done on the tail-race, a number of groynes being built or extended and the mouth of the Otauru Stream being dredged.

Khandallah Substation.—During the year the foundations for the 10,000 kv.a. synchronous condenser were put in. The condenser has now arrived and a start has been made to install same.

Permanent water-supply and sewerage from the Wellington City mains has now been installed.

In connection with the 250 kv. testing outfit, a tank for making puncture tests under oil has been installed at this station.

During the year a large number of tests have been made on insulators and other allied material under high voltages. These tests include flash-over tests (both high-frequency and 50-cycle), puncture tests (50-cycle), porosity tests, and immersion tests.

Tests have also been carried out on the influence of wind and rain on the voltage at which flash-over occurs at various distances to earth.

Reverse power relays have been installed on the incoming 110 kv. lines. Earth-leakage relays have also been installed on the two 11,000-volt feeders to the Hutt Valley Power Board.

Bunnythorpe Substation.—The tank-lowering mechanism and framework for the 110 kv. oil circuit-breaker used as a tie-switch at Bunnythorpe has arrived, and the switch has been dismantled and the framework erected ready for the switch. The re-erection of the switch is proceeding.

Wanganui Substation.—A new panel has been erected by the Wanganui–Rangitikei Power Board in the substation for the supply of 11 kv. power to the East Town Railway Workshops.

Mangamaire Substation.—The 1,500 kv.a. synchronous condenser ordered for this station has arrived, and been partly erected. The hand-operated crane has been installed. A 110-volt D.C. battery and motor-generator set has been purchased for operation of condenser and tripping of oil-switches. A new 2,200-gallon oil-storage tank has been ordered for this station.

Dannevirke Substation.—The building has been extended to accommodate a 1,500 kv.a. synchronous condenser, which is now nearly completely erected. A battery and motor-generator set have been installed for the control circuit. A hand-operated crane has also been installed, as also has an outdoor 2,200-gallon oil-storage tank.

Waipukurau Substation.—A battery and motor-generator-charging set have arrived to replace the present primary-cell tripping battery for the oil circuit-breaker controls.

Napier Substation.—Supply was given from this station to Hawke's Bay Power Board on the 8th April, 1927, and all apparatus has worked very satisfactorily throughout the year.

A 4,500 kv.a. synchronous condenser has been installed in this station for voltage and power-factor regulation. The machine has been tested out satisfactorily, but is awaiting some minor interlocks and trip-coils before it can finally be put into service.

Load.

During the year supply has been given to the Hawke's Bay Power Board, completing the whole system as designed.

The last quarter of the year was conspicuous by the almost entire absence of rainfall over the Mangahao drainage area, creating a very serious shortage of water-power, so that special arrangements had to be made with all Power Boards, Borough Councils, and large meat-works which possessed steam, gas, or oil generating plants, to start these up and either supply their own load or, where possible, deliver surplus power into the Mangahao system, this being in addition to the ordinary stand-by plants of Wellington and Wanganui Cities and Palmerston North Borough. Also, Power Boards were asked to restrict their load as much as possible. In general, the Power Boards proved anxious to co-operate and by cutting out street-lighting, getting large factories, &c., to change over to night shift, cutting out heating and cooking load where possible, the dry period was passed with as little inconvenience as possible, no arbitrary cutting-off of power or reduction of supply being necessary.

Napier and Hastings Boroughs, the Tomoana, Whakatu, and Pakipaki Meat-works, the Central Hawke's Bay Power Board's Waipukurau plant, Longburn Freezing-works, the Manawatu-Oroua Power Board's Feilding plant, the Wellington Meat Export Co.'s and Gear Co.'s freezing-works, all supplied more or less power back into the system during the water-shortage.

The following dates show the times when these auxiliary plants were called on to supply power to the Mangahao system: Wellington steam plant—4th to 9th, 12th to 19th, and 21st to 22nd April; 2nd to 9th, 12th to 19th, and 21st to 22nd May; 2nd August to 3rd September; 5th to 19th and 20th to 23rd September; 3rd to 11th October; 2nd to 7th and 21st to 30th December; 2nd January to 25th March. Wanganui steam plant—4th to 6th April; 3rd to 4th and 13th to 19th May; 8th August; 1st to 2nd, 11th, 14th, 16th to 21st, and 24th September; 4th to 11th October; 5th to 6th and 21st to 30th December; 2nd January to 7th March; 12th to 24th March. Palmerston North gas plant—4th to 6th April; 13th to 19th May; 8th August; 1st to 2nd and 5th to 6th September; 4th to 11th October; 5th to 6th and 21st to 30th December; 2nd January to 7th March; 12th to 25th March. Hastings Diesel plant—2nd January to 8th March; 12th to 25th March. Napier plant—4th January to 25th March. Wellington Meat Export Co.—16th January to 11th March. Pakipaki Freezing-works—17th January to 7th March; 12th to 25th March. Whakatu Freezing-works—13th January to 7th March; 12th to 25th March. Gear Freezing-works—18th January to 7th March. Tomoana Freezing-works—3rd February to 7th March; 12th to 25th March. Feilding plant—6th February to 7th March. Waipukurau plant—3rd February to 7th March.

The maximum load to date is 20,960 kw., and the maximum number of units generated per week, 2,474,340. The plant is therefore overloaded 9 per cent. on plant capacity, and overloaded by 53 per cent. on units generated. It will be necessary during the coming year for Wellington City Council to cut their peak during times of maximum demand on the station, thus reducing the revenue to be obtained from this source.

The following table shows the guaranteed load of all Power Boards, and also the actual load supplied to them, showing that all Boards have taken power far in excess of their respective guarantees.

Summary of Revenue from Power Boards for the Year ending 31st March, 1928.

Power Board, &c.	Guaranteed.		Actual.					
	Load.	Revenue.	Peak Load.				Revenue (Gross).	Rebate.
			30th June.	30th Sept.	31st Dec.	31st March.		
	Kv.a.	£	Kv.a.	Kv.a.	Kv.a.	Kv.a.	£ s. d.	£ s. d.
Horowhenua ..	720	6,160	1,741	1,924	2,333	2,125	16,643 12 1	526 5 3
Wellington City Council	..	50,000	10,496	10,016	9,248	8,544	54,202 4 4	91,019 12 9
Hutt Valley ..	1,200	10,000	2,060	1,878	1,950	2,372	16,917 7 1	840 14 7
Manawatu-Oroua ..	1,100	9,200	2,000	1,960	2,040	2,093	16,586 13 4	957 5 2
Dannevirke	270	2,560	438	419	460	470	3,972 10 0	90 19 10
Tararua	400	3,600	428	403	401	468	3,958 4 4	76 18 11
Wairarapa	282	2,656	426	413	413	465	3,832 17 3	115 7 8
Wanganui	875	7,400	1,941	1,998	2,088	2,016	16,030 3 4	9,616 10 4
Central Hawke's Bay	240	2,320	455	395	476	438	3,928 10 4	389 4 10
Hawke's Bay ..	800	6,800	371	836	1,800	2,136	10,013 7 0	646 17 7

WAIKATO ELECTRIC-POWER SUPPLY.

Capital Outlay.

The capital outlay at the end of the year was £609,228, an increase of £32,387 during the year. This is analysed in Table L herewith, which shows that the principal item in this increase was in the main substations—*i.e.*, at Hamilton No. 1 (Claudelands), Waikino, Waihou, and Hangatiki.

In addition to the above capital outlay provided under the Horahora scheme, works of total capital cost of £363,945, provided under the Arapuni scheme, are in operation, and are supplied with power from Horahora.

The increase in this item during the year has been £95,838, including the purchase of the Grand Junction plant, the cost of the Waikino–Bombay transmission-line, the completion of Henderson and Takapuna Substations, and of the 50 kv. equipment at Penrose Substation.

The combined capital outlay on assets in operation on which capital charges are paid out of revenue is thus as follows: Horahora, £609,228; Arapuni, £363,945: Total, £973,173: as compared with £844,948 last year, an increase if £128,225.

Financial Results of Operation and Future Prospects.

The year ended with a profit, after paying all working-costs, interest, depreciation, and sinking fund, of £6,176, as compared with £17,117 last year. The annual revenue increased from £108,748 last year to £125,312, an increase of £16,564, or 15·2 per cent. Interest, depreciation, and sinking fund increased from £62,918 to £72,568, an increase of £9,650, and working-costs increased from £28,713 to £46,568, an increase of £17,855. Total costs increased by £27,505.

The abnormal increase in working-costs is thus the principal cause of the reduction in profit this year, and Table M herewith shows it to be due principally to an increase in generating-costs of £11,133, and in cost of purchased power of £2,481.

The item of generating-costs includes the operation of the Grand Junction plant since the date of purchase by the Department, and this accounts for the increase. 3,612,720 units were purchased from or generated by this plant during the year at a total cost of £13,300 9s. 11d., as compared with 162,700 units the previous year for £1,250.

The total units generated at Horahora were 88,703,370, at a working-cost of £5,837.

As Horahora was loaded almost up to its full capacity in the previous year, and almost all the power available from McLaren's Falls and Omanawa was being supplied, the normal increase of load would of itself have necessitated greater use of the Junction plant, with its comparatively high generating costs. This effect was increased in January and February as a result of the Arapuni diversion, and in March by the low water stage reached in the Waikato River.

The table given below is an analysis of the sources and amounts of revenue :—

Revenue from—	1925. £	1926. £	1927. £	1928. £
Large mining companies	18,086	16,476	16,150	16,091
Four orginal Power Boards (Cambridge, Central, Te Awamutu, and Thames Valley)	35,302	42,226	50,616	52,487
Additional Power Boards (other than Auckland)	..	504	6,173	18,198
Auckland Power Board	..	10,850	15,139	16,132
Hamilton Borough	5,461	6,205	6,888	7,452
Tourist Department, Rotorua ..	..	276	2,262	2,440
Other wholesale consumers ..	4,264	7,432	8,988	9,871
Miscellaneous	2,071	1,861	2,532	2,641
Total	65,184	85,380	108,748	125,312

The table shows that the only striking increase in revenue is in the case of the new Power Boards, other than Auckland—*i.e.*, Waitomo, Franklin, and (principally) Waitemata. The amount of power supplied to Auckland was not materially greater than in the previous year, and amounted to 15,486,310 units, or approximately one-sixth of their total consumption of power.

The increase in the case of the four original Power Boards has been small, owing partly to the fact that they are approaching a condition of saturation, and partly owing to the improvement of power-factor by them. One of these Boards (Te Awamutu) shows a decrease in revenue for the year.

Future Prospects.

The financial prospect for the coming year is less favourable, as the indications are that the Horahora output will be reduced about 10 per cent. by loss of head, and this difference, as well as the increase in demand, will have to be made up by increased supply from the more expensive Grand Junction and Penrose Diesel plants. With Arapuni likely to be in service fairly early in the year following, the prospect for that year is good.

Extensions during the Year, and Future Extensions.

General, Additional Consumers, and Connected Load.

During the year supply has been given at the following additional points :—

Consumer.	Point of Supply.	Date.
Tourist Department, Rotorua ..	Mamaku	14th April, 1927.
Thames Valley Power Board ..	Kerepeehi (Temporary substation) ..	10th July, 1927.

The substation at Mamaku is a small substation of 150 kv.a. capacity, 50,000 to 11,000 volts stepping down again from 11,000 to 400 volts, to supply Mamaku Township.

The 11,000-volt supply will permit of supply to the timber-mills in the district if any of them require electric power, but up to the present the demand from them has been inconsiderable.

The connected load, not including Auckland, has increased from 52,205 kw. to 64,580 kw., as shown in table N.

The number of milking-machines supplied has increased from 3,308 to 3,559, as shown in Table Q.

The maximum load last year and this year has been as follows : Horahora—Last year, 12,400 kw. ; this year, 12,400 kw. System—Last year, 14,160 kw. ; this year, 15,700 kw.

The "system total" of units generated and purchased for the year was 100,075,668, and thus for the first time exceeded 100,000,000.

The diversity factor, exclusive of power supplied to Auckland and of connected load in Auckland, is 4·8, compared with 4·1 last year.

Horahora.

There were no extensions at Horahora during the year.

Additional Transmission-lines.

The following line was completed during the year: Bombay–Waikino, 50 kv.; put in service on the 10th July.

Completion of the steel structures at Penrose and Henderson Substations enabled the second circuit of the Penrose–Takapuna 50 kv. line to be put in service in November.

The Tamaki–Penrose portion of the 110 kv. pole line was altered, a new line being erected on the Department's 2-chain right-of-way, and the line on the old route removed. The new section was put in service on the 3rd July, 1927. It crosses the Tamaki River on two special steel towers 107 ft. high, the same as for the Arapuni–Penrose tower line.

Arapuni–Penrose 110 kv. Double-circuit Tower Line.—This line was completed in October, but no part of it has yet been put in service.

Ngongotaha–Waiotahi 50 kv. Pole Line.—The survey for this line showed the best route obtainable was from Ngongotaha, round the north of Lake Rotorua, south of Rotoiti and Rotoehu, and north of Rotoma, through the Manawahe district, to Edgecumbe, on the Rangitaiki Plains, and thence in a fairly direct line to Waiotahi. The route is in very rough country through the Manawahe district, and also across the hills between Taneatua and Kutarere. Cartage of poles commenced about the end of October, fitting and erection of poles at the beginning of December, and at the end of the year, of 704 total number of supports on the line, 563 were erected and 500 wired. The line was practically complete by the end of May.

Hamilton–Huntly 50 kv. Line.—This line follows a fairly direct route across the fairly level country between Hamilton and Taupiri, and over the hills to the east of Huntly to a substation on the edge of the town. Construction on it was started in February, and of a total number of about 220 supports twenty-nine were erected and twenty-two wired by the end of March.

Substations.

Penrose (110/22 kv. and 22/50 kv.).—Construction work has continued throughout the year. Inside the substation building the 22 kv. switch-gear battery and 10,000 kv.a. synchronous condenser have been erected. On the outside work three 5,000 kv.a. transformers (110/22 kv.) have been dried out, assembled, and placed in position; 110 kv. oxide-film lightning-arresters have been erected; three 1,667 kv.a. transformers (22/50 kv.) have been dried out, assembled, and placed in position; three 3,333 kv.a. 22/6·6 kv. transformers for the synchronous condensers are being dried out; two 110 kv. oil-switches have been erected, and also the steelwork for the 110 kv. transformer structure and for the Penrose–Takapuna 50 kv. line, and the 50 kv. oil-switches controlling that line.

Diesel Plant, Penrose.—From January onwards work at Penrose was concentrated on completion of the Diesel plant. The date set for completion of this was the 1st June, and the principal factor determining the time of completion was the obtaining of information to enable the foundations for both engines and generators and the rest of the building to be designed. The site was marked out and the ground cleared about the 12th October, and excavations started. The main excavations on the site were finished by the end of November. Two of the engines arrived in Auckland about the 12th November, and the third about three weeks later; the erecting engineer from England arrived at the beginning of December.

Concrete work on the building was started about the 10th December, and in the meantime the engine parts were being cleaned and got ready for erection. Placing concrete on the engine-foundations started about the 12th January, and the first engine and generator foundation was completed about the 24th January, the second about the 28th January, and practically all foundation work was completed by the 4th February. The crane-columns, water-cooling tower, and fuel-oil tanks were commenced about the 8th February, and the first parts of the engines and generators to be erected were taken to the building about the same time. Meanwhile the walls of the building were pushed on, and one crane was erected by about the 23rd February, and the other two (one for each engine) by the end of February. The bed-plates of two engines were placed in position by the 3rd March, and that of the third by the 10th March. By the 31st March the main part of the erection works was completed, except for the valve gear, and the engines had been finally levelled up and bolted down, and the generator rotors were in position. The framework of the cooling-tower was up to its full height, and the fuel-oil storage tanks in position. Since the 31st March, the erection work was completed, the principal additional items being the oil and water piping, exhaust-pipe and silencers, the auxiliary air-compressor, lubricating-oil pumps and cooling-water pumps, and the switchboard to control the three units and the local service power-supply.

The three sets were given a trial run of a few minutes each on 17th and 18th May, and the necessary cables, which had previously been put in position to connect to the bus-bars, were connected in ready to supply. The engines were run for fifty hours on the 22nd, 23rd, and 24th May to dry out the generators on short circuit, and the engines were run without any trouble in parallel with Horahora and King's Wharf station. Their performance on the fuel oil available has, however, not so far been altogether satisfactory.

Bombay (110/50 kv. and 50/11 kv.).—Temporary 50 kv. switch-gear was installed to supply the Bombay–Waikino line from the Horahora–Penrose wood-pole line. The substation building was practically completed during the year, and a start made on the erection of 11 kv. switch-gear. A second house at the substation was built. Bombay, along with Arapuni, Hamilton, and Penrose, will be points of supply to the 50 kv. lines from the Arapuni 110 kv. lines, and the main feature of Bombay is the 110 kv. structure with switches for sectionalizing lines and supplying the 110/50 kv., and the 50/11 kv. transformers. Work on this structure was started in September, on concrete foundations for the steel columns. Owing to the ground-slope, some of these have to be built up a good deal, and a considerable amount of concrete is required. Work on this structure and switch-gear erection has

continued throughout the year. The temporary 50/11 kv. substation supplying the Franklin Power Board has continued in operation throughout the year.

Hamilton No. 2 (110/50 kv.).—A start was made on erection of the steel structure and switch-gear about the end of April, and was finished in October, except for the extra steelwork and additional oil-switches which were ordered subsequently to the main structure.

Hamilton No. 1 (50/11 kv.).—Three additional 500 kv.a. transformers were dried out and installed, thus duplicating the previous installation of 1,500 kv.a. capacity. The necessary pole structure and air-break switches were erected to control these, and the new bank was almost ready to go in service at the end of the year. Extensions to Hamilton workshop were started, and the old crane from Horahora was transferred for use in the workshop. Plans were prepared for a new test-room, and new layout for the substation.

Waikino (50/11 kv.).—A 1,500 kv.a. synchronous condenser was placed in service in November, this serving both to improve power-factor at Horahora, and to enable voltage at Waikino to be controlled. The additional 50 kv. lines terminating at Waikino—*i.e.*, those from McLaren's Falls and Bombay—in addition to the original Horahora–Waikino line, made the installation of 50 kv. oil-switches on each line desirable, together with a bus-sectionalizing oil-switch. These four oil-switches, and lightning arresters on the Bombay and McLaren's lines, were installed during the year, the work being completed in November. The original horn gap and resistance arresters on the Waihi 11 kv. line were replaced by Oxide film pellet-type arresters.

Takapuna (50/11 kv.).—Construction work on the steelwork and switch-gear was completed in May, and this was put in service, replacing the temporary installation, which had been in service since the previous December.

Henderson (Waitemata) (50/11 kv.).—The work was completed on the steel structure and the permanent equipment put in operation in November, replacing the temporary installation which had been in service since the previous December.

Kerepeehi (50/11 kv.).—A 1,000 kv.a. three-phase transformer, with air-break switches controlling the 50 kv. side, was put in service on the 10th July. Construction of the substation building started in August, and was completed in March. A house also was completed, but the permanent substation switch-gear and transformers did not arrive during the year.

Mamaku (50/11 kv. to 150 kv.a.).—This substation was completed and placed in service on the 14th April.

Edgecumbe (Rangitaiki), Waiotahi, Huntly, and Matamata Substations (50 kv.).—Sites were selected for these substations, the first two to supply the Bay of Plenty Power Board, and the others for Central Power Board and Thames Valley Board, and the necessary equipment was ordered to enable them to be completed towards the end of 1928.

New transformers were ordered for Waikino Substation (7–1,000 kv.a.) and for Waihou (4–750 kv.a.) to be connected 50 kv. delta to 11 kv. star, to be substituted for the original star-star and delta-delta connected transformers at these two points, so that that operation with the 11 kv. neutral earthed would be possible.

The transformers thus replaced at Waikino are to be sent to the Gisborne substation, and those replaced at Waihou to the two Bay of Plenty substations.

Operation and Maintenance.

Headworks and Power-house, Horahora.

The plant has been running on overload almost every day now for two years, and has on occasions been carrying continuous overload for ten days at a time. This apparently, has not had any detrimental effect on the machines, but it has necessitated refitting of a number of the switch contacts and connections to prevent overheating.

Apart from trouble directly due to the debris brought down by the Arapuni diversion, the following difficulties have been met with :—

(1) Failure in May of 1,310 kv.a. main transformer, 5/50 kv., No. 2 transformer, No. 2 bank. The failure was due to breakdown of one of the 50,000-volt. porcelain bushings, which flashed over inside the tank and punctured the top turn of the lead cooling-coils. The punctured turn was removed, the damaged bushing replaced by a spare, and the transformer dried out and put in the spare position.

(2) One of the guide-wheel castings of No. 1 turbine was found seriously worn, and a new one was ordered from the makers to replace it. Replacement was carried out in February, and took about three weeks.

(3) The three cables carrying power from the power-station to the transformer-house were found to be heating excessively. (The fourth had previously been replaced by overhead wires.) This was remedied by placing split 12 in. earthenware pipes around them to allow ventilation.

(4) To improve ventilation, the holes that had previously been cut through the bottom of the generator-pits were enlarged.

(5) Six cracked vanes in No. 2 runner of No. 5 turbine were repaired by welding ; also on No. 2 turbine, three vanes on No. 4 runner and four on No. 3 runner ; on No. 3 turbine, two on No. 3 runner and one on No. 2 runner ; and on No. 4 turbine, two on No. 3 runner and two on No. 2 runner.

A lamp was connected in the secondary of No. 2 neutral earthing transformer to indicate discharge to earth. Overload and earth-leakage relays were put in service on outgoing 11 kv. feeders in October.

On the installation of the synchronous condenser at Waikino, voltage at Horahora was lowered 5 per cent. and was raised at all substations a corresponding amount on the 11th December.

Effect of Arapuni Diversion.

Diversion of River at Arapuni.—On the 2nd December, at 4.20 p.m., the Arapuni diversion-tunnel gates were partially closed to commence filling the Arapuni Lake. The flow in the river was then gauged at 8,700 cusecs, of which 7,000 cusecs were required for Horahora, leaving 1,700 cusecs to be impounded. At 10.30 p.m. on the 25th December, the gates were further closed to reduce the flow to approximately 3,000 cusecs, and after some adjustments to allow sufficient water to generate 7,000 kw. at Horahora the gates were left at this setting over the Christmas holiday period. Water commenced to flow over the spillway (320 ft. level) at about 11.30 p.m. on the 31st December. By 12 noon on the 1st January the flow in the new channel was estimated at 2,000 cusecs. The tunnel-gates were closed at 2 p.m. to reduce the flow through them to about 2,000 cusecs, but were opened again at 9 p.m. to increase the flow through them to about 4,000 cusecs, with the object of reducing the erosion in the new channel. The gates were closed completely on the 2nd January for twenty-five minutes for examination, opened again to 4,000 cusecs, closed to 2,000 cusecs at 7 p.m., and completely closed at 9.50 a.m. on the 3rd January.

Steps taken in Anticipation of Trouble.—The possibility of trouble with debris was given a good deal of consideration, but except for the construction of the boom across the river above Horahora and for cutting and burning scrub on the Waitete Flat it did not appear practicable to do much to prevent such trouble. The boom served its purpose well in diverting large quantities of pumice and other floating debris and discharging them over the weir; but after the first three weeks the amount of floating material dropped to almost nothing, and also practically the whole flow of the river was required by the turbines, leaving nothing available to carry any floating debris over the weir. In the latter half of January and the first week of February the greater part of the old crib weir was demolished by blasting, to make an effective channel to the Glenfield-Kennedy gate, so that sand and submerged debris could be discharged through it whenever it was practicable to open the gate. All the foregoing work was carried out by the Arapuni office.

Difficulties met with at Horahora.—These commenced at 11.15 a.m. on the 1st January when large quantities of pumice, tea-tree, fern, flax, &c., began to come down the river. Most of the floating debris was diverted by the weir, but more came into the headrace than could be coped with. The screens in front of Nos. 1 to 6 turbines are in front of the turbine-pit gates, whereas Nos. 7 and 8 machines have the screens between the gates and the turbines. There was one mechanical scraper for the screens on Nos. 1 to 6 turbines, and a second for Nos. 7 and 8. (A second scraper for Nos. 1 to 6 turbines has since been obtained.)

The original screens (Nos. 1 to 6) require the headrace empty to do anything to them, and they had not been examined for three or four years. They are continuous across the front of the whole six machines, and with, say, $\frac{1}{32}$ in. rusting the ferrules between bars, the different bars could move sideways and allow the slack to accumulate in one place. Thus there were several gaps of up to 4 in. between bars, with the result that pieces of pumice could get through larger than could pass through the turbines, so that the turbines themselves could get blocked and the governors could not move the moving guide-vanes. After the first few days this happened to varying degrees on all these six turbines, which at this time had all to be shut down in rotation for cleaning, and, after cleaning, the same thing started again, bringing the machine down to half-load or less in about a day at the most.

Nos. 7 and 8 turbine screens were in better condition, and these turbines have large openings which will pass anything that goes through the screens. The minimum load at one time, however, was down to 300 kw., carried on No. 5 machine, at a time when No. 7 and No. 8 had both to be taken off load. This was on Sunday the 1st January. The half-hourly maximum and minimum loads and total units on the following days were as follows:—

Horahora Output, 2nd January to 9th March.

Date.	Maximum.	Minimum.	Units.
	kw.	kw.	
January 2	4,500	900	64,890
,, 3	4,000	1,300	74,370
,, 4	4,100	2,100	82,950
,, 5	4,500	2,800	88,810
,, 6	4,700	3,200	95,060
,, 7	5,100	3,700	115,570
,, 8 (5)	5,700	3,800	115,210
,, 9	6,200	..	130,800
,, 10	6,000	4,700	131,840
,, 11 Shut down 5 hours ..	6,800	5,400	125,360
,, 12 Shut down 5 hours ..	6,800	5,400	128,660
,, 13	7,100	..	152,465
,, 14	7,400	..	159,445
,, 15 (5) Shut down 7 hours ..	6,900	..	93,180
,, 16	9,300	5,300	185,430
,, 17	9,100	5,700	187,550
,, 18	8,600	5,400	177,600
,, 19	8,900	6,500	188,135
,, 20	9,200	..	193,345
,, 21	8,800	6,300	182,280

Figures below are average for the 5 week-days ending on the date shown :—

Date.	Maximum.	Units.
	kw.	
January 27	8,700	191,600
February 3..	9,700	221,550
„ 10..	10,000	228,250
„ 17..	10,400	234,200
„ 24..	10,400	241,100
March 2	10,500	237,900
„ 9	10,600	243,600

By the middle of March the flow in the river was down to about 6,000 cusecs, or only sufficient to generate a little over 10,000 kw., and the subsequent deficiency in power-supply was due more to lack of water in the river, than to obstruction of the screens. The headrace was emptied six times as follows : Wednesday, 11th January, from 10 p.m. to 3 a.m. ; Sunday, 15th January, from 8.30 a.m. to 3.30 p.m. ; Sunday, 29th January, from 8.30 a.m. to 3.30 p.m. ; Sunday, 5th February, from 8.30 a.m. to 3.30 p.m. ; Sunday, 12th February, from 8.30 a.m. to 3.30 p.m. ; and Sunday, 4th March, from 8.30 a.m. to 3.30 p.m.

These shut-downs were necessary mainly to improve the spacing of the old screens to prevent the turbines getting blocked, but the opportunity was taken on each occasion to clean them and to scour as much debris as possible out of the race.

A 14 in. discharge-pipe was put in No. 1 turbine pit to discharge material directly from in front of the screens. Soundings in the headrace and observation on the occasion of emptying it show little increase in the amount of silt in it since the end of January.

The river above and below Horahora is being carefully observed to note any changes that may affect operation, and a small rise in tail-water level below Horahora was noticeable at the end of March.

A thorough examination in April and May, 1928, of all turbines showed that there had been little wear on any of them, except on No. 1. There is a tendency for sand and other debris to collect in the corner of the headrace in front of No. 1 turbine, which thus gets more than its share of sand and pumice through it, and the four guide-wheel castings on this machine are all considerably worn. New castings have been ordered to replace these. It is probable that the cracked runner-vanes already mentioned were due to the debris through the turbines.

Transmission-lines.

On the Horahora–Waikino line (mountain section) five new towers were erected during the year replacing some of the original towers which were badly corroded.

Material was obtained to alter the top construction of the standard towers on this line by mounting the top insulator on a wooden block, and the two side insulators on wooden cross-arms instead of steel cross-arms. By so doing it is hoped to make the towers less attractive for birds' nests, and also to improve matters by the added insulation of the wood between the insulator and the tower. The alteration is being tried out first on forty towers.

On the Mystery Creek – Te Awamutu section of line, a fire in the Ohaupo peat swamp burned through one leg of an A pole.

Defective (cracked) insulators on the Horahora – Hamilton – Te Awamutu and Waiorongomai–Waihou sections of line continue to be found in considerable numbers, but no actual breakdown has been traced to them. They are usually found by live-line testing, and replaced as soon as convenient.

Very good service has been given by all lines except the Horahora–Waikino line, and by the alterations referred to above it is hoped to improve this line to the standard of the others.

Several defective poles on the Penrose telephone-line were replaced.

Substations.

Penrose.—The temporary 50/6·6 kv. substation remained in service throughout the year. On completion of the 50 kv. switch-gear structure controlling the Penrose–Takapuna line, the switch and wiring for supplying this line temporarily were removed and replaced by the permanent connections.

Bombay.—The temporary 50/11 kv. substation remained in service throughout the year. The third 11 kv. feeder was connected up in May.

Hamilton No. 1.—Overload and earth-leakage relays with 12-volt D.C. trip circuit were installed on all feeders in June. Breathers were fitted to the existing 500 kv.a. transformers. 100/5 amp. current-transformers were installed, replacing 50/5, on the Hamilton Borough metering.

Waikino.—Overload and earth-leakage relays were installed in September. Additional gear to synchronise the Waihi feeder to the 11 kv. bus was installed. The neutral earthing-reactor broke down in December. Two 300/5 current-transformers were damaged owing to fault at Kerepeehi.

Waihou.—A neutral earthing-reactor was installed in June. Overload and earth-leakage relays were installed in August. A 30/5 current-transformer broke down in July. The incoming feeders were put underground in August. S. and C. fuses were installed to protect the 50 kv. side of the second transformer-bank.

Arapuni.—An 11 kv. bushing broke down and was replaced in November. The maximum load on the substation was 640 kw.

Mamaku.—A 50 kv. 11,000/400-volt transformer was installed by the Tourist Department in October, replacing a smaller one.

Ngongotaha.—An induction-regulator and overload and earth-leakage relays were installed in January.

Te Awamutu.—A bird caused a flash-over on the Burke arrester in August. Two 11 kv. compression chamber arresters broke down and were replaced with oxide-film pellet type in August. Overload and earth-leakage relays were installed in November.

Hangatiki.—A fault occurred in April in No. 1 feeder current-transformer chamber, and a similar fault occurred the following February on No. 2 feeder. These faults were in the Power Board's switchgear. In February also a bushing in the trifurcating-box on the transformer end of our incoming cable broke down.

Henderson.—The permanent equipment was put into service on the 22nd November. Connections were made at this substation and at Takapuna to give 11,000-volt supply from Takapuna over one circuit of the 50 kv. line to Henderson in case of breakdown of the main transformer at Henderson, pending provision of a spare transformer.

Takapuna.—A trifurcating-box on the 1,000 kv.a. transformer broke down in June, requiring the spare transformer to be placed in service. 15/5 current-transformer on No. 3 feeder and 20/5 on No. 4 feeder were put in to replace others of 3/5 and 4/5 amp. capacity. One of the 3/5 amp. capacity had broken down.

Grand Junction Plant.

This plant has been in regular operation throughout the year, running two shifts on five days a week and one shift on Saturdays at the beginning of the year, and two shifts on six week-days at the end of the year.

Considerable attention has been required to the boilers, which were rather badly pitted, and in repairs to the brickwork. The mechanical stokers have also on several occasions required adjustment.

Repairs to the boiler-house roof have also been necessary, and also to the pipe-line for condensing water from the Ohinemuri River.

A new rotor is on order for one steam turbine, and on its arrival it is expected that the plant will be capable of generating 2,500 kw. for short periods, the capacity of the boilers and the supply of condensing water being the limiting factors.

New copper cooling-coils were substituted for the iron cooling-coils on the four 500 kv.a. transformers. One of these transformers broke down on the 16th December due probably to water from a leak in the improvised cooling-coils getting into the transformer. A new winding was ordered to replace this.

Two additional transformers, and the additional switch-gear necessary to provide and to control two separate transformer-banks, one for each main turbo-generator were ordered, and erection of these commenced in March.

11,000-volt Lines and Substations.

Little trouble has been experienced on these during the year. On the Horahora–Leamington–Frankton line eight decayed poles were replaced, and single-unit strain insulators, two of which broke down during the year, were replaced with two-unit insulators of the same type. At the New Zealand Co-operative Dairy Co.'s substation, Frankton, building operations above the 11,000-volt cable necessitated placing about 50 ft. of this in earthenware ducts.

Power purchased.

Power purchased during the year amounted to 8,604,078 units, at a cost of £11,268 8s. 7d., including 7,379,095 units from McLaren's Falls for £7,690 7s. 2d. 3,612,720 units were generated by the Grand Junction plant, now owned by the Department. This compares with totals for the previous year of 7,398,942 units purchased for £8,787, which included 7,217,830 from McLaren's Falls and 162,700 from the Grand Junction plant.

General.

The Okere plant has been run regularly at certain hours of the day throughout the year, by arrangement with the Tourist Department.

Owing to the difficulty at Horahora, Waitoa factory was cut off for the March quarter of the year, and supply to some other factories was reduced under the agreements, which provide for this.

For the first two weeks in January it was necessary fairly frequently to cut off feeders to reduce load. This necessity recurred occasionally afterwards, but not to any serious extent.

For the two weeks ending 8th and 15th January Horahora supplied only 629,810 units and 921,750 units or about one-third and one-half of its output previously. The Auckland Power Board, as well as taking no power from us during the three weeks ending 22nd January, supplied to us 129,610, 124,750, and 4,220 units respectively in the three weeks, and by making the most use possible of the Grand Junction and McLaren's Falls plants the system total units for these three weeks were brought up to 1,110,760, 1,374,516, and 1,567,620.

The completion of the Bombay–Waikino line, which completes the ring Horahora–Hamilton–Bombay–Waikino–Horahora, has been of considerable use on occasions. Thus Penrose has been supplied once or twice during the year via Waikino and Bombay, and in emergency Waikino has been supplied via Hamilton and Bombay. Telephone communication also from Horahora to Waikino has occasionally had to be carried out via Bombay.

INTERRUPTIONS TO LINES.

During the year there were fifty-nine interruptions in system, of which sixteen were prearranged and totalled 133 hours 36 minutes. Of the remaining forty-three accidental interruptions, totalling 57 hours 12½ minutes, fifteen were due to unknown causes and totalled 1 hour 39 minutes; the

balance of twenty-eight, totalling 55 hours 33½ minutes, included flash-overs due to lightning, hay blown on lines, broken binders, birds across arresters, and faults in oil circuit-breakers. One interruption, lasting 34 minutes, was due to loss of excitation at the power-house, and affected all lines.

Line-testing.

During the year the routine work of testing live lines was continued, and the following is the result of same :—

Live-line testing, 50 kv. Lines.

Line or Section.	Insulators Defective.	Percentage Defective.	Date of Replacements.
Horahora – Mystery Creek	31	3·92	12th April, 1927.
Horahora–Claudelands	20	8	13th April, 1927.
Mystery Creek – Te Awamutu	15	3·97	1st May, 1927.
Waiorongomai–Waihou	6	2·91	23rd January, 1927.
Horahora–Arapuni	28	11·38	17th July, 1927.
Waikino–Aongatete	1	0·15	12th June, 1927.
Mystery Creek – Te Awamutu	7	1·6	18th September, 1927.
Horahora–Waikino (Huts 1–6).. ..	16(*a*)	9·37	29th September, 1927.
Horahora–Claudelands	13	1·08	12th and 13th October, 1927.
Waiorongomai–Waihou	16	7·84	8th January, 1928.
Horahora–Waikino (mountain section) ..	75(*b*)	6·56	Christmas, 1927.
Horahora–Arapuni	10(*c*)	3·9	..

(*a*) Strain ; six replaced : (*b*) strain ; thirty-four replaced. Replacements on these strains were made in those cases where more than one disc showed defective.

(*c*) Replacements on this section are being held over until it is convenient for Arapuni to do without power at present being used on the power-house installation work. Live-line testing revealed a total of ten as above.

No live-line "changing" has been carried out up to date. Now that the new building at Claudelands is finished, an oven will be fitted for drying purposes and changing operations on the live line will commence.

On the 110 kv. construction lines running at 50,000 volts there has not been any testing carried out.

Waikaremoana Power Development.

The original portion of this plant, which was erected in 1922, partly in anticipation of the major development and partly to supply power to the Wairoa Power Board, was operated by that Board during the first nine months of the year, but in January, 1928, was taken over by the Department and operated by its own staff. The financial results for the year ended 31st March, 1928, are as follows :—

	£
Operating capital	123,040
Annual capital charges (interest and depreciation)	8,367
Operating costs	413
Revenue	5,073

leaving a loss of £3,706 on the year's operations. This loss does not take into account the value of power used on the construction of the main scheme.

Major Scheme.—Construction work on the headworks of the main development of 40,000 kv.a. is dealt with more fully in the Engineer-in-Chief's report. The headworks and power-house were nearing completion at the end of the year, and it was hoped to make a start on the erection of the plant in the station in September. Erection of the outdoor switchgear was commenced early in January, and at the end of June substantial progress had been made. The 110 kv. and 50 kv. lightning-arresters were completed, the 50 kv. oil circuit-breakers assembled, and the 50 kv. air-break switchgear nearing completion. Of the 110 kv. air-break switchgear, the steelwork and all switches have been erected and busbars strained up ; final connections are now being made. The erection of the 110 kv. oil circuit-breakers is in hand. The seven 110 kv. transformers have been transported to site and placed in position on their foundation-pads. The drying-out of these transformers will be put in hand as soon as they can be handled by the 50-ton crane in the transformer-house. The 50 kv. transformers are also on site, being stored near the unloading-crab until they can be dried out and placed in position.

The erection of the main transmission lines to Napier and Gisborne has been pushed ahead. At the end of June 270 of the 278 towers on the Napier line had been erected and 133 towers wired. The Napier–Waikaremoana telephone line has been erected for a distance of 50 miles. On the Gisborne line considerable difficulty has been experienced in the transport of line material to site, owing to the rough nature of the country and the amount of wet weather experienced. To the end of June 69 miles had been erected and a start had been made on the stringing of cable. The insulators on the power-house-Wairoa line have been changed in preparation for an increase in operating voltage on this line from 11,000 to 50,000 volts when the main generating station commences supply.

Electric-power Boards.

Amendments to the original 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.

The development of the reticulated areas of Electric-power Boards has made substantial progress during the year. There are now forty-three districts constituted, and thirty-five actually carrying

out the distribution and sale of electrical energy (August, 1928). The total area covered is 66,903 square miles, or 63 per cent. of the total area of the Dominion; the total population concerned is 929,763, 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 £255,906,336, or 77 per cent. of the total unimproved value of the Dominion.

The attached coloured map shows the location of the various Boards already constituted and the proposed Boards. The areas in which Electric-power Boards have not been set up are, on the whole, comparatively sparsely populated, but there are two localities where it would appear that such Boards could with advantage be formed—viz., the suggested Nelson Electric-power District, including Nelson City, Richmond, Motueka, Brightwater, Wakefield, and surrounding district, and the suggested Waimarino Electric-power District, which includes Ohakune, Raetihi, and surrounding districts.

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 are realizing 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, Mangahao, 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 the Government when the Arapuni Station is completed, which is estimated to be in 1929. Taranaki is now giving a supply from its own generating-station at Tariki. Wairoa is taking power in bulk from the Department's station at Lake Waikaremoana, and supplies the Borough of Wairoa and a large portion of Wairoa County. Six—viz., Opunake, Taranaki, Southland, Wairere, Marlborough, and Teviot—have local water-power stations in operation, and the Golden Bay Power Board is arranging to do likewise. The Westland Power Board has delegated its license to Westland Power, Ltd., for a term of years. One other—viz., Poverty Bay—is arranging to take power in bulk from the Government hydro-electric sources, and is preparing its systems of reticulation with this end in view, whilst meanwhile operating its own fuel plant. The Grey Power Board has erected a steam station of its own. The Tauranga, Otago, and Otago Central Boards have arranged to purchase power in bulk from other authorities. The other four—viz., Hobson, South Taranaki, Buller, and Reefton—are making arrangements which have not yet been finalized.

Table T gives details of the date of constitution, the area, population, and rateable value of each of forty-three 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-seven districts which have taken their polls is £11,272,726. The population of the districts concerned is 926,017, so that the loans authorized amount to £12·1 per head of population, as compared with £13·1 last year. The unimproved valuation of the districts is £230,884,781, the loans authorized amounting to 4·88 per cent. of the unimproved rateable value of the lands pledged as security for the loans. The voting at the polls totalled 49,228 to 7,940—*i.e.*, a majority of 84 per cent.

Table U shows the capital expenditure incurred by each Board up to the end of the financial year 1927–28, the revenue and expenditure, and the amount of rates struck and collected.

The total capital outlay by the thirty-five Boards which have started construction is £11,072,920, and a small proportion of this is on works not yet in service. The gross revenue from the sale of electricity by the thirty-five Boards which had commenced supply was £1,628,191, of which 35·3 per cent. was received by the Auckland Board. The general result is a profit over the whole business of the Power Boards of £107,702 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 five of the Boards struck special rates for the security for loans, which were collected in three 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 will be attained by the Power Boards generally in future as the result of the experience of these earlier districts.

Local Electric-supply Systems.

Including the Government plants, there are now (31st March, 1928) forty-one public electric-power stations in the Dominion, as compared with forty-eight last year. One new hydro station (Marlborough) came into operation, and four water-power (Fairlie, Havelock, Waverley, Rotorua), one gas (Napier), one oil (Hastings), and one steam (Wanganui) stations were shut down from regular operation when bulk supply became available.

The total installed capacity has increased during the year by 7,445 kw., or 5·3 per cent. (from 138,915 kw. to 146,360 kw.), while the sum of the maximum loads has increased by 11,163 kw., or 10·41 per cent. (from 106,282 kw. to 117,445 kw.).

The proportion of installed plant is now as follows:—

	Stations.	Kilowatts.	Proportion per Cent.
Water-power	32	114,132	78·00
Steam-power (excluding hydro stand-by plants at Wellington (10,000), Invercargill (2,450), Waihi (2,500)	3	30,874	21·00
Gas-power	3	208	0·22
Oil-power	3	1,146	0·78
	41	146,360	100·00

The number of consumers supplied has increased from 228,345 to 243,795, an increase of 15,450, or 6·8 per cent., for the year.

The total population included in the various areas of electric-power supply is 1,414,932, or 94 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 0·083 kw., slightly over one-half of the allocation of 0·15 kw., or 0·2 h.p. per head of population, which is the basis of the design of the Government schemes. The units sold per head of population supplied were 320, as compared with 310 last year.

The total length of distribution-line is 17,063 route-miles, as compared with 14,975 last year, an increase of 2,088 miles, or 14·8 per cent. The number of consumers per route-mile is 14·3, as compared with 15·2 last year, the decrease being due to the extra mileage of new lines erected during the year to which the full number of services is not yet connected, and to the increased proportion of country lines.

The maximum power-demand per route-mile is now 6·9 kw., the sales 26,800 units, and the revenue £198. The units are better than last year (25,700), and there is a slight increase in revenue as against £193 last year, but there is a decrease in the corresponding maximum demand of 7·1 kw. last year. The decrease is due to the new territories of the Marlborough and Poverty Bay Power Boards consisting mainly of country reticulation.

The revenue per kilowatt of maximum load of all stations was £28·4, as compared with £27·3 last year. The water-power stations show a revenue of £30·52 per kilowatt, steam stations of £22·5 per kilowatt, oil stations of £32·8 per kilowatt, and gas stations of £44·53 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, sixty-nine showed a profit for the year amounting to £651,239, and twenty-nine showed a loss amounting to £197,835. The general result is a net profit for the whole Dominion of £453,402 after paying working-costs (£1,660,031) and capital (interest and sinking fund) charges (£1,260,286) at the rate of 5·95 per cent. on the total capital outlay of £21,221,722. This shows a net profit of 2·13 per cent., as compared with 0·66 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 94 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:—

Results for Electric-power Supply of New Zealand for the Year ended 31st March, 1928.

—	Water.	Steam.	Gas.	Oil.	Total.
Number of stations	32	3	3	3	41
Average capacity (kilowatts)	3,570	10,291	69	382	3,560
Number of consumers	196,745	42,191	791	4,068	243,795
Installed capacity (kilowatts), (main plant only)	114,132	30,874	208	1,146	146,360
Maximum load (kilowatts)	88,840	27,373	159	1,073	117,445
Units generated	427,556,602	93,472,628	217,429	2,168,297	523,414,956
Annual load-factor (per cent.)	54·9	39·0	15·6	23·1	50·5
Units sold	371,162,947	84,276,442	177,959	1,696,515	457,313,863
Total capital outlay in operation, including distribution systems	£18,205,043	£2,757,453	£33,436	£225,790	£21,221,722
Total capital per kilowatt installed (including distribution system)	£160	£89	£160	£195	£145
Total annual working-costs	£1,339,196	£292,556	£6,606	£21,673	£1,660,031
Total annual working-costs per unit sold	0·868d.	0·83d.	8·9d.	3·05d.	0·88d.
Total annual working-costs per kilowatt (maximum)	£15·1	£10·7	£41·54	£20	£14·0
Total annual capital charges	£1,054,007	£196,613	£1,888	£7,778	£1,260,286
Total annual capital charges per unit sold	0·68d.	0·56d.	2·54d.	1·1d.	0·66d.
Total annual capital charges per kilowatt (maximum)	£11·85	£7·2	£11·87	£7·2	£10·6
Total annual capital charges as percentage of capital outlay	5·8	7·1	5·65	3·43	5·95
Total annual costs	£2,393,203	£489,169	£8,494	£29,451	£2,920,317
Total annual costs per unit sold	1·548d.	1·39d.	11·44d.	4·16d.	1·54d.
Total annual costs per kilowatt (maximum)	£26·95	£17·9	£53·41	£27·2	£24·6
Total annual revenue (not including rates)	£2,714,195	£617,128	£7,081	£35,315	£3,373,719
Total annual revenue per unit sold	1·75d.	1·76d.	9·54d.	5·0d.	1·77d.
Total annual revenue per kilowatt (maximum)	£30·52	£22·5	£44·53	£32·8	£28·4
Net profit	£320,992	£127,959	*	£5,864	£453,402
Ratio of working-costs to revenue (per cent.)	49·0	47·4	93·5	61·5	49·3

*Deficit, £1,413.

Broken Wires and Poles.

During the year there were reported 699 cases of broken wires and sixty-five broken poles.

From incomplete returns the approximate number of miles of each size of conductor is scheduled below, together with a summary of the number of breaks reported in the respective sizes of wires in use. From this it will be seen that the proportion of breaks per mile of conductor erected is very small, and it is significant that 24·4 per cent. of same were directly attributable to the proximity of trees.

As regards broken poles, it has been assumed that, taking an average of twenty-five poles or supports per route mile, there are approximately 426,000 in service, and the proportion of broken poles reported is thus also very small.

Actual Mileages and Sizes of Overhead Conductors in Use at 31st March, 1928.

Size of Conductors (S.W.G.).	Copper.	Failures.	Aluminium.	Failures.	Galvanized Steel.	Failures.	Galvanized Iron.	Failures.	Copper-weld.	Failures.	Steel-cored Aluminium.	Failures.	Bronze.	Failures.
	Miles.		Miles.		Miles.		Miles.		Miles.		Miles.			
7/20 ..	4,447	218	..	..	..	..	..	..	..	..	..	..	..	..
7/18 ..	7,194	226	..	..	..	..	..	..	..	..	..	..	..	..
7/17 ..	1,278	4	..	..	..	..	..	..	..	..	..	..	..	..
7/16 ..	9,635	79	46	..	..	..	..	..	..	..	..	..	..	..
7/15 ..	207	..	2	..	..	..	..	..	..	..	..	..	..	..
7/14 ..	7,458	28	71	..	221	..	..	..	..	..	..	..	..	..
7/13 ..	1,052	..	..	..	..	..	27	..	..	..	..	..	..	..
7/12 ..	345	4	162	3	..	..	..	..	..	..	..	1	..	..
19/12 ..	139	1	..	..	2	..	..	..	..	..	2	..	..	..
19/13 ..	1,187	..	..	..	..	..	..	..	..	..	..	..	..	..
19/14 ..	491	2	..	..	..	..	..	..	..	..	..	..	..	..
19/15 ..	419	4	..	..	..	..	..	..	..	..	..	..	..	..
19/16 ..	722	4	..	..	..	..	..	..	..	..	..	..	..	..
19/18 ..	177	4	..	..	..	..	..	..	..	..	..	..	..	..
12 ..	2,083	102	..	..	..	..	96	..	..	..	..	..	30	..
10 ..	8,797	151	..	..	222	..	251	..	353	4	..	..	..	..
8 ..	9,480	105	..	..	1,715	7	5,248	7	622	..	..	..	..	..
7 ..	..	5	..	..	..	..	..	..	89	..	..	..	..	..
6 ..	45	..	..	..	..	..	15	..	22	..	..	..	..	..
Miscellaneous Sizes.														
7/10 ..	14	..	8	..	..	..	..	..	..	..	..	..	..	..
7/·062 ..	..	..	..	..	..	..	..	..	..	..	107	..	..	..
7/·1227 ..	..	..	..	..	..	..	..	..	..	..	2	..	..	..
7/·135 ..	..	..	83	..	..	..	..	..	..	..	..	..	..	..
6/·186 ..	..	..	42	..	..	..	..	..	..	..	..	..	..	..
6/·144 ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9/16 ..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
1/16 ..	22	..	..	..	..	..	..	..	..	..	..	..	..	..
3/·123 ..	..	..	2	..	..	..	..	..	..	..	..	..	..	..
3/12 ..	..	..	10	..	..	..	..	..	..	..	..	..	..	..
3/10 ..	..	..	44	1	..	..	..	..	..	..	..	..	..	..
37/12 ..	34	..	..	..	..	..	..	..	..	..	..	..	..	..
37/10 ..	10	..	..	..	..	..	..	..	..	..	19	..	..	..
3/0 ..	..	..	..	..	..	..	..	..	..	..	1,140	2	..	..
2/0 ..	..	..	..	..	..	..	..	..	..	..	59	..	..	..
Totals ..	55,249	..	470	..	2,160	..	5,637	..	1,086	..	1,329	..	30	..

Total miles, 65,961.

Note.—Return incomplete.

Growth of Load.

In the early days of electric supply electricity was used almost exclusively for lighting purposes. With the advent of electric motors and the application of electricity for heating purposes the power and heating load increased, until at the present time the energy used for lighting is small compared with that used for other purposes. The benefits of electric drive in factories and workshops have to a large extent been taken advantage of, and the use of electricity for commercial heating and domestic heating and cooking is rapidly increasing. The use of electric ranges and water-heaters during the past few years tends to confirm the opinion that the use of electricity for domestic purposes will soon exceed the demand for industrial and commercial uses.

Returns have again been obtained of electric ranges and water-heaters in use throughout the Dominion, and the figures obtained continue to show satisfactory increases over those of the previous twelve months, and the statistics obtained for the year ending 31st March, 1928, have been scheduled in Table Y. Of the ninety-nine electric-supply authorities engaged in retail distribution of electrica energy, eighty-three of them have an aggregate total of 15,766 electric ranges connected to their systems, and the number now installed represents an increase of 66 per cent. for the year. The return shows the percentage of consumers using electric cooking to the total number of consumers being supplied in each area respectively, and an examination of this column shows where the field for electric cooking still remains to be developed.

The number of consumers using electric water-heaters has increased from 14,160 to 21,513 during the year, an increase of 51·5 per cent.

When electric-supply authorities actively canvass their areas for the above class of load the response is generally favourable, and it is only reasonable to anticipate that in the near future the demand on the available stations will be such as to warrant further extensions to keep up with the requirements. This development of load is particularly noticeable in rural and country areas, where the facilities for more congenial living-conditions are being brought into line with those already existing in the metropolitan areas.

As regards electrically-driven milking-machines, the figures this year show a steady advance over those of previous years — viz., 1925, 3,581; 1926, 4,856; 1927, 6,738; 1928, 8,514. The collection of these statistics was inaugurated in 1923, when the total number of electrically-driven machines was only 1,310. The increase in five years is thus 550 per cent.; and, as there are still about 9,500 machines which are fuel or water driven, the work of conversion is not yet half completed, and the electric-supply authorities have still this additional load of approximately 12,000 horse-power in prospect and ready for canvassing.

Electrical Supply and Wiring Regulations.

Since the above regulations were gazetted the work of the Advisory Committee has continued to be of valuable assistance to the Department in reviewing the regulations in connection with questions raised by the supply authorities and others. With the issuing of Wiring Regulations, hitherto published by the Fire Underwriters' Association, there has been a lot of work associated with interpretations of certain clauses, all of which has been indexed for future reference when the time arrives for a revision of the present issue. The working of the new regulations has, however, been comparatively smooth, and the supply authorities are showing a live interest in seeing that the spirit of same is given effect to.

Inspection of Electric Lines.

Since the staff has been strengthened by the appointment of two Electric-line Inspectors the periodic inspection of the electric lines throughout the Dominion has been maintained in conjunction with inspections necessitated by the addition of 2,088 miles of new lines erected during the year. It is satisfactory to record that the supply authorities are co-operating with the Department in facilitating these inspections, followed in most cases by prompt attention to the removal of defects brought under their notice. The idea previously held by some supply authorities that no attention be paid to maintenance of lines until a disregard of the regulations was made apparent either by accidents or arising out of departmental inspections, is disappearing, and they are recognizing more than hitherto the obligations imposed by the conditions of the license issued to them.

Investigations into the voltage of supply to consumers to ascertain if electric lines are being properly designed and maintained to comply with the permissible voltage variation, and the matter of seeing that the relay protective devices are operating effectively, have not yet been finally organized, but it is anticipated being able to devote more attention to this in the near future. Cognizance of these matters by supply authorities is already in evidence, and it is hoped that with the full co-operation of the Public Works Department the public will eventually enjoy the benefits of efficient electric supply.

Inspections of interior wiring have on occasion been carried out by the Public Works Department during the year (more particularly in public garages), and the defects scheduled as a result of such inspections have revealed a lack of supervision by the supply authority concerned. In my report of last year attention was directed to the necessity for all electric-supply authorities recognizing the responsibility resting on them, through their Inspectors, who are registered under the Wiremen's Registration Act, and to take active steps to detect bad workmanship and unregistered wireman. This matter has again been brought under the notice of all supply authorities by means of a circular letter, with a request that their staffs be instructed to make more frequent and stricter inspections to see that the regulations are being complied with.

The following is a list of the various electric-supply authorities and companies whose lines have been inspected during the past year :—

Power Boards (35).

Ashburton (extensions)	Hawke's Bay (part)	South Canterbury	Wairarapa
Auckland (part)	Hutt Valley	Southland	Wairere
Banks Peninsula	Malvern	Springs-Ellesmere	Wairoa
Cambridge (part)	Manawatu-Oroua	Taranaki	Waitaki (part)
Central (part)	Marlborough (part)	Tararua	Waitemata (extensions)
Central Hawke's Bay	Opunake	Tauranga (part)	Waitomo (extensions)
Dannevirke	Otago	Te Awamutu (part)	Wanganui-Rangitikei.
Franklin (extensions)	Otago Central	Teviot	
Grey	Poverty Bay (part)	Thames Valley	

Cities (1).

Wellington (part).

Boroughs (31).

Hastings	New Plymouth	Rangiora	Tauranga
Hamilton	Ohakune	Riccarton	Te Aroha
Inglewood	Opotiki	Rotorua	Thames
Kaiapoi	Picton	Stratford	Wairoa
Lyttelton	Palmerston North	Sumner	Waitara
Motueka	Patea	Timaru (part)	Westport
Mataura	Queenstown	Taihape	Whakatane.
Napier	Raetihi	Taumarunui	

Town Districts (4).

Havelock North	Kaponga	Mangaweka	Te Puke.

County Councils (8).

Halswell	Heathcote	Kowai	Kaikoura
Murchison	Rangiora	Uawa	Waimairi.

Companies (15).

J. D. Barry, Tokomaru	Hawera	Reefton	Westport - Stockton Coal Co.
Blackball Coal Co.	Kanieri	Tai Tapu	
Farmers' Co-operative Co., Tokomaru	New Zealand Dairy Co., Frankton	Union Steamship Co., Port Chalmers	
Farmers' Freezing Co., Tokomaru	Otago Harbour Board	Waimea	
	J. F. Pettie, Waipiro	Westport Coal Co.	

Licenses issued (Electric-line and Water-power).

Licenses from September, 1927, to July, 1928, were issued to the following: Blackball Coal Co.; Wellington City Council (amendment); Kaitangata Coal Co. (amendment); South Taranaki Power Board; New Plymouth Borough Council (amendment); John Thompson, Queenstown; Eltham Dairy Factory Co.; Waitemata Power Board (Devonport area); John Alfred Potham, Wairoa; Marlborough Power Board (purchase of Havelock plant); Union Steamship Co., Port Chalmers; Waimairi County Council (amendment); Wanganui-Rangitikei Power Board (extensions and purchase of Waverley plant); North Canterbury Power Board; Hikurangi Coal Co. (extensions); Hawke's Bay Power Board (Taradale); Golden Bay Power Board.

Approval Board.

The setting-up of an Approval Board being closely allied with the administration of the regulations, steps have now been taken to draft the necessary legislative enactment. The proposed Act will contain provisions primarily for prohibiting the sale and use of electrical appliances which are dangerous, and will also contain provision for the issuing of approval of electrical appliances, so that the public may have the assurance that apparatus purchased is safe and in conformity with the regulations. The constitution of the proposed Board will be such as to provide representation for all interests concerned.

Registration of Electrical Wiremen.

The Electrical Wiremen's Registration Act has been in operation since the 1st April, 1926 (*i.e.*, two years and three months), and although the administration of the Act during the year occasioned a large amount of work it is now settling down to routine. To the end of June, 1928, there have been registered 264 Inspectors of Electrical Wiring and 2,619 electrical wiremen, an increase of 72 Inspectors and 359 electrical wiremen since July, 1927. In addition to the above registrations, 182 provisional licenses were issued between the 1st July, 1927, and the 30th June, 1928. Of the 2,619 electrical wiremen registered, 406 have been registered after passing the Registration Board's examination.

The work under the Act will in future, now that the wiremen who were working at the time the Act came into force have been registered, consist mainly of the examination of apprentices, the receipt of reports of bad workmanship, and reports of breaches of the Act. It is, however, anticipated that action for breaches of the Act will be taken more by the electrical-supply authorities, and thus avoid the delay which must result from centralization in this matter. Valuable experience has been gained in laying out the information necessary for a successful prosecution, and the services of the Board are available to supply authorities when taking their first prosecutions.

The number of reports of bad workmanship and reports of breaches of the Act received during the year indicates that the supply authorities and their Inspectors are becoming more conversant with the Act and that they are co-operating with the Registration Board in enforcing it. The Act is operating very well, and there is no doubt that the standard of workmanship is steadily improving. It is anticipated the action being taken by the Board in the cases of reports of bad workmanship will have a good effect. The number of endorsements for bad workmanship has steadily increased, and a larger number of registration certificates would have been endorsed had there been power to remove endorsements after a certain period. The endorsement of a certificate for life is too drastic a punishment for most cases reported, and the Board has been reluctant to endorse certificates except for bad work of a particularly dangerous or inferior nature. The elimination of workmen who are incompetent or who persist in doing inferior work will tend to reduce still further the comparative small number of fires and accidents due to the use of electrical energy. The rapidly increasing use of electrical energy and the comfort to be derived from its efficient use makes it necessary that only skilled workmen be permitted to carry out the installation of the wiring and consuming devices.

It is proposed to amend the Act this session to provide for several matters not included in the main Act. The principal amendments are conditional registration where the workman has specialized in some particular part of wiring-work; the employment of apprentices and improvers to carry out certain minor classes of wiring-work; the employment of improvers; provision for the removal of an endorsement for bad workmanship; provision that any repair work or assembly work carried out in a workshop or similar premises shall be subject to inspection by a qualified wireman before being put into use; provision that an Inspector shall not inspect any work carried out by himself, and for the cancellation of registration in the case of incompetent Inspectors; making it an offence for any one to connect up any premises or apparatus until it has been inspected, tested, and approved; making it an offence to withhold information which may be of assistance in proving who carried out certain wiring-work; and provision for the control of the operation of stage-lighting and portable apparatus used thereon.

Section 18, subsection (2), of the principal Act made it necessary for the person undertaking to do any electrical wiring to notify the electrical-supply authority of the name of the wiremen who would be employed on the work. This was found to be unworkable, and was not applied by the electrical-supply authorities. It has now been made necessary for the person undertaking to do the work to give notice to the electrical-supply authority specifying the date on which it is proposed to begin such work, and giving details of the work. This amendment should remove the difficulty experienced by the electrical-supply authorities in obtaining the necessary information to enable progress inspections and tests to be carried out.

The onus of seeing that only qualified men are employed has now been placed on the employer, as it was quite evident that certain employers were employing unregistered wiremen and relying on the fact that it was difficult to prove that a breach of the Act had been committed.

The provision that stage-lighting and portable apparatus shall be under the control of qualified persons will tend to remove any danger which may exist of a panic occurring through a fire on the stage. This portable apparatus and its flexible leads are subject to particularly hard wear in service.

There has been one appeal under section 23 of the Act against the decision of the Board, and, as the evidence was not complete, this has been adjourned.

Forty-eight prosecutions for working contrary to the Act have been taken since the 1st April, 1927, and others are pending. Of the above prosecutions, twelve have been taken against wiremen who had neglected to become registered; two cases were against registered wiremen for failing to return their certificates for endorsement; eleven cases were against employers for permitting apprentices to work without supervision; and one case was against a carpenter for interfering with wiring during alterations to a building. Fines and costs totalling £109 were imposed in the above cases. In the majority of cases only nominal fines were inflicted, but it is proposed to ask for heavier penalties in all future cases.

Ninety-three reports of breaches of the Act were received during the period 1st April, 1927, to 30th June, 1928. Figures for the yearly periods since the Act came into force are as follows: 1st April, 1926, to 31st March, 1927, fifty-two reports; 1st April, 1927, to 31st March, 1928, sixty-three reports. A number of cases were not taken, as the evidence was insufficient to secure a conviction. As the electrical-supply authorities become more familiar with the Act the cases with insufficient evidence will gradually be eliminated.

There were fifty-two reports of bad workmanship received during the period 1st April, 1927, to 30th June, 1928, and a comparison of the yearly figures shows that the electrical-supply authorities are beginning to tighten up on the inferior type of workman. The figures are as follows: 1st April, 1926, to 31st March, 1927, seventeen; 1st April, 1927, to 31st March, 1928, forty-six. Of the cases reported during the period 1st April, 1927, to 30th June, 1928, the following action has been taken: One name was removed from the register, the certificates were endorsed for bad workmanship in thirteen cases, seven wiremen were censured, fifteen wiremen were cautioned, five satisfactory explanations were received, two were cases where the work had been done by unregistered persons, one was referred to the electrical-supply authority to take action, in three of the cases the offence occurred before the Act came into force and no action could be taken, and the other cases are of recent date and are still under review.

Examinations were held in October, 1927, and March, 1928. Details of the examinations will be found in the following table:—

Electrical Wiremen's Examination Results.

	Written Part.												Practical Part.											
	October, 1926.			April, 1927.			October, 1927.			March, 1928.			October, 1926.			April, 1927.			October, 1927.			March, 1928.		
	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.	Entered.	Passed.	Percentage.
Auckland	29	20	69	41	22	54	55	28	51	53	37	70	23	19	83	37	31	84	44	39	89	35	23	66
Christchurch	22	10	45	35	21	60	29	17	59	31	20	65	21	15	71	32	23	72	22	17	77	27	9	33
Dunedin	8	6	75	22	17	78	26	10	38	24	14	58	9	8	89	23	17	74	25	17	68	19	6	32
Gisborne	..	..	..	7	2	29	11	5	45	10	7	70	..	..	..	6	4	67	5	4	80	6	1	17
Greymouth	6	4	67	5	3	60	6	2	33	3	Nil	..	6	4	67	6	3	50	5	5	100	2	Nil	..
Hamilton	18	13	72	28	13	46	20	11	55	14	8	57	20	18	90	28	14	50	20	5	25	13	6	46
Havelock South	..	..	..	..	..	..	..	..	..	1	1	100	..	..	..	..	..	..	..	..	..	1	1	100
Hawera	..	..	..	..	..	..	2	Nil	..	5	2	40	..	..	..	..	..	..	5	5	100	3	2	67
Invercargill	4	4	100	1	Nil	..	8	3	37	10	7	70	6	6	100	1	Nil	..	8	7	87	6	3	50
Kaikoura	2	Nil	..	2	2	100	..	..	..	..	..	..	2	2	100	..	..	..	..	..	..	..	..	..
Masterton	5	4	80	8	5	63	7	3	43	9	3	33	5	5	100	8	8	100	6	5	83	5	Nil	..
Napier	8	7	87	7	2	29	15	6	40	14	11	79	8	7	87	8	7	87	12	9	75	11	10	91
Nelson	5	2	40	6	3	50	6	1	17	4	2	50	6	5	83	5	4	80	4	4	100	..	..	..
New Plymouth	..	..	..	..	..	..	11	7	64	7	3	43	..	..	..	..	..	..	9	7	78	6	6	100
Palmerston North	13	10	77	20	13	65	15	9	60	16	10	63	14	12	86	19	17	90	12	11	92	10	5	50
Stratford	7	4	57	13	4	31	..	..	..	1	Nil	..	7	4	57	15	9	60	..	..	..	..	..	..
Timaru	..	..	..	5	4	80	4	1	25	7	6	86	..	..	..	5	5	100	4	3	75	6	5	83
Wanganui	6	5	83	..	..	..	9	1	11	12	2	17	6	4	67	..	..	..	7	6	86	6	6	100
Wellington	29	16	55	34	22	65	38	26	68	44	34	77	33	23	70	31	18	58	37	28	76	39	26	67
Westport	..	..	..	2	1	50	2	Nil	..	2	1	50	..	..	..	2	1	50	2	2	100	2	1	50
Whangarei	5	4	80	3	2	67	1	1	100	1	1	100	5	2	40	5	3	60	1	1	100	1	1	100
Total	167	109	65	239	136	57	265	131	49	268	169	63	171	134	78	231	164	71	228	175	77	198	111	56
Highest marks obtained	91			86			80			89			94			91			91			96		

The tendency of the Board will be to consistently raise the standard of future examinations to ensure that candidates passing have a good technical knowledge as well as being competent of maintaining a high grade of workmanship.

Work for other Departments.

This Department during the year has again been called upon to co-operate with other Government Departments, amongst which may be quoted work done on the advisory committee set up to report on railway-electrification proposals for Wellington suburban lines of the Railways Department.

The assistance of this Department was also sought by the Mental Hospitals Department in connection with their proposals to equip the hospitals at Porirua, Seacliff, Sunnyside, and Drury.

Reports are also in course of preparation for the Health Department in connection with proposals for electrifying Coromandel Public Hospital. The assistance of this Department was also sought in connection with extensions and alterations to the electrical installation at Hanmer.

Work has also been undertaken on behalf of the Tourist Department in connection with supply of electric light and power for the new hostel at Milford Sound.

For the Cook Islands Administration a proposed scheme and estimate for the supply of electricity at Rarotonga was prepared and submitted.

For the Department of External Affairs this Department is still co-operating for the completion of the hydro-electric plant now in course of erection at Apia.

For the Education Department estimates have been prepared in connection with electric supply to the special school at Otekaike.

Electrical Accidents.

The following is a list of various electrical accidents reported to the Department during the year:—

1/7/27	Horse electrocuted in Hamilton by accidental contact with 3,000-volt line.
13/7/27	Linesman severely injured by fall from pole (Hastings).
14/7/27	Operator severely burnt while operating 3,300-volt air-break switch, due to defective insulator (Manawatu-Oroua).
20/8/27	Child at Tikorea received shock from live fence-wire.
2/9/27	Linesman fell from pole and received concussion through neglect to securely fasten safety-belt (Sumner).
13/9/27	Man committed suicide by throwing fencing-wire over 11,000-volt lines (Wellington).
19/9/27	Man received severe shock while working on high-tension lines (Waikaremoana).
23/9/27	Engineer injured by fall from pole, due to electric shock (Havelock North).
15/11/27	Seven cows electrocuted by contact with fence which had become livened up through a farmer disconnecting without authority the service lines and leaving them across the fence (Wairarapa).
9/12/27	An assistant linesman while working on service connections received shock and fell from a ladder; severely bruised (Dunedin).
18/12/27	Man electrocuted by a defective portable electric hand-lamp (Frankton).
6/1/28	Woman received severe shock and burns from a defective electric kettle (Martinborough).
6/1/28	Boy received shock and burns through climbing on a roof and allowing a bucket to foul live lines (Cambridge).
6/1/28	Horse electrocuted by fence livened up by contact with iron shed containing motor, the leads of which became jammed in bed-plate adjusting-screw (Cambridge).
15/2/28	Man electrocuted in a garage through a wrongly connected plug-point (Westport).
2/3/28	Linesman received shock and burns while working on dead lines, due to flashover of a lightning-discharge (Manawatu-Oroua Power Board).
5/3/28	Man received slight shock from an insufficiently protected motor installation (Wellington).
13/3/28	Linesman electrocuted while working on 230-volt line, due to defective binding (Waimairi County Council).
13/3/28	Linesman received shock and burns through accidental contact with 6,600-volt clamp (Hutt Valley Power Board).
20/3/28	Linesman received shock and burns due to carelessness while measuring high-tension voltage (Central Power Board).
31/3/28	Assistant linesman received shock and slight burns while working on dead electric high tension by carelessly allowing binder-wire to come in contact with live high tension below. There was no reason why high-tension lines should not have been made dead also (Dunedin).
7/4/28	Linesman electrocuted through accidental contact with 11,000-volt air-break switch (Tauranga Power Board).
31/4/28	Horse electrocuted through contact with fallen line (Rangiora).
4/5/28	Carpenter electrocuted while engaged on demolition work through coming in contact with a bolt accidentally livened up through damage to the conduit of a motor installation (Dunedin).
4/6/28	Linesman received shock and burns through contact with 230-volt line wrongly assumed to be dead (Manawatu-Oroua Power Board).
4/6/28	Assistant Engineer seriously burnt through accidentally coming in contact with 11,000-volt lines (Manawatu-Oroua Power Board).
27/6/28	Boy received shock from portable electric drill through wrongly connected three-pin plug (Christchurch).

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Chief Electrical Engineer.

TABLE A.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATION.

Results of Operation.	Tenth Year, 1925.	Eleventh Year, 1926.	Twelth Year, 1927.	Thirteenth Year, 1928.
	£	£	£	£
Capital outlay	1,008,491	1,366,951	1,538,569	1,561,081
Costs—				
Working-costs	23,270	27,035	30,728	40,054
Interest	47,780	50,324	65,094	75,630
Depreciation, 2 per cent.	15,679	19,350	28,168	29,863
Total costs	86,729	96,709	123,990	145,547
Accumulated Depreciation Fund	88,631	111,526	142,594	173,231
Accumulated deficiency	17,738	..	..	..
Sinking Fund Account	..	8,907	35,443	62,465
Revenue—				
City Council	28,925	50,377	64,322*	68,000*
Tramways	9,477	10,122	16,094	16,863
Wholesale consumers	49,822	60,250	67,378	83,722
Retail consumers	1,880	264	269	164
Miscellaneous	2,059	2,342	2,177	2,378
Total revenue	92,163	123,355	150,240	171,127
Maximum load (kilowatts)—				
Power-house	13,180	14,430	16,880	21,020
Substations (66 kv.)	11,190	13,583	15,512	19,313
City Council	6,216	7,244	7,978	10,102*
Tramways	2,760	2,880	2,860	2,720
Average load (kilowatts)—				
Power-house	6,820	7,916	9,000	10,710
Substations (66 kv.)	5,680	6,303	8,200	9,780
City Council	2,930	3,357	3,760	4,480*
Tramways	897	972	980	1,020
Units output—				
Power-house	59,528,216	68,860,614	78,342,797	93,853,759
Fed to village, tunnel, and intake	1,865,344	1,664,917	741,462	757,678
Fed to transmission-lines	56,935,840	65,491,130	76,941,870	93,096,081
Substations (66 kv.)	53,261,142	61,167,881	71,791,696	85,969,069
Units distributed—				
City Council (sold)	25,616,445	29,126,211	32,935,247	39,390,350*
Tramways (sold)	7,851,060	8,511,530	8,583,270	8,893,650
Wholesale consumers and local bodies (sold)	17,420,138	22,988,931	27,829,050	34,912,744
Retail consumers (sold)	399,390	41,453	23,699	20,844
Substations and power-house local consumption (unsold)	..	284,764	1,516,395	1,453,130
Total units distributed	51,287,033	60,952,889	70,887,661	84,770,718
Losses—				
Transmission-line losses	3,676,518	4,323,249	5,150,174	7,127,012
Percentage	6·43	6·270	6·7	7·65
Distribution losses	1,973,199	1,342,454	1,645,497	1,956,029
Percentage	3·71	2·20	2·2	2·3
Average load-factor (per cent.)—				
Power-house	51·8	54·8	53·4	51·0
Substations (66 kv.)	50·8	54·0	52·9	50·6
City	47·1	46·3	47·2	44·4*
Working-costs—				
Per kilowatt (power-house maximum)	£1·76	£1·874	£1·820	£1·905
Per kilowatt (substation maximum)	£2·08	£1·99	£1·981	£2·074
Per unit generated	0·094d.	0·094d.	0·094d.	0·102d.
Per unit distributed	0·109d.	0·106d.	0·104d.	0·113d.
Capital charges—				
Per kilowatt (power-house maximum)	£4·82	£4·828	£5·525	£5·019
Per kilowatt (substation maximum)	£5·67	£5·129	£6·012	£5·462
Per unit generated	0·255d.	0·243d.	0·286d.	0·270d.
Per unit distributed	0·297d.	0·274d.	0·323d.	0·299d.
Total cost—				
Per kilowatt (power-house maximum)	£6·58	£6·702	£7·345	£6·924
Per kilowatt (substation maximum)	£7·75	£7·119	£7·993	£7·536
Per unit generated	0·349d.	0·337d.	0·379d.	0·372d.
Per unit distributed	0·406d.	0·381d.	0·419d.	0·412d.
Revenue (total revenue)—				
Per kilowatt (power-house maximum)	£6·992	£8·548	£8·900	£8·141
Per kilowatt (substation maximum)	£8·230	£9·081	£9·685	£8·860
Per unit generated	0·371d.	0·430d.	0·460d.	0·437d.
Per unit distributed	0·431d.	0·486d.	0·509d.	0·484d.
Per unit sold (city)	0·271d.	0·415d.	0·469d.	0·414d.
Per unit sold (trams)	0·289d.	0·285d.	0·450d.	0·450d.
Per unit sold (wholesale consumers)	0·686d.	0·629d.	0·581d.	0·575d.
Per unit sold (retail consumers)	1·129d.	1·528d.	2·724d.	1·889d.

Substations maximum: Addington, 16,088 kw.; Timaru, 1,616 kw.; Ashburton, 1,306 kw.; Oamaru, 581 kw.; Hororata, 239 kw.; Point, 19 kw.

* Excludes Woolston Borough Council.

TABLE B.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

Item.	Total Expenditure to 31st March,		Expenditure during year 1927–28.
	1927.	1928.	
	£	£	£
Land, roading, and fencing	23,484	24,125	641
Harper diversion	23,007	23,007	..
Headworks, No. 1	209,687	211,346	1,659
Headworks, No. 2	237,699	237,311	*Cr.* 388
Power-house machinery	204,827	205,658	831
Staff village	24,063	24,571	508
Transmission-lines	366,576	365,748	*Cr.* 828
Addington Substation	74,077	80,021	5,944
Primary distribution	66,737	67,859	1,122
Secondary distribution	102,011	106,733	4,722
Service transformers and meters	6,001	8,008	2,007
Vehicles and loose tools	23,732	28,476	4,744
Telephone-lines	1,903	1,903	..
Office furniture	255	255	..
Surveys, preliminary expenses, &c.	113,471	114,627	1,156
Interest during construction	61,039	61,433	394
Total	1,538,569	1,561,081	22,512

TABLE C.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

Item.	1927.		1928.	
	Cost.	Cost per Unit Distributed.	Cost.	Cost per Unit Distributed.
	£	d.	£	d.
Harper diversion	2,488	0·008	2,813	0·008
Generating	8,484	0·029	12,336	0·035
Transmission-line	4,237	0·015	4,184	0·012
Main distribution	2,758	0·009	3,356	0·009
H.T. distribution	3,448	0·012	3,565	0·010
L.T. distribution	2,326	0·009	4,442	0·013
Standby	1,483	0·005	..	..
Management	5,504	0·019	9,358	0·026
	30,728	0·106	40,054	0·113

Units distributed—1927, 70,887,661; 1928, 84,770,718.

TABLE D.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1928.

Consumer.	Light.	Heat.	Power.	Total.
Local bodies, &c.—				
Ashburton Power Board	1,354	6,024	1,524	8,902
Banks Peninsula Power Board ..	363	1,636	333	2,332
Christchurch City Council	..	..	..	72,158*†
Christchurch Tramway Board ..	..	..	..	7,550*
Eyre County Council	41	72	84	197
Halswell County Council	72	197	49	318
Heathcote County Council ..	418	2,077	119	2,614
Kowai County Council	112	219	62	393
Kaiapoi Borough Council	133	249	80	462
Lyttelton Borough Council ..	308	459	580	1,347
Lyttelton Pumping-station ..	..	3	114	117
Malvern Power Board	252	1,122	198	1,572
Rangiora County Council	401	766	524	1,691
Riccarton Borough Council ..	594	2,167	430	3,191
Sumner Borough Council	305	696	125	1,126
South Canterbury Power Board ..	2,830	6,770	2,574	12,174
Springs-Ellesmere Power Board ..	670	2,291	662	3,623
Tai Tapu Dairy Co.	105	238	70	413
Waimairi County (Hillmorton) ..	91	133	20	244
Waitaki Power Board	..	..	..	5,494*
Freezing-works (4)	165	45	2,280	2,490
Flour-mills (2)	10	8	281	299
Dairy factory (1)	2	2	66	70
Quarry (1)	3	16	111	130
Tanneries and wool-scourers (6) ..	34	26	784	844
Seed-cleaning (4)	7	5	173	185
Brickyard (1)	2	1	156	159
Railway workshops (1)	60	20	1,106	1,186
Harbour Board (1)	60	1	1,445	1,506
Institutions (4)	162	438	161	761
Steelworks (1)	3	1,200	26	1,229
Glue-works (1)	4	1	99	104
Woollen-mill (1)	10	2	119	131
Chemical-works (1)	16	14	332	362
Railway-station (1)	77	10	140	227
Railway signalling (1)	29	..	98	127
Twine-mill (1)	2	1	119	122
Retail (24)	7	16	5	28
Substations—				
Addington	18	57	50	125
Ashburton	1	10	..	11
Hororata	1	6	..	7
Point	1	11	..	12
Timaru	2	19	1	22
Oamaru	1	6	..	7
Lake Coleridge	..	..	..	302*
	8,726	27,034	15,100	136,364

* Light, power, and heat combined. † Includes Woolston Borough Council.

Power-house maximum, 21,020 kw.

Number of consumers: Local bodies, 19; industries, &c., 32; retail, 24: total, 75.

TABLE E.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY: GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR YEAR ENDED 31ST MARCH, 1928.

Distributing Authority.	Number of Consumers.	Revenue.						Expenditure.							Balance.	
		Capital Outlay.	From Sale of Electrical Energy.	Rates.	Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Maintenance.	Interest.	Depreciation.	Sinking Fund, Reserve Fund, &c.	Other Expenditure.	Total.	Profit.	Loss.
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department	76	1,561,081	48,748*	..	..	2,378	171,127	..	40,054	75,630	29,863	25,580	..	171,127	..	..
Ashburton Power Board..	3,069	302,374	34,928	..	..	555	35,483	9,237	9,598	16,138	2,400	2,481	37	39,891	..	4,408
Banks Peninsula Power Board	912	97,626	10,478	4,118	343	336	15,275	2,028	5,194	6,123	..	1,042	901	15,288	..	13
Christchurch City Council	25,415	584,312	188,373*	..	2,987	4,921	201,171	63,110†	46,560	26,211	30,749	11,099	..	182,619	18,552	..
Eyre County Council	148	6,400	1,394	..	..	..	1,394	671	163	273	..	50	..	1,157	237	..
Halswell County Council	127	6,627	1,662	..	..	11	1,673	720	513	263	..	50	..	1,546	127	..
Heathcote County Council	1,122	23,985	7,484	..	260	25	7,769	3,081	2,485	626	..	456	..	6,648	1,121	..
Kaiapoi Borough Council	455	10,333	2,939	..	142	..	3,081	949	1,089	641	..	253	..	2,932	149	..
Kowai County Council	293	23,812	2,600	..	8	59	2,667	677	420	1,205	..	..	448	2,750	..	83
Lyttelton Borough Council	552	5,000	4,360	..	..	..	4,360	1,588	1,841	235	..	100	18	3,782	578	..
Malvern Power Board	577	52,297	5,369	..	391	445	6,205	1,897	1,252	2,425	981	417	50	7,022	..	817
Rangiora County Council	450	25,040	5,476	..	..	759	6,235	2,690	1,401	1,469	..	270	23	5,853	382	..
Riccarton Borough Council	1,147	16,820	8,139	..	3	..	8,142	2,817	3,216	581	765	40	..	7,419	723	..
South Canterbury Power Board	5,053	264,768	33,419	..	100	347	33,866	14,067	2,984	8,752	554	4,470	147	30,974	2,892	..
Springs-Ellesmere Power Board	1,716	102,332	16,177	..	188	173	16,538	3,404	2,386	6,350	1,000	1,065	1,606	15,811	727	..
Sumner Borough Council	916	13,032	5,351	..	..	8	5,359	1,544	462	459	..	81	21	2,567	2,792	..
Tai Tapu Dairy Company	240	10,271	3,592	..	744	..	4,336	1,521	1,744	416	348	..	217	4,246	90	..
Waimairi County Council	2,750	64,936	16,434*	..	..	1	16,514	5,065‡	4,927	2,543	..	947	..	13,561	2,953	..
Waitaki Electric Power Board	2,605	130,105	24,720	..	887	105	25,712	4,626	5,975	6,429	5,300	1,712	..	24,042	1,670	..
Totals	47,623	3,301,151	421,643	4,118	6,053	10,123	566,907	119,692	132,264	156,769	71,960	50,113	3,468	539,235	32,993	5,321

* After deducting sales to other distributing bodies, totalling—Public Works Department, £120,001; Christchurch City Council, £4,890; Waimairi County Council, £79. † After deducting amount paid by Waimairi County Council, £4,890. ‡ After deducting amount paid by Springs-Ellesmere Power Board, £79.

	£
Gross profit	27,672
Raised by rates	4,118
Net profit	£23,554

TABLE F.—MANGAHAO HYDRO ELECTRIC-POWER SYSTEM.—RESULTS OF OPERATIONS.

—	1927.	1928.
	£	£
Capital outlay	2,242,871	2,373,921
Costs—		
Working-costs*	26,921	33,914
Interest	98,881	106,441
Depreciation	32,997	35,301
Total costs	158,799	175,656
Revenue	101,897	44,112†
Loss	56,902	131,544
Depreciation Fund	32,997	35,301
Maximum load (kilowatts)—		
Power-house	18,100	20,040
Khandallah Substation	12,720	12,120
Wellington City	11,078	10,496
Hutt Valley Electric-power Board	1,700	2,120
Wellington Meat Export Co.	397·6	455
Railway Department	360	480
Horowhenua Electric-power Board	1,688	1,968
Manawatu-Oroua Electric-power Board	1,632	2,094
Dannevirke Electric-power Board	381	420
Tararua Electric-power Board	382	442
Wairarapa Electric-power Board	820	930
Wanganui-Rangitikei Electric-power Board	1,848	2,016
Central Hawke's Bay Electric-power Board	300	440
Units output—		
Generated—		
Power-house total	72,133,890	74,726,880
Purchased—		
Wellington City Council	5,720,463	22,539,685
Wanganui-Rangitikei Electric-power Board	549,620	2,307,964
Palmerston North Borough Council	143,911	1,176,556
Napier Borough Council	..	1,257,120
Hastings Borough Council	..	841,095
Other sources	..	1,118,809
Total units generated and purchased	78,547,884	103,968,109
Units sold—		
Wellington City Council	36,140,668	40,024,449
Wellington Meat Export Co.	1,292,500	1,574,550
Horowhenua Electric-power Board	5,986,110	7,090,301
Hutt Valley Electric-power Board	6,334,156	9,193,558
Wairarapa Electric-power Board	1,676,550	2,246,344
Tararua Electric-power Board	1,556,650	2,105,967
Dannevirke Electric-power Board	1,337,202	1,612,296
Central Hawke's Bay Electric-power Board	1,188,238	1,945,807
Hawke's Bay Electric-power Board	..	6,035,193
Manawatu-Oroua Electric-power Board	9,068,259	11,442,722
Wanganui-Rangitikei Electric-power Board	6,959,957	11,865,489
New Zealand Railways	704,456	965,175
Headworks and village	1,346,880	1,309,635
Testing, &c. (includes supply to substations)	250,391	375,086
Total units sold	73,842,017	97,786,572
Losses—		
Total losses (units)	4,705,867	6,181,537
Percentage	6·0	5·9
Load-factor (per cent.)—		
Power-house (annual)	45·3	42·4‡
Power-house (average weekly)	55·3	53·1
Working-costs (less power purchased)—		
Per kilowatt (power-house maximum)	£1·49	£1·7
Per unit generated	0·0895d.	0·109d.
Per unit sold	0·087d.	0·084d.
Capital charges—		
Per kilowatt (power-house annual maximum)	£7·28	£7·066
Per unit generated	0·44d.	0·46d.
Per unit sold	0·43d.	0·35d.
Total costs—		
Per kilowatt (power-house annual maximum)	£8·62	£8·76
Per unit generated	0·53d.	0·56d.
Per unit sold	0·517d.	0·43d.
Revenue—		
Per kilowatt (power-house annual maximum)	£5·64	£2·2
Per unit generated	0·339d.	0·142d.
Per unit sold	0·331d.	0·108d.

* Does not include £111,745 for power purchased. † Gross revenue, £155,857. ‡ On units generated; 59·1 per cent. on total units.

TABLE G.—MANGAHAO ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

	Expenditure to 31st March,	
	1927.	1928.
	£	£
Land, roading, tram-lines, and fencing	80,012	83,055
Headworks	664,154	764,461
Generating-station and machinery	278,975	301,207
Transmission-lines	447,847	442,961
Main substations	229,700	258,430
Service buildings and workmen's accommodation	74,700	73,166
Staff village	15,936	..
Vehicles and loose construction tools	7,946	7,262
Office furniture	961	964
Surveys, expenses, and salaries	117,516	130,307
Construction plant and equipment	72,464	52,781
Interest during construction	217,069	236,993
Cost and expenses of raising loans	35,591	22,334
Totals	2,242,871	2,373,921

TABLE H.—MANGAHAO ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

	1927.		1928.	
	Cost.	Per Unit sold.	Cost.	Per Unit sold.
	£	d.	£	d.
Generating	6,037	0·019	6,789	0·016
Transmission	12,468	0·041	16,211	0·038
Substations	3,692	0·012	5,112	0·012
Management and general	4,724	0·015	5,802	0·014
Totals	26,921	0·087	33,914	0·080

TABLE I.—MANGAHAO ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1928.

	Street-lighting.	General Lighting, Heating, and Cooking.	Power.	Total.
Public Works Department	1·3	403·4	175·6	580·3
Construction No. 3 Dam	17·1	46·4	404·5	468·0
Wellington City Council	353·0	40,580·0	25,430·0	66,363·0
Wellington Meat Export Co.	..	63·8	959·0	1,022·8
Railway Department	..	91·0	982·5	1,073·5
Hutt Valley Electric-power Board	94·0	16,436·0	3,572·0	20,102·0
Horowhenua Electric-power Board	29·0	5,041·8	2,480·1	7,550·9
Manawatu-Oroua Electric-power Board	135·0	16,443·3	3,976·7	20,555·0
Dannevirke Electric-power Board	17·8	3,437·6	766·5	4,221·9
Tararua Electric-power Board	11·6	2,569·0	729·8	3,310·4
Wairarapa Electric-power Board	27·0	7,092·0	2,018·0	9,137·0
Wanganui-Rangitikei Electric-power Board	90·0	11,926·0	4,016·0	16,032·0
Central Hawke's Bay Electric-power Board	20·0	2,487·5	476·0	2,983·5
Hawke's Bay Electric-power Board	..	4,500·0	12,168·0	16,668·0
Totals	795·8	111,117·8	58,154·7	170,068·3

TABLE J.—MANGAHAO HYDRO-ELECTRIC POWER SYSTEM.—GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR THE YEAR ENDING 31ST MARCH, 1928.

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.	Maintenance.	Interest.	Depreciation.	Sinking Fund Reserve Fund, &c.	Other Expenditure.	Total.	Profit.	Loss.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department ..	68	2,374,061	11,446*	..	..	1,628	155,857	111,745	21,415	106,441	35,301	..	12,591	287,493	..	131,636
Horowhenua Electric-power Board	2,782	181,375	38,465	..	387	2,501	41,353	16,117	4,714	10,500	2,784	1,665	5,037	40,817	536	..
Dannevirke Electric-power Board	1,823	176,396	19,430	..	181	1,037	20,648	3,882	2,641	8,060	3,095	1,551	2,531	21,760	..	1,112
Central Hawke's Bay Electric-power Board	1,300	107,303	15,027*	..	..	667	16,049	3,419	1,324	6,557	..	741	2,222	14,263	1,786	..
Hawke's Bay Electric-power Board	1,603	176,241	18,483	..	..	1,335	19,818	9,671	163	10,365	..	2,000	1,042	23,241	..	3,423
Hutt Valley Electric-power Board	7,046	305,667	58,568	..	502	1,122	60,192	16,077	7,514	15,382	7,935	3,073	6,563	56,544	3,648	..
Manawatu-Oroua Electric-power Board	3,891	421,728	50,010*	..	658	1,622	52,811	15,629	3,281	24,324	4,819	4,417	4,962	57,432	..	4,621
Tararua Electric-power Board	1,307	136,763	16,860	..	295	692	17,847	3,881	1,038	7,416	..	1,391	4,554	18,280	..	433
Wairarapa Electric-power Board	3,130	339,003	38,714	..	1,966	1,384	42,064	4,474	3,727	20,814	2,214	3,521	11,333	46,083	..	4,019
Wellington City Council ..	23,000	988,493	254,747*	..	..	2,225	339,979	5,229	9,242	29,711	..	114,983	129,854	289,019	50,960	..
Wanganui-Rangitikei Electric-power Board	7,293	463,178	84,851*	..	275	4,030	98,773	15,484	7,461	30,154	..	19,889	24,117	97,105	1,668	..
Totals	53,243	5,670,208	606,601	..	4,264	18,243	865,391	205,608	62,520	269,724	56,148	153,231	204,806	952,037	58,598	145,244

* After deducting sales to other distributing bodies, totalling—Public Works Department, £142,783; Wellington City Council, £83,007; Wanganui-Rangitikei Electric-power Board, £9,617; Central Hawke's Bay Electric-power Board, £355; Manawatu-Oroua Electric-power Board, £521.

Net loss, £86,646.

TABLE K.—WAIKATO ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATIONS.

	Sixth Year, March, 1926.	Seventh Year, March, 1927.	Eighth Year, March, 1928.
Capital outlay—	£	£	£
Horahora—Total expenditure	561,065	576,841	609,228
Less assets not in operation	33,734	..	..
Horahora—Assets in operation	527,331	576,841	609,228
Arapuni—Assets in operation	174,026	268,107	363,945
Total assets in operation	701,357	844,948	973,173
Costs—			
Working-costs	19,612	28,713	46,568
Capital costs—Interest	31,269	37,989	44,190
Capital costs—Depreciation	13,601	16,481	18,646
Sinking Fund	11,342	8,448	9,732
Total costs	75,824	91,631	119,136
Revenue	85,830	108,748	125,312
Profit	10,006	17,116	6,176
Accumulated surplus	30,554	47,670	53,845
Accumulated Depreciation Fund	46,444	63,782	84,272
Accumulated Sinking Fund	28,939	38,515	49,847
Maximum load (kilowatts)—			
System for year (includes Grand Junction and McLaren's Falls)	11,860	14,760	15,700
Power-house for year	11,400	12,400	12,400
Power-house, average weekly	9,665	11,090	11,370
Units output—			
Power-house total generated	65,435,630	79,253,160	88,703,370
Units purchased	1,590,511	7,398,942	11,372,298
Units, generated and purchased	67,026,141	86,652,102	100,075,668
Horahora exciter sets	1,210,230	1,850,000	1,720,690
Horahora local service	..	..	424,600
Units available for outgoing lines	65,815,911	84,802,102	97,930,378
Units sold	60,261,326	75,844,229	87,852,067
Units unaccounted for	5,554,585	8,957,873	10,078,311
Percentage of units available	8·44	10·55	10·29
Total units fed to 11 kv. lines at Horahora	7,626,020	8,458,230	10,463,059
Total units fed to 50 kv. lines at Horahora	56,321,700	68,204,125	76,318,205
Input to 50 kv. substations from Horahora	51,919,046	60,467,232	69,036,223
Transmission losses 50 kv. (units)	4,402,654	7,736,893	6,281,982
Percentage of units to 50 kv. lines	7·82	11·35	9·1
Distribution losses, 11 kv. (units)	874,251	350,588	215,995
Discrepancy in metering	277,680	..	..
Load-factor, annual (per cent.)—			
System	64·5	67·7	72·8
Power-house	65·5	72·9	81·7
Load-factor, average weekly—			
Power-house	77·5	81·6	88·2
Working-costs (less power purchased)	£17,050	£19,926	£35,300
Per kilowatt (power-house annual maximum)	£1·49	£1·645	£2·845
Per kilowatt (power-house average weekly maximum)	£1·76	£1·84	£3·11
Per unit generated at Horahora	0·063d.	0·062d.	0·0955d.
Per unit sold (less units purchased)	0·070d.	0·0645d.	0·111d.
Capital costs	£56,212	£62,919	£72,568
Per kilowatt (power-house annual maximum)	£4·93	£5·07	£5·85
Per kilowatt (power-house average weekly maximum)	£5·81	£5·69	£6·38
Per unit generated at Horahora	0·206d.	0·1905d.	0·1964d.
Per unit sold (less units purchased)	0·230d.	0·199d.	0·228d.
Total costs (less power purchased)	..	£82,845	£107,868
Per kilowatt (power-house annual maximum)	£6·42	£6·715	£8·69
Per kilowatt (power-house average weekly maximum)	£7·58	£7·51	£9·48
Per unit generated at Horahora	0·269d.	0·252d.	0·291d.
Per unit sold (less units purchased)	0·299d.	0·264d.	0·338d.
Total costs on system	£75,824	£92,095	£119,136
Per kilowatt (system annual maximum)	£6·39	£6·25	£7·59
Per unit generated and purchased	0·271d.	0·255d.	0·286d.
Per unit sold	0·302d.	0·292d.	0·326d.
Revenue	£85,830	£108,484	£125,312
Per kilowatt (system annual maximum)	£7·24	£7·72	£7·98
Per kilowatt (power-house annual maximum)	£7·52	£8·75	£10·1
Per kilowatt (power-house average weekly maximum)	£8·88	£9·79	£11·1
Per unit generated and purchased	0·307d.	0·301d.	0·305d.
Per unit sold	0·342d.	0·343d.	0·342d.

TABLE L.—WAIKATO ELECTRIC-POWER SUPPLY (HORAHORA SCHEME).—ANALYSIS OF CAPITAL OUTLAY.

—	At 31st March, 1926.	At 31st March, 1927.	At 31st March, 1928.	Expenditure during Year.
	£	£	£	£
Land roading and fencing at Horahora	3,208	3,208	3,208	..
Headworks	174,519	175,741	177,934	2,193
Generating-station transformers and machinery	115,906	115,969	116,016	47
Staff village, Horahora	11,461	11,492	11,492	..
Transmission-lines	125,900	126,032	126,736	704
Distribution-lines	705	705	705	..
Main substations	43,923	50,952	70,734	19,782
Distribution substations	7,353	7,408	8,729	1,321
Vehicles and loose construction equipment	7,652	7,666	7,781	115
Land, stores, and railway-siding, Claudelands	11,625	11,677	12,125	448
Staff residences	4,270	4,270	4,380	110
Office furniture, Hamilton	967	1,120	1,151	31
Supervision, preliminary expenses on surveys and on construction	21,562	28,587	36,223	7,636
Interest during construction	32,014	32,014	32,014	..
	561,065	576,841	609,228	32,387
Works constructed out of Arapuni moneys brought into operation in conjunction with the Horahora scheme—				
Grand Junction plant	..	..	10,299	10,299
Supervision and preliminary expenses on surveys and on construction	..	..	9,609	9,609
Interest during construction	..	..	17,555	17,555
Electric lines at Arapuni	675	675	675	..
Transmission-lines	137,035	217,582	251,308	33,726
Main substations	36,316	49,850	74,499	24,649
Totals	174,026	268,107	363,945	95,838
Grand totals	735,091	844,948	973,173	128,225

TABLE M.—OPERATING OR WORKING COSTS.

—	1925–26.		1926–27.		1927–28.	
	Cost.	Per Unit sold.	Cost.	Per Unit sold.	Cost.	Per Unit sold.
	£	d.	£	d.	£	d.
Generating	5,511	0·022	5,313	0·0168	16,446	0·0449
Transmission	3,403	0·0139	5,226	0·0165	7,757	0·0212
Main substations	3,621	0·0144	4,434	0·014	5,466	0·0149
H.T. distribution	21	0·000084	..	..	..	..
Management and general	4,494	0·0179	4,954	0·017	5,631	0·0154
Purchase of power	2,562	0·0102	8,787	0·0278	11,268	0·0308
Totals	19,612	0·078	28,714	0·0922	46,568	0·1272

Units sold: 1925-26, 60,261,326; 1926–27, 75,844,229; 1927–28, 87,852,067.

TABLE N.—WAIKATO ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1928.

(Does not include Auckland Power Board.)

Waihi Gold-mining Co.	4,545
Waihi Grand Junction Gold Co.	2,528
Cambridge Co-operative Dairy Co.	411
New Zealand Co-operative Dairy Co., Frankton	828
State Farm, Ruakura	16
New Zealand Railways, Frankton	1,906
Hamilton Borough Council	6,153
Armstrong-Whitworth Co., Arapuni	193
Tourist Department, Rotorua	3,390
Cambridge Electric-power Board	2,211
Central Electric-power Board	6,354
Te Awamutu Electric-power Board	3,520
Thames Valley Electric-power Board	16,493
Waitomo Electric-power Board	1,428
Franklin Electric-power Board	4,085
Waitemata Electric-power Board	10,075
Public Works Department, Horahora	151
Public Works Department, Arapuni	110
Public Works Department, Hamilton	56
Public Works Department, Penrose	127
Total connected load	64,580

TABLE O.—WAIKATO ELECTRIC-POWER SUPPLY.—ROUTE MILEAGE OF DEPARTMENT'S LINES IN OPERATION AT 31ST MARCH, 1928.

—	Size of Wire (S.W.G.).	Miles.
110,000-volt Lines (Single Circuit)—		
Horahora—Tap on Arapuni–Penrose line, Penrose (Arapuni scheme—in operation at 50,000 volts)	19/13	94
50,000-volt (Double Circuit)—		
Penrose–Takapuna	7/14	28·6
50,000-volt (Single Circuit)—		
Horahora—Tap on Arapuni–Penrose line (temporary)	7/14	2·0
Horahora–Waikino	7/12 of No. 0	44·42
Waiorongomai–Waihou	7/12	5·22
Waikino–Aongatete (Department's part of McLaren's Falls line) ..	7/14	17·27
Horahora–Claudelands	7/12	27·5
Mystery Creek – Te Awamutu	7/14	9·5
Te Awamutu – Hangatiki	7/14	19·5
Horahora–Arapuni	7/12	6·8
Arapuni–Ngongotaha	7/14	32·25
Bombay–Waikino	7/14	50·7
Total		337·76

—	Number of Circuits.	Size of Wire (S.W.G.).	Miles.
11,000-volt Lines—			
Waikino–Waihi	1	37/13	5·77
Waihi Grand Junction	1	7/12	0·75
Horahora–Leamington	2	7/14	12·54
Leamington–Hamilton	2	7/16	15·86
Hamilton–Frankton	4–3–2	7/16	3·8
Bombay–Pukekohe	2	7/14	5·0
Total			43·72
Total miles			381·48
Miles of wood-pole portion, Penrose–Takapuna line			9·10
Total route-miles in operation			390·58

TABLE P.—WAIKATO ELECTRIC-POWER SUPPLY.—ROUTE MILEAGE, POWER BOARD LINES, AT 31ST MARCH, 1928.

—	11,000 Volts.		3,000 Volts.		400 Volts.	Total Route-miles.
Number of circuits	2	1	2	1	1	
Cambridge Electric-power Board	..	..	..	99·5	69	168·5 (*a*)
Central Electric-power Board ..	7·25	125·75	..	93	155	381 (*b*)
Te Awamutu Electric-power Board ..	12	37	5	168	70	292 (*c*)
Thames Valley Electric-power Board ..	90	333	..	114·5	135	672·5 (*d*)
Waitomo Electric-power Board*	..	..	..	..	..	..
Franklin Electric-power Board	1	183	..	..	78	262 (*e*)
Waitemata Electric-power Board	5·45	104·73	..	..	157·4	267·58 (*f*)
Hamilton Borough Council	2	..	0·5	5	45	52·5 (*g*)

* No returns available.

(*a*) Also 44 miles of 400 volts on 3,000-volt lines.
(*b*) Also 2½ miles of 3,000 volts on 11,000-volt poles; 66 miles of 400 volts on 11,000-volt poles; and 48 miles of 400 volts on 3,000-volt poles.
(*c*) Also 21 miles of 3,000 volts on 11,000-volt lines, 18 miles of 400 volts on 11,000-volt lines, and 117 miles of 400 volts on 3,000-volt lines.
(*d*) Also 269 miles of 400 volts on 11,000-volt lines, and 99 miles of 400 volts on 3,000-volt lines.
(*e*) Also 118 miles of 400 volts on 11,000-volt lines.
(*f*) Also 77 miles of 400 volts on 11,000-volt lines.
(*g*) Also 4 miles of 400 volts on 3,000-volt lines.

TABLE Q.—WAIKATO ELECTRIC-POWER SUPPLY.—MILKING-MACHINES CONNECTED AT 31ST MARCH, 1928.

Electric-power Board.	½ Horse-power.		1 Horse-power.		1½ Horse-power.		2 Horse-power.		3 Horse-power.		5 Horse-power.		Total Number.	Total Horse-power.
	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.	No.	H.P.		
Cambridge Board	1	½	9	9	115	172·5	126	252	8	24	..	..	259	458·0
Central Board	..	..	51	51	91	136·5	598	1,196	9	27	..	..	749	1,410·5
Te Awamutu Board ..	6	3	23	23	132	198·0	271	542	..	..	..	..	432	769·25*
Thames Valley Board ..	..	..	19	19	5	7·5	1,614	3,228	60	180	2	10	1,700	3,444·5
Waitomo Board†	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Franklin Board	..	..	18	18	187	280·5	129	258	..	..	..	..	334	556·5
Waitemata Board ..	..	..	..	..	..	..	64	128	1	3	..	..	65	131·0
Tourist Department ..	..	..	..	..	2	3·1	10	20	8	24	..	..	20	47·0
Totals	7	·3½	120	120	532	798·0	2,812	5,624	86	258	2	10	3,559	6,816·75

* Includes thirteen ¼ h.p. motors. † No returns available.

ELECTRIC RANGES.

2 kw. and not over 5 kw., 155; 5 kw. and over, 1,132: Total number, 1,287.

ELECTRIC WATER-HEATERS.

Total number, 4,163; Total kilowatts, 2,660.

TABLE R.—WAIKATO ELECTRIC-POWER SUPPLY.—GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR THE YEAR ENDED 31ST MARCH, 1928.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue.					Expenditure.							Balance.	
			From Sales of Electrical Energy.	Rates.	Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Maintenance.	Interest.	Depreciation.	Sinking Funds Reserve Fund, &c.	Other Expenditure.	Total.	Profit.	Loss.
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Public Works Department ..	19	973,173	48,395*	..	..	2,641	51,036*	11,268	34,494	44,190	18,646	9,732	806	119,136	6,176	..
Cambridge Electric-power Board	1,128	104,018	16,360	..	474	1,026	17,860	4,489	5,190	6,045	400	1,134	15	17,273	587	..
Central Electric-power Board..	3,015	258,335	37,491	..	..	2,556	40,047	9,880	7,480	15,125	2,650	2,687	1,842	39,664	383	..
Te Awamutu Electric-power Board	1,353	159,002	23,063	2,138	61	574	25,836	4,640	4,266	8,874	153	1,452	1,201	20,586	5,250	..
Thames Valley Electric-power Board	4,915	706,741	102,749*	3	3,410	3,697	109,859*	33,390	19,974	40,477	4,540	8,791	9,734	116,906	..	2,262
Franklin Electric-power Board	2,319	179,238	25,133	..	1,938	2,860	29,931	5,913	4,532	7,151	7,800	4,000	..	29,396	535	..
Waitemata Electric-power Board	5,512	293,709	44,976	..	1,582	1,836	48,394	9,569	17,183	10,097	833	10,479	233	48,394	..	..
Tourist Department ..	1,451	63,023	13,388	..	..	116	13,504	2,447	3,774	3,152	1,261	2,870	..	13,504	..	..
Hamilton Borough	3,388	69,943	31,530	..	..	91	31,621	7,452	7,120	3,254	..	5,892	3,502	27,220	4,401	..
Te Aroha Borough	640	19,025	6,363	..	..	517	6,880	1,424	1,913	688	..	186	15	4,226	2,654	..
Thames Borough	1,074	31,307	10,776	..	..	133	10,909	3,361	2,661	1,059	1,356	459	..	8,896	2,013	..
Totals	24,814	2,857,514	360,224	2,141	7,465	16,047	385,877	93,833	108,587	140,112	37,639	47,682	17,348	445,201	21,999	2,262

* After deducting amount of sales to other distributing authorities—Public Works Department, £79,806; Thames Valley Electric-power Board, £4,785.

	£
Gross profit	19,737
Raised by rates	2,138
Net profit	£17,599

TABLE S.—RETURN SHOWING AVERAGE REVENUE PER CONSUMER AND PER CAPITA FOR YEAR ENDING 31ST MARCH, 1928.

Licensee.	Ratio of Consumers to Population.	Average Revenue per Consumer.	Average Revenue per Capita.	Capital Outlay per Capita.
	Per Cent.	£	£	£
Ashburton Power Board	17·0	11·56	1·97	17·56
Auckland Power Board	22·1	14·9	3·30	14·65
Banks Peninsula Power Board	22·5	12·23	2·75	24·1
Bluff Borough	22·4	8·47	1·9	6·04
Cambridge Power Board	18·8	15·83	2·97	17·3
Central Hawke's Bay	12·3	12·34	1·52	10·55
Central Power Board	16·7	13·2	2·22	14·32
Christchurch City	27·7	7·91	2·2	6·6
Dannevirke Power Board	14·4	11·35	1·63	13·98
Dunedin City	22·6	9·87	2·23	13·87
Eyre County	13·4	9·42	1·26	5·75
Franklin Power Board	14·1	12·9	1·82	11·32
Grey Power Board	11·8	12·41	1·46	8·8
Halswell County	6·8	13·1	0·91	3·57
Hamilton Borough	21·8	9·33	2·04	4·59
Hastings Borough	29·3	7·74	2·27	10·66
Havelock North Town Board	23·5	13·01	3·06	21·91
Hawera Company	35·4	11·1	3·93	15·55
Hawke's Bay Power Board	10·4	12·37	1·29	11·5
Heathcote County	22·4	6·92	1·55	4·79
Horowhenua Power Board	17·3	14·86	2·58	11·33
Hutt Valley Power Board	19·7	8·54	1·69	8·57
Inglewood Borough	31·1	8·45	2·63	9·72
Invercargill Borough	18·7	11·69	2·19	7·38
Kaikoura County Council	22·2	11·05	2·45	15·33
Kaiapoi Borough	25·2	6·77	1·71	5·85
Kamo Town Board	16·0	8·71	1·4	5·56
Kanieri Electric Limited	18·8	13·38	2·52	15·89
Kaponga Town Board	28·3	13·15	3·74	18·77
Kowai County	15·0	9·1	1·36	12·44
Lyttelton Borough	14·7	7·89	1·16	1·33
Mackenzie County (Fairlie)	9·7	7·78	0·75	5·74
Malvern Power Board	11·4	10·75	1·22	10·77
Manawatu-Oroua Power Board*	10·0	13·57	1·35	10·81
Mangaweka Town Board	26·0	11·86	3·09	13·86
Marlborough Power Board	6·4	7·4	0·48	13·55
Mataura Borough	23·0	4·57	1·05	3·45
Motueka Borough Council	17·7	6·86	1·21	8·58
Murchison County	26·6	15·55	4·14	33·77
Napier Borough	19·3	9·47	1·83	7·65
Nelson City Council	18·4	10·1	1·85	7·32
New Plymouth Borough	24·9	12·05	3·0	18·38
Ohakune Borough	19·1	7·8	1·49	6·92
Opotiki (Lett Bros.)	28·2	9·7	2·75	7·76
Opunake Power Board	15·2	9·88	1·5	15·0
Otago Central Power Board	33·8	9·95	3·37	31·4
Otago Power Board	22·0	7·55	1·65	19·6
Palmerston North Power Board	21·9	10·47	2·29	10·23
Patea Borough Council	17·2	9·19	1·58	6·93
Picton Borough	26·3	8·5	2·24	13·49
Poverty Bay Power Board	10·0	8·62	0·86	5·6
Queenstown Borough Council	25·1	6·45	1·62	15·7
Raetihi Borough	8·7	10·71	0·93	7·86
Rangiora Borough	23·3	6·47	1·51	4·75
Rangiora County	14·2	13·85	1·97	7·93
Riccarton Borough	23·4	7·09	1·66	3·44
Rotorua (Tourist Department)	26·3	9·3	2·45	11·46
South Canterbury Power Board	5·7	14·35	0·81	6·59
Southland Power Board†	11·9	12·8	1·53	24·58
Springs-Ellesmere Power Board	15·0	9·63	1·45	9·0
Stratford Borough	27·2	11·42	3·1	16·21
Sumner Borough	26·1	5·86	1·53	3·78
Taihape Borough	23·0	8·96	2 06	7·38
Tai Tapu Dairy Co.	4·2	18·06	0·76	1·81
Taranaki Power Board	12·2	16·14	1·97	37·0
Tararua Power Board	12·7	13·69	1·75	13·78
Taumarunui Borough	17·8	11·82	2·11	15·19
Tauranga Borough‡	33·7	26·1	8·84	64·08
Tauranga Power Board	9·5	25·9	2·46	13·6
Te Aroha Borough	27·5	10·75	2·96	8·18
Te Awamutu Power Board	7·65	17·52	1·39	9·0
Te Puke Town Board	25·6	10·57	2·7	10·56
Teviot Power Board	21·6	13·3	2·9	30·7
Thames Borough	21·4	10·15	2·18	6·27
Thames Valley Power Board§	3·48	23·33	0·82	5·05
Timaru Borough	15·8	8·8	1·39	6·31
Waimairi County	22·7	6·0	1·36	5·66
Waimea Electrical Supply Co.	15·3	7·38	1·13	5·05
Wairarapa Power Board	16·0	13·4	2·15	16·4
Wairere Power Board	11·7	12·5	1·96	11·4
Wairoa Borough	25·8	11·41	2·95	8·0
Wairoa Power Board	4·86	46·24	2·24	15·0
Waitaki Power Board	14·8	9·87	1·46	8·24
Waitara Borough	24·0	7·42	1·78	5·86
Waitemata Power Board	15·1	8·77	1·32	8·04
Waitomo Power Board	13·9	10·09	1·41	11·71
Wanganui-Rangitikei Power Board	14·0	13·56	1·89	9·55
Wellington City	23·0	14·78	3·39	9·96
Westport Borough	10·5	9·96	1·04	7·07
Whakatane Borough	31·5	12·12	3·82	41·28
Whangarei Borough	26·0	10·32	2·68	7·96
Average for reticulated areas in New Zealand	20·4	11·5	2·36	14·8

* Palmerston North Borough counted as one consumer. † Invercargill and Bluff Boroughs counted as two consumers. ‡ Tauranga Power Board, Te Puke Town Board, and Public Works Department counted as three consumers. § Thames and Te Aroha Boroughs counted as two consumers.

TABLE T.—ELECTRIC-POWER BOARDS OF NEW ZEALAND AS CONSTITUTED ON 31ST MARCH, 1928.

Name of Board.	Proclamation constituting Power Board Area gazetted.	Number of Members on Board.	Approximate Area (Square Miles).		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.
							£	£	£		£		
1. Ashburton	17/11/21	12	1,193	1,349	17,468	533	11,500,000	9,346,863	700,181	Capital	326,150	1,590	96
2. Auckland	1/4/22	12	300	..	175,000	..	50,491,865	50,491,865	..	Capital	1,603,000	7,096	476
3. Banks Peninsula	8/1/20	7	385	..	4,050	..	4,685,385	3,791,413	..	Capital	100,000	331	23
4. Bay of Plenty	20/8/25	8	460	2,615	8,500	3,100	2,219,657	1,769,657	450,000	Unimproved ..	170,000	436	137
5. Buller	11/5/22	5	1,987	..	9,197	..	696,374	696,374	..	Unimproved ..	Poll not yet taken.		
6. Cambridge	8/1/20	8	137	..	6,000	..	2,559,567	1,550,262	..	Capital	113,236	474	71
7. Central	8/7/20	8	817	..	18,039	..	8,091,272	4,554,703	..	Capital	307,000	1,059	78
8. Central Hawke's Bay ..	19/10/22	9	1,300	..	10,500	..	6,839,951	6,839,951	..	Unimproved ..	150,000	543	41
9. Dannevirke	11/8/21	10	578	118	12,188	426	4,275,674	4,275,674	487,019	Unimproved ..	175,000	646	95
10. Franklin	25/9/24	9	822	..	16,359	..	6,763,874	5,084,084	..	Capital	234,820	1,127	154
11. Golden Bay	18/6/25	5	51	..	1,400	..	455,593	240,717	..	Capital	25,000	118	48
12. Grey	26/10/22	9	640	810	10,200	2,085	1,545,502	515,700	107,000	Capital	138,000	1,368	298
13. Hawke's Bay	19/6/24	11	1,682	2	41,090	1,120	18,127,637	11,416,761	136,641	Capital	304,000	681	68
14. Hobson	29/3/23	8	778	..	7,180	..	1,424,942	1,424,942	..	Unimproved ..	Poll not yet taken.		
15. Horowhenua	1/12/21	9	630	..	16,000	..	3,403,255	3,403,255	..	Capital	260,000	973	26
16. Hutt Valley	6/7/22 11/12/24	11	530	..	35,640	..	3,119,920	3,119,920	..	Unimproved ..	390,000	2,333	343
17. 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
18. Manawatu-Oroua	1/12/21	12	1,301	..	39,011	..	13,846,231	13,846,231	..	Unimproved ..	500,000	1,144	96
19. Marlborough	11/9/24	8	3,218	..	20,780	..	9,442,042	6,728,793	..	Capital	300,000	1,334	300
20. North Canterbury	26/2/27	8	746	312	9,340	3,745	6,052,918	5,051,124	1,903,803	Capital	160,300	430	86
21. Opunake	9/8/21 11/3/22	7	197	5	7,000	300	1,728,168	916,111	..	Capital	92,000	61	9
22. Otago	18/10/23 23/12/26	7	781	1,500	12,801	11,281	3,578,923	2,085,383	2,611,066	Capital	240,000	1,217	179
23. Otago Central	26/10/22	9	232	2,452	3,085	2,085	538,838	160,008	863,819	Capital	60,000	380	17
24. Poverty Bay	12/6/24	11	1,751	..	36,276	..	16,502,852	9,599,999	..	Capital	280,000	1,203	244
25. Reefton	30/6/21	5	24	..	1,639	..	178,055	38,504	..	Capital	Poll not yet taken.		

TABLE T.—ELECTRIC-POWER BOARDS OF NEW ZEALAND AS CONSTITUTED ON 31ST MARCH, 1928—*continued.*

Name of Electric-power Board.	Proclamation constituting Power Board Area gazetted.	Number of Members on Board.	Approximate Area (Square Miles).		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.
							£	£	£		£		
26. South Canterbury	3/7/24	12	1,673	3,429	35,618	6,000	12,946,839	12,946,839	2,536,815	Unimproved ..	329,000	1,861	584
27. Southland	19/11/19	12	7,819	3,035	67,090	22	15,200,658	15,200,658	137,513	Unimproved ..	1,650,000	6,516	450
28. South Taranaki	24/4/25	8	162	700	12,000	4,500	6,271,271	3,699,667	..	Capital	Poll not yet taken.		
29. Springs-Ellesmere	1/7/20	5	412	..	11,370	..	6,480,598	6,480,598	..	Capital	140,000	959	56
30. Taranaki	18/5/22	8	354	1,333	13,985	8,015	6,141,672	2,865,396*	3,109,336*	Capital	430,000	1,026	250
31. Tararua	23/3/22	10	700	565	8,485	1,770	2,833,994	2,833,994	1,149,113	Unimproved ..	164,480	714	83
32. Tauranga	14/6/23	7	636	3	8,300	3,506	1,124,773	1,124,773	494,076	Unimproved ..	114,500	421	277
33. Te Awamutu	8/1/20	8	270	..	7,620	..	3,699,132	2,353,948	..	Capital	178,000	173	107
34. Teviot	22/7/22	7	320	..	1,500	..	195,431	255,661	..	Unimproved ..	50,500	191	27
35. Thames Valley	8/1/19	12	2,295	6	37,055	3,739	12,932,134	7,503,921	34,152	Capital	850,000	1,236	806
36. Wairarapa	25/3/20	9	516	1,480	19,500	500	9,183,537	5,161,438	4,209,065†	Capital	327,250	2,284	312
37. Wairere	18/1/23	7	335	72	2,400	300	380,000	623,459	236,541	Unimproved ..	38,500	82	8
38. Wairoa	29/7/20	10	1,354	..	7,678	..	4,378,796	2,609,059	..	Capital	100,000	504	31
39. Waitaki	9/8/23	9	520	1,813	17,029	551	6,735,789	4,406,970	239,322	Capital	135,000	1,286	124
40. Waitemata	15/10/23 25/11/24 29/11/24	12	625	2	33,953	2,536	10,786,927	5,605,857	249,295	Capital	280,000	5,052	1,603
41. Waitomo	6/3/24	7	160	1,100	5,000	3,000	1,066,361	1,066,361	2,500,000§	Unimproved ..	117,000	557	90
42. Wanganui-Rangitikei ..	1/12/21	12	1,648	972	52,000	3,000	22,099,617	6,568,540	1,408,210	Capital	375,000	1,315	214
43. Westland‡	28/10/20	9	750	..	3,272	..	196,268	196,268	..	Unimproved ..	Poll not yet taken.		
Totals	..	378	41,397	25,506	866,148	63,615	303,759,825	230,884,781	25,021,555	..	11,272,726	49,228	7,940

* 1924 figures. † Assessed. ‡ License delegated to Westland Power, Ltd. § 1926 figures.

Table U.—Electric-power Boards.—Return for Year ended 31st March, 1928.

Board.	Main Supply commenced.	Capital Outlay.	Revenue.					Expenditure.				Profit.	Loss.	General Rate.		Availability Rate.		Special Rates.	
			Sale of Electricity (Gross).		Sale of Materials (Profit).	General.	Total (not including Rates).	Capital Charges, &c.	Power.	General.	Total Annual Costs.			Levied.	Collected.	Levied.	Collected.	Levied.	Collected.
			Bulk.	Retail.															
		£	£	£	£	£	£	£	£	£	£	£	£	d.	£	d.	£	d.	£
1. Ashburton ..	1923	316,160	..	34,928	..	555	35,483	18,619	14,394	4,478	37,491	..	2,008	..	..	..	..	..	..
2. Auckland	1908	2,568,817	..	570,149	..	8,430	578,579	184,661	232,113	38,036	454,810	123,769	..	..	..	..	..	..	..
3. Banks Peninsula ..	1921	97,626	..	10,478	343	336	11,157	7,165	5,390	2,733	15,288	..	4,131	$\frac{1}{12}$	..	..	..	$\frac{1}{7}$	4,288†
4. Bay of Plenty* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Cambridge ..	1922	104,018	..	16,360	474	1,026	17,860	7,029	7,123	2,571	16,723	1,137	..	..	..	..	..	..	..
6. Central	1921	258,335	..	37,491	..	2,556	40,047	17,812	14,248	4,954	37,014	3,033	..	..	..	..	..	..	..
7. Central Hawke's Bay	1925	110,860	469	14,623	..	957	16,049	7,298	5,026	1,940	14,264	1,785	..	..	..	..	..	..	..
8. Dannevirke ..	1925	176,396	..	19,430	181	1,037	20,648	9,230	6,523	2,531	18,284	2,364	..	..	..	..	..	..	..
9. Franklin	1925	185,288	..	25,133	1,938	2,860	29,931	8,651	7,925	2,520	19,096	10,835	..	..	..	..	..	..	..
10. Golden Bay* ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11. Grey	1926	108,115	..	17,741	13	292	18,046	7,052	8,475	2,895	18,422	..	376	..	..	..	..	$1\frac{1}{2}$, $\frac{1}{9}$, $\frac{3}{5}$, and $1\frac{1}{8}$	..
12. Hawke's Bay ..	1927	176,241	10,865	7,618	..	1,335	19,818	12,365	9,834	1,042	23,241	..	3,423	..	..	..	..	..	..
13. Horowhenua ..	1924	181,375	..	38,465	387	2,501	41,353	12,165	20,831	5,037	38,033	3,320	..	..	..	..	..	..	..
14. Hutt Valley ..	1925	305,667	..	58,568	502	1,122	60,192	18,455	23,591	6,563	48,609	11,583	..	..	..	..	..	..	..
15. Malvern	1925	54,397	..	5,369	391	445	6,205	2,842	2,236	963	6,041	164	..	$\frac{1}{4}$ and $\frac{1}{6}$	..	..	..	..	..
16. Manawatu-Oroua ..	1924	421,728	6,560	43,971	658	1,622	52,811	28,741	19,501	4,371	52,613	198	..	..	..	..	..	..	..
17. Marlborough ..	1927	281,587	107	4,547	..	5,330	9,984	10,011	1,033	748	11,792	..	1,808	..	..	..	..	..	..
18. Opunake	1924	100,239	..	10,344	..	178	10,522	7,634	2,060	1,792	11,486	..	964	..	..	..	..	..	..
19. Otago	1926	251,703	399	20,400	..	478	21,277	14,365	11,284	1,699	27,348	..	6,071	..	..	..	..	..	..
20. Otago Central ..	1925	63,915	..	6,131	512	220	6,863	3,668	983	1,966	6,617	246	..	..	..	..	..	..	..
21. Poverty Bay ..	1912	202,034	..	29,951	607	747	31,305	5,967	14,793	4,062	24,822	6,483	..	..	..	..	..	..	..
22. South Canterbury ..	1925	274,530	8,983	24,436	100	347	33,866	13,222	15,171	2,027	30,420	3,446	..	..	..	..	..	..	..
23. Southland ..	1925	1,650,033	17,688	74,260	53	10,782	102,783	115,500	25,236	23,909	164,645	..	61,862	$\frac{3}{4}$	47,000‡	..	..	$1\frac{1}{4}$ and $\frac{7}{8}$	11,446§
24. Springs-Ellesmere ..	1922	102,332	..	16,177	188	173	16,538	7,415	4,726	2,670	14,811	1,727	..	..	..	..	..	..	..
25. Taranaki	1927	451,941	5,735	18,011	..	600	24,346	24,075	5,804	3,984	33,863	..	9,517	..	9**	2	2,757	..	..
26. Tararua	1925	141,363	..	16,860	293	747	17,900	8,703	6,385	3,112	18,200	..	300	..	..	..	..	..	..
27. Tauranga	1926	113,016	..	18,220	48	2,170	20,438	7,364	8,947	3,867	20,178	260	..	..	..	..	..	..	..
28. Te Awamutu ..	1921	159,002	..	23,063	61	574	23,698	10,326	7,272	2,835	20,433	3,265	..	$\frac{1}{7}$	2,105‖	..	..	..	..
29. Teviot	1924	48,520	761	3,754	50	12	4,577	3,535	710	574	4,819	..	242	$\frac{1}{2}$	409¶	..	..	..	..
30. Thames Valley ..	1920	711,741	5,130	102,404	3,410	3,697	114,641	49,268	44,065	19,033	112,366	2,275	..	..	..	..	3**	..	..
31. Wairarapa ..	1924	320,533	1,498	37,216	1,966	1,384	42,064	24,335	8,855	9,884	43,074	..	1,010	..	..	..	..	..	..
32. Wairere	1925	32,893	..	2,834	..	92	2,926	2,313	291	899	3,503	..	577	..	..	..	..	..	..
33. Wairoa	1923	80,662	7,487	3,962	468	106	12,023	5,250	6,942	981	13,173	..	1,150	$\frac{1}{40}$	657††	..	..	$\frac{7}{32}$	1,280
34. Waitaki	1926	144,942	..	24,720	887	105	25,712	8,141	8,241	2,360	18,742	6,970	..	..	..	..	..	..	..
35. Waitemata ..	1926	293,709	..	44,976	1,582	1,836	48,394	15,707	15,587	11,398	42,692	5,702	..	..	..	..	..	..	..
36. Waitomo	1926	93,731	..	10,788	..	495	11,283	5,737	5,468	3,542	14,747	..	3,464	..	..	..	..	$1\frac{1}{4}$, $\frac{1}{8}$, $\frac{3}{8}$, and $\frac{3}{8}$	..
37. Wanganui-Rangitikei	1924	495,221	9,339	85,228	275	4,030	98,872	35,767	37,940	9,122	82,829	16,043	..	..	..	..	..	..	..
Totals	..	11,072,920	75,021	1,478,606	15,387	59,177	1,628,191	720,388	609,003	191,098	1,520,489	204,605	96,903	..	50,180	..	2,760	..	17,014

* Not operating at 31st March, 1928. † Includes £170 arrears. ‡ Includes £4,389 arrears. § Composed of arrears and surcharge for years 1925–26–27. ‖ Includes £671 arrears. ¶ Includes £49 arrears. ** Arrears collected.
†† Includes £317 arrears.

The North Canterbury Power Board commenced functioning in July, 1928. The South Taranaki, Hobson, Buller, and Reefton Power Boards are not yet functioning actively. The Westland Power Board delegated its powers to "Westland Power, Limited," which commenced operations in April, 1928.

Table V.—Summary of Returns of Operating Results for the Year ended 31st March, 1928.

Title	Capital Outlay at 31st March, 1928.	Total Revenue (not including Rates).	Working-expenses.		Capital Charges, &c.		Total Annual Costs.	Net Results.		Average Revenue from Sale of Energy.		Working-costs.		Capital Charges, &c.		Total Costs.		Retail Selling-rates.		
			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.
Steam Stations.	£	£	£		£		£	£	£	d.	£	d.	£	d.	£	d.	£	d.	d.	d.
1. Auckland Power Board ..	2,568,817	578,579	270,149	46·7	184,661	7·18	454,810	123,769	..	1·70	22·0	0·802	10·4	0·55	7·1	1·35	17·5	5 to 2 All less 5 per cent.	4½	2⅔ to ⅝
2. Grey Power Board	108,115	18,046	11,370	63·2	7,052	6·52	18,422	..	376	1·74	20·9	1·1	13·22	0·69	8·2	1·79	21·42	6	2 to 3	2 to 1½
3. Nelson City Council.. ..	80,521	20,503	11,037	53·85	4,900	6·1	15,937	4,566	..	4·75	40·0	2·56	21·5	1·1	9·5	3·66	31·0	9	4 to 2	4 to 2
Totals	2,757,453	617,128	292,556	47·5	196,613	7·1	489,169	128,335	376	1·76	22·5	0·83	10·7	0·565	7·2	1·395	17·9	..	..	..
Gas Stations.																				
1. Kaikoura County Council ..	9,659	1,547	1,649	106·0	746	7·72	2,395	..	848	12·6	51·5	13·4	54·96	6·06	24·86	19·46	79·82	12	12	6
2. Letts Bros. Company ..	10,095	3,584	3,237	96·48	180	1·78	3,417	167	..	8·2	46·0	7·4	41·5	0·41	2·31	7·81	43·81	10	5 to 2½	5
3. Motueka Borough Council ..	13,682	1,950	1,720	88·21	962	7·06	2,682	..	732	10·77	38·24	9·5	33·73	5·32	18·86	14·82	52·59	12	4	4
Totals	33,436	7,081	6,606	93·29	1,888	5·64	8,494	167	1,580	9·54	44·53	8·9	41·54	2·54	11·87	11·44	53·41	..	..	..
Oil Stations.																				
1. Picton Borough Council ..	17,538	2,918	2,294	78·6	1,173	6·68	3,467	..	549	8·03	49·0	6·3	38·5	3·2	19·7	9·5	58·2	10	4 to 2	4
2. Uawa County Council ..	6,218	1,092	524	51·57	638	10·3	1,162	..	70	18·7	81·6	9·0	39·1	10·96	47·61	19·96	86·71	17	11	11
3. Poverty Bay Power Board ..	202,034	31,305	18,855	62·95	5,967	2·95	24,822	6,483	..	4·7	31·3	2·83	18·85	0·9	5·96	3·73	24·81	7 to 8 All plus 25 per cent.	4	3 to 1½
Totals	225,790	35,315	21,673	61·5	7,778	3·44	29,451	6,483	619	5·0	32·8	3·05	20·0	1·1	7·2	4·16	27·2	..	..	..
Hydro Stations.																				
1. Coleridge (Public Works) ..	1,605,932	171,127	40,054	23·74	101,210	6·34	141,264	29,863	..	0·492	8·141	0·115	1·905	0·291	4·81	0·406	6·71	..	..	..
Ashburton Power Board ..	316,322	35,483	18,872	54·03	18,619	5·88	37,491	..	2,008	2·25	25·7	1·214	13·70	1·2	13·5	2·41	27·2	..	..	..
Banks Peninsula Power Board	97,626	11,157	8,123	77·52	7,165	7·33	15,288	..	4,131	3·7	40·7	2·7	29·65	2·38	26·15	5·08	55·8	10	2 to ⅜	3 to 1½
Christchurch City Council ..	604,225	201,171	114,560	59·3	37,310	6·14	151,870	49,301	..	1·38	19·7	0·788	11·22	0·256	3·65	1·044	14·87	6 to 1	1½ to 1	1½ to ¾
Eyre County Council ..	6,400	1,394	834	59·83	323	5·04	1,157	237	..	2·19	11·1	1·31	6·6	0·506	2·54	1·81	9·14	Flat Rate.		
Halswell County Council ..	6,627	1,673	1,233	74·18	313	4·97	1,546	127	..	1·625	14·95	1·2	10·99	0·304	2·78	1·504	13·77	Flat Rate.		
Heathcote County Council	23,985	7,769	5,566	74·37	1,082	4·51	6,648	1,121	..	1·57	20·8	1·13	14·87	0·22	2·89	1·35	17·76	5	1 to 1½	3 to 1
Kaiapoi Borough Council ..	10,553	3,081	2,038	69·34	894	8·47	2,932	149	..	3·76	30·6	2·48	20·09	1·09	8·81	3·57	28·90	6	1	1½
Kowai County Council ..	24,275	2,667	1,545	59·42	1,205	5·06	2,750	..	83	5·0	37·5	2·89	21·8	2·26	17·0	5·15	38·80	9 to 8	3	3 to 1
Lyttelton Borough Council	5,000	4,360	3,447	7·88	335	6·7	3,782	578	..	2·12	22·4	1·67	17·7	1·63	1·7	3·3	19·4	4½	1	3 to 1
Malvern Power Board ..	54,397	6,205	3,199	59·6	2,842	5·22	6,041	164	..	3·61	34·1	1·86	17·57	1·65	15·61	3·51	33·18	9 to 1	9 to ½	3 to 1
Rangiora Borough Council	9,976	3,174	2,437	77·38	396	3·97	2,833	341	..	3·05	26·5	2·36	20·3	0·38	3·31	2·74	23·61	5	1½ to ½	2 to ½
Rangiora County Council ..	25,050	6,235	4,114	75·13	1,739	6·91	5,853	382	..	1·94	21·4	1·28	14·09	0·54	5·96	1·82	20·05	8	2 to 1½	3 to ½
Riccarton Borough Council	16,820	8,142	6,033	74·1	621	3·69	6,654	1,488	..	1·6	24·6	1·19	18·0	0·12	1·88	1·22	19·88	6 to 1	1	1½
South Canterbury Power Bd.	274,530	33,866	17,198	51·46	13,222	4·81	30,420	3,446	..	1·41	22·06	0·73	11·35	0·56	8·72	1·29	20·07	8 to 3	3 to 2	3 to 1
Springs-Ellesmere Power Bd.	102,332	16,538	7,396	45·7	7,415	7·24	14,811	1,727	..	4·02	42·0	1·84	19·0	1·85	19·25	3·69	38·25	8	3 to ½	3 to ½

TABLE V.—SUMMARY OF RETURNS OF OPERATING RESULTS FOR THE YEAR ENDED 31ST MARCH, 1928—*continued.*

Title.	Capital Outlay at 31st March, 1928.	Total Revenue (not including Rates).	Working-expenses.		Capital Charges, &c.		Total Annual Costs.	Net Results.		Average Revenue from Sale of Energy.		Working-costs.		Capital Charges.		Total Costs.		Retail Selling-rates.		
			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.
Hydro Stations—continued.	£	£	£		£		£	£	£	d.	£	d.	£	d.	£	d.	£	d.	d.	d.
Sumner Borough Council ..	13,238	5,359	2,027	37·88	540	15·06	2,567	2,792	..	2·38	32·8	0·904	12·44	0·24	3·31	1·144	15·75	5	1½	1½
Timaru Borough Council ..	107,330	28,845	16,815	61·53	8,980	8·75	25,795	3,050	..	2·2	25·2	1·28	14·75	0·68	7·87	1·96	22·62	7	3 to 1½	3 to 2
Tai Tapu Dairy Company ..	10,271	4,336	3,482	96·94	764	7·43	4,246	90	..	1·97	23·9	1·59	19·23	0·35	4·22	1·94	23·45	Flat rate.		
Waimairi County Council ..	68,412	16,514	10,071	60·99	3,490	5 1	13,561	2,953	..	1·62	25·13	0·98	15·33	0·34	5·31	1·32	20·64	5	2 to ½	2 to 1
Waitaki Power Board ..	144,942	25,712	10,601	42·88	8,141	5·62	18,742	6,970	..	3·12	38·5	1·29	15·92	0·99	12·22	2·28	28·14	9 to 3	3 to ⅓	3 to ⅓
2. Dunedin (Waipori) City Council	1,110,298	178,617	60,707	34·34	59,291	4·98	119,998	58,619	..	1·14	14·99	0·39	5·14	0·38	5·029	0·77	10·17	6 to 1	2½ to 1	2 to ½
Otago Power Board ..	251,703	21,277	12,983	63·4	14,365	5·7	27,348	..	6,071	1·48	16·48	0·93	10·25	1·03	11·35	1·96	21·6	7	1½	1
3. Havelock North Town Board	24,097	3,370	1,090	32·0	1,735	7·2	2,825	545	..	3·06	25·0	0·99	8·0	1·57	12·85	2·56	20·85	7	2	2
4. Havelock South Town Board	5,269	354	297	84·04	132	2·50	429	..	75	..	..	..	..	..	..	..	..	9	Flat rate.	
5. Hawera Electric Company ..	104,188	26,349	10,442	44·04	1,294	1·24	11,736	14,613	..	5·1	43·18	2·2	19·02	0·27	2·35	2·47	21·37	8	3	4
																		All less 10 per cent.		
6. Kanieri Electric Company ..	39,733	6,320	5,323	86·84	1,384	3·48	6,707	..	387	0·56	9·75	0·48	8·45	0·126	2·19	0·606	10·64	6	1½	1½
																			Less 25 per cent.	to 50
7. Kaponga Town Board ..	22,531	4,493	3,822	85·07	1,184	5·38	5,006	..	513	3·63	29·95	3·08	25·48	0·95	7·89	4·03	33·37	9 to 1	4 to 1	5 to 2
8. Mangahao (Public Works) ..	2,373,921	155,857	145,659	94·5	106,441	4·89	252,100	..	96,243	0·38	7·69	0·359	7·27	0·26	5·3	0·62	12·58	..	..	..
Central Hawke's Bay Power Board	110,860	16,049	6,965	46·15	7,298	6·58	14,263	1,786	..	2·48	34·3	1·14	15·82	1·19	16·58	2·33	32·4	10	3 to 1½	3 to 1½
Dannevirke Power Board	176,396	20,648	9,054	46·59	9,230	5·23	18,284	2,364	..	3·21	46·25	1·49	21·55	1·52	21·97	3·01	43·52	8	3 to 1½	3 to 1
Hawke's Bay Power Board	176,241	19,818	10,876	58·88	12,365	7·0	23,241	..	3,423	1·1	8·9	0·66	5·25	0·75	5·96	1·41	11·21	8 to 1½	8 to 1½	3 to 1½
Hastings Borough Council	108,228	23,068	14,493	63·07	4,232	3·91	18,725	4,343	..	3·08	28·57	1·9	18·02	0·56	5·26	2·46	23·28	9 to 1½	4 to 1½	3 to 1½
Napier Borough Council	140,933	33,800	24,391	74·26	7,697	5·46	32,088	1,712	..	2·34	30·61	1·74	22·7	0·55	7·17	2·29	29·87	6 to 4	3 to 2	3 to 1½
Horowhenua Power Board	181,374	41,353	25,868	67·25	12,165	6·7	38,033	3,320	..	1·56	19·54	1·05	13·14	0·49	6·18	1·54	19·32	8	4 to 1½	4 to 1
Hutt Valley Power Board	305,667	60,192	30,154	51·49	18,455	6·03	48,609	11,583	..	1·83	27·62	0·94	14·22	0·58	8·71	1·52	22·93	6 to 5	3 to 1	3 to 1
Manawatu-Oroua Power Bd.	421,728	52,811	23,872	47·3	28,741	6·81	52,613	198	..	1·22	24·12	0·57	11·4	0·69	13·75	1·26	25·15	8	3½ to 1½	4½ to ⅓
Palmerston N. Borough Cl.	196,532	44,063	20,850	49·17	12,724	6·47	33,574	10,489	..	2·04	25·15	1·0	12·3	0·6	7·5	1·6	19·8	6	1½	3 to 1¾
Tararua Power Board ..	141,363	17,900	9,497	56·33	8,703	6·15	18,200	..	300	2·07	38·15	1·15	21·46	1·06	19·66	2·21	41·12	8	4 to 2	4½ to 1
Wairarapa Power Board ..	320,533	42,064	18,739	48·4	24,335	7·59	43,074	..	1,010	2·38	40·3	1·15	19·5	1·5	25·3	2·65	44·8	7	3½	6 to 2
Wanganui-Rangitikei Power Board	495,221	98,773	47,062	50·0	35,767	7·22	82,829	15,944	..	2·15	30·75	1·02	15·25	0·78	11·7	1·80	26·95	7	3½	Various.
Mangaweka Town Board	4,784	1,068	1,182	150·38	323	6·75	1,505	..	437	2·39	23·1	3·6	34·76	0·98	9·5	4·58	44·26	12	3½	4½
Wellington City Council ..	996,493	339,979	144,325	42·73	37,140	..	181,465	158,514	..	2·09	26·16	0·89	11·17	0·23	2·87	1·12	14·04	6 to 3	2 to 1	3 to 1½
9. Mackenzie County Council ..	11,163	1,471	222	15·87	612	5·48	834	637	..	5·58	46·23	0·88	7·34	2·44	20·22	3·32	27·56	9 to 4½	4½ to 2	4½
10. Marlborough Power Board ..	281,587	9,984	1,781	37·4	10,011	3·55	11,792	..	1,808	3·8	11·66	1·4	4·45	8·2	25·05	9·6	29·5	9 to 1½	9 to 1½	3 to 2
11. Mataura Borough Council ..	4,486	1,373	1,392	100·5	234	5·21	1,626	..	253	4·3	18·1	4·71	19·8	0·75	3·34	5·46	23·14	6	2½	2½
12. Murchison County Council ..	15,200	1,866	715	40·4	974	6·4	1,689	177	..	2·74	18·61	1·18	7·5	1·51	10·25	2·69	17·75	4	3	3
13. New Plymouth Borough Cl...	386,171	63,029	19,832	33·46	23,350	6·04	43,182	19,847	..	1·52	24·69	0·5	8·26	0·57	9·72	1·07	17·98	7 to 6	2 to 1	2 to 1
Inglewood Borough Council	12,644	3,424	3,065	92·7	750	5·93	3,815	..	391	2·83	30·04	2·63	27·86	0·64	6·82	3·27	34·68	6	2	2
Waitara Borough Council..	10,488	3,187	1,834	64·23	900	8·58	2,734	453	..	4·2	33·6	2·69	21·58	1·32	10·56	4·01	32·14	9	3 to 1	3 to 1
14. Ohakune Borough Council ..	16,616	3,590	1,763	51·12	975	5·86	2,738	852	..	5·22	34·14	2·67	17·45	1·48	9·65	4·15	27·1	9	3 to 1½	4 to 2
15. Opunake Power Board ..	105,185	10,522	3,852	37·2	7,634	7·25	11,486	..	964	2·34	28·7	0·88	10·7	1·75	21·2	2·63	31·9	4, 3, 2	2	3, 2, 1
16. Patea Borough Council ..	12,488	2,851	1,570	56·6	542	4·34	2,112	739	..	2·8	30·02	1·6	16·9	0·55	5·8	2·15	22·7	8½ to 6½	4 to 3	3 1/16 to 1
17. Queenstown Borough Council	12,675	1,304	419	34·01	826	6·51	1,245	59	..	3·12	22·4	1·06	7·62	2·09	15·02	3·15	22·64	7 to 2	..	4 to 2
18. Raetihi Borough Council ..	35,397	4,199	2,047	50·08	1,912	5·41	3,959	240	..	2·22	20·17	1·51	13·65	1·41	12·75	2·92	26·4	10 to 8	2 to 1	3
19. Reefton Electric Company ..	9,199	3,716	2,448	72·94	..	..	2,448	1,268	..	6·71	49·35	4·9	36·0	..	..	..	..	Flat rate.		
20. Southland Power Board ..	1,650,033	102,783	49,145	53·44	115,500	6·99	164,645	..	61,862	1·47	18·76	0·78	10·02	1·85	23·57	2·63	33·59	7 to 1½	7 to 1½	7 to 1½
Bluff Borough Council ..	10,217	3,219	2,134	76·9	659	6·45	2,793	426	..	2·54	14·3	1·95	11·0	0·602	3·37	2·55	14·37	6 to 4	2	3 to 1⅝
Invercargill Borough Council	155,058	46,143	25,883	58·56	13,363	8·61	39,246	6,897	..	2·2	29·7	1·29	17·4	0·66	8·98	1·95	26·38	6 to 2	2·7 to 1	2·7 to 1

TABLE V.—SUMMARY OF RETURNS OF OPERATING RESULTS FOR THE YEAR ENDED 31ST MARCH, 1928—*continued*.

Title.	Capital Outlay at 31st March, 1928.	Total Revenue (not including Rates).	Working-expenses.		Capital Charges, &c.		Total Annual Costs.	Net Results.		Average Revenue from Sale of Energy.		Working-costs.		Capital Charges, &c.		Total Costs.		Retail Selling-rates.		
			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.
Hydro Stations—continued.	£	£	£		£		£	£	£	d.	£	d.	£	d.	£	d.	£	d.	d.	d.
21. Taranaki Power Board ..	457,941	24,346	9,788	41·21	24,075	5·25	33,863	..	9,517	..	13·19	0·605	5·43	1·48	13·37	2·08	18·8	6	3	3 to 1
Stratford Borough Council	54,181	10,368	6,366	61·4	2,761	5·09	9,127	1,241	..	2·51	29·6	1·54	18·2	0·67	7·89	2·21	26·09	8	4 to 1½	4 to 1
22. Taihape Borough Council ..	18,103	5,057	3,371	67·84	996	5·48	4,367	690	..	3·8	23·22	2·58	15·75	0·76	4·65	3·34	20·4	8	1⅓	2
23. Taumarunui Borough Council	60,764	8,455	2,561	32·1	4,367	7·18	6,928	1,527	..	2·84	17·34	0·91	5·57	1·56	9·5	2·47	15·07	9 to 7	3 to 1½	3 to 9
24. Tauranga Borough Council ..	163,616	22,116	6,949	31·66	9,881	6·03	16,830	5,286	..	0·423	6·15	0·14	1·95	0·19	2·77	0·33	4·72	7	1⅓	2 to 1
Tauranga Power Board ..	113,016	20,438	12,814	70·3	7,364	6·5	20,178	260	..	1·51	31·4	1·06	19·7	0·61	11·3	1·67	31·00	5 to 1¼	5 to 1¼	3 to 1
Te Puke Town Board ..	10,355	2,654	1,266	48·4	563	5·43	1,829	825	..	2·43	31·1	1·1	15·07	0·52	6·69	1·62	21·76	8	2½ to 1⅓	..
25. Teviot Power Board ..	48,520	4,577	1,284	28·44	3,535	7·52	4,819	..	242	0·56	7·0	0·16	1·99	0·43	5·48	0·59	7·47	..	..	..
Otago Central Power Board	63,915	6,863	2,949	48·0	3,668	5·73	6,617	246	..	1·63	19·8	0·78	9·5	0·97	11·8	1·75	21·3	£10 per k. w. year	£2 10s. per k.w. year	..
26. Waikato (Horahora) ..	981,883	125,312	46,568	37·96	53,922	5·47	100,490	24,822	..	0·335	7·813	0·127	2·96	0·147	3·43	0·274	6·39	..	..	..
Cambridge Power Board ..	104,018	17,860	9,694	59·25	7,029	6·73	16,723	1,137	..	1·75	32·33	1·04	19·15	0·75	13·89	1·79	33·04	9 to 4½	3 to ¾	3 to ¾
Central Power Board ..	258,335	40,047	19,202	51·2	17,812	6·9	37,014	3,033	..	1·85	34·08	0·95	17·46	0·88	16·19	1·83	33·65	8½	1½	3
Franklin Power Board ..	185,288	29,931	10,445	41·56	8,651	4·66	19,096	10,835	..	2·4	34·55	1·02	14·36	0·84	11·89	1·86	26·25	8	1½	3 to 2
Hamilton Borough Council	71,228	31,621	18,074	57·32	4,899	6·78	22,973	8,648	..	3·08	35·38	1·76	20·28	0·47	5·5	2·23	25·78	6	2	2
Te Awamutu Power Board	159,002	23,698	10,107	43·8	10,326	6·49	20,433	3,265	..	1·7	31·0	0·75	13·58	0·77	13·8	1·52	27·38	8 to 7	2 to 1½	3 to 1½
Thames Valley Power Board	706,741	114,641	63,098	58·67	49,268	6·95	112,366	2,275	..	1·43	24·67	0·84	14·47	0·65	11·3	1·49	25·77	8	3 to 1½	3 to 0·7
Thames Borough Council ..	31,357	10,909	6,022	55·88	1,268	4·04	7,290	3,619	..	2·7	30·72	1·51	17·15	0·32	3·62	1·83	20·77	8	3 to 1½	3 to 0·5
Te Aroha Borough Council	19,026	6,880	3,352	52·68	874	4·59	4,226	2,654	..	2·88	35·35	1·52	18·6	0·396	4·85	1·91	23·45	7 to 5	3 to ½	3 to ½
Tourist Dept. (Rotorua) ..	63,049	13,504	6,221	46·47	4,413	6·99	10,634	2,870	..	3·11	34·33	1·44	15·95	1·02	11·32	2·46	27·27	7	3 to 1	3 to 1
Waitemata Power Board ..	292,684	48,394	26,985	59·9	15,707	5·35	42,692	5,702	..	2·4	38·37	1·4	23·02	0·84	13·4	2·24	36·42	7	3½ to 1½	3½ to 1½
Waitomo Power Board ..	93,731	11,283	9,010	83·51	5,737	6·12	14,747	..	3,464	2·58	39·08	2·16	32·64	1·35	20·8	3·51	53·44	10	3 to 1½	2 to 1½
27. Wairoa Power Board (Waikaremoana)	80,662	12,023	7,923	69·2	5,250	6·5	13,173	..	1,150	1·12	10·98	0·77	7·6	0·51	5·04	1·28	12·64	9 to 1	..	3 to 1½
Wairoa Borough Council ..	18,698	6,909	3,874	58·7	1,416	7·57	5,290	1,619	..	1·57	27·75	0·924	16·3	0·337	5·95	1·261	22·25	6	3 to 1	3 to 1½
28. Waimea Electric Company ..	20,223	4,534	2,882	67·29	455	5·58	3,337	1,197	..	9·02	42·83	6·07	28·82	0·96	4·55	7·03	33·37	11	4	4
29. Wairua (Wilson's Cement Co.)	..	14,420	5,683	40·6	..	..	5,683	8,737	..	0·294	6·1	0·119	2·5	..	..	..	..	4·9 to 2·7	2·7 to 1·5	2·7 to 1·5
Kamo Town Board ..	3,114	784	632	80·61	232	7·45	864	..	80	7·84	34·38	6·32	27·71	2·32	10·17	8·64	37·88	9	4	4 to 3
Whangarei Borough Council	55,755	18,797	11,854	66·4	1,658	5·04	13,512	5,285	..	2·85	36·0	1·89	23·95	0·265	3·35	2·15	27·3	5½ to 5	1½	3 to 2
30. Wairere Power Board ..	22,893	2,926	1,190	41·99	2,313	7·01	3,503	..	577	1·29	13·69	0·54	5·75	1·06	11·17	1·6	16·92	9	4½	1 plus flat rate.
31. Westport Borough Council ..	28,335	4,185	1,758	46·53	2,350	8·29	4,108	77	..	4·79	30·2	2·23	14·0	2·98	18·8	5·21	32·8	9	3 to 1	3
32. Whakatane Borough Council	53,667	4,971	1,876	39·27	3,368	6·27	5,244	..	273	2·02	16·47	0·79	6·46	1·42	11·61	2·21	18·07	9	9	3 to 1
Totals	18,205,043	2,714,195	1,339,196	49·34	1,054,007	5·78	2,393,203	516,254	195,262	1·75	30·52	0·868	15·1	0·68	11·85	1·548	26·95			

Table W.—Electric-supply Stations of New Zealand at 31st March, 1928.

(G = gas; O = oil; S = steam; W = water.)

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load (Kilowatts).	Demand Factor.	Units.				Annual Load-factor Percentage.	Average Units sold per Consumer.	Average Units sold per Capita.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated or purchased.	Sold.	Non-productive.	Percentage Non-Productive.							
Steam Stations.				Kv.a.	Kv.a.	Kw.													
1. Auckland	1908	175,000	38,708	29,000	3,750	26,000	130,000	20·0	88,932,070	80,791,776	8,140,294	8·15	39·04	2,087	462	A.C./D.C.	230/400/460	876	..
2. Grey	1926	12,285	1,454	1,250	..	860	2,575	33·4	3,202,338	2,447,453	754,885	23·57	42·51	1,680	199·2	A.C.	400/230	76	..
3. Nelson	1923	11,000	2,029	624	..	513	3,712	13·8	1,338,220	1,037,213	301,007	22·5	29·7	511	94·3	A.C.	400/230	46·5	..
Totals	..	198,285	42,191	30,874	3,750	27,373	136,287	20·8	93,472,628	84,276,442	9,196,186	9·8	39·0	1,990	425	..	..	998·5	..
Gas Stations.																			
1. Kaikoura	1922	630	140	47	..	30	105·75	28·36	42,780	29,520	13,260	30·99	16·27	210·8	46·85	A.C.	400/230	26·99	..
2. Motueka	1922	1,600	284	62	..	51	158	32·28	51,649	43,439	8,210	15·8	11·56	152·9	27·1	A.C.	400/230	11·7	..
3. Letts Bros.	1914	1,300	367	99	..	78	170·9	45·64	123,000	105,000	18,000	14·63	18	286·1	80·7	D.C.	460/230	12	..
Totals	..	3,530	791	208	..	159	434·65	36·6	217,429	177,959	39,470	18·27	15·6	224·9	50·4	..	..	50·69	..
Oil Stations.																			
1. Picton	1917	1,300	343	136	..	59·5	458	13	120,430	87,187	33,243	27·6	23·1	254·1	67	D.C.	460/230	10	279
2. Uawa (Tolaga Bay) ..	1925	400	94	30	..	13·4	61·5	21·79	19,596	13,971	5,625	28·71	16·69	148·6	34·9	D.C.	460/230	6	..
3. Poverty Bay	1912	36,276	3,631	980	350 (S)	1,000·0	..	..	2,028,271	1,595,357	432,914	21·34	23·15	439	43·97	A.C./D.C.	460/400/230	137	..
Totals	..	37,976	4,068	1,146	350	1,072·9	519·5	..	2,168,297	1,696,515	471,782	21·75	23·1	416	44·5	..	..	153	..
Hydro Stations.																			
1. Coleridge	1915	242,580	20 bulk 56 dom.	33,750	..	21,020	135,880	15·47	93,853,759	83,317,588	10,536,171	11·2	50·97	..	345	A.C.	..	524·8	480
Ashburton ..	1912	(18,001)	3,069	Bulk	200 (O)	(1,377)	(8,901·4)	15·47	(4,810,858)	(3,728,840)	(1,082,018)	22·5	39·9	1,010·5	207	A.C.	400/230	816	..
Banks Peninsula ..	1921	(4,050)	912	,,	90 (W)	(274)	(2,339·5)	11·71	(1,078,508)	(721,880)	(356,628)	33·07	44·9	791·5	178·2	A.C.	400/230	195	310
Christchurch ..	1904	(91,500)	25,415	,,	400 (S)	(10,210)	(72,159)	14·15	(39,757,621)	(34,894,754)	(4,862,867)	12·23	44·45	1,372·9	162·3	A.C.	400/230	267	..
Eyre	1920	(1,110)	148	,,	..	(126·6)	(196·7)	64·4	(191,978)	(153,582)	(38,396)	20*	17·23	1,297·1	172·9	A.C.	400/230	21·5	..
Halswell	1919	(1,850)	127	,,	..	(112·22)	(318)	35·3	(308,936)	(247,148)*	(61,788)*	20*	31·42	1,946*	133·5	A.C.	400/230	22	..
Heathcote	1914	(5,000)	1,122	,,	..	(374·2)	(2,614·33)	14·31	(1,274,242)	(1,185,746)	(88,496)	6·94	38·87	1,056·6	237·1	A.C.	400/230	30	..
Kaiapoi	1917	(1,800)	455	,,	..	(101·4)	(462·34)	21·94	(252,061)	(196,992)	(55,069)	21·85	28·37	432·9	109·4	A.C.	400/230	21	..
Kowai	1922	(1,950)	293	,,	..	(71)	(392·8)	18·1	(188,620)	(127,873)	(60,747)	32·2	30·32	436·4	65·5	A.C.	400/230	63·78	..
Lyttelton	1917	(3,749)	552	,,	..	(194)	(1,343·4)	14·4	(620,463)	(493,465)	(126,998)	20·5	36·5	893·9	131·6	A.C.	400/230	9·2	..

* Assessed.

TABLE W.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1928—*continued.*

(G = gas; O = oil; S = steam; W = water.)

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load (Kilowatts).	Demand Factor.	Units.				Annual Load-factor Percentage.	Average Units sold per Consumer.	Average Units sold per Capita.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated or purchased.	Sold.	Non-productive.	Percentage Non-Productive.							
Hydro Stations—continued.				Kv.a.	Kv.a.	Kw.													
Malvern	1925	(5,050)	577	Bulk.	..	(182)	(1,572)	11·6	(646,960)	(413,070)	(233,890)	36·2	40·5	843·0	81·7	A.C.	400/230	150	..
Rangiora Borough Cl.	1919	(2,100)	490	,,	..	(120)	(903)	13·3	(318,100)	(247,762)	(70,338)	22·11	30·26	505·6	117·9	A.C.	400/230	12	..
Rangiora County Cl.	1919	(3,155)	451	,,	..	(292)	(1,691)	17·27	(911,760)	(773,098)	(138,662)	15·2	35·64	1,714·1	245·0	A.C.	400/230	59·5	..
Riccarton	1916	(4,887)	1,147	,,	..	(330·7)	(3,190·5)	10·3	(1,374,240)	(1,211,068)	(163,172)	11·8	47·43	1,055·8	347·8	A.C.	400/230	18·25	..
South Canterbury ..	1925	(41,618)	2,360	,,	..	(1,514·6)	(5,916)	25·6	(6,717,400)	(5,672,003)	(1,045,397)	15·56	50·63	1,122·5	96·7	A.C.	400/230	563·5	..
Springs-Ellesmere ..	1922	(11,370)	1,716	,,	..	(385)	(3,625)	10·6	(1,461,544)	(963,407)	(498,137)	34	43·3	561·4	84·7	A.C.	400/230	238·65	..
Sumner	1903	(3,500)	916	,,	..	(162·9)	(1,126·6)	14·47	(664,785)	(538,362)	(166,823)	25·1	46·59	587·7	153·8	A.C.	400/230	18·25	..
Timaru	1906	(17,000)	2,693	,,	..	(1,140)	(6,207)	18·2	(3,317,998)	(3,139,808)	(178,190)	5·37	33·2	1,165·9	184·6	A.C.	400/230	534	..
Tai Tapu Dairy Co. ..	1915	(5,700)	240	,,	..	(181·1)	(413)	43·85	(658,986)	(527,188)	(131,798)*	20	41·53	..	..	A.C.	400/230	..	..
Waimairi	1916	(12,082)	2,750	,,	..	(657)	(7,862)	8·36	(3,062,851)	(2,450,281)	(612,570)	20	53·21	1,139·6	202·8	A.C.	400/230	139	..
Waitaki	1918	(17,580)	2,605	,,	390 (O)	(666)	(5,494)	12·1	(2,674,028)	(1,972,254)	(701,774)	26·24	45·83	757·1	112·1	A.C.	400/230	287	250
2. Dunedin (Waipori) ..	1907	80,000	18,090	13,750	860 (O)	11,790	55,348	21·3	48,023,575	37,065,376	10,958,199	22·8	46·5	2,048·9	463·3	A.C.	400/230	476	700
Otago	1926	12,804	2,822	Bulk	..	(1,262)	(7,062·6)	17·87	(4,004,003)	(3,353,628)	(650,375)	16·24	36·2	1,188·3	261·9	A.C.	400/230	468·5	..
3. Havelock North ..	1916	1,100	259	160	..	135	..	..	400,300	264,181	136,119	34	33·9	1,020·0	204·01	A.C.	400/230	16·5	50
4. Havelock South ..	1918	300	50	15	†	†	†	†	†	†	†	†	†	†	†	A.C.	400/230	2	270
5. Hawera County Electric Co., Ltd.	1902	6,700	2,372	1,125	532 (O)	549	3,837·75	14·3	1,430,960	1,133,825	297,135	20·76	29·75	478·0	169·2	A.C.	400/230	78	57
6. Kanieri Electric Limited (Hokitika)	1908	2,500	472	700	150 (O)	630	914	68·9	3,175,500	2,633,830	541,670	17·06	57·5	644·7	121·7	A.C.	400/230	17·7	250
7 Kaponga	1916	1,200	341	165	..	150	505‡	29·9‡	316,300	297,387	19,913	6·3	24	872·1	247·8	A.C./D.C.	400/230	50	58/31
8. Mangahao	1925	358,628	55 dom. 13 bulk	24,000	..	20,040	170,068	11·78	103,968,109	97,786,572	6,181,537	5·95	59·2	..	272	A.C.	..	358·4	896
Central Hawke's Bay	1925	(10,500)	1,301	Bulk	80 (G)	(440)	(2,983)	14·75	(1,945,807)	(1,460,049)	(485,758)	24·9	50·4	1,122·2	139·0	A.C.	400/230	94	..
Dannevirke ..	1925	(12,614)	1,823	,,	..	(420)	(4,221·8)	9·95	(1,612,296)	(1,449,708)	(162,588)	10·08	43·8	795·2	114·9	A.C.	400/230	251·6	..
Hawke's Bay ..	1925	(15,343)	1,603	,,	..	(2,072)	(16,668)	12·4	(4,730,000)	(3,942,866)	(787,134)	16·64	26	483·7	89·8	A.C.	400/230	185	..
Hastings.. ..	1912	(10,150)	2,978	,,	1,175(O)(G)	(804·7)	(5,234)	15·3	(2,104,400)	(1,788,292)	(316,108)	15	29·8	600·5	176·1	A.C./D.C.	460/230 400/230	54	..
Napier	1913	(18,410)	3,569	,,	1,330(O)(G)	(1,073)	(5,734)	18·7	(4,216,410)	(3,369,582)	(846,828)	20·08	44·86	944·1	183·0	A.C./D.C.	460/230 400/230	33	..
Horowhenua ..	1924	(16,000)	2,782	,,	..	(1,968)	(7,551)	26·06	(7,090,301)	(5,906,235)	(1,184,066)	16·69	41·12	212·1	26·8	A.C.	400/230	269·5	..
Hutt Valley ..	1924	(35,640)	7,046	,,	500 (S)	(2,120)	(20,102)	10·5	(8,852,945)	(7,663,587)	(1,189,358)	13·43	47·67	108·7	21·5	A.C.	400/230	255	..
Manawatu-Oroua ..	1924	(39,011)	3,892	,,	..	(2,093·3)	(10,914)	19·1	(11,392,722)	(9,904,214)	(1,488,508)	13·06	62	1,222·8	170·1	A.C.	400/230	494	..
Palmerston North..	1924	(19,210)	4,207	,,	1,350 (G)	(1,688)	(9,641)	17·5	(5,987,926)	(4,965,699)	(1,022,227)	17	40·4	1,180·3	158·4	A.C.	400/230	71·5	..
Tararua	1925	(10,250)	1,307	,,	..	(442·5)	(3,310)	13·36	(2,185,413)	(1,973,837)	(211,576)	9·7	56·4	1,510·2	192·5	A.C.	400/230	162·76	..
Wairarapa ..	1924	(19,500)	3,131	,,	837 (W)	(960)	(9,137)	10·5	(4,987,424)	(3,890,252)	(1,097,172)	22	59·3	1,242·4	199·5	A.C.	400/230	432·5	A, 424 B, 290

* Assessed. † Taken over by Marlborough Power Board. ‡ Partly included in Taranaki Power Board.

TABLE W.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1928—*continued*.

(G = gas; O = oil; S = steam; W = water.)

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load (Kilowatts).	Demand Factor.	Units.				Annual Load-factor Percentage.	Average Units sold per Consumer.	Average Units sold per Capita.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated or purchased.	Sold.	Non-productive.	Percentage Non-Productive.							
Hydro Stations—continued.				Kv.a.	Kv.a.	Kw.													
Wanganui-Rangitikei	1924	(52,000)	7,293	Bulk	1,650 (S)	(3,070)	(16,032)	19·2	(13,736,555)	(10,989,244)*	(2,747,311)*	20*	51·1	1,506·8*	211·3*	A.C.	400/230	651	..
Mangaweka ..	1913	345	90	,,	40 (W)	(34)	(45·97)	73·96	(86,793)	(78,831)	(7,962)	9·17	29·14	875·9	228·4	A.C.	400/230	7	..
Wellington ..	1888	(100,000)	23,000	,,	9,650 (S)	(12,910)	(66,363)	19·45	(46,313,769)	(38,742,838)	(7,570,931)	16·35	40·95	1,684·4	387	A.C.	400/230/105	268	..
9. Mackenzie (Fairlie) ..	1922	1,942	189	40	..	30·26	143	21·2	66,866	60,214	6,652	9·95	25·23	318·5	31	A.C.	400/230	5·5	66
10. Mataura	1913	1,300	300	75	150 (S)	70	340	20·5	91,322	70,852	20,470	22·4	14·86	236·1	54·5	A.C.	440/220	8	22
11. Marlborough	1927	20,780	1,340	625	..	400	2,239	17·8	664,937	292,595	372,342	56	18·9	218·3	10·5	A.C.	400/230	201	100
12. Murchison	1922	450	120	100	..	95	253	37·6	257,500	154,668	102,832	39·9	30·9	1,288·9	343·7	A.C.	400/230	14	150
13. New Plymouth ..	1905	21,000	5,233	3,600	500 (O)	2,400	13,010	18·4	11,043,295	9,342,665	1,700,630	15·3	52·52	1,539·9	387·8	A.C.	400/230	225	120 240
Inglewood	1905	1,300	405	Bulk	120 (W)	(110)	(1,032)	10·65	(391,155)	(279,883)	(111,272)	28·44	40·59	691	215·2	A.C.	400/230	8·12	38
Waitara	1907	1,787	429	,,	..	(85)	(510)	16·6	(228,370)	(163,214)	(65,156)	28·53	30·67	380·4	91·3	A.C.	400/230	11·5	..
14. Ohakune	1914	2,400	460	120	141 (O)	101	592·35	17·06	185,265	158,419	26,846	14·49	20·93	344·3	66·0	A.C.	400/230	19	..
15. Opunake	1924	7,000	1,064	380†	..	360	1,034	34·8	1,307,400	1,041,900	265,500	20·3	41·46	979·2	148·8	A.C.	400/230	137·5	53
16. Patea	1901	1,800	310	82	80 (O)	92·4	272	33·9	273,282	232,955	40,327	14·8	33·7	751·4	129·4	A.C.	110/220	13	78
17. Queenstown	1924	804	202	100	..	55	236	23·3	131,790	94,626	37,164	28·2	27·4	467·9	117·5	A.C.	400/230	25	510
18. Raetihi	1917	4,500	392	470	..	150	650	23·07	407,530	326,124	81,406	19·97	31·01	831·9	72·4	A.C.	400/230	28	308
19. Reefton Electric Light and Power Co., Ltd.	1887	1,200	287	80	..	68	..	..	16,000	12,000	4,000	25	26·84	41·8	10	D.C.	460/230	2·25	27
20. Southland (Monowai) ..	1925	67,090	8,033	7,050	..	4,900	32,285	15·17	21,155,905	14,968,107	6,187,798	29·24	49·28	1,667·1	1,211·2	A.C.	400/230	2,373	154
Bluff	1903	(1,690)	380	Bulk	..	(194)	(816·37)	23·8	(330,441)	(262,100)	(68,341)	24·67	19·49	689·9	155	A.C.	400/230	9·62	..
Invercargill ..	1913	(21,000)	3,946	,,	2,450 (S)	(1,488)	(9,846)	15·1	(5,377,701)	(4,801,684)	(576,017)	10·7	41	1,211·7	228·6	A.C.	400/230	75	..
21. Taranaki	1925	12,285	1,511	3,600	..	1,800	5,293	34·0	4,855,260	3,884,208	971,052*	20	30·79	..	..	A.C.	400/230	252	300
Stratford	1898	3,336	908	Bulk	..	(350)	(1,673)	20·9	(1,192,814)	(990,141)	(202,673)	17	39	1,090·4	296·8	A.C.	400/230	19·5	..
22. Taihape	1913	2,450	564	150	75 (G)	214	906	23·6	459,010	313,020	145,990	31·8	24·49	555	127·7	D.C.	460/230	10·25	30
23. Taumarunui	1924	4,000	715	500	..	460	1,338	34·3	958,126	670,518	287,608	30	23·7	937·7	167·6	A.C.	400/230	15	25
24. Tauranga Borough Council	1915	2,500	848	4,300	..	3,566	4,642	76·82	14,211,925	11,982,350	2,229,575	15·68	45·5	1,761·6	597·5	A.C.	400/230	69·5	110/86
Tauranga Power Board	1925	8,300	788	Bulk	..	(650)	(2,881)	..	(3,459,688)	(2,883,074)	(576,614)	(16·6)	..	365·5	34·7	A.C.	400/230	280	..
Te Puke	1921	980	251	,,	..	(84)	(515·8)	16·2	(274,015)	(258,290)	(15,725)	5·75	37	1,029·0	263·5	A.C.	400/230	8·75	..
25. Teviot	1924	1,580	343	750	..	645	2,076·5	31·06	2,470,446	1,976,356	494,090*	20	43·72	..	..	A.C.	400/230	65	380
Otago Central ..	1925	2,037	690	Bulk	..	(310)	(1,074)	28·8	(1,236,287)	(903,295)	(332,992)	26·93	45·5	1,309·1	443·4	A.C.	400/230	84	..

* Assessed. † Also bulk supply from New Plymouth.

TABLE W.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1928—*continued.*

(G = gas; O = oil; S = steam; W = water.)

Title.	Supply commenced.	Population included in Area of Supply.	Number of Consumers.	Capacity.			Connected Load (Kilowatts).	Demand Factor.	Units.				Annual Load-factor Percentage.	Average Units sold per Consumer.	Average Units sold per Capita.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
				Main Plant.	Stand-by Plant.	Maximum Load.			Generated or purchased.	Sold.	Non-productive.	Percentage Non-Productive.							
Hydro Stations—contd.				Kv.a.	Kv.a.	Kw.													
26. Waikato (Horahora) ..	1913	271,625	19 bulk	12,875	3,000 (S)	15,700	64,580	24·31	100,075,668	87,852,067	12,223,601	12·21	72·77	..	324	A.C.	..	656·38	27
Cambridge ..	1922	(6,000)	1,128	Bulk	..	(506)	(2,203·6)	22·96	(3,018,937)	(2,233,997)	(784,940)	26	68·1	1,980·4	372·3	A.C.	400/230	141	..
Central	1921	(18,039)	3,015	,,	,,	(1,100)	(6,352)	17·32	(5,891,776)	(4,851,608)	(1,040,168)	17·65	61·14	1,609·1	268·9	A.C.	400/230	388·25	..
Franklin	1925	(16,359)	2,319	,,	350 (G)	(727·4)	(4,311)	16·87	(3,007,981)	(2,506,651)	(501,330)	16·66	47·2	1,080·9	153·2	A.C.	400/230	262	..
Hamilton	1913	(15,500)	3,388	,,	..	(891)	(6,153)	14·43	(2,947,233)	(2,454,809)	(492,424)	16·7	37·76	724·5	158·3	A.C.	400/230	46·7	..
Te Awamutu ..	1920	(17,620)	1,353	,,	..	(744)	(3,520·3)	21·13	(3,989,310)	(3,217,554)	(721,756)	18·12	61·2	2,378	422·2	A.C.	400/230	291·5	..
Thames Valley ..	1920	(140,794)	4,915	,,	..	(4,359)	(16,493)	26·42	(22,669,688)	(18,024,393)	(4,645,295)	20·49	59·37	2,719	374·5	A.C.	400/230	673	..
Thames Borough Council	1914	(5,000)	1,074	,,	205 (W)	(350·7)	(1,549)	22·64	(1,405,880)	(956,942)	(448,938)	31·93	45·76	891	191·2	A.C./D.C.	460/400/230	20	..
Te Aroha	1906	(2,324)	640	,,	150 (W)	(180)	(1,135)	15·85	(610,475)	(529,389)	(181,086)	29·7	38·71	827·1	227·3	A.C.	400/230	16·25	600
Tourist Department (Rotorua)	1901	(5,500)	1,451	,,	387 (G)	(390)	(2,721)	14·33	(1,403,668)	(1,034,655)	(369,013)	26·29	41·08	713·0	188·1	A.C.	400/230/200/115	45·25	14
Waitemata	1926	(36,489)	5,512	,,	..	(1,172)	(10,074·8)	11·63	(5,494,849)	(4,503,238)	(991,611)	18·05	53·5	816·9	123·4	A.C.	400/230	266·9	..
Waitomo	1925	(8,000)	1,118	,,	170 (G)	(276)	(1,410)	19·58	(1,328,291)	(1,000,281)	(328,010)	24·69	54·93	894·7	125	A.C.	400/230	65	300
27. Wairoa (Waikaremoana)	1923	5,341	260	2,000	..	1,042	2,963	35·16	2,792,224	2,462,077	330,147	11·82	30·58	2,846·3†	320·6	A.C.	400/230	105·5	680
Wairoa Borough Council	1913	2,337	605	Bulk	..	(237·4)	1,756	13·55	(1,101,364)	(1,005,766)	(95,598)	8·68	52·95	1,662·4	430·3	A.C.	400/230	12·6	..
28 Waimea	1910	4,000	614	100 Also bulk	40 (G)	100	738	13·55	147,778	114,016	33,762	22·84	16·87	185·6	28·5	A.C.	400/230	35	11
29. Wairua (Wilson's Cement Co.	1916	7,560	43	2,500	..	2,300	..	..	13,047,750	11,374,024	1,673,726	12·83	64·75	5,826·8‡	1,504·5	A.C.	400/230	36·38	130
Kamo	1923	(560)	90	Bulk	..	(22·8)	(110·6)	20·6	(29,971)	(23,976)	(5,995)*	20	15·01	333·0	53·5	A.C.	400/230	5·62	..
Whangarei ..	1915	(7,000)	1,819	,,	..	(495)	(3,561)	13·9	(1,841,950)	(1,500,512)	(341,438)	18·53	42·47	824·9	214·3	A.C.	400/230	28·5	..
30. Wairere	1925	2,000	234	480	..	207	855	24·2	584,540	526,139	58,401	10	32·24	2,248·4	263	A.C.	400/230	72·25	65
31. Westport	1925	4,000	420	250	..	125	476	26·2	292,350	189,120	103,230	35·3	26·7	450·2	47·2	A.C.	400/230	21·5	430
32. Whakatane	1922	1,300	410	240	..	290	290	100	891,930	566,168	325,762	36·52	35·1	1,380·8	435·8	A.C.	400/230	25	276
Totals		1,175,141	196,745	114,132	27,052	88,840	508,320	17·48	427,556,602	371,162,947	56,393,655	13·19	54·9	1,885	316	..	..	15,860·46	..

* Assessed. † Includes P.W.D. construction units. ‡ Includes units used in cement-works.

Table X.—Electric-supply Stations.—Appropriations for Year ended 31st March, 1928.

Title.	Ownership.	Supply commenced.	To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Capital Expenditure (out of Revenue).	Total.	Accumulated Funds.				
										Depreciation.	Renewal.	Reserves.	Accident.	Sinking.
Steam Stations.			£	£	£	£	£	£	£	£	£	£	£	£
1. Auckland	Power Board	1908	43,950	..	14,119	..	..	..	58,069	155,054	..	196,849	..	272,130
2. Grey	Power Board	1926	979	..	..	..	..	9	988	943	..	..	..	6,600
3. Poverty Bay	Power Board	..	1,600	..	..	..	..	5,684	7,284	1,600	..	..	..	5,412
4. Nelson	City Council	1923	2,307	..	..	..	2,000	3,643	7,950	8,758	..	..	..	6,589
Totals	..	..	48,836	..	14,119	..	2,000	9,336	74,291	166,355	..	196,849	..	290,731
Gas Stations.														
1. Kaikoura	County Council	1922	..	..	..	..	..	..	..	..	..	..	..	588
2. Motueka	Borough Council	1922	359	..	..	..	..	82	441	..	..	..	..	1,454
Totals	..	..	359	..	..	..	..	82	441	..	..	..	..	2,042
Oil Stations.														
1. Picton	Borough Council	1917	..	..	..	..	..	617	617	..	..	..	..	919
2. Uawa (Tolaga Bay)	County Council	1925	..	..	..	..	..	37	37	..	..	..	..	920
Totals	..	..	..	..	..	..	..	654	654	..	..	..	..	1,839
Hydro Stations.														
1. Coleridge	Public Works Dept.	1915	29,863	..	..	..	..	..	29,863	173,231	..	..	..	62,465
Ashburton	Power Board	1912	2,400	..	..	..	..	..	2,400	2,400	11,435	..	..	9,333
Banks Peninsula	Power Board	1921	..	1,010	..	..	..	..	1,010	..	3,010	..	..	5,884
Christchurch	City Council	1904	30,749	..	18,552	..	..	25,412	74,713	10,000*	3,000	14,953	..	216,458
Eyre	County Council	1920	..	..	..	..	..	..	..	..	507	..	..	396
Halswell	County Council	1919	..	..	..	..	..	155	155	..	..	..	..	497
Heathcote	County Council	1914	..	..	..	..	..	..	..	..	..	..	..	3,239
Kaiapoi	Borough Council	1917	..	..	..	..	..	518	518	..	..	..	..	747
Kowai	County Council	1922	..	..	..	..	..	..	..	..	..	..	..	1,144
Lyttelton	Borough Council	1917	..	..	..	..	..	..	..	..	..	..	..	100
Malvern	Power Board	1925	981	..	..	..	..	..	981	3,701	..	..	..	1,822
Rangiora	Borough Council	1919	348	..	..	..	..	652	1,000	..	..	..	..	763
Rangiora	County Council	1919	..	..	..	..	..	1,434	1,434	..	..	..	..	1,930
Riccarton	Borough Council	1916	765	229	2,000	35	..	1,013	4,042	2,973	815	..	..	40
South Canterbury	Power Board	1925	554	..	..	..	..	..	554	554	..	..	..	9,011
Springs-Ellesmere	Power Board	1922	1,000	..	..	..	..	..	1,000	..	..	..	..	4,672
Sumner	Borough Council	1903	..	..	..	..	..	1,454	1,454	..	..	..	..	27,673
Timaru	Borough Council	1908	..	..	..	..	..	1,173	1,173	..	..	..	..	..
Tai Tapu Dairy Co.	Company	1915	348	..	..	..	..	..	348	1,102	..	..	..	..
Waimairi	County Council	1916	947	..	..	..	..	..	947	..	..	..	..	2,335
Waitaki	Power Board	1918	5,389	..	..	..	..	..	5,389	11,000	..	..	..	659

* Trading stock only.

TABLE X.—ELECTRIC-SUPPLY STATIONS.—APPROPRIATIONS FOR YEAR ENDED 31ST MARCH, 1928—*continued.*

Title.	Ownership.	Supply commenced.	To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Capital Expenditure (out of Revenue).	Total.	Accumulated Funds.				
										Depreciation.	Renewal.	Reserves.	Accident.	Sinking.
Hydro Stations—continued.			£	£	£	£	£	£	£	£	£	£	£	£
2. Dunedin (Waipori)	City Council	1907	17,875	14,932	..	..	16,384	13,288	62,479	95,645	119,563	..	..	86,331
Otago	Power Board	1926	2,627	..	..	..	..	..	2,627	..	..	8,334	..	..
3. Havelock North	Town Board	1916	..	..	..	..	545	..	545	..	..	..	..	3,731
4. Hawera County Electric Co., Ltd.	Company	1902	4,575	..	100	..	..	..	4,675	7,188	..	..	..	..
5. Kanieri Electric, Ltd. (Hokitika)	Company	1908	1,263	..	..	..	..	..	1,263	..	..	..	..	..
6. Kaponga	Town Board	1916	..	..	..	..	..	569	569	..	..	..	..	1,112
7. Mangahao	Public Works Dept.	1925	35,301	..	..	..	..	..	35,301	101,817	..	..	..	..
Central Hawke's Bay	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	3,010
Dannevirke	Power Board	1925	3,095	..	..	..	..	381	3,476	3,095	..	100	..	5,246
Hawke's Bay	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	4,123
Hastings	Borough Council	1912	..	..	..	..	297	3,249	3,546	3,300	2,226	..	..	4,708
Napier	Borough Council	1913	..	1,286	1,286	..	..	..	2,572	..	8,903	8,402	..	7,303
Horowhenua	Power Board	1924	2,784	..	..	..	..	..	2,784	..	4,784	..	999	4,469
Hutt Valley	Power Board	1924	..	..	..	..	..	..	..	10,435	..	..	..	7,631
Manawatu-Oroua	Power Board	1924	4,819	..	..	..	..	..	4,819	..	4,819	..	..	28,437
Palmerston North	Borough Council	1924	..	2,000	..	..	3,000	5,489	10,489	..	2,041	..	..	10,324
Tararua	Power Board	1925	1,326	..	..	..	..	163	1,489	1,827	..	..	..	8,115
Wairarapa	Power Board	1924	2,214	..	..	..	..	795	3,009	..	..	..	..	10,294
Wanganui-Rangitikei	Power Board	1924	14,276	..	..	..	..	..	14,276	14,276	..	4,000	..	12,168
Wellington	City Council	1888	..	17,244	17,244	..	..	73,066*	107,554	..	87,032	22,608	10,107	144,325
8. Marlborough	Power Board	1927	..	..	..	..	..	..	..	..	..	..	..	6,426
9. Mataura	Borough Council	1913	..	..	..	..	..	..	..	..	..	..	..	123
10. Mackenzie County	County Council	1922	..	..	..	..	..	37	37	..	..	..	..	689
11. Murchison	County Council	1922	..	..	..	6	..	260	266	..	..	..	..	1,134
12. New Plymouth	Borough Council	1905	5,404	1,724	..	..	..	15,358	22,486	79,945	13,570	27	..	39,375
Inglewood	Borough Council	1905	..	..	..	..	..	..	..	..	..	..	..	2,229
Waitara	Borough Council	1907	..	..	..	..	..	..	..	..	..	..	..	1,600
13. Ohakune	Borough Council	1914	..	..	..	..	1,000	544	1,544	..	..	..	..	..
14. Opunake	Power Board	1920	..	..	..	..	..	..	..	..	..	..	..	8,828
15. Patea	Borough Council	1901	399	..	..	..	..	116	515	1,949	1,949	..	..	34
16. Queenstown	Borough Council	1924	627	31	..	..	..	..	658	..	84	..	..	350
17. Raetihi	Borough Council	1917	..	..	..	..	..	647	647	..	..	..	..	2,946
18. Reefton Electric Light and Power Co., Ltd.	Company	1887	..	..	..	..	..	..	..	..	..	..	..	..
19. Riccarton	Borough Council	..	765	229	2,000	35	..	1,013	4,042	2,973	815	..	..	40
20. Southland (Monowai)	Power Board	1925	3,168	..	..	..	..	..	3,168	3,168	..	..	..	140,080
Bluff	Borough Council	1903	..	198	..	..	..	203	401	..	6,061	..	..	364
Invercargill	Borough Council	1913	..	500	..	..	..	5,000	5,500	..	32,057	..	..	19,580
21. Taranaki	Power Board	1925	..	1,079	..	..	..	..	1,079	2,292	..	..	..	7,488
Stratford	Borough Council	1898	15,398	..	..	..	..	..	15,398	23,967	..	..	..	38,861
22. Taihape	Borough Council	1913	..	..	..	..	..	..	..	..	..	..	..	..
23. Taumarunui	Borough Council	1924	..	400	..	..	600	291	1,291	..	613	2,350	..	614

*Special expenditure out of revenue on "change over."

TABLE X.—ELECTRIC SUPPLY STATIONS.—APPROPRIATIONS FOR YEAR ENDED 31ST MARCH, 1928—*continued.*

Title.	Ownership.	Supply commenced.	To Depreciation.	Renewal Fund.	General Reserve Fund.	Accident Insurance Fund.	Relief of Rates (Local Authorities)	Capital Expenditure (out of Revenue).	Total.	Accumulated Funds.				
										Depreciation.	Renewal.	Reserves.	Accident.	Sinking.
Hydro Stations—continued.			£	£	£	£	£	£	£	£	£	£	£	£
24. Tauranga	Borough Council ..	1915	..	..	..	..	..	1,191	1,191	1,725	..	..	..	11,433
Tauranga	Power Board	1925	..	..	..	..	..	..	..	1,225	..	..	..	2,746
Te Puke	Town Board	1921	178	213	..	..	..	..	391	1,047	1,166	..	..	726
25. Teviot	Power Board	1924	..	..	..	..	..	..	..	..	..	..	..	1,576
Otago Central	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	1,226
26. Waikato (Horahora)	Public Works Dept. ..	1913	18,646	..	6,176	..	..	..	24,822	84,272	..	53,845	..	49,858
Cambridge	Power Board	1922	400	..	150	..	..	..	550	400	..	150	..	7,250
Central	Power Board	1921	2,650	..	..	..	..	..	2,650	2,650	10,130	4,087	..	15,407
Franklin	Power Board	1925	7,800	..	2,500	..	..	..	10,300	7,855	..	5,108	..	3,208
Hamilton	Borough Council ..	1913	..	2,130	2,000	117	4,551	1,512	10,310	..	10,364	4,131	..	12,490
Te Awamutu	Power Board	1920	153	..	..	..	..	..	153	153	..	..	..	6,555
Thames Valley	Power Board	1920	4,540	..	..	..	..	..	4,540	..	..	..	..	54,801
Thames	Borough Council ..	1914	1,356	250	..	..	..	..	1,606	9,122	850	..	..	4,172
Te Aroha	Borough Council ..	..	..	..	..	..	..	1,583	1,583	3,621	..	..	..	1,312
Tourist Department (Rotorua)..	Government	1901	1,261	..	1,621	..	..	..	2,882	7,806	..	..	..	7,806
Waitemata	Power Board	1926	833	..	4,869	..	..	..	5,702	3,805	..	10,607	..	12,573
Waitomo	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	1,580
27. Wairoa (Waikaremoana).. ..	Power Board	1923	2,142	..	..	..	..	..	2,142	6,923	..	..	..	3,649
Wairoa	Borough Council ..	1913	..	..	..	..	1,296	323	1,619	..	..	..	..	2,300
28. Waimea	Company	1910	675	..	..	..	..	..	675	..	..	..	..	..
29. Wairua (Wilson's Cement Co.) ..	Company	1916	..	..	..	..	..	..	..	..	..	..	..	..
Kamo	Town Board	1923	..	..	..	..	..	153	153	..	..	..	..	319
Whangarei	Borough Council ..	1915	..	1,181	..	..	..	..	1,181	..	2,998	..	..	1,933
30. Wairere	Power Board	1925	..	..	..	..	..	..	..	..	..	..	..	..
31. Westport	Borough Council ..	1925	523	..	..	..	..	374	897	1,022	..	..	..	1,837
32. Whakatane	Borough Council ..	1922	..	..	..	..	..	1,180	1,180	..	..	4,117	..	..
Totals	..	..	230,417	44,625	58,498	193	27,673	158,596	520,002	688,464	328,792	142,819	11,106	1,165,469

TABLE Y.—RETURN OF ELECTRIC RANGES, WATER-HEATERS, AND MILKING-MACHINES.

Licensee.	Ranges, 31/3/28.		Percentage of Number of Consumers	Water-heaters, 31/3/28.	Percentage of Number of Consumers	Milking-machines, 31/3/28.
	2–5 kw.	5 kw. and over.				
Ashburton Power Board	5	434	14·3	273	8·8	36
Auckland Power Board	..	3,024	7·8	5,973	15·4	..
Banks Peninsula Power Board	7	95	11·2	92	10·0	120
Cambridge Power Board	8	81	7·89	312	27·65	259
Central Hawke's Bay Power Board	3	58	4·7	103	7·9	52
Central Power Board	21	117	4·57	681	22·58	749
Christchurch City	1,728		7·65	2,150	9·52	..
Dannevirke Power Board	..	73	4·0	140	7·6	185
Dunedin City	..	541	3·0	675	3·7	118
Eyre County	..	..	..	4	2·7	14
Franklin Power Board	141		6·0	423	18·2	383
Grey Power Board	1	12	0·89	26	1·78	..
Halswell County	11	2	10·23	5	3·93	15
Hamilton Borough	5	51	1·65	67	1·97	..
Hastings Borough	12	62	2·4	2	0·06	..
Havelock North Town Board	11	..	4·2	4	1·5	..
Hawera Co.	2	8	0·4	28	1·2	142
Hawke's Bay Power Board	..	154	9·69	145	9·07	25
Heathcote County	22	130	13·54	150	13·37	4
Horowhenua Power Board	2	307	11·1	547	16·07	382
Hutt Valley Power Board	44	570	8·7	340	4·8	47
Inglewood Borough	3	16	4·7	13	3·2	1
Invercargill Borough	10	81	2·3	2	0·05	3
Kaiapoi Borough	10	2	2·65	1	0·21	3
Kamo Town Board	1	..	1·42	1	1·42	..
Kanieri Electric, Ltd.	2	1	0·64	..	..	4
Kaponga Town Board	..	2	0·57	28	7·98	86
Kowai County	1	2	1·02	1	0·3	5
Lyttelton Borough	..	4	0·73	3	0·5	1
Mackenzie County (Fairlie)	..	1	0·5	1	0·5	1
Malvern Power Board	15	68	14·4	33	5·7	5
Manawatu-Oroua Power Board	..	379	10·0	775	19·9	609
Mangahao (Public Works Department)	..	31	56·3	31	56·3	..
Mangaweka Town Board	..	5	5·0	4	4·0	2
Marlborough Power Board	..	58	4·3	46	3·4	6
Mataura Borough	1	2	1·0	1	0·3	4
Murchison County	..	3	2·5	11	9·1	16
Napier Borough	1	17	0·5	90	2·52	..
Nelson City	..	..	..	1	0·049	..
New Plymouth Borough	75	451	10·0	443	8·4	212
Ohakune Borough	5	3	1·73	6	1·3	1
Opotiki Borough	5	..	1·36	..	..	8
Opunake Power Board	..	36	3·3	99	9·3	198
Otago Central Power Board	2	61	9·15	60	8·69	8
Otago Power Board	9	177	6·6	140	5·0	50
Palmerston North Borough	6	279	6·7	457	10·8	4
Patea Borough Council	..	7	2·8	5	2·0	1
Picton Borough	..	1	0·29	..	..	..
Poverty Bay Power Board	..	144	4·03	70	1·95	..
Queenstown Borough Council	5	2	3·47	..	..	..
Raetihi Borough	..	1	0·256	3	0·77	10
Rangiora Borough	2	16	3·67	18	3·67	..
Rangiora County	..	10	2·22	13	2·89	26
Riccarton Borough	5	124	11·2	147	12·8	..
Rotorua Tourist Department	15	30	3·1	64	4·4	20
South Canterbury Power Board	11	264	11·6	154	6·5	58
Southland Power Board	..	1,124	14·0	579	7·19	771
Springs-Ellesmere Power Board	2	70	4·2	41	2·38	56
Stratford Borough	3	87	10·0	80	8·8	..
Sumner Borough	20	31	5·5	63	6·8	1
Taihape Borough	..	7	1·24	10	1·77	..
Tai Tapu Dairy Co.	..	8	3·33	11	4·58	39
Taranaki Power Board	1	95	6·3	333	22·08	391
Tararua Power Board	14	117	10·0	226	17·29	154
Taumarunui Borough	9	7	2·2	16	2·2	..
Tauranga Borough	37	83	14·0	232	27·5	..
Tauranga Power Board	29	64	11·9	233	29·5	293
Te Aroha Borough	..	10	1·56	13	2·03	6
Te Awamutu Power Board	2	80	6·06	389	29·5	445
Te Puke Town Board	5	3	3·1	19	7 6	4
Teviot Power Board	4	55	17·2	59	17·2	..
Thames Borough	9	4	1·2	26	18·5	..
Thames Valley Power Board	66	160	4·6	1,395	18·1	1,704
Timaru Borough	150	1	5·6	91	3·3	..
Waimairi County	3	275	10·1	343	12·47	13
Waimea Electric Supply Co.	..	..	..	2	0·32	..
Wairarapa Power Board	13	195	6·6	234	7·4	236
Wairere Power Board	2	46	20·5	67	28·6	..
Wairoa Borough	6	68	12·2	88	14·5	..
Wairoa Power Board	23	56	30·7	58	22·5	26
Wairua (Wilson's)	..	..	..	..	..	..
Waitaki Power Board	4	196	7·7	185	7·1	18
Waitara Borough	2	12	3·2	12	2·8	1
Waitemata Power Board	9	399	7·4	596	10·8	61
Waitomo Power Board	..	43	3·84	112	10·1	96
Wanganui-Rangitikei Power Board	653		9·0	818	11·2	320
Wellington City	16	304	1·39	189	0·82	..
Westport Borough	..	4	0·95	6	1·4	2
Whakatane Borough	15	..	3·65	10	2·43	4
Whangarei Borough	18	52	3·85	114	6·26	..
Totals	800	14,966	..	21,513	..	8,514

TABLE Z.—AVAILABLE WATER-POWER IN NEW ZEALAND.

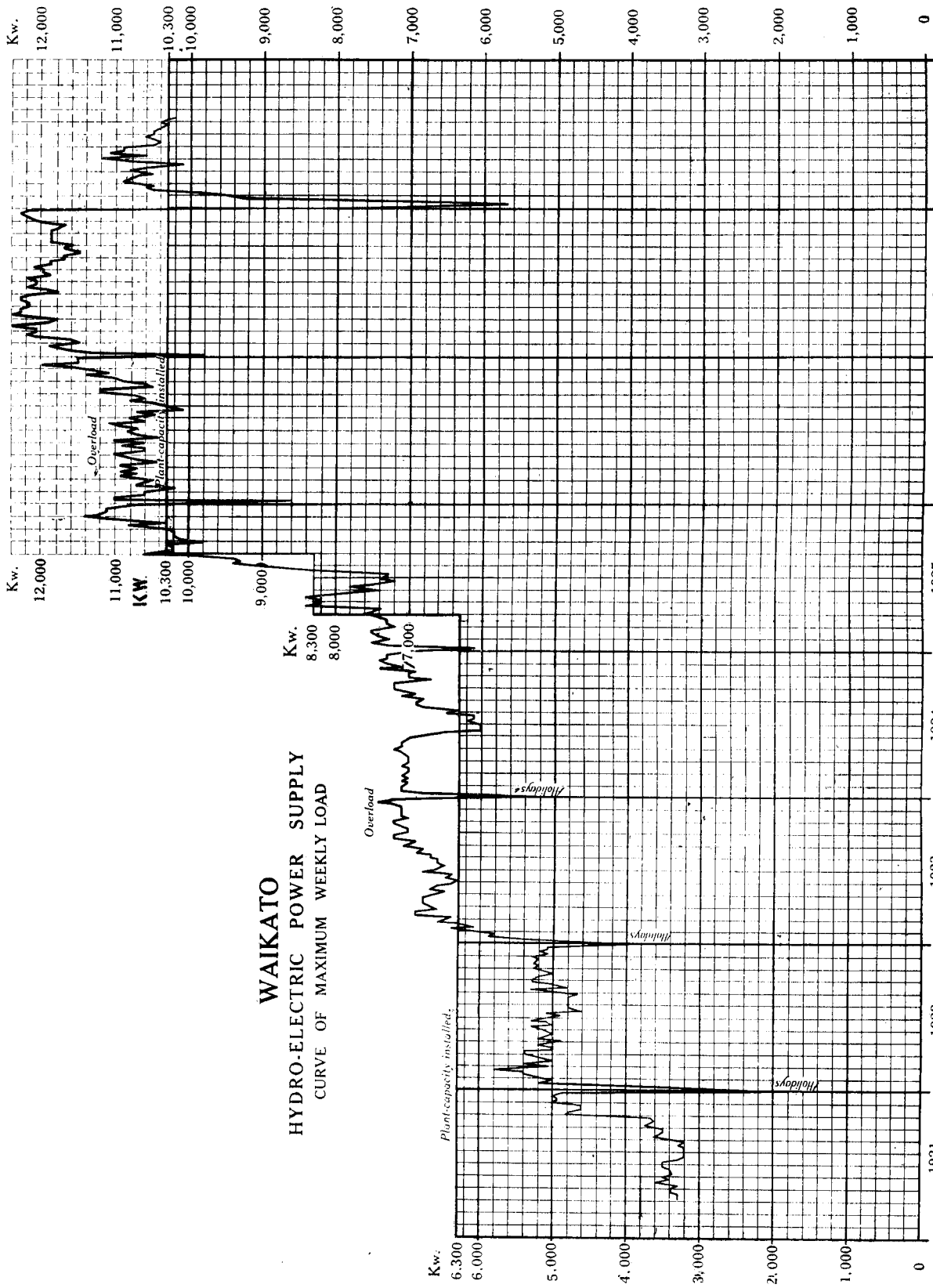
NOTE.—The information given in this table has been recast, and it is hoped that in its new form it will be found more useful.

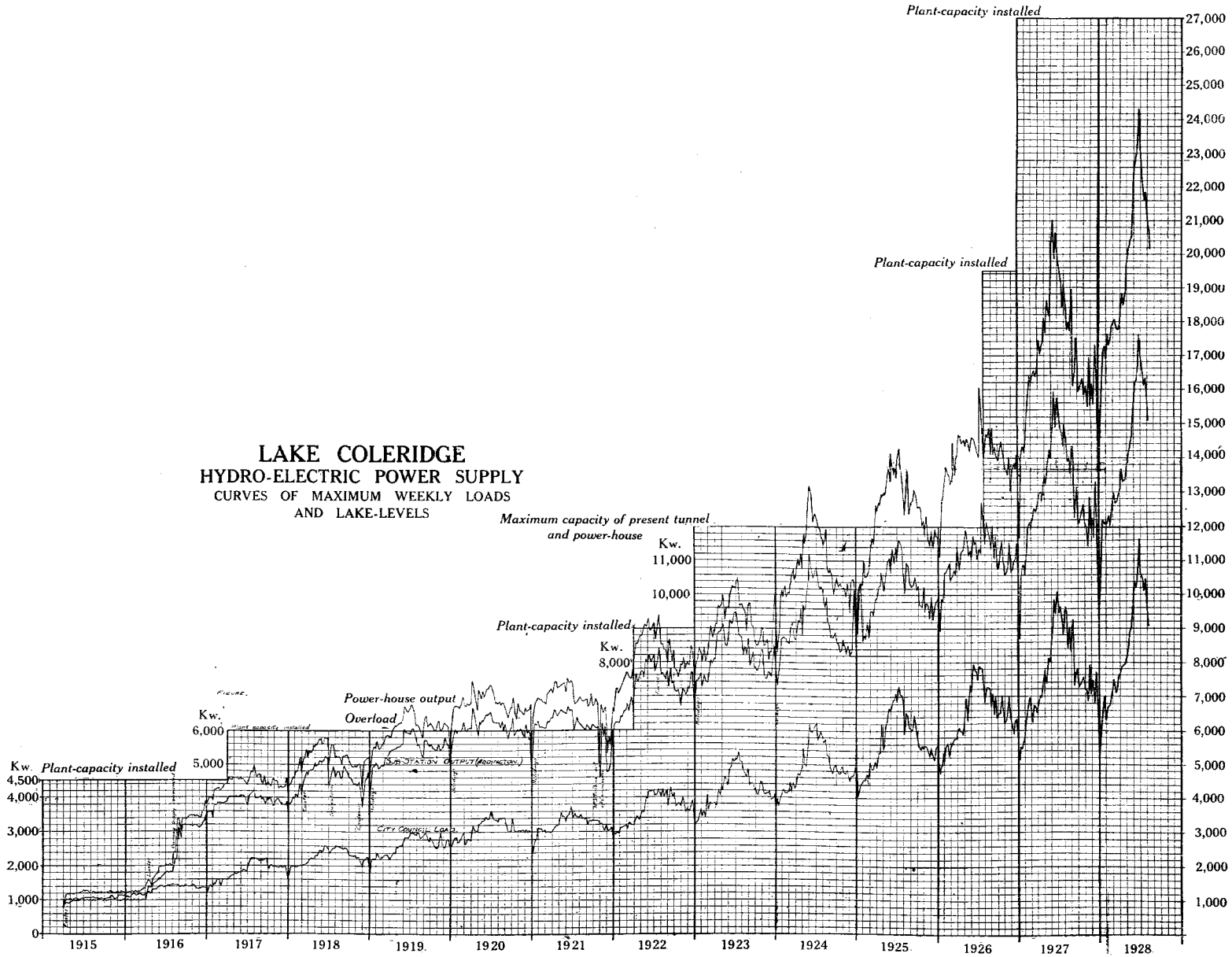
Source of Power.	Gross Head.	Storage: Daily (D), Seasonal (S).	Schemes on which Investigations have been made and Definite Proposals outlined: Proposed Ultimate Capacity.	Plant already installed: Normal Full-load Capacity.	Development at Present under Construction: Normal Full-load Capacity.	Power Schemes in which Detailed Investigation is either Lacking or Incomplete. (Estimate based on 50 per Cent. Load-factor.)
NORTH ISLAND.						
Auckland—	Ft.		H.p.	H.p.	H.p.	H.p.
Omapere Lake	550	D, S	..	..	..	1,000
Wairua Falls	130	D	2,666	2,666	..	..
Kaituna River	784	D, S	65,000	..	..	..
Omanawa	110	..	1,400	1,400	..	..
Wairoa River	80	D	4,200	4,200	..	..
Waikato River—						
Aratiatia Rapids	170	D, S	136,000	..	..	..
Orakeikorako	35	D, S	..	..	..	14,000
Aniwhaniwha	80	D, S	..	..	..	32,000
Atiamuri	25	D, S	..	..	..	10,000
Arapuni	175	D, S	160,000	..	60,000	..
Horahora	27	S	13,800	13,800	..	..
Pokaiwhenua – Horahora	170	D, S	4,600	..	..	..
Marakopa Falls	420	..	..	..	..	3,100
Wairere Falls – Mokau River	65	..	2,000	500	..	..
Hawke's Bay—						
Waikaremoana—						
Upper	440	D, S	40,000	..	..	..
Main	675	..	60,000	2,600*	40,000	..
Lower	365	..	40,000	..	..	..
Te Reinga Falls	125	..	..	..	..	1,300
Waikohu River	847	..	..	..	..	6,000
Wanganui—						
Mangawhero – Wanganui River	680	..	..	..	..	12,000
Raukawa Falls (alternative)	90	..	..	..	..	1,600
Rangitikei River – Makohine	300	D	..	..	..	75,000
Wangaehu River	70	..	..	..	..	1,500
Karioi	180	..	..	..	..	8,800
Taranaki—						
Waitara River	140	..	..	..	..	4,600
Waiwakaiho River	240	D	9,000	3,000	..	..
Tariki – Mangonui River	330	D	6,750	4,500	..	..
Wellington—						
Mangahao River	895	D, Part S	24,000	24,000	..	..
Makuri River	384	..	..	..	..	6,400
Waiohine River – Woodside	120	..	..	..	..	2,400
Hutt River	330	D, S	11,000	..	..	..
Tauherenikau River	440	D	..	..	..	11,000
Kourarau	719	D, Part S	2,600	1,300	..	..

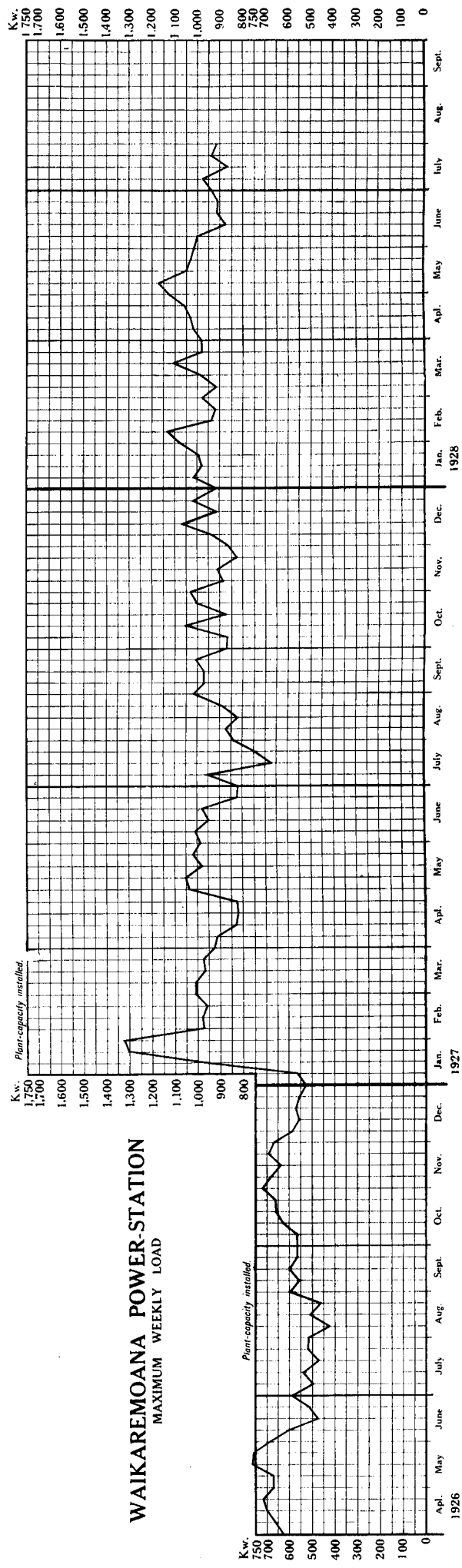
* Will be absorbed by major development.

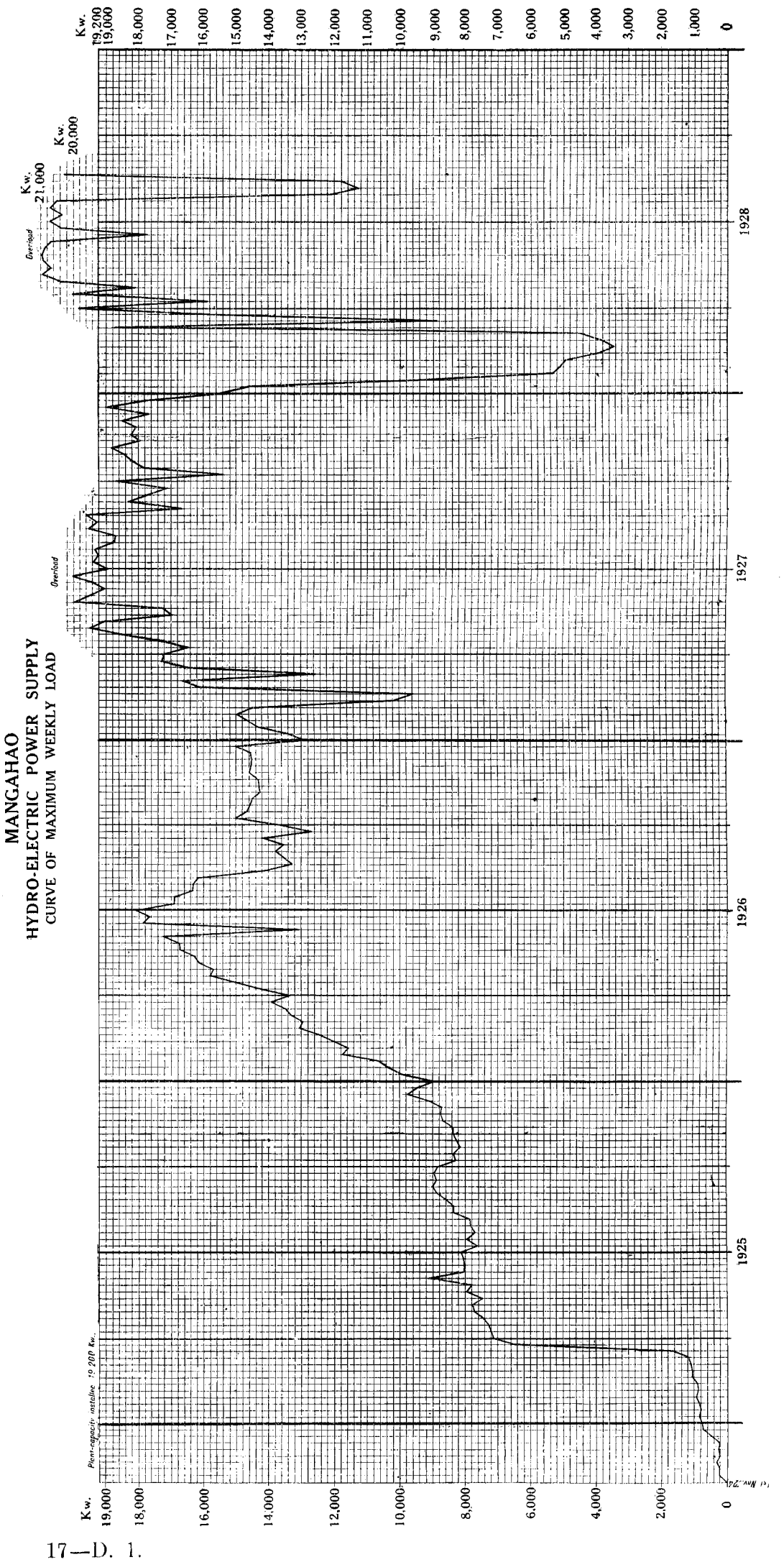
TABLE Z.—AVAILABLE WATER-POWER IN NEW ZEALAND—*continued.*

Source of Power.	Gross Head.	Storage: Daily (D), Seasonal (S).	Schemes on which Investigations have been made and Definite Proposals outlined: Proposed Ultimate Capacity.	Plant already installed: Normal Full-load Capacity.	Development at Present under Construction: Normal Full-load Capacity.	Power Schemes in which Detailed Investigation is either Lacking or Incomplete. (Estimate based on 50 per Cent. Load-factor.)
			SOUTH ISLAND.			
Marlborough—	Ft.		H.p.	H.p.	H.p.	H.p.
Waihopai River	100	..	1,910	1,500	..	..
Clarence River – Ericaburn	180	D	16,000	..	..	..
Nelson and Buller—						
Boulder Lake	2,600	D, S	..	..	..	22,000
Rotoiti Lake	600	D, S	..	..	..	20,000
Rotoroa Lake	465	D S	40,000	..	..	..
Inangahua River	125	..	..	..	..	8,000
Four-mile Creek	450	..	..	..	..	2,000
Cobb River	1,800	..	..	..	..	10,000
Westland—						
Lake Brunner	200	D, S	..	..	..	30,000
Kumara Water-race	330	..	..	..	..	2,400
Otira River	700	..	..	..	..	2,300
Rolleston River - Otira	700	..	..	..	..	2,000
Kanieri Lake	255	D, S	2,000	940	..	..
Toaroha River	760	..	..	..	..	10,000
Whitcombe River – Hokitika River	800	..	..	..	..	16,000
Kakapotahi River	580	..	..	..	..	4,800
Wanganui River – Hende's Ferry	580	..	..	..	..	40,000
Wataroa	700	..	..	..	..	80,000
Canterbury—						
Clarence River – Jollie's Pass	1,160	..	..	..	..	10,000
Clarence River – Conway River	1,050	..	..	..	..	20,000
Waiau-ua (Culverden)	200	..	..	..	..	20,000
Waimakariri River—						
Gorge Bridge	90	D	..	..	..	35,000
Otarama	150	D	57,000	..	..	..
Broken River	119	D	..	..	..	41,000
Esk River	180	D	..	..	..	53,000
Lake Coleridge	480	D, S	46,000	36,000	10,000	..
Acheron River	480	D, S	4,000	..	..	..
Wilberforce River	480	D, S	..	..	..	40,000
Rakaia River	30	D	..	..	..	6,000
Lake Tekapo	100	D, S	40,000	..	..	..
Lake Pukaki	50	D, S	18,000	..	..	..
Ohau River – Ohau Bridge	85	D, S	30,000	..	..	..
Otago and Southland—						
Waitaki River—						
Goosoneck	80	D, S	100,000	..	..	..
Black Jack's Point	70	D, S	90,000	..	..	..
Upper Otematata	43	D, S	55,000	..	..	..
Lower Otematata	37	D, S	50,000	..	..	..
Awakino	70	D, S	100,000	..	40,000	..
Lower Awakino	30	D, S	43,000	..	..	..
Ahuriri River – Waitaki River	300	D, S	..	..	..	15,000
Waipori	725	D, S	28,000	16,250	..	..
Lee Stream	750	..	..	..	..	1,800
Deep Stream – Taieri	900	..	..	..	..	8,400
Taieri River – Deep Stream	220	..	..	..	..	12,000
Tallaburn – Clutha River	890	..	..	..	..	2,200
Teviot River	1,685	S	22,000	1,000	..	..
Manuherekia River	350	..	..	..	..	5,800
Hawea Lake – Wanaka Lake	198	D S	80,000	..	..	..
Shotover River – Wakatipu	250	..	..	..	..	10,000
Lake Te Anau – George Sound	673	D, S	Under consideration	..	..	..
Lake Manapouri – Deep Cove	598	D, S	Under consideration	..	..	..
Lake Monowai – Waiau River	154	D, S	16,000	8,000	..	..
Lake Hauroko – Te Waewae	514	D, S	..	..	..	100,000


WAIKATO
HYDRO-ELECTRIC POWER SUPPLY
CURVE OF MAXIMUM WEEKLY LOAD
Kw.
Plant-capacity installed.
Overload
Holidays
1921
1922
1923
1924
1925
1926
1927
1928


LAKE COLERIDGE
HYDRO-ELECTRIC POWER SUPPLY
CURVES OF MAXIMUM WEEKLY LOADS
AND LAKE-LEVELS
Plant-capacity installed
Maximum capacity of present tunnel and power-house
Plant-capacity installed
Plant-capacity installed
Power-house output
Overload
Kw.
Kw.
Kw.
Kw.
Plant-capacity installed
27,000
26,000
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
11,000
10,000
8,000
6,000
5,000
4,500
4,000
3,000
2,000
1,000
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928


WAIKAREMOANA POWER-STATION
MAXIMUM WEEKLY LOAD
Kw.
Plant-capacity installed.
Apl. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apl. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apl. May June July Aug. Sept.
1926
1927
1928


MANGAHAO
HYDRO-ELECTRIC POWER SUPPLY
CURVE OF MAXIMUM WEEKLY LOAD
Kw.
19,200
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Kw.
20,000
Kw.
21,000
Overload
Overload
1928
1927
1926
1925
Plant-capacity installed, 19,200 Kw.
Kw.
19,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0

SOUTH ISLAND

NEW ZEALAND

SHOWING

POWER BOARD DISTRICTS.

Scale: 35 miles to an inch.

Reference

Cities	thus	NELSON
Provincial Centres	..	HOKITIKA
Boroughs	..	TEMUKA
Town Districts	..	CLINTON
Small Centres	..	Lyell
Railways	..	
Coach Routes	..	
Boundaries of Land Districts	..	

TASMAN SEA

Cook Strait

Tasman Bay

Golden Bay

Kaikoura Peninsula

Pegasus Bay

LAKE COLERIDGE

Banks Peninsula

Otago Peninsula

Canterbury Bight

Stewart Island

South Latitude

East Longitude

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	696,374
2	Reefton	1,850	64,476
3	Grey	12,000	614,694
4	Westland	3,272	196,268
6	Southland	66,009	15,493,548
7	Otago	24,082	4,696,448
8	Teviot	2,400	183,022
9	Otago Central	5,170	1,087,518
10	Waitaki	17,580	4,646,292
11	South Canterbury	41,618	15,483,654
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
19	Marlborough	20,780	6,728,793
21	Golden Bay	1,200	240,717
	Totals	273,927	78,710,742

POWER BOARDS PROPOSED

1	Westland outer area	18	Marchison.
5	Queenstown	20	Nelson.
17	Waiau.	21	Golden Bay extension.

Districts shown red.

NORTH ISLAND

NEW ZEALAND

SHOWING

POWER BOARD DISTRICTS.

Scale: 35 miles to an inch.

Reference

Cities	thus AUCKLAND
Provincial Centres	.. NAPIER
Boroughs	.. FEILDING
Town Districts	.. MANAIA
Small Centres	.. Tokomaru
Railways	..
Coach Routes	..
Boundaries of Land Districts	..

TASMAN SEA

POWER BOARDS FORMED.

No.	Name.	Population.	Value of Rateable Property unimproved.
3	Hobson	7,180	1,424,942
5	Waitemata ..	21,425	5,901,473
6	Auckland ..	175,000	43,469,650
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 .	12,095	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
23	Hawke's Bay ..	40,104	11,611,022
26	Wairoa .	7,712	2,639,963
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	17,512	4,630,943
	Totals	619,562	173,482,924

POWER BOARDS PROPOSED

[illegible]	[illegible]	24	Waimarino
[illegible]	[illegible]	25	East Taupo
4	Rodney	27	Poverty Bay outer districts
8	[illegible]	30	Thames Valley
11	[illegible]	31	Raglan

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	

172° 173° 174° 175° East Longitude 176° 177° 178°

APPENDIX E.

FOURTH 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 fourth annual report for presentation to Parliament through the Hon. the Minister.

Introductory.

The total expenditure by the Board for the year under review was £1,073,607. Of this amount £592,522 was expended from the Revenue Fund and £481,085 from the Construction Fund. The operations under the Revenue Fund involved the payment of subsidies on the maintenance of 6,608 miles of main highways, which length includes sections of roads in boroughs of under six thousand inhabitants, amounting to 186 miles, which were declared main highways on the 23rd February, 1928.

The following summary shows roughly the achievements in the way of construction, the figures in brackets being the lengths for the previous year: Length of highways surfaced, 256 (252) miles, made up as follows—Portland cement concrete, 6 (16) miles; bituminous concrete, nil (12 miles); bituminous macadam (penetration), 34 (38) miles; tar and bituminous surface treatment, 83 (35) miles; gravelling and metalling, 133 (151) miles. Length of highways formed and widened, 173 (174) miles; length of bridges completed, 7,760 (6,408) lin. ft. A comparison of the two sets of figures indicates a reduction in the length laid down of expensive high-class pavements and a substantial increase in the mileage of surface-treated roads.

The most important feature of the year was the passing of the Motor-spirits Taxation Act by Parliament during the session of 1927. It is estimated that the income which will be derived from this tax will exceed the total derivable from both the tire-tax and the motor-registration and annual-license fees. The three principal sources of income now available to the Board are estimated to yield approximately £1,250,000 per annum. The annual expenditure during the next few years from both Revenue and Construction Funds will show an increase from the average of the last two years of £1,100,000 to approximately £1,800,000, but it is worthy of note that despite such increase the amount to be borrowed annually will not be greater than heretofore.

As mentioned above, 186 m. of streets in boroughs were declared to be main highways on the 23rd February, 1928. This mileage represents the total continuations of main highways through boroughs under six thousand inhabitants, and up to the 23rd February the subsidy paid by the Board was in respect of maintenance only, and was based on the amount of subsidy paid to County Councils on the adjoining lengths of main highways. The declaration places the small boroughs in the same position as counties. Maintenance will in the future be subsidized on the basis of the actual expenditure, and, in addition, the boroughs will be entitled to the statutory subsidy payable on construction expenditure.

A necessary preliminary to the declaration of the continuations of the main highways through these boroughs was the inclusion of such boroughs in the highway districts. Accordingly, by resolution of 16th December, 1927, the highway districts were redefined, and were regazetted on the 26th January, 1928. A schedule showing the districts as redefined is attached to this report.

The date of expiry of annual license fees in respect of motor-vehicles was altered in the Motor-vehicles Amendment Act, 1927, from 31st March to 31st May. The result will be that in future the annual license-fees will be received during the financial year in respect of which they are paid, and the cash balance in the Treasury at the end of each year will more clearly show the true position.

Section 33 of the Finance Act (No. 2), 1927, gave the Board power to find out of the Revenue Fund such amount as may be required to pay the interest and sinking-fund charges in respect of loans raised under the authority of the Hutt Road Amendment Act, 1917; the Wellington City and Suburban Highways Construction and Hutt Road Amendment Act, 1924; and the Wellington City and Suburban Highways Construction and Hutt Road Amendment Act, 1927. In consideration of the Board's acceptance of this liability and the payment of such amounts by the Board, the same section provides that the Wellington City Council shall not collect nor receive in any year any part of the fees payable by motorists in the Wellington area under the local taxation scheme. The Board has exercised the powers conferred upon it by this section, and, as an assurance has been given to the Wellington City Council that the interest and sinking-fund charges on loans raised under the Hutt Road Acts will be paid by the Board, the tax of £2 per motor-vehicle upon motorists in the Wellington District has not this year been imposed by the Wellington City Council.

As will be seen under the report on construction, the Board is continuing its policy of closing up unmetalled sections of main highway. There are yet a number of unmetalled gaps to surface on important highways, and by the close of the next working season the Board hopes to see several of these completed.

During the year the Board made two comprehensive tours of the South Island. It is pleasing to record that during the two years which elapsed since its previous tour of this Island a very considerable improvement in the condition of the surface of the main highways has been brought about in practically every locality. This visit enabled the Board to obtain first-hand information in regard to the large number of roads which had been recommended by District Highways Councils for declaration as main highways in consequence of the introduction of the petrol-tax. In several cases the Board took the opportunity of inspecting roads, the claims of which for inclusion in the highways scheme seemed doubtful.

Personal.

In consequence of the death of Mr. P. S. Waldie, Chief Clerk of the Public Works Department, who had been a member of the Board for three years, Mr. J. J. Gibson, Accountant of the Public Works Department, was appointed to be a member of the Board on the 9th February, 1928.

Main Highways Amendment Act, 1927.

Several amendments to the Main Highways Act, 1922, were made by the passing of the Main Highways Amendment Act, 1927. Only two clauses of importance were embodied in this Act, the remainder of the sections being merely machinery clauses. One clause authorized local authorities to borrow their proportion of the cost of reconstruction of any bridge over 30 ft. span without a poll of the ratepayers, provided a resolution by the District Highways Council to the effect that the reconstruction of the bridge is necessary is confirmed by the Board. While the Board has always strongly supported the system whereby the interests of ratepayers are safeguarded by the taking of polls, it was felt that in many cases of bridge reconstruction the expenditure involved in following the statutory procedure was out of proportion to the cost and importance of the works concerned. The operation of this amendment will also expedite the rebuilding of small structures which have, through obsolescence, become a danger to the travelling public.

The second clause, to which reference has been made, was that authorizing the Board to charge the cost of experimental works to the Revenue Fund irrespective of whether the type of work would ordinarily be classified as construction or maintenance.

Declaration of New Main Highways.

In pursuance of section 11 of the Main Highways Act, 1922, the usual annual review of main highways was made. Recommendations for new highways totalling 975 m. in length were received from District Highways Councils. The following roads, of a total length of 64 m. 29 ch., were declared, while 17 m. 12 ch. were revoked.

New Main Highways.	Length. M.	ch.
No. 1 Highway District—		
Hoteo Railway-station Road	0	20
Paparoa–Maungaturoto Railway-station	6	0
No. 2 Highway District—		
Panmure–Howick	4	66
Drury–Waiuku via Pukekohe	20	30
No. 4 Highway District—		
Hick's Bay Wharf Road	1	44
No. 8 Highway District—		
Waitotara Station Road	1	40
No. 10 Highway District—		
Dreyer's Rock Road	6	0
No. 13 Highway District—		
Christchurch–Blenheim Main Highway (alteration in route)	0	48
No. 14 Highway District—		
Christchurch - Governor's Bay via Dyer's Pass	4	0
No. 16 Highway District—		
Cromwell - Hawea Flat (alteration in route)	0	20
No. 17 Highway District—		
Dunedin–Portobello (low road)	10	16
Dunedin–Portobello (high road)	8	65
	64	29

Main Highways revoked.		
No. 2 Highway District—		
Auckland–Helensville	1	55
No. 4 Highway District—		
Rotokautuku Bridge - Tikitiki via right bank Waiapu River	9	66
No. 5 Highway District—		
Napier–Wellington Main Highway (section in Waipawa Borough)	0	31
No. 12 Highway District—		
Westport–Nelson (Westport–Te Kuha)	5	20
	17	12

In addition to the above, 185 m. 41 ch. of the continuations of main highways through boroughs of a population of less than six thousand inhabitants were declared to be main highways. The mileages in the various boroughs are shown hereunder. These declarations, together with the above, brought the total length of main highways in the Dominion at the 31st March, 1928, to 6,608 m. 11 ch.

	M.	ch.
No. 1 Highway District—		
Birkenhead Borough	1	60
Dargaville Borough	3	10
	4	70
No. 2 Highway District—		
Otahuhu Borough	1	47
Ngaruawahia Borough	1	77
Te Awamutu Borough	2	56
Cambridge	2	3
Paeroa	3	60
Waihi	2	77
Thames	4	4
Morrinsville	1	47
Pukekohe	1	47
Te Aroha	2	18
	24	36
No. 3 Highway District—		
Tauranga	4	14
Whakatane	2	36
Opotiki	1	42
Rotorua	4	64
	12	76
No. 5 Highway District—		
Wairoa	2	30
Waipawa	3	31
Waipukurau	1	57
Dannevirke	2	62
Woodville	2	34
	12	54
No. 6 Highway District—		
Taumarunui	3	37
Te Kuiti	2	60
	6	17
No. 7 Highway District—		
Waitara	2	15
Inglewood	2	3
Stratford	3	71
Eltham	3	71
Hawera	3	32
	15	32
No. 8 Highway District—		
Patea	1	51
Taihape	1	55
Ohakune	5	12
Raetihi	1	63
	10	21
No. 9 Highway District—		
Otaki	0	40
Levin	2	21
Foxton	2	68
Feilding	6	43
Shannon	1	57
	13	69

	M.	ch.
No. 10 Highway District—		
Featherston	2	31
Greytown	2	28
Carterton	2	43
Eketahuna	1	76
Pahiatua	1	42
	10	60
No. 11 Highway District—		
Picton	1	32
Blenheim	2	45
Richmond	2	35
Motueka	4	44
	10	76
No. 12 Highway District—		
Westport	1	29
Brunner	4	32
Greymouth	2	75
Kumara	1	0
Hokitika	1	54
Ross	2	24
	13	54
No. 14 Highway District—		
Rangiora	2	55
Kaiapoi	1	24
Riccarton	1	25
Lyttelton	2	63
Akaroa	0	70
	8	77
No. 15 Highway District—		
Ashburton	1	58
Geraldine	2	52
Temuka	0	60
Hampden	1	20
Waimate	1	60
	8	10
No. 16 Highway District—		
Waikouaiti	1	41
Palmerston	1	78
Cromwell	1	32
Queenstown	0	70
Arrowtown	2	59
Alexandra	1	4
	9	44
No. 17 Highway District—		
Milton	0	77
Balclutha	1	49
Mosgiel	1	63
Tapanui	0	21
Lawrence	1	35
Roxburgh	1	64
	7	69
No. 18 Highway District—		
Mataura	2	45
Gore	3	40
South Invercargill	4	42
Bluff	2	63
Winton	1	46
	14	76
Total	185	41

Declaration of New Government Roads.

During the year a number of new Government roads, as under, were declared involving a length of 87 m. 39 ch., while 5 m. 20 ch. were revoked, making the total mileage of Government roads at 31st March, 1928, 1,637 m. 18 ch.

	M.	ch.
No. 1 Highway District—		
Whangaroa–Okaihau	4	0
Auckland–Wainui	13	0
No. 2 Highway District—		
Thames–Coromandel	12	66
No. 6 Highway District—		
Stratford–Taumarunui	18	70
Piopio–Tatu via Aria and Ohura	11	40
No. 14 Highway District—		
Christchurch–Dunedin	20	0
No. 16 Highway District—		
Dunedin–Christchurch	6	40
No. 17 Highway District—		
Clarksville–Clyde	0	63
	87	39

The declaration of the following section of Government road was revoked: No. 12 Highway District—Westport–Nelson (Westport - Te Kuha), 5 m. 20 ch.

The Board feels that it is desirable to point out that the declaration of these main highways as Government roads does not relieve local authorities of all responsibility in connection with their construction and maintenance. The act of declaring them Government roads allows the Board to pay more than the statutory subsidy for the time being in force, the rate of subsidy being fixed by the Board in accordance with the merits of each case. It is only in most exceptional cases that the Board provides the whole of the expenditure.

Finance.

The actual contributions to the Board's Revenue Fund from external sources for the year 1927–28 amounted to £688,980, including an amount of £130,461, representing the first proceeds from motor-spirits taxation, which was imposed by Parliament after the presentation of last year's report. The excess of the actual income over the estimate given in the third annual report is almost wholly accounted for by a substantial increase in the Customs duties on tires and tubes. The following tabulation shows the details of the revenue of the Board from external sources for the past three years. Special attention is drawn to the extraordinary variations in the receipts from the Customs duties on tires and tubes:—

	1927–28. £	1926–27. £	1925–26. £
Transfer from Consolidated Fund	35,000	35,000	35,000
Proceeds of tax on tires and tubes, collected through the Customs Department	219,658	188,450	223,699
Registration and license-fees of motor-vehicles	303,861	283,963	78,038
Motor-spirits tax	130,461	..	..
	£688,980	£507,413	£336,737

For the year ended 31st March, 1928, the appropriations and expenditure under the Revenue Fund were as follows:—

	Available for Authorization.	Appropriated.	Expenditure.	Percentage of Expenditure to Appropriations.
	£	£	£	
North Island	448,552	421,370	346,962	82·34
South Island	237,065	222,437	176,619	79·40
Administration charges	28,000	28,000	22,583	80·65
Commission paid to Postal Department for collection of motor registration and license fees	15,000	15,000	12,022	80·14
Miscellaneous payments, including recoupment of interest on loans to Consolidated Fund	40,000	40,000	34,336	85·84
Totals	768,617	726,807	592,522	81·52

The most important feature in connection with expenditure from the Board's Revenue Fund is that the cost of maintenance of the highway system has not continued to increase at the same extraordinary rate as it did during the first three years of the Board's activities. A graph shown later in this report

in the section dealing with maintenance clearly indicates the position. There are probably two reasons for this development. The first reason, and in the Board's opinion the principal reason, is that during the first three years of the Board's operations a great deal of the highway maintenance was really long-deferred work, due to the inability of the local authorities to provide sufficient funds from their own revenue to enable them to cope with the damage inflicted upon the roads by the increased motor traffic. Secondly, the importation of motor-vehicles has fallen during the year under review, and consequently the increase in traffic on the roads as compared with the increase of the previous two years was not so great (see graph).

An analysis of the Board's expenditure and the expenditure by local authorities on actual maintenance, as distinct from interest on loans and other overhead charges, is shown in the tabulation below :—

—	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage Board's Contribution to Total.	Percentage Local Authorities' Contribution to Total.
	£	£	£		
North Island	346,962	188,142	535,104	64·84	35·16
South Island	176,619	80,923	257,542	68·58	31·42
Totals	523,581	269,065	792,646	66·05	33·95

It is interesting to point out that, although the local authorities in their estimates submitted for maintenance for the year under review indicated their willingness to find a substantially larger sum than for the previous year, their contribution actually dropped from £276,349 to £269,065. It would appear, therefore, that the sum of about £270,000 per annum represents as much as the local authorities can reasonably find towards the cost of maintenance of the primary highway system.

It will also be noted from the above table that the total sum found by the Board on maintenance, as compared with the sum found by the local authorities is almost exactly in the ratio of £2 for £1 whereas during the previous year the ratio was £1·59 to £1. The increase is largely due to the fact that the year under review was the first complete year during which the Board's basic subsidy of £1 10s. for £1 for maintenance obtained throughout. Again, the above figures indicate that the Board is finding a greater percentage of the cost of maintenance of the main highways of the South Island than it is finding in the case of the North Island, the respective proportions being £2·18 to £1 and £1·84 to £1.

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, 1928, gives the following results, expressed in percentages of the Dominion totals :—

	Per Cent.
North Island—	
Maintenance expenditure	67·51
Motor-vehicles	62·19
South Island—	
Maintenance expenditure	32·49
Motor-vehicles	37·81

As in the case of the previous two years, there is again a balance of expenditure in favour of the North Island to the extent of 5 per cent. This figure merely indicates that the accumulated Revenue Fund to the credit of the South Island is increasing at a slightly greater rate than in the case of the North 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 collected for the year ending 31st March, 1928, was made between the two Islands in proportion to the number of motor-vehicles registered in each Island on that date. In making this apportionment the interest on moneys borrowed for construction work in each Island has been charged against the allocation to each Island, and other adjustments in connection with interest on accumulated balances have been made. The balances to the credit of the North Island and South Island respectively on 31st March, 1928, were £277,951 and £362,472. The following statement shows the manner in which these balances have been obtained :—

NORTH ISLAND.

	£	s.	d.		£	s.	d.
Expenditure (general)	346,961	15	8	Balance at 1st April, 1927	317,823	3	3
Abolition of toll-gates	1,807	0	0	Interest from investments—			
Interest and expenses of raising loans, &c.	25,231	4	1	Construction Fund	2,047	19	1
Commission on collection of motor fees	7,476	10	6	Revenue Fund	14,337	17	0
Miscellaneous expenditure	16,758	14	3	Motor Registration—Annual license fees			
Balance	277,950	14	6	and tire-tax	325,576	19	8
				Rent of and tolls from ferries ..	300	0	0
				Transfer from Consolidated Fund ..	16,100	0	0
	£676,185	19	0		£676,185	19	0

	£ s. d.		£ s. d.
Outstanding liability for sinking fund ..	51,251 0 0	Balance brought down	277,950 14 6
Amount expended on construction (see explanation below)	181,605 0 0		
Net balance	45,094 14 6		
	£277,950 14 6		£277,950 14 6

SOUTH ISLAND.

	£ s. d.		£ s. d.
Expenditure (general)	176,618 13 8	Balance at 1st April, 1927	324,920 0 3
Interest and expenses of raising loans, &c.	4,591 16 8	Interest from investments—	
Commission on collection motor fees ..	4,545 11 0	Consolidated Fund	338 8 1
Miscellaneous expenditure	8,530 18 5	Revenue Fund	14,658 0 4
Balance	362,472 5 10	Motor Registration—Annual license fees and tire-tax	197,942 16 11
		Transfer from Consolidated Fund ..	18,900 0 0
	£556,759 5 7		£556,759 5 7

	£ s. d.		£ s. d.
Outstanding liability for sinking fund ..	8,697 0 0	Balance brought down	362,472 5 10
Amount expended on construction (see explanation below)	30,011 0 0		
Net balance	323,764 5 10		
	£362,472 5 10		£362,472 5 10

It is expressly pointed out that the total of the above two balances does not represent the total accumulated fund to the credit of the Revenue Account at the 31st March, 1928, the difference being the sum of £130,461, representing the proceeds from motor-spirits taxation collected up to the end of the financial year.

As explained in detail in the previous year's report, in view of the fact that the Government loan schedule did not, in terms of section 12 of the Main Highways Act, 1922, provide any loan-moneys for the Board's use for the financial year 1927–28, it was found necessary during the year to exercise the powers contained in subsection (2) of section 15 of the original Act. The section in question gives the Board authority to transfer moneys not required for the Revenue Fund to the Construction Fund, and accordingly the sum of £300,000 was transferred. In some quarters this transfer was regarded with suspicion, particularly in view of the fact that in the original Main Highways Act there was no provision for the reimbursement to the Revenue Fund of moneys so transferred; but a provisional arrangement was made by the Board with the Minister of Finance that this sum be transferred temporarily only, and that it be returned to the Revenue Fund when required. To enable this arrangement to be carried out a machinery clause was inserted in the Main Highways Amendment Act, 1927. In this connection also, as explained in last year's report, in order to retain the allocation of the revenue from tire-tax and annual-license fees between the two Islands in terms of section 21 of the original Act, the following resolution was passed by the Board: "That the moneys temporarily transferred from the Revenue Fund to the Construction Fund shall be allocated according to their use between the North and South Islands on the basis now in force in regard to the distribution of revenue funds received from motor-taxation."

Of the £300,000 transferred, a sum of £211,616 has been actually expended on construction, the amounts in each Island being as follows: North, £181,605; South, £30,011. When this £300,000 is retransferred the foregoing sums will be refunded to the respective Island accounts.

When the outstanding liability for sinking fund has also been provided for, it will be seen that the net balances actually in the Board's hands are as follows: North Island, £45,095; South Island, £323,764. There have been numerous references in the press during the past few months to the Board's accumulated revenue of approximately £1,000,000. When the proceeds of the petrol-tax to 31st March, 1928, are added to the above net balance it will be found that the sum in the Board's hands which had not been spent on roadwork at 31st March amounted to under £500,000, the greater part of which is to the credit of the South Island.

For the year ended 31st March, 1928, the appropriations and expenditure under the Construction Fund were as follows:—

——	Available for Authorization.	Appropriated.	Expenditure.	Percentage of Expenditure to Appropriation.
	£	£	£	
North Island	527,512	483,405	362,261	74·94
South Island	174,692	160,095	87,643	54·74
Administration charges and compensation for accidents to workmen	31,500	31,500	31,181	98·99
Totals	733,704	675,000	481,085	71·27

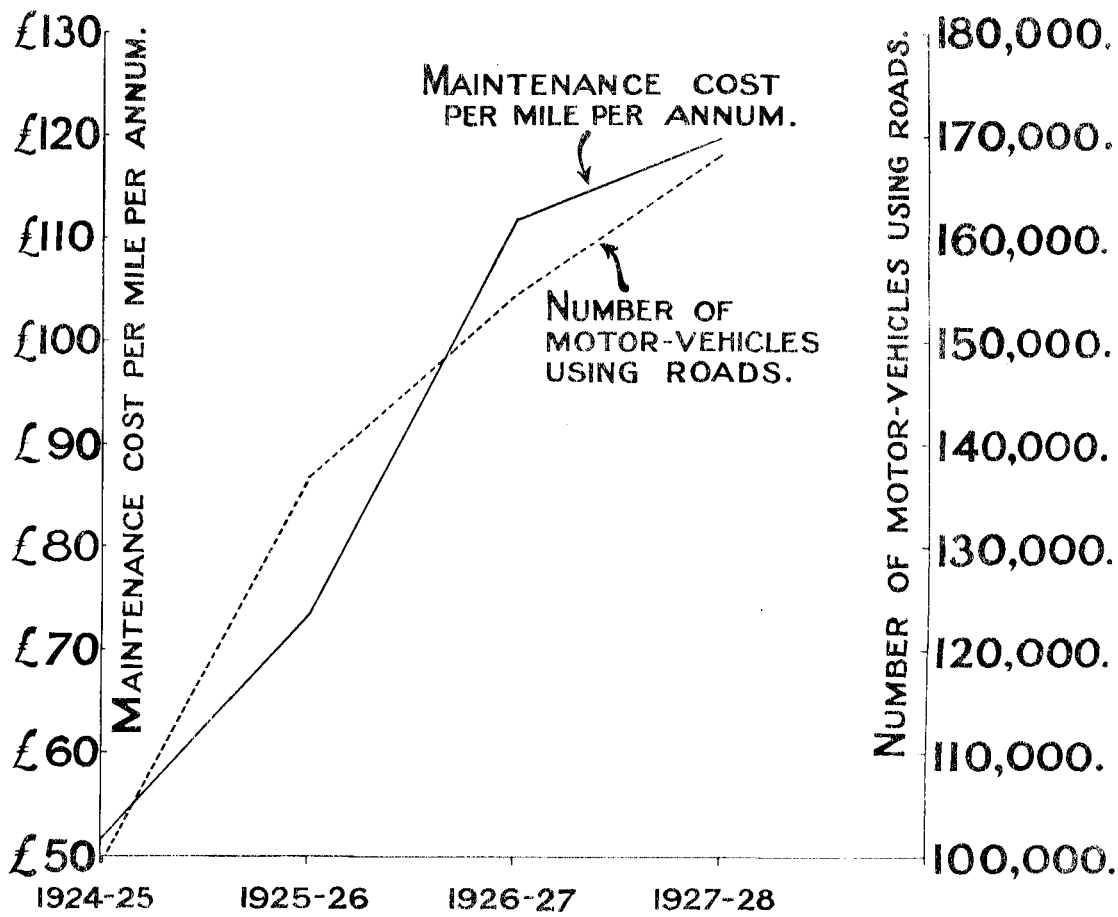
An analysis of the Board's expenditure and the expenditure by local authorities under the Construction Fund shows the following position :—

—	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	£	£	£		
North Island	362,261	224,670	586,931	61·72	38·28
South Island	87,643	37,868	125,511	69·83	30·17
Totals	449,904	262,538	712,442	63·15	36·85

The most interesting point with regard to the construction expenditure is that the total amount found by the local authorities in the North Island during the past year is almost identical with the total for the previous year, the figures being £224,670 and £225,042 respectively, while the corresponding figures for the South Island are £37,868 and £30,818. The latter figures indicate very little greater willingness on the part of the local authorities in the South Island to take advantage of the Board's subsidies for construction purposes.

Maintenance.

It is again gratifying to record that the local authorities of the Dominion have in the vast majority of cases heartily co-operated in securing better maintenance of the highway system. It is also pleasing to record that the local authorities are continuing to purchase, chiefly with the aid of the Board, considerable quantities of up-to-date maintenance machinery. The average cost of maintenance per mile per annum during the past four years is as follows : 1924–25, £51·7 per mile ; 1925–26, £73·2 per mile ; 1926–27, £111·9 per mile ; 1927–28, £119·9 per mile. The diagram below shows the information in graphical form, and also shows the total number of motor-vehicles in use in each year. It is evident that maintenance expenditure per mile is stabilizing to some extent, and this, no doubt, has in great measure been brought about by the adoption of better methods and the use of suitable maintenance plant, and to a certain degree as the indirect result of the mileage of high-class pavements already laid down.



Graph showing the Relationship between the Annual Cost of Maintenance per Mile of the Main Highway System and the Actual Number of Motor-vehicles using the Roads of the Dominion from 1924 to 1928.

Construction.

Good progress has been made during the year with the construction programme. The accomplishments, however, were not so spectacular, perhaps, as in previous years. The Board has continued its policy of concentrating on the closing up of unmetalled gaps in the main-highway system, although, as reported last year, several schemes involving work of this nature have been temporarily retarded by the unwillingness of the local authorities to find their proportion of the cost. The additional finance which will be available to the Board during the forthcoming year, however, will assist very largely in completing the gaps which still exist in the system, and the anticipated achievements are likely to be particularly gratifying to the travelling public.

The most important connections made during the past year have been the completion of the surfacing on the Pokeno–Waihi Main Highway between Waikato and Hauraki Plains Districts, the provision of metalled access between Kaitaia and the rail-head at Okaihau, and the partial completion of the surfacing of the Mamaku Bush section, between Hamilton and Rotorua. The last work was not quite completed by the end of the financial year, but immediately thereafter vigorous steps were taken to secure all-the-year-round access for the thermal district. This objective, at the time of writing has been accomplished.

During the year a number of large bridges were completed. The most important of these structures was the Waihou River Bridge at Kopu, on the Pokeno–Waihi Junction to Coromandel Main Highway. This bridge consists of plate-girder spans and reinforced-concrete decking with bituminous-concrete top. Its length is 1,520 ft., and an electrically-operated swing span has been provided for navigational purposes. The bridge was completed by the Public Works Department in a comparatively short time. The structure was actually opened on the 11th May, 1928. The swing span functions perfectly, and is a credit to the designing staff of the Public Works Department. The completion of the bridge has given great satisfaction to the inhabitants of the district and to the travelling public generally, as it replaces a ferry service which of late years has often proved inadequate to deal with the traffic offering.

Another very important structure completed and opened during the year was the Mokau River Bridge, on the Auckland–Wellington Main Highway. The erection of this bridge eliminated the last ferry on the primary highway system of the Dominion. It is 660 ft. in length, and is constructed of plate girders with reinforced-concrete decking, on which has been laid a bituminous concrete carpet. The bridge contains a lifting span for navigational purposes. The mechanism of the lifting span may be operated either by oil-engine or by hand, and functions perfectly. Since being opened the bridge has been very highly appreciated by the travelling public.

On the Gisborne–Whakatane via Motu Main Highway the Waioeka River Bridge was completed and opened to traffic. This bridge, which is constructed of reinforced concrete throughout, consists of twenty-five 40 ft. spans, and has a deck 18 ft. in width and a footpath 4 ft. in width.

Another important bridge which was almost completed by the end of the financial year is the Manawatu River Bridge on the Foxton–Shannon Main Highway. This structure consists of twelve 60 ft. plate-girder spans on pile piers.

Two other important bridges in the North Island were completed in reinforced concrete—namely, the Mangatainoka Bridge, consisting of six 40 ft. spans, and the Ngaturi Bridge, consisting of two 60 ft. spans and three 30 ft. spans—the former on the Wellington–Napier Main Highway, and the latter on the Pahiatua–Pongaroa Main Highway.

In the South Island the most important structure erected during the year was the Selwyn River Bridge. This bridge consists of thirty-five 30 ft. spans, and is built of reinforced concrete throughout. It provides a roadway 18 ft. in width.

On the Pukeuri–Kurow Main Highway the Otiake River Bridge was completed. This structure is a light-traffic bridge 640 ft. in length.

During the forthcoming year three important bridges in the South Island will probably be commenced—the Hurunui Bridge, on the Christchurch–Blenheim Main Highway, and the Pareora and Ashburton Bridges, on the Christchurch–Dunedin Main Highway.

As a result of the imposition of the petrol-tax, there will be greatly increased activity during the coming working season on construction work throughout the country, particularly on paving-work on the more heavily trafficked portions of the main-highway system.

Before the end of the financial year a paving scheme for the area immediately surrounding Christchurch City was embarked upon.

Alternative tenders for Portland cement and bituminous concrete surfacing were called for a section of the Christchurch–Blenheim Main Highway, and a tender for the former class of work was accepted.

The Board was in a position to make an early start with the scheme around Christchurch because of the large amount of preliminary investigation which had been carried out by a local voluntary committee organized by the Canterbury Progress League and consisting of representatives of the interested local authorities and the local Automobile Association.

For some considerable time, the necessity for urgent reconstruction and paving-work in the vicinity of the City of Dunedin has been apparent, but serious difficulty has been experienced in obtaining the co-operation of local authorities concerned in the manner intended and anticipated by the original highway legislation. A satisfactory arrangement, however, has at last been arrived at between the Board and the Taieri County Council, which controls the first 16 miles of the Dunedin–Invercargill Main Highway immediately south of Dunedin. As a result of this arrangement the Board will proceed vigorously with the reconstruction of the section during the present year. Similar negotiations have been in train for some considerable time between the Board and the Waikouaiti County Council, which controls the section of the Dunedin–Christchurch Main Highway immediately north of Dunedin, but up to the time of writing this report it is regretted that no satisfactory arrangement has been arrived at.

During the forthcoming year it is also hoped to make several important connections in the highway system which have seriously inconvenienced the travelling public for many years. In particular, preparations are in hand to provide all-weather access between Gisborne and Opotiki via Motu by the surfacing of the unmetalled section of 6 miles. It is also hoped to complete the surfacing between the Ohakune district and the southern part of the North Island. In addition, if weather conditions permit vigorous construction work during the summer, it is anticipated that light motor traffic will be able to traverse the whole length of the main highway from Te Kuiti to Bulls via Taumarunui during next winter.

In regard to standards of construction, very satisfactory progress has been made during the year under review. Local authorities are now appreciating the necessity for the requirements of the Board, particularly as regards improved alignment and visibility. The increasing traffic, and the increased speed of that traffic, require frequent modification of these standards, and in approving proposals an endeavour is made to anticipate in a reasonable manner the requirements of the future.

Motor-spirits Taxation Act, 1927.

During the last session of Parliament the Motor-spirits Taxation Act, 1927, was passed. This Act, which provides for the imposition of a Customs duty of 4d. per gallon on motor-spirits imported into New Zealand, will have a very far-reaching effect on the policy and activities of the Main Highways Board. The tax is estimated to produce a total net sum of approximately £720,000 per annum, there being provision in the statute for exemptions for certain users of motor-spirits whose activities do not involve the use of roads. The Act provides that after deducting the expenses of administration and the amount of any refunds or drawbacks on duty the residue shall be apportioned as follows:—

(*a*) Ninety-two per cent. thereof shall be paid into the Revenue Fund of the Main Highways Account under the Main Highways Act, 1922;

(*b*) The balance shall be apportioned among those Borough Councils in whose districts there is a population of six thousand or upwards, in amounts bearing to each other approximately the same proportions as exist for the time being between the populations of the several boroughs.

As shown in the earlier part of this report, a sum of £13[illegible],461 was paid into the Main Highways Revenue Account under the provision contained in paragraph (*a*) above. At the 31st March, 1928, a sum of £10,200 was distributed among the several borough councils in whose districts there is a population of six thousand or upwards. Although the 8 per cent. payable to Borough Councils does not pass through the Main Highways Revenue Account, the staff of the Main Highways Board assists in the administration work in connection with its distribution.

Brief reference is made hereunder to the more important factors which brought about the introduction of the petrol-tax. As was mentioned in last year's report, it was anticipated that there would be a further large increase in the cost of maintenance, and as a result of this the expenditure would exceed the revenue by a substantial amount. Also, during the past two or three years the Board's attention had been drawn to a considerable mileage of road which, although not in the main-highways system, nevertheless was carrying a large amount of motor traffic. While recognizing the claims of many such roads, the Board did not, in view of its financial position, feel justified in recommending their declaration as main highways.

Another significant fact was that during 1927 the motorists and local authorities in a number of individual districts were making preparations for the promotion of local roading schemes involving the imposition of special local taxation on motorists. These were, in the most part, inspired by the results which followed the formation of the Wellington City and Suburban Highways Board, which in 1924 was given statutory power to impose a tax of £1 10s. per motor-vehicle on all vehicles within a specified area, and in 1927 was authorized by Parliament to increase the annual payment to £2 per motor-vehicle. While the disadvantages of one such scheme were not so apparent, nevertheless the multiplication thereof would unquestionably have brought about considerable dissatisfaction amongst those called upon to pay the special taxes; and, moreover, the possible variations in the rates of the taxes required in the different localities would undoubtedly have aggravated the position.

It was considered advisable by the Government to adhere to the fundamental principle in modern highway administration, that the national authority should impose and control all motor-taxation levied for the specific purpose of road-improvement. Although the schemes for local taxation were superseded by the national legislation, nevertheless the fact that quite a number of local schemes were being considered pointed to the necessity of the motorists assisting to a greater extent than in the past towards the cost of the construction of higher-type pavements adjacent to the larger centres of population, which construction was the primary object of practically all the local schemes above mentioned. It was obvious, therefore, that sufficient finance should be available from the national taxation to enable these desirable works to be undertaken without unduly burdening the local authorities through whose areas the most heavily trafficked roads pass.

In the three years during which the Board has been in operation, its notice has been continually drawn to the difficulties with which the smaller boroughs had to contend in endeavouring to maintain the continuations of the main arterial roads through their areas. Consequently, when it was decided to impose additional motor-taxation, provision was made to enable the smaller boroughs to participate to a greater extent in the benefits provided under the main-highways scheme.

Immediately upon the passing of the Motor-spirits Taxation Act the Main Highways Board took steps to remould its policy and enlarge its activities with the object of giving immediate effect to the intentions of the legislation.

The continuations of all main highways through boroughs of a population of under six thousand inhabitants were declared to be main highways on the 23rd February, 1928.

Early in the year 1928 all District Highways Councils were asked to make recommendations for the declaration of an additional length of main highways equivalent to approximately 50 per cent. of the existing system. In response to this request District Highways Councils recommended a total of 4,342 m. of road, of which 2,809 m. were declared to be main highways on the 2nd April, 1928, while a further 747 m. were declared on the 2nd July, 1928, making a total of 3,556 m. of additional main highways. Thus at the time of writing this report the total mileage of main highways in the Dominion exceeds 10,000 m. In deciding upon the new declarations the main object kept in view was to afford relief to the local authorities towards the cost of maintenance rather than to extend the advantages of the Board's construction subsidy.

With regard to the construction of high-class pavements adjacent to the larger centres of population, the Board has taken the initiative and has prepared paving schemes covering the ensuing five years in the areas adjacent to all centres of population of over six thousand inhabitants. In framing these schemes the Board in most cases has consulted with the District Highways Councils and the local Automobile Associations. The additional finance provided by the petrol-tax will enable the Board to increase its construction subsidy on practically all such schemes to £3 for £1. At the end of the financial year initial steps had already been taken for the commencement of paving-work in several localities.

A comprehensive review of the Board's finance, taking into full consideration the proceeds of the petrol-tax, together with the fact that a number of local authorities are carrying too great a share of the cost of maintenance of the highway system, has induced the Board to recommend to the Government legislative provision for an increase in the maintenance subsidy of £1 10s. for £1 to £2 for £1, and that such increased rate of subsidy be made retrospective to the 1st April, 1928. In addition, the Board has often been impressed with the difficulties experienced by many local authorities in financing the reconstruction of bridges. It has therefore recommended that power be given to enable its subsidy towards the cost of construction or reconstruction of bridges to be increased to £2 for £1 on bridges not exceeding £10,000 in cost, instead of the present subsidy of £1 for £1 up to this figure. In the case of bridges costing more than £10,000 it is proposed that the Board be given discretion to pay such a rate of subsidy as it may consider justified in the circumstances.

In connection with the additional 3,556 m. of new main highway referred to above, it was not intended to allocate funds for construction purposes, but, as the Public Works Department on many of the roads in question was providing subsidies for construction purposes before their declaration as main highways, the Board has decided to continue to subsidize such work as would in the ordinary course of events be subsidized by the Department.

While the Board's desire is to have all its funds expended on road works as expeditiously as it can, it is more than possible that there will be a considerable accumulation of funds at the close of the financial year ending 31st March, 1929. This will be due to the fact that the large paving schemes and other construction work rendered possible by the petrol-tax could not commence contemporaneously with the collection of such tax. The schemes had to be formulated, submitted to the District Councils, and thereafter to the local bodies. These negotiations all take time, and, after settlement of conditions, plans and specifications have to be prepared and approved, and the local bodies in many cases have to take polls and raise loans for their contributions.

Though the Board is expediting the consummation of the schemes as fast as possible, it is clear that some will not be in full swing before the end of the year. But in the years following it is anticipated that the accumulation will be rapidly eliminated. Moreover, the estimates are for a five-years programme, but if it is found that funds permit, the Board will be in a position, as the schemes are in order to proceed, to speed up the operations according to the state of its finances. It is clear that, as the whole of the Board's estimates are based on receipts over a period of years, and include any temporary accumulations, these accumulations cannot be devoted to any other purpose without upsetting entirely the programme laid down by the Board and disorganizing the whole system.

Purchase of Plant.

The policy of purchasing and hiring plant on the hire-purchase system to local authorities has been continued. The total value of plant on hire-purchase at 31st March, 1928, amounted to £75,707. The following statement shows the plant ordered and hired to local authorities from the 31st March, 1927, to the 31st March, 1928, the amount involved being £24,502: Power graders, 12; ordinary road-graders, 6; motor-lorries, 3; trailer, 1; crushers, 7; elevators, 3; tractors, 10; granulator, 1; oil-engine, 1; bitumen-sprayer, 1; preheater, 1; rotary screens, 2; electric motors, 2; drag-line excavator, 1; &c.

In addition to the above, the Board purchased the following plant for its own use at a total cost of £8,080: Power graders, 4; ordinary road-graders, 4; road-rollers, 2; motor-lorries, 2; crusher, 1; elevator, 1; excavator, 1; scarifier, 1; tractors, 2; and trailers, 4.

Elimination of Level Crossings.

The elimination of the following crossing was completed:—

Auckland–Wellington via Taranaki Main Highway: Crossing at Turakina.

The following eliminations were almost completed at the end of the financial year:—

Wellington–Napier via Wairarapa: Crossing at Matahiwi Hill.

Christchurch–Blenheim via Parnassus: Crossing at Weka Pass.

The following eliminations are under way:—

Wellington–Napier via Wairarapa: Crossing at Piripiri.

Auckland–Wellington via Taranaki: Crossing at Hawera.

Dunedin–Christchurch: Crossing at Tumai.

Plans have been prepared for the elimination of the crossings at Porirua and Paraparaumu on the Auckland–Wellington via Taranaki Main Highway, and it is hoped to have these under construction during the forthcoming year. A further tentative programme of eliminations has been gone into with the Railway Department, and surveys and investigations are in hand for a further five schemes.

Road-signs.

During the year the Public Works Department, under the Motor Vehicles Act, 1924, brought out regulations for cautionary signs on all roads. The Main Highways Board has decided to subsidize the cost of such signs on main highways on the basis for the time being in force for general maintenance, and has also decided to increase the subsidy on direction-signs to the same rate.

Testing of Highway Materials.

The Petrological Laboratory has continued to carry out the standard tests on roadmaking materials. Table 6A shows the tests carried out during the year on rocks, while Table 6B shows results of abrasion tests carried out on a number of samples of gravel from different parts of the Dominion. The testing of samples of tar, bitumen, and bituminous concrete was carried out as usual by the Dominion Analyst, Wellington.

Experimental Work.

During the year two special sections of experimental road were laid down—one on the Christchurch–Dunedin Main Highway a few miles south of Christchurch, and the other on the Napier–Taupo Main Highway a few miles south of Taupo Township. The former section was laid down in several classes of bituminous concrete manufactured from a variety of aggregates. The coarse aggregates used were uncrushed shingle, partially crushed shingle, and crushed quarry-stone. The second experiment consisted of the construction of approximately half a mile of oil-treated pumice road. The method used was that known in America as the "oil-mix method." Very interesting results were obtained, and it is proposed during the forthcoming year to carry out several miles of similar work on pumice roads. In addition to the above, short lengths of road have been treated with calcium chloride and with various classes of bituminous materials for the purpose of ascertaining their behaviour under traffic.

Examination of Foremen and Overseers employed on Road Construction.

The third examination of foremen and overseers for the purpose of issuing certificates of competency was held on the 28th February, 1928. Fifty-two candidates sat for the examination, out of which six obtained a complete pass, seven completed the examination, and five obtained a partial pass. Certificates have now been issued to the following successful candidates: P. S. Finlayson, W. J. Hawkes, O. G. Hewison, J. H. Kendall, B. L. Larson, R. M. Lankshear, J. G. Mahood, O. R. Marshall, F. F. Maynard, J. G. McIvor, F. Muggeridge, H. J. L. Wotten, S. Annabell, J. W. Bean, H. V. Bond, D. E. Brown, F. Hermans, H. N. McDonald, J. V. Neill, L. Oldham, R. B. Price, S. G. H. Robinson, S. G. Stockley, J. Stringer, J. A. Williams.

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, 1928:—

Whangaroa–Okaihau.—Whangaroa–Kaeo Concrete Bridge Section: Several very dangerous corners have been widened on this section.

Waiare Junction to County Boundary: 46 ch. of formation has been completed and 9 ch. of road metalled.

Kawakawa–Mangamuka.—Rangiahua–Mangamuka: The whole length of 6½ m. of deviations has now been completed. The bottom course of limestone was also laid and completely rolled during the year. In addition, approximately 1 m. of gravelling was carried out. The completion of this work provided for the first time a metalled connection between Kaitaia and the rail-head at Okaihau.

Mangamuka – Te Karae.—57 ch. of this road has been formed, and 3 m. 57 ch. of bottom course has been laid and rolled.

Kohukohu – Te Karae.—2 m. 50 ch. of this main highway has been formed, and 2 m. completely metalled and rolled. The top coat of shingle has also been placed.

Waimamaku–Ohaeawai.—Taheke Deviation: On this deviation the Mangatoa Bridge has been completed and 91 ch. of new formation metalled throughout.

Hokianga County Section: A length of 2 m. at Waima has been given a top course of metal.

No. 3 Bridge, in the Pakanae Gorge, has been finished.

Kaikohe–Omapere.—1 m. of road has been formed by relief workers.

Maungatapere–Kaikohe.—Poroti–Parakao: The whole length of this section has now received its final coat of shingle.

Whangarei–Kawakawa.—Whakapara Bridge: This new bridge, consisting of three 40 ft. spans, has been completed.

Akerama–Waiomio: All the formation work on the unmetalled length in the Bay of Islands County, a distance of 6½ m., has been completed, including the erection of three bridges.

Dargaville–Maungaturoto.—Hardie's Bridge: This bridge, consisting of five 40 ft. spans, and its approaches have been completed.

Kaiwaka–Mangawai.—Approximately ½ m. of this road has been metalled during the year.

Wayby–Maungaturoto.—Mainene Bridge: This bridge, consisting of two 40 ft. spans, and its approaches have been completed.

Breakneck Valley Bridge: This bridge and its approaches have been completed.

Kaiwaka–Maungaturoto: 16 ch. of this road has been surfaced with limestone.

Warkworth – Kaipara Flats.—30 ch. of wearing-course has been placed.

Waiwera–Mangawai.—Tomorata–Mangawai: A length of 65 ch. of this road has been metalled, connecting up Tomorata and Mangawai.

Helensville–Waiwera.—Upper Waiwera – Waiwera: On this length considerable work has been done and very great improvements made; ½ m. of gravelling has been carried out.

Auckland–Wainui, via Birkenhead.—Birkenhead–Albany: The re-formation, widening, and metalling work of this section have proceeded very slowly. The work was originally let by contract, and after protracted negotiations, extending for a period of six months, the contract was determined. Better progress has since been made with the work: 3½ m. of base-course metalling has been completed and the formation is now well forward.

Albany – Dairy Flat: The final length of unmetalled road on the south side of Dairy Bridge and beyond Dairy Bridge to Massey Road Junction was completely surfaced. The metalling of this length provides an all-weather route between Auckland and Silverdale.

Kumeu–Albany.—The section of main highway between Sunnyside Flat and Pukeatua Junction has been surfaced with gravel.

Auckland–Helensville.—Waitakere Section: The remaining gap of unmetalled road has now been surfaced, thus making a connection along this highway between Auckland and Helensville.

Great South Road.—Auckland–Papakura: The concrete pavement between Auckland and Papakura was completed, except for 26 ch. at various bridges. The length constructed during the year was 5 m. 12 ch.

Bombay Hills Deviation: The earthwork and culverting of this deviation was completed, and the road opened for summer traffic.

Mercer Town District Section: Raising and widening of the road on this section was commenced during the year, and good progress has been made.

Rangiriri Hills Section: A length of 3 m. 23 ch. of bituminous sealing was completed.

Pokeno–Waihi.—Maramaru Deviation: This deviation, 1 m. 27 ch. in length, was formed and metalled.

Pekapeka Road: A length of 2 m. 70 ch. of this road was metalled.

Pokeno – Waihi Junction to Coromandel.—Waihou River Bridge at Kopu: This bridge was almost completed at the end of the financial year.

Thames – Northern Boundary Thames County: A considerable amount of stone walling and widening has been carried out.

Kopu–Raglan.—Reconstruction work has been continued between Thames and Hikutaia.

Hamilton–Rotorua.—Karapiro Deviation: This deviation, near Cambridge, was commenced and is now approximately half completed.

Mamaku Bush Section: A deviation 3 m. 24 ch. in length has been completed, and the gravelling is in hand. Steps are also being taken to apply a wearing-course of gravel to the length of 10½ m. which was laid with a foundation course of rhyolite last year.

Waitoa–Taupo.—Putaruru–Southern Boundary Matamata County: A total length of 4 m. 64 ch. has now been laid in bituminous macadam.

Tirau–Northern Boundary Matamata County: A total length of 15 m. 56 ch. of this section has now been surfaced with bitumen.

Matamata Town District Section: The portion of this main highway in Matamata Town District has been surface-treated with bitumen.

Matamata–Tauranga (No. 2 District).—Kaimai Hill: Regrading and widening of this section on the Waikato side have been put in hand as relief work. A total length of 4 m. 44 ch. has been formed to 20 ft. width, and a commencement has been made with the surfacing of this length with rhyolite.

Matamata Town District Section: This section of the main highway has been surfaced with bitumen.

Matamata County Section: A length of 1 m. 56 ch. has been surfaced with bitumen.

Gisborne–Whakatane, via Motu.—Waioeka Bridge: This bridge, consisting of twenty-five 40 ft. spans, has been completed in reinforced concrete and opened to traffic.

Whakatane–Tauranga.—Otamarakau–Paengaroa: 4 m. of this section has been re-formed and pumiced.

Tauranga–Waihi.—119 ch. of formation and metalling have been completed.

Cambridge–Rotorua.—Steel's Mill – Rotorua: A deviation 56 ch. in length has been formed and metalled. 250 ch. of the road has been widened, and a considerable length surfaced with rhyolite. Between Tarukenga and Ngongotaha 2¾ m. of metalling was completed.

Rotorua–Napier.—Rotorua–Waiotapu: This section of road was considerably improved during the year. A number of sharp bends have been straightened out and a considerable length of the road surface treated with pumice.

Cambridge–Taupo.—Between Atiamuri and Wairakei 10½ m. of road has been widened and straightened. A considerable length has also been treated with pumice.

Tauranga–Matamata (No. 3 District).—Kaimai Hill: On the Tauranga side of the hill 5 m. of formation and 4 m. of bottom-course metalling have been completed. Between Ruahihi and the county boundary a further 1½ m. of formation and 2 m. of metalling have also been completed.

Whakatane–Rotorua.—Whakatane–Rotoma: A length of 80 ch. of this road has been metalled.

Te Teko – Te Ngae: This section of road has been considerably improved during the year by cutting off all sharp bends and by the treatment of the surface with pumice. At Te Ngae a section of 2½ m. of road was metalled.

Te Ngae – Paengaroa.—Between Te Ngae and Waiwhakaretu a considerable amount of improve ment work has been carried out.

Gisborne–Wairoa, via Hangaroa (No. 4 District).—The chief work on this highway during the year was the construction of a deviation of the Tiniroto Hill. The grades on the old road were as steep as 1 in 6, and the road climbed to a height of 300 ft. more than necessary. The new deviation has much improved alignment and a maximum grade of 1 in 14. Altogether 9 m. 60 ch. of re-formation was carried out and 3 m. 52 ch. of metalling finished.

Gisborne–Opotiki, via Motu.—4 m. 54 ch. was re-formed and 4 m. metalled. Two level crossings were eliminated.

Gisborne–Opotiki, via the Coast.—Altogether 7 m. of gravelling and $1\frac{3}{4}$ m. of formation were carried out during the year. Two and a half years ago motor traffic could proceed only $11\frac{1}{2}$ m. north of Gisborne in winter, whereas it is now possible all the year round to reach a point 87 m. north of Gisborne in a little over three hours' running-time.

Gisborne–Wairoa, via Morere.—A length of 4 m. 66 ch. was reconstructed in bituminous macadam.

Napier–Gisborne, via Wairoa.—Napier Borough Section – Te Ngaru Crossing: 2 m. of bituminous surface treatment was completed on the Westshore embankment and a further 25 ch. of similar work was carried out in the Petane Township.

Wairoa–Gisborne, via Hangaroa (No. 5 District).—Horseshoe Bend Deviation: This deviation was almost completed during the year.

Sunken Bridge Culvert: This culvert and filling were also completed.

McRae's Bridge Deviation: This bridge and deviation were also completed.

Petane–Taupo.—A few miles south of Taupo a section of pumice road, nearly half a mile in length, was treated with asphaltic road-oil for experimental purposes.

Napier–Wellington, via Wairarapa (No. 5 District).—Hawke's Bay County Section: At Waitangi washout a length of 60 ch. was surface-treated with bitumen. The formation of the Pakipaki deviation, 1 m. 14 ch. in length, was completed.

Waipawa–Waipukurau: The bituminous surfacing of the remaining 2 m. between Waipawa and Waipukurau was completed. The metalling of the Corkscrew Gully deviation was carried out.

Dannevirke County Section: $3\frac{1}{2}$ m. of first-coat sealing-work and 4 m. of second-coat sealing-work were carried out during the year.

Whakaruatapu Deviation and Bridge: The formation work on this deviation has been completed. The construction of the steel bridge, 170 ft. long and 70 ft. in height, is under way.

Mangatewai-iti Deviation: This deviation, approximately 43 ch. in length, is almost completed. The grade was improved from 1 in 10 to 1 in 15.

Matahiwi Hill Deviation: This deviation, the object of which is to eliminate two level crossings, has been completely formed, and metalling is in hand.

Piripiri Overbridge: The construction of this overbridge to eliminate a dangerous level crossing is in hand.

Woodville County Section: 2 m. 70 ch. of first-coat sealing-work has been carried out between Oringi Station and Corby Settlement roads.

Dannevirke–Waipukurau, via Porangahau.—Mangamaire Bridge: This bridge, consisting of three 40 ft. spans, and its approaches have been completed.

Napier–Tukituki, via Omahu.—Hawke's Bay County Section: 3 m. of sealing-work was carried out between Napier and Taradale, and 1 m. from Hastings Borough boundary towards Omahu. The Waimarama Deviation was completely formed and metalled and is now open to traffic.

Taradale Town Board Section: The whole of this section of highway has now been surface-treated.

Taradale–Rissington.—Taradale Town Board Section: A length of 24 ch. of this section has been sealed with one coat.

Woodville – Palmerston North.—Woodville County Section—Bridge at 0 m. 32 ch.: This bridge, consisting of one 60 ft. span and one 40 ft. span placed alongside each other, has been completed and opened to traffic.

Manawatu Gorge Section: 2 m. of first-coat sealing-work was completed at the end of the financial year, and the surface treatment of the remainder of the section is in hand.

Kawhia – Junction Auckland – Wellington Road, via Kawa.—Kawhia – Oparau River Bridge: The metalling of the unsurfaced gap of this section, 62 ch. in length, has been completed. A concrete arch culvert and a creek-diversion have also been constructed.

County Boundary – Waipa River Bridge: 5 m. 30 ch. of formation and a similar length of gravelling have been completed.

Waitomo Caves – Lemon Point.—The widening and metalling of a bluff, 3 ch. in length, near the county boundary has been completed.

Te Kuiti – Bulls, via Taumarunui (No. 6 District.)—Kurakura Deviation: The whole of the formation work on this deviation has now been completed, and 40 ch. of bottom-course metalling has also been carried out.

Ringham's Bridge: This bridge is under construction, and the formation of the approaches is in hand.

Hiwi Road: 3 m. 14 ch. of formation work has been carried out; 3 m. 5 ch. of gravelling has also been completed.

Taumarunui–Raurimu: 59 ch. of this road has been formed in the vicinity of Oio.

Raurimu – Kaitieke County Boundary: 2 m. 66 ch. of formation and metalling has been completed, and three bridges constructed.

Piopio–Tatu.—Waitewhena Road: 1 m. 9 ch. of gravelling has been completed on this road.

Stratford–Taumarunui.—Paparata Saddle – Ohura County Boundary: 2 m. 36 ch. of gravelling has been completed, making a continuous section of metal from Tatu to Tokirima Hill.

County Boundary – Taumarunui: 75 ch. of formation work on the Opetea and Aorangi Roads has been completed.

Ongarue Bridge: This bridge, of reinforced concrete, consisting of four 50 ft. spans on concrete piers, has been completed.

Auckland–Wellington, via Taranaki (No. 7 District).—Mokau River Bridge: This bridge and its approaches were completed during the year.

Mokau–Tongaporutu: A further length of 3 m. 27 ch. of bituminous macadam has been constructed south of the Mokau River.

Clifton County Section: A large reinforced-concrete bridge of three spans, together with a deviation of 36 ch. in length, is in course of construction at the Waiau Stream.

Inglewood County Section: A length of 2 m. 30 ch. of bituminous macadam was completed during the year 1½ m. north of Inglewood, and 70 ch. between Tariki and Waipuku.

Eltham County Section: 95 ch. of sealed road has been widened, and strengthened with shoulders of bituminous macadam.

Hawera County Section: Over a length of 180 ch. of this section the sealed surface has been widened, and strengthened by the addition of bituminous macadam shoulders 2 ft. in width on each side of the road.

Lepperton Junction – Hawera, via Opunake.—Taranaki County Section: 51 ch. of this section has been regraded, metalled, and surfaced with bitumen. An additional length of 150 ch. of macadam road was surface-treated with bitumen.

Egmont County Section: 4 m. 48 ch. of bituminous macadam has been laid. A concrete bridge and deviation at the Rautini Stream, north of Rahotu, are under way. The Pungareere Stream Bridge has been completed and the Heimama Stream Bridge is almost completed.

New Plymouth – Kaimata, via Inglewood.—Inglewood County Section: 99 ch. of regrading-work and 23 ch. of deviation are in hand; 70 ch. of bituminous-macadam pavement is also in hand between Maketawa and Manganui.

Eltham–Opunake.—1 m. 70 ch. of bituminous macadam was completed near Awatuna. There is now a bituminous surface the whole way from Eltham to Opunake.

Ohura Road.—3 m. 56 ch. of this road has been formed or widened and 54 ch. metalled during the year.

Stratford County Section: 2 m. 29 ch. of this section between Toko and Gordon Road was surface-treated with bitumen.

Rawhitiroa Road.—1 m. of this road has been widened with bituminous-macadam shoulders.

Stratford–Opunake.—The surface-sealing of several sections of this highway in Stratford County, totalling 232 ch. in length, is in hand.

Auckland–Wellington, via Taranaki (No. 8 District).—Patea County Section: 28 ch. of road has been reconstructed and metalled. In addition, a length of 1 m. 46 ch. was constructed in bituminous macadam.

Waitotara County Section: 5 m. 51 ch. of sealing-work was carried out on this section.

Wanganui County Section: 3½ m. of this section was surface-treated with bitumen.

Turakina Railway-crossing: The overhead bridge and deviation for the purpose of eliminating this railway-crossing were completed and opened to traffic.

Turakina River Bridge: A contract has been let for the construction of a new steel and concrete bridge of two 100 ft. spans, and work has been commenced.

Te Kuiti – Bulls, via Taumarunui (No. 8 District).—Rangitikei County Section: A length of 3 m. 40 ch. of new metalling was carried out south of Waiouru.

Waimarino County Section: 40 ch. of new metalling was completed near Waitangi.

Rangitatau East and Watershed Roads.—1 m. 18 ch. of re-formation and 35 ch. of new metalling were completed on this highway between Bruce Road and Kauarapaoa Road.

Wanganui–Horopito.—2 m. 42 ch. of widening was completed during the year together with a 40 ft. rolled-steel-joist bridge. 1 m. 20 ch. of metalling was completed south of the Mangawhero River.

Auckland–Wellington, via Taranaki (No. 9 District).—Ngahauranga Gorge: 1 m. 23 ch. of this section was widened to a minimum of 24 ft., and 1 m. 65 ch. remetalled. Three large reinforced culverts were also constructed.

Johnsonville – Tawa Flat: The widening and remetalling of a length of 3 m. 9 ch. of this section were completed.

Tawa Flat – Porirua: The widening and remetalling of this section, 2 m. in length, were completed.

Porirua–Paremata: 53 ch. of this section was sealed during the year.

Paremata–Waikanae: On this section a total length of 3 m. 57 ch. of surface-sealing was completed.

Waikanae–Otaki: A length of 4 m. 60 ch. of bituminous macadam has been carried out.

Otaki–Manakau: 1 m. of bituminous macadam was completed. Three deviations have been formed and partially metalled.

Sanson–Bulls: 2 m. 14 ch. of reconstruction work and 3 m. of surface-sealing have been carried out.

Levin – Palmerston North, via Shannon.—2 m. 25 ch. of reconstruction and metalling was carried out between Tokomaru Bridge and Tokomaru .

Foxton–Shannon.—Manawatu River Bridge and Deviation: This bridge, consisting of twelve 60 ft. plate-girder spans, was well advanced at the end of the year under review. The formation of the road approach at the Shannon end of the bridge was completed, and the formation work at the Foxton end is under way.

Himitangi–Ashhurst, via Palmerston North.—Burke's Drain Bridge: The concrete-work on this bridge was completed.

Kairanga County Section: 78 ch. of bituminous surface treatment was carried out.

Greatford–Woodville, via Feilding and Ashhurst.—Oroua County Section: Jack's Creek Bridge was completed during the year, and two other concrete bridges are in hand. A deviation at McCool's Corner near Ashhurst was also completed.

Wellington–Napier, via Wairarapa (Nos. 9 and 10 Districts).—Taita Gorge Section: 1 m. 20 ch. of surface treatment was carried out on this section.

Akatarawa – Mangaroa Hill: 42 ch. of this length was widened to 24 ft., and culverts extended where necessary.

Mangaroa Hill – Rimutaka Hill: 2 m. 57 ch. of this length was widened to 24 ft. and the alignment considerably improved. 3 m. 22 ch. of remetalling was carried out in preparation for sealing-work.

Rimutaka Hill – Featherston Borough Boundary: On this section 1 m. 26 ch. of widening to 24 ft. has been completed and surfaced with gravel. A length of 50 ch. of bituminous surface-sealing has been carried out.

Waiohine Bridge – Waingawa Bridge: 2 m. 33 ch. of this section was widened, and 3 m. 21 ch. of bituminous macadam constructed.

Masterton County Section: 38 ch. of widening was carried out between Masterton and Mount Bruce.

Faulkner's Bridge – Eketahuna: 15 ch. of this section was widened to 24 ft.

Eketahuna Deviation: Formation of this deviation is completed, 72 ch. having been carried out during the year. A contract has been let for the erection of the Wiwaka Bridge over the Makakahi River, and a commencement has been made with the work.

Mangatainoka Bridge: This reinforced-concrete bridge, consisting of six 40 ft. spans, has been satisfactorily completed and is now open for traffic.

Pahiatua–Pongaroa.—Ngaturi Bridge: This reinforced-concrete bridge, consisting of three 30 ft. and two 60 ft. spans, has been completed and opened to traffic.

Allen's Bridge, Makuri Township: The approaches to this bridge have been completed.

Masterton–Tinui.—24 ch. of widening-work on the Masterton County section of this highway has been completed. At the Rorokoko Deviation 12 ch. of widening has been carried out.

Castlepoint County Section: Thirteen corners were improved, and a certain amount of widening and new culverting was carried out.

Masterton–Weber, via Alfredton.—Between Masterton Borough and Te Ore Ore 77 ch. of bituminous surface treatment was completed.

Martinborough–Otaraia.—On this main highway 24 ch. was widened to 24 ft., raised above flood-level, and metalled.

Featherston–Martinborough.—2 m. 40 ch. of re-formation and widening and 2 m. 10 ch. of bituminous macadam were completed.

Blenheim–Nelson.—Ruapeka Stream Bridge: The construction of this bridge has been completed.

Rai Hill Widening: 16 ch. of this hill has been widened and gravelled. Further improvements are in hand.

Nelson–Westport. (No. 11 District).—Tahunanui–Glenhope: The construction of Pretty Stream Bridge in reinforced concrete has been completed.

Doctor's Creek Bridge: The deviation at this bridge has been completed.

Doughboy Creek Bridge: The construction of this bridge and its approaches are in hand.

Richmond–Pakawau.—Motueka River Bridge: The completion of this bridge consisting of fifteen 44 ft. spans in reinforced concrete is well under way.

Small's Creek Bridge: This reinforced-concrete bridge and its approaches have been completed.

Stoney Creek Bridge: This reinforced-concrete bridge and its approaches have been completed.

Lindsay's Bridge – West Road: 17½ ch. of formation and one 8 ft. culvert have been completed.

Collingwood County Section: The construction of the Tomatea Creek culvert has been completed. Squire's Creek and Church Creek culverts are in hand.

Westport–Karamea.—Karamea River Bridge: The fencing of the approaches to this bridge has been completed.

Westport–Nelson (No. 12 District).—Ohikanui Bridge: The approaches to this bridge were completed.

Hawk's Craig Retaining-wall: The construction of this retaining-wall in concrete, 288 ft. in length, has been completed.

Stitt's Bluff: The construction of this concrete wall, 176 ft. in length, has been completed.

Inangahua Junction Combined Bridge Approaches: The approaches to this bridge were completed.

Hawk's Craig Creek Washout Bridge: This bridge, 100 ft. in length, has been renewed.

Dellavadovas Creek Bridge: This bridge, 50 ft. in length, has been completed.

Back Creek Bridge: The renewal of this bridge has been carried out.

Black Pine Creek Bridge: A temporary bridge has been erected at this creek to enable the new bridge to be commenced.

Bridge No. 38: Materials have been ordered for the renewal of this bridge.

Dee Creek Bridge: This structure is being rebuilt.

Widening Cascade Point: Considerable improvements have been effected to the alignment and grades at this point.

Inangahua Junction – Waiho.—The following small bridges on this highway have been completed: Hinau Bridge, Leggoes Creek Bridge (No. 4), Blackwater Bridge (No. 2), Waimaunga Culvert, Granite Creek Bridge, Cameron's Creek Bridge, Dry Creek Bridge. The following minor bridges are in hand: Maimai Station Bridge, Stoney Creek Bridge, Marsden's Culvert, Fitzgerald Overflow Bridge (No. 2), McEnroe's Overflow Bridge (No. 1), Slaty Creek Bridge.

Kumara – Arthur's Pass.—Rocky Creek Bridge: The construction of this bridge is in hand.

Christchurch–Blenheim, via Parnassus.—Weka Pass Deviation: The construction of this deviation to eliminate a dangerous level crossing and to improve the alignment and grade of the highway is almost completed.

Waimairi County Section—Styx–Chaney's: Towards the end of the year under review alternative tenders were invited for the construction of 2 m. 72 ch. in Portland-cement concrete and bituminous-concrete pavement on this section. A tender was accepted for Portland-cement concrete, and a commencement has been made with the work.

Christchurch–Dunedin (No. 14 District).—Selwyn River Bridge: This reinforced-concrete bridge, consisting of thirty-five 30 ft. spans, was completed during the year, and opened in December, 1927.

Rolleston–Rakaia: Reconstruction of this section of road was undertaken. 17 m. has been completed to a width of 40 ft. A length of 14 m. has been surfaced with fine gravel.

Rakaia–Methven.—2 m. 63 ch. of new metalling was carried out on this highway.

Darfield–Arundel.—2 m. 10 ch. of new gravel was completed.

Pukeuri–Kurow.—Otjake River Bridge: This light-traffic bridge, 640 ft. in length, was constructed during the year. The bridge is now open to traffic.

Dunedin–Christchurch (No. 16 District).—Waitati Section: The surface-sealing of this section was completed early in the year.

Evansdale–Merton, via Kilmog: Approximately 6½ m. of this section has been widened and improved generally by relief labour.

Tumai Railway-crossing: A deviation and overhead bridge are to be constructed to eliminate this crossing. The deviation and approaches to the bridge are well in hand.

Palmerston–Queenstown, via Beck's.—Queenstown – Roaring Meg: 86 ch. of metalling was carried out on this section.

Kawarau Gorge Section: Substantial improvements were completed on this length with relief labour.

Maniototo County Section: The Idaburn Bridge, consisting of three 20 ft. spans, was completed.

Cromwell – Hawea Flat.—4½ m. of formation was carried out on the Vincent County section.

Clarksville–Springvale.—A 7 ft. culvert was installed at Gorge Creek.

Tuapeka County Section: A reinforced-concrete bridge has been erected over Lowburn Creek.

Dunedin–Invercargill (No. 17 District).—Green Island Borough Section: 2 m. 4 ch. of bituminous macadam was completed on this section.

Green Island – Henley: Approximately 2 m. of widening-work has been carried out on this length.

Stony Creek Deviation: A commencement has been made with this deviation, which will eliminate a tortuous section of highway.

Waipahi Stream Bridge: This reinforced-concrete bridge, 82 ft. in length, has been completed.

McNab – Rae's Junction.—40 ch. of formation and gravelling has been carried out. The erection of the Pomahaka River Bridge was also completed.

Dunedin–Portobello.—3½ m. of widening was carried out during the year by relief labour.

Balclutha – Tuapeka Mouth.—The reconstruction, widening, and surfacing of the whole of this highway have now been completed. A drag-line excavator was used to obtain gravel-supplies.

Mosgiel Junction – Middlemarch.—The construction of bridges over Whare Creek and Shannon Creek is in hand.

Invercargill–Dunedin (No. 18 District).—4½ m. of tar and bituminous surface treatment was completed on this highway.

Invercargill–Riverton.—3 m. of preparation work was carried out in readiness for bituminous surface treatment.

Invercargill–Fortrose.—2¾ m. of new formation has been completed ready for gravelling, and the bridge over the Mataura River has been erected.

Winton–Ohai.—The new bridge over the Aparima River has been commenced.

Signed on behalf of the Main Highways Board.

F. W. Furkert, C.M.G.,
Chairman.

SCHEDULE OF MAIN HIGHWAY DISTRICTS AS GAZETTED ON 26TH JANUARY, 1928.

HIGHWAY DISTRICT NO. 1.—AUCKLAND NORTH.

All that area comprised within the Counties of Mangonui, Hokianga, Bay of Islands, Whangaroa, Hobson, Whangarei, Otamatea, Rodney, and Waitemata, and the Boroughs of Dargaville, Birkenhead, Northcote, and the Town Districts (not forming part of a county) of Kaitaia, Kamo, Hikurangi, Kaikohe, Warkworth, Helensville, Henderson, Glen Eden, and New Lynn.

HIGHWAY DISTRICT NO. 2.—AUCKLAND SOUTH.

All that area comprised within the Counties of Eden, Manukau, Franklin, Waikato, Raglan, Waipa, Coromandel, Thames, Hauraki Plains, Ohinemuri, Piako, and Matamata, and the Boroughs of Newmarket, Otahuhu, Pukekohe, Cambridge, Ngaruawahia, Te Awamutu, Te Aroha, Morrinsville, Paeroa, Waihi, Thames, and the Town Districts (not forming part of a county) of Ellerslie, Howick, Papatoetoe, Manurewa, Papakura, Waiuku, Tuakau, Huntly, Leamington, and Matamata.

HIGHWAY DISTRICT NO. 3.—TAURANGA.

All that area comprised within the Counties of Tauranga, Rotorua, Whakatane, Opotiki, and Taupo, and the Boroughs of Tauranga, Rotorua, Whakatane, Opotiki, and the Town District (not forming part of a county) of Te Puke.

HIGHWAY DISTRICT NO. 4.—GISBORNE.

All that area comprised within the Counties of Matakaoa, Waiapu, Uawa, Waikohu, and Cook.

HIGHWAY DISTRICT NO. 5.—HAWKE'S BAY.

All that area comprised within the Counties of Wairoa, Hawke's Bay, Waipawa, Waipukurau, Patangata, Dannevirke, Weber, and Woodville, and the Boroughs of Wairoa, Waipawa, Waipukurau, Dannevirke, Woodville, and the Town Districts (not forming part of a county) of Taradale and Havelock North.

HIGHWAY DISTRICT NO. 6.—KING COUNTRY.

All that area comprised within the Counties of Waitomo, Taumarunui, Ohura, Kaitieke, Kawhia, and Otorohanga, and the Boroughs of Te Kuiti, Taumarunui, and the Town Districts (not forming part of a county) of Otorohanga and Manunui.

HIGHWAY DISTRICT NO. 7.—TARANAKI.

All that area comprised within the Counties of Clifton, Whangamomona, Taranaki, Inglewood, Egmont, Stratford, Waimate West, Eltham, and Hawera, and the Boroughs of Waitara, Inglewood, Stratford, Eltham, Hawera, and the Town Districts (not forming part of a county) of Opunake and Manaia.

HIGHWAY DISTRICT NO. 8.—WANGANUI.

All that area comprised within the Counties of Patea, Waitotara, Waimarino, Wanganui, and Rangitikei, and the Boroughs of Patea, Ohakune, Raetihi, Taihape, Marton, and the Town Districts (not forming part of a county) of Waverley, Rangataua, Mangaweka, Hunterville, and Bulls.

HIGHWAY DISTRICT NO. 9.—WELLINGTON WEST.

All that area comprised within the Counties of Kiwitea, Pohangina, Oroua, Kairanga, Manawatu, Horowhenua, Hutt, and Makara, and the Boroughs of Feilding, Foxton, Shannon, Levin, Otaki, Upper Hutt, Eastbourne, and the Town District (not forming part of a county) of Johnsonville.

HIGHWAY DISTRICT NO. 10.—WELLINGTON EAST.

All that area comprised within the Counties of Pahiatua, Akitio, Eketahuna, Mauriceville, Castlepoint, Masterton, Wairarapa South, and Featherston, and the Boroughs of Pahiatua, Eketahuna, Carterton, Greytown, Featherston, and the Town District (not forming part of a county) of Martinborough.

HIGHWAY DISTRICT NO. 11.—NELSON.

All that area comprised within the Counties of Collingwood, Takaka, Waimea, Sounds, Marlborough, and Murchison, and the Boroughs of Picton, Blenheim, Richmond, Motueka, and the Town District (not forming part of a county) of Tahunanui.

HIGHWAY DISTRICT NO. 12.—WEST COAST.

All that area comprised within the Counties of Buller, Inangahua, Grey, and Westland, and the Boroughs of Westport, Greymouth, Brunner, Kumara, Hokitika, Ross, Runanga, and the Town District (not forming part of a county) of Cobden.

HIGHWAY DISTRICT NO. 13.—CANTERBURY NORTH.

All that area comprised within the Counties of Awatere, Kaikoura, Amuri, Cheviot, and Waipara.

HIGHWAY DISTRICT NO. 14.—CANTERBURY CENTRAL.

All that area comprised within the Counties of Tawera, Oxford, Ashley, Kowai, Rangiora, Eyre, Waimairi, Heathcote, Paparua, Halswell, Mount Herbert, Akaroa, Waireiwa, Springs, Ellesmere, Malvern, and Selwyn, and the Boroughs of Rangiora, Kaiapoi, Riccarton, New Brighton, Sumner, Lyttelton, Akaroa, and the Town District (not forming part of a county) of Leeston.

HIGHWAY DISTRICT NO. 15.—CANTERBURY SOUTH.

All that area comprised within the Counties of Ashburton, Geraldine, Mackenzie, Levels, Waimate, and Waitaki, and the Boroughs of Ashburton, Geraldine, Temuka, Waimate, Hampden, and the Town Districts (not forming part of a county) of Tinwald and Pleasant Point.

HIGHWAY DISTRICT NO. 16.—OTAGO CENTRAL.

All that area comprised within the Counties of Maniototo, Vincent, Lake, Waihemo, and Waikouaiti, and the Boroughs of Palmerston, Waikouaiti, Port Chalmers, West Harbour, Naseby, Alexandra, Cromwell, Queenstown, and Arrowtown.

HIGHWAY DISTRICT NO. 17.—OTAGO SOUTH.

All that area comprised within the Counties of Peninsula, Taieri, Tuapeka, Bruce, and Clutha, and the Boroughs of Green Island, Mosgiel, Milton, Kaitangata, Balclutha, Tapanui, Lawrence, and Roxburgh.

HIGHWAY DISTRICT NO. 18.—SOUTHLAND.

All that area comprised within the Counties of Southland, Wallace, and Fiord, and the Boroughs of Gore, Mataura, Winton, South Invercargill, Bluff, Riverton, and the Town Districts (not forming part of a county) of Lumsden, Wyndham, Otautau, and Nightcaps.

TABLE 1.—MAIN HIGHWAYS ACCOUNT.

CONSTRUCTION FUND.

INCOME AND EXPENDITURE ON CAPITAL ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1928, AND TOTAL TO DATE.

EXPENDITURE.	Government Roads.	Ordinary Main Highways.	Total for Year 1927–28.	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.	£ s. d.	£ s. d.
No. 1	29,621 7 2	10,578 3 3	40,199 10 5	182,683 13 2
No. 2	30,407 8 11	48,444 9 0	78,851 17 11	256,875 12 2
No. 3	31,246 16 0	3,036 14 4	34,283 10 4	88,536 7 2
No. 4	20,868 15 9	3,753 16 8	24,622 12 5	155,328 16 0
No. 5	1,389 5 0	17,211 11 3	18,600 16 3	80,712 12 2
No. 6	40,175 16 1	3,821 6 4	43,997 2 5	119,446 8 3
No. 7	14,494 8 2	25,257 7 3	39,751 15 5	190,523 2 6
No. 8	6,496 14 0	14,667 13 6	21,164 7 6	61,549 16 0
No. 9	25,854 0 6	39,278 6 4	65,132 6 10	196,094 8 9
No. 10	4,649 6 3	15,602 16 4	20,252 2 7	52,133 12 0
No. 11	9,675 7 4	485 10 3	10,160 17 7	19,478 9 6
No. 12	3,957 1 2	333 0 0	4,290 1 2	74,484 12 6
No. 13	126 1 0	4,207 16 9	4,333 17 9	61,154 6 7
No. 14	4,020 12 2	10,938 11 11	14,959 4 1	35,291 1 9
No. 15	..	3,050 17 4	3,050 17 4	9,766 2 5
No. 16	1,480 15 8	3,477 1 8	4,957 17 4	35,009 7 0
No. 17	28,834 14 7	12,505 6 10	41,340 1 5	76,305 2 11
No. 18	1,406 12 7	9,729 5 0	11,135 17 7	34,369 13 6
	254,705 2 4	226,379 14 0	481,084 16 4	1,729,743 14 4

INCOME.	Total for Year 1927–28.	Total since Declaration of Main Highways (9/6/24).
By Recoveries on account of expenditure of previous years :—		
Highway District—	£ s. d.	£ s. d.
No. 2, Government roads	1 7 8	7 7 8
No. 4, ,, ...	..	2 8 8
No. 7, ,, ...	7 6 10	7 6 10
No. 12, ,, ...	..	0 19 0
No. 13, ,, ...	..	102 0 0
	8 14 6	120 2 2
Receipts under section 15, Finance Act, 1923, from Public Works Fund, General Purposes Account*	200,000 0 0	826,000 0 0
Loans raised under Main Highways Act, 1922—		
Consolidated stock	..	542,007 14 0
Debentures	..	100,000 0 0
Inscribed stock	50,000 0 0	50,000 0 0
Balance, excess of expenditure over income, carried to general balance-sheet	231,076 1 10	211,615 18 2
	481,084 16 4	1,729,743 14 4

* Interest on these amounts is paid from Consolidated Fund.

TABLE 1.—MAIN HIGHWAYS ACCOUNT—*continued.*

REVENUE FUND.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1928, AND TOTAL TO DATE.

EXPENDITURE.	Government Roads.	Ordinary Main Highways.	Total for Year 1927–28.	Total since Inception of Main Highways Act, 1922, to 31/3/28.
To Net expenditure on maintenance of main highways:—				
Highway District—	£ s. d.	£ s. d.	£ s. d.	£ s. d.
No. 1	7,325 9 4	29,937 7 8	37,262 17 0	86,127 19 6
No. 2	7,508 16 2	52,875 17 9	60,384 13 11	135,523 12 5
No. 3	21,479 12 10	7,930 4 4	29,409 17 2	71,621 4 8
No. 4	11,623 15 2	3,338 17 2	14,962 12 4	53,366 3 5
No. 5	3,898 5 4	41,087 6 2	44,985 11 6	128,663 17 8
No. 6	5,769 15 11	6,854 1 3	12,623 17 2	48,722 13 7
No. 7	13,432 17 11	30,327 3 5	43,760 1 4	107,948 13 2
No. 8	513 5 9	30,208 10 0	30,721 15 9	78,689 13 4
No. 9	10,035 5 2	35,942 15 4	45,978 0 6	107,199 5 7
No. 10	2,559 0 10	24,313 8 2	26,872 9 0	75,827 18 10
No. 11	10,725 6 0	10,190 11 3	20,915 17 3	66,614 18 8
No. 12	36,904 0 1	1,138 1 9	38,042 1 10	120,052 15 9
No. 13	2,871 18 10	14,647 15 1	17,519 13 11	45,966 15 1
No. 14	644 13 3	20,893 12 4	21,538 5 7	52,893 6 10
No. 15	..	27,429 16 3	27,429 16 3	65,864 19 9
No. 16	5,933 10 6	9,608 2 5	15,541 12 11	28,099 13 4
No. 17	2,532 6 1	15,716 13 8	18,248 19 9	38,936 0 10
No. 18	818 14 2	16,563 12 0	17,382 6 2	53,302 5 2
	144,576 13 4	379,003 16 0	523,580 9 4	1,365,421 17 7
Abolition of toll-gates (section 20, Finance Act, 1925)			1,807 0 0	10,344 14 7
Accident compensation			534 4 4	713 0 11
Administration and supervision expenses, including salaries and travelling-expenses of Public Works officers, printing, stationery, postages, and miscellaneous expenses			22,583 1 7	69,267 9 11
Charges and expenses of raising loans			250 0 0	42,467 14 6*
Commission on collection of motor-registration fees by Postal Department			12,022 1 6	31,097 2 0
Depreciation of furniture, fittings, &c.			43 3 5	132 6 6
Depreciation of plant not in service			10 0 0	10 0 0
Erection of signposts (subsidies to) on County boundaries			536 10 11	770 12 7
Expenses of District Councillors attending District Council meetings and annual conference			214 7 9	306 13 3
Fees and travelling-expenses of members of the Main Highways Board, other than Government members			1,300 1 1	5,938 0 7
Interest on loans, recoupment to Consolidated Fund (section 4, Finance Act, 1919)			29,246 0 7	73,275 3 4
Management charges of consolidated stock on account of Construction Fund			327 0 2	355 11 9
Miscellaneous expenses (advertising, maps, rent of halls, traffic tallies, transport of samples, &c.)			68 3 7	942 11 8
			592,522 4 3	1,601,042 19 2
Balance, being excess of income over expenditure, carried to general balance-sheet			128,140 14 5	770,883 17 11
			£720,662 18 8	£2,371,926 17 1

INCOME.	Total for Year 1927–28.	Total since Inception of Main Highways Act, 1922, to 31/3/28.
By Income from—		
Interest from investments of—	£ s. d.	
Construction Fund	2,386 7 2	
Revenue Fund	26,385 15 6	
	£ s. d.	£ s. d.
	28,772 2 8	117,108 8 10
Interest from local bodies on plant purchased on their behalf ..	2,610 1 10	4,505 2 7
Motor-registration licenses, fees, and fines (section 24, Motor-vehicles Act, 1924)	303,861 8 6	934,041 9 5
Motor-spirits tax (section 9, Motor-spirits Taxation Act, 1927) ..	130,460 17 7	130,460 17 7
Recoveries on account of expenditure of previous years—Ordinary main highways	..	28 12 0
Rent of and tolls from ferries	300 0 0	2,081 10 6
Tire-tax (sections 13 and 14, Main Highways Act, 1922)	219,658 8 1	1,043,700 16 2
Transfer from Consolidated Fund (section 14, Main Highways Act, 1922)	35,000 0 0	140,000 0 0
	£720,662 18 8	£2,371,926 17 1

* Includes £42,007 14s. transferred from Construction Fund, for which transfer legislative authority is being sought.

TABLE 1.—MAIN HIGHWAYS ACCOUNT—*continued.*

GENERAL BALANCE-SHEET AS AT 31ST MARCH, 1928.

LIABILITIES.	Revenue Fund.	Construction Fund.	Total.
	£ s. d.	£ s. d.	£ s. d.
Accumulated Revenue Fund—			
Balance at 31/3/27	642,743 3 6		
Add excess of income over expenditure for 1927–28	128,140 14 5		
	770,883 17 11	..	770,883 17 11
Sundry creditors	110,662 19 3	59,417 10 6	170,080 9 9
Interest accrued on loans	3,636 3 8	..	3,636 3 8
1928–29 and 1929–30 motor-registration fees—			
Received during 1927–28	250,000 0 0	..	250,000 0 0
Writings-off in Suspense	25 19 9	182 3 2	208 2 11
Temporary transfer from Revenue Fund	..	300,000 0 0	300,000 0 0
	1,135,209 0 7	359,599 13 8	1,494,808 14 3

ASSETS.			Revenue Fund.	Construction Fund.	Total.
			£ s. d.	£ s. d.	£ s. d.
Cash in Public Account—					
At call			379,986 0 1	72,570 17 6	452,556 17 7
Invested temporarily until required			242,900 0 0	..	242,900 0 0
			622,886 0 1	72,570 17 6	695,456 17 7
Sundry debtors			12,052 14 7	51,363 2 10	63,415 17 5
Motor-registration fees in hands of Postal Department ..			98,532 13 6	..	98,532 13 6
Interest due and accrued			6,103 0 8	..	6,103 0 8
Stocks of material, tools, &c.			5,472 9 0	21,004 7 0	26,476 16 0
Stocks, &c., deficits Suspense Account			25 19 9	182 3 2	208 2 11
Roadmen's cottages, huts, and road buildings generally ..			2,644 0 0	2,863 5 0	5,507 5 0
Furniture, fittings, &c.—	£ s. d.				
Expenditure to 31/3/28	599 10 8				
Depreciation and hire to 31/3/28 ..	136 3 11				
			463 6 9	..	463 6 9
Plant and equipment—					
For Main Highways Board—					
Expenditure to 31/3/28	37,018 18 6				
Less depreciation charged to works ..	3,181 12 6				
			33,837 6 0	..	33,837 6 0
Purchased for local bodies—					
Expenditure to 31/3/28	75,706 19 6				
Less repayments of principal ..	24,265 9 3				
			51,441 10 3	..	51,441 10 3
Construction Fund—					
Excess of expenditure over income, 1927–28	231,076 1 10				
Less balance at 31/3/27	19,460 3 8				
			..	211,615 18 2	211,615 18 2
Temporary transfer to Construction Fund			300,000 0 0	..	300,000 0 0
Advances to local authorities (Main Highways Amendment Act, 1926, section 2)..			1,750 0 0	..	1,750 0 0
			1,135,209 0 7	359,599 13 8	1,494,808 14 3

H. ARTHUR, Acting Accountant, Public Works Department.

F. W. FURKERT, 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.—G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE 2.—LENGTHS OF MAIN HIGHWAYS AT 31ST MARCH, 1928.

Number and Name of Highway District.	Ordinary Main Highways.	Main Highways declared Government Roads.	Total all Main Highways.
	M. ch.	M. ch.	M. ch.
1. Auckland North	413 50	163 37	577 7
2. Auckland South	408 73	57 57	466 50
3. Tauranga	179 36	266 40	445 76
4. Gisborne	102 19	138 40	240 59
5. Napier	404 43	36 50	441 13
6. King-country	146 15	187 28	333 43
7. Taranaki	249 42	60 25	309 67
8. Wanganui	277 56	49 60	327 36
9. Wellington West	283 7	25 32	308 39
10. Wellington East	322 42	15 40	338 2
Totals, North Island ..	2,787 63	1,001 9	3,788 72
11. Nelson	179 14	128 4	307 18
12. West Coast	13 54	334 65	348 39
13. Canterbury North	269 68	38 20	308 8
14. Canterbury Central	328 57	74 0	402 57
15. Canterbury South	438 50	..	438 50
16. Otago Central	244 14	14 40	258 54
17. Otago South	278 77	20 40	299 37
18. Southland	429 76	26 0	455 76
Totals, South Island ..	2,183 10	636 9	2,819 19
Totals, Dominion	4,970 73	1,637 18	6,608 11

TABLE 3.—CONSTRUCTION WORK COMPLETED DURING YEAR 1927-28.

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. Auckland North	14 71	26 51	..	..	..	1 4	837	15 29	15 29
2. Auckland South	20 27	9 23	17 46	1 70	..	5 12	..	..	..
3. Tauranga	19 50	11 73	..	..	..	..	1,048	8 25	8 25
4. Gisborne	15 34	7 6	..	4 66	..	..	330	7 15	7 15
5. Napier	3 11	4 45	26 22	..	..	..	379	6 63	2 61
6. King-country	14 15	19 71	..	..	..	..	65	15 13	15 13
7. Taranaki	0 62	0 54	4 11	12 15	..	..	692	11 78	11 78
8. Wanganui	4 23	6 3	7 9	1 46	..	..	63	5 14	5 14
9. Wellington West ..	13 51	0 28	9 58	5 60	..	..	814	1 10	1 10
10. Wellington East	8 50	0 52	6 47	5 31	..	..	461	2 5	2 5
11. Nelson	0 61	0 61	..	..	..	..	110	0 38	0 38
12. West Coast	0 13	0 13	..	..	..	..	214	1 14	1 14
13. Canterbury North ..	..	..	..	..	..	..	350	..	..
14. Canterbury Central ..	17 16	15 56	..	..	0 14	..	1,086	22 72	22 72
15. Canterbury South ..	1 67	9 10	3 55	..	..	..	724	..	..
16. Otago Central	12 20	1 6	3 64	..	..	..	60	27 40	..
17. Otago South	22 19	18 25	..	2 4	..	..	287	33 4	15 4
18. Southland	3 70	1 5	4 24	..	..	..	240	..	..
Totals	173 20	133 22	83 16	33 52	0 14	6 16	7,760	158 20	108 58

TABLE 4.—APPROPRIATIONS AND EXPENDITURE FOR THE YEAR ENDING 31ST MARCH, 1928.

Number and Name of Highway District.	Construction.		Maintenance.	
	Available for Authorization.	Expenditure.	Available for Authorization.	Expenditure.
	£	£	£	£
1. Auckland North	59,229	37,393	43,899	37,263
2. Auckland South	99,050	73,609	91,830	60,385
3. Tauranga	43,094	32,379	33,841	29,410
4. Gisborne	43,073	22,927	21,831	14,963
5. Hawke's Bay	31,933	17,569	66,952	44,985
6. King-country	39,376	41,692	20,989	12,624
7. Taranaki	42,328	37,959	46,879	43,760
8. Wanganui	19,880	20,191	30,396	30,722
9. Wellington West ..	113,943	59,577	54,741	45,978
10. Wellington East	35,606	18,965	37,194	26,872
11. Nelson	16,089	9,673	26,695	20,916
12. West Coast	14,270	3,971	49,477	38,042
13. Canterbury North ..	15,826	3,996	26,079	17,520
14. Canterbury Central ..	39,490	13,849	33,161	21,538
15. Canterbury South ..	11,316	2,906	29,891	27,430
16. Otago Central	10,518	4,082	19,047	15,542
17. Otago South	38,268	38,810	18,790	18,249
18. Southland	28,915	10,356	33,925	17,382
Totals for Dominion ..	702,204	449,904	685,617	523,581
Totals, North Island ..	527,512	362,261	448,552	346,962
Totals, South Island ..	174,692	87,643	237,065	176,619

TABLE No. 5.—MAINTENANCE OF MAIN HIGHWAYS (INCLUDING BRIDGES).

Number and Name of Highway District.	Length maintained.	Expenditure.			Average Cost per Mile per Annum.			
		By Board.	By Local Authority.	Total.	1927–28.	1926–27.	1925–26.	1924–25.
	M. ch.	£	£	£	£	£	£	£
1. Auckland North ..	577 7	37,263	22,550	59,813	103·6	65·6	56·1	77·0
2. Auckland South ..	466 50	60,385	34,471	94,856	203·3	181·0	85·1	53·5
3. Tauranga	445 76	29,410	6,406	35,816	80·3	69·1	48·6	28·1
4. Gisborne	240 59	14,963	10,144	25,107	104·3	152·7	93·9	59·5
5. Napier	441 13	44,985	30,009	74,994	170·0	169·4	104·5	73·4
6. King-country ..	333 43	12,624	6,132	18,756	56·2	69·8	55·4	58·5
7. Taranaki	309 67	43,760	16,875	60,635	195·7	198·8	105·0	67·1
8. Wanganui	327 36	30,722	16,869	47,591	145·3	167·6	88·9	54·4
9. Wellington West ..	308 39	45,978	24,639	70,617	228·9	166·3	120·2	91·7
10. Wellington East ..	338 2	26,872	20,047	46,919	138·8	138·0	104·7	77·7
Totals, North Island	3,788 72	346,962	188,142	535,104	141·2	131·6	82·9	62·9
11. Nelson	307 18	20,916	10,459	31,375	102·1	119·9	63·9	48·1
12. West Coast	348 39	38,042	3,160	41,202	118·3	114·2	94·6	61·6
13. Canterbury North ..	308 8	17,520	10,243	27,763	90·1	79·5	47·7	37·7
14. Canterbury Central ..	402 57	21,538	13,610	35,148	87·3	81·4	46·1	52·2
15. Canterbury South ..	438 50	27,430	18,636	46,066	105·0	79·5	73·9	39·7
16. Otago Central ..	258 54	15,542	4,417	19,959	77·2	49·3	26·1	12·6
17. Otago South	299 37	18,249	8,862	27,111	90·5	81·7	54·2	22·5
18. Southland	455 76	17,382	11,536	28,918	63·4	76·0	56·6	24·6
Totals, South Island	2,819 19	176,619	80,923	257,542	91·4	85·4	59·6	38·5
Totals for Dominion	6,608 11	523,581	269,065	792,646	119·9	111·9	73·2	51·7

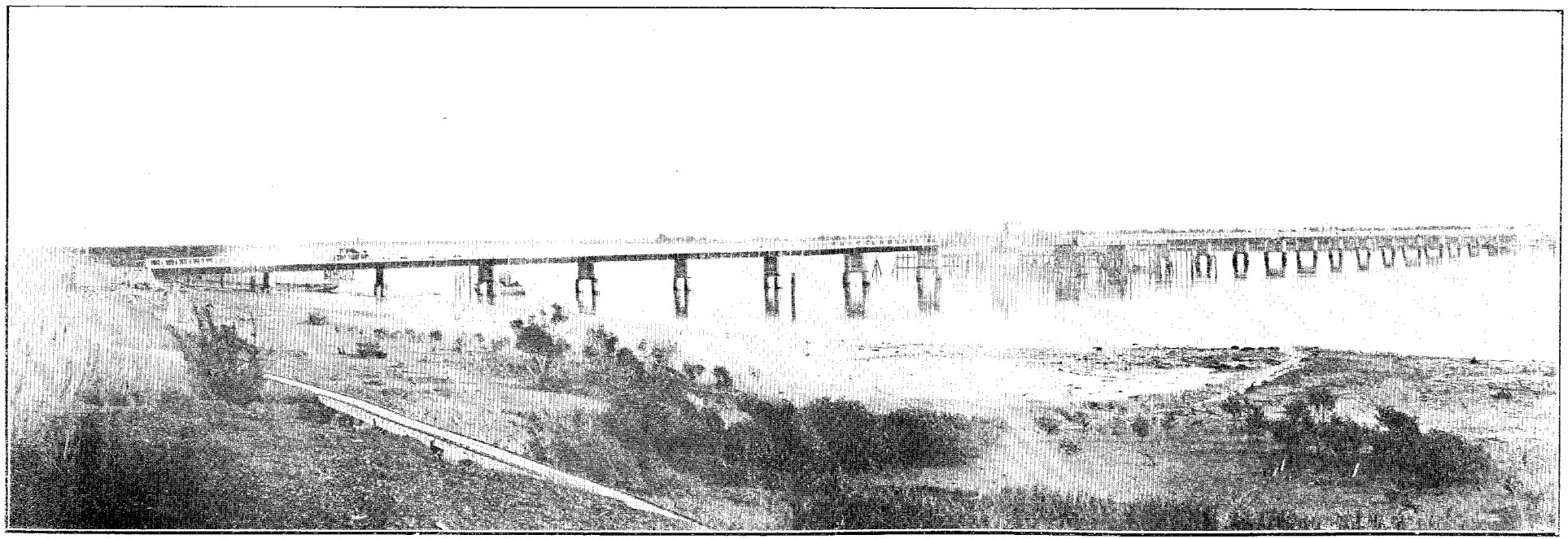
TABLE 6.—(*a*) TESTS OF STONE COMPLETED DURING THE YEAR ENDING 31ST MARCH, 1928.

Locality.	Weight in Pounds Per Cubic Foot.	Absorption of H_2O in Pounds per Cubic Foot.	Abrasion.		Hardness.	Toughness.	Geological Classification.
			Percentage of Wear.	French Coefficient.			
111. Hosking's Hill, Hutt Road, near Ngahauranga	164	0·32	5·1	7·8	19·46	14	Crushed greywacke cemented with quartz.
112. Hosking's Hill, Hutt Road, near Ngahauranga, Block 15	165	..	..	..	..	8	Quartz with little crushed greywacke.
113. Dubi's quarry-face, Te Arai Riding — Rodney County Council	147·7	3·21	14·8	2·70	5·6	6	Sandstone.
114. Schedewy's Hill, Warkworth — Rodney County Council: Allotment 148, Mahurangi, Block XV (Surface)	147	5·35	12·6	3·18	4·2	4	Sandstone.
115. Mount Brame Quarry, Kokako, Rodney County Council: Allotment portion N 155 (Quarry-face)	166	1·25	4·2	9·52	18·6	8	Altered basalt.
116. Mount Brame Quarry, Kokako, Rodney County Council: Allotment portion N 155	163·5	1·25	6·6	6·06	..	..	Weathered altered basalt.
117. Ryan's quarry, Allotment 52 — Rodney County Council: Oruawhero Parish, Block IV, Pahiri	153	1·45	6·44	6·2	15·2	6	Altered basalt.
118. Huntly Town Board	166·5	0·18	3·9	10·25	18·85	24	Greywacke.
119. Rotorua	147·5	0·167	28·9	1·38	..	..	Obsidian.
120. Horekino, Section 2A, Block III	165·4	0·21	3·15	12·68	..	..	Altered greywacke.

(*b*) ABRASION TESTS OF GRAVELS COMPLETED DURING THE YEAR ENDING 31ST MARCH, 1928.

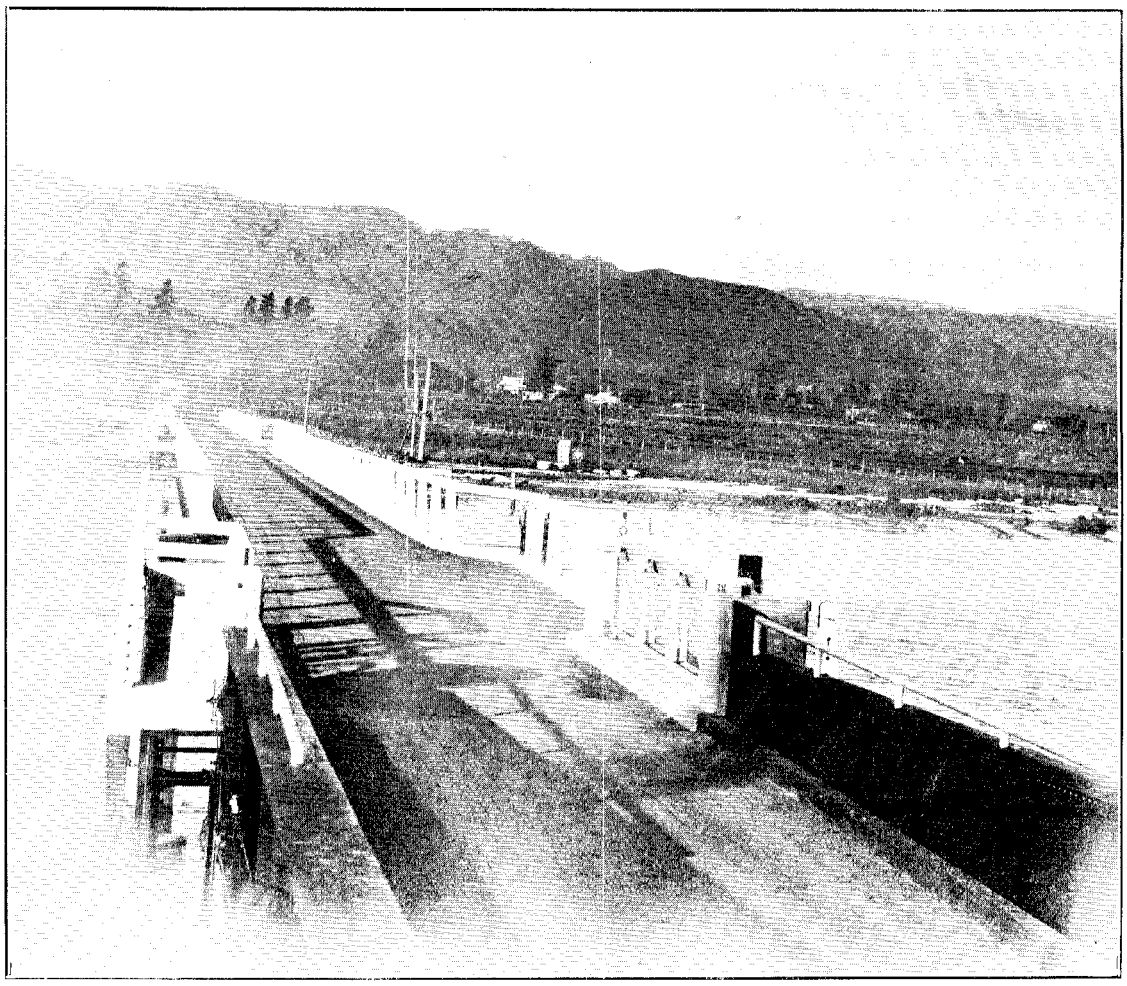
Locality.	Percentage of Wear.	French Coefficient.
1. Waingawa River – Masterton	5·24	7·6
2. Hutt Bridge – Akatarawa Road	10·8	3 7
3. Mangatainoka–Pahiatua	7·73	5 2
4. Pahuratahi Stream – Kaitoke	17·85	2·2
5. Tauherenikau Lower Bridge – Martinborough	7·48	5·1
6. Morgan's pit	19·01	2·1
7. Otaki River Terrace, 20 ft.	7·35	5·4
8. Marton–Tutaekuri	9·1	4·4
9. Waikanae River terrace, 20 ft.	8·5	4·7
10. Rangitikei River, Mair's terrace, 20 ft.	4·4	9·1
11. Rangitikei River, Bulls	2·6	15·4
12. Rangitikei River, Mair's	2·8	14·3
13. Rangitikei River, Bulls terrace, 30 ft.	6·7	6·0
14. Ohau River Bridge	6·9	5·8
15. Oroua River, Feilding	9·4	4·3
16. Manawatu River, below Gorge	12·0	3·3
17. Wangaehu River Bridge (volcanic gravel)	9·0	4·4
18. Waikare River, White's Road, Putaruru	39·8	1·0
19. Waikato River, Bent's pit, Arapuni	6·7	6·0
20. Tukituki River, Napier, right bank, Clive Grange, Bridge	5·0	8·0
Samples of shingle ex Morris J. Belcher, shingle-merchants, Otorohanga—		
21. Sample 1	15·7	2·5
22. Sample 2	15·5	2·6
23. Sample 3	14·0	2·9
24. Taihape River, Matapiro, Hawke's Bay (Pliocene marine gravel)	3·7	10·8
25. Mohaka River, left bank, three miles below bridge	3·8	10·5
26. Wairoa River, dredged from bed, two miles up-stream, Wairoa	11·8	3·4
27. Waikoau Viaduct (gravel from quarry near)	12·7	3·1
28. Mohaka River, upper terrace, right bank, from pit	8·6	4·7
29. Redcliff–Taradale	15·6	2·6
30. Hutt River Bridge – Akatarawa Road	10·8	3·7
31. Mangatainoka–Pahiatua	7·7	5·2
32. Makakahi River	15·95	2·5
33. Mangahao River	9·85	4·1
34. Ruamahanga, Martinborough	2·35	17·0
35. Ruamahanga, Masterton	2·6	15·4
36. Mangatainoka River	3·94	10·2
37. Ruamahanga, Lower Bridge	7·95	5·0
38. Waiohine Bridge – Greytown	5·01	8·0

By Authority: W. A. G. SKINNER, Government Printer, Wellington.—1928.

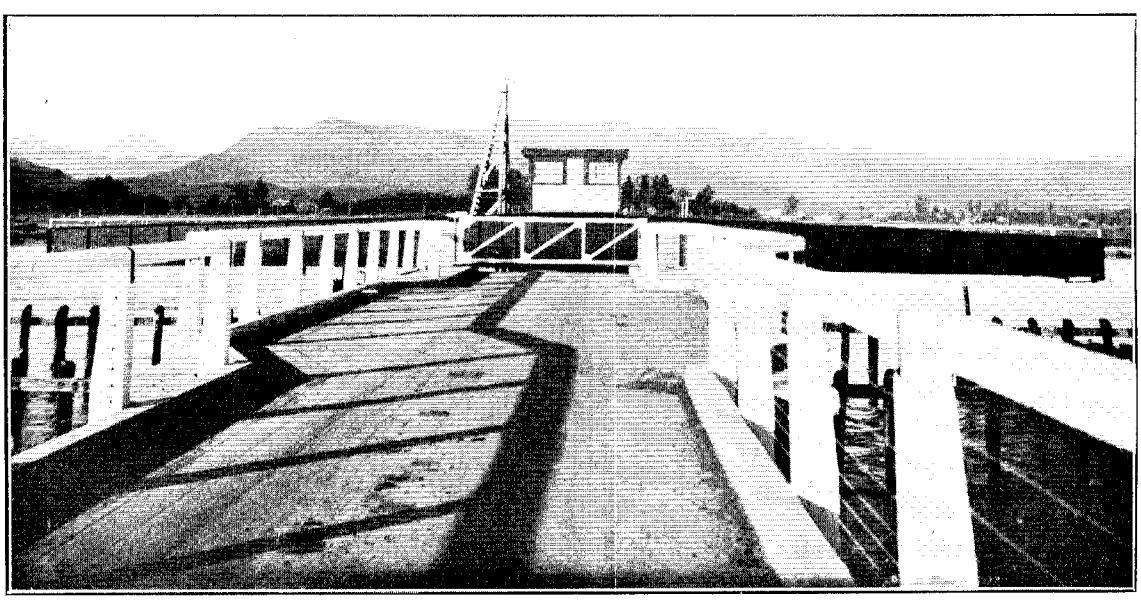


WAIHOU RIVER-BRIDGE AT KOPU.
Twenty-three 60 ft. steel plate girder spans and one 140 ft. swing span. Total length, 1,520 ft.

POKENO-WAIHI JUNCTION TO COROMANDEL MAIN HIGHWAY.



View at end of Swing Span.
Swing span closed and gate open.

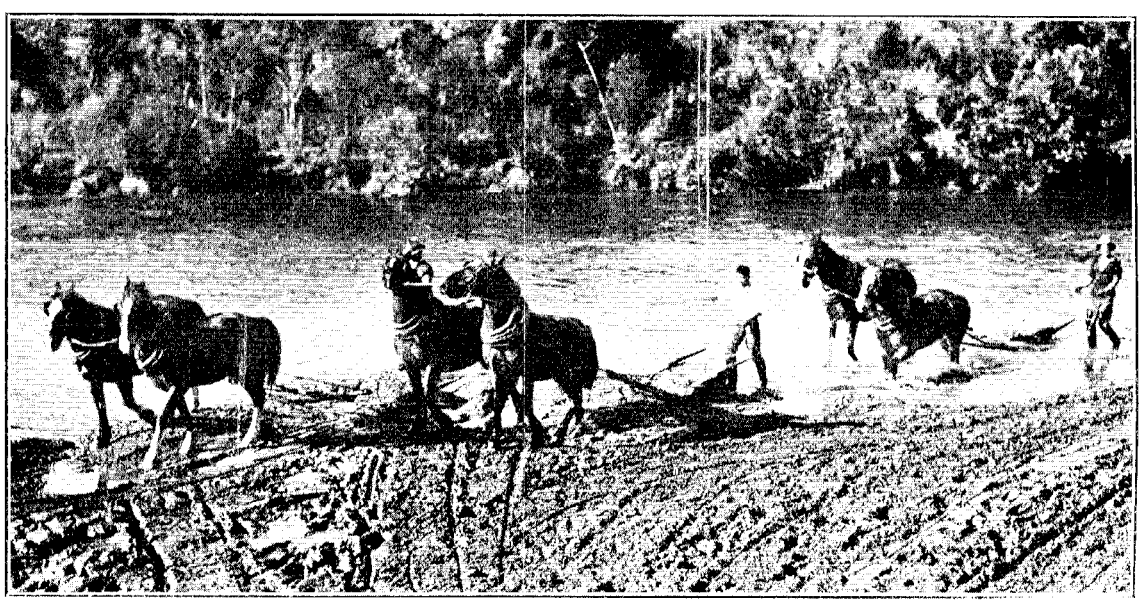


View showing Swing Span open and Gate closed against Traffic
Operator's cabin in centre of swing span.

POKENO WAIHI JUNCTION TO COROMANDEL MAIN HIGHWAY. WAIHOU RIVER BRIDGE AT KOPU.

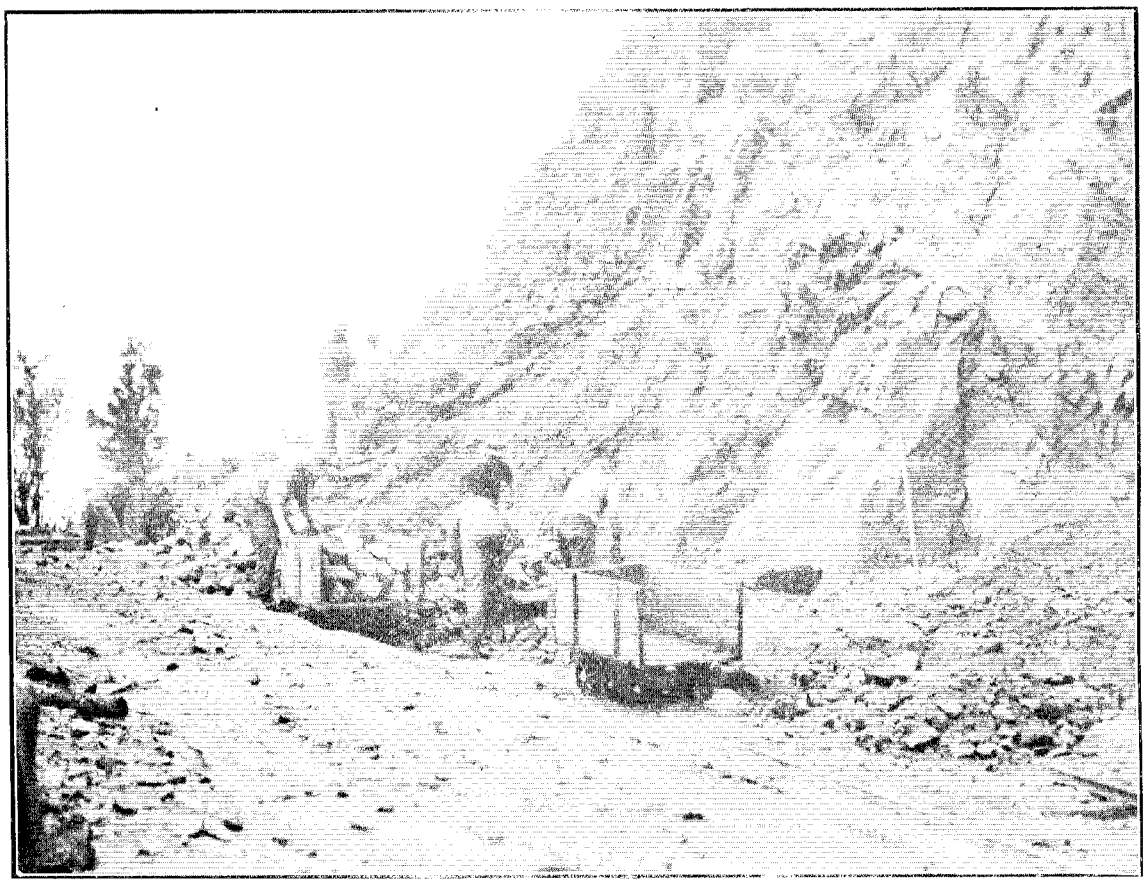


Newly formed Deviation through Native Bush near Tapapa



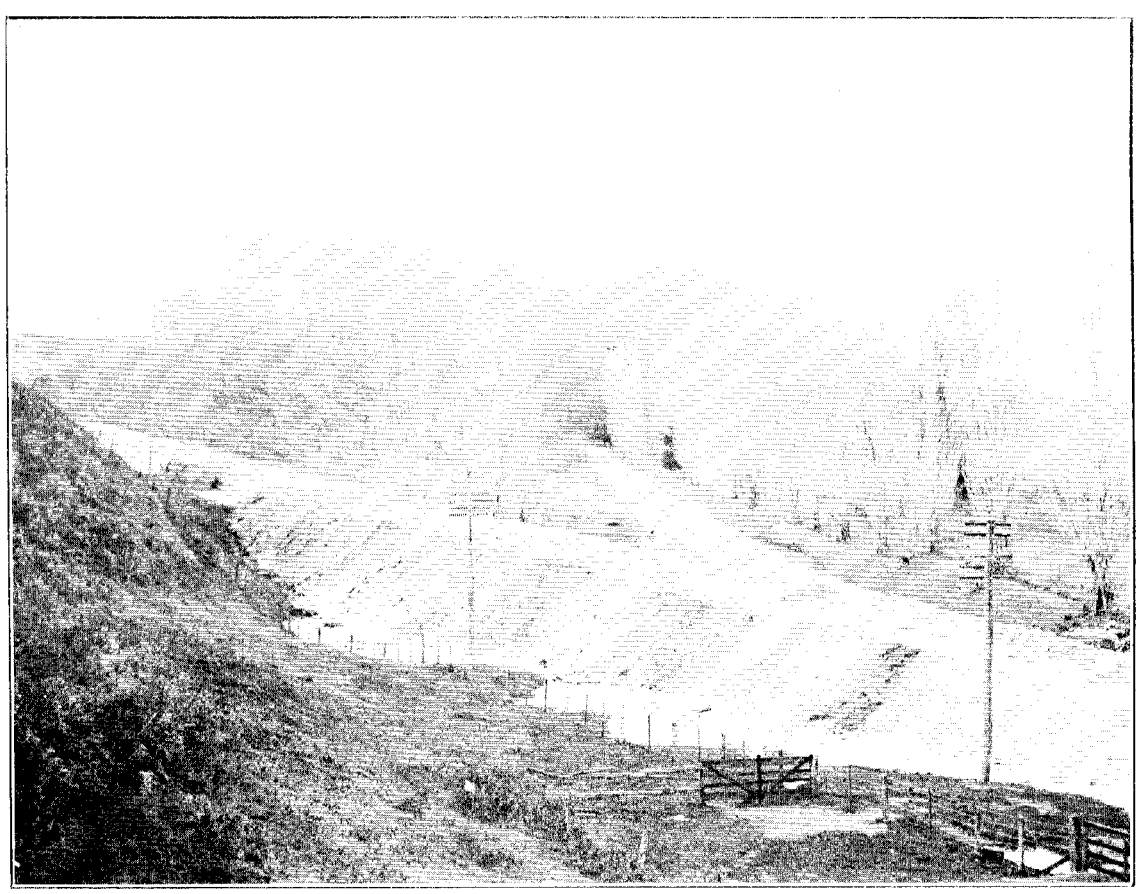
Scooping Gravel from Waimakariri Stream

HAMILTON ROTORUA MAIN HIGHWAY. MAMAKU BUSH SECTION



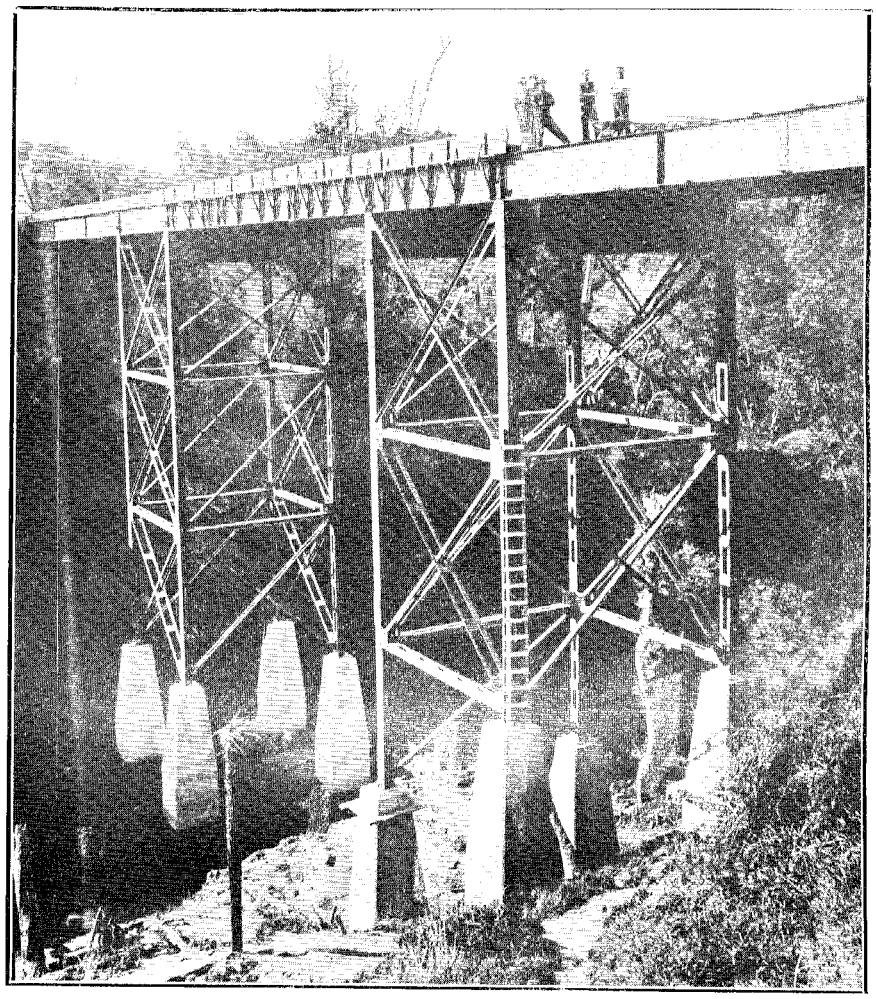
Quarrying Rock for Spalls for Foundation.

MATAMATA TAURANGA MAIN HIGHWAY. KAIMAI HILL SECTION.

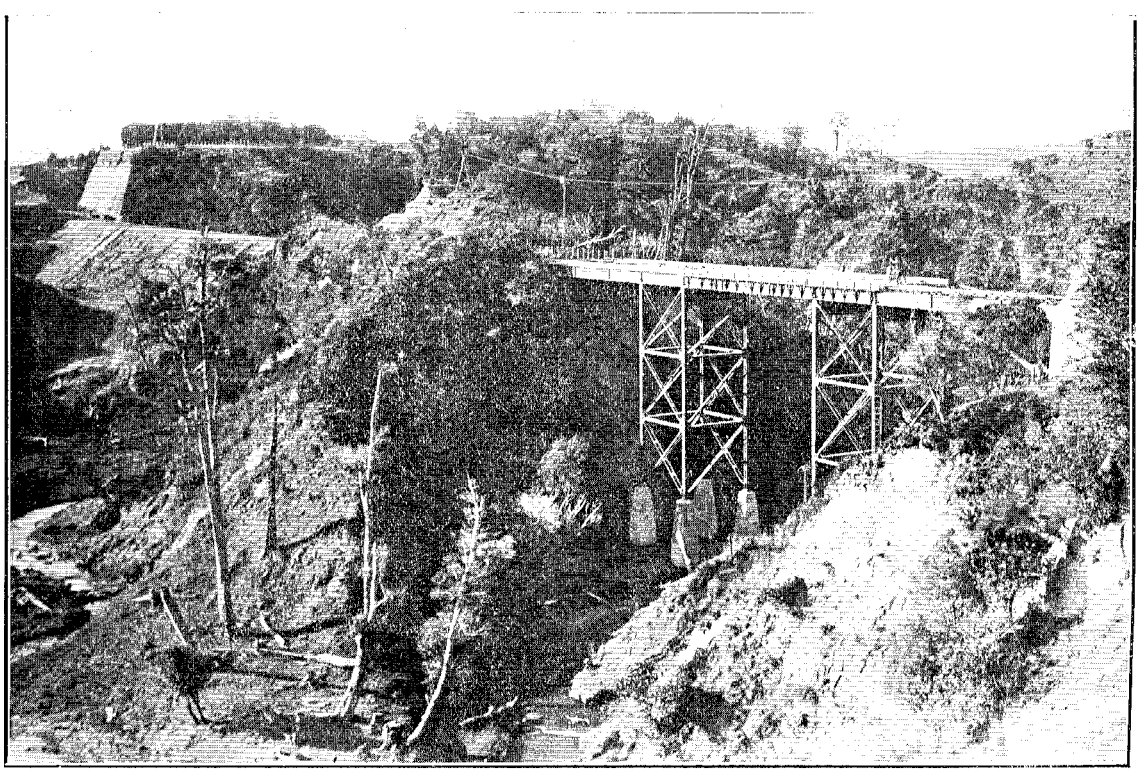


Karapiro Deviation.
New road in foreground.

HAMILTON ROTORUA MAIN HIGHWAY

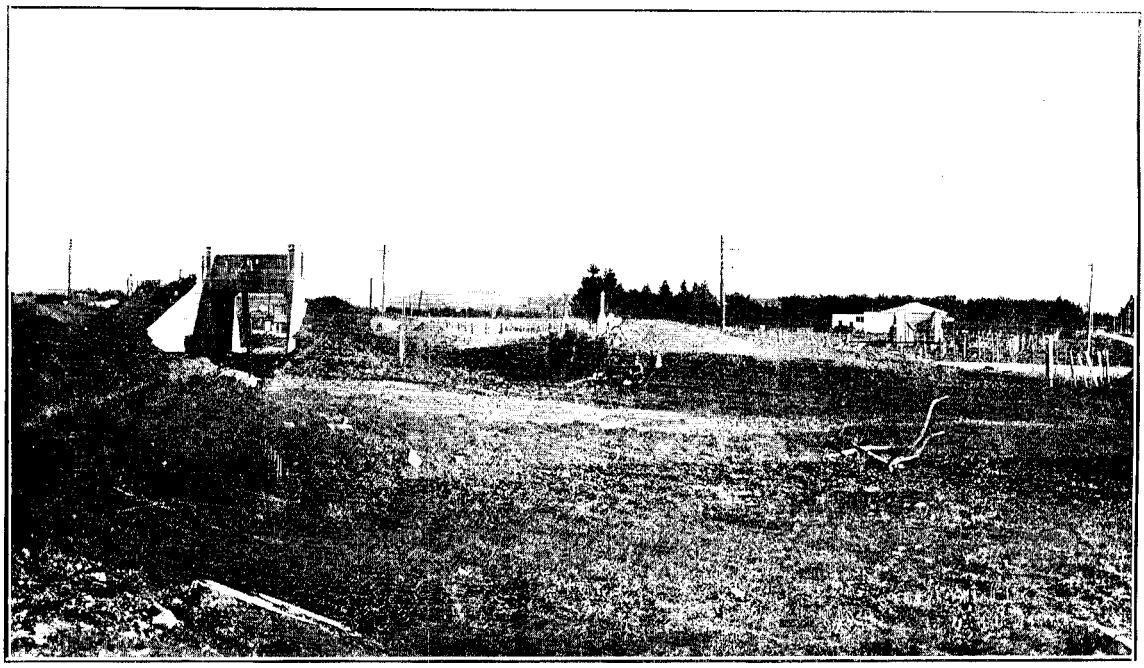


Construction almost completed: Concrete Deck being placed.

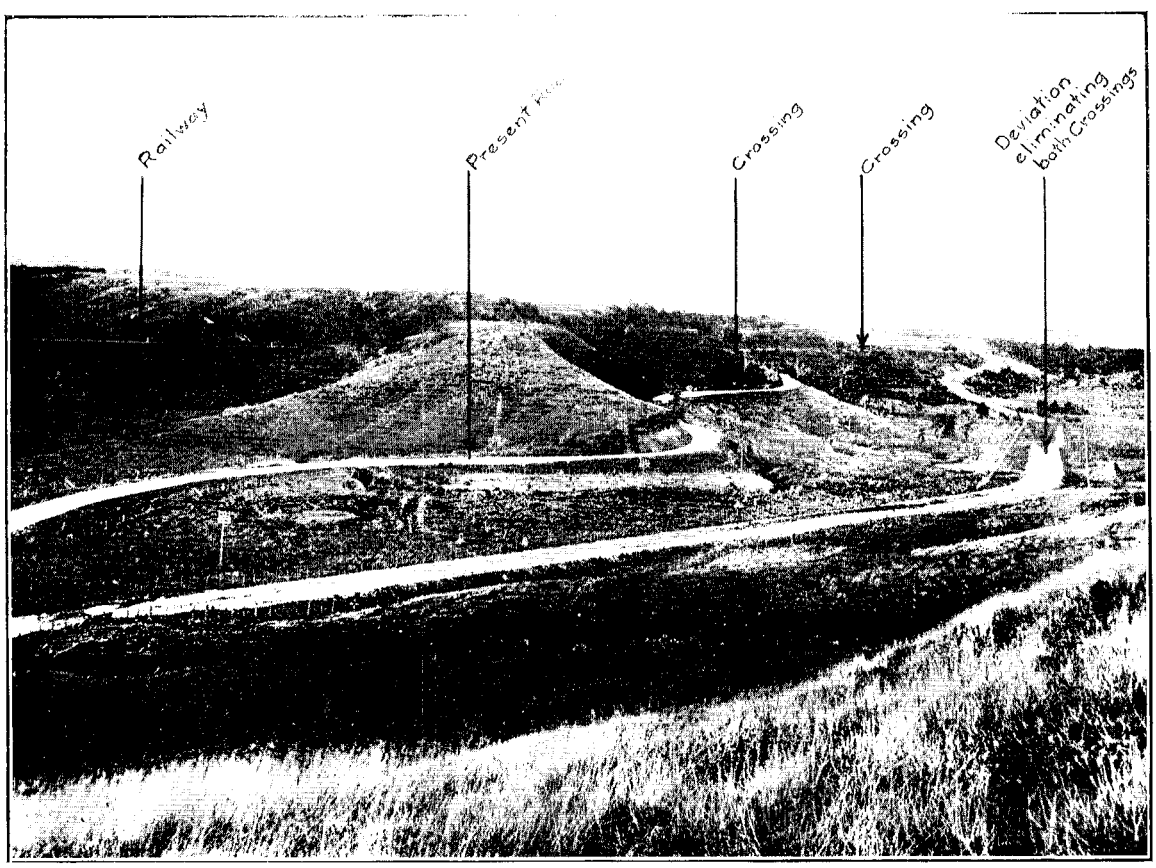


General View, showing Approach Cuttings and Banks, also Cable-way used for Erection.
Three 50 ft. and two 20 ft. steel plate girder spans on steel towers and concrete foundations; 19 ft. roadway. Concrete deck with bitumen surface. Height of deck above bed of creek, 68 ft.

NAPIER–WELLINGTON via WAIRARAPA MAIN HIGHWAY. WHAKARUATAPU STREAM BRIDGE.

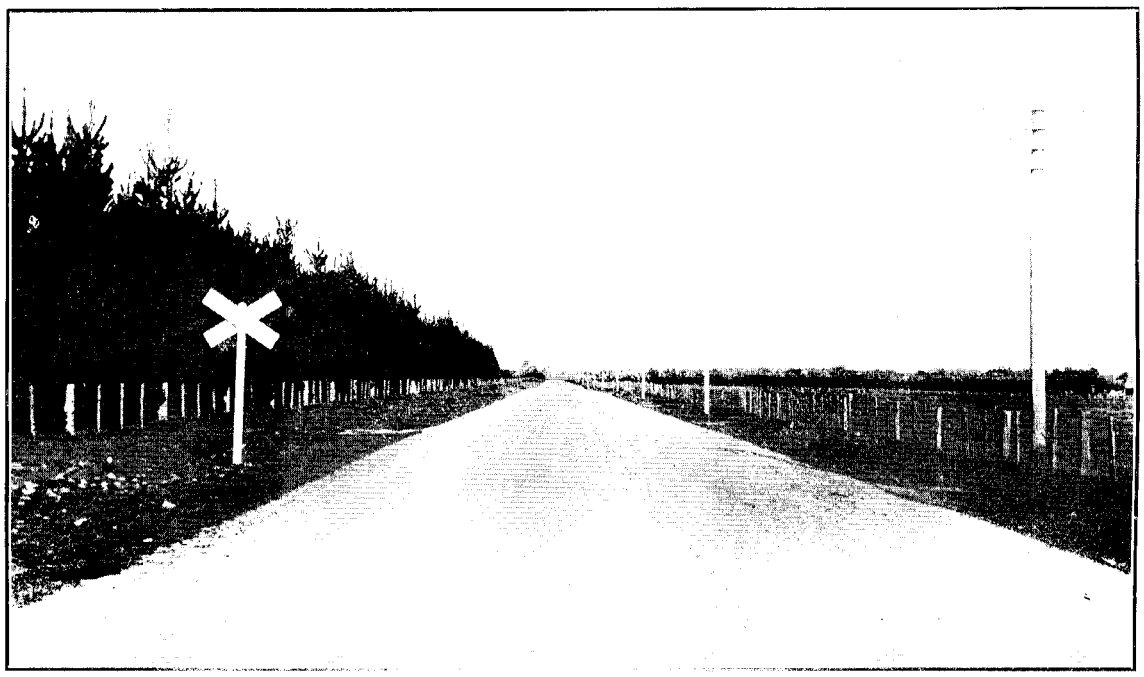


Elimination of Railway Level Crossing at Piripiri by Construction of Overbridge. Approaches in course of construction.

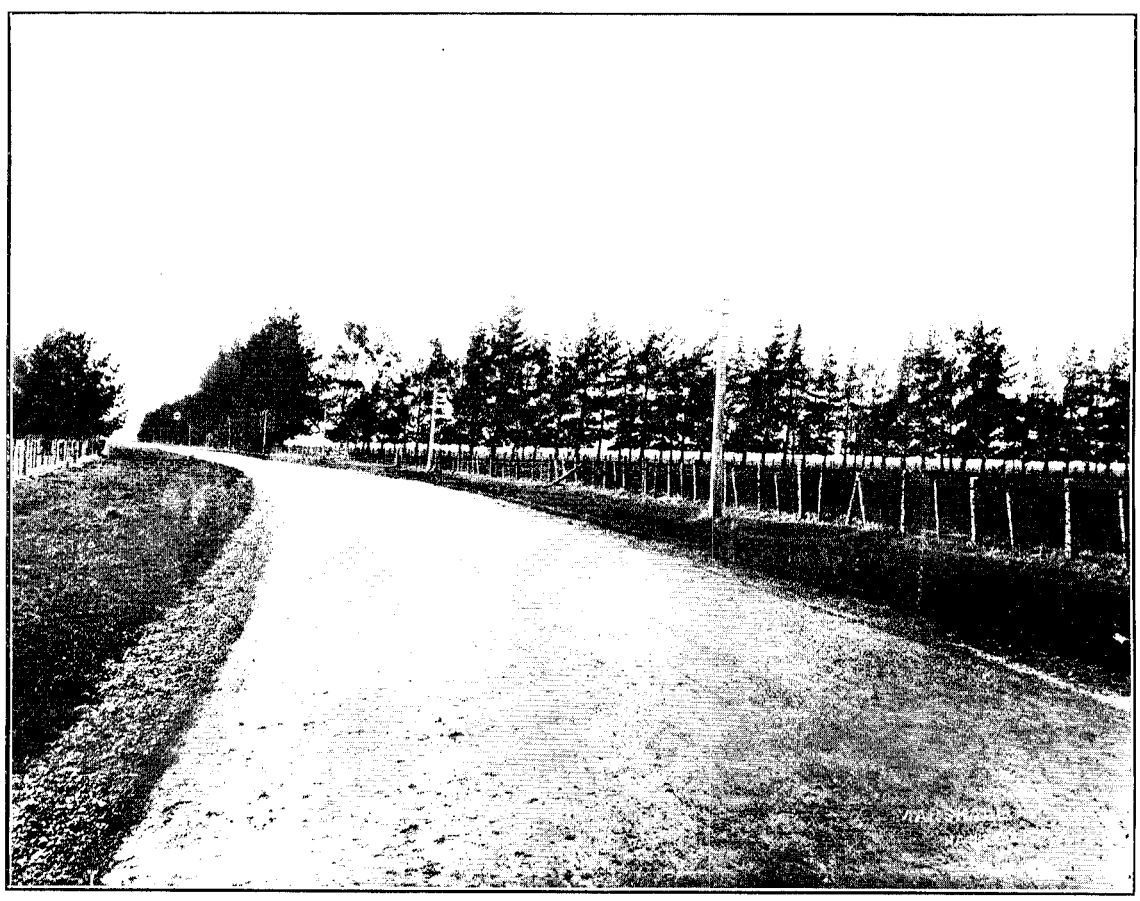


Elimination of Railway Level Crossings at Matahiwi by Deviation.

WELLINGTON NAPIER via WAIRARAPA MAIN HIGHWAY. ELIMINATION OF RAILWAY LEVEL CROSSINGS.

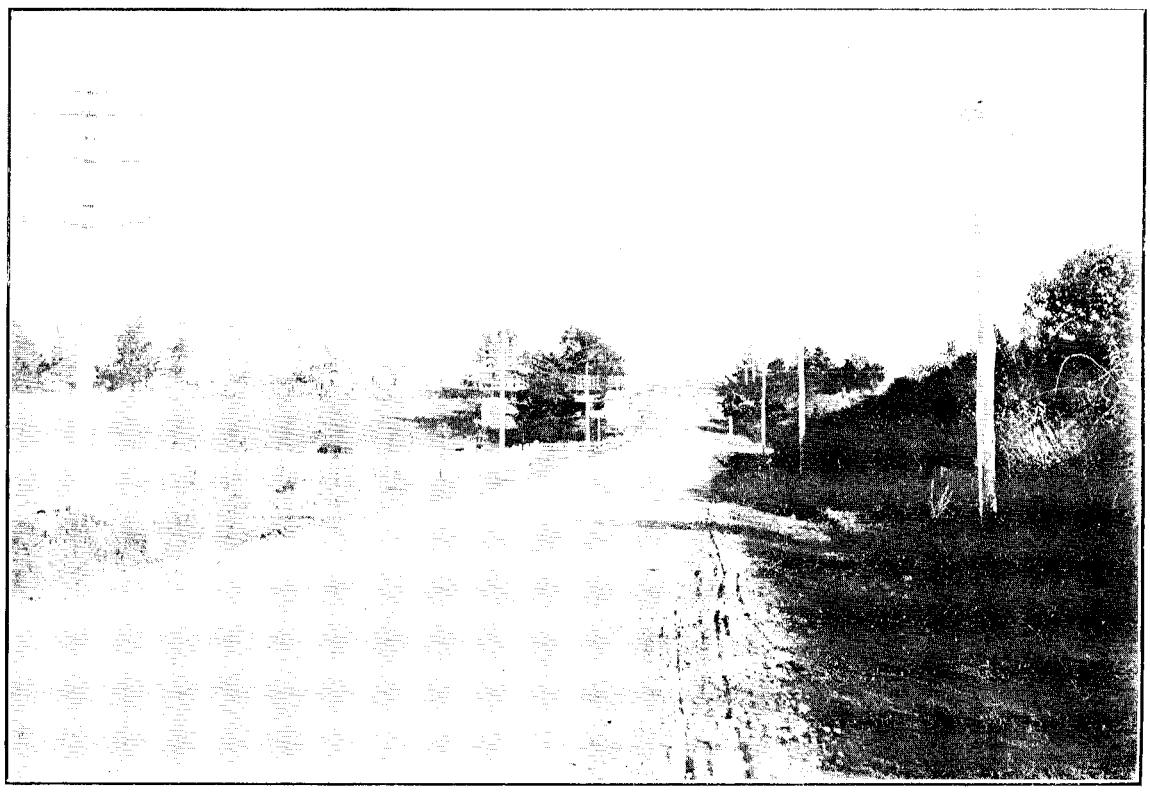


Bituminous Surface Treatment.



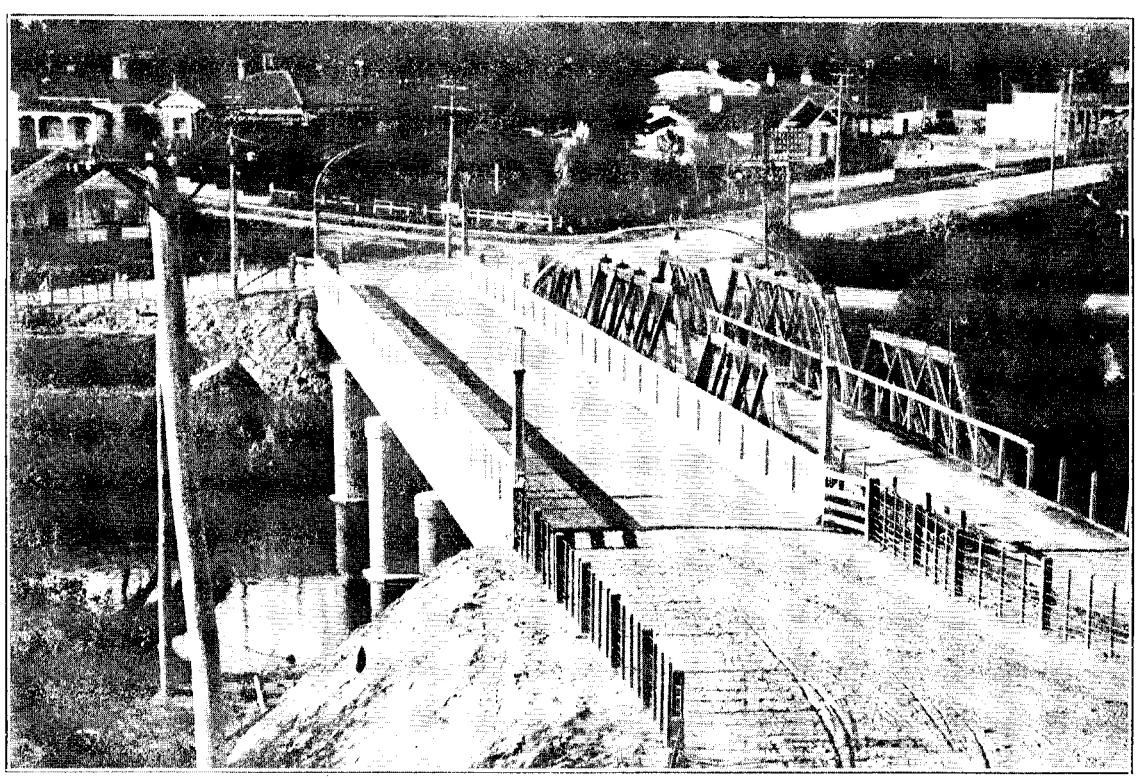
Bituminous Surface Treatment.

WELLINGTON NAPIER via WAIRARAPA MAIN HIGHWAY. DANNEVIRKE COUNTY SECTION.



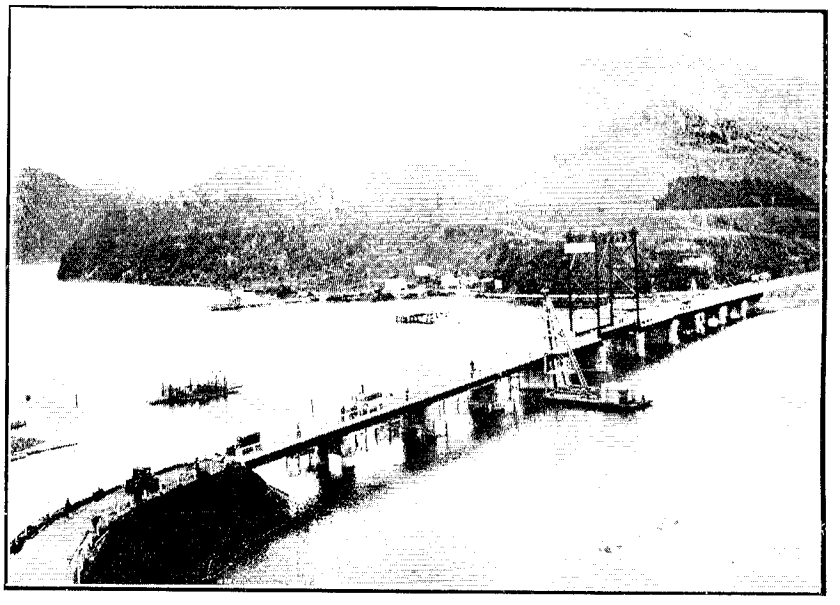
Bituminous Macadam (Penetration).

WELLINGTON–AUCKLAND *via* TARANAKI MAIN HIGHWAY.—HOROWHENUA COUNTY SECTION.

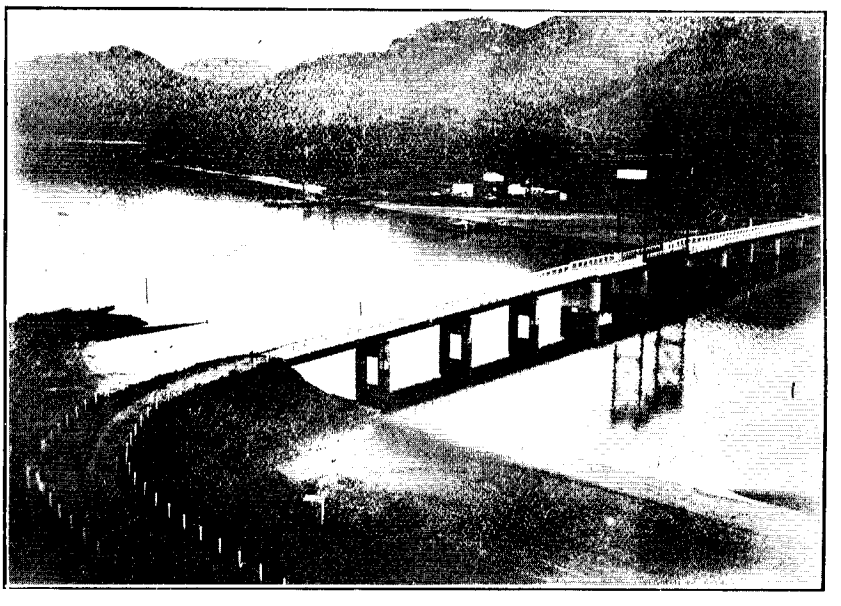


Ongarue River Bridge, Taumarunui.
Four 50-ft. reinforced-concrete beam spans; 18ft. roadway.

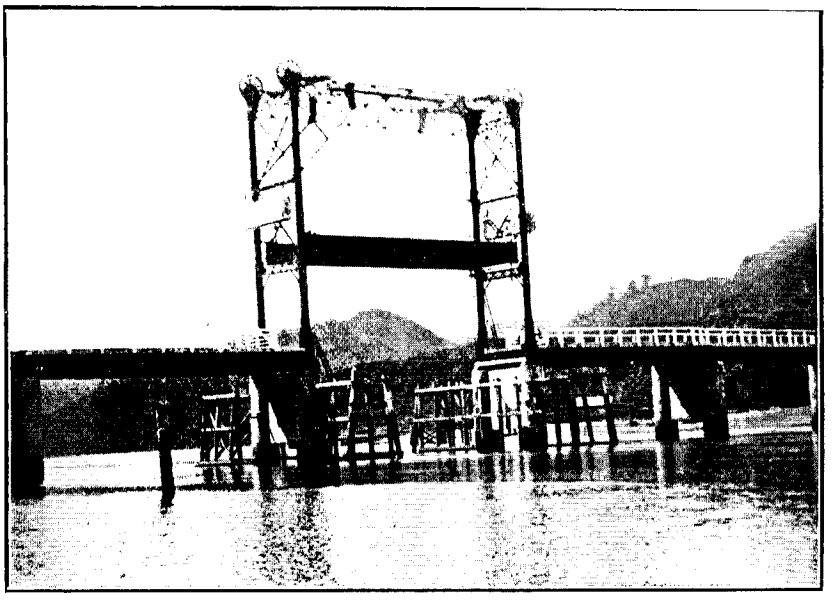
STRATFORD–TAUMARUNUI MAIN HIGHWAY.



Construction almost completed: Ferry still in use.

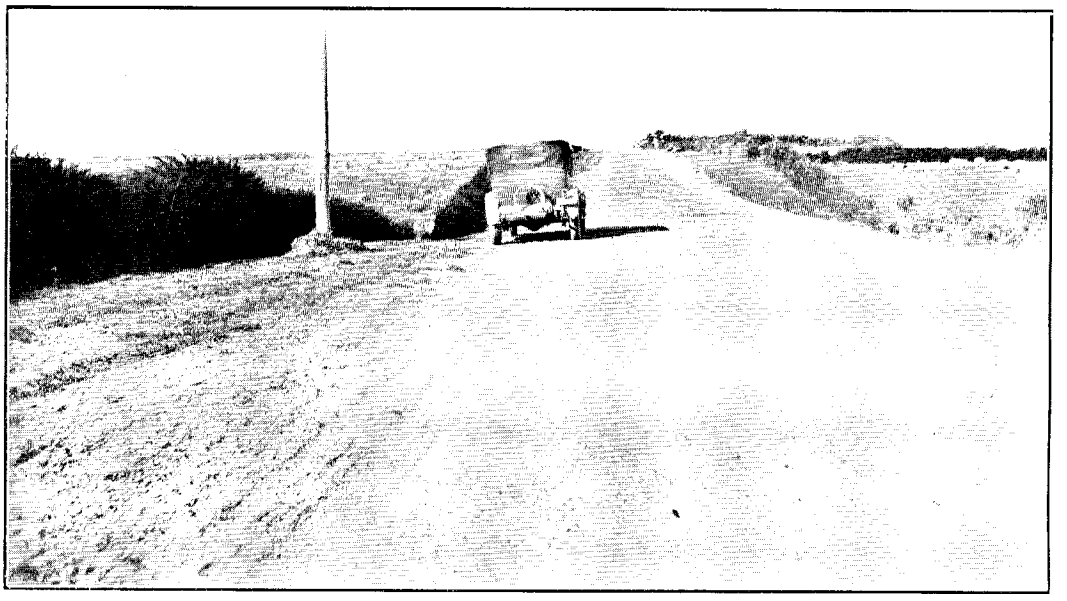


Construction completed: Ferry dismantled.

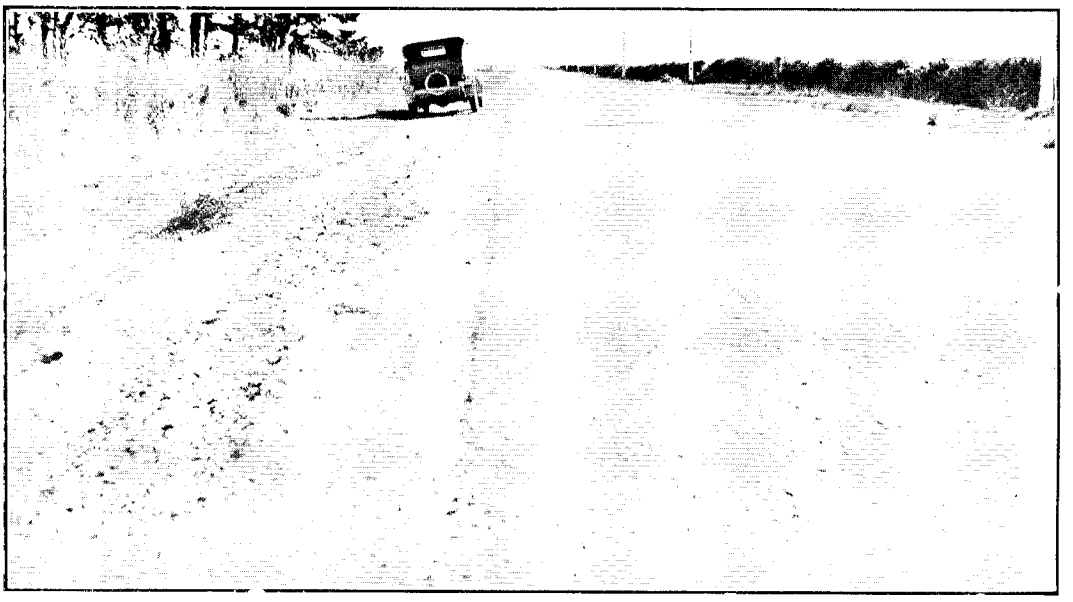


View showing Vertical lift Span and Fender Piling.
Ten 60 ft. steel plate girder spans with concrete deck, and one 60 ft. vertical lift span with timber deck.

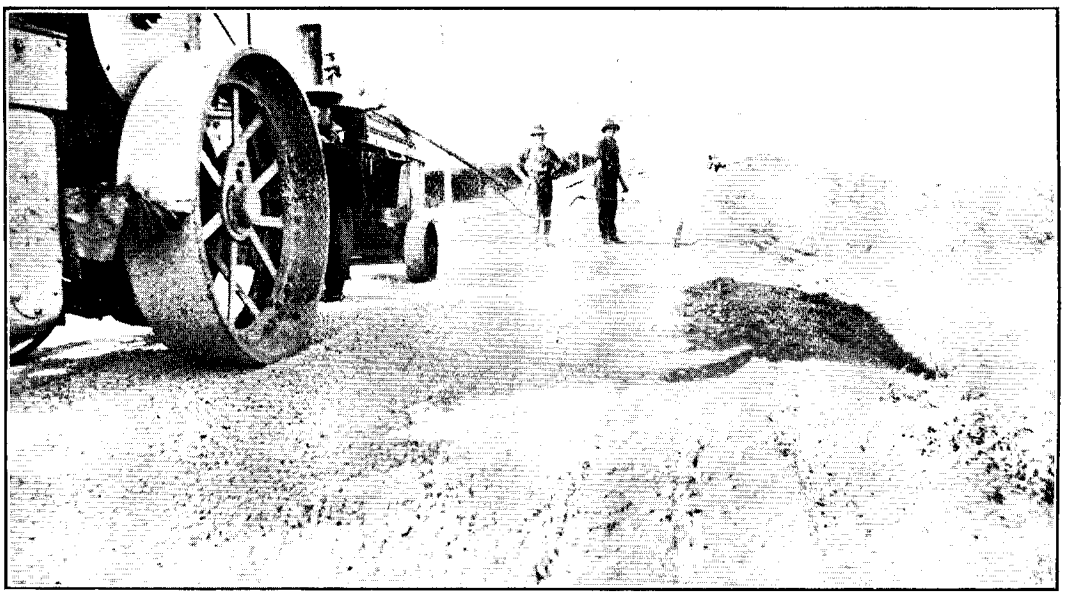
AUCKLAND WELLINGTON via TARANAKI MAIN HIGHWAY—MOKAU RIVER BRIDGE.



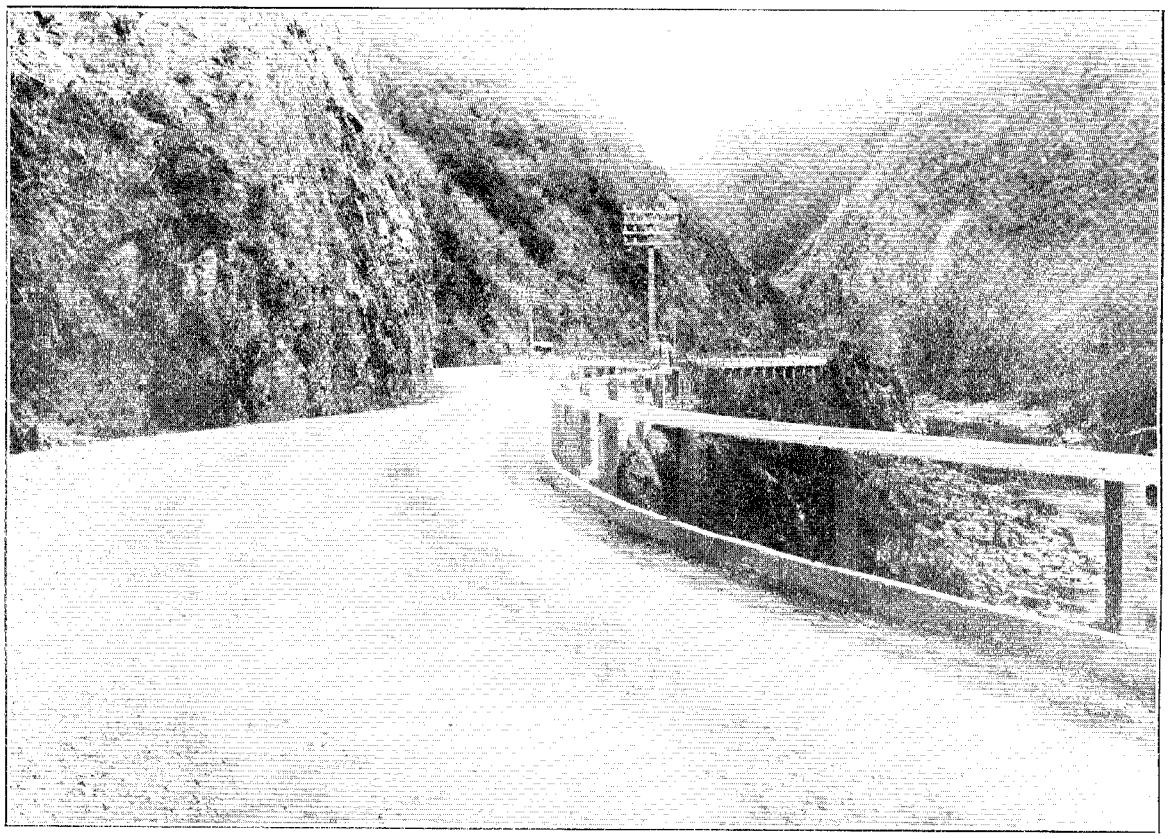
Bituminous Surface Treatment.



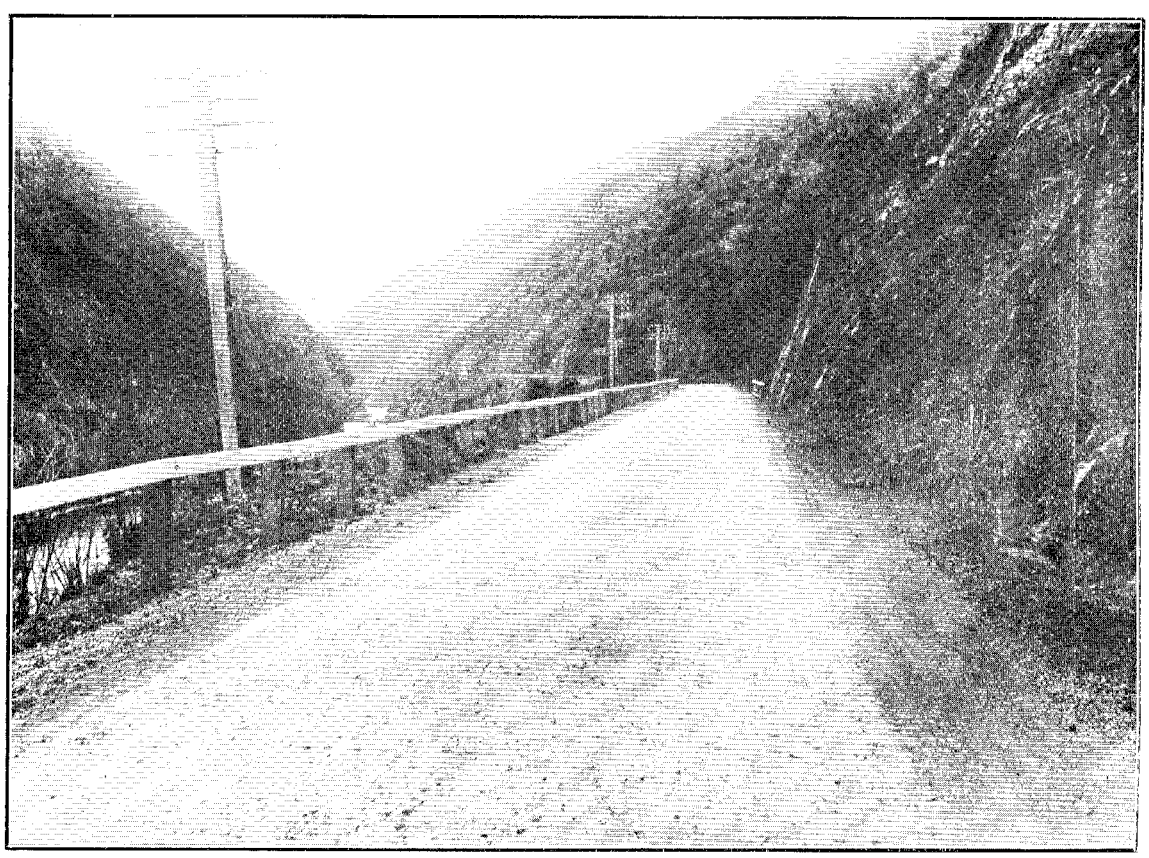
Bituminous Surface Treatment.



Bituminous Surface Treatment.

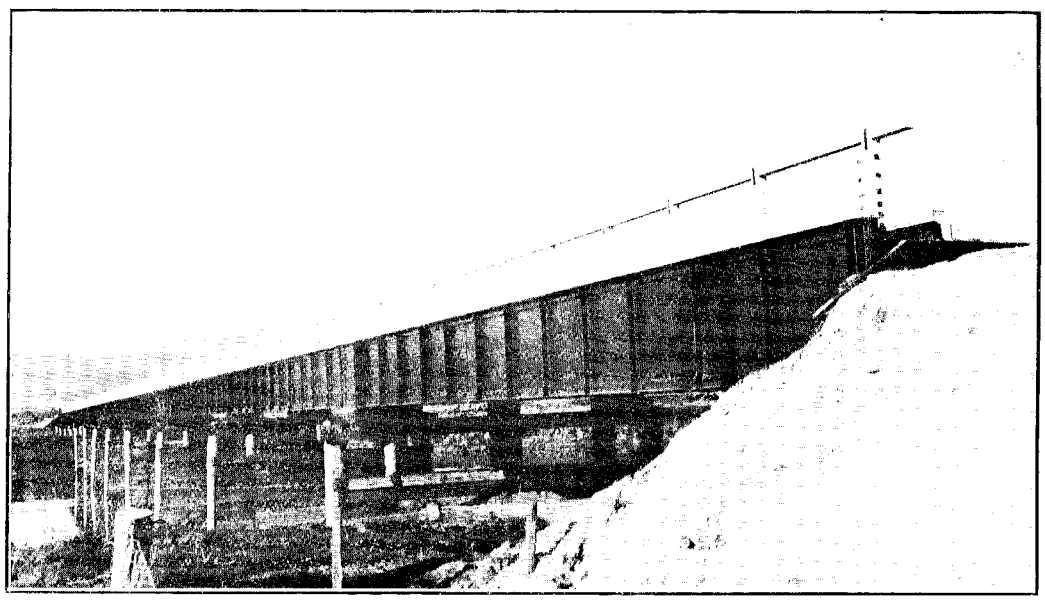


First-coat Sealing-work.



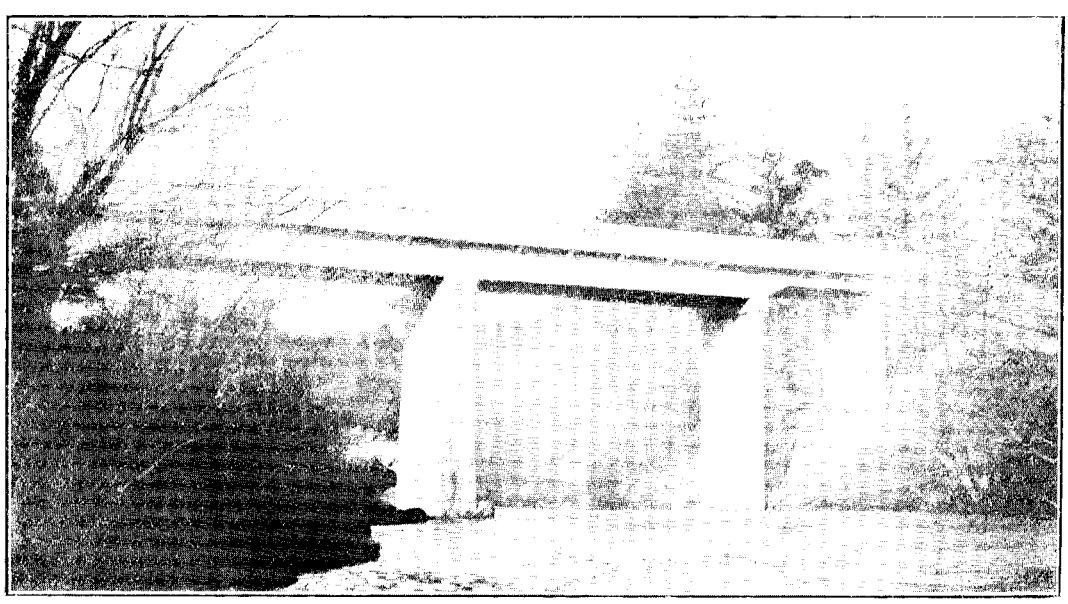
First-coat Sealing-work.

WOODVILLE–PALMERSTON NORTH MAIN HIGHWAY.—MANAWATU GORGE SECTION.



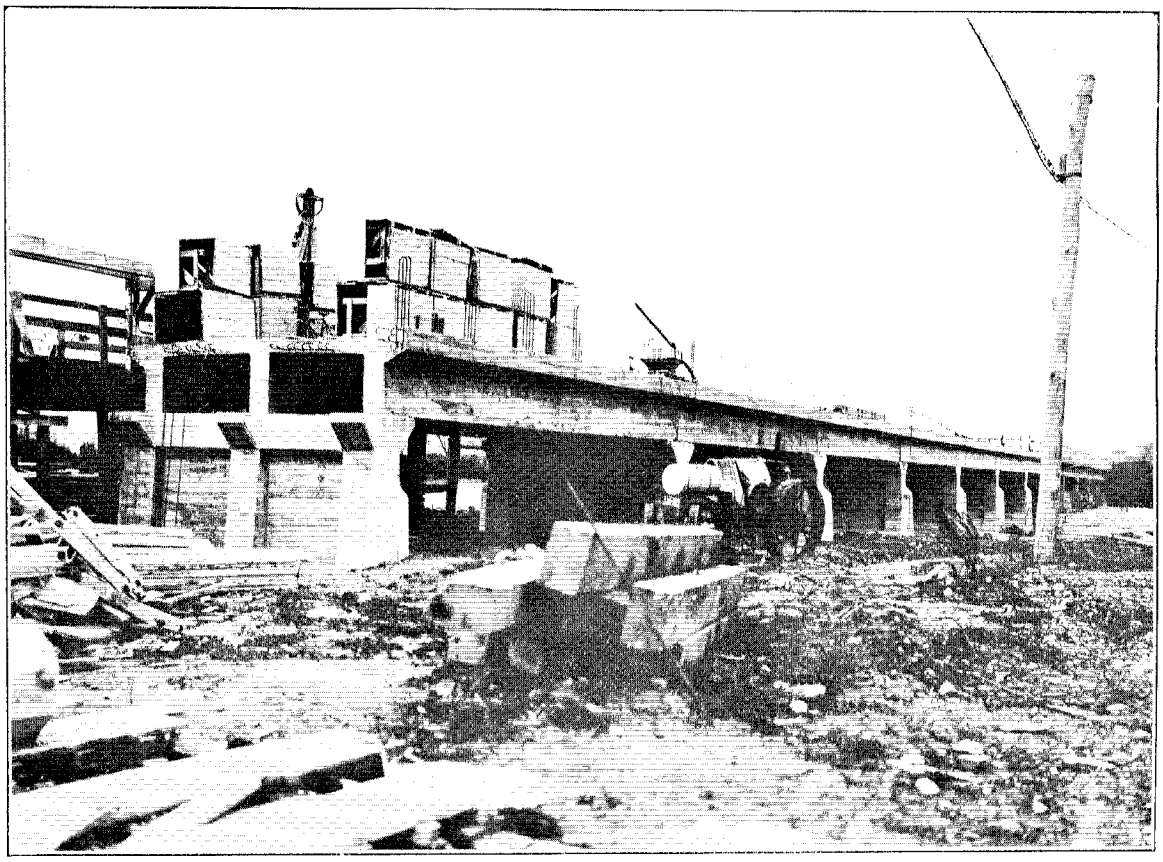
MANAWATU RIVER BRIDGE, SHANNON.
Twelve 60 ft. steel plate girder spans; 18 ft. roadway. Timber deck with bituminous surfacing.

FOXTON SHANNON MAIN HIGHWAY



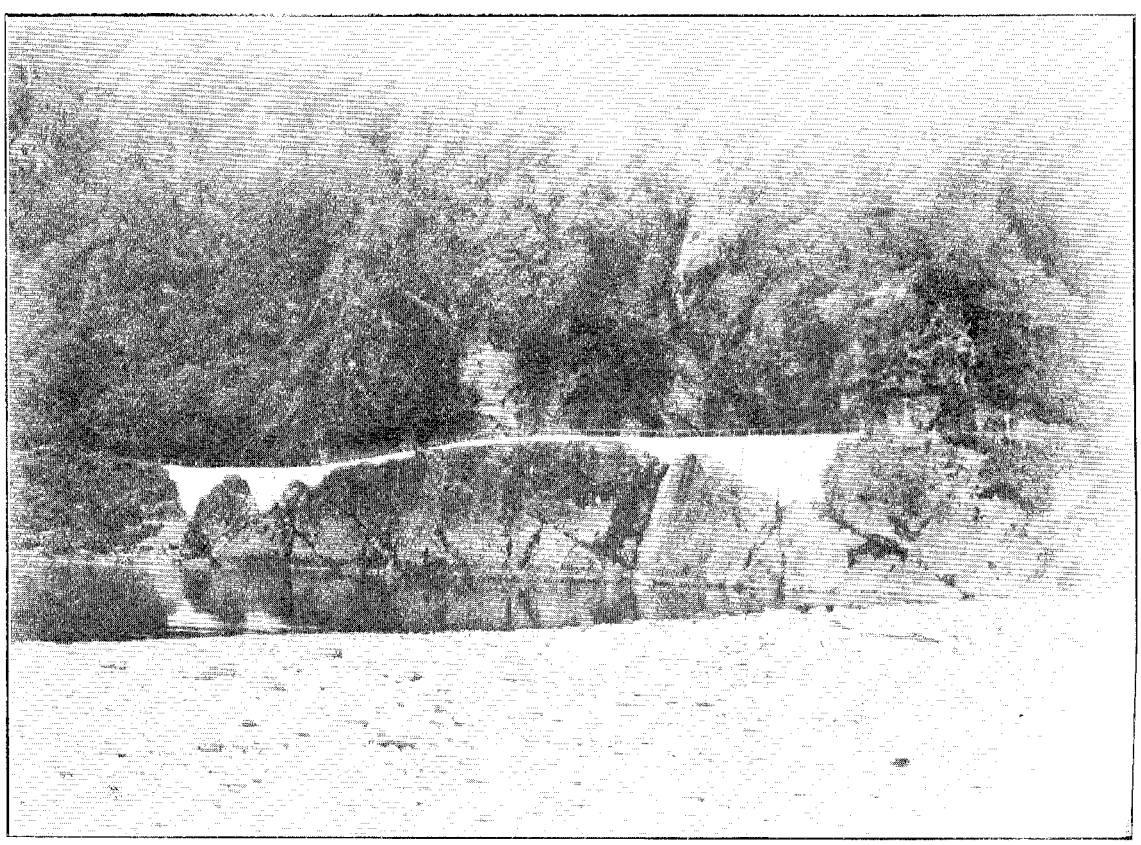
NGATURI RIVER BRIDGE.
Two 60 ft. and three 30 ft. spans.

PAHIATUA PONGAROA MAIN HIGHWAY.



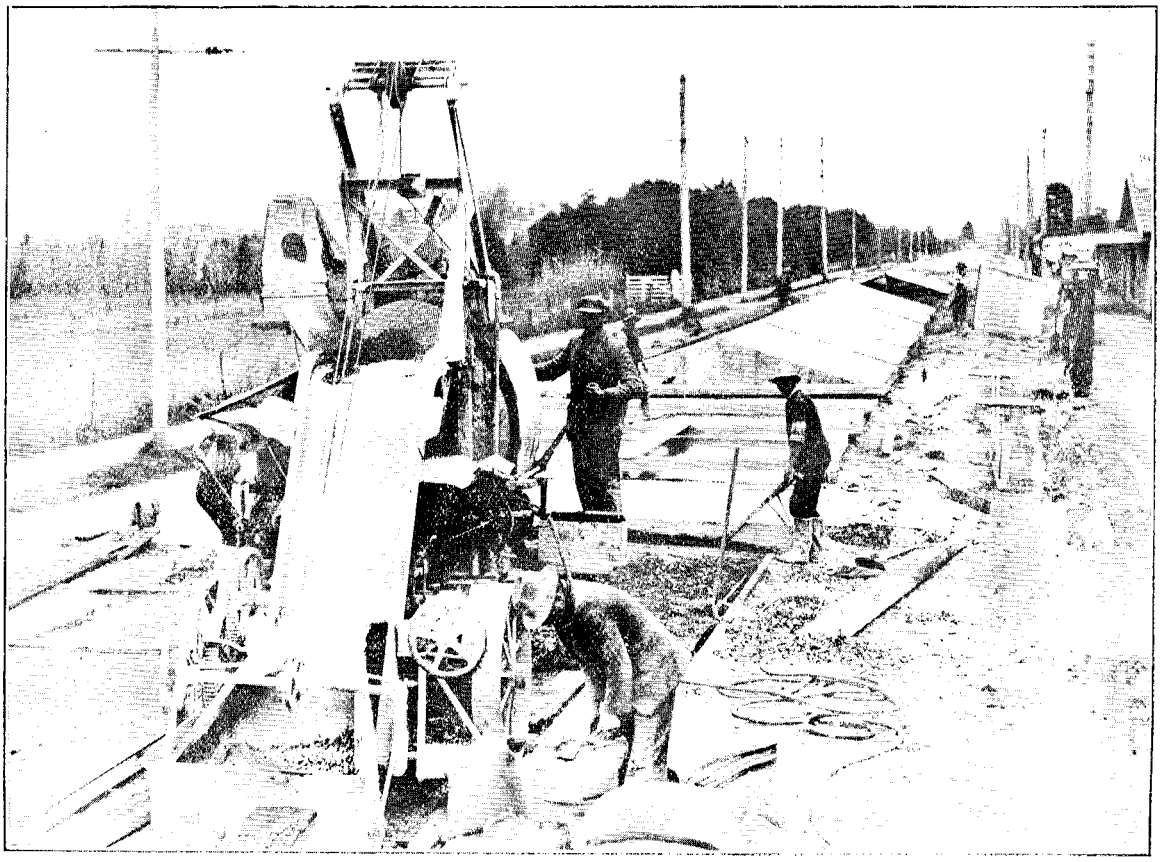
Motueka River Bridge under Construction.

RICHMOND COLLINGWOOD MAIN HIGHWAY.



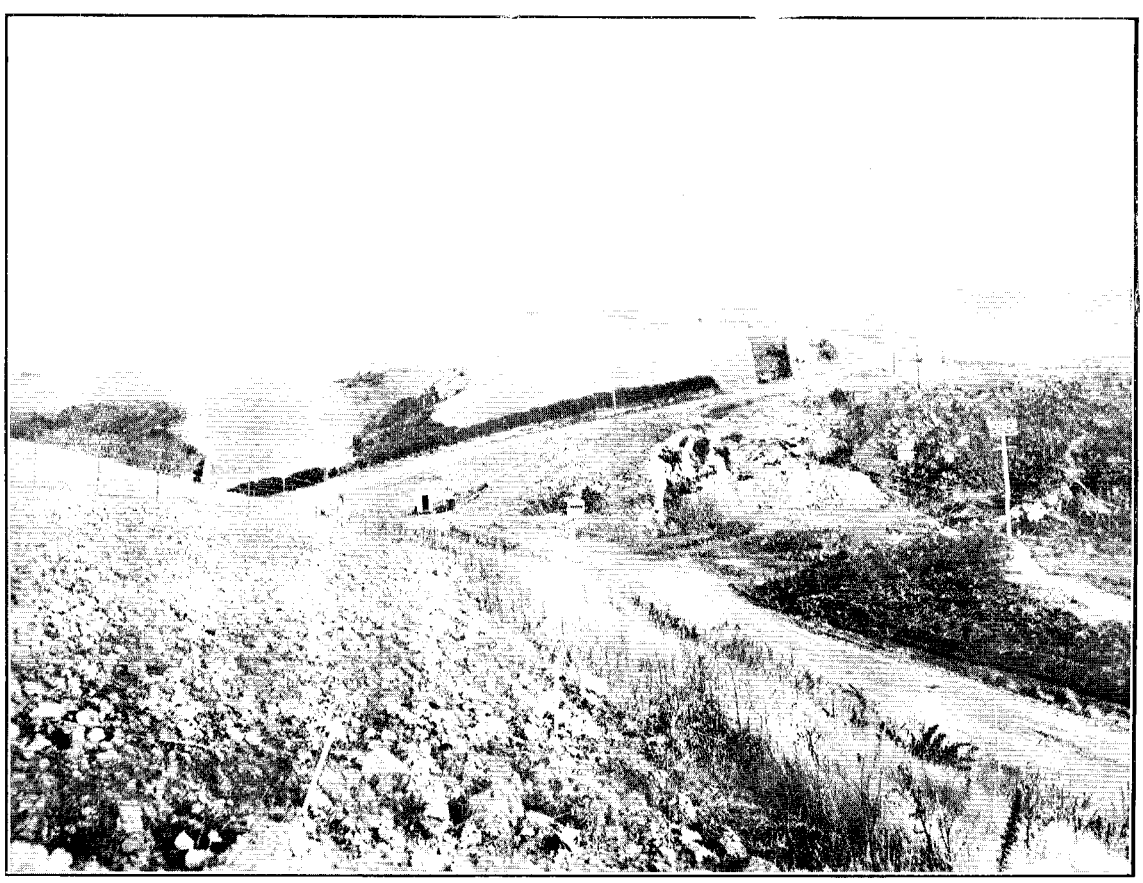
Concrete Retaining-wall replacing Timber Crib work at Hawk's Crag.

WESTPORT NELSON MAIN HIGHWAY. BULLER GORGE SECTION.



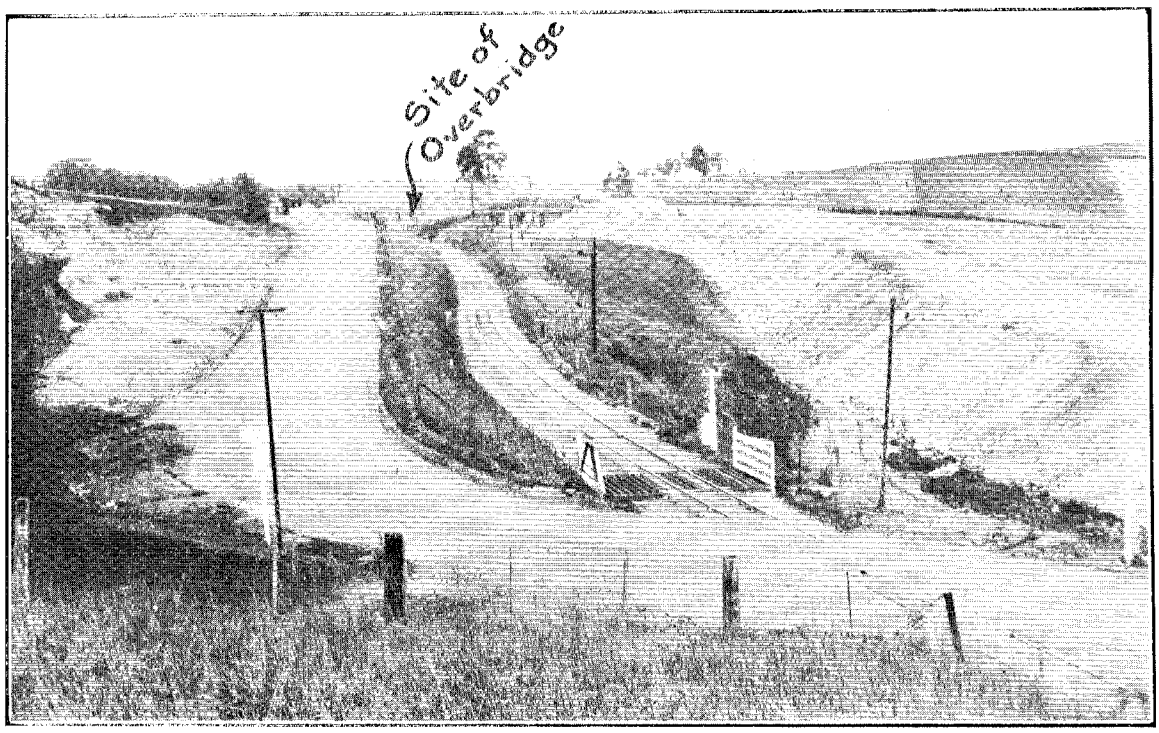
Portland cement Concrete Road in course of Construction.

CHRISTCHURCH BLENHEIM MAIN HIGHWAY.—STYX RIVER TO CHANEY'S SECTION.



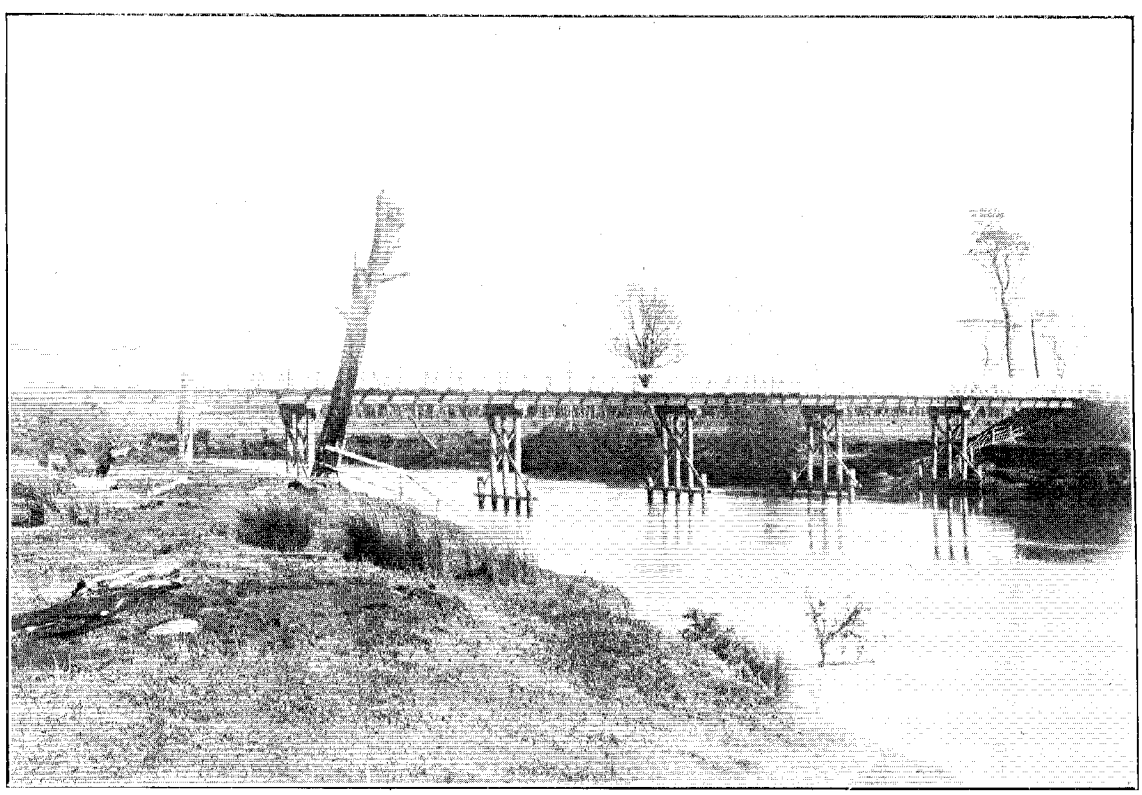
Stoney Creek Deviation in course of Construction.
New alignment will be straight.

DUNEDIN INVERCARGILL MAIN HIGHWAY.



Elimination of Railway Level Crossing at Tumai.
Present crossing in foreground. Approach bank to overbridge in course of construction.

DUNEDIN CHRISTCHURCH MAIN HIGHWAY.



Mataura River Bridge.

INVERCARGILL FORTROSE MAIN HIGHWAY.