NEW ZEALAND.

PUBLIC WORKS STATEMENT.

1939.

BY THE

Hon. R. SEMPLE,

MINISTER OF PUBLIC WORKS.

WELLINGTON.

BY AUTHORITY: E. V. PAUL, GOVERNMENT PRINTER.

1939.

1939.

NEW ZEALAND.

PUBLIC WORKS STATEMENT

(BY THE HON. R. SEMPLE, MINISTER OF PUBLIC WORKS).

MR. SPEAKER,—

Before proceeding to review, in particular, works carried out during the past year it seems desirable, in view of the widespread interest shown by a large section of the people in public works, to make a few general observations. Honourable members are aware that throughout the whole history of this Dominion public works have always been a very important factor in the process of its development and general advancement. Whatever has been achieved up to the present has been made possible to a great degree by works which have created opportunities for land settlement and production and have also provided utility services in various directions.

I recognize that the responsibility of administering public-works activities calls for the careful consideration of all kinds of schemes and projects that will promote the interests of the Dominion. The policy which has been, and is being, pursued under my administration is framed to advance the well-being of all sections of the community.

I have found that there is a popular belief that public works relate mostly to the construction of railways, roads, and bridges. While it is true that a large proportion of public-works expenditure is and should be devoted to such works, there are many other important undertakings which form part of the Government's public-works programme. I refer to such activites as the erection of public buildings for State administrative purposes, departmental buildings, post-offices, police-stations, courthouses, education and health institutions; the construction of national hydro-electric schemes, irrigation schemes, lighthouses, harbour-works, and aerodromes; land-drainage, reclamation, and river-control. In addition to works under these headings, there is the constant maintenance of the various buildings and structures, and the operation of hydro-electric power and irrigation schemes.

Of the works mentioned the buildings are, of course, more or less for administrative purposes, but the others have a considerable economic value. Proof of

this is afforded by the fact that any work undertaken arises from a special need in some particular district or from a general expression of public opinion that a particular work is vitally necessary.

I feel it to be my duty always to thoroughly investigate any proposal which might be brought forward, and to approve of only those projects wherein the public interests and benefits are paramount to all other considerations.

Since this Government assumed office the general prosperity of the country has increased, and it naturally follows that an expansion in public works is necessary not only to keep pace with, but to stimulate and promote, development. Special attention has been given to agricultural and pastoral requirements in the way of providing better roading facilities, and in many localities settlers now have the advantage of all-weather road access by reason of extensive metalling and bridging carried out during the past three years. The reconstruction and improvement of the principal roading system of the Dominion has been advanced by a vigorous policy in respect to main highways, with the result that better transport facilities now exist for our primary industries and commercial activities.

Considerable progress has also been made towards the completion of several major railway connections in both Islands which will serve large areas of settled land which hitherto have been handicapped by inadequate means of transport.

The development of hydro-electric schemes has enabled the State to augment its bulk supply to meet the increasing demands for power, and has also enabled reticulation to be extended into many additional areas. For the purpose of increasing production in districts which do not enjoy sufficient rainfall, major irrigation works are in progress, and although some of these schemes will not be completed for some time yet, those which have been in operation are showing excellent results.

The steadily increasing commercial air services and the requirements of defence have necessitated the construction and improvement of civil and military aerodromes, and a substantial advance has been made in the past year towards the completion of many works in this category.

The erection of public buildings of all kinds has proceeded, and much-needed accommodation has been and is being provided for the various Departments of State.

The mechanization of construction works has done much in the way of expediting progress and in enabling important and urgent works to be carried out at economic costs.

I am pleased to be able to record that the efficient organization and personnel of the Public Works Department has continued to function with every satisfaction, and the workmen have given of their best services in fulfilling the Government's public-works policy.

In previous Statements I have referred to the question of river-control and to the necessity for introducing a comprehensive scheme for the purpose of arresting the accumulating losses of productive land through flood erosion. I had hoped to be able to introduce into the House this session a Bill to deal with the whole matter, but pressure of other work has prevented this. I am having the Bill prepared during the coming recess, and will have it ready to introduce next session.

FINANCE.

The payments and receipts and accumulated totals in connection with the Public Works Fund and other associated votes and accounts for the year 1938–39 are shown in the tabulation following.

The gross expenditure amounted to £21,091,543, of which £5,741,099 was expended by other Government Departments; the recoveries in reduction of expenditure amounted to £4,169,654, of which £1,262,076 was recovered by other Departments; the net expenditure totalled £16,921,888, of which £4,479,023 was expended by other Departments.

In addition, the Department collected £1,703,366 for the supply of electric energy, irrigation receipts, and miscellaneous revenue from other sources.

1939.

NEW ZEALAND.

PUBLIC WORKS STATEMENT

(BY THE HON. R. SEMPLE, MINISTER OF PUBLIC WORKS).

MR. SPEAKER,—

Before proceeding to review, in particular, works carried out during the past year it seems desirable, in view of the widespread interest shown by a large section of the people in public works, to make a few general observations. Honourable members are aware that throughout the whole history of this Dominion public works have always been a very important factor in the process of its development and general advancement. Whatever has been achieved up to the present has been made possible to a great degree by works which have created opportunities for land settlement and production and have also provided utility services in various directions.

I recognize that the responsibility of administering public-works activities calls for the careful consideration of all kinds of schemes and projects that will promote the interests of the Dominion. The policy which has been, and is being, pursued under my administration is framed to advance the well-being of all sections of the community.

I have found that there is a popular belief that public works relate mostly to the construction of railways, roads, and bridges. While it is true that a large proportion of public-works expenditure is and should be devoted to such works, there are many other important undertakings which form part of the Government's public-works programme. I refer to such activites as the erection of public buildings for State administrative purposes, departmental buildings, post-offices, police-stations, courthouses, education and health institutions; the construction of national hydro-electric schemes, irrigation schemes, lighthouses, harbour-works, and aerodromes; land-drainage, reclamation, and river-control. In addition to works under these headings, there is the constant maintenance of the various buildings and structures, and the operation of hydro-electric power and irrigation schemes.

Of the works mentioned the buildings are, of course, more or less for administrative purposes, but the others have a considerable economic value. Proof of

this is afforded by the fact that any work undertaken arises from a special need in some particular district or from a general expression of public opinion that a particular work is vitally necessary.

I feel it to be my duty always to thoroughly investigate any proposal which might be brought forward, and to approve of only those projects wherein the public interests and benefits are paramount to all other considerations.

Since this Government assumed office the general prosperity of the country has increased, and it naturally follows that an expansion in public works is necessary not only to keep pace with, but to stimulate and promote, development. Special attention has been given to agricultural and pastoral requirements in the way of providing better roading facilities, and in many localities settlers now have the advantage of all-weather road access by reason of extensive metalling and bridging carried out during the past three years. The reconstruction and improvement of the principal roading system of the Dominion has been advanced by a vigorous policy in respect to main highways, with the result that better transport facilities now exist for our primary industries and commercial activities.

Considerable progress has also been made towards the completion of several major railway connections in both Islands which will serve large areas of settled land which hitherto have been handicapped by inadequate means of transport.

The development of hydro-electric schemes has enabled the State to augment its bulk supply to meet the increasing demands for power, and has also enabled reticulation to be extended into many additional areas. For the purpose of increasing production in districts which do not enjoy sufficient rainfall, major irrigation works are in progress, and although some of these schemes will not be completed for some time yet, those which have been in operation are showing excellent results.

The steadily increasing commercial air services and the requirements of defence have necessitated the construction and improvement of civil and military aerodromes, and a substantial advance has been made in the past year towards the completion of many works in this category.

The erection of public buildings of all kinds has proceeded, and much-needed accommodation has been and is being provided for the various Departments of State.

The mechanization of construction works has done much in the way of expediting progress and in enabling important and urgent works to be carried out at economic costs.

I am pleased to be able to record that the efficient organization and personnel of the Public Works Department has continued to function with every satisfaction, and the workmen have given of their best services in fulfilling the Government's public-works policy.

In previous Statements I have referred to the question of river-control and to the necessity for introducing a comprehensive scheme for the purpose of arresting the accumulating losses of productive land through flood erosion. I had hoped to be able to introduce into the House this session a Bill to deal with the whole matter, but pressure of other work has prevented this. I am having the Bill prepared during the coming recess, and will have it ready to introduce next session.

FINANCE.

The payments and receipts and accumulated totals in connection with the Public Works Fund and other associated votes and accounts for the year 1938–39 are shown in the tabulation following.

The gross expenditure amounted to £21,091,543, of which £5,741,099 was expended by other Government Departments; the recoveries in reduction of expenditure amounted to £4,169,654, of which £1,262,076 was recovered by other Departments; the net expenditure totalled £16,921,888, of which £4,479,023 was expended by other Departments.

In addition, the Department collected £1,703,366 for the supply of electric energy, irrigation receipts, and miscellaneous revenue from other sources.

Class of Work.	Expenditure, 1938–39. Gross.	Recoveries.	Net.	Total Net Expenditure to 31st March, 1939.
EXPENDITURE, PUBLIC WORKS FUND.				
Railways—	£	£	£	£
New construction	1,299,134	64,488	1,234,646	41,611,130
Improvements and additions to open lines	2,653,040	89,604	2,563,436	22,200,208
Roads	1,455,194	164,356	1,290,838	26,317,197*
Public buildings	2,208,510	122,216	2,086,294	16,159,049†
Lighthouses, harbour-works, and harbour defences	37,900	4,050	33,850	1,368,672
Tourist and health resorts	24,953	401	24,552	781,636
Telegraph extension	872,646	296,702	575,944	12,876,634
Departmental	547,939	331,848	216,091	3,596,632
Irrigation, water-supply, and drainage	283,733	119,253	164,481	1,550,381
Lands-improvement	241,636	106,959	134,677	1,251,757
Swamp land drainage	24,931	19,607	5,324	105,607
Settlement of unemployed workers	526,397	181,713	344,684	1,411,851‡
Native-land settlement	1,166,104	672,408	493,695	1,190,412
Dairy industry loans	300	..	300	46,125
Cost and discount, raising loans, &c.	..	..	..	3,828,307
Closed accounts (for more detail see Table 1)	..	..	..	8,120,785
Totals, General Purposes Account	11,342,417	2,173,605	9,168,812	142,416,383§
Electric Supply Account (previously Aid to Water-power Works Account)—				
Construction	980,389	19,763	960,626	16,383,268‖
Working-expenses	384,203	7,046	377,157	..
Waihou and Ohinemuri Rivers Improvement Account	..	..	..	709,740¶
Totals, Public Works Fund	12,707,009	2,200,414	10,506,595	159,509,391
EXPENDITURE, OTHER VOTES AND ACCOUNTS.				
Main Highways Account—				
Annual appropriation—				
Construction, reconstruction, and improvements	3,040,502	223,912	2,816,589**	12,431,988††
Maintenance, repairs, and renewals	1,632,729	62,483	1,570,246**	..
Administration, plant, and miscellaneous expenditure	411,209	31,620	379,589**	..
Interest, fees, and loan redemptions	382,893	..	382,893**	..
Permanent appropriations (rate subsidies, interest on transfer from Public Works Fund, &c.)	309,963	..	309,963**	..
Consolidated Fund—				
Maintenance, public buildings, roads, &c.‡‡	231,408	34,887	196,521	..
Aerodromes and landing-grounds	334,766	205,169	129,597	..
Plant, material, and miscellaneous services‡‡	1,789,317	1,411,169	378,148	..
Closed accounts (for details see Public Works Statement, 1933)	..	..	..	18,955,387
Employment Promotion Fund (expenditure by Public Works Department): Amounts not included above	251,747	..	251,747	..
Totals, Other votes and accounts	8,384,534	1,969,240	6,415,293	31,387,375
Grand total of expenditure, Public Works Fund and other votes and accounts for the year ended 31st March, 1939	21,091,543	4,169,654	16,921,888	..
Capital expenditure to date	..	..	..	190,896,766

* Includes £4,500 expended under section 16, subsection (1), Native Land Amendment and Native Land Claims Adjustment Act, 1923. † Excludes expenditure on workers' dwellings totalling £319,918 transferred to State Advances Account; includes £154,488 expended under Reserves and other Lands Disposal Act, 1936, section 32. ‡ Includes £4,865 expended under Finance Act, 1932 (No. 2), section 6. § Does not include expenditure under Ellesmere Land Drainage Act, 1905, or £1,226,000 transferred to and included in Main Highways Construction Fund. ‖ Total capital, excluding suspense items as per accounts in Table No. 5 ¶ Excludes interest and loan charges. ** For annual income and expenditure accounts see Appendix E. †† As per accounts in Appendix E. ‡‡ Excludes transfers to Public Works Fund vote, &c. (£20,020.)

Class of Work.	Recoveries, 1938–39.
RECEIPTS,* PUBLIC WORKS DEPARTMENT.	
Ordinary Revenue Account—	£
Irrigation (receipts for year)	26,140
Miscellaneous receipts for year	21,603
Electric Supply Account (sales of energy, miscellaneous receipts, &c.): Receipts for year	1,622,457
Main Highways Account (repayment of advances, &c., and interest): Receipts for year	33,166
Total receipts	1,703,366

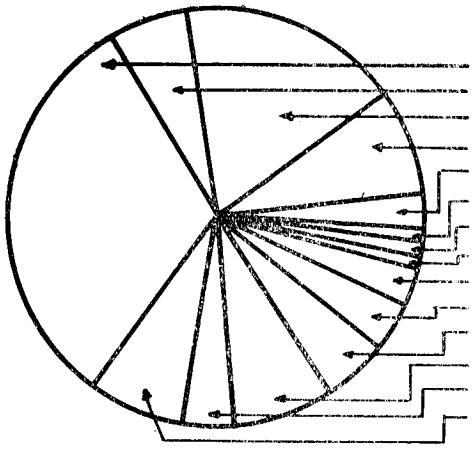
* Excludes motor-spirits tax, registration fees, &c., collected by other Departments.

Summary.

	Public Works Department.	Other Departments.	Total.
	£	£	£
Gross expenditure	15,350,144	5,741,099	21,091,543
Recoveries and receipts	4,610,944	1,262,076	5,873,020

Of the net expenditure of £16,921,888 previously mentioned, £12,234,412 may be regarded as having been expended from loan-moneys (£9,168,812 General Purposes Account, £390,000 Electric Supply Account, and £2,675,600 Main Highways Account) the balance—*i.e.*, £4,687,476 being expended from revenue and taxation.

In diagrammatic form the ratio which the various classes bear to the whole is shown below. It should be noted that the figures are gross—that is, before deducting recoveries, which include subsidies from the Employment Promotion Fund, contributions from the Consolidated Fund, and similar amounts which if deducted, would detract from the true portrayal of activities.



	£	Per cent.
Roads, including construction and maintenance of main highways	7,232,490	31·73
Hydro-electric (construction and working-expenses) ..	1,364,592	5·99
Railway-construction, improvements, and additions ..	3,952,174	17·34
Public buildings, including schools	1,839,790	8·07
Settlement of unemployed workers	526,397	2·31
Lands improvement	241,636	1·06
Irrigation	283,733	1·24
Public buildings, roads, &c. (maintenance)	231,408	1·01
Air defence, aerodromes, and landing-grounds ..	703,486	3·09
Telegraph extension	872,646	3·83
Native-land settlement	1,166,104	5·11
Plant, material, and services for other Departments ..	1,789,317	7·85
Miscellaneous	887,770	3·90
Revenue receipts	1,703,366	7·47
	£22,794,909	100·00

In regard to the ways and means of the General Purposes Account of the Public Works Fund the position is as under:—

	£	£
Balance available 1st April, 1938		153,860
Add funds received during the year—		
Finance Act (No. 2), 1936, section 2 (Public Works)	2,580,355	
Finance Act, 1937, section 11 ..	6,000,000	
Finance Act, 1938, section 2 ..	1,041,924	
Miscellaneous	125,772	
		9,748,051
		9,901,911
Deduct expenditure during 1938–39—		
Under annual appropriations ..	9,168,812	
Under permanent appropriations ..	94,225	
		9,263,037
Balance available 31st March, 1939		£638,874

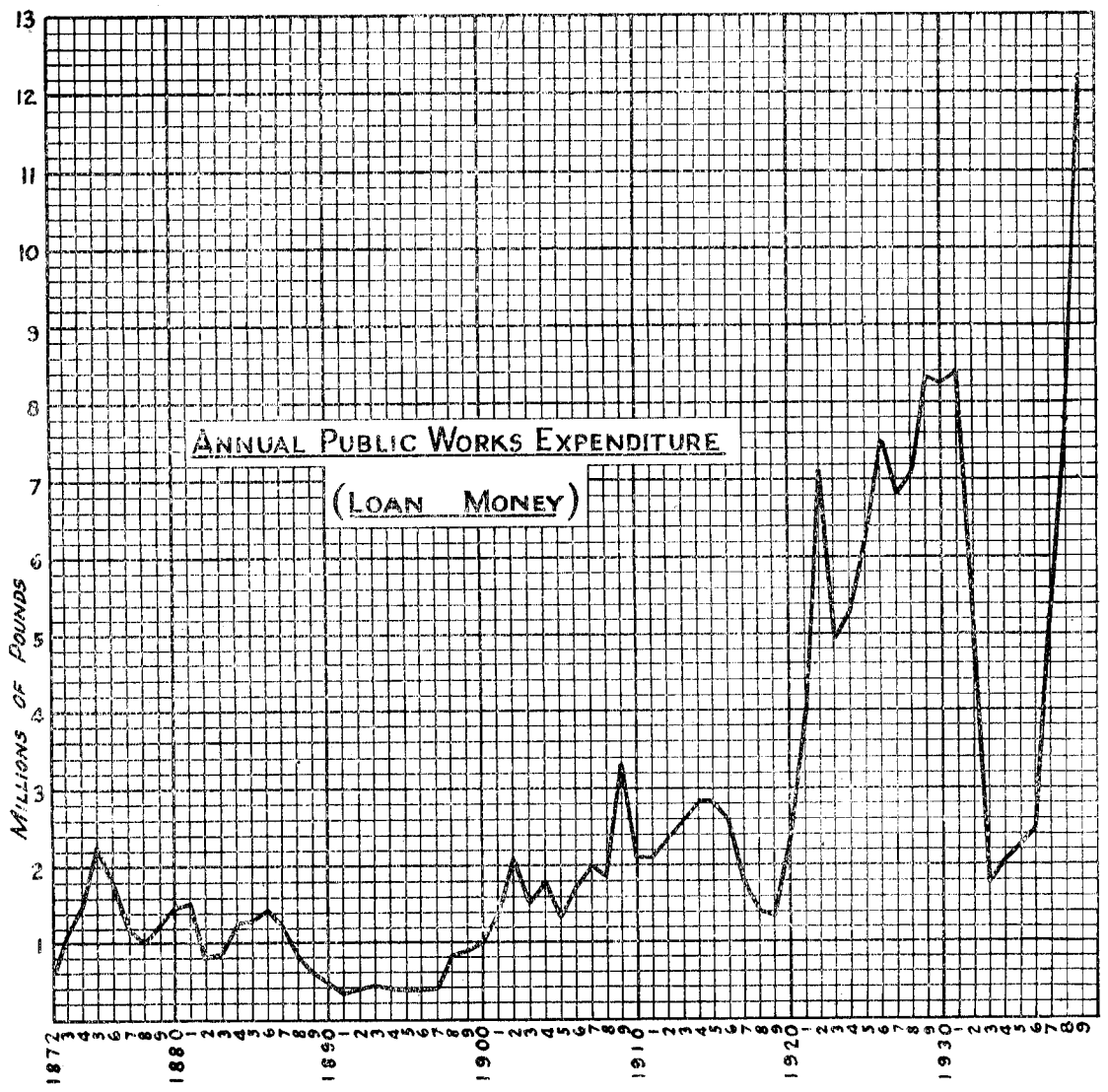
The estimated net expenditure under the General Purposes Account for the current financial year is £13,161,000, and arrangements are being made with the Minister of Finance to provide the necessary funds. This is the amount shown on the Public Works estimates, which also show an estimated net expenditure of £1,840,000 from the Electric Supply Account and £5,267,200 from the Main Highways Account, a total for all these accounts of £20,268,200.

Summary of Votes under Control of Minister of Public Works and Proposed Ways and Means of Raising the Necessary Funds—Year ending 31st March, 1940.

Vote.	Loans.	Consolidated Fund.	Special Revenue.	Total.
	£	£	£	£
Departmental	210,000	..	..	210,000
Railway-construction	1,230,000	..	..	1,230,000
Public Buildings	1,250,000	..	..	1,250,000
Lighthouses and Harbour-works	37,000	..	..	37,000
Development of Tourist Resorts	35,000	..	..	35,000
Roads	1,400,000	..	..	1,400,000
Lands Improvement	330,000	..	..	330,000
Irrigation	285,000	..	..	285,000
Electric Supply	1,273,600	..	566,400	1,840,000
Main Highways	2,480,200	..	2,787,000	5,267,200
Maintenance of Public Works and Services	..	750,000	..	750,000
Totals	8,530,800	750,000	3,353,400	12,631,200

For the current financial year 1939–40 a sum of £750,000 will be provided from the Consolidated Fund for expenditure on maintenance of Public Works and Services. The expenditure on Main Highways from revenue is estimated to reach £2,787,000 and from loan-moneys £2,480,200. It is estimated that approximately £141,486 revenue from the Electric Supply Account will be available after providing for sinking fund, interest, and operating-expenses for expenditure on construction works, the balance of the year's construction programme under this heading—*i.e.*, £1,273,600—will be raised by way of loans.

The diagram below gives the annual public-works expenditure from loan-money since 1872.



The proposed expenditure from loan-moneys and revenue for votes comprised in the Public Works Fund coming under the control of other Ministers of the Crown is set out hereunder:—

Vote.	Loans.	Consolidated Fund.	Special Revenue.	Total.
	£	£	£	£
Railway Improvements and Additions to Open Lines (Minister of Railways)	3,300,000	..	700,000	4,000,000
Education Buildings (Minister of Education) ..	900,000	..	..	900,000
Telegraph Extension (Postmaster-General) ..	600,000	..	..	600,000
Swamp-land Drainage (Minister of Lands) ..	14,000	..	..	14,000
Settlement of Unemployed Workers (Minister of Lands)	695,000	..	55,000	750,000
Native Land Settlement (Minister of Native Affairs)	675,000	400,000	275,000	1,350,000
Defence (Minister of Defence)	2,200,000	..	..	2,200,000
Total	8,384,000	400,000	1,030,000	9,814,000

The above figures (*i.e.*, £9,814,000), plus those shown in the summary of votes under the control of the Minister of Public Works (*i.e.*, £12,634,200), plus permanent appropriations under Highways (*i.e.*, £332,800), amount to £22,781,000.

In the Budget an additional £1,136,000 was shown under the heading of "Financial Programme" for the following works and services not included above: Land for Settlement, £260,000; State Forests, £650,000; State Coal-mines, £45,000; and Iron and Steel Industry, £181,000.

MAIN HIGHWAYS.

On many occasions I have emphasized the necessity of an adequate and safe highway system in order to meet the needs of modern road transport. My endeavours have been directed towards reconstruction and improvement works where the need was most urgent, and also the continuous maintenance of highways to a reasonable standard. The highway system includes the most important arterial routes which carry concentrated traffic from feeder and settlement roads. It is most essential, therefore, that, in the interests of safety, unsatisfactory conditions be improved as soon as possible. Wherever the standard is below traffic requirements it is found that maintenance becomes uneconomic, and for this reason also reconstruction becomes necessary. For example, a macadam road under a moderate flow of traffic can be maintained at reasonable cost but, if the quantity of traffic increases, more intense and costly maintenance is required, and the point is reached when, under very dense traffic, it is practically impossible, irrespective of cost, to upkeep the macadam surface in anything like a reasonable condition. Under such circumstances it becomes necessary to provide a paved surface which does not disintegrate, and which, compared with the macadam type, can be maintained at very moderate expense. One feature of a sealed highway is that the cross-section and superelevation are stabilized and a uniform condition is retained, notwithstanding seasonal or traffic variations. On the other hand, a macadam surface quickly deteriorates under heavy traffic, and in extremely wet or dry periods the position is accentuated. On account of the semi-permanent nature of paving it is essential that before a seal-coat is applied the subgrade and foundation be reconstructed to a proper standard and the road surface carefully prepared to obtain the correct shape.

Another aspect of highway sealing is that it makes a definite contribution towards greater safety on the roads. Not only is the surface safer because of the elimination of the loose top-course with its corrugations and pot-holes, but general visibility and comfort are increased through the removal of the dust nuisance.

During the past year there has been a continued increase in the growth of motor traffic as revealed by the greater number of vehicles licensed for operation and the record consumption of motor-spirits. The density of present-day traffic therefore requires that every effort be maintained in the direction of reconditioning the highways system to a standard in keeping with the needs of modern transport. Particularly does this apply to the State highways of the Dominion which carry a tremendous amount of arterial traffic. Very substantial improvements have been made since the Government assumed direct control of State highways, and the public is benefiting considerably, both directly and indirectly. For example, the development of commercial transport has been possible only because of the excellent standard of the improved highways. Under such circumstances it is not possible at present to consider any curtailment in highway activities or expenditure.

Satisfactory progress has been made with the programme of works, other than actual reconstruction and surfacing, for the purpose of making main highways safer for all classes of users. A considerable amount of protective fencing has been erected on hilly sections and also in other localities where this protection affords added safety. The erection of guide-posts has been extended throughout most districts, particularly where night traffic is appreciable and where fog conditions are common. This simple method of marking the boundary of the trafficable portion of road and indicating the variation in alignment has effected a very material improvement from the safety viewpoint. Another phase of activity in regard to safety has been the adoption of a policy of improving visibility at the junction of side roads with main highways. In this connection the co-operation of local bodies has been obtained in respect of highways under their control, and many corners have already been improved under a standard scheme of subsidy.

In the course of investigating the problem of road safety it became apparent that a common hazard affecting both motorist and pedestrian arose from the lack of footpaths, especially in closely-settled localities where vehicular traffic was heavy. The matter was discussed with the Main Highways Board, and as a result financial assistance is now given from highway funds towards the construction of footpaths where circumstances require. A condition of the subsidy is that the footpath proposals must include the provision of a paved surface, as otherwise the tendency would remain for pedestrians to prefer the paved highway to any loose-top footway.

Consideration is being given to the provision of separate cycle-tracks where road traffic exceeds an average of 1,600 vehicles per day. There are a number of difficulties in connection with the construction of cycle-tracks, however, not the least of which are the limited width of existing highway reserves and the irregular or uneven surface of the land. However, the matter is being carefully investigated in order that traffic conditions affecting the cyclist, the motorist, and the pedestrian can be materially improved.

The question of highway lighting was carefully considered by the New Zealand Road Safety Council, which came to the conclusion that it would be desirable to install some modern form of lighting on those portions of highway carrying a sustained average daily traffic of 2,500 motor-vehicles or more. This recommendation was adopted, and the Main Highways Board, with the assistance of a technical advisory committee, has made extensive investigations into the various types of lighting which might prove suitable. It is hoped that in the near future it will be possible to commence the lighting installation on the two most heavily trafficked highways in the Dominion.

It is pleasing to be able to record that there is evidence of practical results having been achieved from the safety campaign in respect of main highways. While the ratio of accidents in urban areas has increased and in settlement areas has remained stationary, on main highways there has been a reduction of 18 per cent. This indicates that the general improvement of main highways has made a definite contribution towards road safety, and it is my earnest hope that still more favourable results will be obtained in the future.

A detailed statement of works undertaken throughout the year under review is contained in the annual report of the Main Highways Board, which is attached to this Statement. The report discloses that the total receipts from revenue sources

for the past financial year amounted to over £2,800,000, compared with £2,600,000 for the preceding year. With the exception of revenue from tire-tax, which was some £9,000 less than in the previous year, the receipts from other taxation levied for highways purposes reached peak figures.

The total expenditure from the Main Highways Account for the last financial year on actual works, as distinct from loan and special charges, amounted to £4,369,000, as against £3,392,000 in the previous year. Construction and improvement works, including the elimination of dangerous railway-crossings, absorbed £2,878,000, maintenance involved an expenditure of £1,311,000, whilst £180,000 was spent on the renewal of bridges. In addition, interest and loan charges amounted to £439,000 and general rate subsidies paid to local authorities totalled £209,000. Last year's programme of works involved the borrowing of £2,675,600 for main highways' activities.

The improvements completed included the formation and widening of lengths totalling 491 miles and the metalling of numerous sections aggregating in length 188 miles.

Extensive paving operations during the past year resulted in the completion of 385 miles of initial dustless surfacing, this being the greatest amount of new sealing completed to date in any one year. The length of dustless surfaced highways at the 31st March, 1939, totalled 2,800 miles, which represents approximately 23 per cent. of the main highways system.

Further progress was made in the elimination of dangerous railway-crossings, and in the period under review 40 elimination schemes were completed, as against 35 in the preceding year. As at March, 1939, a summary of the Government's programme for removing these potential dangers is as follows: Works completed at 90 crossings; contracts let or work in hand at 30 crossings; proposals completed or under preparation for 39 crossings.

In the matter of bridging it is interesting to note that over 25,000 lineal feet of new bridging was opened to traffic during the past year, this being more than twice the aggregate in any previous period. The principal structures completed were: The Rakaia River Bridge, 5,762 ft. long; the Whirokino Viaduct, 3,600 ft. long, and the North Rangitata Bridge, 2,122 ft. long. The bridge over the Rakaia River provides a separate structure, 24 ft. wide, for highway traffic, where in the past both road and rail traffic have been carried on a single bridge. One of the major benefits of having a separate bridge in this case is that road vehicles are no longer subject to delays through having to await the passage of rail traffic. The Whirokino Viaduct has been constructed to carry arterial highway traffic over a long stretch of road which becomes covered with water to a depth of several feet in times of major flooding. The new bridge over the north branch of the Rangitata River forms part of the major deviation in the State highways system of the South Island. The deviation, which will shorten the distance for through traffic by nearly 10 miles, was practically completed at the end of the year under review, and has since been opened to traffic. The replacement of hundreds of bridges on the main-highways system has become a matter of urgency, and every endeavour is being made to expedite design and construction work as much as possible.

The maintenance of the main-highways system, including the amounts spent by the Main Highways Board and local authorities, represents an average cost per mile of £119·9, compared with £101·2 for the preceding year. However, the past year was characterized by extraordinary storms in a number of concentrated areas where the flood conditions were very severe indeed. The repairing of a certain amount of flood damage is anticipated each year in the course of maintenance operations, but in some districts the flooding was quite extraordinary. The increase in the average maintenance-cost per mile is due to the damage caused by major floods, as expenditure in that respect is equivalent to over £16 per mile over the complete highway system.

The programme for the maintenance and construction of main highways for the current year is based on a continuance of activities on practically the same scale of operations as for the past year.

HYDRO-ELECTRIC DEVELOPMENT.

The hydro-electric developments have continued to be one of the Government's most successful undertakings. The conditions attendant on the more prosperous times of the past three years have given the public more confidence and a greater sense of security, which is reflected in continually increasing demands for electric power.

Largely as a result of the Government's housing policy and stimulating of local industries, the increase in the number of consumers is the greatest for any one year since 1928. The number of units generated in the Government stations shows an increase of 17·14 per cent. in the North Island and 18·97 per cent. in the South Island, whilst the operating returns of the various distributing authorities indicate an increased consumption of 13·35 per cent., as compared with 14 per cent. last year.

The operation of the various existing power schemes and the financial returns received therefrom continue to be satisfactory. The gross revenue has increased to £1,688,583, and after paying operating expenses, interest, and depreciation it has been possible to make available a sum of £585,131 to the Sinking Fund Account, which is still, however, £558,076 in arrears.

To meet the increasing demand for additional power in all directions the Department has been actively engaged on new work and additions to power-stations and transmission-lines and on surveys and investigations for additional works and lines.

In the generating-stations the erection of the third unit (20,000 kW.) at Waikaremoana is almost complete, whilst construction work is in hand and orders have been placed for plant for an additional two units each 21,000 kW. for Arapuni, and for two units each 20,000 kW. for the new lower development at Waikaremoana. Two additional units each 15,000 kW. for the Waitaki Power-station are being delivered, and preliminary work in connection with installation is in hand, whilst orders have been placed for a 25,000 kW. unit for the new development which will be built in the Rakaia River at the termination of the Rangitata irrigation canal.

Main transmission-lines inter-connecting the Lake Coleridge - Waitaki system with Southland, and with the West Coast, have been completed, as also has a second main line between Arapuni and the Bay of Plenty. Work is in hand on an additional main line between Arapuni and Auckland, a main line between Melling and Masterton, a duplication of line from Napier to Woodville, and an extension of main line north from Whangarei to Kaitaia to give supply to the new Bay of Islands Power Board. Also, during the year a substation has been built and supply given from the Government system for the first time in the Taumarunui district.

In addition, survey and other investigation work has been going on continually to develop a comprehensive long period programme of construction.

Operating Results.

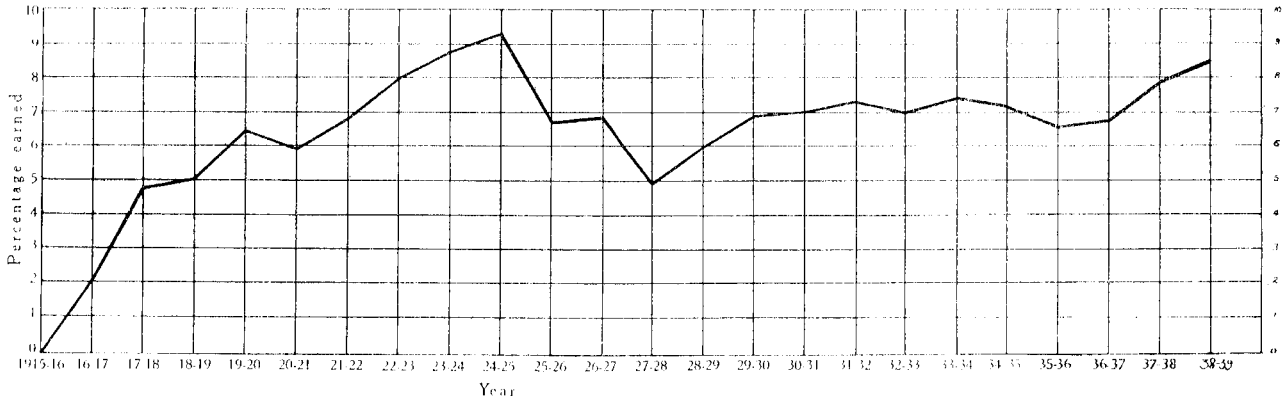
Financially the year has been a successful one, and the whole Electric Supply Account has been able to earn 8·41 per cent. on the operating capital after paying net operating-expenses.

The position of the account is summarized in the following table, and the result since the State commenced operation in the electric supply business is shown in the following graph :—

Percentage earned on Operating-capital after paying Working-expenses.

——	Average Operating-capital.	Gross Revenue.	Working-expenses.	Net Balance.	Percentage Net Balance to Operating-capital.
	£	£	£	£	Per Cent.
North Island system	9,208,227	1,127,132	200,438	926,694	10·064
South Island system	6,247,478	561,451	187,835	373,616	5·980
Totals ..	15,455,705	1,688,583	388,273	1,300,310	8·413

Percentage earned on Operating-capital after paying Net Operating-expenses.



In the North Island the Depreciation Reserve required by the State Supply of Electrical Energy Act—viz., 12½ per cent. of the capital invested—has already been reached, and an amount sufficient only to maintain this 12½ per cent. is therefore chargeable to depreciation, with a consequential credit balance of £530,170 on the year's operations. This balance has been used to reduce arrears of statutory sinking-fund provision which have been accumulated in earlier years. In the South Island the Depreciation Reserve has not yet reached the 12½-per-cent. limit mentioned above, and consequently the sum of £82,617 has this year been charged to Depreciation Reserve. After charging this amount the year's operations show a profit of £58,535.

The general position to date is that the Electric Supply Account has been able to meet all operating and interest charges, has provided the statutory requirement of £1,680,732 for depreciation, and, in addition, has provided £1,091,878 towards sinking-fund requirement of £1,649,954. Also, £87,199 has been paid to General Reserve from profits made from time to time on Lake Coleridge system. In other words, the electric-supply system as a whole has paid interest and operating charges and provided £2,859,809 in reserves, of which £496,364 has already been utilized by Treasury for the paying-off of loans which formed part of the original capital. There are, however, still arrears of sinking fund, amounting to £558,076, to be met.

Electric-supply Operating Accounts.

(*a*) *North Island Electric-power Supply.*

The Arapuni-Mangahao-Waikaremoana plants have operated satisfactorily throughout the past year, and the revenue shows an increase of £148,640 over that of the previous year.

The result of the year's operations was as follows:—

	£	£
Capital investment at end of year	.	9,710,555
Revenue	1,127,132	
Operating-expenses ..	200,438	
Balance	£926,694	

The balance has been used in paying interest charges (£353,676) and £33,547 as the Department's share of the capital charges on the King's Wharf generating-plant of the Auckland Electric-power Board, also £7,228 to provide the full statutory contribution to depreciation, and £2,073 has been charged against cost of raising loans.

The reserve accounts established in connection with this system show that £1,042,933 has been credited to depreciation and £741,038 to sinking fund.

(*b*) *South Island Electric-power Supply.*

The Lake Coleridge-Waitaki-Monowai-Arnold River plants have operated satisfactorily throughout the year, and the revenue shows an increase of £69,900 over that of the previous year.

The year's operations resulted as under:—

	£	£
Capital investment at end of year	..	6,654,048
Revenue	561,451	
Operating-expenses	187,835	
Balance	£373,616	

The balance has been used in payment of interest (£231,060), £82,617 has been paid to depreciation, and £1,404 has been charged against cost of raising loans.

GENERAL.

The capital invested in the electric-supply systems operating throughout the Dominion totals £37,367,664, which includes £16,364,603 of Government expenditure. The gross revenue received for the year was £6,296,326. After paying working-costs, interest, sinking-fund (except in the case of Government expenditure on which sinking fund is payable out of profits), and depreciation charges, the net profit for the year under review was £1,126,936, as compared with £878,594 for 1938, which indicates that the electric-supply business as a whole is in a healthy condition. The average revenue received by the Government for each unit sold was 0·358d., compared with 0·366d. for last year. The average revenue per unit sold by all the retail supply authorities to consumers throughout the Dominion was 0·982d.

This is the first occasion on which the average revenue received has come below the penny, and is, I think, worthy of special mention. In 1925 the figure was as high as 2·12d., and even in 1935 it was 1·17d. When we realize that even in Great Britain, where the density of population is very much greater, and where even yet many sparsely-populated sections have not been supplied, the average return per unit sold was in 1938 over 1·3d. in New Zealand currency, there is no question but that we can justly claim success for our various electrical undertakings.

Further details of the different electrical undertakings will be found in the report of the Chief Electrical Engineer attached as an Appendix to this Statement.

RAILWAYS.

Dargaville Branch Railway.—Work on this line has progressed steadily during the year. The formation and ballasting of the section between Kirikopuni and Tangowahine have been completed, and the goods and passenger service on this length has been continued in operation by the Department.

Construction between Tangowahine and Dargaville has been carried on as fast as the men and staff available have allowed. Ballasting operations have been continued over a length of 4 miles, formation was completed over a further length of 3 miles, and excavation is in hand on the remaining length of 1 mile to the new site of Dargaville Station. A contract has been let for the erection of the Awakino River Bridge, the only bridge remaining to be constructed on this line.

It is anticipated that the rails will be laid to Dargaville Station by next March, and the whole work will probably be completed within the ensuing twelve months.

Paeroa–Pokeno Railway.—Excellent progress has been made with the construction of this railway. Owing to the changed standards of alignment and grading since the line was previously surveyed a considerable amount of time had to be spent on survey and investigations before construction could proceed on an extensive scale. A large amount of accommodation for workmen had also to be built, and plant and material assembled.

However, with this preliminary work completed, progress has been rapid At the Paeroa end, except for a few short lengths, formation has been complete, on the first 8 miles, including all culvert work, but not the major bridges.

At the Pokeno end construction is in hand over a total length of 10 miles. The major portion of the work is being done by machinery and to date about 350,000 cubic yards of material have been shifted.

East Coast Main Trunk Railway: Extension to Opotiki.—It had been intended to commence construction on the extension of this railway from Taneatua to Opotiki during the year, but plant and material from other railways were not available, and construction was postponed.

Survey work has been carried on with a small party, and it is intended that construction should commence this year. Owing to the lack of sufficient plant and service material construction operations will only be on a small scale for some time, but the work will be expedited as construction plant from completed railways becomes available.

Gisborne–Napier Railway.—Considerable time was lost and heavy additional expenditure incurred on this railway owing to the disastrous floods of February and May last year. Many months were occupied on clearing up slips, restoring service roads, and generally repairing the damage done by the floods.

The section between Napier and Putorino suffered greater damage than most of the rest of the line, and this portion was restored by the Railways Department, assisted, where possible, by my Department. It was reopened for goods traffic in November last year. The section from Putorino to Raupunga was completed and handed over to the Railways Department for operation.

At the end of June last the section from Putorino was completed and ready for operation. On 1st July, in the presence of a large attendance of people from all over the district, I officially handed over to the Honourable the Minister of Railways the Napier–Wairoa Railway and the extension to Waikokopu, thus giving the people of Wairoa and district transport facilities for which they have long waited.

A rail-car service has been inaugurated by the Railways Department, and this speedy and comfortable method of travel has been well patronized since its inception.

On the Gisborne–Waikokopu Section of the railway considerable time was occupied in clearing up flood damage, but since this was done good progress has been maintained.

Earthwork is practically completed throughout the length, but owing to the broken nature of the country it is anticipated that a considerable amount of slip clearing will be necessary during the next year or two.

Good progress has been made with tunnelling operations.

The Waikoura Tunnel, 70 chains long, has been completed, the Coast Tunnel has been enlarged and concreted at each end, and in the largest tunnel, the Waiau–Tikiwhata, about 35 chains have been completed at each end, leaving a mile still to do. It is anticipated that this tunnel will be completed at the end of next year.

Of the smaller tunnels, four have been completed, and the rest are well under way and will be completed in plenty of time to fit in with the rest of the construction programme.

In spite of the lack of sufficient skilled men, bridge-construction has proceeded according to schedule, and unless there is delay in connection with the supply of steel-plate-girder spans and reinforcing-steel all the bridges will be completed in time to allow platelaying to proceed in accordance with the programme laid down.

Twelve bridges have now been completed, seven are in an advanced stage of construction, and arrangements for the construction of the remainder are well in hand.

In addition, three highway bridges and one overbridge, made necessary by the relocation of the main highway in the vicinity of the railway, have been constructed.

Work has commenced on some of the station yards, and Muriwai Station has been almost completed.

Fencing operations have been continued during the year, and the many and varied operations made necessary by the construction of a railway have proceeded satisfactorily.

In spite of the many difficulties that have been encountered in the construction of this railway and the setbacks that have been occasioned by abnormal storms and floods, good progress is being made, and it should be completed during 1941.

Turakina-Okoia Deviation.—Very good progress has been made with this deviation, which is designed to shorten the distance and improve the grading and curvature on the Wellington – New Plymouth Railway. The majority of the grading and the formation on this section is now almost complete, while the Fordell Tunnell, 72 chains in length, has been driven and lined, and in the Turakina Tunnel, which is 104 chains long, 58 chains have been completed.

A start has been made with the construction of the Wangaehu and Turakina Bridges, and I anticipate that the whole section should be ready for platelaying and ballasting at the end of the current period.

Palmerston North Railway Deviation.—The construction of this deviation, which was originally commenced in 1926 and closed down in 1929, was recommenced at the beginning of the year under review.

The work as originally set out involved quantities in the vicinity of 1,000,000 cubic yards, and approximately half of the general excavation had been carried out when the work closed down.

On the work being recommenced, however, the proposals were enlarged, and it has been decided to proceed also with the Whakarongo Deviation.

The main portion of the work involves a very extensive excavation for the goods-yard and the transport of the material from there to fillings at the passenger station and general shunting yards.

In addition to this, there are some eleven overbridges across the heavily trafficked roads in this vicinity, as well as a bridge over the Mangaone Stream.

On account of the large amount of excavation involved in the goods-shed cutting, and the necessity for transporting it some considerable distance for fillings and overbridge approaches, it was decided to largely mechanize this work by the use of power shovels for excavation, motor-lorries for transport, and carry-all scrapers and bull-dozers where suitable for short leads and for spreading material.

Good progress has been made, but it is only possible to employ a limited number of men owing to the necessity for synchronizing the excavation with the overbridge approaches and other works.

Plimmerton–Paekakariki Railway Duplication.—This work, which is portion of the duplication of the railway between Wellington and Paekakariki, was commenced approximately three years ago, and the section between Plimmerton and Pukerua Bay is now practically complete.

Formation generally has been heavy, and one of the features of this work has been the necessity for very extensive sub-soil drainage in order to stabilize the sub-grade. For many years past the swampy nature of this section has been a source of considerable trouble to the Railway Department, but the drainage which has now been put in will, I think, be very satisfactory.

The very wet cutting at the summit near Pukerua Bay is rather an anomaly, seeing that it is the highest point on the line and was found to be the wettest and most difficult.

From Pukerua Bay towards Paekakariki the duplication has been carried out to within a short distance of the first tunnel, where the double line merges into a single track extending to the north end of the last tunnel before Paekakariki, and from there the duplication continues to Paekakariki.

The excavation along this section has been very heavy, the work having been carried out almost entirely by returned soldiers, who have made very excellent progress indeed.

It is hoped to hand over the whole section to the Railway Department for platelaying very shortly.

South Island Main Trunk Railway.—As mentioned in my last Statement, the construction of this railway has been divided into two sections, the north end extending from the existing open line at Wharanui to the Kahautara Bridge, a distance of 48 miles 70 chains, and the south end from the Kahautara Bridge to Parnassus, a distance of 29 miles 40 chains.

During the current period a large step forward has been made, and on the northern end the section from Wharanui to the Clarence, a distance of approximately 20 miles, has, with the exception of the Blue Slip, been completed, rails have been laid, and ballasting is well in hand.

Station-yards have been constructed at Kekerangu, Parikawa, and the Clarence.

I hope to arrange with the Railway Department for the transport of stock over this section during the ensuing season.

On the southern end construction is practically completed to the Hundalee Station, 11½ miles from Parnassus, rails have been laid, and ballasting is almost completed, and arrangements have already been made for the running of a limited amount of traffic over this section.

Work is now being concentrated on the central section, and the majority of the grading, apart from tunnelling-work, has been finished. There is still, however, a considerable amount of tunnelling to do, but of the twelve remaining tunnels all are under construction, and on the general average are about 50 per cent. complete.

The principal tunnel on this section has, of course, been that through the Amuri Bluff, where extremely difficult underground conditions have been met with, and these have necessitated an increase in the section of concrete lining in order to cope with the very heavy pressures experienced.

Good progress has been made with the bridging, the principal remaining works being the construction of the Hapuku River Bridge (for which a contract has been let), the Kowhai, Kahautara, Oaro, and Okarihia Bridges.

During the period the sub-structure of the Clarence Bridge was completed, and this is now ready for the erection of the steel girders, which have been delayed owing to difficulty in obtaining material.

The Conway River Bridge, which is of considerable magnitude, was also completed, as well as some half a dozen smaller bridges.

On account of the very steep nature of a great deal of the sea coast-line along which this railway is being constructed it has been necessary in many cases to traverse places where the line would be exposed to considerable wave action, and in these places heavy protective works are required, stone being obtained from the quarry at Goose Bay for this purpose. It is anticipated, however, that a certain proportion of very heavy concrete blocks will have to be manufactured and deposited at the toe of these banks, in order to provide the very substantial protection necessary. This will, however, be among the last works to be carried out, and can only be put in hand after the formation at these various places has been completed.

It is unnecessary for me to enlarge on the natural obstacles and difficulties which have had to be overcome in the construction of this railway, as many of these have been fully detailed in my previous Statements. It is, however, satisfactory to record that the rate of progress has been well maintained and the completion of this very important project is now definitely in view.

Westport–Inangahua Railway.—Steady progress was maintained on this railway during the past year. The progress was retarded and the difficulties increased by the exceptionally heavy rainfall, which amounted to 211·5 in. for the year.

The bridging programme was rendered difficult on account of the shortage of carpenters, due to the heavy demand in the main centres of population for carpenters for the housing programme. This shortage was successfully overcome by employing semi-skilled workers on co-operative contract. Modern plant was used as much as possible, but its use is considerably restricted due to the abnormal rainfalls making the ground too soft to carry the plant.

During the year the two remaining tunnels were completed, and of a total of 3,605 lineal feet of bridging, 1,885 lineal feet is completed, 1,227 lineal feet is under construction, and it is anticipated that all except 275 lineal feet will be completed by the end of the year.

The formation is completed, except for two gaps with a total length of 1 mile 70 chains which are in hand.

A contract will shortly be let for the platelaying of the 17½ mile gap between the railheads.

RAILWAYS: IMPROVEMENTS AND ADDITIONS TO OPEN LINES.

The net expenditure out of the Public Works Fund under the heading "Railways: Improvements and Additions to Open Lines" for the year ended 31st March, 1939, was £2,670,832, this sum being made up as follows:

	£
Wellington new station	63,044
Wellington–Johnsonville–Paekakariki electrification	29,966
Plimmerton–Paekakariki duplication	40,662
Scroggy Hill Deviation	7,085
Papakura–Horotiu duplication	138,817
Turakina–Okoia Deviation	124,717
Palmerston North Deviation	37,598
St. Leonards–Sawyer's Bay duplication	34,657
Stratford–Okahukura–Taumarunui automatic-signalling installation	25,315
Christchurch new station and yard	41,179
Oamaru foreshore protection	10,000
Dwellings	140,434
Rolling-stock	1,336,913
Workshops buildings and plant	199,493
Station rearrangements and sidings	92,109
Grade easements, improvements, &c.	28,542
Overbridges	22,170
Road services	275,532
Miscellaneous	22,599
	£2,670,832

Good progress has been made with the additional accommodation that is being provided at the new station at Wellington and the reorganization of the yard, while the electrification of the Wellington–Paekakariki Section has advanced satisfactorily, along with the Plimmerton–Paekakariki duplication.

Further progress was made during the year with the duplication works between Papakura and Horotiu and St. Leonards–Sawyer's Bay, and also with the deviations at Scroggy Hill, Turakina–Okoia, and Palmerston North. Progress was also made with various grade-easement works throughout the system. The installation of automatic signalling between Stratford, Okahukura, and Taumarunui is now nearing completion, and it is expected that this work will be completed in two or three months' time. Progress has been made with the elimination of level crossings in various localities, a number of overbridges having been brought into use during the year.

The new terminal for the Department's road-passenger services at Dunedin is nearing completion, and the new building at Wellington for the road services and Stores Shipper is well in hand. During the year the road-passenger and goods services were extended considerably by the purchase of new vehicles and privately-owned services.

The programme for the building of dwellings for the staff and for the carrying-out of improvements to the existing dwellings has progressed during the year.

Further activity was maintained in the construction of rolling-stock, 5 rail cars, 39 cars and vans, and 1,373 wagons being turned out, while 50 locomotives, 106 cars, 81 vans, and 3,459 wagons were under construction or on order at the close of the year.

SETTLEMENT AND OTHER ROADS.

When presenting my first Statement after assuming my present office I made reference to the inadequate roading facilities then existing in respect of isolated and remote settlement. It was quite evident that primary production was most advanced in those areas where reasonably good all-weather roads met the needs of farming and settlement interests. Not only did such roading serve development requirements, but it also provided economic transport for the conveyance of commodities for marketing.

On the other hand, the lack of good roading meant that the development of potential areas was being seriously retarded, while the settler who was endeavouring to pioneer new territory was enormously handicapped through lack of road access.

I expressed my intention to concentrate activities towards improving unsatisfactory conditions in respect of backblock road access because I was convinced that by so doing the general welfare of the Dominion would be further advanced. The prosperity of New Zealand is dependent upon the returns from the soil, and it is therefore essential that every encouragement be given to rural development and production. Apart from the question of the economic transport of produce, good roads bring social benefits to the people, such as education, health services, recreational, and community amenities.

For the purpose of improving settlement access I invited local authorities to prepare schedules showing roads which required metalling in order to provide all-weather communication to outlying settlement. From these schedules a programme was formulated, primary consideration being given to roads classified in the first order of urgency. Grants and subsidies were allocated and with the co-operation of County Councils substantial progress has been made towards increasing the mileage of metalled feeder roads. Many of the proposals included in the programme have been completed, and, in quite a number of cases where it was anticipated that work would extend over a period of years, the metalling already carried out is in advance of the original plan.

Within the past three years 2,878 miles of metalling were completed, of which 1,080 miles were completed during the past year. These figures evidence the sympathetic and practical consideration which the Government has extended to the primary industries of the Dominion in the direction of facilitating settlement and production.

In addition to metalling operations, 1,596 miles of roads were formed or reconstructed during the past three years, 531 miles having been completed in the last financial year.

A considerable amount of bridging and culverting was also carried out during the period under review, either by the Public Works Department or by local authorities under grants or subsidies from the Public Works Fund. The length of bridging completed for use totalled 13,504 lineal feet, compared with 10,710 lineal feet in the previous year, while the length of culverting aggregated 66,884 ft., compared with 71,570 ft. in the previous year.

The net expenditure on settlement and other roads for the year ended 31st March, 1939, amounted to £1,290,838, compared with £1,126,757 for the preceding annual period.

I find it necessary to refer briefly to the financial position of County Councils, which are the local governing bodies most directly associated with rural roading problems. It is pleasing to be able to record that, generally speaking, these authorities exercise a broad outlook when reviewing roading needs in their respective territories. In some cases, however, it appears that considerations arising from the riding system of finance influence to a large extent the expenditure programme rather than the degree of urgency of work. There are indications that local-body opinion to-day is recognizing that improved transport conditions have practically eliminated purely localized interests, and that the roading schemes must be dealt with as they affect the district as a whole.

Compared with other recent years, the past year was comparatively free from flood damage of any major character, and there were only a few occasions when County Councils applied for financial assistance. Several local authorities were faced with the repairing of damage sustained in the early months of the last calendar year, and for this reason were unable to devote as much attention to the metalling of settlement roads as otherwise would have been the case.

In addition to roading for settlement purposes, construction work was continued throughout the past year on a number of important arterial and tourist routes, and satisfactory progress was recorded.

The following is a brief description of some of the major projects under construction within the period covered by this report:—

Two large works in the North Auckland and Auckland districts were completed—namely, the Brynderwyn–Waipu Deviation, which provides an alternative and more direct route for traffic between Whangarei and Auckland, and the Waitakere Scenic Drive just out of Auckland City.

Good progress was made with the reconstruction of the arterial road between Rotorua and Lake Waikaremoana, the improving of the Waiouru to Tokaanu Road, and the construction of the new road connection between Taumarunui and Tokaanu.

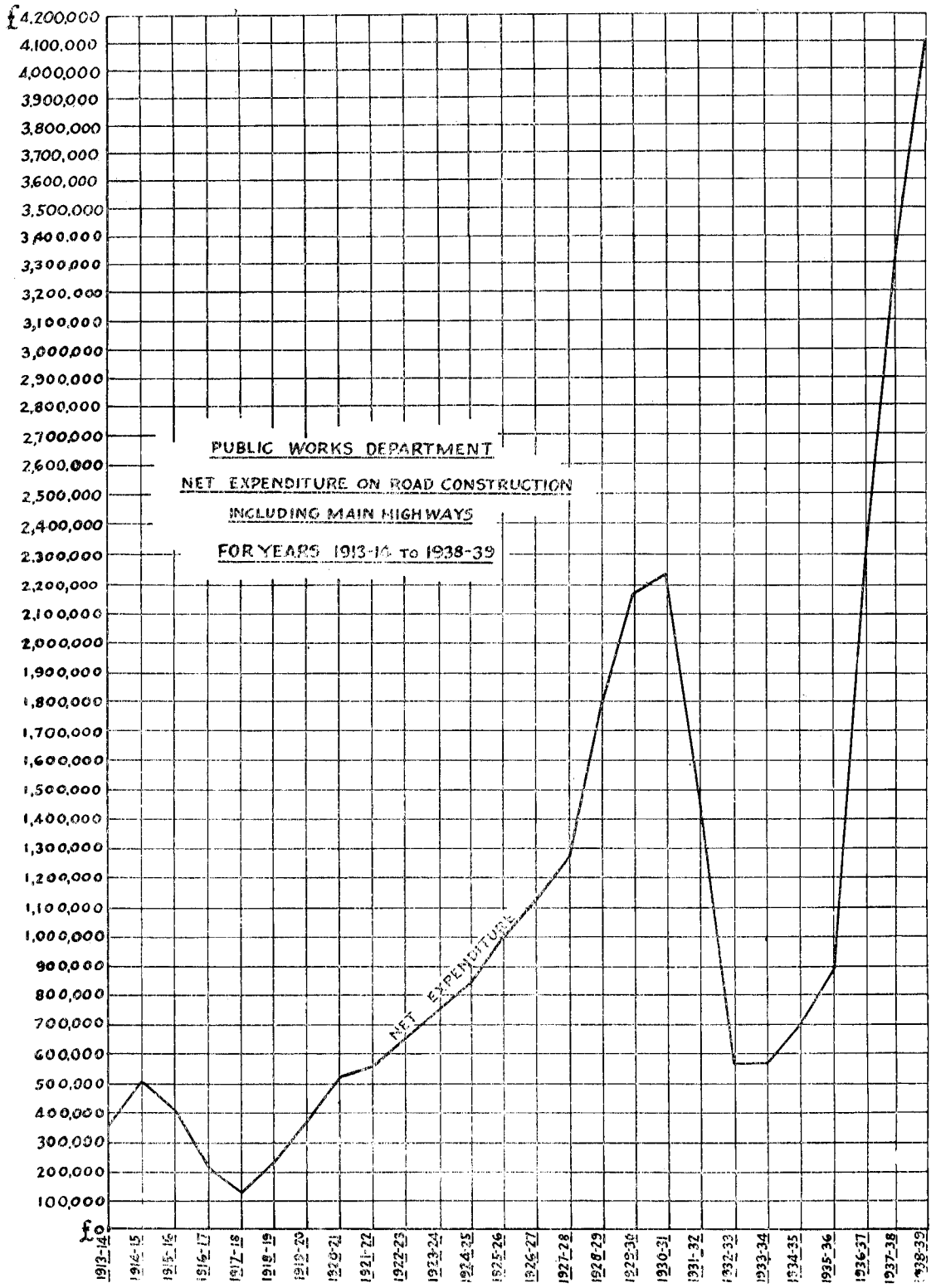
Work was well advanced in respect of the reconstruction of roads in order to improve access to Wellington. The Western Hutt Road between Melling and Silverstream, including the erection of a modern bridge over the Hutt River, was completed and opened to traffic, and, with the exception of reinforced-concrete

bridges, which are under construction, the improvements to the Haywards–Pahautanui Road were completed. The major deviation following the coastal route between Plimmerton and Paekakariki was well advanced and should be opened for traffic prior to the commencement of the Centennial celebrations.

The remaining section of the Summit Road along the Port Hills at Christchurch, comprising the length between Dyer's Pass and Gebbie's Pass, was completed and opened to traffic. This portion of road has since been declared a main highway and a sealed surface provided. Work is proceeding vigorously on the extension of the Main South Road, which will open up the whole of the southern portion of Westland district. When completed this road will connect near the mouth of the Haast River with the road over the Haast Pass and form a direct traffic connection to the Otago District. The construction of the new road over the Pass is proceeding from the Otago side, and formation has been carried out over the main divide into the Westland district.

Construction work on the road from Hollyford to Lake McKerrow was continued throughout the year.

A review of the expenditure on roading generally over the last twenty-six years is illustrated by the graph hereunder:—



IRRIGATION AND WATER-SUPPLY.

Irrigation is considered one of the most important developmental works being carried out by the Government.

In Otago there are now thirteen schemes in operation, commanding an area of 63,000 acres, of which 50,000 acres are regularly irrigated and last year the revenue received from the sales of water was £25,980, as against £24,100 the previous year.

No new work was undertaken in Otago as the schemes investigated did not show sufficient promise to justify proceeding with them. This condition is due to the necessity for expensive conservation of water in dams or the high cost of pumping water to higher altitudes.

In Canterbury there are two schemes in operation, commanding 17,403 acres, of which 2,491 acres were irrigated last season, and £334 revenue was obtained.

The irrigating season both in Otago and Canterbury was noted for the unprecedently wet weather conditions that obtained until the middle of January, and the exceptionally dry conditions that then set in and persisted until the end of June. The effect of this uncommon season was to delay the demand for water until the season was half over, thus leaving many of the irrigators unprepared for the drought that followed. This adversely affected the revenue on the schemes which supplied water on demand—namely, the Omakau Scheme in Otago and the Redcliff and Levels Schemes in Canterbury.

The year's construction activity was confined to Canterbury on schemes which will derive their water-supply from the Rangitata River. It was found in Canterbury that the main rivers provided the most reliable source of water-supply on account of possessing large glaciers at their sources, which act as natural storage reservoirs which let the water down during hot north-westerly winds, when it is most required. For this reason schemes of considerable magnitude must be undertaken at one time.

The area in the Ashburton County between the Rangitata and Rakaia Rivers proved the most promising one to start on, and this entailed the authorization of the large supply race known as the Rangitata Diversion Race.

This race is 42 miles long, and, besides supplying 1,000 cusecs of water for the irrigation of 234,000 acres of land, it is also capable of generating 30,000 horse-power of electric energy during the winter months, when the water is not required for irrigating the land.

The construction of this race is being vigorously proceeded with; eighteen large mechanical plant units are being worked three shifts each day, moving 125,000 cubic yards of excavation per month, and to date about one-half of the 3,000,000 cubic yards of earthwork contained in the work is completed. Other features of the main race construction comprise a large concrete headworks and regulator, a 12-ft.-diameter reinforced-concrete syphon 8,700 ft. long, and six 11-ft.-diameter reinforced-concrete syphons to carry the race under the Ashburton and Hinds Rivers and their tributaries.

The turbine and generating set for the electric-power development have been ordered, and the race and power development is scheduled to be completed by the winter of 1941.

Concurrent with the construction of the Rangitata Race, two large irrigation schemes—namely, the Mayfield–Hinds scheme 54,000 acres, and the Ashburton–Lyndhurst scheme 34,000 acres—are proceeding, and are scheduled to be ready when the main race is completed. These schemes also entail the removal of large

quantities of earthwork, and work is proceeding at the rate of 25,000 cubic yards per month on each scheme.

Three other schemes will follow in due course to complete the programme to be supplied from the Rangitata Race.

Besides the excavation of the races, the works on the irrigation schemes in hand entail the construction of thousands of concrete structures for regulating the flow of water and providing crossings over the races, and to date about nine hundred of these structures have been built.

The whole of the irrigation works are fully mechanized and 50 large-power units and their accessory plant are used on this work.

This large equipment of earth-moving plant has necessitated the establishment of a large workshop at Temuka, which is used night and day on the maintenance of the plant. The machines installed in the workshop are capable of doing any repair-work at short notice, and sixty-five men are employed on this phase of the work.

It has been proved that workmen who have been trained in the workshop are capable of turning out parts that are superior to the original parts, and at cheaper cost, so that an annual saving on the maintenance is estimated at £25,000.

The planning and carrying out of these works will be of great assistance to Canterbury, where progress has always been retarded through the uncertainty of rainfall during the growing season, and in the past very large losses have been sustained through drought conditions causing failure of crops and limiting the stock-carrying capacity of the land to less than one sheep per acre.

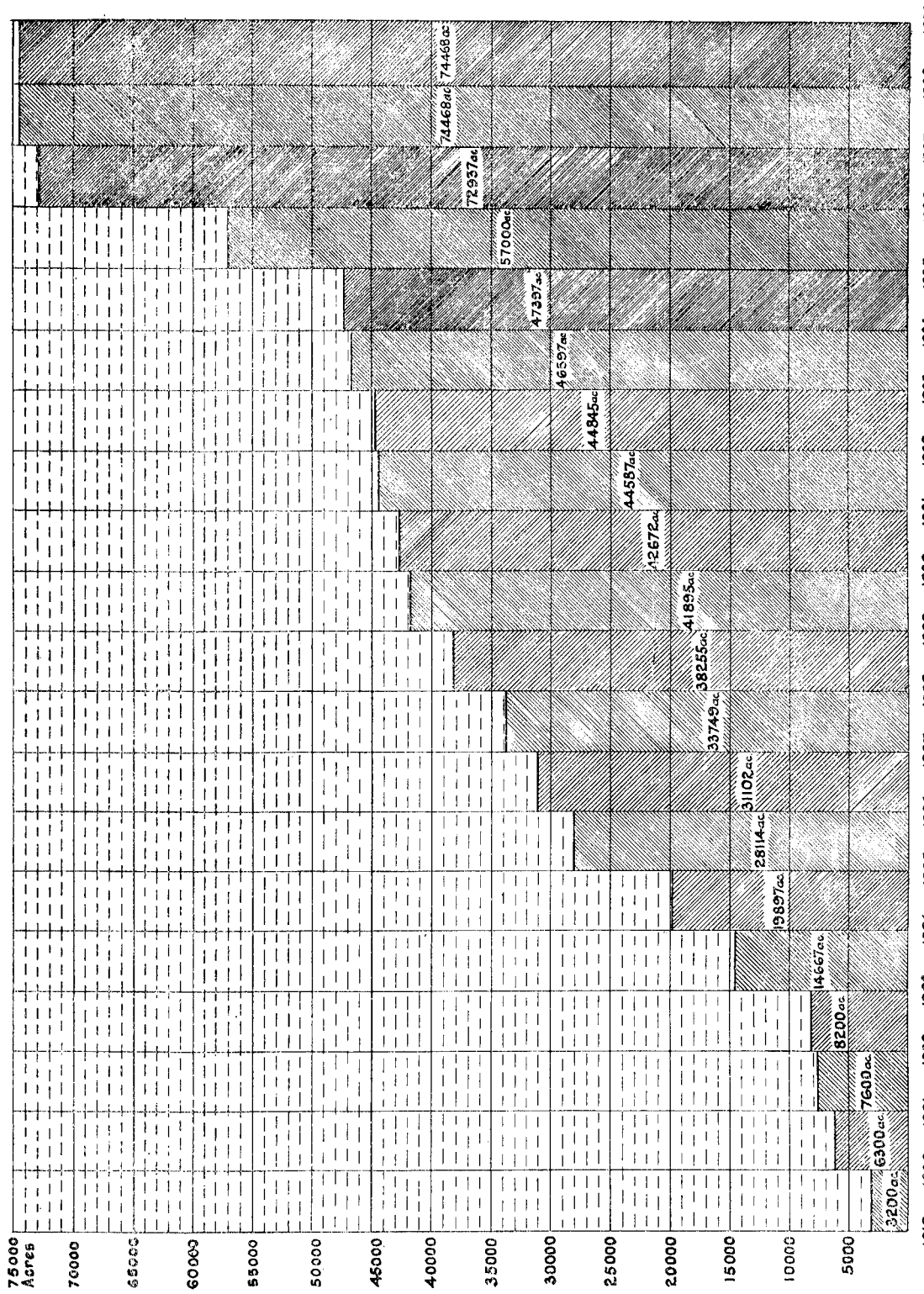
Experimental work carried out during the last three years has conclusively proved that, with irrigation, crop losses can be entirely avoided, and the grass pasture can be maintained to enable the land to carry six ewes per acre. Experiments in growing sugar beet and other root crops also show very promising results.

The Downlands Water-supply Scheme is another developmental work being constructed in South Canterbury. The scheme is planned to supply domestic and stock water over an area of 153,000 acres situated in the Levels, Waimate, Mackenzie, and Geraldine Counties, near Timaru.

The work has been in progress for eighteen months, and involves the laying of over 800 miles of water piping and the construction of several large storage reservoirs. The work is fully mechanized, the larger pipes being laid in trenches excavated by a large trenching-machine, whilst the smaller sizes are pulled into the ground by large tractors leaving them 18 in. below the ground without disturbing the surface for farming. The delivery of piping has now reached 60 per cent. of the total requirements, the intake is completed, three reservoirs have been excavated ready for concreting, and pipe-laying has reached a stage where it is expected that 90,000 acres will receive a supply in nine months' time, other large areas following in quick succession.

The following graph shows the growth of irrigation acres under Government schemes in the last twenty years : —

TOTAL AREA FOR WHICH IRRIGATION WATER IS AVAILABLE.



PUBLIC BUILDINGS.

The net expenditure for last year in the various classes of buildings was:

	£
General Government buildings	807,644
Courthouses	34,868
Prison buildings and works	7,656
Police-stations	77,745
Post and Telegraph buildings	280,951
Mental Hospital buildings	128,839
Health and Hospital institutions	88,099
	£1,425,302

New Departmental Buildings.

Steady progress has been maintained in the direction of providing reasonable accommodation for Government Departments.

During the year the erection of steel frames for new departmental buildings in Auckland and Wellington was completed. Preparatory to arranging contracts for the remaining construction work, tenders for these buildings were invited in due course, but as it was deemed advisable to revise the specifications in order to reduce the quantity of imported materials all offers were declined. Subsequently fresh tenders were obtained, and contracts have now been finalized in accordance with the amended conditions.

The Government Life Insurance buildings in Wellington and Nelson were practically completed. The new Government Buildings at Napier and a building for the State Fire Insurance Department at Invercargill are now in occupation, and departmental buildings have been erected at Wairoa.

The strengthening of the Customs Building in Wellington was completed, and the building formerly occupied by the Head Office of the Railways Department was renovated to accommodate the headquarters staff of the Defence Services.

Towards the end of the year under review a disastrous fire destroyed a large building in Wellington which was within a few weeks of completion. This accommodation was being erected to house the Social Security Department, and, as the Department was to function actively at the close of the financial year, it became a matter of extreme urgency to provide other office accommodation. The Government therefore decided to proceed immediately with the erection of a new building on another site, and for this purpose an area of railway land in Aotea Quay was quickly prepared by using mechanical plant and equipment. Special arrangements were made with a firm of contractors to expedite the construction of a new four-storied building under departmental supervision, and the completed structure was ready for occupation within a period of just over seven weeks. This was a remarkable achievement, and enabled the Government's Social Security proposals to be brought into operation in fulfilment of its original intentions.

Courthouses.

A steady and sustained effort is being made in connection with the programme for replacing old and unsuitable courthouses, but in this respect there is a considerable amount of work yet to be done.

The new courthouse at Blenheim was completed and opened during the year. The building affords a very fine example of what is considered to be an appropriate type for our secondary courthouses.

Other courthouses completed since my last statement was presented include those at Ashburton, Kaeo, and Wataroa, whilst additions and alterations of a minor nature have been made in a number of other cases, including Levin, Dargaville, and Lower Hutt.

Good progress is being made towards the provision of improved facilities at Whangarei and Invercargill, where new courthouses are being built.

The future programme is still a large one, and in this connection land for new buildings has been acquired at Nelson, New Plymouth, Thames, and Omakau.

New buildings have either been approved or plans are under preparation for the replacement of existing buildings at Christchurch, Ruatoria, Thames, and Nelson.

Extensive alterations are under consideration for the Auckland Magistrates' Court and the Dunedin Court buildings. It is hoped that during the current year it will be found possible to have the proposed alterations and extensions to the Supreme and Magistrates' Courts, Wellington, commenced. These are becoming increasingly necessary in order that the inadequate and congested accommodation at both Head Office and the Courts may be improved.

Agriculture.

In pursuance of the Government's policy of providing better and increased facilities for research the erection of new laboratory buildings at the Ruakura and Wallaceville Animal Research Stations was put in hand during the past financial year. It is anticipated that both buildings will be ready for occupation within the early future. The new laboratories embody modern ideas in lay-out, and the facilities that will be available will be appreciated by officers whose work in the past has been so greatly handicapped in this respect. The Government is appreciative of the fact that the accommodation and facilities at both stations are still somewhat inadequate, and consideration is being given to the extent and nature of the extensions that will be necessary at Ruakura to cope with the expansion of investigations at that centre, and to the provision at Wallaceville of facilities for the study of additional problems in animal diseases and nutrition.

A commencement has also been made with a programme of work designed to extend and modernize the staff and trainees quarters at Flock House, which a short time ago was acquired by the Government. The work already undertaken comprises the erection of new staff quarters, and the provision of a new kitchen and dining-room, which will allow of the original Flock House building being remodelled and converted into dormitories for the trainees, whose sleeping-quarters were far from satisfactory for an institution of this kind.

Prisons.

There has been no particularly large expenditure during the year, as accommodation in general is at present sufficient for the needs of the Department. The programme of mechanization of industries has been continued, and progress in this direction has resulted in the saving of much time, thus enabling the available prison labour to be utilized to better advantage, vocationally as well as economically.

At the Hautu Prison Camp a much-needed electric-light installation is nearing completion, and the provision of a water-supply to stock-grazing paddocks has proved of great value in lowering the losses of stock which were caused through stock having to search for a water-supply in the swamp. A water-supply for the Rangipo Prison has also been completed.

The provision of new milking-plant at the Invercargill Borstal Institution has been satisfactorily completed, and among other completed improvements at this Institution may be mentioned the laundry and drying-room, wool-shed, and slaughterhouse.

At New Plymouth a further area of land adjacent to the prison has been obtained, and this will prove of value for the grazing of stock and the growing of vegetables.

The completion of further staff cottages at Paparua will give additional relief in the problem of accommodation for married staff.

At the Waikeria Borstal Institution a mechanical spraying-plant for orchard purposes has been installed and is giving every satisfaction.

Police-stations.

The gross expenditure on police-stations during the year was £77,754, the principal items relating to the erection of the new police-station at Palmerston North, which is nearing completion, and the purchase from the Wellington City Council of additional land adjoining the site of police headquarters in Wellington.

New police-stations were erected at Newmarket, Ellerslie, St. Clair (Dunedin), Linwood, Manaia, Matainui, Pleasant Point, and Moera, and an office was provided at Tokaanu.

Houses and land for use as police-stations were purchased at National Park, Khandallah, and Northland, while sites for police-stations were acquired at Whangarei, Mission Bay, St. Heliers Bay, Waiheke Island, Hamilton, Clive, New Plymouth, Levin, Paekakariki, and Mount Cook (Wellington).

Plans are in course of preparation for a number of police buildings which are urgently required to replace structures that have outlived their usefulness. In this connection the necessary provision is being made on the estimates for the current year.

Post and Telegraph Buildings and Land.

During the last financial year the following post-office buildings were completed: Avondale, Devonport, Grey Lynn, Linwood, Little River, Milton, St. Albans, Sumner, and Tauranga. In addition, residences for Postmasters were erected at Cambridge, Kaipara Flats, Mangaweka, Poolburn, Waiau, and Wairoa, and a residence for the staff was provided at Te Teko. Other buildings completed were a line-depot and store building at Huntly; a line-depot, store, and garage building at Geraldine; a line-depot, store, garage, and workshop building at Gisborne; a line-depot and battery building at Clyde; line-depot, store, and garage buildings at Amberley and Milton; and garage buildings at Devonport and Motueka.

Major additions and alterations were made to post-office buildings at Newmarket, Parnell, Te Awamutu, Waimauku, Waitangi (Chatham Islands), Wakefield, and Wellesley Street (Auckland), and alterations and additions providing for improved accommodation were made to the departmental buildings at Ashhurst, Balfour, Christchurch (garage), Geraldine, Gore, Lyttelton, Mount Albert, Paekakariki, Takaka, Taradale, Te Akau, and Warkworth.

Several buildings and sites no longer required were disposed of during the year. Post-office buildings at Linwood, Milton, and St. Albans were demolished to make room for new buildings. Sites and additional land for departmental purposes were acquired at twenty-four places.

At the end of the financial year, the following buildings were in course of erection: Christchurch (chief post-office, first block); Dunedin (store and workshops); Gisborne (automatic telephone exchange); Hamilton (chief post-office); Invercargill (chief post-office); Mount Pleasant (automatic telephone exchange); New Brighton (automatic telephone exchange); Okaihau (Postmaster's residence); Otorohanga (post-office and residence); Wanganui (chief post-office); Wellington (Office building and line-depot); Whakatane (line-depot, store, and garage).

Also in progress were large additions to the chief post-office buildings at Auckland, Oamaru, and Palmerston North; additions to the post-office buildings at Ellerslie, Huntly, Kaipara Flats, Okaihau, Opotiki, Rangiwahia, and Waiau; and additions to the automatic-telephone-exchange building at Mount Eden and the store and garage building at Kaitaia.

MENTAL HOSPITALS.

The work of development and extension to Kingseat Mental Hospital has again occupied a major portion of the programme. The hospital block, boiler-house, laundry and workshops block have been completed. A Nurses' Home and two villas for male patients are at present under construction.

The water-supply at Tokanui has been improved, and kitchens have been added to many wards to provide improved service.

The erection of the new boiler-house at Porirua has been completed and much of the machinery has been installed. A residence for an Assistant Medical Officer has been erected, a new bakehouse and butcher's shop is in course of erection, and considerable improvements to the general roading at Porirua have been carried out.

The new Nurses' Home at Ngawhatu is nearing completion and the erection of a new laundry at Templeton completed. Extensive alterations have been carried out in the main kitchen block at Sunnyside, and a new workshop block is being erected to replace the old building which was destroyed by fire.

Two new villas are in course of construction at Hokitika, and at Auckland improvements have been made to kitchens.

Such services as water-supply, telephones, drainage, and fire-fighting appliances have been renewed or extended as required.

HEALTH AND HOSPITAL INSTITUTIONS.

The new hospital for male patients at Queen Mary Hospital, Hanmer Springs, has been practically completed, and proposals are in preparation for extensions to the boiler-house and laundry and for a new massage and bathhouse block.

The contract for the erection of the new Dental Training Clinic in Wellington is nearing completion, and the erection of a hostel for dental nurses in training is receiving consideration.

It is intended to provide facilities at the Mount Cook Public School, Wellington, for the medical examination of school-children.

A site is to be acquired at Auckland for the purpose of erecting a modern Obstetric Hospital, and plans are being prepared for the erection of a similar hospital at Christchurch, for which a site has already been obtained. Provision is also being made for improvements at St. Helens Hospitals at Wellington and Invercargill.

It is hoped that a commencement will be made this year with the erection of a new sanatorium and bathhouse at Rotorua, and plans will be formulated as soon as possible.

EDUCATION.

During the past year the gross expenditure of capital funds on the erection of school buildings, additions, and teachers' residences, and the purchase of sites, amounted to £746,721. This sum includes £19,643 provided by the Consolidated Fund to meet the cost of relatively minor works.

The following table shows for the last four years the capital expenditure on school buildings, additions, teachers' residences and sites: —

	1935-36. £	1936-37. £	1937-38. £	1938-39. £
Public schools	87,908	162,894	331,558	467,255
Education Board offices	..	..	..	3,850
Secondary schools	23,516	24,092	58,924	56,819
Technical schools	59,350	77,836	97,740	82,568
Training colleges	610	6,730	1,984	27,071
Native schools	8,399	12,172	34,180	39,632
University colleges	..	3,022	39,086	58,710
Massey Agricultural College	..	525	..	..
Child-welfare institutions	221	..	351	..
Special schools	..	2,473	312	840
School for Deaf, Sumner	..	..	4,841	6,295
N.Z. Institute for the Blind	..	..	..	1,000
Kindergartens	..	..	881	1,181
Refund portion purchase money sale of Education Board offices	..	..	..	1,500
Gross total	180,004	289,744	569,857	746,721
Less credits-in-aid	48,547	7,848	7,913	66,411
	£131,457	£281,896	£561,994	£680,310

ESTABLISHMENT OF AERODROMES AND SUBSIDIARY SERVICES.

Activities along this avenue of my Department's operations continue to develop and become more diversified and widespread. Whereas in 1935, development was practically confined to the construction of some half a dozen civil aerodromes utilizing the maximum amount of manpower, to-day operations cover intensive

development of Air Force Stations, Civil Aerodromes, Seaplane alighting areas, Seaplane base at Auckland, and all facilities relating to Air routes, both internal and overseas. In all cases the most efficient and expeditious methods of construction are being adopted and the contracting principle utilized where possible.

Local Air Services: Internal Air Transport has continued to expand and consolidate its position. The only new service commencing during the year was Union Airways' extension from Auckland to Gisborne via Tauranga and Opotiki, but the rearrangement of the Auckland–Dunedin main trunk service with a through calling point at Wellington, has materially assisted to build up traffic. This steady growth of traffic and the increased importance of air transport is shown in the following table.

Year ending.	Length Air Lines (Miles).	Distance flown (Miles).	Passengers.		Freight.		Mail.	
			Number.	Passenger-miles.	Pounds.	Ton-miles.	Pounds.	Ton-miles.
30th June, 1936 (half year)	1,108	356,900	10,490	1,117,000	15,590	725	26,300	1,969
30th June, 1937 ..	1,566	857,947	26,617	2,889,600	52,110	2,339	128,250	10,550
30th June, 1938 ..	1,669	1,662,997	58,431	6,394,803	113,192	5,607	248,680	21,551
30th June, 1939 ..	2,015	1,992,159	65,183	7,185,957	224,734	1,034	332,648	30,688

A feature of air service operations has been the regularity and safety that has been achieved by the operating companies, and this shows that the aerodromes and air route facilities are being developed along sound lines.

The work on civil aerodrome and landing-grounds at 30th June, 1939, may be summarized as follows:—

Fields licensed	59
Emergency fields available	10
New fields initially licensed	6
Fields removed from license register as not required or unsatisfactory	1
Major construction work has been in hand during the year on	21
Fields already licensed but under enlargement or improvement	16
New fields under development	16
Available emergency-landing grounds under improvement ..	2
New emergency-landing grounds under development ..	4
Total number of fields on which work was in hand	48
Fields maintained as Government emergency-landing grounds or fields in remote localities	23
Licensed fields maintained pending handing over to local authorities	13

A number of new fields may be expected to come into initial use this coming summer, and an extension of trunk air services and feeder services is confidently anticipated. Investigations, surveys, and construction proposals have been undertaken in connection with many other possible aerodrome-sites with a view to their development in the future either as licensed aerodromes to augment the network serving air transport needs or as emergency-landing grounds.

My Department has continued to co-operate with the Post and Telegraph Department in the provision of aeradio facilities to assist the safe and efficient operation of internal air lines. Transmitting-stations have now been provided and are operating at fifteen aerodromes, two initially this year. In addition, separate aeradio-receiving and direction-finding stations are being provided at eleven centres. All station buildings have been erected, one station is operating, and the installation of equipment is in train at the remainder. A radio approach beacon has been provided at Taieri, Dunedin, and although not yet in regular use has been operating experimentally.

Overseas Air Services: Flying-boats. This is a new activity that has been given increasing attention and importance. When it was determined that the extension of the England Australia Air Service to New Zealand would eventuate during 1939, immediate steps were taken to commence the development of the adopted flying-boat base at Mechanic's Bay, Auckland. An administration block, workshops, and technical buildings were erected, and are now occupied by technical staff. In addition, assistance is being rendered to provide berthing, mooring, and slipping facilities, while a hangar to accommodate the large flying-boats is being provided at the R.N.Z.A.F. Base, Hobsonville.

To assist the safe and smooth operation of aircraft over long, open ocean spaces it has become necessary to provide entirely new aeradio facilities essentially for the purpose. A subsidiary station has already been erected and equipped at Awarua, Southland, while extensive development of the new Musick Memorial Station at East Tamaki Head, Auckland, is well in hand. At the latter station temporary buildings are being erected initially, as time will not permit the completion of the more extensive permanent buildings before the initial services commence.

In anticipation of and to prepare for possible future developments of aviation in the Pacific my Department equipped and despatched an expedition into the Pacific to carry out preliminary surveys for landing-facilities. Investigatory work in this connection is proceeding.

A temporary aeradio and meteorological reporting-station has been maintained and serviced at Raoul Island in the Kermadec Group, and arrangements are now finalized for proceeding immediately with the establishment of the permanent station.

Royal New Zealand Air Force Establishment. As a defence measure, special urgency has been afforded to an extensive expansion programme for the Royal New Zealand Air Force. This has necessitated the provision, at the earliest moment, of increased accommodation—both residential and technical—at existing stations and the provision of a number of entirely new stations.

The existing station at Hobsonville is being developed as an aircraft-repair depot, and will eventually accommodate at least twice the personnel stationed there a year ago.

The existing advanced Flying Training School at Wigram is being expanded to train some four times as many pilots and airmen as formerly; while a similar Flying Training School is now being provided at Woodbourne, near Blenheim. The development of the new operational station at Ohakea is now well forward, and it will be occupied this coming summer and a similar station is under construction at Whenuapai, near Auckland.

The construction of a wooden hangar at Taieri, Dunedin, is the commencement of a small development scheme for Territorial Air Force training purposes in that locality.

General.

Other avenues in relation to aviation and with which the Department is associated are: Compilation of the *New Zealand Air Pilot*; "Notices to Airmen affecting Aerodromes"; plotting of aeradio direction-finding maps; aviation strip maps; collection and compilation of meteorological information; air photography and surveys; and the inspection of aerodromes for licensing purposes.

TELEGRAPH EXTENSION.

The expenditure on telegraph extension by the Post and Telegraph Department during the past financial year in respect of telephone, telegraph, and radio facilities throughout the Dominion amounted to £575,943, as against £312,260 for the year ended the 31st March, 1938.

Further improvements to the long-distance toll service were effected during the year by the establishment of an additional three-channel carrier-telephone system between Wellington and Christchurch. The installation of this system, which is being operated over the submarine coaxial telephone cable between Wellington and Seddon and thence over one of the land-line circuits to Christchurch, has enabled the Department to increase from nine to twelve the number of inter-Island telephone

circuits. Increased facilities were also made available between Christchurch and Dunedin by the establishment of two three-channel carrier systems which were brought into commission between those centres in December last. One of the six channels thus provided has been permanently connected through to Wellington to give a direct toll outlet between Wellington and Dunedin, and a more efficient service between these two important centres is now assured. Consequent upon the provision of this Wellington–Dunedin direct-toll circuit, the twelve telephone channels available across Cook Strait have been allocated as follows :—

Wellington–Christchurch toll service	6
Wellington–Christchurch voice-frequency telegraph service ..	1
Wellington–Dunedin toll service	1
Wellington–Blenheim toll service	2
Wellington–Blenheim voice-frequency telegraph service ..	1
Wellington–Nelson toll service	1
	12

As the toll and telegraph business expands additional carrier equipment will be installed to provide further facilities over the coaxial telephone cable for inter-Island traffic.

A three-channel carrier system was brought into operation between Seddon and Greymouth during the year, and the three channels have been extended to Christchurch by way of Seddon–Christchurch circuits in order to provide temporary toll facilities between Greymouth and Christchurch pending the rearrangement of the toll and telegraph lines via the Otira route necessitated by the enlivening of the Canterbury–Westland 66,000 volt transmission-line.

Other carrier systems brought into service during the year were as follows :—

Wellington – Palmerston North : One three-channel system.
Wellington – New Plymouth : One three-channel system.
Auckland – New Plymouth : One three-channel system.
Auckland–Hamilton : One three-channel system.
Hamilton–Napier : One three-channel system.
Gisborne–Napier : One three-channel system.
Wellington–Napier : One three-channel system.
Dunedin–Invercargill : Two three-channel systems.
Nelson–Takaka : One single-channel system.
Dunedin–Cromwell : One single-channel system.
Dunedin–Heriot : One single-channel system.

Other improvements to the plant and equipment used in connection with the toll and telegraph services include the installation of toll switchboards at a number of exchanges, including important extensions to the existing equipment at Auckland, Hamilton, Palmerston North, and Wellington, the installation of special toll-switching equipment at Lower Hutt, and the laying of a special underground cable providing 150 trunk lines between Napier and Hastings. In addition, new outlets for toll traffic were provided by the erection of additional aerial circuits between various centres.

The first multi-channel voice-frequency telegraph systems to be used in New Zealand were established during the year, the initial installations comprising a three-channel system between Wellington and Christchurch and an eight-channel system between Wellington and Blenheim, while further extensions are pending. This system of utilizing carrier-speech channels for telegraphic communication makes it possible to operate up to eighteen two-way teleprinter or morse telegraph channels over one carrier-speech channel.

The number of telephone connections continues to increase at a rapid rate, the net gain in subscribers during the year totalling 9,755, compared with 9,710 for the previous year. The grand total of telephone-stations in the Dominion on the 31st March was 206,216, which is 14,197 in excess of the previous year's figures.

The following is a brief summary of the more important additions which have been made to telephone-exchange plant in order to provide for the steady demand for exchange service and to improve the standard of service for existing subscribers :—

The laying or erecting of 81 miles of lead-covered cable containing 17,721 miles of wire for subscribers' circuits.

The laying of 32½ miles of underground cable ducts.

The erection of 481 miles of pole-line and 4,795 miles of open-aerial wire for the connection of telephone-exchange subscribers' stations.

The establishment of 85 public-call offices and pay-stations.

The reconstruction or partial reconstruction of open-aerial systems at a large number of telephone-exchanges.

The provision of additional switching-apparatus at 34 exchanges.

The replacement of existing switchboards at 8 exchanges.

The installation of branching multiple-switchboard equipment at the Otorohanga Exchange.

The provision of an additional inter-office trunk cable between the Auckland Central, Remuera, and Devonport Exchanges.

Practically the whole of the equipment for the new automatic telephone exchange at Napier has now been received, and the installation work is being proceeded with as rapidly as possible. It is expected that the cut-over of this exchange to automatic working will take place in December next.

An order was placed in October last for the supply of equipment for the new automatic telephone exchange at Gisborne. The equipment is due to arrive in the Dominion towards the end of the year.

The extension equipment for the St. Albans automatic exchange and the initial equipment for the two new sub-exchanges which are to be established at New Brighton and Mount Pleasant (Christchurch) have now arrived in the Dominion. Installation work is proceeding at St. Albans and will be commenced at New Brighton and Mount Pleasant at an early date. Equipment for an extension of the central exchange at Christchurch is under order and due to arrive shortly.

Orders have been placed for the initial equipment for the establishment in the Auckland metropolitan area of new automatic exchanges at St. Heliers, Otahuhu, Mount Albert, and Avondale, and for extension equipment to be installed at the Devonport, Takapuna, Onehunga, Mount Eden, Remuera, Ponsonby, and Auckland Central automatic exchanges. Delivery of the equipment will be spread over a period of three years, and it is probable that eighteen months or two years will elapse before any appreciable portion of the equipment can be put into service.

Extension equipment has been received for the Dunedin main exchange and for the Hamilton, Hastings, Hawera, Palmerston North, Masterton, Khandallah, and Miramar automatic exchanges, while equipment for the Whangarei, Courtenay Place, and Wellington Central exchanges is due in the near future.

At Wellington Radio the erection of six steel towers is being undertaken to replace the wooden masts which were erected to support the new aerial system. On completion of this work the existing tower will be dismantled. Additional transmitting-equipment has been installed at both Wellington Radio and Awarua Radio to cope with the expanding services being provided by these stations. At Awarua Radio direction-finding equipment is being installed to assist in the navigation of aircraft in the projected trans-Tasman air-service. This will work in conjunction with similar equipment being installed at the new radio-station which is being established at East Tamaki (near Auckland) to cater adequately for the requirements of the trans-Tasman air-service in the matter of radio navigational aids. As a national memorial to the late Captain Musick and crew who perished in the "Samoan Clipper" in January, 1938, while returning to New Zealand after making the inaugural flight of the Auckland - Honolulu Air-mail Service, the site of the new station will be known as Musick Point, and the station will be named the Musick Memorial Station.

To avoid the maintenance of two radio stations in the same district, it is proposed to transfer the services of Auckland Radio from the Chief Post Office building, Auckland, to the Musick Point Station.

TOURIST AND HEALTH RESORTS.

The expenditure for the year ending 31st March last was £24,552, as compared with £23,159 for the previous year. The major portion of the expenditure during last year was incurred on extensions to the Rotorua electrical system, particularly the reticulation of the Ngakura and Horahora districts, additions to the Te Anau Hotel and Lake House, Waikaremoana.

Much-needed improvements were carried out to the roads and tracks in the Rotorua district, and work in connection with the formation of the road to Scoria Flat, Tongariro National Park, was advanced.

LANDS IMPROVEMENT.

Under this section work was continued in connection with the improvement and control of rivers, reclamation of tidal-flats and sand-dune areas, and drainage schemes.

The clearing of several rivers has been undertaken, and flooding has been minimized as a result of the removal of willow-growth and other obstructions.

Some of the major works were the clearing of the Hoteo and Mangaorongo Rivers and the Taupiri Drainage Scheme in the Auckland District; the clearing of the Mokauiti and Mokau Rivers in the Taumarunui District; the Ngaruroro river-control scheme in the Napier District; the Karamea River flood-control scheme in the Greymouth District; and the Ashley River flood-control scheme in the Christchurch District. The extensive works in connection with the Ashley River were completed and handed over to the Ashley River Trust for maintenance. In connection with proposed Ruawai drainage improvements, a comprehensive engineering investigation was made and a scheme designed so that the project could be considered. Investigations were also made in respect of a number of rivers in various districts, and for which schemes of control are under consideration.

Reclamation operations at the Hutt River estuary were completed, 92 acres having been reclaimed.

In certain districts, particularly North Auckland and Auckland, sand-dune reclamation was actively continued, large areas of marram-grass and lupin being planted or sown. Tree-planting has also been a feature of the improvement work carried out in sand-dune areas.

SETTLEMENT OF UNEMPLOYED WORKERS.

The development of land for small-farm settlement was continued during the year, the work being undertaken partly by the Public Works Department and partly by the Lands and Survey Department's own land-development organization.

The number of men employed on the various schemes increased from the previous maximum of 1,324 to 1,646 in March, 1939. This increase was due to additional areas being taken in hand, and at the 31st March a total of 118,435 acres was under development. The figure last year was 73,000 acres.

The stock carried on the new pastures laid down included 81,848 sheep, 7,227 dairy cattle, and 10,142 run cattle.

The gross expenditure during the year against this vote was £526,397.

PLANT AND MECHANICAL EQUIPMENT.

During the year under review the policy of utilizing mechanical equipment on public works has been continued, and further purchases have been made of various types of modern machines. Generally speaking, it can be said that the amount

of plant now on hand is reasonably sufficient for the scale of operations in progress, but it will be necessary to ensure that replacement is effected as circumstances require. In past years obsolete and depreciated plant has been kept in use too long, presumably because of a desire to conserve capital outlay; but it is a false economy to continue the operation of equipment which is incapable of giving efficient service. It has been my constant aim to replace, as soon as the necessity arose, any item of plant which had outlived its real usefulness, and the wisdom of this course is shown by the low-cost operation and high output of the mechanical equipment employed on public works to-day. It is only by this method that full advantage can be taken of the continued developments which are taking place year by year in the technical design and increased efficiency of manufacturing enterprises throughout the world.

The types of machinery which have been obtained have been selected because of their general utility value for New Zealand conditions. For example, mechanized units which have been acquired primarily for earth-moving in connection with the construction of roads, railways, aerodromes, and irrigation projects can also be operated successfully in the interests of defence, if necessary, or in the clearing of land for settlement purposes. In the event of a national emergency, therefore, the Department's mechanical equipment would be readily available to undertake promptly any special works which might be required.

An illustration, in a minor way, of the value of suitable mechanical equipment in a time of urgent need was given in my last report in reference to the use of departmental plant for restoring communications immediately after the extraordinary flooding which occurred in the Hawke's Bay district in April, 1938.

I have felt it my duty to afford honourable members and the public generally the opportunity of seeing for themselves just what results can be accomplished by the successful operation of efficient mechanical plant. With this objective, I have during the past year made special arrangements on several occasions to demonstrate various machines operating under normal working-conditions. The reconstruction of the Ngahauranga Gorge section of highway near Wellington to the standard which has been adopted could not have been undertaken at justifiable cost without the use of mechanical plant, and that work is typical of many other constructional schemes in progress.

The efficiency of mechanized equipment depends very largely indeed upon adequate and continuous maintenance. In this connection the Department has established up-to-date servicing and repair depots throughout the country where any item of plant can be overhauled and reconditioned. An important feature has been the training of New Zealand operators for the various machines, and also the training of mechanics who attend to the servicing of the plant, both in the field and at the depots. An indication of the very satisfactory work being done at these repair-shops is seen in the fact that in many cases spare parts are being made in New Zealand at prices which compare favourably with imported spares. In addition, the time factor is of great importance, and the capacity to manufacture essential spares assists considerably towards the full-time operation of equipment.

HARBOUR-WORKS.

At Little Wanganui the construction of a new wharf has been deferred pending developments at Karamea Harbour. The present wharf has been built up to extend storage space for timber. At Westport the proposal formulated some years ago to increase the tidal capacity by dredging 3,000,000 cubic yards of material from the lagoon has received the approval of the Government. Tenders for a shallow-draught suction dredge have now been received and are under consideration. During the past year groyne construction and improvements have been effected at Organ's Island, and the breakwaters have received attention. Stone for both of these works was obtained from a suitable quarry at Cape Foulwind.

At Waikawa, Southland, a slipway and winch for the use of local fishermen have been constructed.

LIGHTHOUSES.

The erection of radio beacon stations has progressed favourably during the past year, due to the more rapid delivery of the apparatus from England. The beacon at Cape Campbell has been completed, the one at Stephens Island almost completed, while at Cuvier and Moko Hinau Islands some heavy preliminary work has been done. Plans are under preparation for a radio beacon at Cape Reinga, near Cape Maria Van Diemen.

Most of the lighthouse-stations have received attention during the year in the way of repairs and maintenance. Particular attention has been given to the installation of suitable tramways and winches to facilitate the unloading of stores, &c., at the lighthouse-stations which are somewhat inaccessible.

The French Pass light which was damaged some years ago as a result of a collision by a vessel has been repaired and strengthened. This work necessitated the working of short shifts due to tidal conditions.

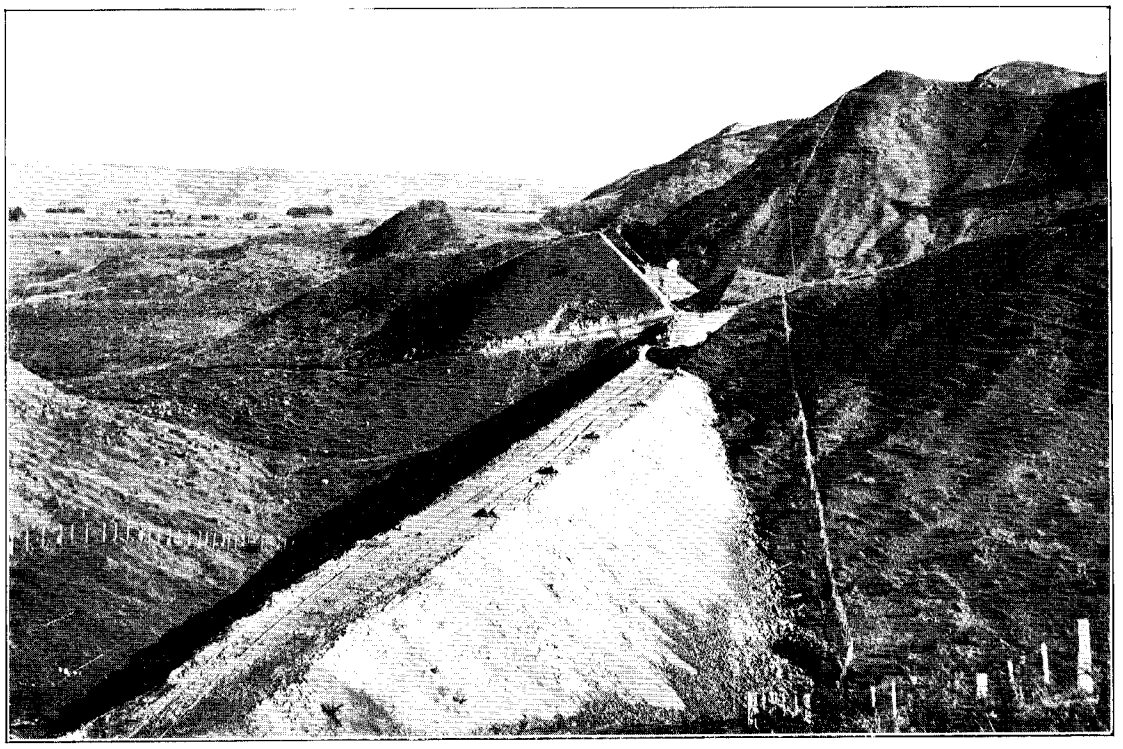
NATIVE-LAND SETTLEMENT.

The net expenditure from the Public Works Fund for the year under review was £493,695, as compared with £254,827 for the previous year. The gross expenditure this year was £1,166,103, as against £814,135 last year. The difference between the gross expenditure and the net capital expenditure this year—viz., £672,408—is represented by grants from the Employment Promotion Fund, £415,000, and farm receipts from Native lands in course of development and settlement totalling £257,408.

With the exception of £24,972 expended under the Native Housing Act, 1935 (an additional amount of £35,011 disbursed from the Special Housing Fund is reflected in the Native Trustee's Account), the above figures represent expenditure on the development, settlement, cultivation, and improvement of Native lands, and the progress achieved in regard to these activities is indicated in the following statement, which shows the position at 31st March, 1939:—

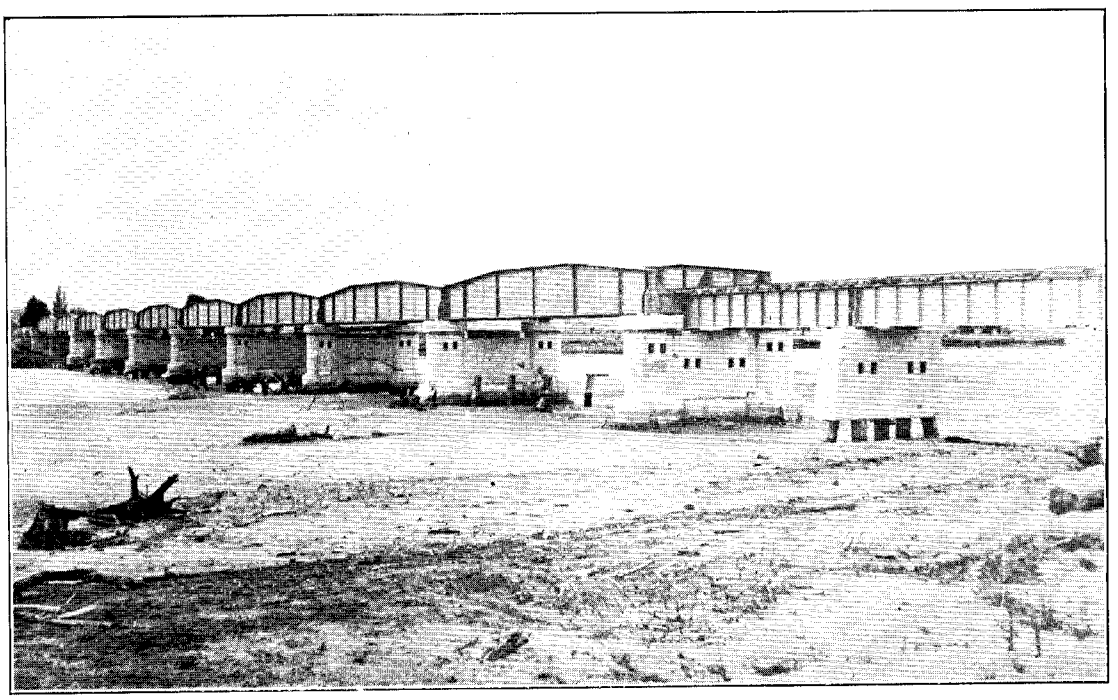
Area gazetted for development (acres)			841,000
Area under development (acres)			255,000
Individual settlers established			1,900
Labourers employed			3,000
Dependants (excluding settlers and labourers)			17,000
Houses erected to date (total)			1,088
Live-stock tallies—			
Dairy stock			50,500
Run sheep			22,500
Sheep			136,000
Receipts for year—		£	
Butterfat (Department's proportion only, 40 per cent.)		116,360	
Wool		34,324	
Live-stock		91,546	
Sundries		15,178	£
			257,408

The development and settlement of Native lands, the construction and repair of houses for Maoris, and the promotion of employment amongst the people are measures which are directed by the Board of Native Affairs and controlled by the Native Department. A full report dealing with the operations of the Board, and the policy adopted to encourage and assist the Maori people in their establishment as self-supporting members of the community, is contained in parliamentary report G.–10.



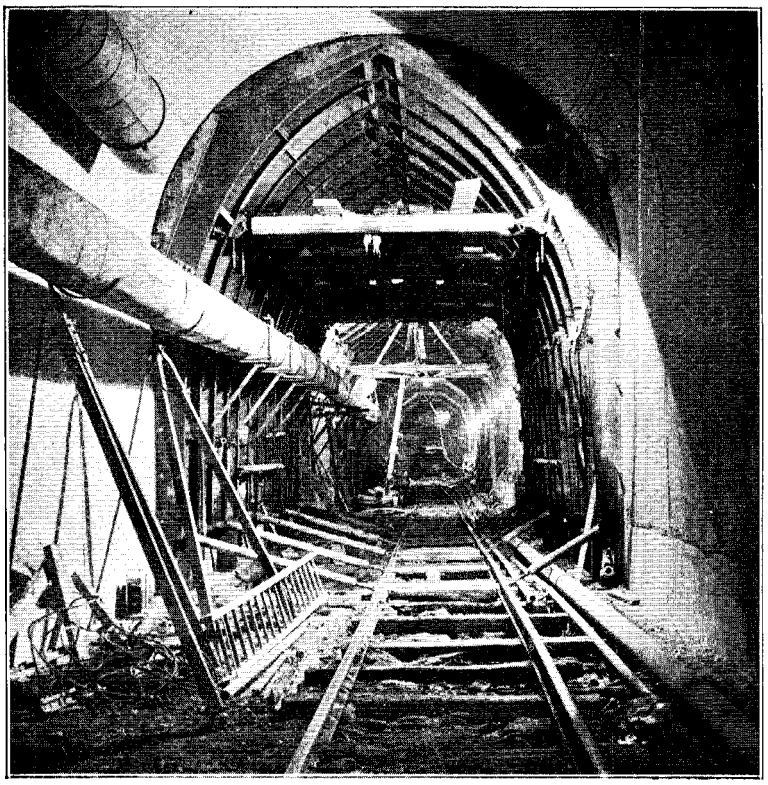
View towards Wangaehu Valley.

TURAKINA–OKOIA RAILWAY DEVIATION.

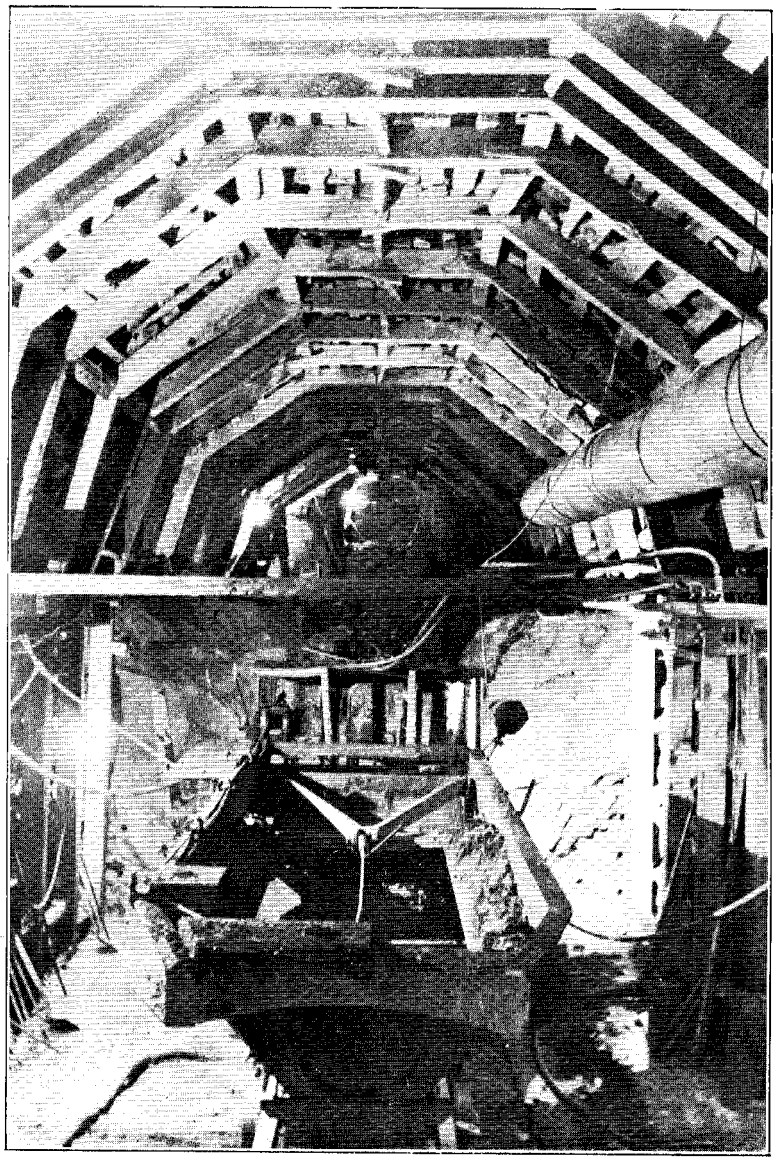


Waipaoa River Bridge. Nine 60 ft. and Six 30 ft. Plate-girder Spans.

GISBORNE–NAPIER RAILWAY.



Waikoura Tunnel, North End. View showing Stages of Construction: Timbering in Background; Steel Formwork in Middle Distance, and Finished Lined Tunnel in Foreground.



Waiau–Tikiwhata Tunnel, South Face. View shows Timbering and Mechanical Muck-scraper.

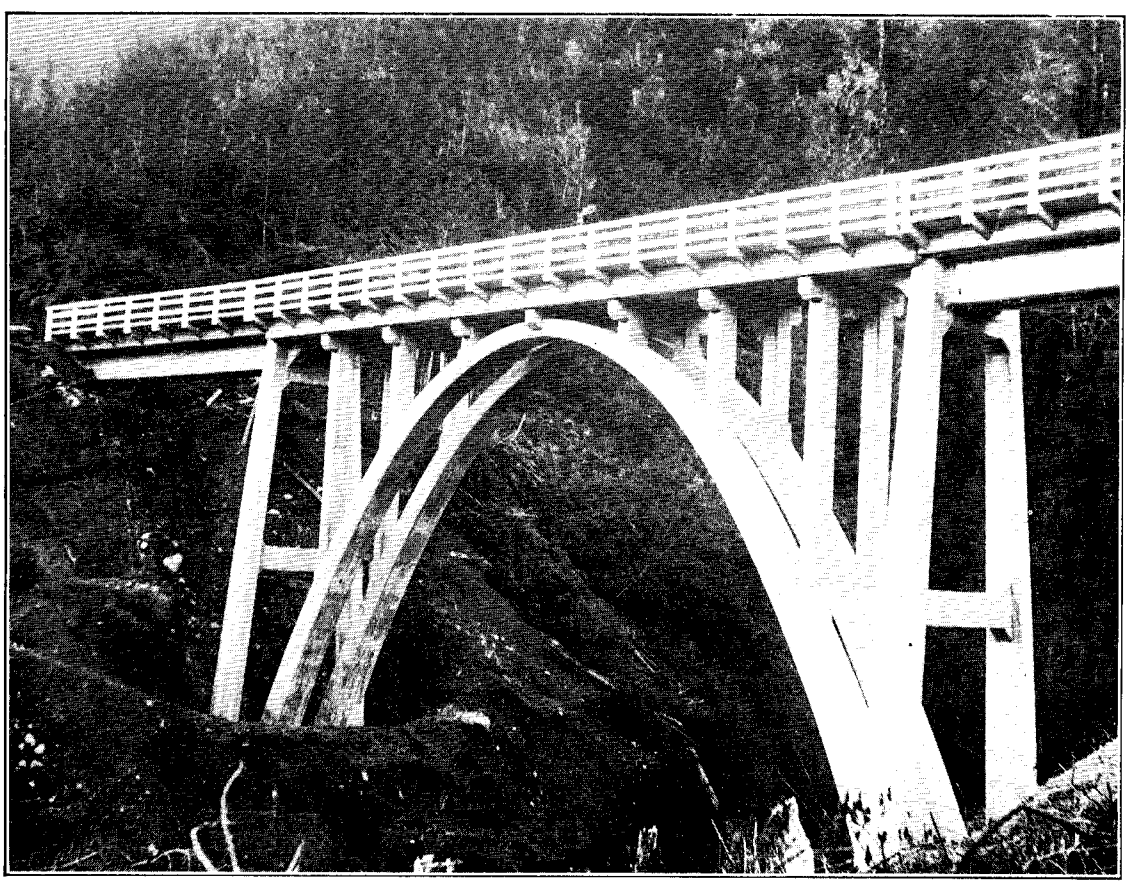
Level-crossing Elimination, Overbridge, 10 m. 49 ch. Railway Formation in use as Temporary Road.

GISBORNE–NAPIER RAILWAY.

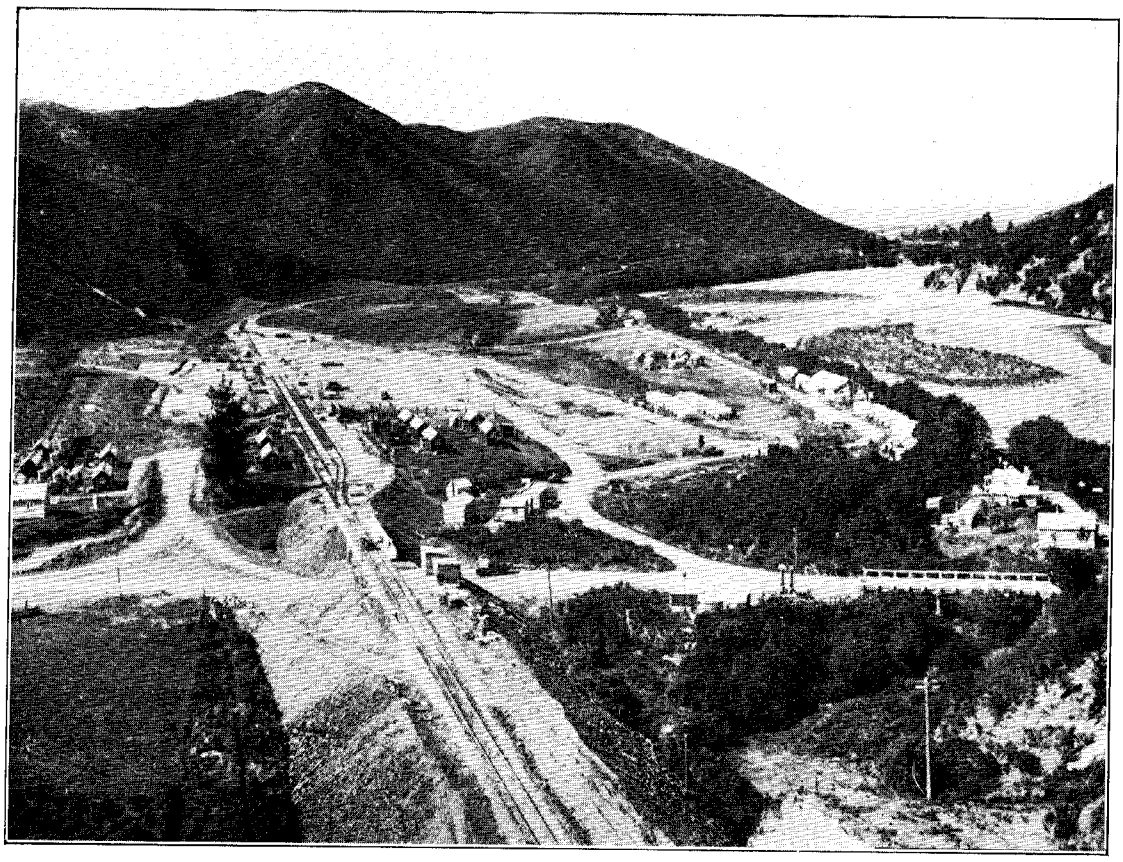
Buller River Bridge. Six 100 ft. and One 30 ft. Plate-girder Spans.

WESTPORT–INANGAHUA RAILWAY.

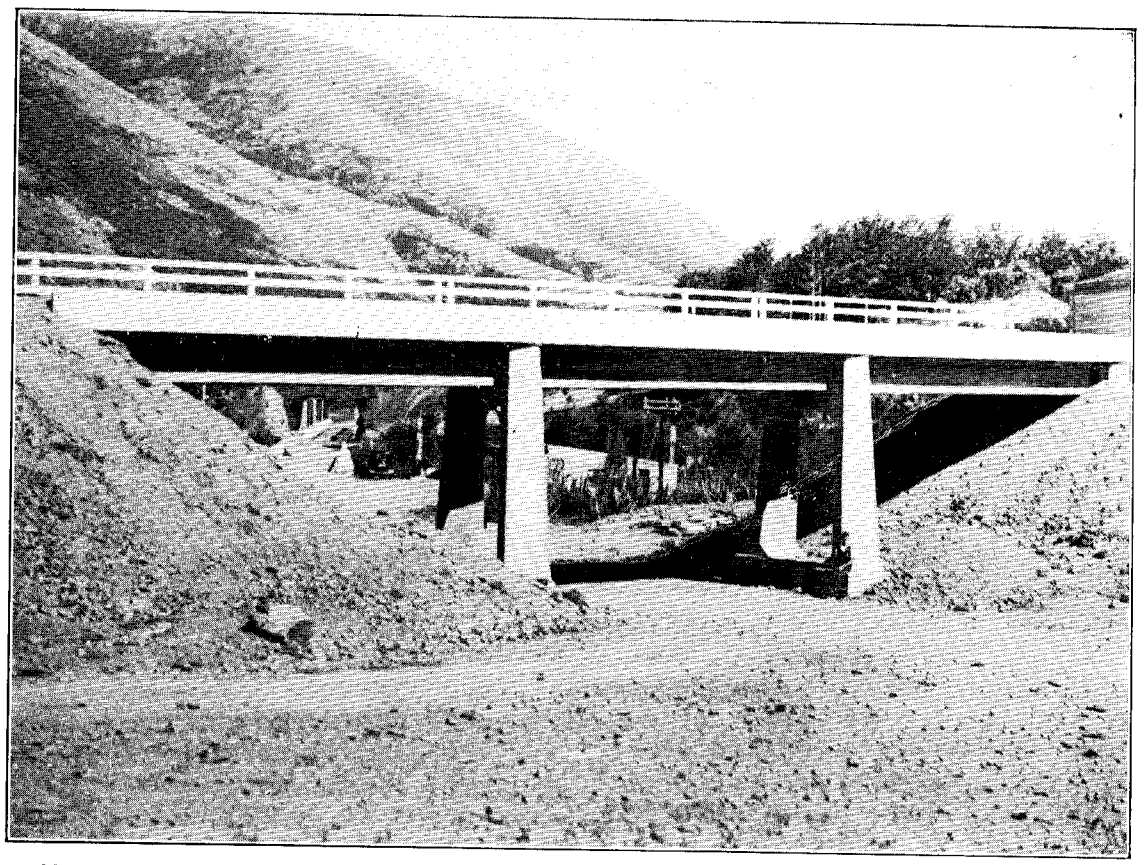
Cascade Creek Bridge. Five 80 ft. and One 40 ft. Plate-girder Spans on 7½ chains Radius Curve.



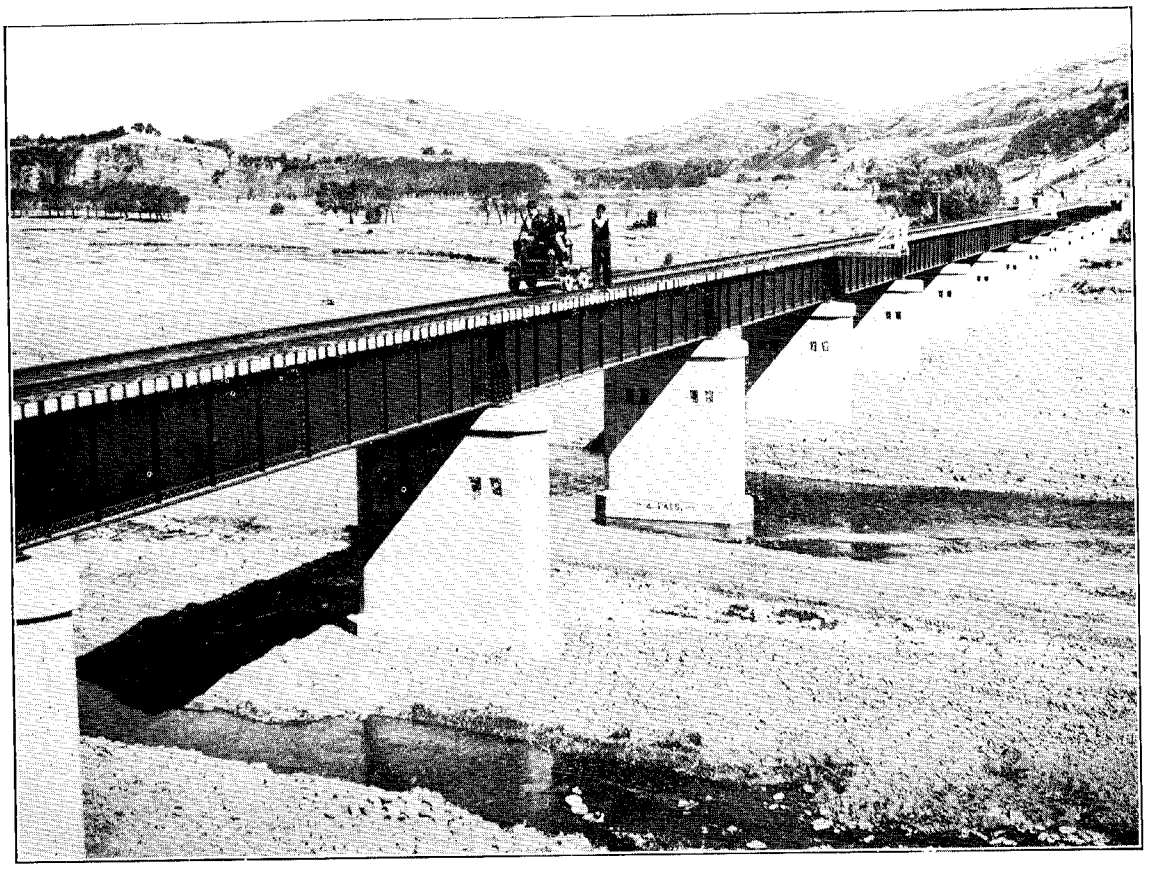
Redmond Creek Bridge. Reinforced-concrete Ballasted Deck Construction. One 80 ft. Arch Span and Three 40 ft. Spans.



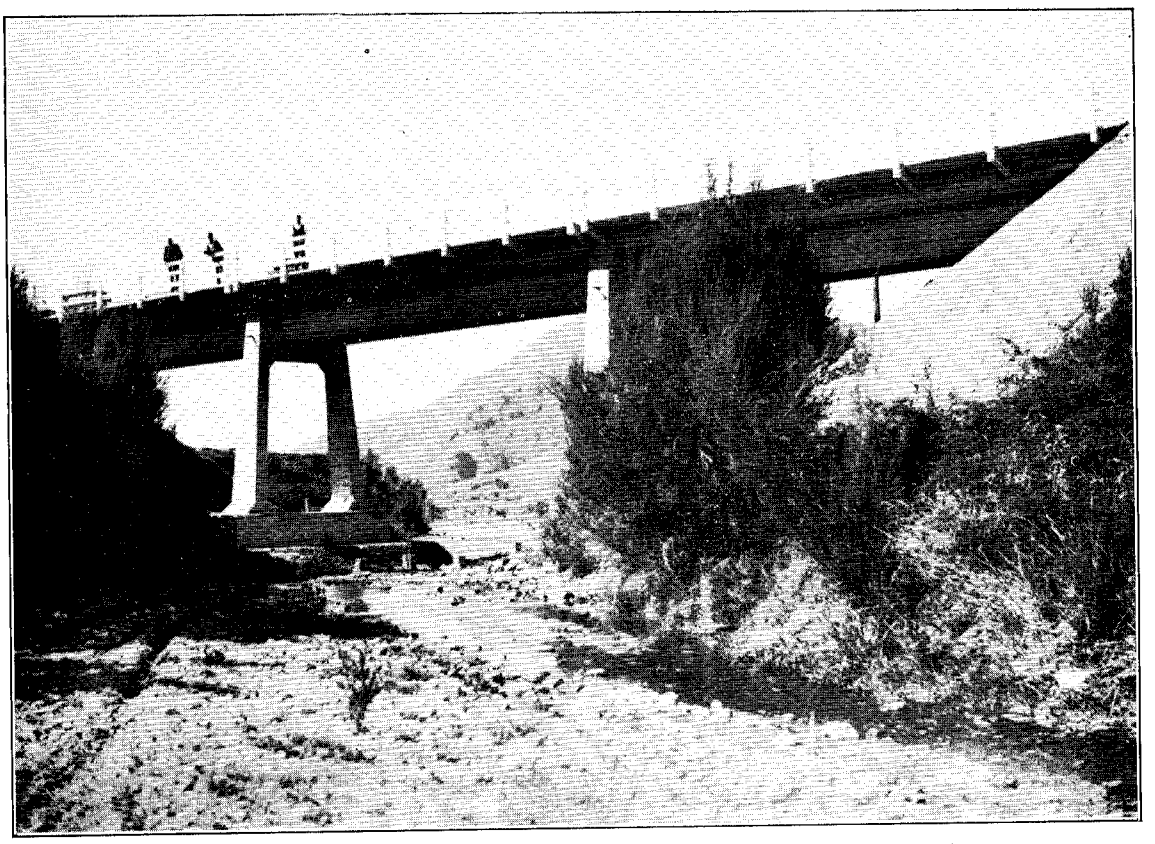
Hundalee Station Yard and Camp-site.



Hundalee Subway. Reinforced-concrete Ballasted Deck Construction. Three 30 ft. Girder Spans, for Railway Loading.

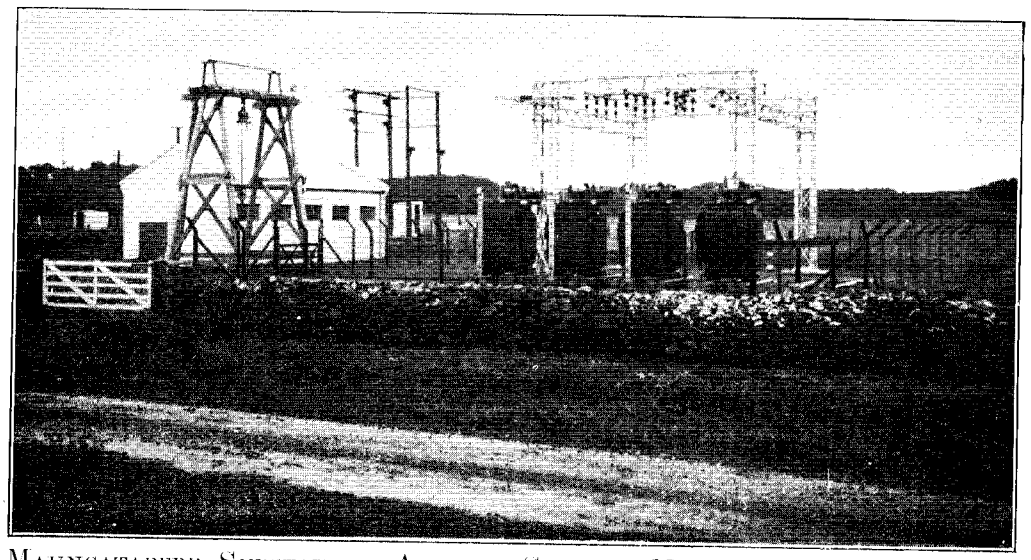


Conway River Bridge. Sixteen 45 ft. Plate-girder Spans.

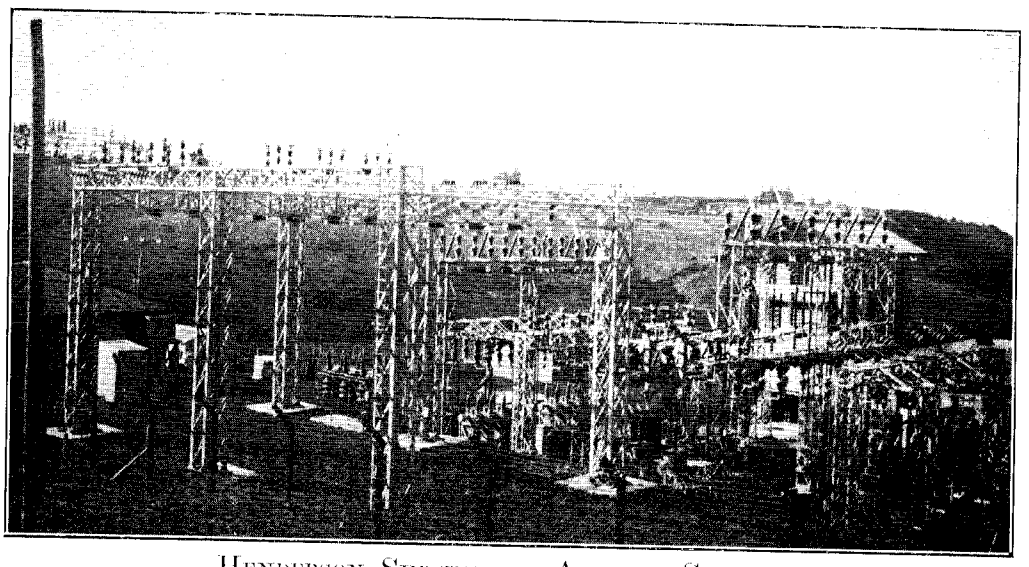


Micks Creek Bridge. Three 45 ft. Reinforced-concrete Spans.

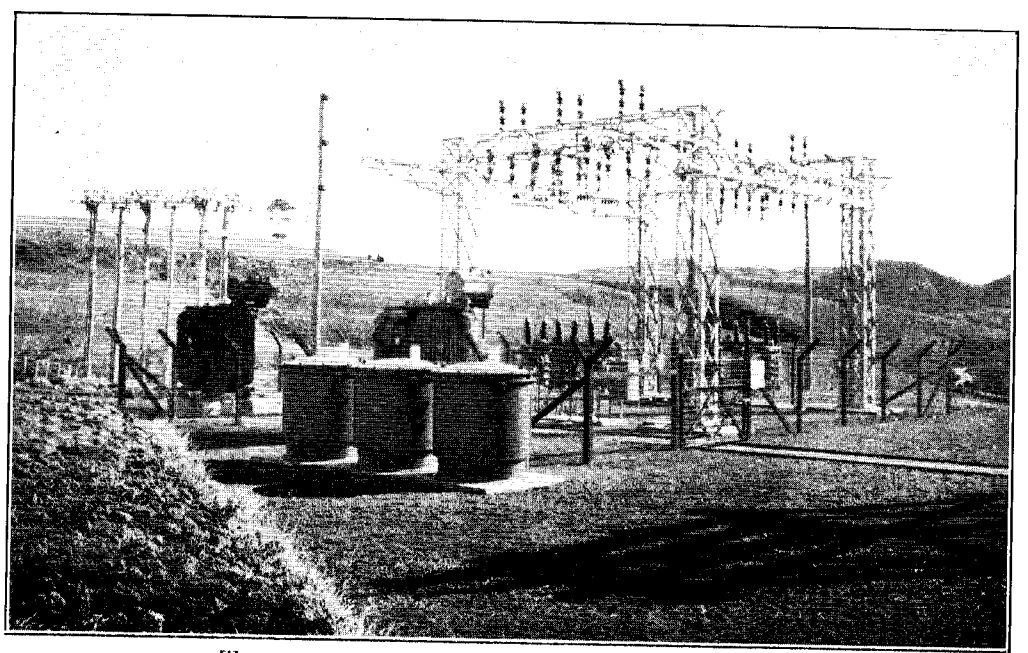
SOUTH ISLAND MAIN TRUNK RAILWAY.



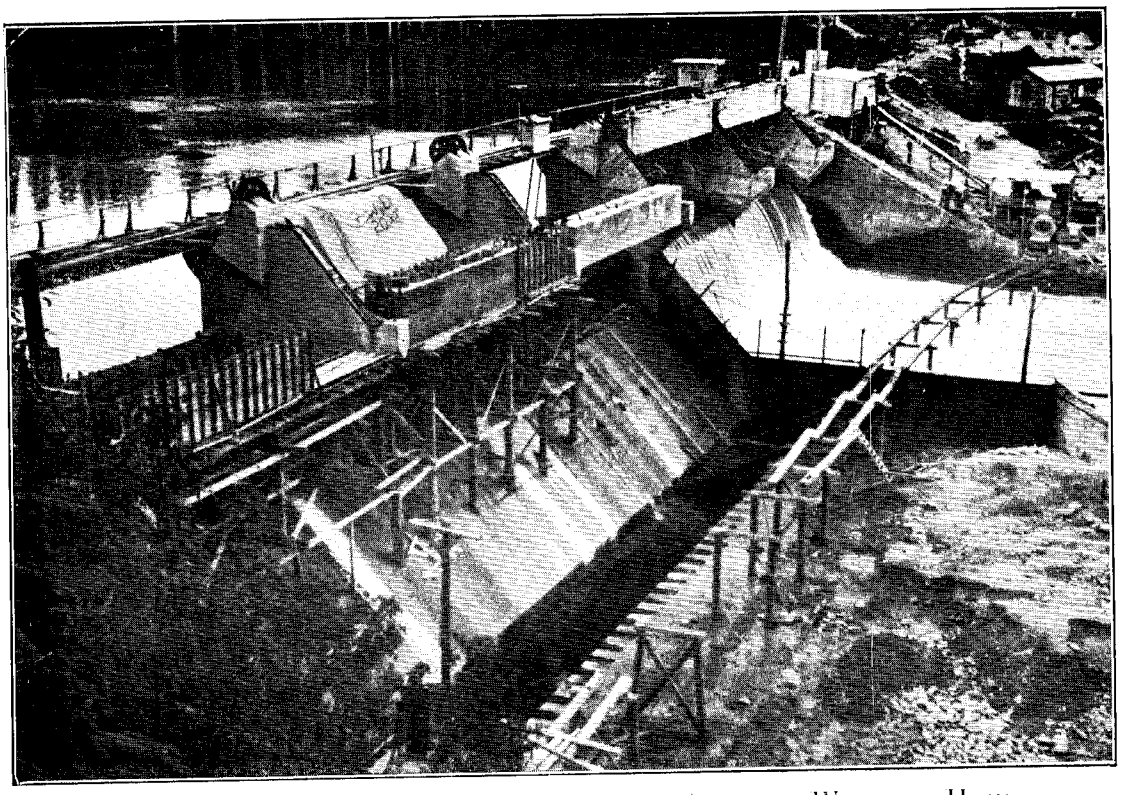
MAUNGATAPERE SUBSTATION, ARAPUNI SCHEME, NORTH AUCKLAND SECTION.



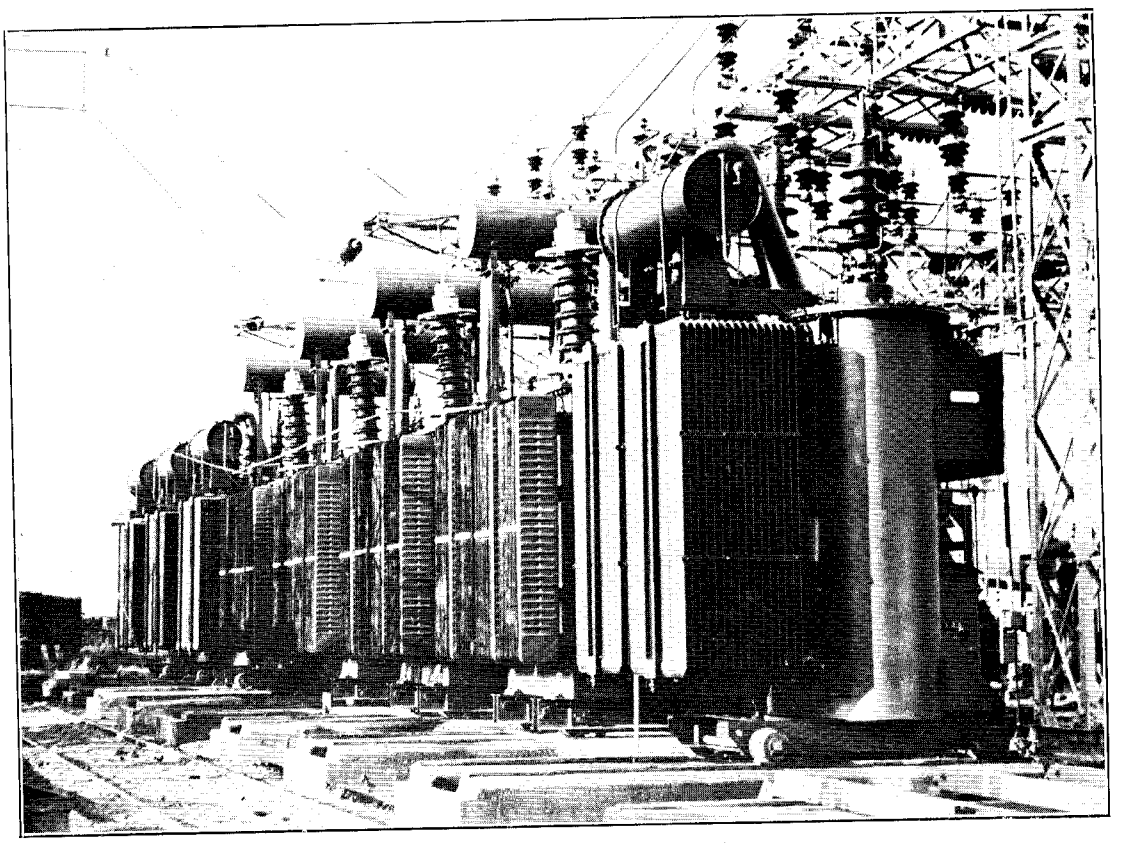
HENDERSON SUBSTATION, ARAPUNI SCHEME.



TAHEKEROA SUBSTATION, ARAPUNI SCHEME.

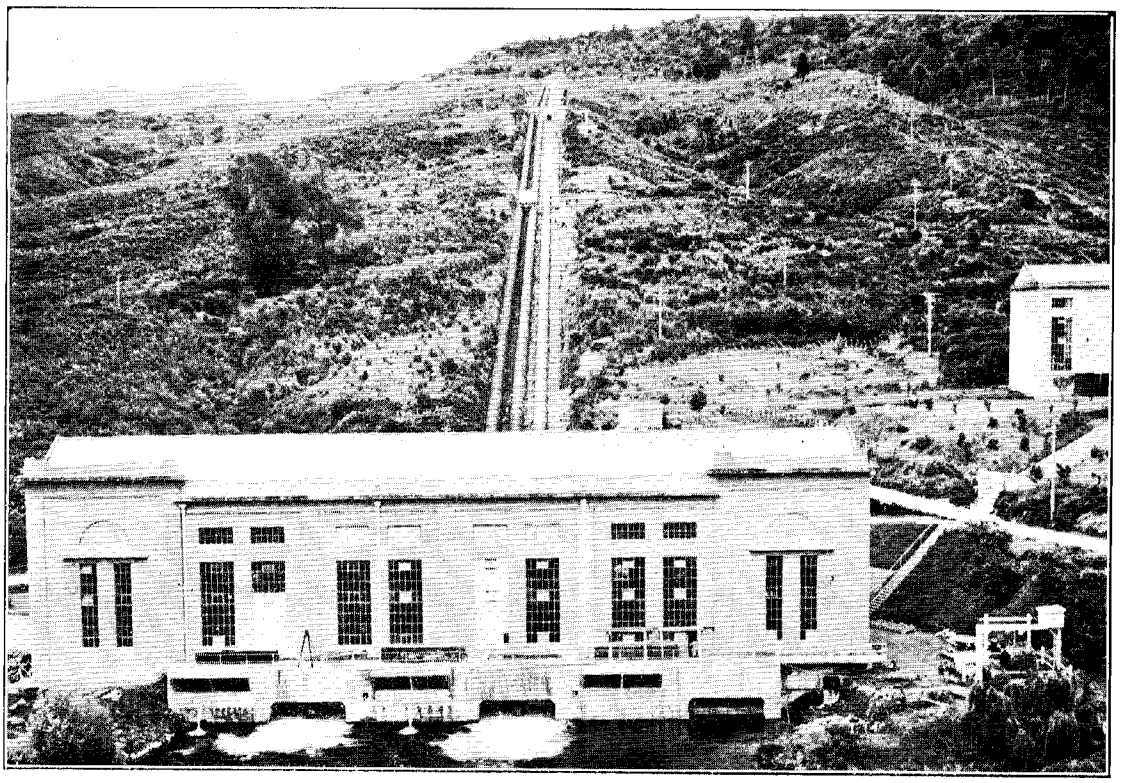


Arnold River Scheme: Kaimata Dam, Showing Work in Hand.



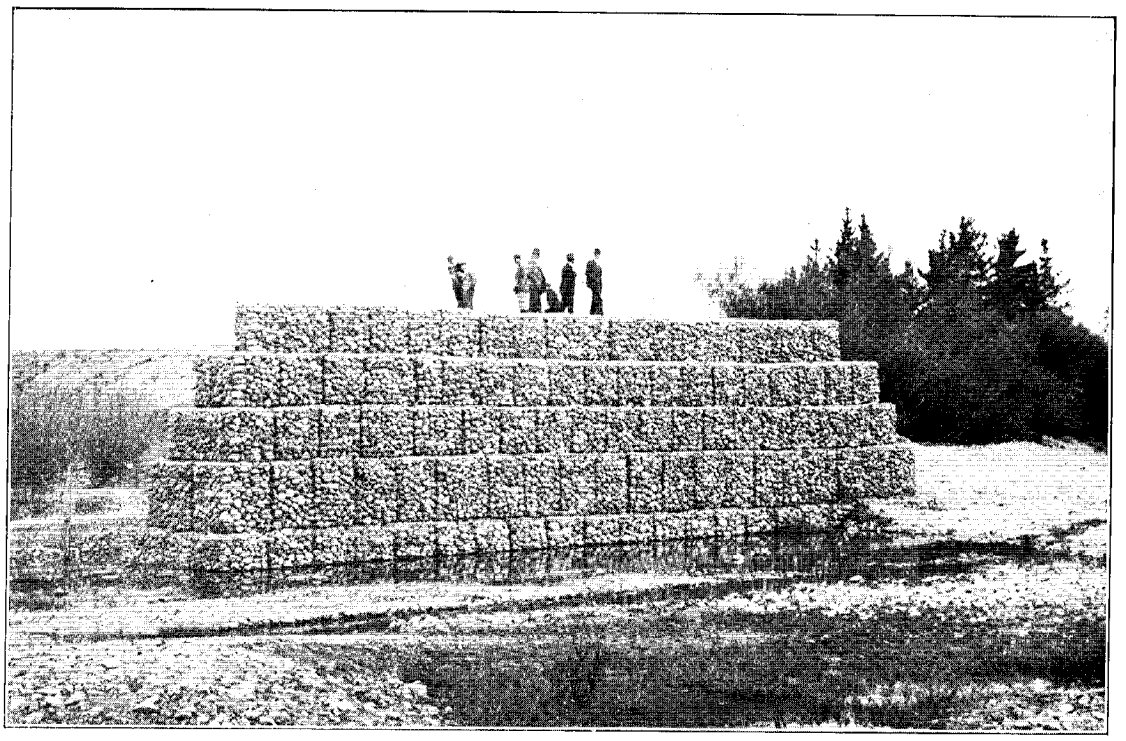
New Transformer Bank, Gore Substation.

SOUTH ISLAND ELECTRIC-POWER SYSTEM.



WAIKAREMOANA MAIN DEVELOPMENT: NO. 3 PIPE-LINE NEARLY COMPLETED.

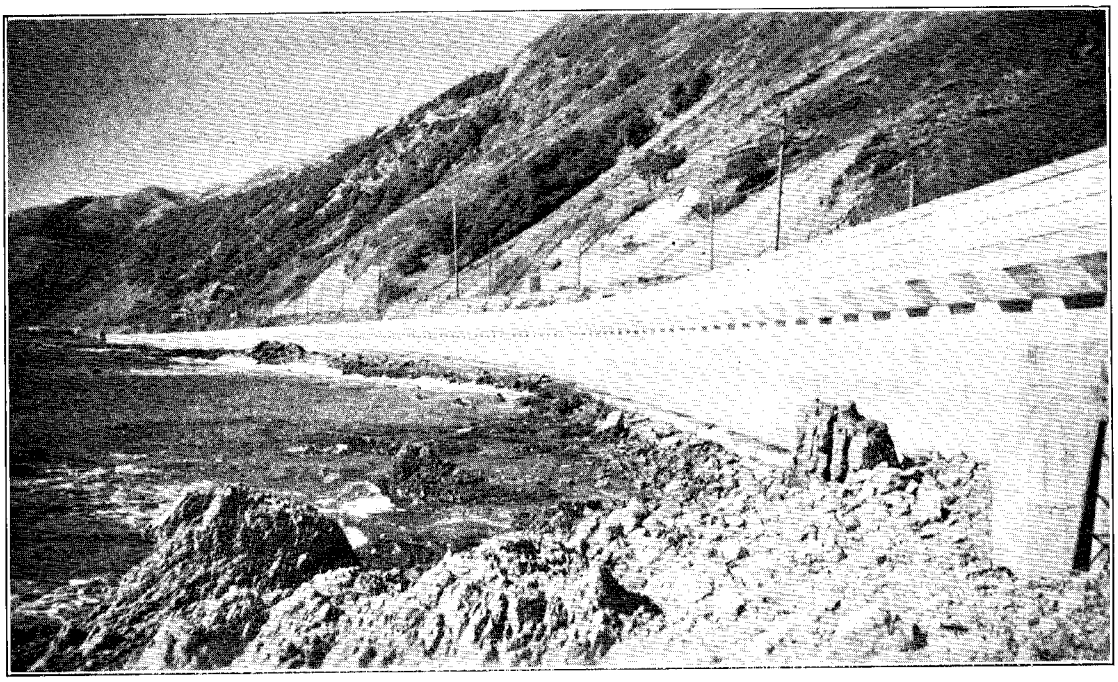
NORTH ISLAND ELECTRIC-POWER SYSTEM.



VIEW SHOWING GROYNE.

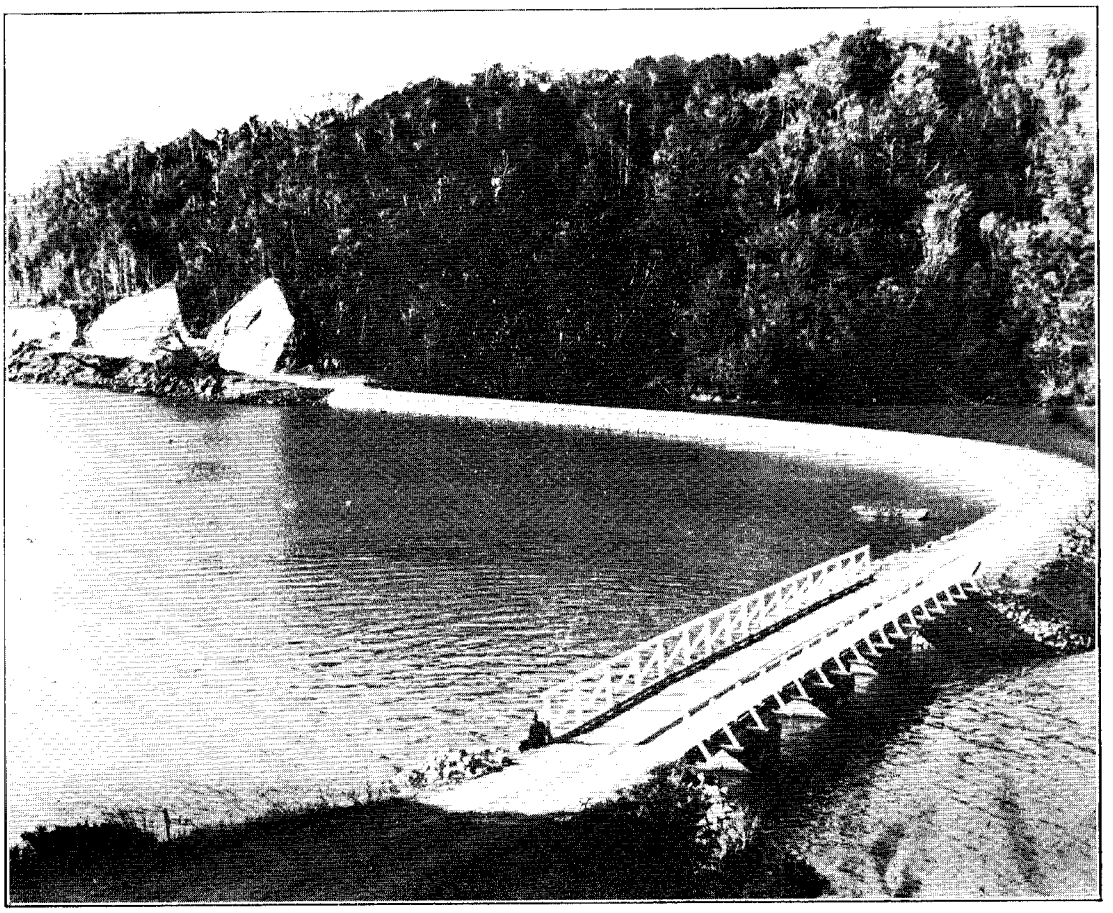
ASHLEY RIVER CONTROL SCHEME.

Partly-constructed Sea-wall: Storm of 14th January, 1939.



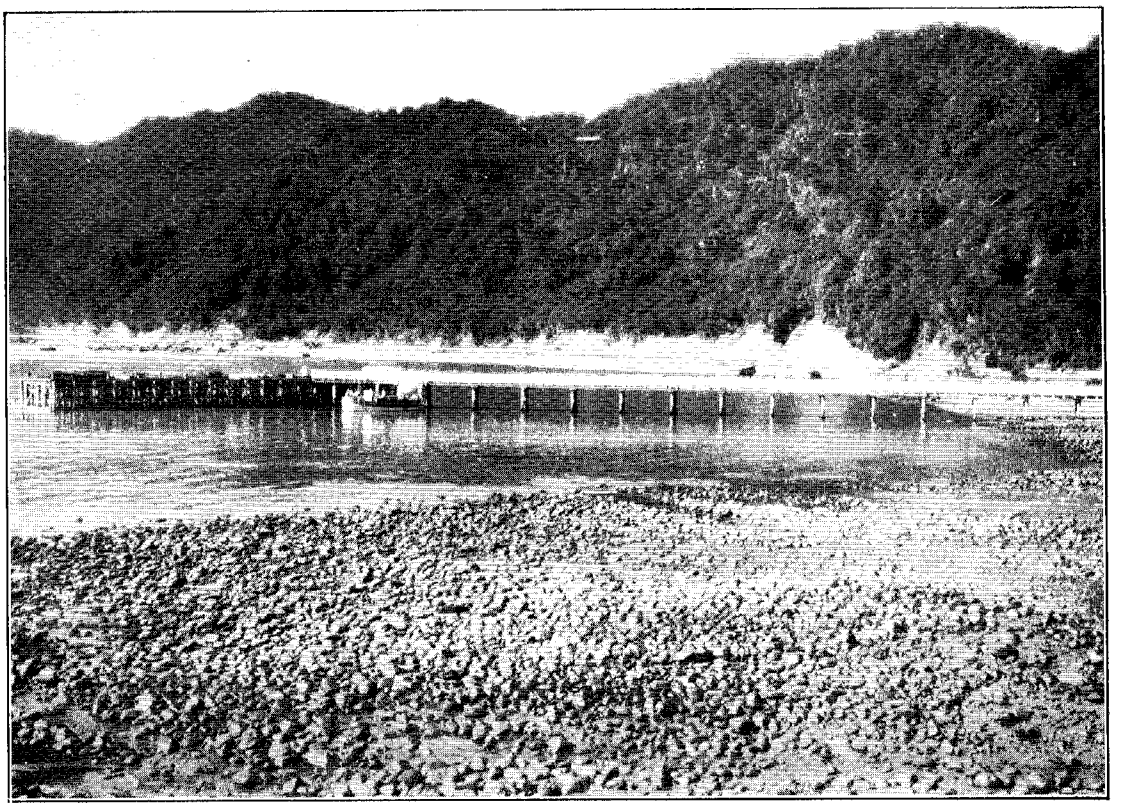
View looking North along a length of the finished Sea-wall.

PLIMMERTON–PAEKAKARIKI ROAD.

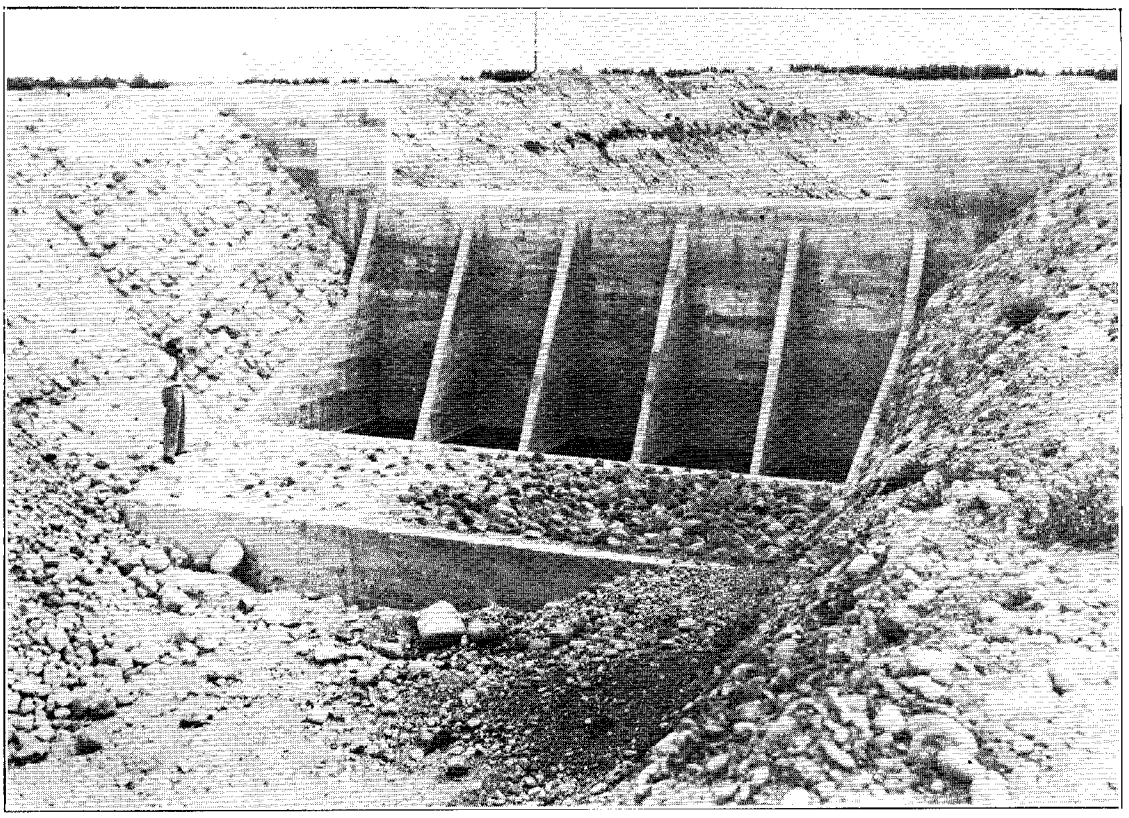


MANGARAKAU BRIDGE AND EMBANKMENT OVER TIDAL ARM: NEW ROAD CONSTRUCTION.

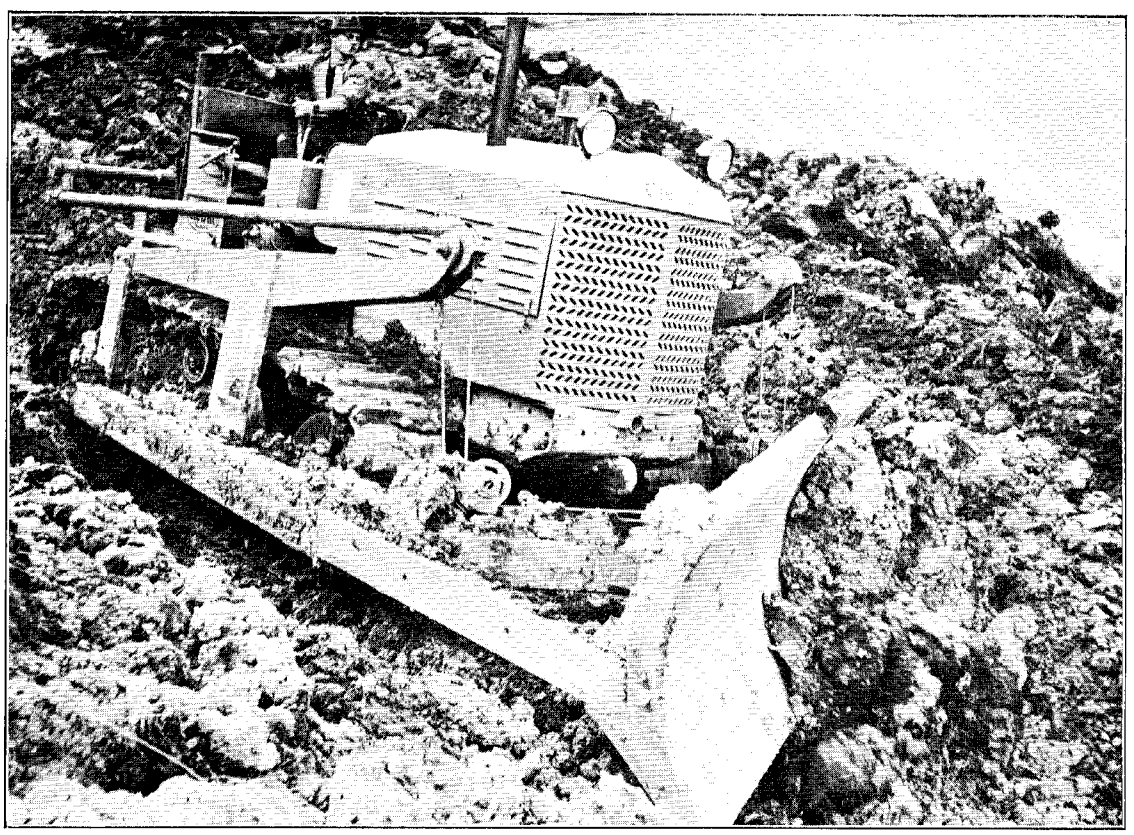
PAKAWAU TO MANGARAKAU, NELSON DISTRICT.



JACKSONS BAY WHARF: SOUTH WESTLAND. ROAD-FORMATION IN BACKGROUND.

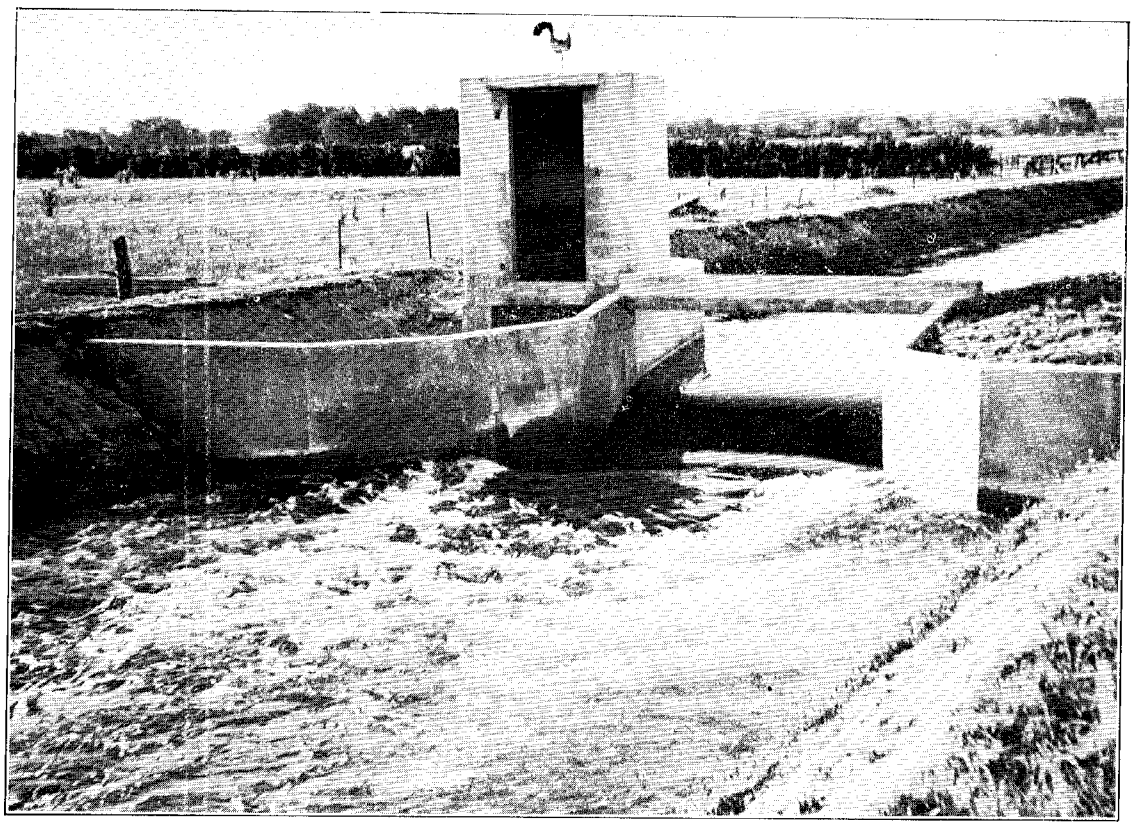


Weir or "Drop" for Absorption of Energy and Velocity-control.
Capacity: 1,000 Cubic Feet of Water per Second.



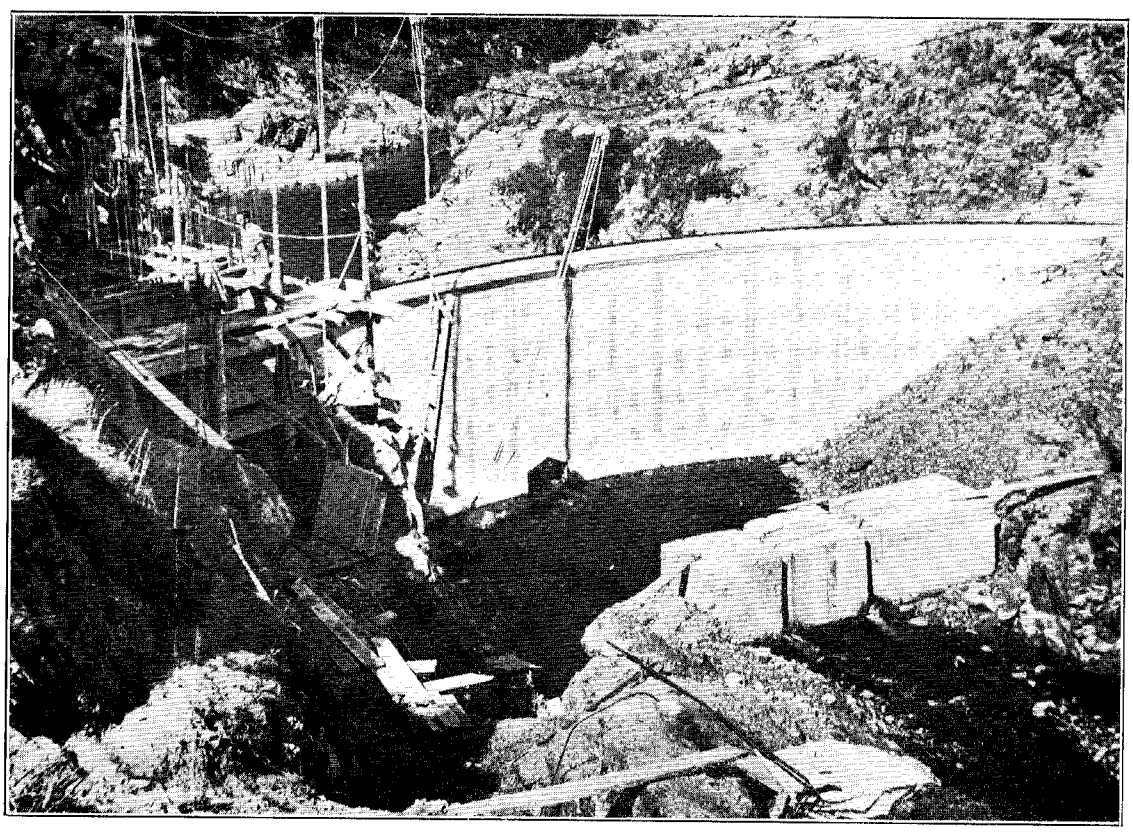
Bench being formed by Angledozer, Surrey Hills Portion.

RANGITATA DIVERSION RACE.



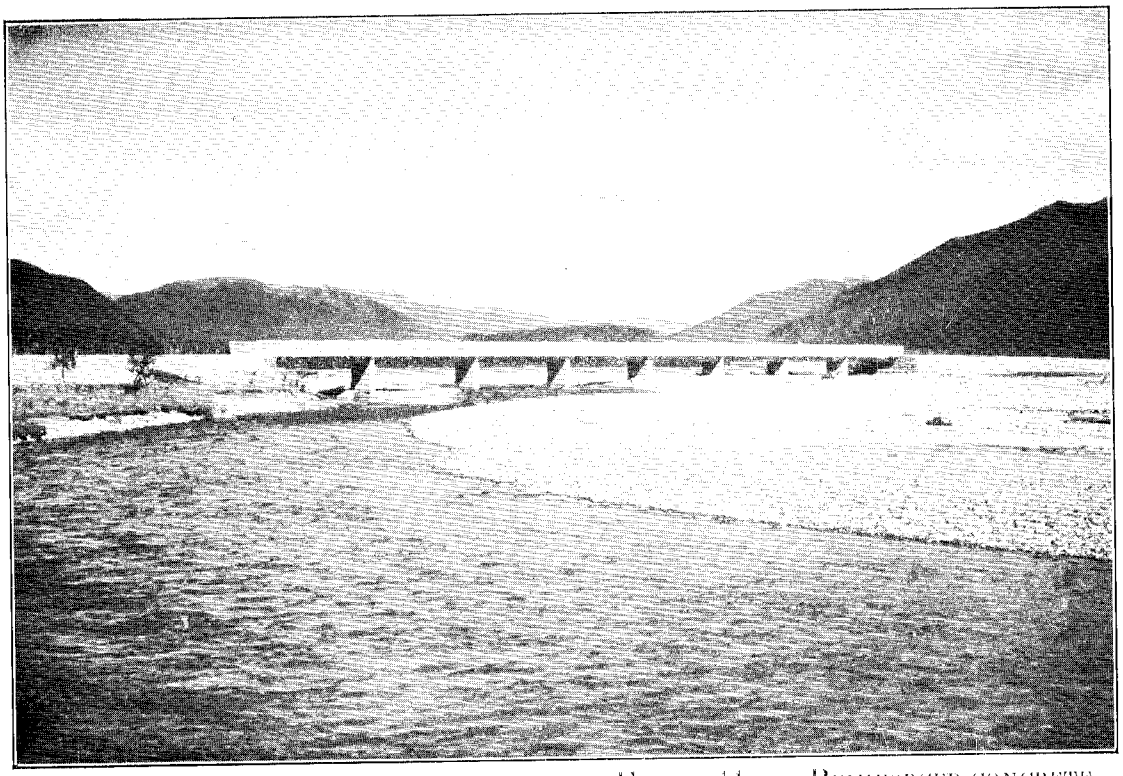
Parshall Measuring Flume on Diversion Race; Discharge, 80 Cusecs.

LEVELS PLAIN IRRIGATION SCHEME.



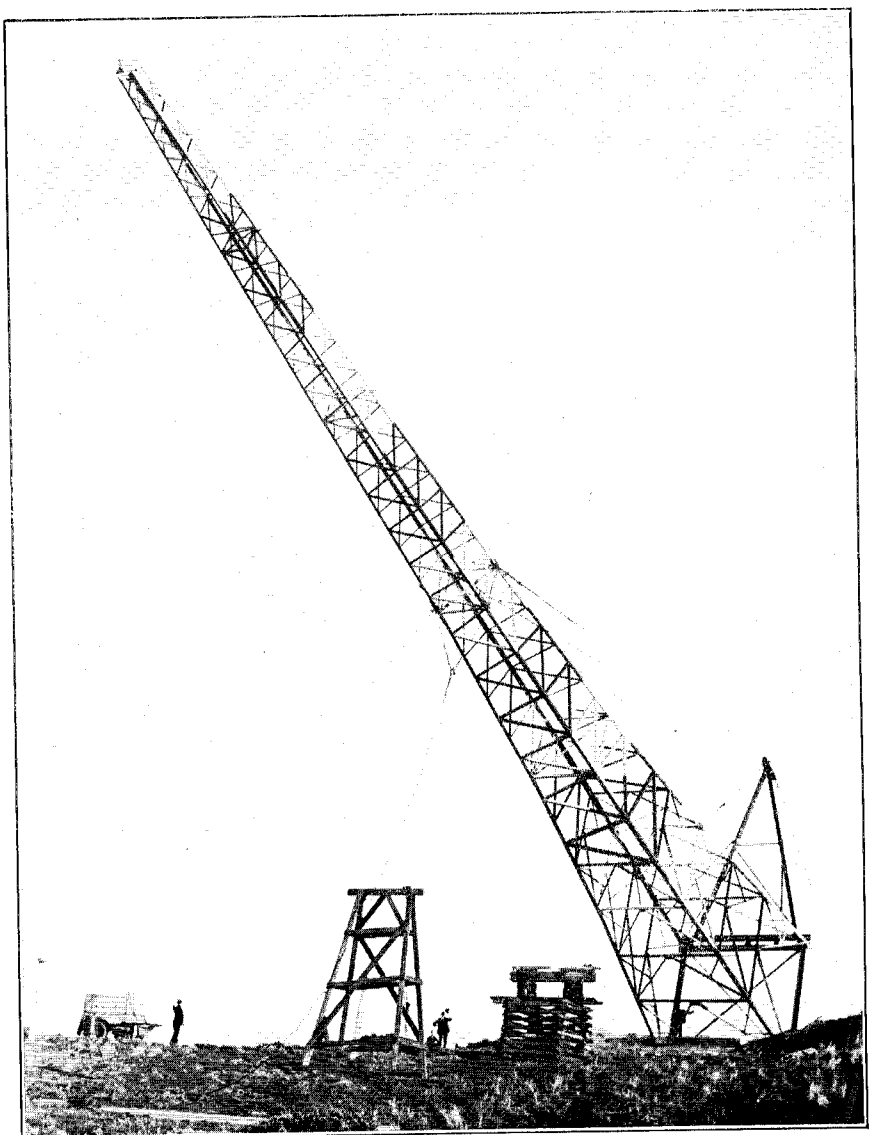
Downs Water-supply Scheme, Timaru. Arch Dam and Intake Works at Tengawai Gorge.

CANTERBURY IRRIGATION SCHEME.



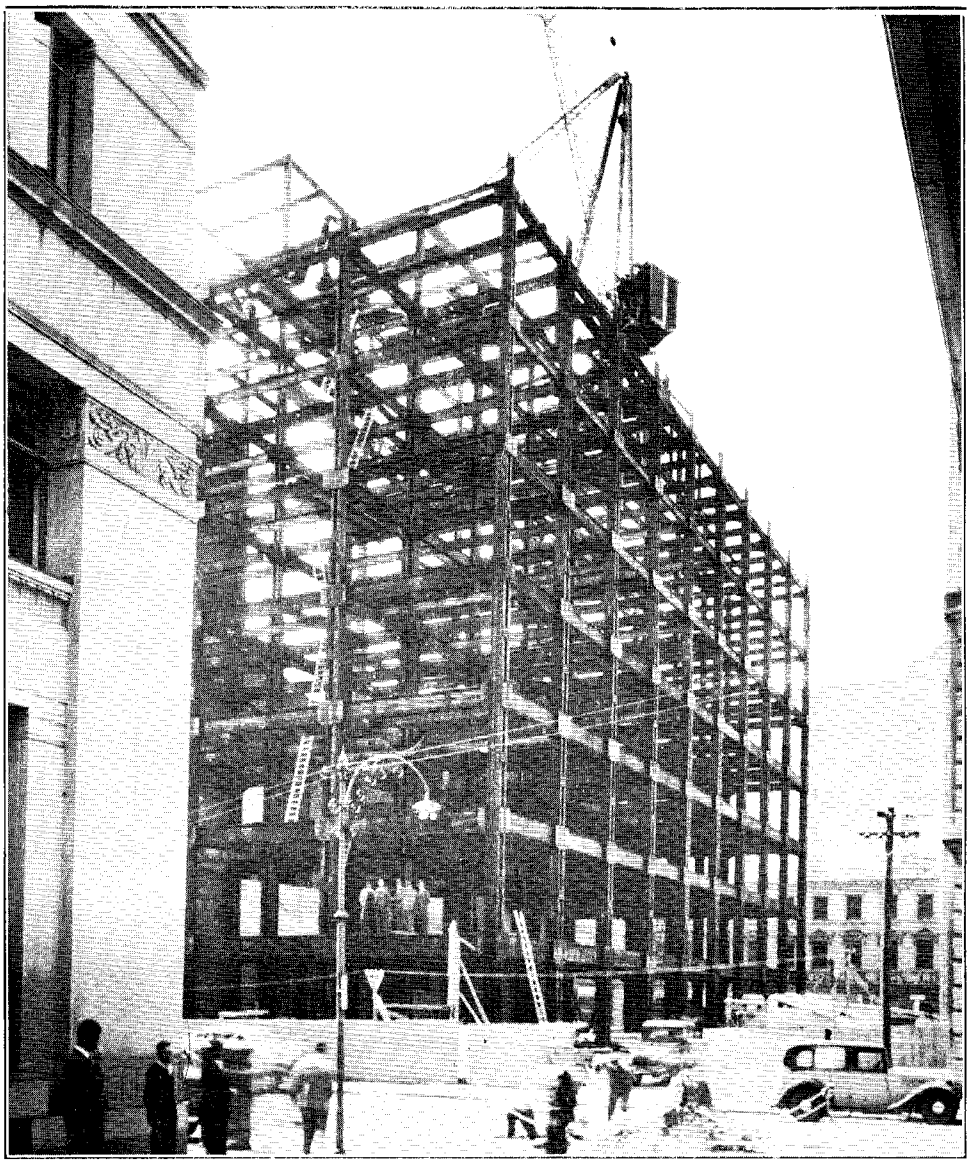
Maruia River Bridge at Williscroft. Eight 44 ft. Reinforced-concrete Girder Spans, 10 ft. Roadway.

SPRINGLANDS JUNCTION TO MATAKITAKI ROAD.

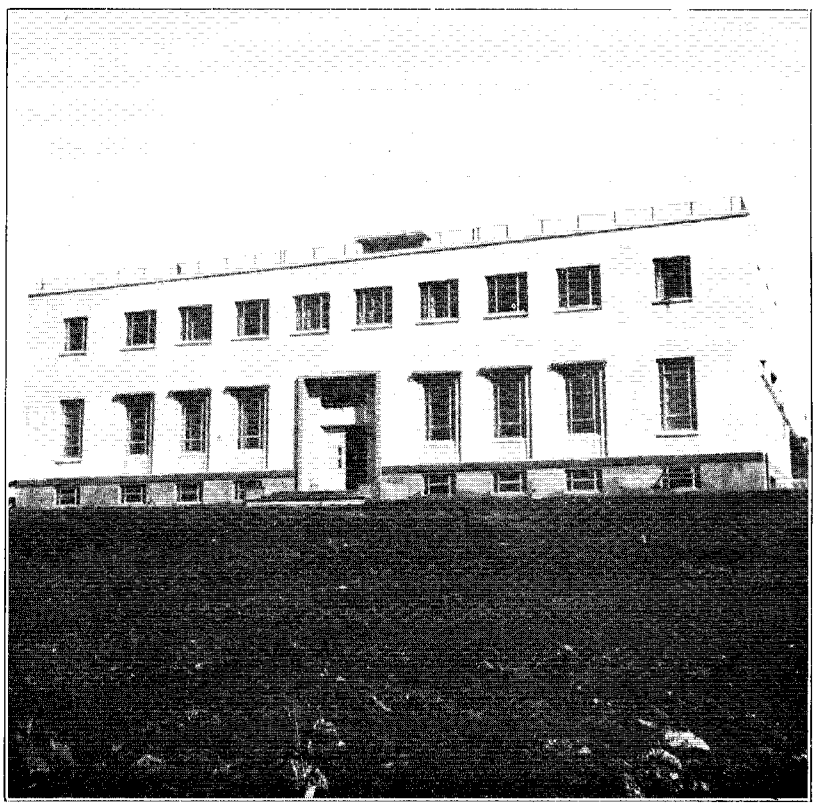


View showing Erection of the First of Six Radio Towers, ZLW Station, Mount Etako, Wellington.

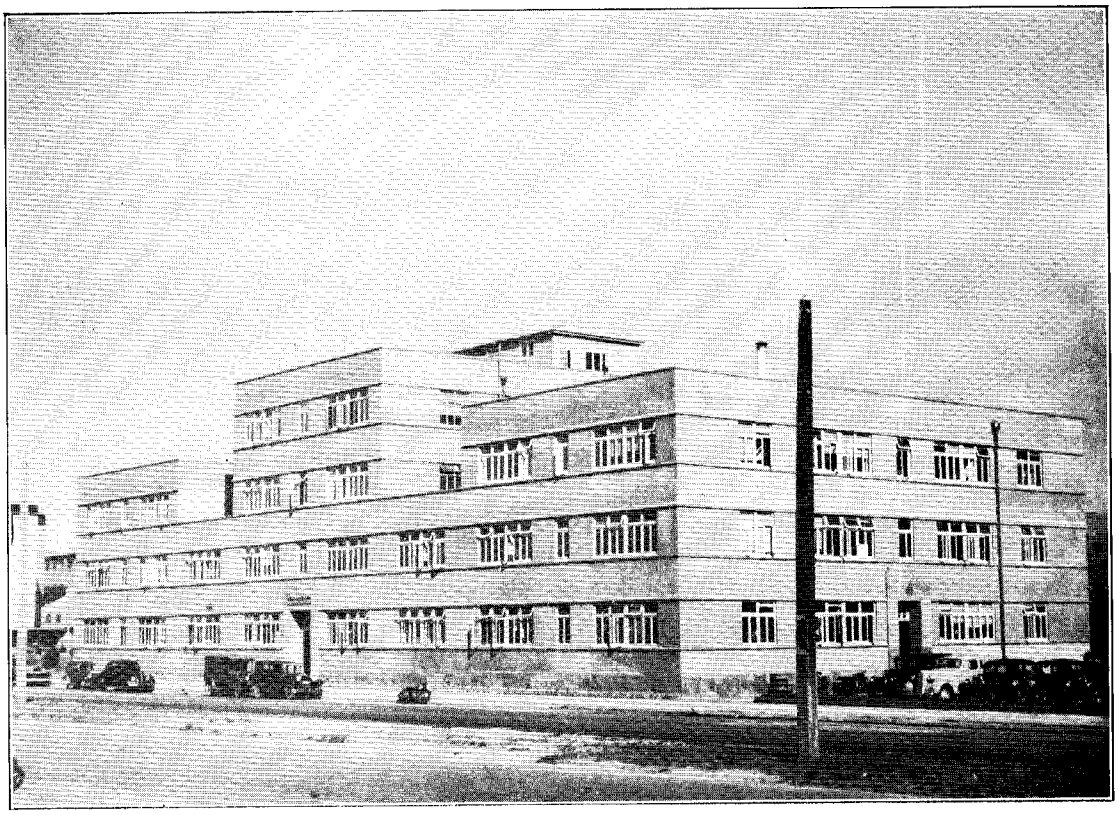
POST AND TELEGRAPH DEPARTMENT.



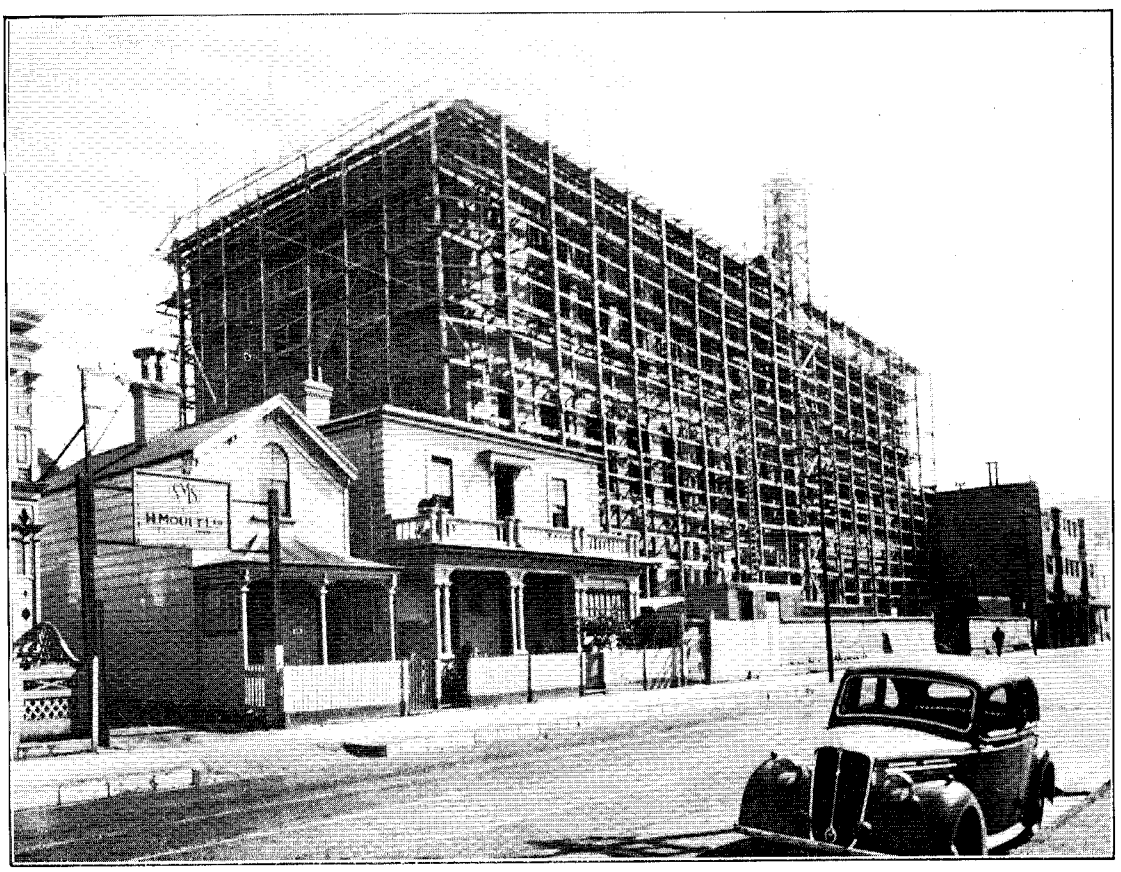
New Government Buildings, Jean Batten Place, Auckland.



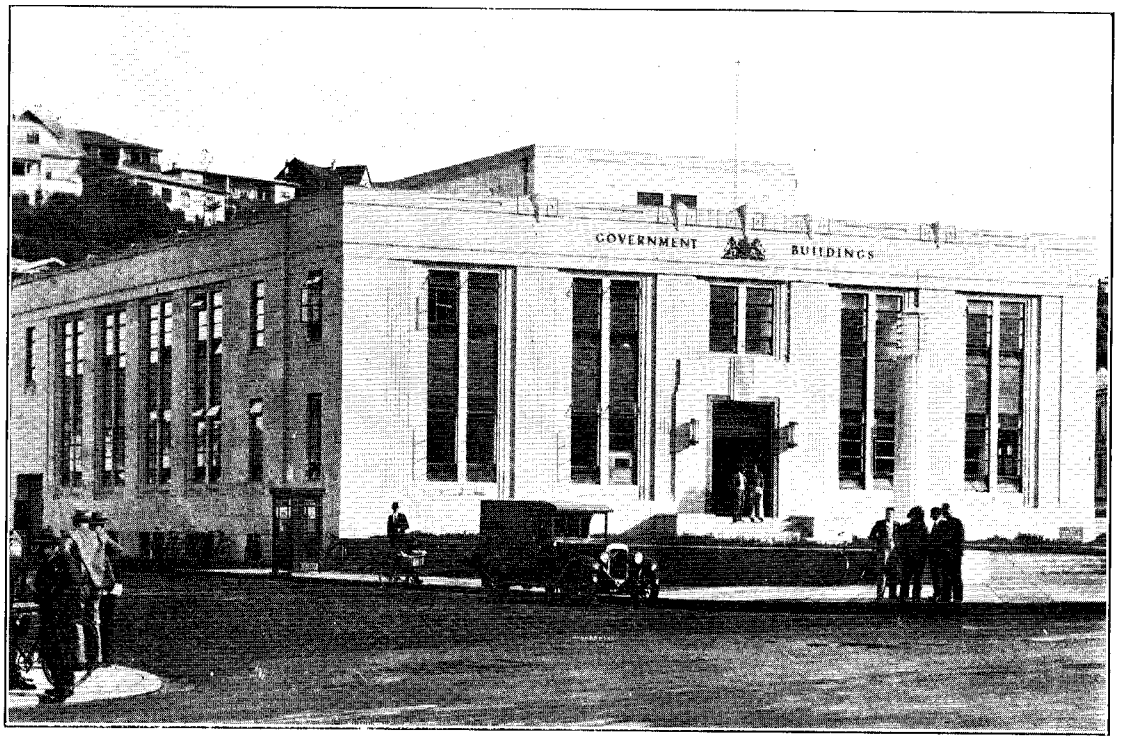
Plant Research Building, Mount Albert, Auckland.



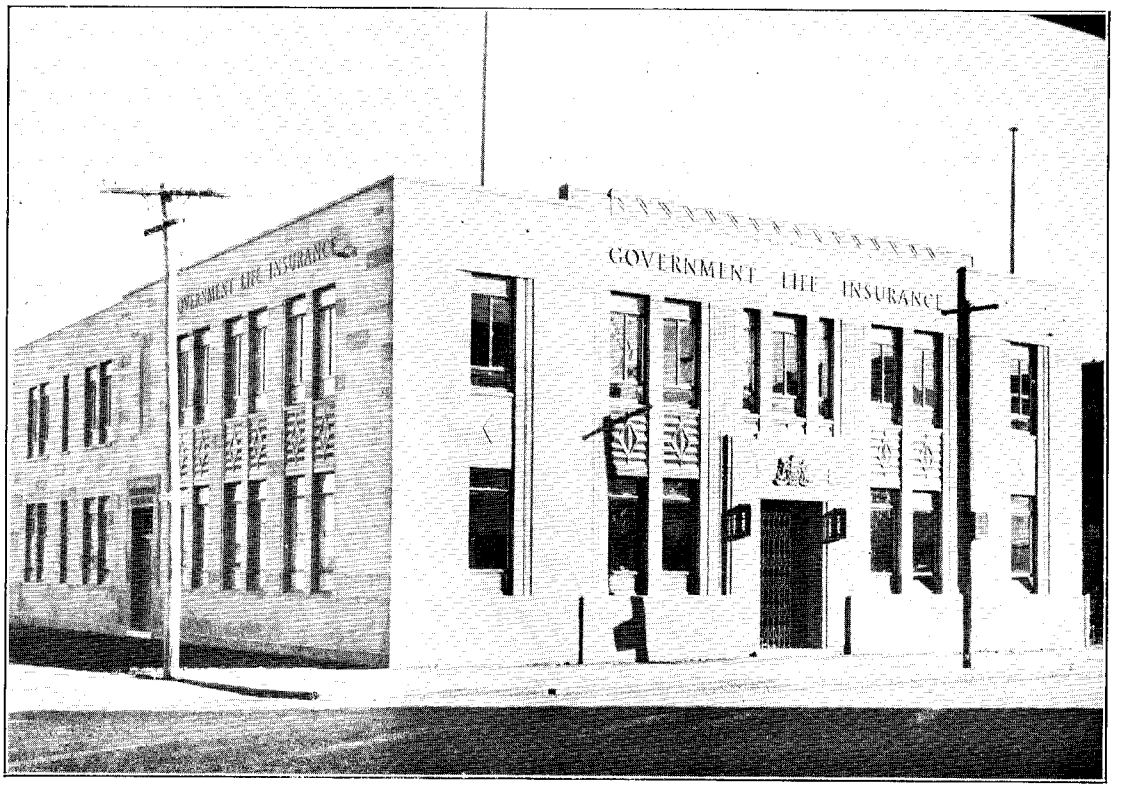
Social Security Building, Wellington.



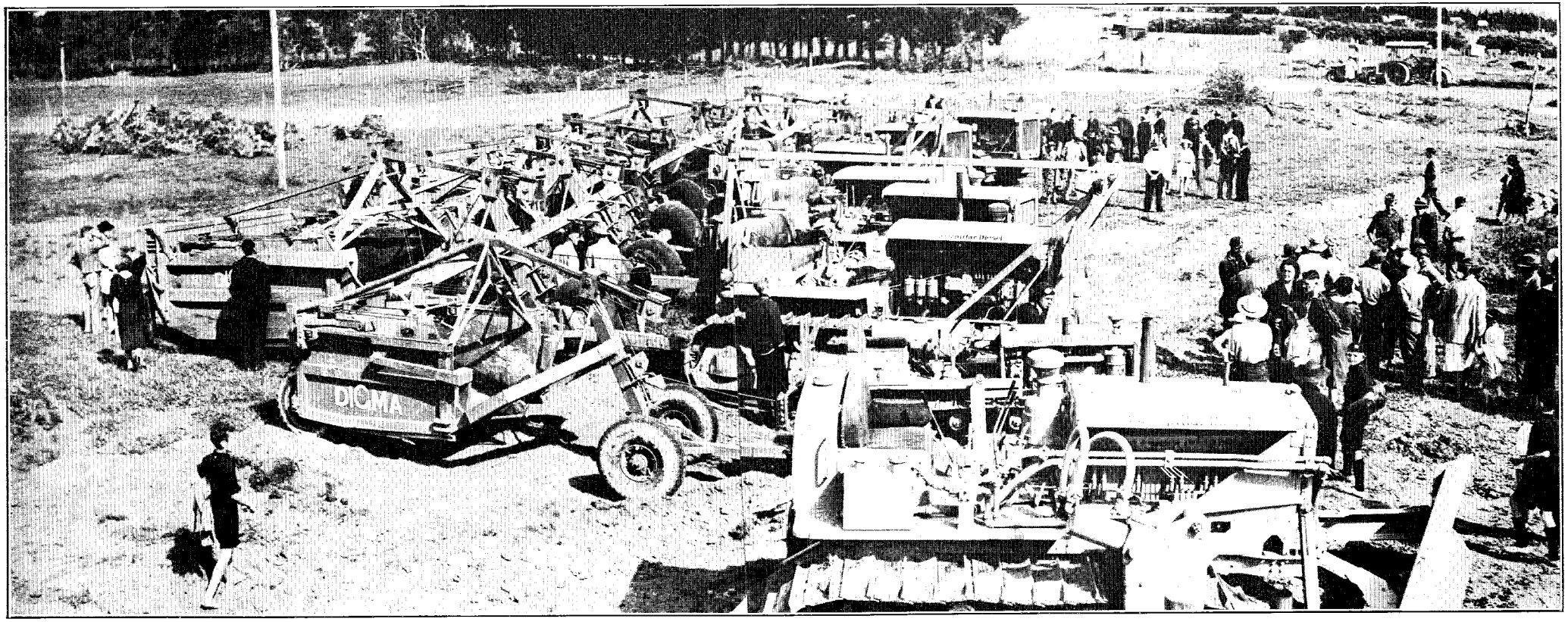
Dental Clinic, Willis Street, Wellington.



New Government Buildings, Napier.

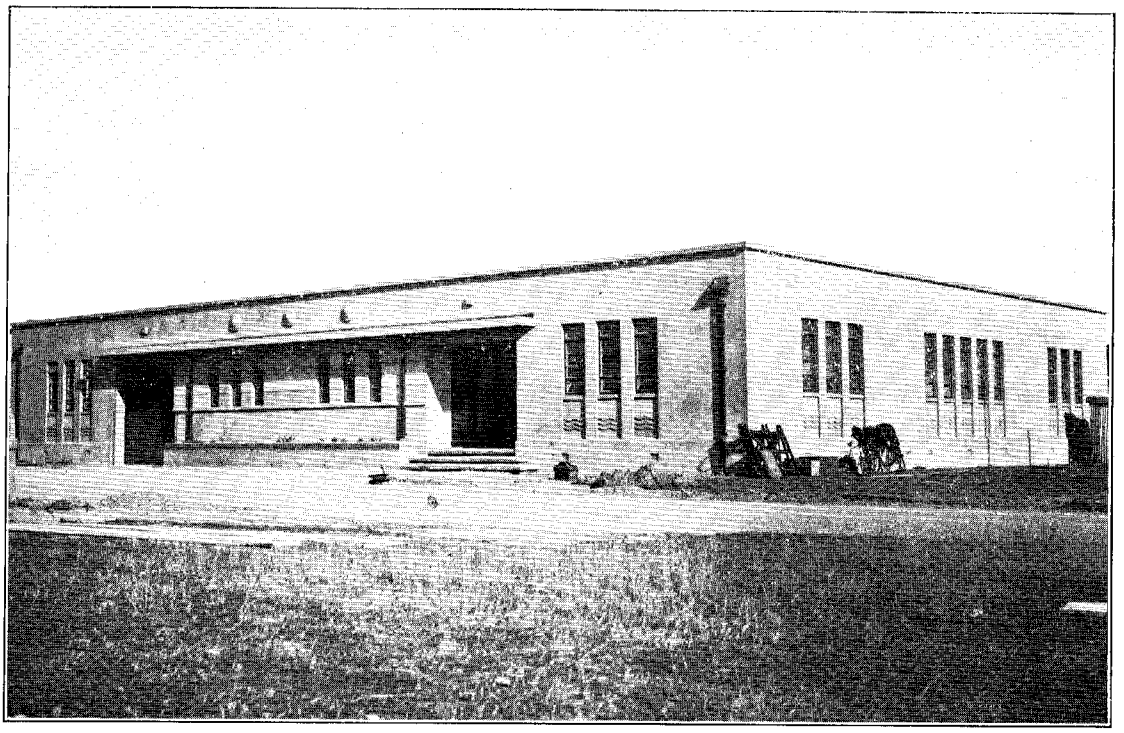


Government Life Insurance Building, Nelson.

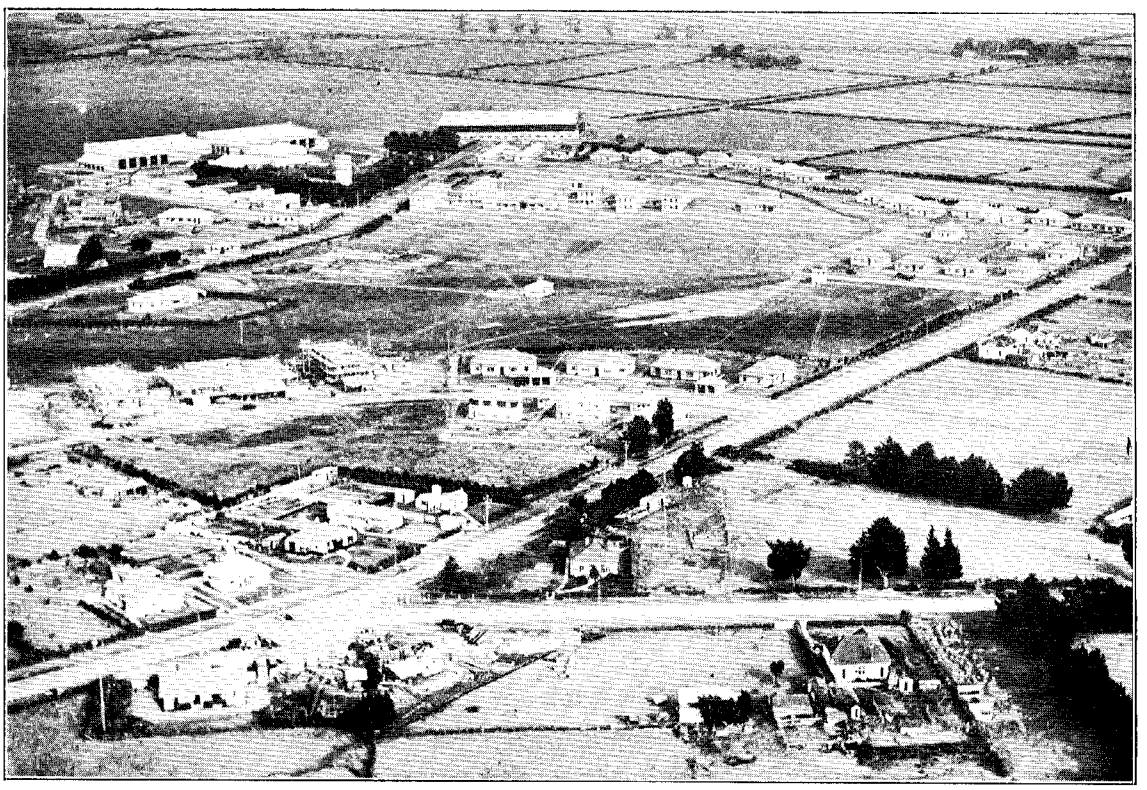


PLANT ASSEMBLED FOR WORK ON LEVELLING FLYING-FIELD.

R.N.Z.A.F. STATION, WHENUAPAI, AUCKLAND.

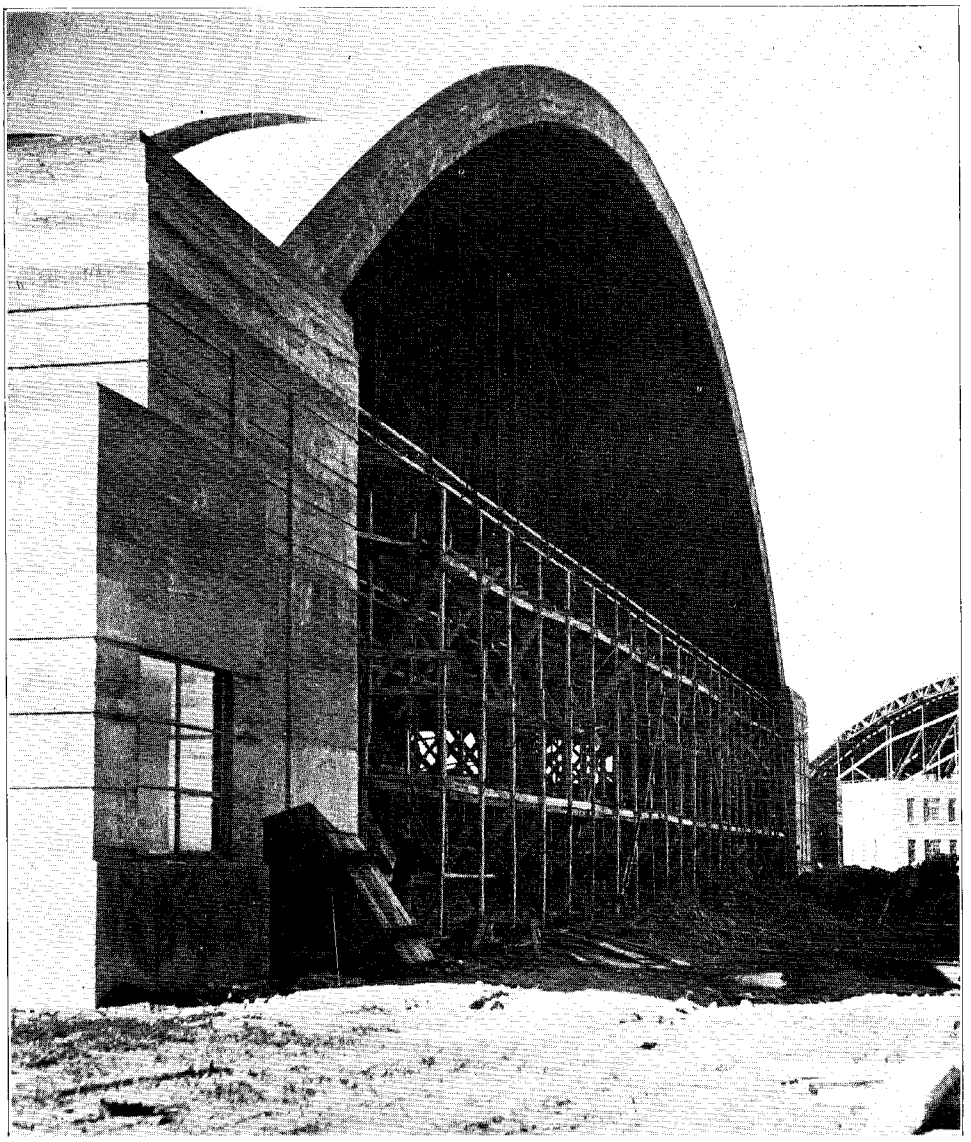


Main Store No. 1.

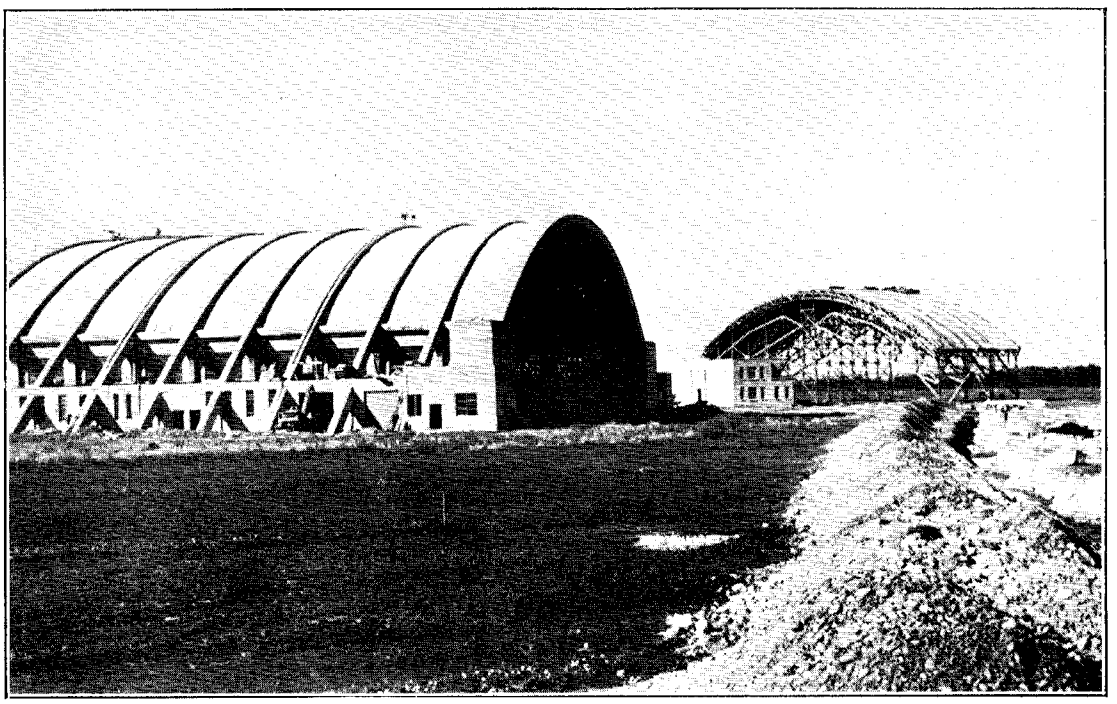


Aerial View of Part of Wigram Aerodrome showing Housing Accommodation Area.

R.N.Z.A.F. FLYING TRAINING SCHOOL, WIGRAM.

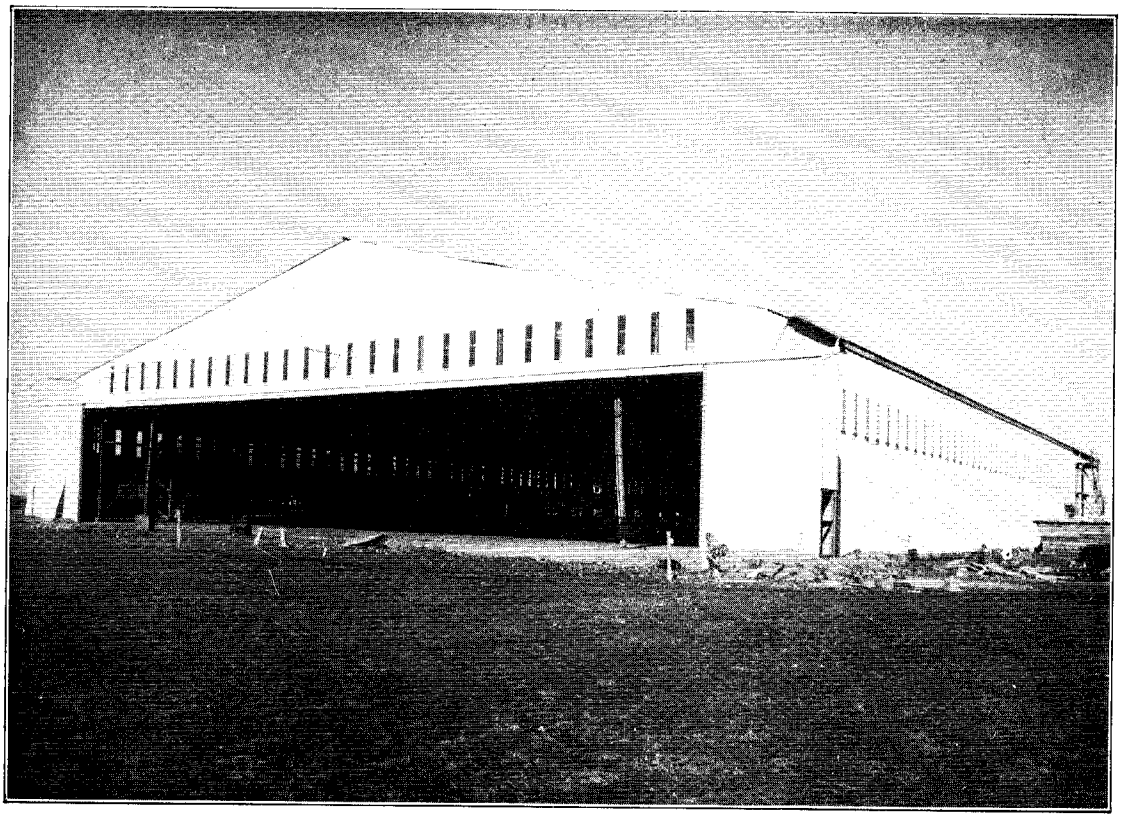


No. 1 Main Concrete Hangar. Front under Construction.

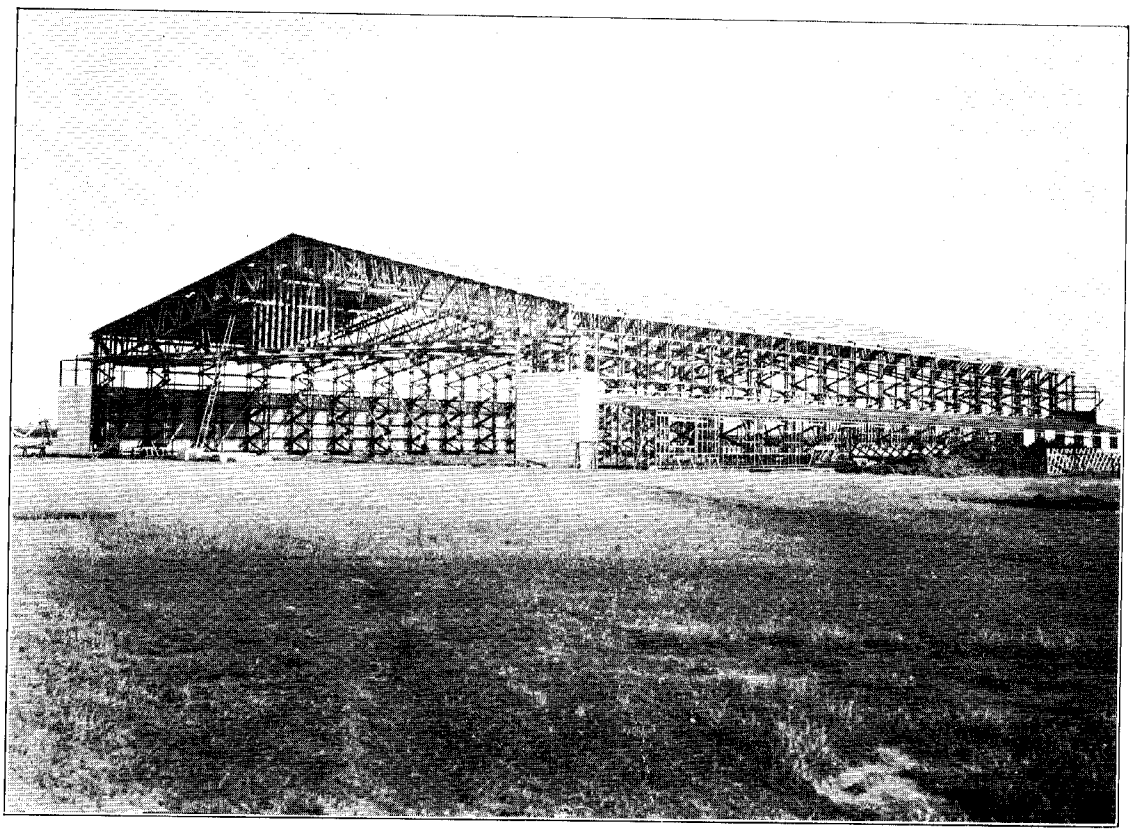


No. 1 Main Hangar. Administration Building in Background; Falsework being moved to Position in No. 2 Hangar.

R.N.Z.A.F. STATION, OHAKEA.

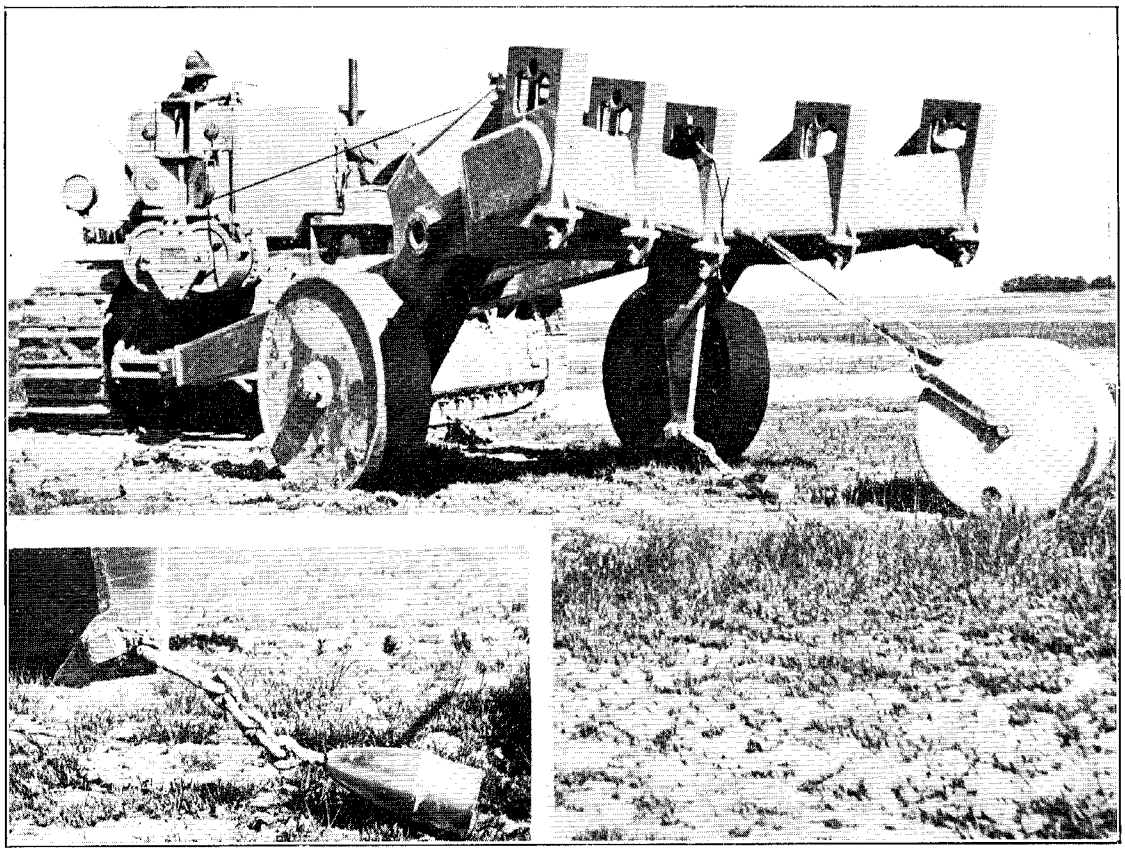


Completed Hangar, R.N.Z.A.F. Station, Hobsonville.



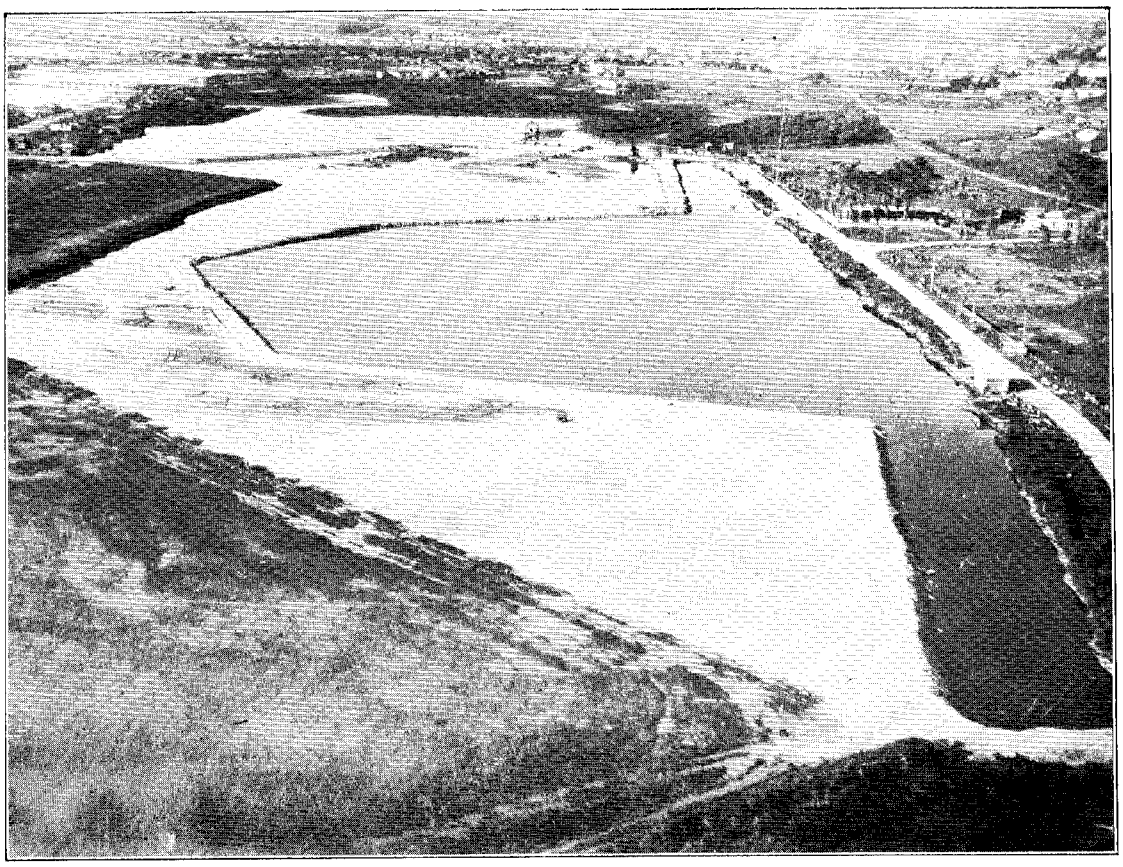
Hangar under Construction, R.N.Z.A.F., F.T.S., Wigram.

TEMPORARY TIMBER HANGARS.



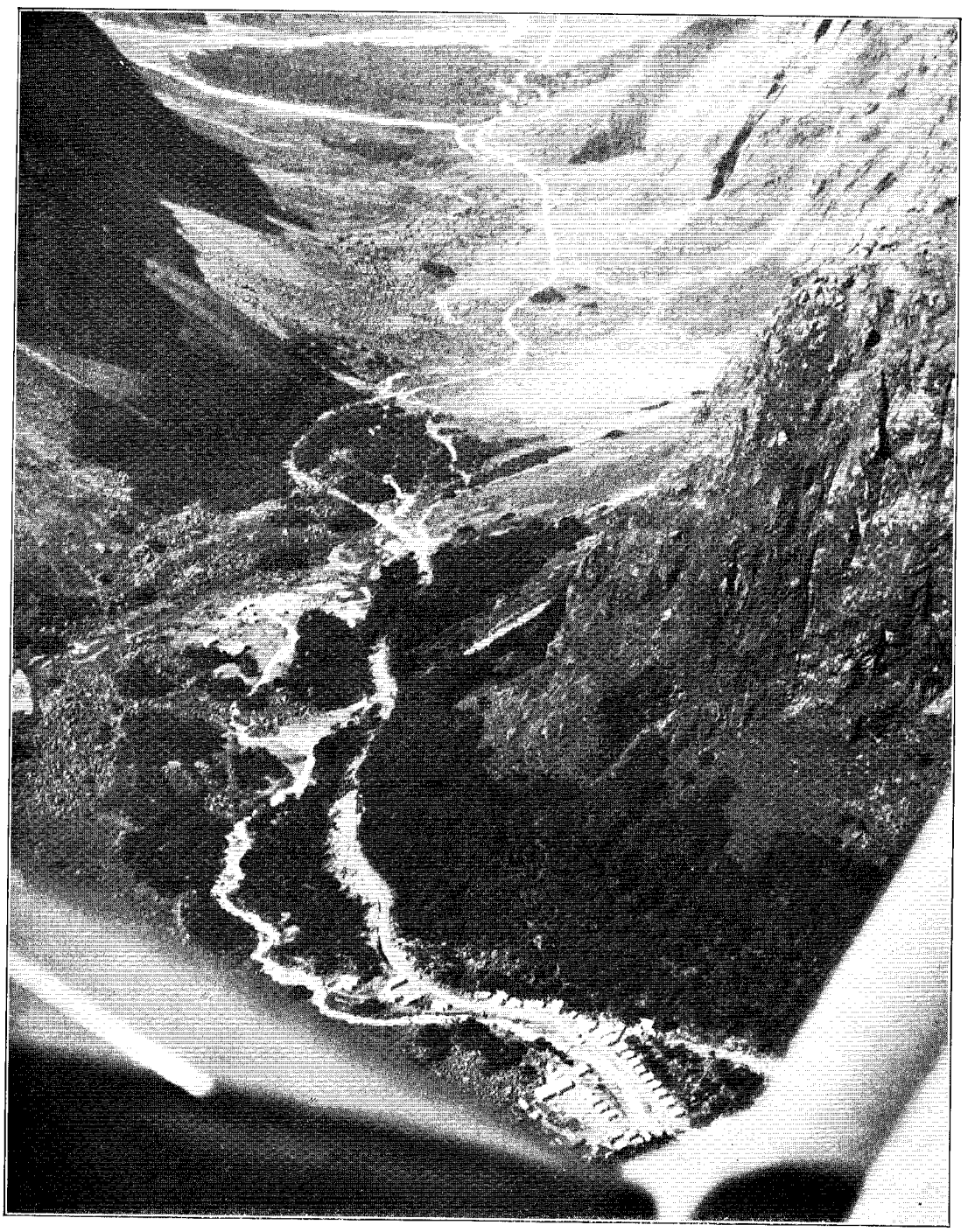
MECHANICAL ROOTER ADAPTED FOR CONSTRUCTION OF MOLE DRAINS. (INSET: DETAIL OF MOLE AND MOUNTING.)

TIMARU AERODROME.



EXTENSIONS UNDER CONSTRUCTION.

GREYMOUTH AERODROME.



Aerial Photo looking down Hollyford Valley.

HOLLYFORD–OKURU ROAD.

TABLE No. 1.

SUMMARY SHOWING THE TOTAL EXPENDITURE ON PUBLIC WORKS AND OTHER SERVICES OUT OF PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT) TO 31ST MARCH, 1939, AND THE LIABILITIES ON THAT DATE.

Number of Table containing Details.	Works.	Total Net Expenditure to 31st March, 1938.	Expenditure during Twelve Months ended 31st March, 1939.	Recoveries on Account of Services of Previous Years.	Total Net Expenditure to 31st March, 1939.	Liabilities on 31st March, 1939.	Total Net Expenditure and Liabilities.	Works.
		£	£	£	£	£	£	
3	Railways*	60,013,256	3,798,083	..	63,811,339	84,866	63,896,205	Railways.*
..	Roads†	25,026,359	1,290,838	68	26,317,129	114,740	26,431,869	Roads.†
4	Public buildings‡	13,978,530	2,180,518	13,331	16,145,717	193,910	16,339,627	Public buildings.‡
..	Telegraphs	12,300,690	575,944	..	12,876,634	15,786	12,892,420	Telegraphs.
..	Departmental	3,380,541	216,091	177	3,596,455	8,199	3,604,654	Departmental.
..	Charges and expenses of raising loans	3,828,307	..	..	3,828,307	..	3,828,307	Charges and expenses of raising loans.
..	Lighthouses, harbour-works, and harbour defences	1,334,822	33,850	200	1,368,472	1,262	1,369,734	Lighthouses, harbour-works, and harbour defences.
..	Irrigation and water-supply§ ..	1,385,900	164,481	32	1,550,349	26,276	1,576,625	Irrigation and water-supply.§
..	Lands improvement‖	1,162,905	134,977	4,415	1,293,467	16,405	1,309,872	Lands improvement.‖
..	Tourist and health resorts	757,084	24,552	..	781,636	2,693	784,329	Tourist and health resorts.
..	Settlement of unemployed workers ¶ ..	1,067,167	344,684	..	1,411,851	9,781	1,421,632	Settlement of unemployed workers.¶
..	Swamp land drainage	100,283	5,324	2,598	103,009	80	103,089	Swamp land drainage.
..	Native land settlement	696,717	493,695	3,387	1,187,025	54,076	1,241,101	Native land settlement.
		125,032,561	9,263,037	24,208	134,271,390	528,074	134,799,464	
	Closed accounts :—							Closed accounts :—
..	Immigration	3,312,769	..	108	3,312,661	..	3,312,661	Immigration.
..	Purchase of Native lands	2,054,024	..	..	2,054,024	..	2,054,024	Purchase of Native lands.
..	Defence	1,401,040	..	11,552	1,389,488	..	1,389,488	Defence.
..	Development of mining	830,855	..	..	830,855	..	830,855	Development of mining.
11 of 1877	Aiding works on Thames goldfields	48,859	..	..	48,859	..	48,859	Aiding works on Thames goldfields.
..	Plant, material, and services ..	139,344	..	688	138,656	..	138,656	Plant, material, and services.
..	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.
..	Motor transport services	33,635	..	..	33,635	..	33,635	Motor transport services.
..	Thermal springs	14,600	..	..	14,600	..	14,600	Thermal springs.
10 of 1878	Coal-exploration and mine-development	10,835	..	..	10,835	..	10,835	Coal-exploration and mine-development.
		8,133,133	..	12,348	8,120,785	..	8,120,785	
..	Transfer to Main Highways Account, Construction Fund	1,226,000	..	..	1,226,000	..	1,226,000	Transfer to Main Highways Account, Construction Fund.
	Totals	134,391,694	9,263,037	36,556	143,618,175	528,074	144,146,249	Totals.

* Does not include expenditure on Hutt Railway and Road Improvement, Wellington-Manawatu Purchase, and Railways Improvement Accounts. Includes £150,000 paid to Midland Railway bondholders. † Includes £4,500 expended under section 16 (1), Native Land Amendment and Native Land Claims Adjustment Act, 1923. ‡ Includes £12,500 expended under Finance Act, 1929, section 32. Includes £154,488 expended under Reserves and other Lands Disposal Act, 1936, section 32. § 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. ‖ £6,727 previously expended on irrigation under this item now transferred to Irrigation and Water-supply; does not include £300,930 expended and included under Roads Class. Includes £46,125 advanced on account of Dairy Industry Loans. ¶ Includes £4,865 expended under Finance Act, 1932 (No. 2), section 6.

TABLE No. 2.

GENERAL SUMMARY.

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1917–18 to 1938–39.

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, 1917.	Expenditure.										
		1917–18.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	2,338,275	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
Public Works, Departmental	1,194,655	127,962 *Cr. 2,662*	115,419 *Cr. 4,119*	121,677	143,280 *Cr. 6,280*	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*
Irrigation and Water-supply	160,582	11,650 *Cr. 18,451*	22,919	34,115	55,345 *Cr. 9,854*	83,313	58,131	95,467	127,995	56,227 *Cr. 31*	56,937	49,735 *Cr. 2,798*
Railways	33,716,001	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*
Payment to Midland Railway Bondholders	150,000	..	..	..	..	..	..	..	..	..	..	..
Roads:—												
Miscellaneous Roads and Bridges	9,875,300	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..	1,068,847	6,912	4,186	12,465	11,050	11,264	4,850	2,867	2,755	3,934	2,230	2,330 *Cr. 467*
Development of Thermal Springs and Natural Scenery ..	16,023	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account*	300,930	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	11,261,100	135,042	225,076	387,959	538,823	563,962	647,762	754,049	606,492	563,818	577,147	704,798
Development of Mining	896,014	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*
Purchase of Native Lands	1,569,983	*Cr. 57*	..	*Cr. 57*	*Cr. 59*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*
Native Lands Purchase Account	491,980	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	2,061,963	*Cr. 57*	..	*Cr. 57*	*Cr. 59*	*Cr. 52*	..	..	..	..	*Cr. 535*	*Cr. 56*
Telegraph Extension	3,411,031	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

* Excludes expenditure subsequent to 1900 included under separate class "Lands Improvement."

[*Continued on page 3.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1917–18 to 1938–39—*continued.*

Description of Services.	Expenditure. 1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.	1935–36.	1936–37	1937–38.	1938–39.	Total Net Expenditure to 31st March, 1939.
	£	£	£	£	£	£	£	£	£	£	£	£
Immigration	50,266 *Cr. 283*	41,756	33,544	5,265 *Cr. 210*	.. *Cr. 583*	.. *Cr. 532*	.. *Cr. 370*	.. *Cr. 362*	.. *Cr. 146*	.. *Cr. 144*	.. *Cr. 108*	3,312,661
Public Works, Departmental	142,252 *Cr.88,499*	132,783 *Cr.51,671*	131,816 *Cr.16,381*	151,377 *Cr.33,947*	104,904 *Cr.52,639*	98,703 *Cr.33,872*	76,486 *Cr.31,154*	99,384 *Cr.28,178*	137,769 *Cr. 17,709*	188,040 *Cr 19,489*	216,091 *Cr. 177*	3,596,455
Irrigation and Water-supply*	55,198 *Cr. 8*	69,657	62,614	37,749	53,290 *Cr. 96*	66,838	91,241	85,414	11,062	71,659	164,481 *Cr. 32*	1,550,349
Railways	1,216,277 *Cr. 2,595*	1,812,521 *Cr. 1,296*	1,987,196 *Cr. 792*	952,388 *Cr. 20,568*	160,853 *Cr. 9,056*	132,111 *Cr. 20*	125,600	258,011 *Cr.134,696*	1,019,094 *Cr. 464*	2,412,990 *Cr. 700*	3,798,083	63,661,339
Payment to Midland Railway Bondholders	..	..	..	..	..	..	..	..	..	..	..	150,000
Roads:—												
Miscellaneous Roads and Bridges	780,990 *Cr. 330*	1,005,330 *Cr. 415*	1,379,810 *Cr. 472*	1,078,270 *Cr. 564*	396,559 *Cr. 1,171*	359,671 *Cr. 445*	371,573 *Cr. 471*	444,377 *Cr. 250*	913,720 *Cr. 172*	1,126,757 *Cr. 253*	1,290,838 *Cr. 68*	24,625,494
Roads to give access to Outlying Districts	51,582	53,693	91,126	3,940	..	..	..	..	..	..	..	233,983
Roads on Goldfields	1,005	1,885	4,586	..	..	..	..	..	..	..	..	1,140,699
Development of Thermal Springs and Natural Scenery	..	..	..	..	..	..	..	..	..	..	..	16,023
Lands Improvement Account	..	..	..	..	..	..	..	..	..	..	..	300,930
Total, Roads	833,247	1,060,493	1,475,050	1,081,646	395,388	359,226	371,102	444,127	913,548	1,126,504	1,290,770	26,317,129
Development of Mining	.. *Cr. 260*	.. *Cr. 260*	.. *Cr. 260*	..	.. *Cr. 50*	..	..	.. *Cr. 143*	.. *Cr. 17*	.. *Cr.1,141*	..	879,714
Purchase of Native Lands	..	..	..	..	..	*Cr. 7,123*	..	..	..	..	..	1,562,044
Native Lands Purchase Account	..	..	..	..	..	..	..	..	..	..	..	491,980
Total, Land Purchases	..	..	..	..	..	*Cr. 7,123*	..	..	..	..	..	2,054,024
Settlement of Unemployed Workers	..	..	..	..	118,723	172,109	222,309	151,345	92,016	310,665	344,684	1,411,851
Telegraph Extension	624,414	594,383	419,756	249,978 *Cr. 32*	99,999	144,160	135,933	195,380	232,513	312,260	575,944	12,876,634

* Includes £6,727 previously included under Lands Improvement class.

TABLE No 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1917–18 to 1938–39—*continued.*

Description of Services.	Total Net Expenditure to 31st March, 1917.	Expenditure.										
		1917–18.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.
Public Buildings:—	£	£	£	£	£	£	£	£	£	£	£	£
General (including Miscellaneous)	383,681	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	447,097	37,233	..	..	..	..	..	..	..	..	..	..
Judicial { Courthouses	924,403	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	23,113	26,484 *Cr. 2,568*	25,279 *Cr. 86*	24,197	22,812 *Cr. 908*	22,358 *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*
Post and Telegraph	1,242,750	33,525	26,072	66,543	93,364 *Cr. 560*	112,906 *Cr. 675*	77,211 *Cr. 69*	108,395	65,917 *Cr. 210*	89,865 *Cr. 453*	86,052 *Cr. 1,114*	77,194 *Cr. 834*
Customs	49,441	..	..	..	..	..	..	..	..	..	..	..
Quarantine Stations	6,255	..	..	35,490	15,529	4,581	154	171	284	..	..	..
Mental Hospitals	832,107	26,502	14,640	18,277	27,368	41,838	13,852	26,541	68,438	77,835 *Cr. 283*	68,635	51,119 *Cr. 3,600*
Public Health	32,754	..	..	..	..	..	..	..	..	..	..	..
Health and Hospital Institutions	148,879	4,080	2,332	8,484	4,099	26,131	20,981 *Cr. 1,399*	7,420	27,951	31,177 *Cr. 300*	15,840	14,361 *Cr. 310*
School Buildings	2,488,585	63,082	115,656	195,500	244,722	2,469 *Cr. 9,255*	.. *Cr. 368*	.. *Cr. 1,090*	.. *Cr. 905*	.. *Cr. 1,050*	.. *Cr. 7,953*	..
Agricultural	54,282	5,685	4,229	7,227	9,345	1,115	514 *Cr. 27*	282 *Cr. 171*	3,242 *Cr. 686*	7,932 *Cr. 865*	4,164 *Cr. 310*	2,863
Workers' Dwellings	270,446	15,505	7,293	26,674	..	..	..	..	..	..	..	..
Total, Public Buildings	6,880,680	214,221	235,846	469,195	500,852	334,809	255,818	188,910	243,877	280,780	315,299	216,237
Lighthouses, Harbour-works, and Harbour-defences:—												
Lighthouses	205,369	561	1,663	253	758	16,350	3,260	4,473	2,850	5,690 *Cr. 750*	5,758	7,979
Harbour-works	388,703	2,359	3,729	3,245	4,080	2,424	6,524	6,334	423	3,717 *Cr. 131*	13,263 *Cr. 204*	15,891 *Cr. 165*
Harbour-defences	546,003	56	..	..	..	..	.. *Cr. 1,235*	.. *Cr. 16*	..	..	..	..
Total, Lighthouses, &c.	1,140,075	2,976	5,392	3,498	4,838	18,774	8,549	10,791	3,273	8,526	18,817	23,705
Rates on Native Lands	68,672	..	..	..	..	..	..	..	..	..	..	..

[*Continued on page 5.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1917-18 to 1938-39—*continued.*

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1939.
	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.	1935–36.	1936–37.	1937–38.	1938–39.	
Public Buildings :—	£	£	£	£	£	£	£	£	£	£	£	£
General (including Miscellaneous)	4,272	14,106*	85,204	33,189	2,107	594	30,713	39,447	57,668	258,978	790,452	2,120,110
	Cr. 420	*Cr. 3,156*	*Cr. 55*	*Cr. 4,231*	*Cr. 2,067*	*Cr. 1,075*	*Cr. 14,087*	*Cr. 125,964*	*Cr. 59*	*Cr. 201*	*Cr. 1,917*	
Parliamentary	35	27,142	15,723	37	..	..	..	..	27	..	78	527,372
Courthouses	8,387	15,765	19,572	3,513	970	72	533	8,701	2,655	16,403	34,873	1,674,829
	Cr. 95	*Cr. 29*	*Cr. 16,403*	*Cr. 529*	*Cr. 222*	*Cr. 255*	*Cr. 93*	*Cr. 4,278*	*Cr. 644*	*Cr. 200*	*Cr. 274*	
Judicial Prisons	12,573	18,814	2,504	2,621	2,026	1,018	1,605	2,123	4,621	9,476	7,656	
	Cr. 321	*Cr. 285*	*Cr. 134*	*Cr. 67*	*Cr. 71*				*Cr. 20*		*Cr. 2,033*	
Police-stations	6,925	8,442	8,360	2,535	1,022	74	2,754	6,710	7,149	11,086	77,745	
	Cr. 605	*Cr. 319*	*Cr. 54*	*Cr. 91*	*Cr. 80*	*Cr. 79*	*Cr. 240*	*Cr. 35*	*Cr. 172*	*Cr. 546*	*Cr. 197*	
Post and Telegraph	62,087	104,157	138,671	104,505	2,763	21,078	100,484	232,285	158,005	248,145	280,951	3,466,150
	Cr. 1,980	*Cr. 197*	*Cr. 1,391*	*Cr. 3,179*	*Cr. 4,823*	*Cr. 1,502*	*Cr. 582*	*Cr. 2,760*	*Cr. 1,436*	*Cr. 36,844*	*Cr. 8,166*	
Customs	..	..	..	..	..	..	..	..	..	..	..	49,441
Quarantine Stations	..	..	..	..	..	..	..	..	..	..	..	62,464
Mental Hospitals	96,782	152,096	134,140	45,938	28,756	73,021	98,629	67,465	142,109	125,829	128,840	2,355,797
				Cr. 860			*Cr. 40*		*Cr. 177*			
Public Health	..	..	..	..	..	..	..	..	..	..	..	32,754
Health and Hospital Institutions	19,637	16,651	17,338	3,316	301	1,248	656	2,191	12,921	15,747	88,099	487,567
				Cr. 1	*Cr. 113*	*Cr. 150*						
School Buildings	..	..	..	259,149	52,623	52,239	51,506	122,357	268,884	546,846	660,666	5,097,529
	Cr. 2,428		*Cr. 1,110*	*Cr. 40*		*Cr. 805*	*Cr. 217*	*Cr. 933*	*Cr. 2*	*Cr. 412*	*Cr. 187*	
Agricultural	2,808	2,963	1,509	..	..	48	88	85	60,902‡	2,269‡	111,158‡	271,704
	Cr. 2,395	*Cr. 1,721*	*Cr. 194*	*Cr. 1,927*	*Cr. 1,535*	*Cr. 437*	*Cr. 32*		*Cr. 115*	*Cr. 34*	*Cr. 557*	
Workers' Dwellings†	..	..	..	..	..	..	*Cr. 319,918*	..	..	..	..	..
Total, Public Buildings	205,262	354,429	403,680	443,878	81,657	145,089	*Cr. 48,241*	347,394	712,316	1,196,542	2,167,187	16,145,717
Lighthouses, Harbour-works, and Harbour-defences :—												
Lighthouses	2,637	4,460	4,103	5,046	688	1,276	4,021	3,320	630	8,260	21,638	309,793
		Cr. 500										
Harbour-works	14,425	10,736	6,742	6,987	*Cr. 5,277*	11,988	2,581	*Cr. 399*	669	3,417	12,212	513,871
									Cr. 2	*Cr. 200*	*Cr. 200*	
Harbour-defences	..	..	..	..	..	..	..	..	..	..	..	544,808
Total, Lighthouses, &c.	17,062	14,696	10,845	12,033	*Cr. 4,589*	13,264	6,602	2,921	1,297	11,477	33,650	1,368,472
Rates on Native Lands	..	..	..	..	..	..	..	..	..	..	..	68,672

* Includes £12,500 expended under Finance Act, 1929, section 32.

† Transferred to State Advances Account.

‡ Includes £154,488 expended under Reserves and other Lands Disposal Act, 1936, section 32 (Flock House purchase).

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1917-18 to 1938-39—*continued.*

Description of Services.	Total Net Expenditure to 31st March, 1917.	Expenditure.										
		1917-18.	1918-19.	1919-20.	1920-21.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.
	£	£	£	£	£	£	£	£	£	£	£	£
Contingent Defence	1,036,977	6,714	8,809 *Cr. 922*	10,187	8,701	15,586	1,702 *Cr. 463*	4,931 *Cr. 280*	27,133 *Cr. 580*	89,670 *Cr. 33*	34,014 *Cr. 751*	39,986 *Cr. 465*
Tourist and Health Resorts	258,509	931	1,620	6,194	19,041	17,996 *Cr. 110*	5,435	27,264	12,343 *Cr. 81*	43,486	31,981	36,673 *Cr. 516*
Lands Improvement*	131,043	1,838	*Cr. 4,268*	2,964	2,064	17,478	26,204	18,182	34,172	70,493 *Cr. 19*	56,267 *Cr. 135*	72,898 *Cr. 2,574*
Charges and Expenses of raising Loans	1,253,075	1	..	..	184	174,280	62,399	311,905	241,930	297,180	155,373	100,297
Interest and Sinking Funds	218,500	..	..	..	..	..	..	..	..	..	..	..
Coal-exploration and Mine-development	10,835	..	..	..	..	..	..	..	..	..	..	..
Thermal Springs	14,600	..	..	..	..	..	..	..	..	..	..	..
Plant, Material, and Services	84,195	6,811	20,638 *Cr. 31*	47,682	169,910	122,801	*Cr. 4,983*	*Cr. 49,159* *Cr. 16*	*Cr. 30,956* *Cr. 1*	36,930 *Cr. 855*	*Cr. 9,334* *Cr. 1,992*	*Cr. 17,610* *Cr. 8,985*
Motor Transport Service	..	..	..	..	..	..	22,679	962	5,000	4,994	..	..
Transfer to Main Highways Account :—												
Construction Fund	..	..	..	..	..	..	..	..	226,000	..	400,000	200,000
Total Ways and Means Credits	..	*43,492*	*11,993*	*112,864*	*19,628*	*11,616*	*20,127*	*9,142*	*40,793*	*27,474*	*146,933*	*40,026*
Grand Total—Net Expenditure	66,286,782	1,193,930	1,195,489	1,907,850	3,121,132	5,449,351	3,892,320	4,056,423	4,558,570	4,588,111	3,841,126	3,360,638

* Expenditure prior to 1901 (totalling £300,930) included under separate class "Roads."

[*Continued on page 7.*

TABLE No. 2—*continued.*

GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1917-18 to 1938-39—*continued.*

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1939.
	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38	1938-39.	
	£	£	£	£	£	£	£	£	£	£	£	£
Contingent Defence	67,652 *Cr. 648*	46,766 *Cr. 1,325*	13,812 *Cr. 586*	.. *Cr. 4,039*	.. *Cr. 624*	.. *Cr. 76*	..	.. *Cr. 704*	.. *Cr. 64*	.. *Cr. 40*	.. *Cr. 11,552*	.. 1,389,488
Tourist and Health Resorts	39,254 *Cr. 440*	20,547 *Cr. 1,213*	60,288 *Cr. 2,494*	87,609 *Cr. 85*	14,454 *Cr. 877*	13,510 *Cr. 21*	12,880 *Cr. 705*	13,683 *Cr. 20*	16,789	23,159	24,552	781,636
Lands Improvement*	85,861 *Cr. 87*	79,454 *Cr. 112*	70,534 *Cr. 1,041*	38,899 *Cr. 506*	38,906 *Cr. 248*	71,825 *Cr. 329*	82,092 *Cr. 722*	37,909 *Cr. 1,006*	62,673 *Cr. 10,366*	147,436 *Cr. 10,699*	134,677 *Cr. 4,415*	1,247,342 ..
Swamp Land Drainage	..	..	..	..	14,807	13,959 *Cr. 297*	15,019 *Cr. 231*	12,922 *Cr. 263*	24,965	19,402	5,324 *Cr. 2,598*	103,009 ..
Dairy Industry Loans..	..	..	..	..	..	..	..	10,750	30,510	4,565	300	46,125
Charges and Expenses of raising Loans	438,238 *Cr. 3,811*	518,158	164,535	98,098	15,851	14	600	..	..	..	..	3,828,307
Interest and Sinking Funds	..	..	..	..	..	..	..	..	..	..	..	218,500
Coal-exploration and Mine-development	..	..	..	..	..	..	..	..	..	..	..	10,835
Thermal Springs	..	..	..	..	..	..	..	..	..	..	..	14,600
Plant, Material, and Services	*Cr. 6,551* *Cr. 1,224*	*Cr. 35,092* *Cr. 360*	*Cr. 42,824* *Cr. 216*	*Cr. 103,571* *Cr. 1,338*	*Cr. 45,463* *Cr. 161*	1,421 *Cr. 22*	*Cr. 10,513* *Cr. 165*	22,438 *Cr. 418*	‡ *Cr. 1,642*	.. ..	*Cr. 688* ..	138,656 ..
Native Land Settlement	..	..	..	..	..	179,485 *Cr. 52*	125,790 *Cr. 9,662*	71,901 *Cr. 9,491*	112,318 *Cr. 3,423*	254,869 *Cr. 25,018*	493,695 *Cr. 3,387*	1,187,025 ..
Motor Transport Service	..	..	..	..	..	..	..	..	..	..	..	33,635
Transfer to Main Highways Account :— Construction Fund	200,000	200,000	..	..	..	..	..	..	..	..	..	1,226,000
Total Ways and Means Credits	*106,429*	*62,859*	*41,583*	*72,214*	*74,416*	*47,092*	*378,689*	*309,501*	*36,630*	*95,921*	*36,556*	..
Grand Total—Net Expenditure	3,870,577	4,854,314†	4,769,076	2,994,624	984,446	1,369,370	1,163,891	1,578,298	3,333,039	6,022,337	9,226,481	143,618,175

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

TABLE No. 3.

Expenditure on Railways to 31st March, 1939.

Lines of Railway.	Mileage opened for Traffic.	Total Expenditure by General Government to 31st March, 1938.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1938–39: New Works.		Total Expenditure by General Government to 31st March, 1939.	Valuation of Works constructed by Provinces and Midland Railway Company.
				Construction and Surveys.	Railways Improvement and Works on Open Lines.		
	M. ch.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Kaihu Valley	24 32	179,143 14 9	..	..	..	179,143 14 9	..
Opua Wharf to Whangarei and Onerahi	58 06	609,244 10 4	..	..	12,798 13 5	622,043 3 9	..
Otiria to Ngapuhi	13 45	127,448 8 0	..	..	..	127,448 8 0	..
Whangarei Branch (Kioreroa to Waiotira)	19 79	420,882 1 0	..	..	205 18 9	421,087 19 9	..
North Auckland Main Trunk—							
Ngapuhi Northwards	11 00	879,773 19 0	..	*Cr.* 3,334 3 6	..	876,439 15 6	..
Helensville Northwards	83 39	2,993,682 3 3	..	..	4,376 16 9	2,998,059 0 0	..
North Auckland Main Trunk to Dargaville	..	463,377 8 6	..	42,119 19 0	..	505,497 7 6	..
Helensville to Te Awamutu	148 67	5,940,589 2 9	..	..	193,924 12 1	6,134,513 14 10	..
Waiuku Branch (Paerata to Waiuku)	12 69	208,912 9 6	..	..	..	208,912 9 6	..
Huntly to Awaroa	8 75	184,379 5 0	..	..	..	184,379 5 0	..
Waikokowai Branch	..	3,442 0 0	..	..	..	3,442 0 0	..
Frankton to Thames	62 58	506,461 15 9	..	..	14,435 16 9	520,897 12 6	..
Cambridge Branch (Ruakura Junction to Cambridge)	12 02	61,832 17 3	..	..	817 15 10	62,650 13 1	..
Morrinsville to Rotorua	69 33	442,693 17 11	..	..	4,358 0 6	447,051 18 5	..
Marton to Te Awamutu	209 69	3,139,892 6 10	..	..	45,936 17 2	3,185,829 4 0	..
Waipa Gravel Access Branch	..	114 0 0	..	..	..	114 0 0	..
Raetihi Branch	8 50	89,452 2 1	..	..	..	89,452 2 1	..
Rotorua to Taupo	..	37,862 13 11	..	..	..	37,862 13 11	..
Paeroa to Pokeno	..	29,180 12 10	..	101,270 9 6	..	130,451 2 4	..
Paeroa to Tauranga	50 65	1,251,495 4 0	..	..	5,455 10 8	1,256,950 14 8	..
Tauranga to Taneatua, including Te Maunga to Maunganui Branch	59 17	1,497,428 2 0	..	..	325 2 11	1,497,753 4 11	..
Taneatua to Opotiki	..	..	..	2,006 7 0	..	2,006 7 0	..
Gisborne to Motu	49 32	626,804 4 10	..	..	498 16 5	627,303 1 3	..
Gisborne to Ormond Tramway	..	4,975 1 7	..	..	..	4,975 1 7	..
Napier to Gisborne—							
Gisborne Southwards	11 51	284,625 13 5	..	..	..	284,625 13 5	..
Waikokopu Northwards	..	1,205,429 17 6	..	460,039 4 1	..	1,665,469 1 7	..
Wairoa Northwards	..	20,681 12 6	..	..	..	20,681 12 6	..
Napier Northwards	38 62	2,528,873 19 0	..	46,958 4 7	71 12 1	2,575,903 15 8	..
Waikokopu Branch	..	650,666 16 5	..	24,207 2 2	..	674,873 18 7	..
Wellington to Napier—							
Napier to Woodville and Palmerston North	114 06	1,171,943 19 3	..	..	12,726 13 11	1,184,670 13 2	..
Wellington to Woodville, including Te Aro Extension	129 30	3,285,514 4 4	..	..	75,493 18 1	3,361,008 2 5	..
Featherston to Martinborough	..	399 0 0	..	..	..	399 0 0	..
Wellington to Waitara—							
Wellington to Longburn	83 37	4,185,208 18 8	..	..	188,366 0 7	4,373,574 19 3	..
Foxton to Waitara and Moturoa	196 22	2,275,358 1 1	..	..	200,872 14 9	2,476,230 15 10	..
Mount Egmont Branch	6 00	70,536 1 6	..	..	..	70,536 1 6	..
Moturoa to Opunake	..	3,105 0 0	..	..	..	3,105 0 0	..
Opunake Branch (Te Roti to Opunake)	22 63	447,862 16 7	..	..	22 1 4	447,884 17 11	..
Manaia Branch (Kapuni to Manaia)	..	9,483 6 0	..	..	..	9,483 6 0	..
Rangitikei River Quarry Line	..	206 0 0	..	..	..	206 0 0	..

TABLE No. 3—*continued.*

Expenditure on Railways to 31st March, 1939—*continued.*

Lines of Railway.	Mileage opened for Traffic.	Total Expenditure by General Government to 31st March, 1938.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1938-39: New Works.		Total Expenditure by General Government to 31st March, 1939.	Valuation of Works constructed by Provinces and Midland Railway Company.
				Construction and Surveys.	Railways Improvement and Works on Open Lines.		
	M. ch.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Stratford to Okahukura	89 00	3,093,349 17 1	..	75 14 0	23,919 7 3	3,117,344 18 4	..
Nelson to Greymouth—							
Nelson to Inangahua	64 47	721,892 14 0	..	1,741 10 0	2 3 10	723,636 7 10	78,307 0 0
Stillwater to Inangahua	57 32	230,277 10 10	..	..	7,998 18 3	238,276 9 1	279,685 0 0
Ngahere to Blackball	3 40	147,881 12 11	..	..	..	147,881 12 11	..
Westport to Ngakawau	19 56	212,035 14 2	..	..	2,532 15 1	214,568 9 3	..
Ngakawau to Mokihinui	7 12	33 9 6*	..	..	..	33 9 6	..
Mokihinui to Colliery Line	3 69	†	..	..	..	..	..
Westport to Cape Foulwind	7 00	‡	..	..	..	..	..
Westport to Inangahua	5 74	856,180 5 0	..	135,919 9 8	..	992,099 14 8	..
Greymouth to Rewanui	2 44	264,646 13 11	..	..	428 18 10	265,075 12 9	..
Point Elizabeth Branch	8 70	74,363 19 11	..	..	..	74,363 10 11	..
Greymouth to Ross and Mikonui	36 68	436,932 14 9	..	..	8,135 16 10	445,068 11 7	..
Picton to Waipara—							
Picton Southwards	56 06	1,242,634 7 9	..	190,293 12 2	11,066 13 11	1,443,994 13 10	..
Waipara Northwards	44 14	1,005,473 5 11	..	242,418 10 0	5,089 6 2	1,252,981 2 1	..
Christchurch to Greymouth—							
Rolleston to Bealey	73 07	1,012,029 5 11	..	..	4,570 4 7	1,016,599 10 6	61,579 0 0
Whitecliffs Branch	11 38	25,021 0 0	..	..	77 13 11	25,098 13 11	..
Greymouth to Bealey	58 12	1,991,137 5 10	..	..	10,996 18 1	2,002,134 3 11	263,889 0 0
Hurunui to Waitaki—							
Main Line (Waiau to Waitaki)	219 07	2,719,840 15 1	..	..	102,347 9 8	2,822,188 4 9	316,135 0 0
Oxford Branch (Rangiora to Oxford West)	21 76	49,697 17 2	..	..	..	49,697 17 2	..
Etreton Branch (Kaiapoi to Bennett's)	20 07	44,257 0 0	..	..	..	44,257 0 0	..
Lyttelton Branch	6 26	230,708 18 4	..	..	356 0 10	231,064 19 2	340,500 0 0
Southbridge Branch (Hornby to Southbridge)	25 31	92,263 3 4	..	..	203 12 4	92,466 15 8	..
Little River Branch (Lincoln to Little River)	22 46	112,292 4 6	..	..	..	112,292 4 6	..
Rakaia to Methven	22 20	77,090 19 2	..	..	413 3 10	77,504 3 0	..
Ashburton to Springburn	27 29	64,025 11 3	..	..	..	64,025 11 3	..
Orari to Geraldine	..	321 0 0	..	..	..	321 0 0	..
Fairlie Branch (Washdyke Junction to Fairlie)	36 05	70,502 15 5	..	..	..	70,502 15 5	75,124 0 0
Waimate Branch	12 63	80,862 4 6	..	..	..	80,862 4 6	..
Canterbury Interior Main Line—							
Oxford to Malvern	11 44	46,248 0 0	..	..	..	46,248 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	252 71	4,286,383 16 10	..	..	134,441 1 9	4,420,824 18 7	82,259 0 0
Duntroon Branch (Pukeuri to Kurow)	37 33	86,265 8 6	..	..	*Cr.* 22 0 0	86,243 8 6	37,500 0 0
Ngapara Branch (Waiareka Junction to Ngapara)	14 76	25,238 2 0	..	..	313 6 0	25,551 8 0	58,009 0 0

* The funds for this extension—namely, £35,501 2s. 11d.—were provided by the Westport Harbour Board. † The funds for purchase of this line—namely, £15,745—were provided by the Harbour Board. ‡ The funds for this line—namely, £93,450—were provided by the Westport Harbour Board.

TABLE No. 3—*continued.*

EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1939—*continued.*

Lines of Railway.	Mileage opened for Traffic.	Total Expenditure by General Government to 31st March, 1938.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1938–39: New Works.		Total Expenditure by General Government to 31st March, 1939.	Valuation of Works constructed by Provinces and Midland Railway Company.
				Construction and Surveys.	Railways Improvement and Works on Open Lines.		
Waitaki to Bluff—*continued.*	M. ch.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Livingstone Branch (Windsor to Tokarahi)	11 75	75,380 15 4	..	..	*Cr.* 30 0 0	75,350 15 4	..
Waihemo Branch (Palmerston to Dunback)	8 55	32,961 8 11	..	..	..	32,961 8 11	..
Fernhill Railway	1 60	1,330 0 0	..	..	..	1,330 0 0	..
Brighton Road Branch	..	6,474 0 0	..	..	..	6,474 0 0	12,829 0 0
Outram Branch (Mosgiel to Outram)	8 78	12,051 0 7	..	..	..	12,051 0 7	29,691 0 0
Lawrence Branch	58 67	719,348 5 9	..	..	4,723 19 8	724,072 5 5	..
Balclutha to Tuapeka Mouth	..	2,489 0 0	..	..	..	2,489 0 0	..
Catlin's River Branch (Balclutha to Tahakopa)	42 67	463,709 6 3	..	..	..	463,709 6 3	..
Heriotburn Branch (Waipahi to Edievale)	26 23	124,808 4 5	..	..	..	124,808 4 5	..
Waikaka Branch (McNab to Waikaka)	12 65	68,423 0 0	..	..	..	68,423 0 0	..
Gore to Lumsden	36 39	112,857 18 2	..	..	..	112,857 18 2	..
Edendale to Glenham	9 36	50,490 13 11	..	..	..	50,490 13 11	..
Riversdale to Switzers	13 70	82,285 4 0	..	..	..	82,285 4 0	..
Seaward Bush to Catlin's (Appleby to Tokanui)	32 79	185,229 5 5	..	..	..	185,229 5 5	..
Otago Central (Wingatui to Cromwell)	147 27	1,454,692 16 5	..	..	2,470 15 2	1,457,163 11 7	..
Invercargill to Kingston—							
Main Line	87 04	372,768 9 7	..	..	8,293 11 9	381,062 1 4	91,937 0 0
Mararoa Branch (Lumsden to Mossburn)	10 40	27,508 4 4	..	..	..	27,508 4 4	..
Winton to Heddon Bush	..	140 0 0	..	..	..	140 0 0	..
Makarewa to Orepuki and Waiau	56 34	361,049 12 4	..	..	1,200 4 1	362,249 16 5	37,097 0 0
Thornbury to Wairio	22 15	103,790 15 10	..	..	867 17 11	104,658 13 9	23,200 0 0
Forest Hill (Winton to Hedgehope)	12 40	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	..	31,235 10 1	..	..	..	31,235 10 1	..
South Island	..	5,763 0 0	..	117 9 6	..	5,880 9 6	..
Rolling-stock	..	12,671,131 18 11	..	..	1,527,281 17 11	14,198,413 16 10	..
Motor-omnibus Service, Wellington	..	60,571 1 11	..	..	..	60,571 1 11	..
General	..	17,658 2 7	..	24,446 7 0	..	42,104 9 7	..
Depreciation provided for out of Railway Revenue and actually repaid to Public Works Fund	..	*Cr.* 762,612 9 4	..	..	..	*Cr.* 762,612 9 4	..
Stock of Permanent-way Materials	..	8,942 15 9	..	..	..	8,942 15 9	..
Totals	..	71,468,696 13 1*	..	1,268,279 15 2	2,618,366 19 8	75,355,343 7 11*	1,787,741 0 0†

* The £10,400,000 accrued depreciation of assets referred to in section 23 (2), Government Railways Amendment Act, 1931, not deducted.

† Includes value for £150,000 paid to debenture holders under the Midland Railway Petitions Settlement Act Amendment Act, 1903.

TABLE No. 4.

EXPENDITURE ON PUBLIC BUILDINGS OUT OF PUBLIC WORKS FUND TO THE 31ST MARCH, 1939 AND THE LIABILITIES ON THAT DATE.

—	Total Expenditure to 31st March, 1938.	Expenditure for Year ended 31st March, 1939.	Total Expenditure to 31st March, 1939.	Liabilities on Authorities, Contracts, &c., to 31st March, 1939.	Total Expenditure and Liabilities.
General—	£	£	£	£	£
Alexandra Depot, Wellington*	8,084	..	8,084	..	8,084
Government House, Wellington (land and new building)	76,691	1,079	77,770	..	77,770
Offices for public Departments†	1,036,010	453,669	1,489,679	27,938	1,517,617
Air Defence	28,157	316,883	345,040	39,901	384,941
Miscellaneous	182,387	16,348	198,735	2,744	201,479
Parliament Buildings—					
Old buildings	76,553	..	76,553	..	76,553
New buildings	393,898	78	393,976	..	393,976
Alterations to streets surrounding grounds and purchase of land	57,089	..	57,089	..	57,089
Judicial‡	1,557,059	117,769	1,674,828	4,610	1,679,438
Postal and telegraph‖	3,193,365	272,785	3,466,150	11,247	3,477,397
Customs	49,441	..	49,441	..	49,441
Quarantine-stations	62,464	..	62,464	..	62,464
Mental hospitals	2,226,957	128,840	2,355,797	19,975	2,375,772
Health and hospital institutions§	432,222	88,099	520,321	3,473	523,794
School buildings	4,437,050	660,479	5,097,529	78,794	5,176,323
Agricultural	161,103	111,158	272,261¶	5,228	277,489
Totals	13,978,530	2,167,187	16,145,717	193,910	16,339,627

* Expenditure *re* Defence requirements only. Other expenditure included in "Judicial" class. † Includes £12,500 expended under Finance Act, 1929, section 32. ‡ Includes Courthouses, prisons, and police-stations. ‖ Includes £134,485 for land transferred from Railway Department. § Includes £32,754 previously shown under "Public Health." ¶ Includes £154,448 expended under Reserves and other Lands Disposal Act, 1936, section 32 (Flock House purchase).

TABLE No. 5.

ELECTRIC SUPPLY ACCOUNT.—STATEMENT OF ACCOUNTS AT THE 31ST MARCH, 1939.

GENERAL BALANCE-SHEET

AT 31ST MARCH, 1939, COMPARED WITH POSITION AT 31ST MARCH, 1938.

Liabilities.	1938-39. £ s. d.	1938-39. £ s. d.	*1937-38.* £ s. d.
Aid to Water-power Works and Electric Supply Accounts—			
Debentures Stock issued—			
At 2½ per cent. interest	1,300,000 0 0		*1,300,000 0 0*
At 3 per cent. interest	3,149,372 9 6		*3,149,372 9 6*
At 3½ per cent. interest	1,449,225 0 0		*1,449,225 0 0*
At 3¾ per cent. interest	573,555 0 0		*574,555 0 0*
At 4 per cent. interest	1,647,600 0 0		*1,647,600 0 0*
At 4½ per cent. interest	2,623,913 18 0		*2,623,913 18 0*
At 5 per cent. interest	3,159,227 13 6		*3,159,227 13 6*
Debentures not yet converted	50 0 0		*50 0 0*
		13,902,944 1 0	*13,903,944 1 0*
Consolidated Fund—			
Interest accrued on loans to 31st March, 1939	133,577 6 10		*132,713 15 8*
Sundry creditors for interest unclaimed	12 0 0		*10 0 0*
		133,589 6 10	*132,723 15 8*
Temporary loan		12,000 0 0	*12,000 0 0*
Temporary transfers from other accounts		210,000 0 0	
Interest reserve, being excess of interest charged to schemes over interest actually paid on capital liability		82,126 3 2	*81,196 7 10*
Carried forward		14,340,659 11 0	*14,129,864 4 6*

Assets.	1938-39. £ s. d.	1938-39. £ s. d.	*1937-38.* £ s. d.
North Island scheme—			
Assets as per separate balance-sheet		10,280,338 13 5	*9,687,193 12 6*
South Island scheme—			
Assets as per separate balance-sheet	7,013,536 11 10		*6,635,189 0 3*
Investments, Sinking Fund	10,321 2 3		*11,679 15 7*
		7,023,857 14 1	*6,646,868 15 4*
Surveys and General		18,665 8 5	*18,717 6 3*
Carried forward		17,322,861 15 11	*16,352,779 14 1*

TABLE No. 5—*continued.*

ELECTRIC SUPPLY ACCOUNT.—STATEMENT OF ACCOUNTS AT THE 31ST MARCH, 1939—*continued.*

GENERAL BALANCE-SHEET

AT 31st MARCH, 1939, AS COMPARED WITH POSITION AT 31st MARCH, 1938—*continued.*

Liabilities.	1938–39.		1937–38.	*Assets.*	1938–39.		1937–38.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
Brought forward	..	14,340,659 11 0	*14,129,864 4 6*	Brought forward	..	17,322,861 15 11	*16,352,779 14 1*
Sundry Creditors—				Balance in Electric Supply Account at the end of year—			
North Island scheme	100,632 17 2		*86,139 11 3*	Cash in Public Account	7,000 5 9		*44,198 7 10*
South Island scheme	36,102 10 8		*40,896 4 1*	Imprests outstanding	8,926 5 2		*18,856 18 2*
Surveys and general	..		*168 8 3*			15,926 10 11	
		136,735 7 10					*63,055 6 0*
			127,204 3 7				
Charges paid in advance—							
North Island scheme	8 16 5		*2 1 6*	Suspense Account	..	100 4 9	*266 11 9*
South Island scheme	723 9 0		*1,662 12 4*				
		732 5 5					
			1,664 13 10				
Depreciation Reserve—							
North Island scheme	1,042,932 14 2		*1,016,184 7 5*				
South Island scheme	637,799 5 1		*552,104 19 1*				
		1,680,731 19 3					
			1,568,289 6 6	Stocks—Surveys and General	..	70 0 0	*104 9 8*
Sinking Fund—							
Amount utilized for redemption of loans	496,364 8 4		*315,264 8 4*				
Available for further redemptions ..	595,513 18 8		*191,321 2 3*				
		1,091,878 7 0					
			506,685 10 7				
Writings-off in Suspense—							
North Island scheme	0 12 6		*143 13 11*				
South Island scheme	1,021 2 7		*742 8 9*				
		1,021 15 1					
			886 2 8				
General Reserve—							
South Island scheme	..	87,199 6 0	*82,399 5 8*	Sundry debtors for interest due but unpaid	..	..	*787 5 10*
Total	..	£17,338,958 11 7	*£16,416,993 7 4*	Total	..	£17,338,958 11 7	*£16,416,993 7 4*
Contingent Liability.							
Arrears due to Sinking Fund	558,076 9 3						

NOTES.—(*a*) No charge for cost of exchange on interest payments made in London is included. (*b*) Owing to the interconnection of the various schemes, it has not been found practicable to show separately the accounts of these schemes as required by the State Supply of Electrical Energy Act, 1917.

J. W. SCOTT, A.R.A.N.Z., Chief Accountant, Public Works Department.

I hereby certify that the General Balance-sheet has been duly compared with the relative books and documents submitted for audit, and correctly states the position as disclosed thereby, subject to the departmental notes enfaced thereon.—J. H. FOWLER, Controller and Auditor-General.

TABLE No. 5—*continued.*

NORTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT

FOR YEAR ENDED 31ST MARCH, 1939, COMPARED WITH YEAR ENDED 31ST MARCH, 1938.

Gross Revenue Account.

—	1938–39.		1937–38.	—	1938–39.		1937–38.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
To Generating-expenses, headworks, and power-house—				By Sales of energy—			
Arapuni	23,289 16 6		*17,232 13 4*	Wholesale	1,112,597 6 6		*966,482 5 0*
Horahora	3,031 19 1		*4,315 5 7*	Retail	2,654 0 0		*2,247 15 4*
Mangahao	11,115 16 4		*10,172 11 3*			1,115,251 6 6	*968,730 0 4*
Waikaremoana	11,945 12 3		*14,138 6 2*				
Standby stations	24,424 6 4		*13,468 18 4*	Rents—			
		73,807 10 6		Cottages, &c.	9,798 12 3		*8,261 5 5*
			59,327 14 8	Lines, plant, &c.	794 10 8		*823 15 6*
Transmission-lines—						10,593 2 11	
Patrol, maintenance, &c.	..	32,330 11 5	*36,728 5 4*				*9,085 0 11*
Substations—							
Operation and maintenance ..	..	30,853 19 8	*25,988 3 11*				
Management and general—				Miscellaneous—			
Salaries, office expenses, accident, sick, and holiday pay, testing, &c.	..	63,446 1 5	*55,500 6 3*	Tests and inspection	1,286 4 7		*677 4 9*
				Penalties	1 0 0		..
						1,287 4 7	*677 4 9*
		200,438 3 0	*177,544 10 2*				
Balance to Net Revenue Account		926,693 11 0	*800,947 15 10*				
		£1,127,131 14 0	*£978,492 6 0*			£1,127,131 14 0	*£978,492 6 0*

Net Revenue Account.

—	1938–39.	1937–38.	—	1938–39.	1937–38.
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Interest for year ended 31st March, 1939	353,675 18 3	*349,816 3 5*	By Balance from Gross Revenue Account	926,693 11 0	*800,947 15 10*
Depreciation on completed works	7,228 1 7	*50,725 6 11*			
King's Wharf Station, half annual charges on capital costs thereon	33,547 5 2	*37,592 10 2*			
Cost of raising loans and expenses	2,072 12 3	*2,151 8 2*			
Balance to Profit and Loss Appropriation Account ..	530,169 13 9	*360,662 7 2*			
	£926,693 11 0	*£800,947 15 10*		£926,693 11 0	*£800,947 15 10*

TABLE No. 5—*continued.*

NORTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

Profit and Loss Appropriation Account

for Year ended 31st March, 1939, compared with Year ended 31st March, 1938.

——	1938–39.	1937–38.	——	1938–39.	1937–38.
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Balance from previous year	..	*155,175 8 4*	By Balance from Net Revenue Account	530,169 13 9	*360,662 7 2*
Adjustment of error 1936–37	..	*50,548 11 1*			
Sinking Fund Account	530,169 13 9	*154,938 7 9*			
	£530,169 13 9	*£360,662 7 2*		£530,169 13 9	*£360,662 7 2*

Depreciation Reserve Account.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Replacements, renewals, &c.	21,127 2 3	*21,443 4 6*	By Balance at close of previous year	1,016,184 7 5	*949,888 3 11*
Balance to General Balance-sheet	1,042,932 14 2	*1,016,184 7 5*	Interest at 4 per cent. per annum	40,647 7 5	*37,014 1 1*
			Amount set aside as per Net Revenue Account ..	7,228 1 7	*50,725 6 11*
	£1,064,059 16 5	*£1,037,627 11 11*		£1,064,059 16 5	*£1,037,627 11 11*

Sinking Fund Account.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
To Balance	741,037 17 0	*210,868 3 3*	By Balance at close of previous year	210,868 3 3	*55,929 15 6*
			Profit and Loss Appropriation Account	530,169 13 9	*154,938 7 9*
	£741,037 17 0	*£210,868 3 3*		£741,037 17 0	*£210,868 3 3*

TABLE No. 5—*continued.*

NORTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1939.

Liabilities.	1938-39.		1937-38.	*Assets.*	1938-39.		1937-38.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
Depreciation Reserve	..	1,042,932 14 2	*1,016,184 7 5*	Headworks, power-house, machinery, &c.—			
				Arapuni	2,510,228 7 11		*2,487,053 4 2*
				Horahora	312,224 10 4		*310,870 14 7*
				Mangahao	1,298,614 4 6		*1,281,862 17 3*
				Waikaremoana	644,174 16 5		*558,143 8 0*
Sinking Fund—						4,765,241 19 2	*4,637,930 4 0*
Utilized for redemption of loans	210,868 3 3		*55,929 15 6*				
Available for further redemptions ..	530,169 13 9		*154,938 7 9*				
		741,037 17 0	*210,868 3 3*	Auxiliary plants—			
				Diesel Station, Penrose	62,189 7 8		*62,189 7 8*
				Steam Station Grand Junction	8,862 4 0		*8,959 2 4*
				Steam Station, Huntly	10,847 1 11		*10,847 1 11*
						81,898 13 7	*81,995 11 11*
Sundry creditors—							
Public Works Department	26,231 12 4		*19,138 15 0*				
Other Government Departments ..	2,056 19 1		*1,394 15 9*				
Non-departmental	72,344 5 9		*65,06 0 6*	Transmission-lines	..	1,746,006 14 1	*1,589,664 7 2*
				Substations	..	1,155,149 1 2	*1,077,808 18 2*
		100,632 17 2	*8,139 11 3*	Office buildings, land, railway siding, harbour facilities, &c.	..	64,256 18 8	*61,461 10 4*
				Temporary development, Waikaremoana ..	..	800 0 0	*800 0 0*
Writings-off in suspense	..	12 6	*143 13 11*	Lower development, Waikaremoana ..	..	125,836 6 3	*17,431 17 5*
Charges paid in advance	..	8 16 5	*2 1 6*	Exploration and preliminary surveys ..	..	5,258 17 6	..
Head Office Account	..	8,395,725 16 2	*8,373,855 15 2*	Salaries and expenses of engineers and others on surveys and during construction	..	505,680 13 0	*495,2.0 6 7*
				Cost of raising loans	..	296,454 5 4	*296,454 5 4*
				Interest during construction	..	963,962 2 3	*955,627 1 4*
						9,710,554 11 0	*9,216,414 2 3*
				Plant, motor-vehicles, &c.	..	70,801 0 3	*57,728 16 8*
				Stocks	..	229,041 14 0	*165,223 4 5*
				Sundry debtors—			
				Public Works Department	5,431 15 5		*5,871 18 7*
				Other Government Departments ..	6,233 17 9		*6,903 4 5*
				Non-departmental	258,196 0 3		*234,977 15 10*
						269,861 13 5	*247,752 18 10*
				Payments in advance	..	79 14 9	*74 10 4*
		£10,280,338 13 5	*£9, 87,193 12 6*			£10,280,338 13 5	*£9,687,193 12 6*
Contingent Liability.							
Arrears due to Sinking Fund	£304,208 14 5						

TABLE No. 5—*continued.*

SOUTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT

FOR YEAR ENDED 31ST MARCH, 1939, COMPARED WITH YEAR ENDED 31ST MARCH, 1938

Gross Revenue Account.

——	1938-39.		1937-38.	——	1938-39.		1937-38.
To Generating-expenses, headworks, power-houses, and auxiliary plant—	£ s. d.	£ s. d.	*£ s. d.*	By Sales of energy—	£ s. d.	£ s. d.	*£ s. d.*
Lake Coleridge	16,698 3 11		*9,954 4 9*	Wholesale	454,254 12 5		*387,057 15 11*
Waitaki	8,495 3 3		*9,164 8 1*	Retail	94,879 12 11		*92,555 9 0*
Kaimata	877 5 9		*329 5 8*			549,134 5 4	*479,613 4 11*
Dobson	26,300 12 5		*3,456 10 11*				
Lyttelton Diesel station	..		*1,217 14 0*	Bad debts recovered	..	54 6 9	*192 10 10*
Southland	15,118 7 1		*11,198 6 8*	Discounts forfeited	..	23 18 9	*23 3 0*
Purchases in bulk	4,140 5 5		..	Rents—			
		71,629 17 10		Land and buildings	3,290 2 0		*2,637 11 9*
			35,320 10 1	Electric lines and plant, &c. ..	1,698 7 6		*1,725 15 0*
Transmission and distribution—						4,988 9 6	*4,363 6 9*
Primary distribution	20,108 1 2		*11,484 1 1*				
Secondary distribution	13,319 11 10		*9,043 6 4*				
		33,427 13 0		Fees for testing and repairing electrical appliances and earnings of motor-vehicles	..	2,505 0 2	*1,945 17 9*
			20,527 7 5				
Substations	..	17,949 7 3	*16,788 1 3*				
Plant, tools, testing, &c.	..	8,325 2 1	*268 3 0*				
Electrical testing	..	448 15 11	*194 2 5*	Miscellaneous—			
Trunk telephone system	..	1,096 14 6	*822 4 1*	Commissions, sales of appliances, &c.	..	4,593 19 6	*5,290 12 4*
Management and general expenses ..	..	54,916 6 3	*52,721 8 8*				
		187,793 16 10	*126,641 16 11*				
Balance, to Net Revenue Account ..	..	373,506 3 2	*364,786 18 8*				
		£561,300 0 0	*£491,428 15 7*			£561,300 0 0	*£491,428 15 7*

Net Revenue Account.

		£ s. d.	*£ s. d.*			£ s. d.	*£ s. d.*
To Interest for year ended 31st March, 1939	..	231,059 18 11	*220,111 11 6*	By Balance from Gross Revenue Account	..	373,506 3 2	*364,786 18 8*
Depreciation on completed works ..	..	82,616 10 7	*112,374 15 3*	Revenue from rates, &c.	..	150 11 7	*122 1 11*
Cost of raising loans	..	1,404 2 0	*1,362 12 11*				
Commission, collecting rates, &c. ..	..	41 7 7	*73 5 0*				
Balance to Profit and Loss Appropriation Account	..	58,534 15 8	*30,986 15 11*				
		£373,656 14 9	*£364,909 0 7*			£373,656 14 9	*£364,909 0 7*

TABLE No. 5—*continued.*

SOUTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

Profit and Loss Appropriation Account.

——	1938–39.			1937–38.			——	1938–39.			1937–38.		
	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
To General Reserve Account (reversing debit balance, Southland section as at 31st March, 1938)	4,800	0	4	*12,231*	*1*	*9*	By Balance from Net Revenue Account	58,534	15	8	*39,986*	*15*	*11*
							Arrears of rates recovered	1,226	5	7	*1,147*	*4*	*11*
Sinking Fund Reserve Account	54,961	0	11	*24,702*	*19*	*5*	Transfer from General Reserve Account	..			*4,800*	*0*	*4*
	£59,761	1	3	*£36,934*	*1*	*2*		£59,761	1	3	*£36,934*	*1*	*2*

Depreciation Reserve Account.

	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
To Replacements, Renewals, &c.	19,006	8	6	*46,641*	*18*	*1*	By Balance from previous year's statement	552,104	19	1	*467,665*	*9*	*6*
Balance	637,799	5	1	*552,104*	*19*	*1*	Interest at 4 per cent. per annum	22,084	3	11	*18,706*	*12*	*5*
							Amount set aside as per Net Revenue Account	82,616	10	7	*112,374*	*15*	*3*
	£656,805	13	7	*£598,746*	*17*	*2*		£656,805	13	7	*£598,746*	*17*	*2*

General Reserve Account.

	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
To Transfer to Profit and Loss Appropriation Account under section 13 (2) (*b*) of the State Supply of Electrical Energy Act, 1917	..			*4,800*	*0*	*4*	By Balance at close of previous year	82,399	5	8	*67,703*	*7*	*6*
							Adjustment for excess amount transferred to Profit and Loss Appropriation Account, 1936–37	..			*7,264*	*16*	*9*
Balance	87,199	6	0	*82,399*	*5*	*8*	Profit and Loss Appropriation Account (reversing debit balance, Southland section as at 31st March, 1938)	4,800	0	4	*12,231*	*1*	*9*
	£87,199	6	0	*£87,199*	*6*	*0*		£87,199	6	0	*£87,199*	*6*	*0*

Sinking Fund Reserve Account.

	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
Balance	350,840	10	0	*295,817*	*7*	*4*	By Balance at close of previous year	295,817	7	4	*271,114*	*7*	*11*
							Interest	62	1	9	..		
							Amount set aside as per Profit and Loss Appropriation Account	54,961	0	11	*24,702*	*19*	*5*
	£350,840	10	0	*£295,817*	*7*	*4*		£350,840	10	0	*£295,817*	*7*	*4*

TABLE No. 5—*continued.*

SOUTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY—*continued.*

BALANCE-SHEET AT 31ST MARCH, 1939.

Liabilities.	1938–39.		1937–38.	*Assets.*	1938–39.		1937–38.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
Depreciation Reserve	..	637,799 5 1	*552,104 19 1*	Headworks, power-house, machinery, &c.—			
				Lake Coleridge	807,799 17 8		*793,272 14 0*
Reserve Fund—				Waitaki	1,782,888 3 10		*1,768,828 16 10*
Balance at close of previous year ..	82,399 5 8		*74,968 4 3*	Kaimata	117,376 3 8		*107,022 0 5*
Adjustment	4,800 0 4		*7,431 1 5*	Southland	200,017 10 0		*200,578 18 6*
		87,199 6 0				2,908,081 15 2	
			82,399 5 8				*2,869,702 9 9*
Sinking Fund—				Auxiliary plants—			
Amount utilized for redemption of loans	285,496 5 1		*259,434 12 10*	Dobson Diesel Station	125,548 2 4		*106,322 2 3*
Available for further redemptions ..	65,344 4 11		*36,382 14 6*	Lyttelton Diesel Station	2,805 7 7		*2,805 7 7*
		350,840 10 0				128,353 9 11	
			295,817 7 4				*109,127 9 10*
				Transmission and distribution	..	1,774,956 3 6	*1,633,709 7 9*
				Substations	..	622,431 15 10	*525,781 2 3*
Sundry creditors—				Offices and stores, buildings, &c. ..	19,187 8 9		*17,983 12 3*
Public Works Department	12,422 1 3		*10,717 2 9*	Trunk Telephone System	59,436 15 5		*43,780 15 10*
Other Government Departments ..	3,576 5 6		*2,100 18 2*	Exploration and preliminary surveys ..	64 5 3		*7 19 6*
Non-departmental	20,104 3 11		*28,078 3 2*	Salaries and expenses during construction	125,421 15 3		*116,562 0 10*
		36,102 10 8		Interest during construction	482,498 1 11		*469,157 16 8*
			40,896 4 1	Charges and expenses of raising loans ..	533,616 9 0		*533,802 5 10*
						1,220,224 15 7	
Charges paid in advance	..	723 9 0	*1,662 12 4*				*1,181,294 10 11*
						6,654,048 0 0	*6,319,615 0 6*
Writings-off in suspense	..	1,021 2 7	*742 8 9*	Plant, tools, &c.	..	126,411 10 6	*115,028 6 9*
				Stocks of material	..	115,592 0 10	*100,494 19 2*
Head Office Account	..	5,910,171 10 9	*5,673,245 18 1*	Sundry debtors—			
				Public Works Department	4,859 2 6		*2,111 6 1*
				Other Government Departments ..	1,910 8 1		*2,467 5 11*
				Non-departmental	110,714 7 5		*95,451 2 2*
						117,483 18 0	
							100,029 14 2
				Payments in advance	..	1 2 6	*20 19 8*
				Sinking Fund investments	..	10,321 2 3	*11,679 15 1*
		£7,023,857 14 1	*£6,646,868 15 4*			£7,023,857 14 1	*6,646,868 15 4*
Contingent Liability.							
Arrears due to Sinking Fund	£253,867 14 10						

TABLE No. 6.

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, 1938.	Area commanded (Gross).	Area for which Irrigation Water is available.	Works authorized.		Works completed.		Expenditure to 31st March, 1939.	Remarks.
			As per Design.	During 1938–39.					Main Canals.	Distributaries.	Main Canals.	Distributaries.		
Canterbury—		Cusecs.	Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Acres.	M. ch.	M. ch.	M. ch.	M. ch.	£	
Ashburton ..	Rangitata River ..	1,300	1,000	..	..	..	315,000†	..	42 0	..	17 0	..	196,659	Under construction. Diversion race only for supplying main races of schemes marked * and also supply of electric energy.
*Ashburton–Lyndhurst	Rangitata River ..	1,300	450	..	23·00	30·41	68,000*	..	55 0	80 0	15 65	60 72	134,466	Under construction.
Levels	Opihi River ..	180	180	120	22·00	40·72	20,000	11,500	6 61	50 60	6 61	50 60	78,853	Completed.
*Mayfield–Hinds ..	Rangitata River ..	1,300	450	..	23·00	39·54	110,000*	..	20 0	210 00	7 00	21 00	35,720	Under construction.
Redcliff ..	Waitaki River ..	3,000	55	55	21·00	38·68	7,000	4,603	3 69	13 76	3 69	13 76	27,640	Completed.
Otago North—														
Otekaike ..	Otekaike River ..	9	15	..	21·63 (Duntroon)	35·77	1,500	800	14 37	3 47	14 37	3 47	3,631	Completed. Used only on west side of river.
Steward Settlement	Waitaki River ..	..	110	..	20·63 (Steward Settlement)	33·85	18,000	..	14 60	50 31	14 60	50 31	12,115	Completed.
Otago Central—														
Ardgour ..	Lindis River ..	35	20	19	19·53 (Tarras)	20·66	2,000	1,364	13 0	2 40	13 0	2 40	33,700	Completed.
Arrow River ..	Arrow River ..	40	50	36	27·64 (Arrowtown and Frankton)	27·77	6,536	2,936	..	..	9 18	27 60	143,028	Completed.
Bengerburn ..	Bengerburn ..	1	4	4	..	..	1,000	144	2 6	..	2 6	..	801	Completed.
Earnscleugh (Fraser River)	Fraser River and storage dam	10	47 (all races)	62	15·88 (Earnscleugh)	21·61	2,743	2,247	11 30	17 60	11 30	17 60	65,773	Completed.
Hawkdun (formerly Mount Ida)	Tributaries of Manuherikia River and Eweburn Reservoir	..	60	35	24·12 (Naseby and Naseby Plantation)	27·61	10,000	8,818	66 0	101 0	66 0	90 12	71,871	Completed.
Idaburn ..	Idaburn Dam ..	3	8	6	23·17 (M a Creek, Blackstone Hill)	22·34	2,500	565	10 0	0 40	7 26	0 40	6,739	Main scheme completed.

† Includes schemes marked *.

TABLE No. 6—*continued.*

IRRIGATION AND WATER-SUPPLY—*continued.*

SCHEDULE OF SCHEMES COMPLETED OR UNDER CONSTRUCTION—*continued.*

Scheme.	Source of Supply.	River Discharge (Minimum).	Main Canal Discharge (Maximum).		Average Rainfall from Records available.	Rainfall, 1938.	Area commanded (Gross).	Area for which Irrigation Water is available.	Works authorized.		Works completed.		Expenditure to 31st March, 1959.	Remarks.
			As per Design.	During 1938-39.					Main Canals.	Distributaries.	Main Canals.	Distributaries.		
Otago Central—ctd.		Cusecs.	Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Acres.	M. ch.	M. ch.	M. ch.	M. ch.	£	
Ida Valley and Galloway—														
Ida Valley ..	Manorburn, Poolburn, Moa Creek, and Totara Creek. (Storage Manorburn Dam)	..	110	83	16·81 (Moa Creek)	17·40	14,000	11,729	73 0	54 0	73 0	29 50	304,627	Completed. Additional storage furnished by Poolburn and Lower Manorburn Dams. Hope's Creek Dam to be constructed will command additional area.
Galloway ..	Manorburn Dam ..	..	30	24·5	14·43 (Galloway)	15·86	3,450	2,642	10 50	10 7	10 50	10 7		
Lower Manorburn Dam	Manorburn Creek	4	7	6·5	..	..	..	..	..	2 0	..	2 0		
Last Chance (Fruitlands and Earnscleugh Tops)	Shingle, Coal Gorge, Butcher's Creek, and Conroy's Creek	8	20	15·5	17·03 (Earnscleugh and Roxburgh East)	20·98	4,300	2,313	22 0	5 70	20 78	5 70	63,905	Butcher's Creek Dam now completed will augment existing supply and serve an additional area.
Manuherikia–Alexandra - Clyde No. 1	Manuherikia River	77	100	86	15·08 (Alexandra, Ophir, and Clyde)	16·98	7,000	4,941	23 0	46 20	23 0	46 20	257,280	Completed.
Omakau ..	Manuherikia River and Storage Dam, Thompson's Creek, and Dunstan Creek	36 7	65 7	48 8·5	20·39 (Clyde, Ophir, and Blackstone Hill)	20·97	10,800 (irrigable)	13,400	42 0	50 0	44 10	49 36	310,372	Completed.
Tarras	Lindis River ..	35	70	33	19·53 (Tarras)	20·66	6,000	2,675	21 70	17 55	21 70	17 55	136,804	Completed.
Teviot River ..	Teviot River and Lake Onslow Dam	40	80	52	18·19 (Roxburgh East)	20·35	5,300	3,791	20 48	14 57	20 48	14 57	79,135	Completed and serving all land requiring water.
General investigations, and surveys, &c.	..	..	..	..	..	..	..	..	..	..	..	..	14,869	
Total: Schemes completed or under construction							437,129	74,468	472 31	731 3	402 68	514 73	1,887,988	

TABLE No. 6—*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, 1938.	Area commanded (Gross).	Length of Main Canal.	Length of Distributaries.	Expenditure to 31st March, 1939.‡	Remarks.
Canterbury—		Cusecs.	Cusecs.	Inches.	Inches.	Acres.	Miles.	Miles.	£	
*Barrhill	Rangitata River ..	1,300	250	23·00	50·41	53,000*	..	..		Investigations into the feasibility of irrigation in the Canterbury Province have been in hand since January, 1934. Investigations include the following phenomena, viz.: Soil moisture, mechanical analysis of soil, depth of ground water, evaporation, rainfall, and river-flow.
Orari	Rangitata River ..	1,300	250	22·00	40·72	40,000	..	..		
*Valetta-Tinwald ..	Rangitata River ..	1,300	450	23	45·23	84,000*	..	..	24,684	
Investigations of other proposed schemes	..	..	..	..	..	..	..	..		
Marlborough—										
Investigation of proposed schemes	..	..	..	..	16·06	..	..	..	5,253	Comprehensive investigation surveys of schemes for the Wairau Valley and parts of the Wairau Plains are in hand.
Otago Central—										
Cromwell Flat and Lowburn (Roaring Meg)	Hydro-electric development of Roaring Meg and pumping from Clutha and Kawarau Rivers	29 (Roaring Meg)	..	20·70 (Luggate)	21·71	..	..	..	3,774	Hydro-electric scheme under investigation. Power would be available for pumping irrigation supplies to 8,000 acres in Upper Clutha Valley. Portion of this area could be supplied from Hawea River power and pumping scheme.
Maniototo (Upper Taieri)	Taieri River and storage dam	25	500	16·92 (Waipiata)	18·01	100,000	60	..	16,734	Modified scheme for complete irrigation of 5,000 acres is possible without storage, or for reasonable partial irrigation of 15,000 acres. Surveys practically complete for scheme to irrigate 100,000 acres.
Scandinavian ..	Tributaries of Manuherikia River	..	20	30·66 (St. Bathan's)	..	..	..	..	..	For lands about St. Bathan's. To bear £15,000 towards cost of Falls dam, Upper Manuherikia scheme. Irrigable area, 3,000 acres.
Upper Clutha Valley (including Hawea Flats)	Hawea and Clutha Rivers (pumping) with power-station at outlet of Lake Hawea	580 (Hawea R.) 3,000 (Clutha R.)	..	21·90 (Hawea Flat, Luggate, and Tarras)	23·11	..	..	..	..	Investigations have been made for a hydro-electric power development at the outlet of Lake Hawea. Sufficient power would be available to pump water from the Hawea and Clutha Rivers to 13,700 acres in the Upper Clutha Valley.
Upper Manuherikia (extension of Omakau Scheme)	Manuherikia River and storage dam at Manuherikia Falls	36 (at dam-site)	..	21·90 (Clyde, Ophir, and Blackstone Hill)	23·11	16,000	58	60	6,553	Surveys and investigations have been made for the extension of the Omakau scheme (now under construction) to supply lands between Tiger Hill and Clyde. Irrigable area, 12,000 acres.
Investigation of proposed schemes	..	..	..	..	..	..	..	..	2,254	Includes the reading of river and rain gauges.
Total: Schemes under investigation		..	..	..	..	..	..	..	59,252	
Grand total		..	..	..	..	..	..	..	1,947,240	

‡ Includes expenditure from Public Works Fund, Consolidated Fund, Unemployment Fund; also administration and loan charges.

APPENDICES

TO THE

PUBLIC WORKS STATEMENT, 1939.

APPENDIX A.

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1938–39.

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

SIR,— Public Works Department, Wellington, 3rd July, 1939.

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

I have, &c.,
R. SEMPLE,
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 1938-39.

Vote No.	Summary.	Appropriation.	Gross Expenditure.	Credits in Aid.	Net Expenditure.
	General Purposes Account—	£	£ s. d.	£ s. d.	£ s. d.
36	Public Works, Departmental	198,000	547,367 16 6	331,351 8 11	216,016 7 7
37, 38	Railways	4,309,000	3,952,174 15 4	154,092 3 5	3,798,082 11 11
39, 40	Public Buildings	2,420,000	2,208,509 14 5	122,215 19 10	2,086,293 14 7
41	Lighthouses and Harbour-works ..	51,000	37,899 19 5	4,049 18 11	33,850 0 6
42	Development of Tourist Resorts ..	55,000	24,953 2 9	401 9 7	24,551 13 2
43	Roads, Bridges, and other Public Works	1,435,000	1,455,193 11 5	164,355 11 9	1,290,837 19 8
44	Telegraph Extension	750,000	872,645 18 5	296,702 6 9	575,943 11 8
45	Lands, Miscellaneous	187,000	241,935 13 5	106,959 0 6	134,976 12 11
46	Irrigation, Water-supply, and Drainage	140,000	283,733 10 0	119,252 10 1	164,480 19 11
47	Swamp Land Drainage	19,000	24,930 19 8	19,606 16 2	5,324 3 6
48	Settlement of Unemployed Workers ..	340,000	526,397 7 5	181,713 4 1	344,684 3 4
49	Native Land Settlement	375,000	1,166,103 10 3	672,408 2 7	493,695 7 8
	Unauthorized—				
	Services not provided for	..	571 10 8	496 16 6	74 14 2
	Totals, General Purposes Account ..	10,279,000	11,342,417 9 8	2,173,605 9 1	9,168,812 0 7
	Electric Supply Account—				
50	Development of Water-power	1,556,000	1,364,594 10 4	26,810 1 7	1,337,784 8 9
	Totals, Public Works Fund ..	11,835,000	12,707,012 0 0	2,200,415 10 8	10,506,596 9 4

APPENDIX A—*continued.*

Vote No	Name of Vote.	Appropriation.	Gross Expenditure.	Credits in Aid.	Net Expenditure.
	PUBLIC WORKS FUND.				
	General Purposes Account—	£	£ s. d.	£ s. d.	£ s. d.
36	Public Works, Departmental	198,000	547,367 16 6	331,351 8 11	216,016 7 7
	Railways —				
37	Railway-construction	1,465,000	1,299,134 5 2	64,488 0 2	1,234,646 5 0
38	Railways Improvements and Additions to Open Lines	2,844,000	2,653,040 10 2	89,604 3 3	2,563,436 6 11
39	Public Buildings	1,600,000	..	..	..
	Subdivision I—Public Buildings, General	..	860,773 4 5	53,304 8 0	807,468 16 5
	Subdivision II—Courthouses ..	..	34,959 18 3	92 5 8	34,867 12 7
	Subdivision III—Prison Buildings and Works	..	8,090 5 8	434 10 10	7,655 14 10
	Subdivision IV—Police-stations ..	..	77,753 18 0	9 0 0	77,744 18 0
	Subdivision V—Postal and Telegraph	..	281,996 9 0	1,045 0 8	280,951 8 4
	Subdivision VI—Mental Hospitals ..	..	129,455 12 7	615 17 11	128,839 14 8
	Subdivision VII—Health and Hospital Institutions	..	88,402 11 10	303 11 9	88,099 0 1
40	Education Buildings	820,000	727,077 14 8	66,411 5 0	660,666 9 8
41	Lighthouses and Harbour-works ..	51,000	37,899 19 5	4,049 18 11	33,850 0 6
42	Development of Tourist Resorts ..	55,000	24,953 2 9	401 9 7	24,551 13 2
43	Roads, Bridges, and other Public Works	1,435,000	1,455,193 11 5	164,355 11 9	1,290,837 19 8
44	Telegraph Extension	750,000	872,645 18 5	296,702 6 9	575,943 11 8
45	Lands, Miscellaneous	187,000	241,935 13 5	106,959 0 6	134,976 12 11
46	Irrigation, Water-supply, and Drainage ..	140,000	283,733 10 0	119,252 10 1	164,480 19 11
47	Swamp Land Drainage	19,000	24,930 19 8	19,606 16 2	5,324 3 6
48	Settlement of Unemployed Workers ..	340,000	526,397 7 5	181,713 4 1	344,684 3 4
49	Native Land Settlement	375,000	1,166,103 10 3	672,408 2 7	493,695 7 8
	Unauthorized—				
	Services not provided for	..	571 10 8	496 16 6	74 14 2
	Totals, General Purposes Account ..	10,279,000	11,342,417 9 8	2,173,605 9 1	9,168,812 0 7
	Electric Supply Account—				
50	Development of Water-power	1,556,000	1,364,594 10 4	26,810 1 7	1,337,784 8 9
	Totals, Public Works Fund ..	11,835,000	12,707,012 0 0	2,200,415 10 8	10,506,596 9 4

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

J. W. SCOTT, A.R.A.N.Z.,
Chief Accountant.

J. WOOD,
Engineer-in-Chief and Under-Secretary.

The expenditure charged to the Public Works Fund has been examined and found correct subject to the remark that, as the Appropriation Act, 1938, made no provision for subdivisions in vote, "Public Buildings," the allocation of expenditure to the several subdivisions of that vote has not been checked.—J. H. FOWLER, Controller and Auditor-General.

APPENDIX B.

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

The Engineer-in-Chief to the Hon. the 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 financial year ended the 31st March, 1939.

RAILWAYS.

Table No. 3 (pages 8, 9, and 10) shows the expenditure on Government Railways in New Zealand up to 31st March, 1939, and also the mileage opened for traffic.

Dargaville Branch Railway.

The formation and ballasting of the section from Kirikopuni to Tangowahine, 0 m. to 10 m. 17 ch., has been completed. Some 5,600 cubic yards of ballast have been placed, and the section is now in good order. A goods and passenger service has been continued in operation by the Public Works Department.

Between Tangowahine, 10 m. 17 ch., and Te Wharau, 14 m. 56 ch. (at which point the new work commences) 5,580 cubic yards of ballast have been placed in first or second lifts. Private crossings have been installed.

On the new work commencing at 14 m. 56 ch. formation has been completed to 17 m. 35 ch., and from there to the junction with the existing Kaihu Railway at 18 m. 25 ch. earthworks are in hand. Designs for the new Dargaville Station Yard have now been completed by the Railways Department, and formation work will be begun shortly.

New fences have been erected on both sides between 15 m. 12 ch. and 18 m. 20 ch.

Culverts between 14 m. 56 ch. and 18 m. 25 ch. have been completed. A contract for the erection of the Awakino River Bridge at 15 m. 66 ch. has been let, and is due for completion in September next.

The number of employees has remained constant at slightly over one hundred. The largest cutting is being excavated by a powered excavator on a contract basis.

It is anticipated that rails will be laid to the Dargaville Station Yard, and a preliminary lift of ballast placed by March, 1940. The completion of the work, including station buildings, &c., may extend over a further twelve months.

Tauraroa Quarry.—The output of crushed metal for the year was 39,257 cubic yards, distributed as follows: Public Works Department, 19,254; Railways Department, 18,164; Local bodies, 811; Private purchasers, 1,027. The principal use is for metal for ballasting the unopened Dargaville Branch Railway and for reballasting working railways under the control of the Railways Department. Other uses are for the maintenance and reconstruction of State highways and for metalling settlement roads. The quarry continues to fulfil a most useful function as a convenient and economical source of crushed metal.

Paeroa–Pokeno Railway.

The work on this railway was continued during the year, and satisfactory progress has been made with the various details of construction, which is being carried out from the Paeroa and Pokeno ends respectively. The position is as described hereunder:—

Paeroa Section.—All permanent-line survey was completed from 8 m. to 19 m., thus completing the full length. Two trial lines were surveyed from 17 m. 27 ch. to 19 m. in connection with the permanent location.

Formation work was commenced at 0 m. 55 ch., the end of the Paeroa Station Yard, and completed to 7 m. 51 ch., with the exception of a gap of 40 chains at the Netherton Station Yard and a partially formed length from 2 m. to 2 m. 16 ch., being the west approach to the Waihou Bridge. Rapid progress has recently been made on the Hauraki Plains area. The earthwork in position now

totals 128,800 cubic yards, of which 30,000 cubic yards were placed the previous year. All culvert construction was completed for the above length. Two drag-line machines have been operated on earthwork, while the No. 1 Waihou Suction Dredge was utilized to pump sand into the Waihou Bridge approaches. A third drag-line is now to be placed on side drains in the peat area.

A further forty-five married workmen's quarters, with outbuildings, were erected at Pukahu, Kerepechi, Ngatea, and Mangatarata Camps, making a total of fifty-one, plus twenty-six single workmen's huts. The old Waihou River workshop building has been refitted for the railway works, and an annexe, 31 ft. by 41 ft., has been added. One carpenters' shop, 30 ft. by 20 ft., was erected.

Pokeno Section. Earthwork construction of this line commenced in August of last year, with one mechanical shovel, and since then the number of machines has increased to nine. Double-shift working was commenced last December, and to date a total of 321,000 cubic yards of material has been handled.

The total length of formation in hand is 10 miles, of which 4 miles are nearing completion as regards earthwork.

Of the 23 miles of original survey on this section it has been found necessary to make deviations on 20 miles. Of this length, 12 miles have been investigated, the new permanent line surveyed, and the plan work completed. The remaining 8 miles have been investigated, and the permanent-line survey is in hand. In the course of relocation the route has been shortened by approximately 2¼ miles.

An additional eighty married and fifty-six single workmen's quarters, together with a recreation hall, were completed during the year.

East Coast Main Trunk Railway: Extension to Opotiki.

It was intended that construction on the extension of the East Coast Main Trunk Railway from Taneatua to Opotiki should commence during the year, but owing to the fact that plant and service material from other railway-works were not available, and also because the survey was hardly sufficiently advanced, construction was postponed.

During the year survey-work was continued with a small party, insufficient staff being available for carrying on survey operations on a large scale.

Permanent pegging was completed from 100 m. 8 ch. to 103 m. 71 ch. Cross-sections were set out and cut to 103 m. 45 ch.

Permanent location and grading investigations have been completed to 105 m. 60 ch. Preliminary estimates are being compiled as the survey-work proceeds.

It is anticipated that construction will be commenced in the near future.

Napier Gisborne Railway.

At the beginning of the period, work on this railway was considerably handicapped by the cleaning-up of the line made necessary by the disastrous floods of February and April last year.

However, with the completion of flood-damage restoration, construction work returned to normal, and, aided by a fairly dry late summer and autumn, good progress has been made on all sections.

The Napier–Putorino Section was restored by the Railways Department, assisted where possible by this Department, sufficiently to carry traffic, and the goods service to Wairoa was resumed on 5th December, 1938.

The section between Putorino and Raupunga (13 miles in length) was completed and handed over to the Railways Department on 27th February, 1939, and at the end of the period the balance of this portion of the line as far as Waikokopu was practically ready for handing over also.

Particulars of the more important items of construction carried out during the year are as follows:—

Putorino Wairoa Section (Length, 33 m. 12 ch.).—Between Putorino and Te Kumi 20,000 cubic yards to 30,000 cubic yards of filling were replaced in washouts, and from 12,000 cubic yards to 15,000 cubic yards of slips were removed. General flood damage to formation, track, and fences was also repaired. Two hundred lin. feet of 48 in. diameter concrete pipes were laid to act as a covered side drain from above the north portal of the Mohaka Tunnel to a point clear of slip country.

Between Te Kumi and Wairoa, formation work consisted of fettling, a moderate amount of ballasting, cleaning up of cuttings, and the installation of a number of small culverts.

Work on bridges was confined to the placing of guard-rails on all bridges, and the lifting of the Wairoa end span of the Wairoa River Bridge to rectify settlement which developed in the earthquake of 1931.

During the period 3,646 cubic yards of ballast were placed.

Cart-docks and concrete buffer-stops were constructed at Waihua and Ohinepaka Station Yards.

Wairoa Station Yard.—An engine-shed, rail-car shed, engine-driver's room, latrine, and refreshment-room were completed. The station building was reconditioned and altered to suit the Railways Department's requirements, after transfer in May of this Department's office to a new building in Queen Street, Wairoa. The station platform was sealed, and cart-docks and platform gates and fences completed. A new water service was laid through the yard from the Wairoa Borough's main to the engine-sheds and the group of old permanent cottages. Installation of locomotive-watering standpipes is held over pending supply of the necessary equipment by the Railways Department. This supply used 1,800 ft. of 5 in. and 1,850 ft. of 4 in. bitumen-dipped steel pipe.

Tenders were called and contracts were let for the erection of thirteen cottages on a site purchased within the Wairoa Borough. Of these, six were completed and handed over to the Railways Department

and work on the balance was well advanced. Tenders were called for two more cottages, but no contracts had been let at the close of the period. A water-supply using 1,650 ft. of 4 in. bitumen-dipped steel pipe was laid to reticulate these cottages from the borough's mains for domestic and fire-fighting supplies.

Access roads to the cottage-sites were formed and metalled. Footpaths have yet to be formed, kerbs and channels laid, and roadway and footpaths sealed.

A contract was let for renovating the six existing cottages, and at the close of the period five of these were under the control of the Railways Department, although renovation was not in all cases complete.

Stock-yards were completed and concrete paving laid in the smaller and most-used pens.

A contract was let for the construction of a five-span overhead bridge with two step-over piers at Ohinepaka Station, and at the close of the period the bridge was completed except for a small section of hand-railing, and filling of the ramps was in hand.

Wairoa–Waikokopu Section (Length 24 m. 11 ch.).—Work on this section consisted chiefly of ballasting and fettling and general cleaning up of formation. Guard-rails were placed on all bridges, and the Nuhaka River Bridge at 17 m. 47 ch. was resleepered. At 9 m. 5 ch. a new 20 ft. plate-girder bridge on reinforced-concrete piled abutments was completed. A total of 4,759 cubic yards of ballast was placed.

A small shelter-shed was erected at Tuhara Station Yard, and at Whakaki Station Yard two cottages were erected.

At Nuhaka Station Yard stock-yards were completed and the loading-out pens paved with concrete. The whole of the platelaying in this yard was gone over and reconditioned.

The goods-service between Wairoa and Waikokopu was continued throughout the year.

Kopuawhara Section (Length, 11 m. 20 ch.).—On this section a total length of 40 ch. of permanent fencing was erected. It is not anticipated that any extensive work under this head will be undertaken until the coming summer.

The extremely wet winter that succeeded the April flood of last year caused slipping on formation and service road up to the beginning of October, and considerable extra work was entailed, more expecially on the roads.

A total of 122,500 cubic yards of material was removed, of which 40,000 cubic yards comprised the reforming and flattening of batters, more especially in the vicinity of the 24 m. peg, where considerable slipping of high cuttings occurred.

The necessary length of sea-walls, 213 ft., have been completed, the greater part of this, 178 ft., being at the south end of the Opoutama Stream Bridge at 24 m. 13 ch.

Waikokopu Stream Bridge at 23 m. 21 ch.—This bridge is well on the way to completion. Delay in the delivery of steel made it necessary to proceed with the construction of the embankment across the estuary before completing the bridge. Foundations at abutment A and piers B and C were not of a satisfactory nature, and pile-extensions were necessary, especially at pier B, where a length of 20 ft. was added to each pile. In span C–D the deck portion has been poured, and work is in hand building up the embankment adjacent to abutment E.

Opoutama Stream Bridge at 24 m. 13 ch.—This bridge, which was practically complete at the date of last year's report, was finished shortly thereafter, and the embankment across the estuary to the north was completed with spoil from the section between 23 m. 50 ch. and 24 m.

Kopuawhara Stream Bridge at 27 m. 47 ch.—Test bores having indicated the absence of the solid bottom reported by earlier drillers, considerable amendment to pile-length became necessary. The total length of piling driven was 2,113 linear feet, an increase of 548 ft., which was the aggregate of the pile-extensions. At date, pile-driving is complete, and all piers have been cast to underside of concrete girders. Reinforcing steel has been placed in the forms for the three 45 ft. spans.

It is anticipated that the bridge at 23 m. 21 ch. will be complete by the end of July and the Kopuawhara Stream Bridge by mid-August.

Detailed plans of foundations of the concrete-arch viaduct at 30 m. 15 ch. have recently been completed, and a commencement has been made with the pier and arch foundations; so far eight pier-foundations and the excavation for the northern arch abutment have been opened up. In all, 152½ ft. of shaft have been excavated. The surface spoil has been stripped from the southern hillside to facilitate excavation of abutment A and piers B, C, and D. It is anticipated that with prompt delivery of steel this bridge will be complete by October, 1940.

Final plans of bridges at 32 m. 1 ch. and 33 m. 27 ch. have not yet been completed. It is expected, however, that the construction of these bridges should be complete at approximately the same time.

The shortage of carpenters has had an adverse effect on the progress of all structures, and further tradesmen are required for proper progress.

The tunnel at 30 m. 9 ch., which was almost complete at date of last report, was shortly thereafter finished, the total length being 168 ft.

The bottom heading of the tunnel at 30 m. 52 ch. has only recently been opened up, a length of 60 ft. out of a total of 336 ft. being driven to date.

The bottom heading of the tunnel at 31 m. 40 ch. has been completed for a length of 384 ft. and a small top heading carried for the same distance, the party concentrating on breaking down and lining. This is complete for a distance of 144 ft.

A complete bottom heading for the whole length of 206 ft. has been driven in the tunnel at 32 m. 5 ch., and at date enlargement at the south portal is in progress, 50 ft. having been enlarged. Seventeen feet of wall and footing excavation were completed.

The tunnel at 33 m. 7 ch. (length, 6 chains) was completed in December last year. The party carrying out this job had been withdrawn after the February flood and had been engaged for the ensuing six months on service roads repairs, recommencing tunnelling operations in August.

Work at the south end of the long tunnel (Waiau Tikiwhata) has been carried on continuously since the last report, and a length of 1,400 ft. has been excavated and 937 ft. of full concrete lining has been placed. The nature of the ground driven through has in general been very good, but a length of broken water-bearing ground at 33 m. 60 ch. necessitated the immediate placing of concrete lining over a length of 231 ft. close to the face.

Arrangements have been made to increase the strength of this party by the addition of a concreting shift, and it is expected that this will considerably increase the progress of this work and enable the tunnel to be completed during the early summer of 1940, which will fit in with the platelaying and bridge programmes.

The Waikokopu Station Yard has been relaid in new 70 lb. track, and ballasting has recently been completed in preparation for handing over to the Railways Department.

Preparation for an early start on platelaying beyond Waikokopu has been made, and all the crossing and loop materials for Opoutama Station Yard at 25 m. 70 ch. have been cut and assembled.

It is expected that, by the end of 1939, track will have been laid to between 28 m. and 29 m., and to the south end of the viaduct at 30 m. 15 ch. early in 1940. It will be then possible to complete the track-laying for Opoutama Station Yard.

As indicated earlier in this report, continuous work by large gangs of men was required up to early October to reform and maintain service and other roads. The dry summer helped matters considerably, as far as the service roads were concerned, but even so it has been a difficult matter to keep them in good enough order for the heavy traffic they have to carry.

Wharerata Section (length, 19 m. 17·75 ch.).—The bulk of the work on this section during the year consisted of tunnelling, there being three major and four minor tunnels in course of construction.

Earthwork is in the last stage of completion, only one cutting and two large fillings remaining. A considerable number of large slips have been removed. These were the result of floods followed by an exceptionally wet winter, and it is not anticipated that much further slipping will occur.

Except for a number of small culverts between 19 m. and 20 m. 36 ch., which can be constructed more economically when better access is provided by the completion of the tunnels, culverting is completed. Ninety-three feet of 12 in.- and 18-in.-diameter culverts were constructed during the year.

A number of completed water-drives were badly silted up during the floods. These were cleaned out, and in the case of two unlined drives at 18 m. 40 ch. and 18 m. 50 ch. lining with concrete was considered advisable. The length involved was 555 ft., and lining is completed.

In the Waikoura Valley, 14 m. to 17 m. 50 ch., formation is completed except for the approach fillings to bridges. From 16 m. 5 ch. to 16 m. 75 ch. the embankment was formed with spoil from the Waikoura Tunnel at 17 m. 51 ch.

At 18 m. 67 ch. and 19 m. 51 ch. two large slips, estimated at 8,000 cubic yards and 10,000 cubic yards respectively, obliterated the completed formation. Both were successfully removed by Diesel shovels, but further signs of slipping are evident at 18 m. 67 ch.

At 20 m. 27 ch., as the result of the blocking of a water-drive by a large slip during the floods, a partially completed filling, 92 ft. deep, was washed out, the loss being estimated at 12,000 cubic yards. To reduce the total quantity of filling required (60,000 cubic yards) a minor deviation of the railway was adopted.

In addition, a Diesel shovel borrowed some 19,200 cubic yards from a bluff nearby. This filling is now three-fifths completed, the balance of the material required being available from the coast tunnel.

In the Tikiwhata Valley, at 35 m. 73 ch., the last big rock-cutting on the section is nearing completion, spoil being used for the 105 ft. filling at 35 m. 62 ch. This filling, containing some 70,000 cubic yards, is now three-quarters completed and provides a useful dump for spoil from the Waiau Tikiwhata tunnel.

Between 35 m. 70 ch. and 35 m. 76 ch., 356 ft. of retaining-wall is necessary. This will not be constructed until materials can be conveyed across the filling at 35 m. 62 ch.

The material excavated on the section during the year, including slips and borrow, amounted to 60,798 cubic yards. Completed earthwork now amounts to 531,048 cubic yards, or 97 per cent. of the whole quantity.

Two reinforced-concrete highway bridges, each of three 45 ft. spans, have been completed over the Maraetaha River at 14 m. 70 ch. and 15 m. 15 ch. These bridges eliminate three railway-crossings and greatly improve the road-alignment. The construction of railway bridges at 14 m. 53 ch. and 14 m. 71 ch. has been started.

The Waikoura Tunnel (length, 1,730 ft.) was successfully pierced on 12th May, 1939, the error in alignment being 1 in., and in the level three-quarters of an inch. The tunnel is curved at each end. Progress was not quite as rapid as expected, and averaged 60 ft. of completed tunnel, including lining, per week. The ground, though generally good, was variable, and minor falls to some extent delayed progress. In the course of excavation small natural gas-vents were encountered at two or three points. The gas was tested and proved to be 96 per cent. methane. The volume was insufficient to cause any danger. 350 ft. of lining has yet to be completed, the work being carried out from the north end only.

At the start of the year the bottom heading of the Coast Tunnel (length, 3,074 ft.) had been completed, and preparations made for enlarging and lining from the south end. A length of 386 ft.,

including lining, was completed from this end, and in November the party was transferred to the north end, where some 6 chains of unstable ground required immediate attention. The tunnel here skirts the hillside on a curve, and for 405 ft. excavation was in pug, rubble, and clay. Extra-heavy concrete lining 18 in. in thickness was necessary, materials being brought through the bottom heading from the south portal. All the bad ground at the north end has now been lined, and work is once more proceeding from the south end. The excavation completed, including the bottom heading, is 49 per cent. of the total length, and 801 ft., or 26 per cent., of lining has been finished.

The tunnel at 20 m. 10 ch. (length, 393 ft.) was completed in April, and, although short, proved difficult to construct, the ground being very heavy. One bad run in the roof occurred, going right to the surface, 80 ft. above formation-level. The party were very fortunate and escaped with minor injuries to one man.

Over a length of 134 ft. at the north end it was necessary to construct concrete foundations under the main sill-props to enable excavation to proceed.

Progress at the north end of the Waiau–Tikiwhata tunnel (length, 9,802 ft.) has been steady but not spectacular. Difficulty of access to the portal and the very restricted working-space available have mitigated against the rapid handling of concreting and other materials. 2,130 ft. of excavation or 21·7 per cent. of the total length, has been completed, and 1,706 ft. of tunnel lined with concrete, equal to 17·4 per cent. To expedite progress a separate party will be employed on the concrete lining when men are available from the Waikoura Tunnel. It was originally estimated that this tunnel would be completed in October, 1940, but it is now probable that it will not be completed before the end of 1940.

The excavation of the three short tunnels in the Tikiwhata Valley at 35 m. 40 ch., 46 ch., and 58 ch. is well advanced, 510 ft. out of a total of 980 ft. being completed.

The machine-shop has been fully occupied during the year, but has been handicapped through the difficulty in obtaining trained fitters.

At the Wharerata Station Yard, 14 m. 40 ch., the goods-shed was erected to provide additional storage for cement during construction.

Gisborne Section (length, 14 m. 7·35 ch.).—Work on this section is well advanced, such earthwork as remains depending largely on the completion of bridges. A special effort was made during the latter half of the year to accelerate bridge-construction, the weather conditions being very favourable for foundation work.

Earthwork was completed to 12 m. 60 ch., and between 12 m. 60 ch. and 14 m. some 15 chains have been left to provide material for bridge-approach fillings. The total quantity removed amounts to 167,577 cubic yards.

The deviation from 13 m. 60 ch. to 14 m. 10 ch. necessitated by the flood of February, 1938, is partly completed, and a Diesel excavator will be available for this work shortly.

At 10 m. 33 ch. the diversion of the Wairekaia Stream, 9 chains long, was completed, and the stream diverted under the new highway bridge. Spoil from the diversion was used for the approach fillings to the overbridge at 10 m. 49 ch.

Ninety-four chains of fencing were erected during the year, leaving 150 chains to complete the fencing of the reserve on this section.

Two hundred and sixty feet of culvert, ranging from 18 in. pipe to 5 ft. by 5 ft. reinforced box, were constructed. Three additional small-pipe culverts at present in hand will complete the culverting on the section.

The sixteen bridges on this section total 2,230 ft. Eleven, totalling 1,405 ft., have been completed, while the construction of the remaining five is well advanced.

The Waipaoa Bridge at 5 m. 4 ch., consisting of nine 60 ft. and six 30 ft. steel spans on concrete piers, was completed early in the year.

At 5 m. 67 ch. three 25 ft. steel spans were erected over the Wherowhero Stream.

At 6 m. 55 ch. a single 25 ft.-span bridge was completed.

At 7 m. 50 ch. across the Pakowhai Stream, three 25 ft. spans are in position. The outlet to this stream is into a large swamp bordering the sea. An improved outlet channel some 40 chains long was excavated by Diesel drag-line to a tidal inlet, greatly improving the drainage of the railway in the vicinity.

At 9 m. 43 ch. concrete abutments for a single 25 ft. span were completed, and temporary decking fitted to carry the track pending the arrival of the steel span.

At 10 m. 34 ch. a bridge consisting of four 25 ft. spans was erected across the new diversion channel of the Wairekaia Stream.

At 11 m. 27 ch. the six concrete piers for the Maractaha Stream No. 1 Bridge, 180 ft. long, were completed, and await the arrival of the steel girders.

At 12 m. 23 ch. Maractaha No. 2 Bridge—three 60 ft. spans—all piles have been driven, and the mass foundation for the south abutment poured.

At 12 m. 60 ch. Maractaha No. 3 Bridge—one 60 ft. and three 30 ft. spans—pier B was completed, and pier C is in hand.

At 13 m. 26 ch. Maractaha No. 4 Bridge—two 60 ft. and three 45 ft. spans—mass concrete foundations for all piers were constructed during the low-water period.

At 13 m. 76 ch. Mangakotukutuku Bridge—two 60 ft. and one 40 ft. spans—abutment A and pier B were completed, and pier C and abutment D are under construction.

In addition to the above railway-bridges a highway bridge of three 45 ft. spans across the Wairekaia Diversion Cut at 10 m. 36 ch. was finished in time for the Christmas holiday traffic. At 10 m. 49 ch. an overbridge, consisting of four 45 ft. reinforced-concrete spans, was completed and eliminates a level-crossing for the main highway.

The permanent track was laid to 11 m. 25 ch. The first lift of ballast was completed to 10 m. 10 ch., and the second lift to 8 m. 8 ch.

At Muriwai Station Yard all sidings have been laid, and the ballasting of the yard is practically completed. The goods-shed has been built, and is in use for the storage of construction materials.

It is anticipated that during the coming year there will be no difficulty in completing work on this section of the railway.

Turakina Okoia Railway Deviation.

This deviation, which is 10 miles 20 chains long, was commenced early in 1937, and at the date of my last report good progress had been made with the formation and 46 chains of tunnelling had been completed. The principal features of this line were the construction of the Fordell Tunnel, 72 chains in length, the Turakina Tunnel, 104 chains in length, and the building of the Wangaehu and Turakina Bridges.

During the period almost the whole of the outside formation has been completed, 675 chains being now ready, of which 355 chains were built during the year.

The Fordell Tunnel has been completed and lined, and at Turakina 41·25 chains of tunnel have been completed, which with the work carried out in the previous period amounts to a total of 58·25 chains, leaving 45·75 chains yet to do. There is also a small tunnel approximately 3 chains in length at the 5 m., and this will be finished in about two weeks' time.

These two tunnels are being driven through a class of country which is not commonly experienced on railway-work, and a working technique has had to be developed to suit it. That this has been done successfully is evidenced by the excellent progress made.

Test piles have been driven at the Wangaehu and Turakina Bridges, and the erection of a temporary staging is in hand at the former preparatory to making a start with the regular pile-driving.

The fencing of the railway boundaries and the provision of gates at private crossings are well in hand.

Ten chains of road in the Matarawa Valley have been formed and metalled, and this road now gives direct access from Okoia to Fordell, while the deviation of the Ruatangata Road with a temporary level crossing is well under way.

The formation of Wangaehu and Fordell Station yards has been completed, and the latter has been trimmed and is now ready for the laying of the tracks.

Good progress with all works has been made during the year, and over the majority of the period favourable weather conditions enabled those on outdoor labour to benefit by increased output.

The plant depot and repair-shop has had a busy time keeping the construction plant in repair, as well as making and fabricating a considerable quantity of special work.

The average number of men employed on the works was 286.

Palmerston North Railway Deviation.

This deviation is being constructed mainly on account of the fact that the existing goods and passenger yards in Palmerston North were too small for economical and safe working, and it therefore became necessary to shift the main station and yards to the outskirts of the town.

A route was selected leaving the existing main line at Longburn, thence in a northerly direction to a point opposite the western boundary of the City of Palmerston North, then running parallel to the north-western boundary of the city and joining on to the main line again near Kelvin Grove, a total distance of 7 miles 18 chains.

In addition to the main deviation, a secondary deviation was necessary to connect the new line with the Napier line at Whakarongo, the length of deviation being 2 miles 11 chains. Ample provision has been made for the new goods and passenger yards, and the proposals also include the elimination of all railway level crossings, which have been such a source of serious accident in the past.

This work was originally commenced in 1926, but was closed down in 1929 as the then Government considered the work was not sufficiently urgent to be undertaken at that time. The work was recommenced in June, 1938, and has been progressing steadily.

The total quantity of excavation in the original proposals was approximately 1,000,000 yards, and of this approximately half had been completed when the work was closed down in 1929. The excavation completed since work was recommenced, all of which has come from the goods-yard cutting, amounts to 86,276 cubic yards. This material has been used almost entirely for filling in the goods-yard.

Some of the excavation work has been carried out by manual labour, but mostly by modern machinery. The material has been transported almost entirely by lorries, which method has proved very satisfactory to date. It is anticipated, however, that during the coming year, with the longer leads and more unsuitable material, a considerable amount of the spoil will have to be moved by rail.

Since the work was commenced the Railways Department have substantially amended the layout of the goods-yard, with the result that the excavation quantities have been considerably increased. The total quantity yet to be excavated is approximately 380,000 cubic yards, including work on the Whakarongo Deviation. Of this amount, approximately 290,000 cubic yards will probably be required for overbridge ramps and 50,000 cubic yards will be required to complete necessary fillings, leaving a probable balance of about 40,000 cubic yards.

A total of 6,890 cubic yards of metal have been excavated for metalling service tracks for lorries on the main goods-yard excavations, forming temporary roadways where required, and metalling road-crossings.

The original formation work between Longburn and Palmerston North, which had been completed previously, was trimmed right through for one track to Rangitikei Line, to enable the platelaying work to be commenced over a distance of 4 miles 33 chains. The formation of the second track was trimmed for a distance of 2 miles 10 chains, and this work is proceeding. Trimming-work has been carried out mostly by means of graders, angle-dozers, and carryall scrapers. The yard at Longburn has also been trimmed up in readiness for platelaying, and the trimming of the Palmerston North passenger-yard is about 50 per cent. complete.

A total of 4 miles 35 chains of 85 lb. rails was laid from Longburn to Rangitikei Line. The ballasting has been completed for the full three lifts for approximately two-thirds of this distance and two lifts for the balance.

Two small steel 14 ft. span bridges were completed at 84 miles 59 chains and 86 miles 24 chains on the Palmerston North Longburn section. The abutments for these bridges had been completed previously.

All the temporary piles for the Mangaone Stream Bridge, which consists of five 20 ft. spans, to carry five lines of track, were driven during the period. A total of seventy-seven 16 in. octagonal reinforced-concrete piles were cast and sixteen piles had been driven at the end of March, the bearing being quite satisfactory. A temporary bridge was also completed at the side of the permanent bridge in order to enable the track to be laid across so that the platelaying work would not be held up. Most of the steel for this bridge was in hand, and a commencement had been made with the bending of same.

A commencement has been made with the excavation of the Kawhau Drain Culvert, which is 750 ft. in length with an 18 ft. clear span. Some of the steel has also come to hand, and 4 tons had been bent at the end of March. All the small culverts on the main deviation had been completely previously.

A total of 63 chains of new fencing was completed on this deviation, and all that remains to be done now are minor adjustments to fences at the sites of all overbridges.

The whole of the drains, which had been cut previously, were cleaned out and trimmed up during the year, some of these being in a very bad state.

Whakarongo Deviation.—No work had previously been carried out on this deviation. The clearing of trees, fences, &c., has been completed throughout. The fencing on both sides has also been completed, a total of 471 chains, concrete posts being used. All the small culverts have been placed, and a large 6 ft. by 5 ft. reinforced culvert at 0 miles 25 chains was also completed. Batter drains have also been cut over the full length of cuttings.

A total of 3,854 cubic yards of clay was excavated by means of carryall scraper on the section from 0 m. 63 ch. to 2 m. 10 ch. This work has since had to be discontinued, partly owing to wet weather and partly due to the fact that the machine was required on the main Palmerston North Deviation.

Both deviations have been completely resurveyed and cross-sectioned and fresh quantities taken out and plans prepared where necessary. Site plans for overbridges have also been prepared for six of the existing level crossings, but to date final plans have not been completed and no work has been carried out. A commencement has been made with the construction of the Longburn Overbridge, which fits in with the new deviation, but this work is being carried out under the control of the Main Highways Board. No plans have yet been finalized for any of the station buildings, goods-sheds, engine-sheds, &c.

Plimmerton–Paekakariki Railway Duplication.

The duplication of the railway between Plimmerton and Paekakariki was commenced approximately three years ago as portion of a scheme to duplicate the whole main line between Wellington and Palmerston North.

This section of line carries very heavy traffic to the capital city. The principal bottle neck causing congestion of trains is that between Plimmerton and Paekakariki, where the line rises from either point to Pukerua Bay.

Under the present arrangements trains gather at Plimmerton on the north run and at Paekakariki for south-bound traffic. The duplication will permit several trains to be on this length at once, thereby relieving time-table restrictions.

Plimmerton to Pukerua Bay Section.—The ruling gradient is approximately 1 in 66, and formerly there were numerous curves of 12 chain radius. When duplication was being carried out opportunity was taken to improve the alignment, and the minimum curvature is now 16 chains and the overall running-speed between Plimmerton and Pukerua Bay increased to 45 miles per hour.

Along this length heavy earthwork was involved. The principal point of engineering interest is probably the effective manner in which the drainage of the very wet cutting near Pukerua Bay has been dealt with by subsoil drainage. It is strange that the highest point of the line should be the wettest and cause most trouble.

The Railways Department has been faced with expensive maintenance over a long period, but the new system appears to have drained the road-bed most effectively.

The excavation has been carried out almost entirely by returned soldiers, and the progress made is largely attributable to their excellent work.

Pukerua Bay to Paekakariki Section.—From Pukerua Bay towards Paekakariki the line is duplicated by paralleling the existing formation on the east side to within a short distance of the first tunnel (No. 8). The double line here merges into a single track through a high-speed turnout and continues as a single line to the north end of No. 13 Tunnel. From here to Paekakariki a single line branches through another high-speed turnout and continues as a double track to Paekakariki Station. Extremely heavy excavation was encountered along this section.

During the year 605 lineal feet of culverts were placed and approximately 149,000 cubic yards of excavation and 20 chains 70 links of fencing carried out. The average number of men employed was 110.

South Island Main Trunk Railway, North End.

Clarence Section (56 m. 6 ch. to 76 m. 13 ch. = 20 m. 7 ch.).—With the exception of 30 chains at the Blue Slip, formation work on this section is completed. The earthwork done during the year has been practically confined to formation of station-yards at Kekerangu, Parikawa, and Clarence

Bridge, and formation of approaches to overbridges at 63 m. 5 ch. and 64 m. 65 ch. Formation of station-yards has been completed, involving nearly 50,000 cubic yards of earthwork, and approximately 100,000 cubic yards have been placed in the approaches to the two overbridges. The completion of these approaches has been held up pending construction of the overhead bridges, but it is hoped that these will be completed during the coming year.

In December, 1938, the Blue Slip commenced to move again at the north end, where it had previously appeared that the country was more or less stable. It is estimated that upwards of 200,000 cubic yards of material will have to be removed to render this portion of the slip stable. One Diesel shovel has been employed cutting back the face since early in the present year and another shovel is being transferred from Wellington in order to speed up the work.

A plan has been prepared of a comprehensive system of drainage covering the whole face of the slip, and as soon as weather permits this aspect of the work will be vigorously proceeded with. Provided no further large movements occur, it is expected to complete the work at the Blue Slip within twelve months.

During the year under review a total of 24,000 cubic yards of slip material has been removed and dumped into the sea, Diesel shovels and locomotives and a tractor and carryall scoop having been employed for the purpose.

Girders for all of the seven railway-bridges on this section, totalling 900 lineal feet in length, have been assembled, riveted, and placed in position. All girders have been painted, and the permanent rails and sleepers laid.

The overhead bridge at 64 m. 65 ch. is nearly completed, about six weeks' work being necessary to complete.

Three large and several small culverts in station-yards have been extended during the year.

With the exception of several short gaps, permanent fencing has been completed during the year from 61 m. 16 ch. to 76 m. 13 ch., the total length of fence erected being 13 miles 14 chains.

Telephone-line has been completed from 60 m. 40 ch. to 76 m. 13 ch., and the old line from 56 m. 6 ch. to 60 m. 40 ch. has been rebuilt to bring it up to present-day standards.

Platelaying on the main line, including bridges, has been completed, and platelaying of loops and dead-ends in Kekerangu Station yard has also been completed. It is expected that the work required to complete platelaying on Clarence Section—viz., Parikawa and Clarence Bridge Station yards—will be finalized in three months' time.

Ballasting, main line only, has been completed from 67 m. 40 ch. to 76 m. 13 ch., with the exception of boxing-up, which it is proposed to do immediately before handing the section over to the Railways Department. From 56 m. 6 ch. to 67 m. 40 ch. the line has been adequately maintained.

Marram-grass planting to check drifting sand has been practically completed, and bare patches in areas previously planted have been replanted. A good deal of maintenance planting will be necessary for some time to come in order to preserve the areas already planted.

Kaikoura Section (76 m. 13 ch. to 104 m. 54 ch.—28 m. 41 ch.).—Formation work is approaching completion from 76 m. 13 ch. to 93 m. 20 ch. and is in hand from 93 m. 20 ch. to 99 m. A total of 130,000 cubic yards has been shifted during the year.

Approaches to the Clarence River Bridge are well in hand, 55,000 cubic yards, out of a total of 80,000 cubic yards, having been placed during the year.

Ten chains of masonry-rubble walls have been erected at the toes of unstable batters.

Twenty-five thousand cubic yards of rock have been placed to protect the seaward batters from the effects of pounding by heavy seas, but it will be necessary to place approximately as much again to give adequate protection.

Tunnelling has proceeded satisfactorily, and this is being carried out expeditiously and cheaply by means of the plant provided, which includes compressed-air drills, large fans, scrapers for loading the spoil into trucks, concrete guns and steel profiling to help in placing the concrete lining, and Diesel locomotives for transporting materials. Progress has been retarded for some distance in from all portals owing to the difficult nature of the country, which has consisted of loose rubble and boulders. During the period under review work has proceeded on four tunnels, a total length of 1,934 lineal feet, together with eight portals, having been completed.

This brings the total length of tunnelling on this section to 3,810 lineal feet, and all portals have now been completed.

It is expected that all tunnelling operations on this section will be completed before the end of the present year.

The substructure of the Clarence River Bridge was completed during the latter part of 1938, but completion of the superstructure is being delayed on account of the difficulty in obtaining the necessary steel for the 122 ft. truss spans. The bridge has a total length of 1,524 ft. overall, and consists of two 30 ft. end spans and twelve 122 ft. steel truss spans carried on reinforced-concrete cylinder piers and piled abutments. Up to the present it has been possible for the Railways Workshops to deliver one only of the main truss spans.

The erection of the steelwork is being undertaken by the Department, and work on the construction of the necessary staging and falsework is proceeding satisfactorily.

Gabion protective work at the bridge abutments has been completed, and the construction of several large regulating groynes on the south bank is well in hand.

Mororimu Stream Bridge, 60 lineal feet, and Black Millar Bridge, 40 lineal feet, both in reinforced concrete, have been completed, together with approaches and protective works. A start has been made with the construction of Ohau Stream Bridge, 60 lineal feet, in reinforced concrete.

Work on the Hapuku River Bridge is in hand under contract, a start being made in April last. This bridge consists of twenty-three reinforced concrete arch spans, each 67 ft. long, earth-filled, and carried on concrete piers and abutment sunk through the river shingle in timbered excavations and countersunk by hand into the underlying conglomerate,

Steady progress has been made with culverts, a total length of 875 feet, varying in size from 12 in. to 6 ft. having been completed during the year.

A start has been made with the permanent fencing of this section, 104 chains having been erected during the year at various places in order to exclude stock from the construction works.

Seven miles of permanent telephone-line have been erected, and this work will be carried on to completion during the next twelve months.

A crushing and screening plant with a capacity of 50 cubic yards per day was erected early this year to obtain concrete aggregates for use in tunnels, bridges, and culverts, and is in full working-order.

Survey was completed from 97 m. 48 ch. to 104 m. 54 ch., including foundation tests at all bridge-sites.

Owing to the progress of the work, a large amount of camp-shifting has been necessary, the Shades Camp having been shifted to Clarence Bridge, and portion of Aniseed Camp to Kaikoura. A new two-roomed school has been erected at Aniseed to replace the one lost by fire in February last. A large amount of repair work has been rendered necessary to make good damage caused by two wind-storms, in August of last year and February of this year, respectively.

The average number of men employed on the works during the last twelve months has been approximately 360.

South Island Main Trunk Railway, South End.

(44 m. to 73 m. 40 ch. : Length, 29 m. 40 ch.)

Since my last report very substantial progress has been made on this end of the line ; the majority of the formation work suitable for hand methods has been completed, and the construction of bridges, the completion of tunnelling, and the protection of the formation, by means of heavy stone sea-walls where the line infringes on the coast-line and crosses small embayments, constitute, apart from platelaying and ballasting, the major portion of the work yet to do.

Wherever possible, men have been drafted from ordinary formation work to tunnelling, mechanized work, and skilled jobs.

Tunnelling parties have been increased, as men and machinery became available, from four last June to eleven at present ; five of these parties in the shorter tunnels are working by hand methods, and the remainder have been wholly or partly mechanized. During the period the work at the south end of this railway naturally fell into two phases—firstly, the completion of all works from Parnassus at 44 m. to Hundalee Station at 55 m. 60 ch. in order that this section might be opened for traffic as early as possible, and, secondly, the vigorous prosecution of the tunnels, of which there are fifteen, between Hundalee and the Kahautara River at 73 m. 40 ch., together with the building of sea-walls and bridges.

By concentrating bridge and machine gangs on the Parnassus Hundalee portion the railhead was pushed forward from south of the Ferniehurst Station yard to Hundalee, 11½ miles from Parnassus, and this point is now being used as the railhead for supplies of material to this end of the railway-works, thus enabling further concentration of headquarters at Oaro by shifting the store and workshops to that point.

The Conway River Bridge at 50 m. 50 ch. was completed with the placing of the sixteen 45 ft. plate girders, and the reinforced-concrete bridges over Mick's Creek at 53 m. 40 ch. and Open Creek at 54 m. were erected. The subway crossing the railway over the Christchurch Kaikoura Main Highway at 55 m. 47 ch. was finished by the end of the year, completing the formation to the Hundalee Station. During this time trimming and platelaying was following the formation, and the access road and 35 ft. reinforced-concrete bridge to the Ferniehurst Station yard were completed.

At the Ferniehurst Station, the station goods-shed and stock-yards have been erected, the water-supply completed and the sidings laid and ballasted.

The Hundalee Station yard is well in hand, the majority of the sidings and ballasting being completed. The station platform and temporary stock-yards (an extension of the permanent yards for use while this station is the railhead) are built and the permanent stock-yards are well in hand.

The progress thus made enabled stock-trains to be run during the latter portion of the period between Parnassus and Hundalee.

On the section between Hundalee and Kahautara, the driving of No. 1 tunnel at 60 m. 75 ch. has been done and only awaits the excavation of the portal to complete the tunnel. Earthworks are complete from here through No. 2 tunnel to about 61 m. 40 ch., where heavy sideling to the Okarahia Bridge at 61 m. 60 ch. is in hand. The pile-driving for this latter bridge of nine 45 ft. spans, some 75 ft. above ground-level, is now in hand.

On the southern end of the Amuri Bluff tunnel, conditions were particularly difficult owing to the very unstable nature of the valley-floor and the slides which took place at the approaches to the portals. Men and machines were therefore concentrated on this locality in order to get under cover before winter. By adopting cut-and-cover methods and by excavating 20,000 cubic yards with shovel, drag-line, and bulldozer, 4½ chains of heavily-reinforced tunnel barrel was built in the open, and this enabled the work to be proceeded with in safety after the weather broke.

At the northern end of the tunnel 1,080 ft. have been driven and lined. This tunnel, which is the longest on the job, has, of course, been completely mechanized.

The material through which the tunnel has been driven, particularly at the northern end, is very liable to swell, with consequent heavy pressures, and the lining has had to be strengthened very considerably to meet the difficult conditions. No. 5 tunnel at 64 m. 47 ch. is in hand and 51 ft. have been completed.

Slow progress through clayey country at the southern end of No. 6 tunnel at 67 m. 64 ch. was made at the start, but has since improved, and to date 468 ft. have been completed. No. 7 tunnel at 70 m. 1 ch. is well forward, 246 ft. being completed, as is No. 8 tunnel, where 243 ft. have been done. The four last-mentioned tunnels are being worked by bottom heading and hand methods, as their short length hardly justifies their economical mechanization. Nos. 11 and 12 tunnels are partially mechanized and are being lined from a central concrete-mixing plant between the two. Of the former, 210 ft., and of the latter, 23 ft. have been lined, while 197 ft. have been opened out, but not lined. Parties are working at both ends of No. 13 tunnel and have lined 38 ft. No. 14 tunnel, 376 ft. long, has been enlarged and lined during the year, with the exception of 15 ft. and the northern portal.

No. 15 tunnel at 72 m. 50 ch. has been completely mechanized throughout, and 600 ft. have been lined.

At Goose Bay, the one suitable place in the vicinity, 23,000 cubic yards of stone were quarried for the stone protection of the highway, and although a large quantity of rubble has had to be handled some of this has been profitably used on road and railway embankments.

The Claverley Subway at 59 m. 63 ch., two 40 ft. reinforced-concrete spans, has been completed, and with the erection of the Limestone Creek Bridge at 57 m. 70 ch. now in hand, formation will be completed to the Stockyard Creek Bridge at 60 m. 66 ch.

Generally speaking, the outstanding feature of the year on the Oaro Section has been the organizing of the various tunnelling parties and the provision and layout of the necessary plant and machinery to enable the work to be carried out expeditiously.

In the early part of the year there was a shortage of experienced tunnellers, but this has been made good partly by the transfer of men from other places and partly by the training of men who, though inexperienced last year, have developed into more useful tradesmen.

The rate of progress is increasing monthly and should now keep in step with the rest of the other operations, so that the work generally can be finished to schedule.

With the virtual completion of the Parnassus–Hundalee Section it was necessary to shift the machine-shop, stores, and general transport headquarters from Parnassus to Oaro. This was quite a large undertaking, but is now completed.

The average number of men employed during the period was 472.

Westport–Inangahua Railway.

Cascade Section (5 m. 70 ch. to 8 m. 78 ch.; length, 3 m. 8 ch.).—This section has been maintained during the year. A daily works train was run between Westport and Cascade Creek for the purpose of transporting men, and 18,740 tons of coal were transported from the Cascade Coal Co.'s bins to Westport.

A 5 ft. by 5 ft. reinforced-concrete culvert was constructed at 6 m. 55 ch., where a washout occurred.

Cascade–Inangahua Junction Section (8 m. 78 ch. to 23 m. 62 ch. (Westport chainage) and 58 m. 30 ch. to 62 m. (Stillwater chainage); length, 18 m. 34 ch.).—The average number of men employed throughout the year has been 263, with a maximum of 290, and at present 240 men are employed.

The work on this section has progressed as fast as conditions permitted, bridge-construction being the governing factor. The heavy rainfall, 211·5 in. per annum, has also increased the difficulties, but in spite of the natural difficulties satisfactory progress has been made.

The bridge-building programme was rendered difficult to adhere to on account of the unprecedented demand for skilled tradesmen for work in the main centres of population, which prevented the Department from securing this type of labour at the usual award rates.

This shortage was successfully overcome by employing semi-skilled workers on co-operative contract for bridge-building and letting private contracts for the construction of culverts.

Modern plant has been used as much as possible on formation work, but its use is considerably restricted owing to the wet conditions caused by the very high rainfall which necessitated the plant being laid up or transferred to other work during the adverse operating period.

Formation: The formation work, which is nearing completion, was considerably advanced during the year, the principal features being the removal of a 50,000-cubic-yard slip near Slaty Creek, the formation of a 65,000-cubic-yard bank at 20 m. to 20 m. 22 ch., and the approach to the Buller River Bridge at 63 m. 30 ch. Except for a 40,000-cubic-yard bank between 21 m. 61 ch. and 22 m., the only uncompleted formation is a length between 60 m. 30 ch. and 62 m., and this work is in hand.

Tunnels: The whole of the tunnels are now completed, the two remaining tunnels at 13 m. 26 ch., and 13 m. 42 chs., of lengths of 180 ft. and 851 ft. respectively, being completed during the year.

Bridges: The distinct feature of this railway is the large number of bridges required, there being twelve bridges with a total length of 3,603 ft., or 55 chains, on the 18½ mile section.

Of this length, 1,885 ft. are completed, 1,227 ft under construction, and it is anticipated that all except 275 ft. will be finished by the end of the current year.

The details of the bridges are as follows:—

Cascade Creek Bridge (9 m. 3 ch.): Five 80 ft. and one 40 ft. steel-plate-girder spans on reinforced-concrete piers. Completed.

Bridge at 10 m. 24 ch.: Three 30 ft. steel-plate-girder spans on mass-concrete piers and 82 ft. of mass-concrete retaining-wall. Piers of retaining-wall completed, girders being fabricated.

Redmond Creek Bridge (11 m. 41 ch.): One 85 ft. reinforced-concrete-arch span, three 40 ft. reinforced-concrete-girder spans on reinforced-concrete piers and foundations. Completed.

Stable Creek Bridge (15 m. 51 ch.): Ten 40 ft. and one 20 ft. reinforced-concrete-girder spans on reinforced-concrete piers and abutments. Eight piers and three spans are completed.

Newman Creek Bridge (15 m. 60 ch.): Eight 40 ft. and one 20 ft. reinforced-concrete-girder spans on reinforced-concrete piers and abutments. In hand; four piers completed.

Slaty Creek Bridge (16 m. 55 ch.): Foundations being tested.

Tracy Creek Bridge (19 m. 32 ch.): Foundations being tested.

Orikaka River Bridge (21 m. 58 ch.): Three 100 ft. steel-plate-girder spans on concrete piers founded on cylinders. In hand: plant and materials being received and temporary trestle being erected.

Welshman Creek Bridge (61 m. 70 ch.): One 100 ft. and two 25 ft. steel-plate-girder spans on concrete piers and abutments. Design completed; work being started.

Bridge at 61 m. 13 ch.: One 30 ft. steel-plate-girder span. Design completed; girders received.

Buller River Bridge (60 m. 20 ch.): Six 100 ft., one 45 ft., and one 30 ft. steel-plate-girder spans on concrete piers founded on cylinders. Completed.

Inangahua River Bridge (59 m. 20 ch.): Nine 60 ft. steel-plate-girder spans on concrete piers. Completed.

Culverts and Water-drives: Six reinforced-concrete culverts ranging in size from 2 ft. by 2 ft. to 9 ft. by 9 ft., having an aggregate length of 168 ft., were completed, and two more having a total length of 90 ft. are in hand.

Pipe culverts varying in diameter from 1 ft. to 3 ft. and having an aggregate length of 210 ft. were completed.

Concrete-lined water-drives 7 ft. by 8 ft. 6 in. by 142 ft. long and 4 ft. by 6 ft. by 106 ft. long have been completed.

Platelaying: The platelaying material for this section is on hand, and tenders will shortly be called for platelaying.

Fencing: Two miles of fencing have been completed.

IRRIGATION.

CENTRAL OTAGO.

Operation and Maintenance of Irrigation Schemes.

No new construction works were put in hand during the past year, and construction work was confined to the completion of the Manuherikia Diversion Tunnel. This tunnel is 78 chains long, and was completed and put into service last September. The work done during the year consisted of lining 180 ft. of tunnel and the dismantling and re-erection of 500 ft. of armco fluming to carry the water over an embankment section of the race at the tunnel outlet.

The schemes were well maintained during the year, and the major item of maintenance was the general overhaul of the 1,980 ft. of 30 in. pipe at Chatto Creek syphon. The total area operating under an acreage basis under agreements in 44,652 acres, and the area actually irrigated was 42·881 acres, or 617 acres more than the previous season. In addition, the Omakau Scheme, which commands 13,400 acres over which water is supplied on the demand basis, provided irrigation water to 8,150 acres, or an increase of 1,150 acres over the previous season.

The sales on the demand basis on the Omakau and Dunstan Schemes amounted to 5,915 acre-feet, or a reduction of 4,465 acre-feet from the previous season. This reduction was due to the demand being withheld until late in December owing to the plentiful spring rainfall.

The season, which was exceptionally favourable in respect to natural rainfall until the end of December, developed into drought conditions in the New Year, and these conditions obtained without respite until the middle of April this year. The water-supply in the dams was plentiful, and reasonable supplies were maintained on all schemes except the Tarras and Bengerburn Schemes, where restriction of supplies had to be resorted to during the end of the season.

The rainfall at Alexandra during the period 1st January to 15th April, 1939, was only 1·61 in., as compared with the lowest previous record of 2·74 in. over a period of nineteen years.

The completed schemes, which are operated by the Department, and Steward Settlement and Otekaike Schemes, which are operated under local control, now total 63,000 acres.

The following table shows the particulars of the schemes operated by the Department:

Scheme.	Area actually irrigated.	Area that should have been irrigated.	Number of Irrigators.
	Acres.	Acres.	
Arrow River	2,613	2,918	47
Ardgour	1,364	1,364	11
Bengerburn	114	144	13
Earnscleugh	1,972	2,190	48
Galloway	2,391	2,391	20
Hawkdun	8,248	8,977	66
Idaburn	565	565	8
Ida Valley	11,755	11,755	59
Last Chance	2,770	2,770	31
Manuherikia	4,910	4,941	75
Tarras	2,675	2,675	17
Teviot River	3,504	3,942	46
	42,881	44,652	441
Omakau including Dunstan ..	8,150	..	59
Totals	51,031	..	500

The financial result of the year's working is as follows: Revenue, £25,652; working-expenses, £22,533; profit on working, £3,119.

The decrease in revenue of £1,538 on the previous year's figure of £27,190 is due chiefly to the wet early spring reducing sales on the Omakau and Dunstan Schemes and the smaller amount of extra water sold during the same period to other schemes.

The total amount of rates collected during the year was £25,980, as against last year's figure of £24,100.

General.—Several small investigation surveys were carried out during the year, and records were taken of the usual stream-flow, lake-levels, and meteorological data.

CANTERBURY.

Operation and Maintenance of Irrigation Schemes.

The schemes in operation are the Redcliffs Scheme and the Levels Scheme, where water is sold on the demand basis. These schemes did not operate until February, 1939, owing to the phenomenal and unseasonal rainfall which was experienced during the spring and up till the end of January.

Although a late start was made, 1,000 acres were watered in the Redcliffs Scheme and 1,500 acres in the Levels Scheme.

Excellent results were obtained from this watering, and the farmers who participated had bumper crops, where their neighbours crops completely failed.

The success of these farmers was recognized, and large areas of further land are now being bordered and prepared for irrigating next season.

The land watered represented 14 per cent. of the total area commanded, which is nearly double that watered last season.

The completed schemes in operation are shown in the following table:—

Scheme.	Area actually irrigated.	Area for which Water was available.	Number of Irrigators.
	Acres.	Acres.	
Redcliffs	1,080	4,603	9
Levels	1,411	12,800	37
Totals	2,491	17,403	46

The financial result of the year's operations is as follows: Revenue, £334; working-expenses, £2,636.

The low revenue was due to the phenomenal rainfall during the early portion of the season and the fact that it takes some time for irrigators to prepare land and crops for irrigation.

Schemes under Construction.

Ashburton–Lyndhurst Scheme.—Race Formation completed: For year: 15 m. 73 ch.: 143,639 cubic yards. To date: 76 m. 57 ch.; 379,450 cubic yards. Percentage completed: 72 per cent.

Fencing: For year: 17 m. 3 ch.; to date: 34 m. 3 ch.; percentage completed: 74 per cent.

Structures:—	Number.	Percentage completed.
For year—		
Drops	148	50·1
Bridges	68	49·4
Bridges and drops combined	12	88·4
Syphons	64	54·7
Special structures	7	43·1
Turnouts	..	22·5
Fence crossings	16	26·3
Total structures completed to date	772	51·2

Survey: Pegging race-lines—for year, 10 m. 87 ch.; to date, 111 m. 76 ch. Plotting race-lines—for year, 11 m. 7ch.; to date, 95 m. 49 ch. Total length to be surveyed, 125 m.

Several large Diesel powered plant units were used on this construction.

The demonstration area of 36 acres has continued to yield excellent results, the average carrying-capacity for the year being 9·96 sheep per acre, the average during the growing-period being 14·1 sheep per acre.

The irrigation of this area has practically eliminated the grass-grub, which badly infests the surrounding area.

Mayfield–Hinds Irrigation Scheme.—Good progress has been made on this scheme, which has been designed to irrigate 54,000 acres.

The race-excavation will amount to 1,000,000 cubic yards, and the total length of races will amount to 230 miles, whilst approximately two thousand structures will be required to regulate the flow of water.

The work completed to date consists of 160,000 cubic yards of race-excavation and the erection of eighty structures. This latter work has been handicapped by the shortage of skilled workmen, but men are now being trained, and it is expected to increase the amount of this class of work during the current year.

The work is fully mechanized, and several large Diesel-powered excavating-units are employed.

Rangitata Diversion Race.—This race has a capacity of 1,000 cusecs, is 42 miles long and contains approximately 3,000,000 cubic yards of excavation.

The position in regard to this excavation is as follows:—

Previously excavated	370,000 cubic yards.
Excavation for year	895,000 „
Total excavation to date	1,265,000 „

The average rate of excavation last year was 74,600 cubic yards per month, but the monthly rate has been progressing so that a rate of 124,000 cubic yards per month has been attained.

The work is now in various stages of completion over a length of 27 miles from the intake end, eighteen high-powered mechanized excavating-units being kept fully employed.

Structures: During the year the following structures were completed:—

Three reinforced-concrete drops (7 ft. fall).
Seven reinforced-concrete access bridges.
Four reinforced-concrete road bridges.
One reinforced-concrete drainage syphon.

Several more structures are in hand.

Accommodation: Accommodation was provided for thirty married men and fifty single men. A staff headquarters office and store were erected at Springlands.

Conduits: Active preparations are being made for the construction of the reinforced conduits which are necessary to pass the race flow under the Hinds and Ashburton Rivers and their tributaries. Six of these crossings are required, and each conduit will have an internal diameter of 11 ft.

Since the works were commenced it was found necessary to carry the water over a difficult position of the country by another reinforced-concrete conduit which will be 12 ft. in diameter and 132 chains long.

Downs Water-supply.—Rapid progress has been made on this scheme, which has been designed to supply domestic and stock water to an area of 154,000 acres near Timaru. The total length of piping required is about 4,000,000 ft. The larger pipes are being laid in trenches excavated by a Diesel-powered trenching-machine, and the smaller sizes are being pulled into the ground by large tractors operating a mole drain attachment.

The present position of the work is as follows:—

Survey: Plans completed, 100,000 acres; work located, 54,000 acres; detailed reticulations, 30,000 acres.

Pipe-supplies: 13-in. diameter main 80,000 ft. delivered; 3½-in. diameter pipe to ¾-in. diameter pipe, 1,858,000 ft. delivered. The value of this quantity represents 60 per cent. of the total requirements.

Main Pipe-line: Pipes, 13 in. diameter, have been laid for 44,000 ft.

Galvanized-pipe Lines: Reticulation pipes have been laid over an area of 20,000 acres and are ready to be connected to the main.

The total length of pipes laid is 420,000 ft., in sizes varying from ¾ in. to 3½ in.

Intake: The intake dam and control structure on the Tengawai River is practically completed.

Three storage reservoirs have been excavated, and the concrete lining of one is in hand.

It is expected that about 90,000 acres will receive a supply in about nine months' time.

Canterbury Irrigation Investigations.

On account of shortage of suitable staff the topographical survey was suspended during the year, but this work will resume as soon as circumstances permit.

Continuous stream-gauging records were obtained on all installed stations, and a new station on the Ashley River was put into operation during the year.

Ground-water depth, soil moisture, and rainfall observations were continued.

Evaporation, wind, humidity, and temperature readings were recorded with the following results:—

Station.	Evaporations for Year ending 31st May, 1939.	Wind Mileage.
	In.	Miles.
Levels	30·92	9,142
Ealing	32·78	18,401
Kirwee	45·98	30,308
Blenheim	50·56	17,198
Pendarves	38·90	17,171
Methven	48·83	35,881

Rainfall Run-off.—Observations for rainfall run-off were recorded on six high-level automatic rain-gauges in the North Ashburton River catchment, and the outflow was measured at a recorder at the Gorge.

Marlborough Irrigation Investigations.

The topographical and tentative layout surveys were completed and estimates of cost prepared.

Stream records on the Wairau Ferry Bridge station were continued, and soil moisture, evaporation, wind, and rainfall records were continued.

HYDRO-ELECTRIC DEVELOPMENT.

Arapuni Scheme.

Arapuni Power-house Extensions.—A considerable amount of maintenance-work in the nature of concrete lining and stone riveting was carried out in the inspection tunnels in the vicinity of the power-house and the falls.

This work was closed down in October, 1938, and left in a safe condition, the men being required for works in connection with the Karapiro investigations.

Near the power-house the blacksmith's shop was completed, the necessary accessories were installed, and the access road completed.

The erection of precast panelling and lamp standards on the access road to the power-house was completed.

Nos. 5 and 6 Units, Penstock Tunnels.—This work was commenced towards the end of April, 1939. Two hoppers were erected on the stop-log platform outside the power-house, and two runways were built on which to run trucks from the tunnel-entrances to the hoppers outside.

Excavation was commenced on both tunnels early in June, the drives being started with floor-levels at 150 ft.; these levels will be maintained until they intersect with the bottom levels of the inclined tunnels, and from this point on the tunnels will be driven full size.

To date No. 5 tunnel has been driven to a point 18 ft. up from the lower intersection angle and 204 cubic yards of material have been excavated; No. 6 tunnel has been driven to a point 16 ft. up from the lower intersection angle and 248 cubic yards have been excavated.

Lowering of the Level of the Tail-race at the Sand Bar. This work was commenced on the 17th April, 1939, since which date it has been carried on continuously. An endeavour is being made to drag the boulders from the bar on to the banks of the river, and results to date have been most encouraging. Approximately 800 cubic yards of boulders of various sizes have been dragged on to the bank, and there is no doubt that a much greater amount than this has been disturbed by the dragging and taken away by the river.

At the present time the lower portion of the bar has not been worked over, and until this is done the full benefit of the work will not be apparent.

A road has been formed, and all is in readiness to shift the machine to the opposite bank farther down stream and thus be able to haul down-stream with the help of the current, from which position the lower portion of the bar will be dragged.

Karapiro Investigations.—Work was commenced on the preliminary sub-surface investigations in connection with this scheme on the 20th September, 1938. In the first instance six drives were put in and two shafts were sunk. It was then decided to employ boring-machines, and all plant obtainable was hired; boring operations commenced on 11th October and have been carried out almost continuously ever since.

To date fifty-six bores have been put down to a total depth of 4,812 ft. At present only one plant is on the job, taking bores on the west bank, between the river and the top of the cliff. Another plant is engaged in boring at a site in a Tertiary deposit approximately a mile down stream from the quarry-site.

The results obtained from the borings at the quarry-site indicate generally that the support for the necessary structures is satisfactory, but that the greywacke contains fractures and cleavages which would require a comprehensive form of grouting to render the rock water-tight.

Maintenance Horahora Power-station. Repairs in the nature of protection work to the tuff comprising the foundations of the permanent weir were carried out by extending the concrete apron in places and filling up with concrete the holes worn in the tuff.

The tunnel connecting the old auxiliary plant to the headrace was found to be almost in a state of collapse. This condition was remedied by the sealing of the tunnel-entrance with a concrete slab.

Waikaremoana Power Scheme.

No. 3 Penstock.—This penstock has been completed and is now ready for the water tests.

One hundred and forty-six concrete pedestals and four anchor blocks were constructed by the Department, some 1,083 cubic yards of concrete being placed. The steel pipes were fabricated on the works and have been finally fixed in position by the contractors, the pipe-line, which is 3,580 ft. long and varies in diameter from 78 in. to 66 in., being of welded construction throughout. The pipes are at present resting in the pedestals on wooden wedges, but as soon as the pipes are filled they will be packed up with cement mortar. Expansion joints are provided in each section and the necessary manholes are fitted. At the top end the pipe has been joined to the surge-chamber and at the lower end to the rotary valve of No. 3 unit.

After being welded in place the pipes were sand-blasted by the Department and given three coats of special red lead. Painting on the outside has been held up owing to the fact that the bloom is not yet scaling sufficiently to permit of easy cleaning, and only about one-third of the outside area has been painted.

No. 3 Unit.—Following the removal of the temporary wooden floor and the clearing-up of the area below, boxing and concrete work for the foundations were commenced. Seven hundred cubic yards of concrete were placed on this work up to generator-floor level, and the steel liner of the draught-tube has yet to be grouted in place. The air-outlet duct was constructed in concrete and the necessary canopy placed over the outlet end. Holding-down bolts were placed, cable ducts and drains were built, and the machines grouted in.

Various concrete walls were constructed in the power-station, sections of the control-room floor are being poured in concrete, and the construction of cable ducts and shelves and the fitting of brackets in the cable tunnels are in hand.

Transformer foundations were built in the outdoor station, and miscellaneous general work completed.

At the surge-chamber an elevated concrete winch-platform was completed, and the placing of winches is in hand.

Waikaremoana Lower Development.

Work on this scheme has been mainly confined to preliminary activities and the provision of accommodation for workmen.

A main access road from Tuai to the new station at Piripaua was first constructed, and then roads to the surge-chamber and the various tunnel-faces, camps &c., were commenced. Approximately 5½ miles of road were constructed and metalled, including the installation of necessary culverts and the erection of five small bridges.

The quarry opened at Tuai did not provide sufficient stone, but the crushing-plant has been used continuously, spalls being taken from the construction excavation, the river-bed, and the lake-shore. About 9,500 cubic yards of crushed metal were placed on the roads, and top-dressing is in progress.

Camps were established at Korora and at Piripaua, but owing to the shortage of tradesmen it was necessary to have all single huts and married men's hutments made in Napier and Gisborne. The sections were assembled on the site, and so far 100 married quarters and 100 single huts have been erected. The standard combined bath and washhouse buildings have been constructed, one for every two married quarters. Cookhouses to cater for eighty-four men each were built at both camps and are in operation. Large bathhouses, the necessary latrines, and other miscellaneous buildings were constructed.

Eight staff hutments were erected, and a Y.M.C.A. hut was practically completed.

The following buildings have been erected and are in use: Store, fitting and blacksmith shop, joiners' shop, mill, and plumber's shop. Smaller service buildings have also been erected.

Five permanent cottages, with garages, were completed at Piripaua. In Tuai Village sixteen garages were constructed, and the foundations for a new social hall are now in hand.

Excavation work is in hand on both ends of the Whakamarino Canal, the spalls obtained being set apart for the pitching of the wall in front of the recreation area.

Boring for grout-pipes for the Whakamarino Dam has been in progress, and about 100 lineal feet of pipes have been placed in position.

The tunnel-face on the eastern side of the siphon area has been opened up and shows a sound papa face. On the western face work is still in progress, and the papa exposed to date is not suitable for a face.

A party is engaged lowering the creek and opening up the necessary faces in the canyon preparatory to tunnelling.

The opening-up of the tunnel-face on the side opposite to the surge-chamber is in hand.

The face from No. 2 anchor block up to the penstock tunnels is being stripped, papa is available throughout the length, and the excavation of the area for No. 2 anchor block is well in hand.

The 7-ft. 6-in. diameter steel pipes for the penstocks are being fabricated at Tuai by the contractor for the No. 3 penstock pipes, and this work has been practically completed. The twin pipe-line will be 7 ft. 6 in. diameter throughout, and the two penstocks will make a total length of 1,820 ft. The pipes are sand-blasted after welding, and the first coat of special red-lead paint is immediately applied. Completed pipes are stored at Tuai until the pedestals are completed and field welding can be started.

The excavation of the river-diversion at Piripaua is well advanced, some 12,500 cubic yards having been removed to date. The pilot channel and berm are complete, the excavation for the drop weir being trimmed for concreting, and the final section of excavation is in progress.

Between the drop weir and the bridge, the pitched stone protection walls have been completed on both sides, and work is proceeding upstream from the bridge. Owing to the depth of the papa, much more walling has been built than was originally considered necessary, and, owing to the presence of water, continuous pumping has been required.

The permanent concrete bridge of two 30 ft. spans has been completed, the piers being poured into holes cut in the solid papa. The heavy-duty cattle-stop and the bridge approaches have been almost completed.

The 11 kV. line has been erected and livened up, and at the Siphon, Piripaua Camp, and at Piripaua power-house, site-transformers have been installed. From these, 400 volt lines have been run and 230 volt lines supply street lights, house lighting, &c. The villages have been wired and connected with the system, and the workshops, store, &c., are also supplied with power. A high-tension telephone system has been run between the power-stations.

The R.D. 6 caterpillar and the R.B. 17 shovel have been employed continuously and have given excellent service. Further plant is being assembled, and when in operation will assist towards expediting the construction programme.

The workshops have been fitted out, and the usual repairs and maintenance have been carried out.

Three factors have militated against speedy progress on the works. Firstly, the weather until late last year was extremely wet, the rainfall being 33 in. over the annual average, while the damage to the main highways and railways has had a decided effect on the progress of the work. Secondly, the lack

of suitable excavating-plant has necessitated the use of hand methods and, thirdly, the difficulty in obtaining tradesmen has slowed up the whole job.

The number of departmental employees on all jobs, including the pipe-line and No. 3 unit, has increased to 185.

Kaimata Dam.

During the past year work was continued on the construction of the new thrust block and apron across the full width at the toe of the dam, and also on the addition of a strengthening slab on the dam-face.

In the course of the apron work it was found that serious erosion had occurred under the toe of the dam, and this had to be filled carefully. After filling with concrete, grout was forced in to ensure that no cavities remained. Fortunately, no serious floods occurred during the progress of these operations but numerous freshes caused delays lasting a few days at a time.

The automatic gates for raising the level of the lake by 10 ft. were completed during the year and brought into use shortly after the close of the year under review.

Prior to the winter, advantage was taken of the opportunity to close down the station temporarily for the purpose of examining and repairing the penstocks, aqueduct, and tunnel. At the same time improvements were made to the tail-race, which had filled up very considerably, and alterations were made to the surge-chamber to allow for the extra head of 10 ft.

At the close of the period under review, the position is that the improvement and repair works at this station have been practically completed, the result being an increase in the capacity of the station by approximately 1,000 kV.A.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES.

Whangarei District.

Motatau to Kaikou Road (Bay of Islands County).—As was mentioned last year, this road gives access to a large area of Native country where farming operations have been retarded very much on account of the wet nature of the access. This season 1 mile 20 chains has been metalled and two timber bridges redecked.

Tutaematai to Rawhiti Road (Bay of Islands County).—This is a new road running generally along the coast from Whangaruru Harbour below the Cape Brett Peninsula to Parekura Bay, and gives access to extensive areas of Native country. Those Europeans who are dairying on lands near Parekura Bay have never previously had any road access, and the new road, while meeting this need and encouraging the development of the Native lands, will also provide motor access to picturesque vantage points all along the coast.

Kerikeri Inlet Road (Bay of Islands County).—Construction work upon this road was commenced one or two seasons ago, and during the period under review new formation and metalling over a length of 4 miles 40 chains was carried out. There are a number of settlers in this locality who previously had access only by water, and the new road will assist them greatly in the more capable development and profitable management of their farms.

Tapuhi to Ruapekapeka Road (Bay of Islands County).—Before new work was commenced upon this road the old access was on poor alignment and also narrow and unmetalled. The reformation, culverting, and metalling improvements which have been carried out over a distance of 3 miles 30 chains will give much improved access to good-quality lands occupied by European and Native farmers.

Black Bridge to Opua Road (Bay of Islands County).—This road is important in that it gives access to the oldest historical lands in the Dominion, the Waitangi Estate, where the Treaty of Waitangi was signed in 1840. However, the road as it has existed up till the present has been on comparatively steep grades and in many places of a particularly winding character. With a view to facilitating the management and control of traffic during the Centennial celebrations which will take place at Waitangi next year, arrangements are being made to reconstruct the road throughout. An engineering survey has already been made, and the actual reconstruction work will be commenced almost immediately.

Aratapu to Redhill Road (Hobson County).—This is a settlement road on the Tangaihi Peninsula. The development of the adjoining farming-lands has been delayed considerably owing to the fact that the road was not metalled. In order to increase production and to assist the settlers as much as possible with the profitable management of their properties, a metalling programme was commenced. During the period under review 1 mile 19 chains was reformed and 3 miles 52 chains were metalled. The road will form a connecting-link, and at present gives access to eighteen settlers.

Dargaville to Pukehuia Road (Hobson County).—Much work has been carried out upon this road of recent years, and the only improvements remaining to be done comprise the erection of two bridges. Work was commenced upon these during the period.

Mangarata Bridge, Pukehuia to Arapohue Road (Hobson County).—One reinforced-concrete bridge with a span of 80 ft. was erected during the year.

Redhill to Bassett's Road (Hobson County).—The work which is being carried out upon this road has the same object in view as that which is being done on the Aratapu to Redhill Road in the same sector of the county. During the year 2 miles 40 chains of metalling were completed, and this gives all-weather access to eight settlers as well as to a portion of the settlement on Bassett's Small Farm Block.

Waima Valley Road (Hokianga County).—Work has been proceeding upon this road during the last few seasons with a view to giving access to large areas of undeveloped Native lands. Much of the area is comprised of rich river flats, and when the whole of the work has been completed the Natives in the locality who are farming their own properties will have the same opportunities of profitably developing their holdings as have settlers in other areas already provided with metalled access.

Gile's Road (Hokianga County).—The work commenced in previous years was continued during the season. Formation over a distance of 44 chains was completed, making the results to date 4 miles 52 chains of formation and 2 miles 59 chains of metalling. Seven settlers have already been given metalled access, and four more will benefit in like manner when the programme in view has been completed next season.

Mangamuka Stream Bridge, Iwitaua Road (Hokianga County).—One reinforced-concrete bridge 150 ft. long and with approaches totalling 24 chains was completed during the season. Previously the only means of crossing from the adjoining State highway on to Iwitaua Road was by fording the river, and this was not possible during heavy rains, but now that the new bridge has been completed the nearby settlers will no longer have any difficulty getting access to and from their properties throughout the whole of the year.

Motutoa to Kouta Road (Hokianga County).—This road has been in an indifferent condition for a number of years, and as dairying activities in the locality have been increasing each season the necessity arose to consider roading improvements. Work was commenced during the season, but only a small portion was completed. The remainder will receive attention next year.

Taipuha to Maungaturoto Road (Otamatea County).—This road is used extensively by settlers and others as a through connection, and as the need for a route of higher standard became apparent arrangements were made to widen the road. One mile fifty-two chains was completed during the year and, together with a section of somewhat greater length completed during the previous year, was given a base course of metal.

Chadwick's Road (Otamatea County).—Work on this new road to give access to a settler who occupies some hundreds of acres on the foreshores of the Kaipara Harbour has been considered on several occasions during the last few years. The Council has been offered subsidies to cover the cost of the access, but difficulties in connection with the acquisition of land for the road were encountered and little progress could be made. The legalization of a small section was completed without any difficulty, however, and this length, amounting to 50 chains, was formed and culverted during the year. While primarily the road is to give access to a European settler, it will also greatly facilitate the consolidation and development of a large area of Native land.

Waihaua Road (Otamatea County).—As with Chadwick's Road already described, this access will benefit one European and also the inhabitants of a Native settlement. Only a small section of 25 chains of formation and culverting was completed during the period under review, and the remainder will receive attention next season.

Brynderwyn to Waipu Road (Whangarei and Otamatea Counties).—This work, which involves the construction of an entirely new road, is a deviation to avoid the longer route by way of the tortuous Waipu Gorge and was completed during the year. The season's programme comprised 3 miles 5 chains of formation and culverting and 5 miles 60 chains of metalling, together with the erection of a bridge of 80 ft. span over the Piroa Stream at the common boundary of the two counties.

Puhipuhi Back Road (Whangarei County).—This is a settlement road giving access to many settlers in the northern sector of the county. As a result of urgent representations made by those persons using the road to get access to their properties, a special subsidy was made available during the year, and with this assistance the Council proceeded with a reconstruction and metalling programme. Improvements of this nature were completed over a distance of 5 miles 7 chains.

Whangarei to Taumaterau Heads Road (Whangarei County).—The widening and metalling of this road were commenced. Besides being a popular scenic drive, the route gives access to a large area of good dairying and grazing country, and when the metalling improvements have been completed the settlers in the district will have much greater opportunities of profitably developing and managing their holdings.

Matawherohia Road (Whangaroa County).—This road gives access to three settlers on comparatively large holdings in good sheep- and cattle-grazing country. Reconstruction and metalling improvements were carried out over a distance of 3 miles 10 chains.

Omaunu Block Road (Whangaroa County).—Metalling improvements were carried out upon this road during the previous season, but owing to the greater amount of traffic using the road, together with the inauguration of a school-bus service, the need arose to add an extra layer of metal over a distance of 8 miles 40 chains.

Awanui to Mangonui Road (Mangonui County).—The present highway up the east coast of the North Auckland Peninsula terminates at Mangonui, and from there to Awanui the road is in status only a county road. Previously it was of very poor standard, being in many places on practically the same alignment as it was when the first bullock-wagons crossed between the two townships many years ago. With the coming of motor transport the improvement of the road became urgent, and a planned programme was commenced two or three years ago. With the exception of bridging, which will be erected in reinforced concrete, almost the whole of the work is in the final stages of completion. During its progress the work has probably been the most important of all roading-works, apart from highway works, in the district. Much good dairying-land now has easier, better, and quicker access.

Lake Ohia to Merita Bay Road (Mangonui County).—The present access from the Awanui to Mangonui Road to the Karikari Peninsula is by a short road to the Tokerau Beach, thence along

this beach, when the tide is favourable. Little attention had been given previously to the roads serving the Native lands on the peninsula, and with a view to assisting with the consolidation and development of these areas arrangements were made to proceed with formation and metalling work. Formation and culverting were completed over a distance of 1 mile 14 chains and metalling over a distance of 2 miles 60 chains. Engineering surveys were also made with the object of locating a road which would dispense with the present necessity of traffic proceeding along the treacherous Tokerau Beach.

Church Road (Mangonui County). This is one of the settlement roads branching off the Awanui to Mangonui Road. Two or three seasons ago the western end was reconstructed and metalled, and it became apparent that similar improvements would be needed on the eastern end, by reason of through traffic using the road as a shorter access from east to west and to provide better facilities for a circuit cream-collection service. During the season under review 2 miles 20 chains were reconstructed and metalled.

Waipapakauri to Tangoake Road (Mangonui County).—This road is commonly known as the "Far North Road," and traverses the northern peninsula beyond Waipapakauri. Many Native blocks are in course of being consolidated and developed, and the programme of roading improvement now receiving attention will facilitate the management of these lands.

Auckland District.

Coromandel to Kennedy Bay Road (Coromandel County).—The difficulties which arose last year in connection with the legalization of this road have continued to hinder a commencement with construction work of any magnitude. A deviation of 54 chains, the erection of a timber bridge of three 20 ft. spans, and the installation of 180 lineal feet of culverts, comprise the work completed during the season.

Hot Water Beach Road (Coromandel County).—Widening and metalling work upon this road, which gives access to settlers in the south-eastern portion of the county, was continued during the year. Reformation was carried out over a distance of 1 mile 38 chains and metalling over a length of 4 miles 38 chains.

Mercury Bay to Whenuakite (Purangi) Road (Coromandel County).—Reformation work was carried out this year over a distance of 2 miles 52 chains, and the metalling of the whole length, together with the installation of 158 lineal feet of culverts, was completed.

Tuateawa Road (Coromandel County).—Reconstruction and metalling work was completed over the whole length of 2 miles 35 chains, together with the erection of a temporary bridge over a small stream and the installation of 242 lineal feet of culverts.

Barrett's Road (Paerata) (Franklin County).—All settlers on this road have been given metalled access as a result of work carried out over a distance of 2 miles 6 chains.

Donnelly's Bridge (Ramarama) (Franklin County).—An old wooden bridge almost destroyed by floods was replaced during the year with a reinforced-concrete structure of one 50 ft. span 24 ft. wide.

Graham's Beach Road (Franklin County).—This road serves as access from the wharf to dairying areas in the Awhitu Peninsula, and during the year a distance of 2 miles 20 chains was formed and metalled.

Graham's Beach to Big Bay Wharf Road (Franklin County).—Metalling was carried out over a distance of 2 miles to give all-weather access to settlers and to several beach cottages.

Orua Bay Road (Franklin County).—Metalled access was given to five settlers and several seaside cottages as a result of metalling-work carried out over a distance of 1 mile 75 chains of this road.

Otaua to Maioro Road (Franklin County).—The metalling-work commenced in previous years was continued, and an additional length of 1 mile 17 chains was completed. Two settlers have been given access, and at the same time the operation of a cream route circuit has been greatly facilitated.

Port Waikato to Maioro Road (Franklin County).—Formation and metalling work was completed during the year over a distance of 2 miles 54 chains to give access to eight settlers occupying considerable areas of good dairying-lands.

Waipipi to Kohekohe Top Road (Franklin County).—Reformation and metalling work was carried out over a distance of 1 mile 40 chains to complete a necessary connection both for settlement access and for cream-collection.

Tryphena to Kaitoke Road (Great Barrier Island County).—This is the road giving access to Claris Aerodrome. Reformation and metalling work has been in hand during the season, and a distance of 2 miles 40 chains was completed.

Hamilton's Road (Hauraki Plains County).—Formation and metalling work was completed over a distance of 1 mile on this access road.

Kerepehi Extension Block Roads (Hauraki Plains County).—The Land Drainage Department is attending to the formation and metalling of roads in the Kerepehi Extension Block.

Orchard West Road (Hauraki Plains County).—This is another work under the control of the Land Drainage Department, which completed heavy formation work over a distance of 1 mile of peat lands.

Torehapa West Road (Hauraki Plains County).—Construction work upon this road was commenced, and 1 mile 28 chains was widened to a width of 14 ft. and another section of 1 mile to a width of 12 ft. Metalling over the whole length was also completed.

Cashmore's Bridge (Manukau County).—One reinforced-concrete bridge of a span of 26 ft. 6 in., together with approaches, was completed to replace a decayed wooden structure on the Kawakawa to Orere Road.

Clevedon to Maraetai (North Road) (Manukau County).—This is a comparatively large work involving the realignment and regrading of an important road serving an extensive dairying and agricultural area as well as being used very much by through traffic. Formation work was completed over a section of 2 miles and metalling over a distance of 6 miles.

Moumoukai Hill Road (Manukau County).—Metalling operations upon this road have been completed and all settlers now have metalled access. The distance completed during the year was 1 mile 69 chains.

Orere Stream Bridge (Manukau County).—One reinforced-concrete bridge of three spans and of a total length of 96 ft. was erected on this road.

Otau Mountain Road (Manukau County).—Reformation and metalling work was carried out during the year over a distance of 4½ miles. This completes the programme in hand upon the road and provides access to five settlers occupying grazing-country.

Okauia Native School Road (Matamata County).—Formation and metalling work is being carried out over a distance of 1 mile 18 chains to give access to a new Native school and to a Native settlement. Almost the whole of the formation and 11 chains of metalling were completed during the season.

Paraonui Road (Matamata County).—Formation and metalling work was completed over a distance of 3 miles 77 chains, giving all-weather access to six settlers.

Puketurua Group Roads (Matamata County).—Several schemes for the metalling of all clay roads in a small settlement or in a particular block have been carried out in recent years. There are five roads in this group, and 4 miles 64 chains have been reformed and 4 miles 30 chains metalled.

Waipa Bridges (Puketurua to Uraura Road) (Matamata County).—Two reinforced-concrete bridges, having spans of 30 ft. and 20 ft. respectively, were erected during the year.

Waihi to Whangamata Road (Ohinemuri County). This road, besides giving access to a number of settlers, is a popular tourist drive during the summer months and is being improved to cope with the increased traffic. During the year a commencement was made on that section of the road within the Ohinemuri County, and light reconstruction work has been completed over the first section of 6 miles and the last section of 2 miles. Attention was given to other portions of the road wherever necessary, and arrangements were made for the supply, under contract, of 6,500 cubic yards of crushed metal.

Waitewheta Stream Bridge (Harris Road) (Ohinemuri County).—Five settlers on the road to which this bridge gives access, previously crossed the Waitewheta Stream by a concrete ford, but this sustained irreparable damage during a storm of 1936. During the year a reinforced-concrete bridge 119 ft. long was erected to give permanent access.

Waitoki Road (Ohinemuri County).—Formation and metalling work was completed over a distance of 1 mile 53 chains of this new road. One bridge of rolled-steel joist construction was erected and 627 lineal feet of culverting installed.

Haurua Road (Otorohanga County).—Metalling was completed over a distance of 1 mile 58 chains to give all-weather access to four settlers and to provide a through connection.

Karaka Road (Otorohanga County).—This is one of the roads in the Arohena Settlement. Other roads within the settlement have been metalled in previous years, and during the past season similar improvement work was carried out over a distance of 2 miles 30 chains of Karaka Road. This gives alternative metalled access to the block.

Mangauika Road (Otorohanga County).—Two settlers were given all-weather access as a result of metalling improvements carried out over a distance of 70 chains. The erection of a light traffic bridge 42 ft. long was also completed during the period.

Tahaia Bush Road (Otorohanga County).—Reformation and metalling work was completed over a distance of 1 mile 20 chains and is still continuing. Two settlers have been given all-weather access.

Tahaia Cross Road (Otorohanga County).—Metalling has been carried out over a distance of 68 chains of this road to give all-weather access to three settlers.

Kiwitahi Railway Road (Piako County).—The work commenced in previous years upon this road was continued, and a distance of 1 mile 50 chains was metalled to complete the provision of all-weather access to each settler.

Mellins Road Bridge (Piako County).—One bridge, 70 ft. long, of rolled-steel joist construction on timber piles was erected over the Waitoa River.

Thompson's Track (Piako County).—Reconstruction work on this track was completed during the period, also an additional length of 2 miles 71 chains of formation. The first section of 1 mile 21 chains was widened to 14 ft. and three bad creek crossings were concreted. Five settlers obtain access by this track, which also gives a stock-route to the northern end of the Bay of Plenty.

Klondyke Road (Raglan County).—Metalling-work was carried out over a distance of 3 miles 25 chains to give all-weather access to four settlers. Operations are being continued to meet the needs of others living farther along the road.

Mangati to Te Akau Wharf Road (Raglan County).—This road was metalled several years ago, but the original work was not sufficiently strong to carry the heavy traffic. As a result, arrangements were made to add extra metal, and during the season 2 miles 24 chains were completed. The whole programme will involve a length of 4 miles 44 chains, and operations are continuing.

Sainsbury Road (Raglan County).—Three settlers have been given all-weather access as a result of metalling-work carried out over a distance of 2 miles.

Waikorea to Naike via Speedys Road (Raglan County).—The reformation and metalling commenced in previous years were continued, and 5 miles 13 chains were metalled. Additional work is being carried out, and nine settlers have already been provided with all-weather access.

Waimaori Road (Raglan County).—Metalling-work was carried out over a distance of 4 miles 15 chains to give all-weather access to seven settlers.

Waimarama to Kaawa Road (Bothwells) (Raglan County).—Additional work, comprising 68 chains of reformation and widening and 4 miles 77 chains of metalling, was completed during the year, making the total length dealt with since the commencement of the work 9 miles 56 chains. Six settlers have been given all-weather access.

Waitetuna to Waipa Road (Raglan County).—The base-course metalling completed over a distance of 5 miles 31 chains during the previous year was surfaced with metal chips, and this has completed all-weather access to six settlers.

Dyer's Swamp Road (Rodney County).—During the period 1 mile 40 chains of this settlement road was reformed, and metalling is now receiving attention.

Levett's Bridge (Rodney County).—A wooden bridge, destroyed by floods some time ago, was replaced with a reinforced-concrete structure 105 ft. long.

Run Road (Rodney County).—Metalling-work was carried out over a distance of 1 mile 70 chains to give access to ten settlers.

Ryan's to Hakaru Road (Rodney County).—During the year 2 miles 24 chains of this road were formed and metalled to open up a large area of good dairying-land and to provide better access for three established settlers, who had previously been working their properties under disadvantage.

Takatu Road (Rodney County).—Formation and metalling work was carried out over a distance of 2 miles 24 chains to give access to two settlers.

Hikutaia to Whangamata Road (Thames County).—Reformation and metalling work commenced during the previous period was continued over a distance of 1 mile 65 chains.

Kapakapa Estuary Bridge (Paritu to Opoutere Road) (Thames County).—Work has been commenced upon the erection of a timber bridge 40 ft. long over the Kapakapa Estuary. Previously the occupiers of five dairy-farms used to cross this estuary by fording at suitable stages of the tide.

Gordonton to Motumaoho Road (Waikato County).—This work involves the claying of a peat road and metalling over a distance of 3 miles. Most of the improvements have been completed, giving all-weather access to twelve settlers and providing a through connection between Gordonton and Morrinsville.

Hampton Downs Road (Waikato County).—Two miles thirteen chains of new formation and 1 mile 53 chains of metalling have been completed to give access to two settlers.

Ngahinepouri Old School Road (Waipa County).—Formation, culverting, and gravelling work was carried out over a distance of 1 mile 2 chains to give all-weather access to three settlers.

Rotongata Road and Karaka Roads (Waipa County).—These roads are within the Arohena Settlement, and during the season reformation and metalling works over a distance of 7 miles 13 chains were completed to provide all-weather access to seven settlers.

Wharepapa Road (Waipa County).—Formation and metalling work was carried out over a distance of 1 mile 62 chains of this road to give access to lands in the Wharepapa Block which are now being developed for settlement. The erection of a bridge over the Puniu Stream is a portion of the programme, and work was commenced upon this structure.

Wharepapa Settlement Roading (Waipa County).—New formation work over a distance of 2 miles 62 chains and metalling over a length of 54 chains, together with the erection of one small bridge, was completed during the year. The development of the lands in this settlement was previously controlled by the Waikato Land Development Society, but has now been taken over by the Department of Lands and Survey.

Black Bridge Road and Group (Waitemata County).—The work commenced during the previous season has been completed, a total distance of 8 miles 23 chains being formed and metalled. In addition to opening up a considerable area of country, the work has given all-weather access to eight settlers and has provided a useful connecting-link between two main highways.

Waitakere Ridgway Drive (Waitemata County).—During the year construction work upon this popular scenic drive was completed. A sealed surface now exists over the total length of 15 miles 20 chains, and parking-places have been provided at various vantage points. A one-way loop road has been formed and metalled circling the summit of Pukematakeo Trig., which is one of the highest points on the drive. A commencement has been made with the clearing and burning of timber on both sides of the drive in order to lessen the fire risk to the surrounding bush.

Waimumu Road (Waitemata County).—This road gives access to a number of settlers who had previously been inconvenienced during the winter months. The whole length of 1 mile 18 chains was metalled, and ten settlers now have all-weather access.

Waiheke Island Roads.—A roading programme to give access to settlers and residents on this island was completed. Regrading and general improvement work was carried out over a distance of 2 miles from Surfdale Wharf to Matiatia Wharf and a similar length from Surfdale Wharf to Ostend.

Tauranga District.

Copenhagen Road (Opotiki County).—This is a settlement road upon which 1 mile 70 chains of metalling was completed during the season.

Omaramutu Road (Opotiki County).—One mile seventy-seven chains of metalling was carried out on this settlement road during the year under review.

Verralls Road (Opotiki County).—Metalling was completed on this road over a distance of 1 mile 21 chains.

Dansey Road (Rotorua County).—Metalling improvements carried out in previous years were extended during last year, when an additional length of two miles 26 chains was completed.

Horohoro Block Access Roads (Rotorua County).—Roads to give access to the subdivisions of the Horohoro Native Block are being formed and metalled, and a length of 2 miles 31 chains received attention during the season.

Oturoa Road (Rotorua County).—The metalling improvements commenced during previous periods were continued during the year, an additional length of 4 miles being completed.

Reporoa Settlement Roads (Taupo County).—Additional improvements were required on the several roads serving sections in the Reporoa Crown Settlement, and metalling was carried out over a distance of 3 miles 4 chains.

Taupo to Western Bay Road (Taupo County).—A new road is being constructed along some 6 miles of the western shore of Lake Taupo to give access to sheltered fishing-waters. Formation was carried out over a distance of 5 miles 59 chains, and 1 mile 2 chains was surfaced with pumice.

Vailes Road (Taupo County).—Metalling was completed over a distance of 3 miles 43 chains of this settlement road.

Whirinaki Cross Road (Taupo County).—This road gives access to holdings in a Crown settlement, and metalling was carried out during the year over a distance of 4 miles.

Ohauiti to Waimapu Road (Tauranga County).—Settlers upon this road have experienced difficulties in getting access to and from their properties, and in order to facilitate access and to assist with the better development of their holdings arrangements were made to metal several miles of the road. During the period 2 miles 44 chains were completed.

Soldiers (Kaimai) Road (Tauranga County).—This is a settlement road on the Kaimai Ranges upon which 1 mile 8 chains of metalling was carried out during the season.

Youngson's Road (Tauranga County).—Metalling was completed over a distance of 1 mile 13 chains on this settlement road.

McCoy's Road (Whakatane County).—Cream-collection in the district was rendered troublesome and tedious by reason of the unmetalled condition of this road, and in order to improve matters the County Council was given a subsidy to assist with the cost of metalling. Improvements of this nature were completed over a distance of 2 miles.

Manawahe Settlement Roads (Whakatane County).—The several roads in this settlement give access to lands which have proved somewhat difficult and expensive to develop. However, the settlers were making progress with the management of their properties, and in order to facilitate their operations as much as possible the County Council was offered a grant to cover the cost of metalling improvements. The work was commenced, and a distance of 4 miles 62 chains was completed.

Rotorua to Waikaremoana Road (Rotorua and Whakatane Counties).—The heavy work of reconstructing and metalling this road has continued and the results for the period are: Engineering surveys, 7 miles 30 chains; heavy rock formation, 2 miles 76 chains; metalling, 2 miles 43 chains; culverting, 1,532 lineal feet; and slips of rock and rubble, 25,479 cubic yards. Although this is a big work, no construction difficulties are being experienced, and the programme for the year has gone ahead smoothly. An average number of 105 workmen were employed during the period.

Whakatane River Bridge (Whakatane County).—A new reinforced-concrete bridge, 660 ft. long, with 44 ft. spans and a roadway 10 ft. 6 in. wide, has been erected over the Whakatane River at Ruatoki to give access to a large area of Native lands.

Tarawera River Bridge (Whakatane County).—One bridge 120 ft. long, together with approaches, has been completed to give access to the Edgecumbe Block, now under development by the Lands and Survey Department.

Gisborne District.

Bushy Knoll Road (Cook County).—During the last several seasons a good deal of metalling has been carried out on this back-country road to give all-weather access to a large tract of grazing-country. During the period under review an additional length of 50 chains was completed.

Hangaroa to Waikaremoana Road (Cook County).—This road is in the high back-country of the county. Metalling improvements have been carried out in progressive form, and the length completed during the last period was 1 mile 2 chains.

Hihiroroa Road (Cook County).—This road is very similar in type to the Hangaroa to Waikaremoana Road, and during the period a length of 1 mile 21 chains of metalling was completed.

Puatai Road (Cook County).—New formation work is needed on this road to give access to Native lands undergoing development, and a length of 1 mile 40 chains was completed during the year.

Waimata to Arakihi Road (Cook County).—This is a back-country-settlement road which has been receiving attention each year. Last season additional metalling was carried out over a length of 1 mile 70 chains.

Kopuapounamu Road (Matakaoa County).—This road gives access to back-country grazing-runs. Difficulty was experienced in connection with legalization, but this was finalized in sufficient time to enable a deviation of 54 chains and metalling of 1 mile to be completed during the season.

Potaka to Waikura Road (Matakaoa County).—Metalling was carried out over a distance of 1 mile 69 chains on this road to give access to settlers on back-country grazing-runs.

Te Araroa to East Cape Road (Matakaoa County).—Reformation and metalling work was continued during last season, and 3 miles 40 chains of metalling and 9 chains of formation were completed.

Tolaga to Arakihi Road (Uawa County).—The work commenced during the previous period was extended during the year, and 2 miles 29 chains of additional metalling completed.

Te Horo to Tikapa Road (Uawa County).—This is a new road under construction to give access to lands occupied and managed by Native farmers. One concrete culvert 8 ft. by 7 ft. and 48 ft. long, together with 65 chains of metalling, was completed during the year.

Te Hue Road (Uawa County).—Several soldier settlers have occupied properties upon this road for many years and have continued to farm their holdings under difficulties until recently, when arrangements were made to give the County Council a grant to cover the cost of metalling the whole of the access. Work of this description was completed over a section of 1 mile 18 chains during the season.

Tokomaru to Mata Road (Uawa County). This road gives access to large back-country sheep-stations, and the formation and metalling work commenced during previous seasons was continued. Last year 2 miles 60 chains of metalling were completed.

Gisborne to Motu via Whakarau Road (Waikohu County).—Many years ago this was the old coach-road between Gisborne and Opotiki, but with the construction of other roads it is now used only as access for settlers and as a stock-route. The County Council made application for a subsidy to assist with the cost of light widening-work, together with metalling, and during the season 1 mile 19 chains received attention.

Mutuera Road (Waikohu County).—Formation and metalling improvements were carried out over a distance of 1 mile 60 chains.

Tarndale Road (Waikohu County).—Formation work was commenced upon this road several years ago with the object of giving vehicular access to a number of station-owners who previously used river-beds to get in and out from their homesteads. Three miles fourteen chains of formation were carried out during the season to complete this portion of the work, and a distance of 65 chains was metalled.

Taumarunui District.

Waiouru to Tokaanu Road (East Taupo County).—This road is known as the "Desert Road," and gives a shorter access from the south to Lake Taupo. With the object of completely reconstructing the road, operations have been in hand for some while, and during the period under review the work completed comprised formation, 7 miles 40 chains, and metalling 5 miles 40 chains.

Kawautahi Road (Kaitieke County).—Metalling-work on this settlement road was carried out over a distance of 1 mile 60 chains.

Kouturoa Road East (Kaitieke County).—With a view to giving access to timber-mills and to several back-country settlers work was continued during the year, and additional metalling over a distance of 2 miles was completed.

Oio No. 2 Road (Kaitieke County).—Formation of 1 mile 51 chains and metalling of 1 mile 8 chains, together with the erection of one bridge, were completed during the year.

Awaroa to Mahoe Road and Vickerman's Access (Kawhia County).—This road, which forms one of the through links between Waitomo County and the Kawhia Harbour, was metalled over a distance of 7 miles 16 chains.

Rakanui Road (Kawhia County). This a settlement road serving European and Native settlers, together with a Native school. Widening and metalling were carried out during the year over a distance of 2 miles 40 chains.

Huia and Turoto Roads (Ohura County). Metalling was completed over a distance of 2 miles.

Kakahi Road (Ohura County). Work involving the metalling of 4 miles of this road was carried out during the year.

Mangakara Road (Ohura County). Metalling was completed over a distance of 2 miles 30 chains, and this connects all the gaps in the metalling between Ohura and Mangakara.

Otunui Road (Taumarunui County).—Metalling of 2 miles 34 chains, together with a small amount of pipe culverting, was completed during the year.

Taumarunui to Tokaanu Road (Taumarunui County). Construction work upon this road, which will connect Taumarunui directly with Tokaanu on Lake Taupo, has proceeded satisfactorily during the period. Work completed during the year comprised: formation, 6 miles 36 chains; metalling, 4 miles 69 chains; and culverting, 1,500 lineal feet.

Fullerton's Road (Waitomo County).—Formation improvements and metalling were carried out upon this road over a distance of 4 miles 40 chains.

Mangaokewa Road (Waitomo County).—Improvements upon this road were undertaken in two sections in order to spread the benefit over the greatest number of settlers. A length of 1 mile 60 chains received attention.

Mokau River Road (Waitomo County). This is a river-bank road on the northern side of the river. Consideration has been given to the possibility of completing this road, and as a first step 2 miles 20 chains of the existing formation were metalled and 140 lineal feet of culverting installed.

Taumatamaire Road (Waitomo County).—Both the County Council and the Public Works Department have attended to metalling work upon this road, and 3 miles 32 chains were completed during the year.

Te Kuiti to Taumarunui Road: Te Kuiti to Kopaki Section (Waitomo County). Metalling improvements upon this settlement road were carried out by the Waitomo County Council, which completed a distance of 6 miles.

Totoro Road (Waitomo County). With a view to assisting development of a large area of Native land, arrangements were made to metal this road, and a section of 4 miles 66 chains was completed during this season.

Tumu Tumu Road (Waitomo County.)—Formation of 2 miles 20 chains and metalling of 3 miles 20 chains, together with the installation of 90 lineal feet of culverting, were completed during the year.

Stratford District.

Hutiwai Road (Clifton County). This settlement road was previously of narrow construction with a number of dangerous overhanging bluffs, and was unmetalled. Widening and metalling were authorized, and during the year 2 miles 34 chains were widened, 45 chains metalled, and 357 lineal feet of culverts were installed.

Urati to Ngatoto Road (Clifton County). The settlers upon this road raised a loan several years ago to assist with the cost of formation work, and within the last few years made an application through the County Council for additional assistance towards the cost of metalling. Work has been proceeding over several seasons, and during the period under review 2 miles 8 chains were metalled and a small amount of culverting completed.

Parihaka Road (Egmont County).—This was one of the few remaining unformed and unmetalled roads in the county. Work was commenced in the previous year, and during the past year 22 chains of the road were formed, 2 miles 72 chains metalled, and two bridges of a total length of 68 lineal feet were erected.

Bedford Road Bridges (Inglewood County).—This settlement road on the lower slopes of Mount Egmont, was formed some five or six years ago, but at that time the several mountain streams crossing the road were bridged only in a temporary manner. The cyclonic storm of February, 1936, caused severe flooding in these streams, and many of the temporary bridges, together with numbers of culverts, were completely washed out. Permanent bridges are now being erected in reinforced concrete, and the programme completed during the year consisted of four structures of a total length of 245 lineal feet.

Omata and Waikare Roads (Patea County).—Both of these roads give access to lands which were settled many years ago, but neither road was metalled. Work is now being carried out, and during the season 2 miles 10 chains were completed.

Mangamahoe Road (Rangitikei County). This is a settlement road in a productive backblocks grazing district and serves a number of settlers. With the advance of transport greater facilities were necessary, and arrangements were made with the County Council covering a metalling programme over a distance of several miles. Work has been proceeding for several seasons, and during the period under review an additional length of 1 mile 23 chains was metalled.

Matau Road Group (Stratford County).—Lands in the Matau and Ngatimaru districts were opened for settlement many years ago, and although access roads were formed at that time the settlers were not established sufficiently strongly to raise a loan to assist with the cost of metalling each road. Consequently little progress was made, and two or three seasons ago, in view of the urgent need of all-weather access to the settlers, arrangements were made to metal about 20 miles of access roads. These comprise the Mangaoapa, Matau, Junction, and the Matau North Roads. Work has progressed steadily and during the period under review an additional length of 9 miles 50 chains was metalled.

Mangaeturoa North Road (Waimarino County).—Metalling improvements were carried out over a distance of 4 miles 38 chains, and 570 lineal feet of culverts were installed.

Waimarino to Raetihi Road (Waimarino County). The original track constructed to give access to settlers upon this road has been found of recent years to give insufficient facilities for access, and arrangements were made to widen the track to a full width road. Work of this description has been completed over a distance of 3 miles 23 chains.

Rata Maire Road (Waimarino County).—This road was of similar description to many others in this county, and in view of the desirability of providing all-weather access to settlers, a grant was made to cover the cost of metalling improvements. Work of this nature was carried out during the period over a distance of 3 miles 14 chains.

Mangapapa Group Roads (Whangamomona County).—The Mangapapa Road is the chief road in this group and gives access from the main highway in the Tangarakau Gorge to a plateau. The settlers using the road have occupied their grazing properties for upwards of twenty years, and their need of a metalled access grew more urgent as additional land was brought into productivity. Metalling-work was commenced during the previous period, and in the year under review an additional length of 2 miles 37 chains was completed.

Moki Road (Whangamomona County). The country adjacent to this road is generally easier in character than most other lands within the county, but there are extensive areas which have never been developed because of poor access. After considerable negotiation, a grant was given to cover the cost of metalling, and 3 miles 65 chains were widened and metalled, and 190 lineal feet of culverts installed.

Napier District.

Mangamaire Road (Dannevirke County).—Reconstruction and metalling are in hand upon this road. Most of the formation work involved, together with additional culverting, was completed during the year, but metalling was not commenced. This will receive attention next season.

Mangatoro Stream Bridge (Fourth Crossing), Mangatoro Valley Road (Dannevirke County).—A suspension bridge consisting of one span of 150 ft. with a deck 3 ft. wide for foot traffic was erected during the year. The cables are carried over reinforced-concrete towers and are anchored to reinforced concrete blocks.

Maunga Road (Dannevirke County).—During the year the County Council forwarded proposals to cover the reformation, culverting, and metalling of a distance of 1 mile 40 chains. By the close of the period the reformation and 220 lineal feet of culverting had been completed. Metalling was commenced, but owing to wet conditions had to be deferred.

Pokokamuka Road (Dannevirke County). Although this road was formed many years ago and not metalled the formation generally remained in comparatively good condition, but there were numbers of sharp corners which needed attention. These were widened, and a small amount of metalling was carried out.

Heay's Access Road (Hawke's Bay County). Metalling improvements were carried out over a distance of 2 miles 15 chains on this back-country settlement road to give all-weather access to settlers on comparatively large grazing properties.

Napier to Taihape Road (Hawke's Bay County). This road is coming into increasing prominence each year as a through connection from Hawke's Bay to the lower King-country at Taihape. Metalling has not yet been completed, and during the season the County Council metalled an additional length of 2 miles with the assistance of a Government subsidy.

Well's Access Road, Puketitiri (Hawke's Bay and Taupo Counties). Work was carried out over a distance of 60 chains, and the portions most likely to give trouble in wet weather were metalled.

Ireland's Road (Patangata County).—This is a settlement road on which 55 chains of new metalling was carried out during the period.

Mangatarata Road (Patangata County). Metalling improvements were carried out over a distance of 1 mile 25 chains to give all-weather access to settlers.

Mangatarata to Long Range Road (Patangata County).—This is a new road which is being formed with the object of giving a more direct access and to provide a convenient stock route. Work was commenced, and a distance of 4 miles 6 chains was formed and culverted.

Wallingford to Hatuma Road (Patangata County).—Metalling was carried out over a distance of 1 mile 10 chains to give access to settlers on large grazing properties.

Blackburn to Springhill Road (Waipawa County).—The County Council arranged to metal 1 mile of this road by public contract, and the work was completed.

Cook's Road (Waipawa County).—New metalling-work received attention over a distance of 80 chains on this settlement road.

Makaretu Block Road (Waipawa County).—There were a number of dangerous corners upon this settlement road, and some of these were widened and the material, mostly rock, used for metalling other sections. The improvements covered a total distance of approximately 30 chains.

Ardkeen Settlement Road (Wairoa County).—This road gives access to settlers who have been upon their properties for many years. All-weather access was urgently needed, and during the period the County Council arranged to metal 1 mile 54 chains with the assistance of a Government subsidy.

Glenbrook and Tangoio to Mohaka Roads (Wairoa County).—These also are settlement roads, and a distance of 1 mile 20 chains of new metalling was carried out by the local body under the public contract system.

Haliburton's Road (Wairoa County).—This road is a backblocks access road and was metalled over a distance of 1 mile 28 chains.

Mangaone to Mangapoike Valley (Tangiwai) Road (Wairoa County). This is an old settlement road giving access to large areas of grazing country. Metalling received attention during the year over a distance of 75 chains.

Mohaka River Bridge (Willow Flat Road), (Wairoa County).—Work was completed during the year on the suspension bridge of one span of 180 ft. 6 in. with a deck width of 8 ft. Some trouble arose as a result of floods, but additional protective measures were taken, and the whole work is now satisfactorily completed.

Mohaka to Putere Road (Wairoa County).—This road gives access to a large number of back-country grazing properties, and new metalling-work received attention over a distance of 3 miles 41 chains.

Otara Stream Bridge, Mossman's Access Road (Wairoa County).—Work upon this bridge was suspended as a result of the disastrous floods of February and April, 1938, but the contract has since been completed and the structure handed over to the County Council for maintenance. It consists of one span of 100 ft. with concrete foundations, hardwood towers, and timber deck on steel stiffening-beams.

Ponui Road (Wairoa County).—New metalling was carried out over a distance of 2 miles 34 chains.

Rotokakarangu Road (Wairoa County).—This is a settlement road upon which new metalling was carried out during the year over a distance of 2 miles 43 chains.

Ruapapa to Waikaretaheke Road (Wairoa County).—Metalling-work has now been completed. The programme for the year consisting of 2 miles 7 chains.

Willow Flat Road (Wairoa County).—This road gives access to large areas of backblocks grazing country, and during the year the County Council attended to the metalling of 3 miles 26 chains under the public contract system. Widening was carried out on the more difficult portions before metalling was commenced.

Oporae to Waihi Road (Weber County).—New metalling-work was carried out over a distance of 1 mile 18 chains on this road to complete the programme commenced during the previous period.

Waimata Road (Weber County). This road was formed and metalled over a distance of 1 mile 56 chains.

Waipatiki Stream Bridge, Limestone Road (Weber County).—This bridge of rolled-steel-joist construction, and consisting of one span of 25 ft. with a hardwood deck 9 ft. wide between wheel-guards, was erected.

Wellington District.

Cunningham's Bridge (Akitio County).—One reinforced-concrete bridge, consisting of one span of 45 ft. with a roadway 20 ft. wide, was erected during the year.

Huiaiti Road (Akitio County).—New metalling-work received attention over a distance of 1 mile 34 chains.

Spur Road (Akitio County).—The metalling improvements commenced in previous years were continued during the period, and an additional length of 1 mile 70 chains was completed.

Waihoki Road (Akitio County).—Metalling received attention over a distance of 1 mile 60 chains on this settlement road.

Tinui Pakowai Road (Castlepoint County).—This is a new road which has been constructed to give access to grazing properties. Formation was carried out during the year over a distance of 5 miles 60 chains, but bridging has yet to receive attention.

Otahome Road (Castlepoint County).—Work was commenced during the previous period, and in the year under review the remaining length of 2 miles 50 chains was metalled.

Te Mai Road (Castlepoint County).—Metalling was carried out over a distance of 1 mile on this road.

Harman's Bridge (Eketahuna County).—One reinforced-concrete bridge, consisting of one span of 40 ft. with a roadway 12 ft. 6 in. wide, was erected during the year.

Tawhero Road (Eketahuna County).—This is a settlement road on which 68 chains of metalling was completed during the season.

Cape Palliser Road (Featherston County).—This road gives access to large grazing properties on the East Coast, and during the year 5 miles 4 chains of formation and 1 mile 60 chains of metalling were completed.

Wainuioru Road (Featherston County).—Metalling received attention over a distance of 1 mile.

Haywards to Pahautanui Road (Hutt County).—Reconstruction work upon this important connecting road has been almost completed with the exception of bridging. During the period 1 mile 28 chains of formation 24 ft. wide and 6 miles of sealing, together with the installation of 431 lineal feet of pipe culverts, were completed. Progress is being made with the erection of new bridges, but these will not be completed until next season.

Plimmerton to Paekakariki Road (Hutt County).—Work is proceeding vigorously upon the construction of this new road, which will obviate the use of the notorious Paekakariki Hill. With the exception of a small section through a swamp, the whole of the road between Plimmerton and Pukerua Bay has been tar-sealed. Formation is well in hand along the foreshore between Pukerua Bay and Paekakariki, and in some places kerbing and channelling is receiving attention. The construction of the large sea-wall is nearing completion, 76·79 chains being finished, and the remainder, 15·1 chains, in hand. Several lengths of lighter retaining and crib walls have been completed, and both overbridges—one at Pukerua Bay and one at Paekakariki—have been completed.

Western Hutt Road (Hutt County).—The new ferro-concrete bridge over the Hutt River at Silverstream was completed during the year and opened to traffic. This structure consists of eight spans each of 62 ft. with a roadway 22 ft. wide and two footpaths each 4 ft. wide. Both approaches have been sealed. Work is proceeding on the Melling to Petone section of the road, but operations have been delayed to some extent pending the moving of the railway-track.

Young's Bridge (Kairanga County).—A reinforced, concrete bridge, consisting of one span of 17 ft. with a roadway 24 ft. wide, was completed during the year.

Mangarere Road (Kiwitea County).—New metalling over a distance of 1 mile 68 chains was completed on this road, together with the installation of 270 lineal feet of pipe culverts.

Renfrew Road (Kiwitea County).—New formation work was needed on this road to give better access to alpine sports-grounds, and during the year 47 chains of road was formed.

Titirangi Road (Kiwitea County).—The metalling of 1 mile 28 chains was completed.

Waipuru Road (Kiwitea County).—This road gives access to settlers, and during the year new metalling was carried out over a distance of 1 mile 73 chains.

Duffy's Road (Masterton County).—This road gives access to settled land, and 1 mile of new metalling was carried out to give access during all weathers.

Homewood Road (Masterton County).—One reinforced-concrete culvert 9 ft. by 9 ft. and 30 ft. long was constructed, together with a road-deviation 10 chains in length.

Kaiwhata River Bridge (Masterton County).—The old structure over this river was damaged badly as a result of floods, and proposals covering the erection of a new bridge were approved

Waihora Road (Masterton County).—New formation work was carried out over a distance of 1 mile 2 chains.

Waingawa Camp Road Bridge (Masterton County).—One reinforced-concrete bridge consisting of three spans, each of 20 ft., with a roadway 20 ft. wide, is in course of erection.

Hall's Bridge (Mauriceville County).—The erection of one reinforced-concrete bridge of one 30 ft. span with a roadway 12 ft. wide was completed.

Woodville to Ashhurst Road (Oroua and Woodville Counties).—This is a new road in course of construction over the ranges immediately north of the present highway through the Manawatu Gorge. Work has been proceeding over the last two seasons, and during the year a distance of 3 miles 50 chains of new construction was completed. The existing road on the Woodville side of the ranges is also receiving attention to bring it up to a standard comparable with the new portion. Plans of the new bridge to be erected across the Pohangina River on the Palmerston North side have been prepared, and tenders will be called shortly.

Makino Stream Bridge, Reid's Line (Oroua County).—One reinforced-concrete bridge consisting of one span of 40 ft. with a roadway 24 ft. wide is being erected. The work is almost completed.

Bolton's Bridge (Pahiatua County).—Work is in hand upon a reinforced-concrete bridge of one 45 ft. span and two cantilever-end spans. The abutments and falsework for the main span are well advanced.

Hull's Bridge (Pahiatua County).—The erection of this bridge consisting of three spans, one of 90 ft. and two of 60 ft., with a roadway 20 ft. wide, has been completed.

Makairo and Waitakotorua Bridges (Pahiatua County).—Work is proceeding upon the erection of these two bridges. They are both reinforced-concrete structures each of three spans, one of 60 ft. and two of 38 ft., with a roadway 20 ft. wide.

Glenburn Road (Wairarapa South County).—Metalling of this settlement road for a distance of 2 miles 24 chains was completed.

Thorndon Overbridge (Wellington City).—Work upon this overbridge was completed during the year, and the bridge was opened to traffic.

Nelson District.

Ure River Road (Awatere County).—Construction work upon this new road has proceeded steadily during the year and is now almost completed. Formation and metalling received attention over a distance of 2 miles 40 chains.

Fifteen-mile Creek Bridge (Collingwood County).—Work on this bridge was completed. The structure is a three-span cantilever type in reinforced concrete—a total length of 100 ft.

Pakawau to Mangarakau Road (Collingwood County). Construction work upon this new road, serving areas of pastoral, milling, and mining country along and below the Westhaven Inlet, was practically completed during the year. Metalling during the year covered a distance of 7 miles 6 chains, and with the completion of this work all-weather access has been given to localities where previously settlers had to contend with tidal conditions. Subsequent to the construction of this road a considerable amount of coal and timber transport has developed.

Paturau Road (Collingwood County).—This is really a continuation southwards of the Pakawau-Mangarakau Road to the mouth of the Paturau River. There was an old road in existence, but this crossed low-lying country and was quite often under water. The new road covers a distance of almost 3 miles 40 chains, and during the year 2 miles 20 chains were cleared and approximately 1 mile of formation was completed.

Long Valley Bridge Kaituna Valley Road (Marlborough County).—The County Council let a contract during the year for the erection of one reinforced-concrete bridge, consisting of three 40 ft. spans with a roadway 10 ft. wide. Work on a road-deviation over a distance of 1 mile 11 chains is also included in the contract, and upon completion of these improvements much more direct access will be given to settlers in the Kaituna Valley.

North Bank Road, Wairau River (Bartlett's Creek to Pine Valley Stream), (Marlborough County).—Arising from erosion which was occurring in the Wairau River consideration was given to proposals to construct stop-banks and spur groynes to protect the River Bank Road and adjoining land. Stop-banks have been constructed over a distance of 1 mile 52 chains, and nine spur groynes have been erected.

Johnstone's Creek Road (Murchison County).—Reformation, widening, and metalling have been carried out for a distance of approximately 26 chains to improve access to settlers. There is yet some metalling to receive attention, but the County Council will deal with this progressively as the need arises.

Maruia River Footbridge (Murchison County).—A suspension footbridge of one span of 100 ft. was erected to give more convenient access to settlers on the West bank of the Maruia River and to provide a safe and convenient crossing for children on their way to school.

Owen River Road (Murchison County). The County Council let a contract covering the reformation and metalling of 37 chains of this road, together with the installation of 48 lineal feet of culverts, and this work was completed during the period.

Rappahannock Road (Murchison County).—Formation and metalling received attention over a distance of 40 chains, giving improved access to backblock settlers.

Portage to Torea Road (Sounds County).—During the year this road was metalled over a distance of 1 mile 20 chains.

Te Mehia to Onahau Road (Sounds County).—Metalling-work on this road was completed over a distance of 1 mile 10 chains.

Go-ahead Creek Bridge, Old Collingwood Inland Road (Takaka County).—One reinforced-concrete bridge consisting of one span of 35 ft., with a roadway 12 ft. wide was completed.

Hidden Treasure Road, Puramahoi (Takaka County).—Metalling improvements have received attention over a distance of 1 mile 20 chains to provide improved access to outlying farms.

Canaan to Takaka Road (Waimea County). This road gives access to settlers in the high country on the Takaka Hills. Metalling was carried out during the year over a distance of 1 mile 50 chains, and 120 lineal feet of new pipe culverts were installed.

Clarke Valley Road (Waimea County).—This road has been metalled over a distance of 2 miles 20 chains to give all-weather access to coal-mines and to gold-mining areas.

Eves Valley Culvert (Waimea County).—One reinforced-box culvert 12 ft. by 5 ft., and 36 ft. long, together with a small amount of road improvements, was completed during the year.

Orchard Creek Culvert, Tadmor-Bush End Road (Waimea County).—One reinforced-concrete culvert 12 ft. by 7 ft. and 28 ft. long, together with approach roading, was completed.

Rosedale Creek Bridge (Waimea County).—Work is proceeding upon the erection of a reinforced-concrete bridge consisting of two spans each of 30 ft. This will eliminate a ford on an important road serving a large farming area in the Motueka Valley.

Upper Stanley Brook Bridge (Waimea County).—One bridge in reinforced concrete, consisting of three spans each of 42 ft. with a roadway 12 ft. wide, was completed during the year.

Greymouth District.

Cain's Road (Buller County).—Formation and metalling work was carried out over a distance of 60 chains on this road.

Karamea to Collingwood Road.—Metalling-work upon this road has been receiving attention in annual stages, and during the year an additional length of 2 miles 24 chains between Oparara and Kohaihai was completed.

Millerton Roads (Buller County).—These roads give access to a mining township, and during the year reconstruction and metalling work over a distance of 2 miles 70 chains was completed.

Access Roads to Pakihi Lands (Buller County).—The Department of Lands and Survey, working in conjunction with the Cawthron Institute, is experimenting with the development of several hundred acres of pakihi lands near Sergeant's Hill. As the development of various areas are commenced access roads become necessary, and during the year under review an additional length of 30 chains was formed.

Carter's Beach Domain Road (Buller County). This road gives access to subdivisions in the Township of Carter's Beach and also to the new aerodrome. A length of 2 miles 30 chains was metalled.

Crooked River Valley Road (Grey County).—This is a new road opening up undeveloped lands, and during the year an additional length of 1 mile 70 chains was formed and metalled, and one bridge 60 ft. long was erected.

Ford's Creek Bridge (Grey County).—Construction work on this timber and concrete bridge 60 ft. long was commenced during the year.

Brown Grey River Bridge–Grey Valley to Maruia Road (Grey County).—Work is proceeding upon the erection of one large timber and rolled-steel-joist bridge 105 ft. long.

Alexander Mine Road (Inangahua County).—During the year under review 2 miles 63 chains of new formation and metalling were completed. Two bridges, each of a span of 25 ft., in concrete and timber, together with 426 lineal feet of culverts, were also completed.

Big River to Rough River Road (Inangahua County).—During the year the erection of a reinforced-concrete bridge consisting of eleven spans and totalling 550 ft. in length was completed

Maruia River Bridge–Williscroft's (Inangahua County).—This bridge is on the Matakitaki to Springlands Junction Road, which is now being improved to carry the traffic from the Nelson District through Murchison to the Lewis Pass. The structure is of reinforced concrete 360 ft. in length and has been completed.

Matakitaki to Springlands Junction Road (Inangahua County).—Three culverts in reinforced concrete and of a total length of 110 lineal feet have been installed.

Palmer's Road (Inangahua County).—The existing formation on this road was widened and metalled over a distance of 1 mile 40 chains to give all-weather access to a large area of grazing country.

Snowy River Road (Inangahua County).—Work was commenced during the year on a deviation over a distance of 1 mile to restore access which was destroyed during a flood.

Springs Junction to Hot Springs Road (Inangahua County).—This road is a portion of the Lewis Pass Road and, upon the completion of the new highway over the pass, has been given attention to bring it up to the standard of the other new work. Widening was completed over a distance of 9 miles 45 chains and metalling over a length of 4 miles 77 chains.

Station Creek Bridge–Matakitaki to Springlands Junction Road (Inangahua County).—Construction work on a reinforced-concrete bridge 120 ft. long is nearing completion.

Arahura to Milltown Road (Westland County).—Widening and metalling improvements are being carried out on this road over a distance of 2 miles 20 chains, but a section of only 1 mile 45 chains was completed during the season.

Gillespies Beach Road (Westland County).—This new road, giving access to Gillespies Beach, where extensive gold-dredging operations are in progress, was completed during the year.

Happy Valley Road (Westland County).—New track-construction has been completed over a distance of 3 miles 22 chains to give access to good farming-land.

Main South Road (Westland County).—Weheka to Bruce Bay Section: Work on this section of approximately 32 miles is now almost completed. During the year 9 miles 40 chains of formation and metalling were carried out, and the only work of this nature yet remaining on the section is in connection with the approaches to the several new bridges. The most important item now in hand is the Karangarua River Suspension Bridge, and work on this structure is proceeding steadily. The bridges over Jacobs River, Mahitahi River, Black Creek, Bullock Creek, and Havelock Creek have been completed, but the bridge over the Manakaiaua River is still in hand.

Bruce Bay to Haast Section: Formation work is proceeding steadily on this section of road, which is now well opened up.

Haast to Jackson's Bay Section: Work is also proceeding on this portion of the road, and a distance of 7 miles has already been formed, culverted, and metalled.

Mananui to Mahinapua Road (Westland County).—Metalling-work is in hand over a distance of 1 mile 77 chains of road.

Waiho to Glacier Road (Westland County).—Work is proceeding on the Waiho to Glacier Road, where a motor road is being formed over a distance of 2 miles 40 chains to give access to the Franz Josef Glacier.

Waitangi River Bridge (Westland County).—The erection of a bridge 360 ft. long over the Waitangi River has been completed, thus giving access to a large area of good country which is now being brought under development.

Weheka to Cook River Ford (Westland County).—Metalling-work has been completed over a distance of 5 miles on this road.

Christchurch District.

Little Akaloa to Decanter Bay Road (Akaroa County).—Extensive improvements have been completed upon this road, which gives access to the wharf at Decanter Bay. Metalling was commenced, but will not be completed until the coming season.

Lewis Pass Road (Amuri County).—Construction work upon this new road has been completed with the exception of two small bridge items.

Ashburton River Bridge, Bland's (Ashburton County).—Work was completed on a timber-pile bridge 100 ft. long across the south branch of the Ashburton River to give access to grazing-lands.

Mount Peel Station to Forest Creek Road (Geraldine County).—Grading and reconstruction work was carried out on a further section of 12 miles of this high country road. Additional metal is being placed, and most of the programme is completed. Paved fords have been constructed over two creeks to minimize the damage occurring with each flood.

Summit Road, Dyer's Pass to Gebbie's Pass (Halswell, Heathcote, Mount Herbert, and Wairewa Counties).—The construction of this new road, which was commenced in previous years, was completed during the season. Formation and metalling over a distance of 5 miles 40 chains comprised the year's programme. This section was declared a main highway and afterwards sealed by the Main Highways Board.

Ball Hut Road (Mackenzie County).—This road, which gives access from the Hermitage to ski-ing grounds, had become more difficult to use by reason of the poor standard of the original construction. During the year complete reformation work was commenced, and a distance of 5 miles was widened to 18 ft. and metalled. All culverts were repaired and others installed where necessary.

Waitohi River Bridge (Waipara County).—One new timber bridge, 120 ft. long, consisting of two timber-truss spans on pile piers was erected. Protective-work involving the construction of a groyne and a stop-bank is also receiving attention.

Purau to Port Levy Road (Mount Herbert County).—Widening work is being carried out over a distance of six miles on this road, and a section of 2 miles 40 chains on the Purau side was completed.

Rampaddock Road (Kowai County).—Reformation work providing for a greater width of roadway was carried out over a section of 2 miles, and twelve culverts of a total length of 280 lineal feet were installed.

DUNEDIN DISTRICT.

Lakeside to Stirling Road (Bruce County).—Gravelling-work received attention over a distance of 1 mile 20 chains of this access road.

Blackburn to Mount Stuart Road (Bruce County).—Formation was carried out over a distance of 1 mile 45 chains to give a roadway 22 ft. wide, and 224 lineal feet of concrete pipes 9 in. in diameter were installed.

Clutha River Bridge, Clydevale (Bruce County).—Construction work on this bridge, consisting of seven spans each of 100 ft., was completed during the year. The distance between wheel-guards is 12 ft., with the exception of the centre span, which has a roadway 18 ft. wide.

Popotunoa to Waipahi Road (Clutha County).—New gravelling-work was carried out over a distance of 3 miles 3 chains.

Clifton Settlement Road (Clutha County).—Gravelling over a distance of 2 miles 17 chains was carried out to give access to settlers.

Kaihiku River Bridge (Clutha County).—This bridge, consisting one 40 ft. span and two 30 ft. spans with a width of 8 ft. between wheel-guards, was completed during the year.

Tahakopa to Wyndham Road (Clutha County).—Formation was completed over a length of 3 miles 40 chains and base-course metalling over a distance of 3 miles 70 chains. A final-coat metalling was also applied over a distance of 40 chains.

Lower Shotover to Speargrass Flat Road (Lake County).—Gravelling-work was completed over a section of 1 mile 30 chains.

Mount Nicholas to Head Von River Road (Lake County).—Improvements, consisting of gravelling over a distance of 2 miles 2 chains, were completed during the year.

Pembroke to Mount Aspiring Road (Lake County).—Back-country settlers had difficulty in reaching their homesteads safely by reason of unformed access across a steep bluff. Fording of the Matukituki River was necessary, and as loss of life had occurred arrangements were made to remove any danger by completing the construction of the road along the bluff. This was comparatively heavy work, but the new access was completed during the season.

Kyeburn River Bridge, Nobbler (Maniototo County).—Construction work on this reinforced-concrete bridge, consisting of four spans each of 45 ft. with a roadway 10 ft. wide, has been completed, and the formation of approach roads is now receiving attention.

Maniototo to Pateroa Road (Maniototo County).—New gravelling-work over a section of 1 mile was carried out during the period.

Bald Hill to Hummock Runs Road (Taieri County).—Gravelling improvements were completed over a distance of 6 miles 34 chains on the Middlemarch to Mount Stoker Section of this road to give access to back-country settlers.

Outram to Hindon Road (Taieri County).—Gravelling-work was carried out over a distance of 3 miles 42 chains.

Old Switzers Road (Tuapeka County).—New gravelling-work over a distance of 1 mile 30 chains was completed.

Breakneck Road (Tuapeka County).—First-coat gravelling was carried out on 1 mile 41 chains of this settlement road, and the second coat will be applied during the coming season.

Waikaia Bush Road (Tuapeka County).—New road-construction was completed over a distance of 3 miles.

Smith's Road (Tuapeka County).—New gravelling-work was carried out over a distance of 1 mile 62 chains.

Chapman's Gully Road (Vincent County).—Gravelling improvements received attention over a distance of 2 miles on this access road.

Clutha River Bridge, Lowburn Ferry (Vincent County).—Construction of this bridge was completed during the previous year with the exception of dwarf abutments and approach roads. These two items were dealt with during the season, and the whole of the work is now completed.

Crawford's Road (Vincent County).—Widening was carried out over a distance of 1 mile, and the whole length was gravelled.

Makarora to Haast Road (Vincent County).—Construction work was continued vigorously during the year on this new road, which will connect the Otago district with the main south road in South Westland. During the year 4 miles 2 chains of bush-felling, 5 miles 51 chains of formation, 3 miles 20 chains of base-course metalling, and 9 miles 60 chains of top-course metalling were completed. A reinforced-concrete bridge, consisting of an arch span of 102 ft. with two land-spans each of 14 ft., is being erected over the Fish River. The footings of piers and abutments and false work for the arch have been commenced. The reinforced-concrete structure over the Makarora River and consisting of one span of 65 ft., two of 60 ft., and two of 24 ft., with a roadway 10 ft. wide, has been completed.

Mount Trotter to Palmerston Road (Waikouaiti County).—New gravelling-work was carried out over a distance of 1 mile 30 chains on this road to give access to settlers.

Dansey's Pass Road (Waitaki County).—Improvements consisting of new gravelling-work were carried out over a distance of 1 mile on this road.

Taylor's Road (Waitaki County).—New gravelling-work received attention over a distance of 1 mile 60 chains.

McLeod's Road (Waitaki County).—Gravelling-work was carried out over a distance of 1 mile 8 chains.

INVERCARGILL DISTRICT.

Cross Road, Titipua (Southland County).—Formation and gravelling work together with 288 lineal feet of culverting, was carried out over a distance of 2 miles 12 chains on this road giving access to settlers.

Dipton Flat Road (Southland County).—Gravelling improvements received attention over a distance of 72 chains.

Eyre Creek Road (Southland County).—Gravelling-work was carried out over a distance of 1 mile 9 chains to give all-weather access to settlers.

Mataura to Clinton Road (Southland County).—During the season under review metalling received attention over a distance of 2 miles 68 chains.

Oreti River Bridge, Bay Road (Southland County).—Work was commenced during the year on the erection of a new bridge over the Oreti River, and at the close of the period fifty-four piles had been driven and one abutment, together with five concrete piers, had been poured.

Waikaia to Waikaka Road (Southland County).—Gravelling improvements were carried out over a distance of 64 chains of this road.

Cockburn Road (Wallace County).—Formation work over a distance of 70 chains and metalling work over a distance of 80 chains were completed.

Mararoa River Bridge, Mount Nicholas Access Road (Wallace County).—One new bridge of a length of 225 ft., together with approaches, was completed.

Merrivale to Te Tua Road (Wallace County).—Gravelling-work was carried out over a distance of 1 mile 9 chains of this road to give access to settlers.

Hollyford to Okuru Road (Lake County).—Construction work on this new motor road was continued vigorously during the year. Bush-work has now been completed over a distance of 5 miles 75 chains, formation over a distance of 4 miles 72 chains, and base-course gravelling of half-width over a distance of 4 miles 45 chains.

Lora Road (Wallace County).—Formation and gravelling-work was carried out over a distance of 1 mile 20 chains to give access to Crown lands being offered for selection.

Wakapatu Native Development Road (Wallace County).—Native lands in this locality are being developed for closer settlement, and a new road is needed. Work is proceeding, and during the period under review 74 chains of bush-clearing, 77 chains of ditching, and 50 chains of formation were completed.

LANDS IMPROVEMENT.

WHANGAREI DISTRICT.

Sand-dune Reclamation.—Kaitaia Area: Work commenced in July, 1938, and ended in September. Little attempt was made to extend the marram coverage, all efforts being directed towards strengthening isolated weaknesses which had appeared in the 2,400 acres formerly planted at the southern end of the Ninety-mile Beach. However, marram-grass nurseries were established at half-mile intervals for a distance of 8 miles north of existing plantations to meet future needs. In the Te Kao area, besides strengthening the previous plantings, approximately 74 acres were added. Five marram nurseries were established at Houhora Heads to provide for future needs on the East Coast.

Lupin was sown broadcast where and when conditions were favourable for extension.

Between Ahipara and the Waipapakauri Beach Road the tree plantations were strengthened and extended in sheltered localities. Various species of pine, including some *Cupressus macrocarpa*, totalling 75,200 trees, were planted in approximately 110 acres. The "strike" appears to be satisfactory.

Kikuyu-grass as a coverage after lupin was tried with encouraging results.

Te Kopuru Area.—Work in this area was carried out from the beginning of July to the end of September, 1938. Fourteen acres of marram-grass nurseries were established along 5 miles of coast-line at half-mile intervals southwards from the drifts fixed in former seasons to a point opposite Tikinui. Marram "blanking" was done on the fixed drifts as required to make good losses—a total area of 94 acres being treated. Lupin was sown as and when required, slightly over $\frac{3}{4}$ ton of seed being used. Lupin-growth suffered from the abnormally dry season, but the marram has grown well.

Altogether 13,100 trees were planted out, 10,000 being used to blank the 12 acres planted in 1937, the balance being used to extend the plantations for another 3 acres. Experiment with kikuyu-grass gave satisfactory results and justifies further planting.

Ruawai Drainage Improvements.—During the year an extensive engineering investigation involving an aerial survey was made of the 20,000 acres lying within the Raupo Drainage District. From the field data obtained a comprehensive scheme of improvements to existing stop-banks, flood-gate outlets, internal drainage, &c., as well as provision of additional canals, was designed to alleviate existing unsatisfactory conditions. All details of the Department's scheme have been received in Head Office for consideration.

Dargaville Borough and Hobson and Otamatea Counties Water-supply.—Investigations in connection with this scheme were completed and comprehensive proposals prepared and submitted to the Government for consideration in regard to the question of subsidy. An outline of the scheme was placed before the local bodies concerned, and they are now considering their policy and making a canvas of the district to ascertain settlers' and industrial requirements. Investigation work this year has been limited to installation of two concrete-measuring weirs and recording of data relative to discharge in the supply-stream.

Rawene Tidal Flat.—During the construction period last year approximately nine men were employed on this work. The stop-bank and flood-gates were completed in October, and tide-water was excluded from this 200-acre reclamation on 22nd December. Since then the work has been strengthened and maintained as required.

AUCKLAND DISTRICT.

Hauraki Plains East Water-supply.—This scheme, which is estimated to cost £84,000, was commenced during the year, and the laying of concrete and galvanized-pipe mains is progressing favourably.

Hikutaia River (Clearing).—Willows were removed from a length of 1 mile 50 chains with a log-hauler and stacked in readiness for burning.

Hoteo River (Clearing).—This scheme was continued during the year, an additional 5 miles 26 chains being cleared of willows. This brought the completed length to nine miles, and the works were then closed down. The river is now clear of willows from the coast to a point adjacent to the Warkworth–Tauhoa, via Kaipara Flats, Main Highway and approximately 20 chains from the Hoteo Railway-station. The work has proved of great benefit to the district, besides minimizing the flooding of the main highway and railway.

Mangaorongo Stream (Willow-clearing).—Preliminary arrangements for the commencement of this work were completed, and with the arrival of the necessary plant operations will shortly be in full swing. Machinery will be used on this job wherever possible. Camps for workmen are now in course of erection, and willows have been frilled and poisoned over a length of two miles.

Mangatawhiri and Mangatangi Streams (River Protection).—The drainage of this area is to be investigated, and it is expected that the necessary surveys will shortly be put in hand.

Morrison's Culvert.—A 4-ft. pipe culvert, 56 ft. in length, was completed, together with flood and sluice gates in the Lower Waihou River, Kaimanawa Area.

Matatoki Drainage Scheme: Bond's Road Area.—All breaches in the stop-banking system have been repaired and new banks formed for 31 chains. Drains totalling 52 chains were excavated and a 3 ft. culvert and floodgate installed at the main outlet to the area.

Otau Drainage.—Further surveys in connection with the drainage of this district were carried out, and a report in amplification of that previously prepared is in preparation.

Piako and Waitoa Rivers (Clearing Willows).—This work is being carried out by the Lands Department, and during the period lengths of 1 mile 18 chains and 3 miles 40 chains were cleared in the Piako and Waitoa Rivers (lower section) respectively.

Taupiri Drainage Scheme.—This work, which is being carried out by drag-line in continuation of the major work done in previous years, was continued. A further length of 12 miles 5 chains was completed and handed over to the Taupiri Drainage Board. During the period 3 miles 60 chains of drain, involving a quantity of 37,897 cubic yards of excavation, were completed. The major portion of this length was through very heavy swamp and heavy bush, and progress has consequently been retarded.

Upper Waiwera (Tahekeroa and Bayer's Roads), (Clearing).—The clearing of willows and other growth from the streams affecting these roads was commenced, and satisfactory progress has been made. The work, which covers a length of seven miles, of which 260 chains are willow-infested, will give relief from flooding to some eighteen settlers. Altogether 2 miles 8 chains have been cleared, and beneficial results are already apparent.

Waihou and Ohinemuri Rivers Improvement (Maintenance).—General maintenance was carried out on both these rivers within the limits of the scheme, particular attention being paid to all floodgates and outlets thereto. Some 2 miles 25 chains of berm was cleared of heavy gorse and blackberry.

Whangape Stream (Clearing).—Proposals covering the widening to a bottom width of 50 ft. of the length of the Whangape Stream from the Waikato River to the Lake Whangape have been submitted by the Raglan County Council and have been approved. Tenders will be invited for this work at an early date.

Sand-dune Reclamation Works.—Pakiri – Te Arai Mangawai Areas: Operations during the year covered mainly the maintaining of the planted areas and extending the nurseries. In addition, 700 acres of new marram-planting was undertaken and this is in a satisfactory condition. Young lupins have become established in sheltered areas, and future seed-supplies should now be assured. The marram on the dunes adjacent to the Pakiri River is already proving effective in checking drifts.

South Kaipara Heads: Reclamation work in this locality has progressed very favourably, and a good cover of lupin has been established over an area of approximately 700 acres. One ton of seed was collected during the summer months, and the area was also covered with lupin-seed in pods and on branches. Fifty acres of marram were replanted and 260 acres of new work carried out.

North Waikato Heads and Kariotahi: Weather conditions during the year were generally favourable, and good progress was made with this work. Two hundred acres of new marram were planted, besides blanking in damaged patches. Owing to unfavourable weather conditions at the time seed was ripening, a smaller quantity of lupin-seed than was expected was saved. However, over 7,000 lb. was saved or purchased, and this will be sufficient for next spring sowing. Seed was

broadcast on approximately 1,000 acres, of which about 600 acres was new ground. About 512,000 trees were planted. Varieties used included *Pinus radiata*, *P. muricata*, *P. pinaster*, and *Cupressus macrocarpa*. After replacing trees lost on areas previously planted, an area of 255 acres of new ground was covered. Besides the trees planted out on this area, 70,000 were forwarded to Woodhill, making a total of 582,000 trees planted out and sent away. Of these 22,000 were obtained from Rotorua and the remainder were grown by the Department. Besides those planted out, over 307,000 seedlings were lined out, making the total trees handled for the season about 890,000. Total areas to date covered by the different operations are: Marram-grass planting, 4,240 acres; Lupin-sowing, 2,280 acres; Tree-planting, 661 acres. A drying-room has been erected in connection with accommodation at No. 3 Camp, and sheds have been built for the protection of the trucks and other machines located on the area. Concrete water-tanks have been constructed to replace those of corrugated iron originally installed, and a hot-water system was added to the kitchen equipment at the main cookhouse. Fourteen chains of new sand-arresting fencing were erected and old fences maintained and raised. These fences are operating admirably, and a continuous foredune is now well established. Line-clearing was carried out as usual on lengths similar to last year—about 1,000 miles of old lines and 200 miles of new. Several sections of land which were privately owned and were either sand or covered with scrub have been ceded to the Crown and fenced in with the reclamation area.

Woodhill–Muriwai–Helensville: Reclamation work was continued in this area during the period. Fairly favourable weather conditions were experienced, although in the dry spell encountered during the summer months some loss occurred among the newly-planted marram. The plantations, however, are healthy, and all species are making fast growth. Marram and lupin planted in the early stages of this work now cover fairly large blocks, approximately 5,000 acres. Eight hundred acres of new marram were planted and 1,200 acres replanted. The tree nursery has been enlarged and now has a capacity for 500,000 seedlings lined out. Altogether 320,000 were lined out this period, 550,000 trees were planted, and all species are in a satisfactory condition and making fast growth. Six tons of lupin-seed, of which 4½ tons were sown, were collected, and 200 miles of lines cut for tree-planting. Summarized, the work carried out to date is—8,400 acres of marram and 1,965,275 trees planted, 1,552 miles of lines and 14 miles of fire breaks cut, and 12 miles of foredune fencing erected.

Taumarunui District.

Mokau River (Willow-clearing).—Ring-barking and poisoning of willows on the Mokau River has now been completed from the Wairere falls to the eight-mile Junction, three miles being completed during the period under review, and making a total treatment of 21 miles 50 chains to date. The cutting and hauling over a length of 3 miles is now under way. Maintenance-work was carried out over 6 miles of river previously hauled.

Mokauiti (Willow-clearing).—The remaining 1 mile of this work was completed, all willows under the original proposal having now been poisoned, cut, and stacked. Light maintenance-work is still required in several sections.

Mokau River.—On a subsidy basis, the Waitomo County Council carried out maintenance in respect of willows on the Mokau River from the Awakau Road northwards for 8 miles in order to keep the river open for navigation.

Napier District.

Kumeti Creek Survey.—A survey of Kumeti Creek from its source in the Ruahine Range to its junction with the Manawatu River was put in hand. The survey was commenced at the junction with the Manawatu River, and the traverse was completed for a distance of 3 miles 69 chains. Cross-sections, which are being taken with the level and are up to 36 chains long, were completed to peg 3 miles 54 chains. This survey is being undertaken to enable the position with regard to the deposition of shingle to be studied.

Kumeti Drain (Flood-protective Works).—During the year further deposition of shingle took place in the drain, more particularly between Weirs Nos. 4 to 5, causing flood-water to overflow the banks. Also considerable lateral erosion occurred over a length of 18 chains below Thorburn's Bridge, allowing flood-water to spread over a wide bed. Unless the lateral erosion is controlled, shoaling of the bed may ultimately cause flood-water to overflow the banks at this point also. Proposals were submitted and approved for putting in lateral erosion-control groynes below Thorburn's Bridge and extending the stop-banking between Weirs Nos. 4 to 5, as well as carrying out maintenance repairs to various weirs which were damaged by the impact of heavy timber and boulders on the steps and mats. This work is now proceeding, and to date 2,500 cubic yards of shingle and clay have been delivered for stop-banks, weirs have been repaired, and the lateral groynes below Thorburn's Bridge are in hand.

Miscellaneous.—A number of surveys and investigations in connection with proposed water-supply and flood-control schemes were carried out in Southern Hawke's Bay.

Ngaruroro River-control Scheme.—For the first four months of the year under review work on this scheme was delayed while the damage caused by last year's flood was being repaired.

Since the commencement of the work in 1936 work had been carried out by hand-labour in conjunction with horse teams and drays, but in January last mechanically-operated scoops were started, and by the end of February three units were in operation. These machines are working in areas that cannot be worked by man-labour at a reasonable cost. Very good work has been done by this plant, and the cost has been satisfactory.

Negotiations for the purchase of land required for the scheme have been carried out by the Land Purchase staff of the Public Works Department, and satisfactory settlements have been made.

In order to dry the land sufficiently to enable the building of stop-banks to be carried out extensive drainage operations were necessary at Puninga. The result of this has been very satisfactory, the whole of the swamp area there being now in a practically dry state. In addition to this, heavy willow plantations at Chesterhope and Puninga have been cleared.

During the year approximately 11 miles of levee have been built, absorbing 379,000 cubic yards of spoil. In addition, over 50,000 cubic yards were handled in repairing flood damage, and 80,000 cubic yards were raised by the excavator from drains and borrow pits.

Ten miles of fencing have been erected and 9 miles of protection belt planted. Some 75 chains of fascines have been put in and established for the purpose of maintaining channel-alignment.

Wellington District.

Hokio-Manawatu Rivers (Sand Dunes Reclamation).—Satisfactory progress has been made during the period. During the season 395,220 trees of various kinds were raised and planted out. One hundred and twenty acres were planted in marram-grass, as well as blanking up old work.

Paraparaumu Camp.—The useful work of draining, clearing, &c., is still being carried out by single men in this camp.

Hutt River Estuary Reclamation.—Except for maintenance-work, &c., the reclamation has been completed, 92 acres being reclaimed. During the year 119,007 cubic yards were dumped, making a total of 1,042,793 cubic yards which was excavated from the river-bed and from quarries close at hand.

Ahikouka River Board.—The 14 chains of new stop-bank protecting the Ahikouka Settlement has been satisfactorily constructed.

Colombo Street Bridge, Masterton Borough.—A reinforced-concrete bridge of four 40 ft. spans has been lengthened by the addition of two 40 ft. spans to one end and a new approach formed.

Nelson District.

Awatere Water-supply to Seddon District.—This work, which has been designed mainly to serve farm lands in the Seddon area, has been under construction during the year.

The headworks have been completed, 97 chains of 12 in. pipe-line and 37 chains of 10 in. pipe-line have been laid. Work on the difficult crossing of the Awatere River is in hand, 23 chains of 10 in. pipe-line having been laid and 18 chains concreted.

Wai-iti River (Protective Works).—Further repairs to the Wai-iti River stop-bank in Waimea West were carried out by the farmers concerned with the assistance of Government grants made to the Waimea County Council. This work is designed to form part of the major protection scheme, the investigations for which are now complete.

Waimea River.—The detailed investigation survey, covering this river and its main tributaries, the Wairoa and Wai-iti, which has been in hand during the past two years, has now been completed.

The area of the plain is approximately 30 square miles, and of this area about 10 square miles is affected by flooding, including two State highways and various other roads.

Plans, reports, and estimates for a comprehensive scheme of control have been prepared. This work entailed the traversing and levelling of 7 miles 71 chains of river-bank on the Wai-iti River, 6 miles 76 chains on the Wairoa River, and 8 miles 30 chains on the Waimea River, making a total length of survey of 23 miles 17 chains.

In addition to this work, numerous cross sections of the river have been taken, involving approximately 3½ miles of pegging and levelling.

An aerial survey of the floodable area has also been made.

Takaka River.—During the period a survey of this river in the Lower Takaka district was carried out by contract let by the Takaka County Council under Government subsidy.

The work comprised traversing, levelling, and cross-sectioning over a distance of 3 miles 63 chains on the right bank, and for approximately 1 mile on the left bank.

This survey was carried out to determine a scheme for river-control in relation to farm lands and highways.

Greymouth District.

Karamea River (Flood-control).—This work is nearing completion. The work done for the year included Otumahana wall 42,800 tons stone, stop-banking 50,000 cubic yards, bank-protection 25 chains, and trestle work, 1,032 ft.

The diversion of the river from the Otumahana Lagoon has restored the original mouth, but an extension of Otumahana wall was necessary to confine the river-mouth to a reasonable width. The works have already considerably improved the carrying-capacity of the river, and the stop-banking has eliminated the flood menace.

Oparara River (Flood-control).—Two large river cuts and 1 mile of embankment were constructed. A timber training-wall at the river entrance is nearing completion.

Hokitika River (Erosion).—Further work was carried out to prevent the erosion of farming lands at Koiterangi.

Arahura River (Flood-control).—The work consists of three large gabion-headed groynes and subsidiary bank-protection. Unemployed labour was used, and the work is nearing completion.

Grey River (Erosion at Coal Creek Flat).—This work was necessary to prevent a disastrous erosion which threatened Coal Creek Flat and the road communications. The work is completed, and consisted of 1 mile of heavy stop-bank and 1 mile of heavy stone river-bank revetment.

Grey River (Groyne at Raupo Soldiers' Settlement).—A large groyne and stop-bank was constructed at Raupo Settlement to close a large overflow channel which threatened the destruction of this settlement.

Christchurch District.

Ashley River Trust (Flood-control Works).—This extensive work was completed during the year and handed over to the Ashley River Trust for maintenance.

New Brighton (Sand-dune Fixation).—The fore dune along the New Brighton Esplanade was fixed by means of scrub fences and marram grass planting over a length of 1 mile. Unemployed labour was used for the work.

Ashburton River (Flood-control).—The completed work on this scheme consists of 5 miles of floodway clearing, 1½ miles of stumping, and 4 miles of stop-banking containing 21,900 cubic yards of excavation. Three tractors and accessory plant were used on this work.

Opihi River (Protection Works).—This work is 92 per cent. completed: it consists of 14,200 cubic yards of stop-banking and 700 cubic yards of rock-protection over a length of 70 chains.

Broad Gully and Dog Kennel Creek (Flood Channel).—This scheme consists of 6 miles of flood channel 100 ft. wide to carry a flood-discharge from two creeks to the sea and prevent damage to crops. The work is almost completed and involved 150,000 cubic yards of mechanical plant excavation.

Dunedin District.

Catlins River Erosion (Pounawea Domain).—Protective work is in hand at the Pounawea Domain to prevent the destruction of the beach amenities. The work is nearing completion.

SMALL-FARMS SCHEMES.

Auckland District.

Mangawai Kauri-gum Reserve.—Satisfactory progress was made during the year with the development of this block, in continuation of the work carried out in previous years. A considerable area has been cleared of scrub, gum-holes have been filled, and the land drained, ploughed, and grassed. To date, 637 acres are in pasture, while 155 acres have been ploughed and are in fallow. Some 500 chains of shelter-belt trees have been planted. All grass-lands are in a satisfactory condition, and at present the block is carrying 186 head of run cattle and two horses.

Kaipara Harbour Mangrove Reclamation (Glorit Section), (Peterson's Block).—A further 300 acres were cleared of mangroves during the year, the whole of this area being double-disked and left to fallow. The area has also been drained by spider drains at 2-chain intervals, involving a total length of 57 miles of drains. To give access to the various sections, eight bridges, 13 ft. by 12 ft., were built over the main drain. The buffalo-grass planted on the four miles of stop-banks has made good growth, resulting in little maintenance being required to keep the banks in good order.

Kaipara Harbour Mangrove Flat Reclamation (Kukutango Block), (Jordan's Block).—The dewatering of 272 acres of this area and the building of 2 miles 73 chains of stop-banks were completed during the period. Some 12 acres of mangroves were cleared by machines but the advent of wet weather necessitated the postponement of such work until conditions were more favourable.

Oyster Point Section.—This area is now dewatered, stop-banking is almost completed, and three floodgates have been placed in this section. During the period an additional length of 17 chains of access road was completed, making a total length of road 3 miles 1 chain.

Mill Road Block.—An area of 43½ acres has been cleared of blackberry &c., and sown with grass, with excellent results. Forty chains of new drain were excavated and 154 chains of old drain opened up. One hundred and four chains of fencing were completed.

Taumarunui District.

Ngatamahine Block.—The developmental work undertaken during the year was as follows: 13 miles 30 chains of fencing, 420 acres laid down in permanent pasture, 340 acres ploughed, and 450 acres of scrub cut and burnt.

A large main drain, 382 chains long, was constructed, whilst 23 chains of additional internal roading and metalling were completed.

Pururu Block.—The Lands Development Branch took over this block at the end of January, 1939. The development work carried out during the year comprised 14 miles 27 chains of permanent and subdivision fencing. Three hundred acres were ploughed, of which 80 acres were put in crops and 220 acres in grass. In addition, 122 chains of drains were constructed.

Piu Block.—This block was taken over by the Lands Development Branch at the end of January, 1939, prior to which date good progress had been made with the development work.

During the period 100 acres were cleared and stumped, 117 chains of fencing were erected, and 120 chains of main drains excavated. Some 205 acres were sown in permanent pasture and 78 acres in crops. Roadwork was continued for a further 25 chains, and 50 chains of last year's roading were metalled.

Stratford District.

Makaranui Scheme.—During the past year 590 acres were stumped and cleared in readiness for ploughing, and stumping was carried out over an area of 115 acres. The length of drains constructed totalled 826 chains, and creeks were cleared over a length of 527 chains. Old fencing, totalling 473 chains, was repaired, and 169 chains of new fencing were erected. Sixteen chains of roading were formed,

and stock bridges aggregating 195 ft. in length were constructed. Seventy acres were ploughed, 130 acres were sown in temporary pasture, 160 acres were sown in permanent pasture, and 120 acres were sown in crops.

Raetihi Scheme.—The work undertaken during the year comprised 90 acres of ploughing and the erection of a 12 ft. bridge.

Ohakune Scheme.—69 chains of old fencing were repaired and 98 chains of new fencing were erected. An area of 55 acres was ploughed and 154 acres were top-dressed. A total length of 1,315 ft. of water-pipe was laid, and 10 chains of drains were completed.

Napier District.

Ahuriri Lagoon Reclamation. The Ahuriri Lagoon, formerly an extensive arm of the sea of some 7,500 acres in area, is now being drained and reclaimed by the Department on behalf of the Small-farms Board. The lagoon was partially drained by the uplift of the land which accompanied the disastrous earthquake of 1931, and this rendered its complete drainage possible and also desirable on account of the great prospective value of the land due to its proximity to the Town of Napier. This work was commenced in 1934, and the method adopted has been to build approximately 11 miles of stop-bank to protect the flats from inundation by flood-water from the adjoining hills.

The internal drainage of the areas thus protected has to be effected by pumping, on account of their being largely below sea-level. Two pumping-stations have been erected for this purpose.

One of the chief difficulties connected with the reclamation work is the removal from the soil of salt left there by the sea which once covered its surface. With a view to accomplishing this a special system, comprising some 350 miles of small drains, has been constructed. These drains have been dug in parallel lines 2 chains apart over the whole area of land. Their purpose is to carry off the salt in solution as it is leeched out of the soil, and tests which have been carried out by the Department of Agriculture indicate that the amount of salt in the ground is being steadily decreased by this means.

An area of from 600 acres to 700 acres of the reclaimed land has been put down in rye-grass and barley, and the block, under the management of the Lands Department, is now carrying from seven thousand to eight thousand sheep, and approximately two hundred head of dry stock.

At the beginning of the year under review, the greater part of the block was still flooded from the disastrous storm of Anzac Day, 1938. As a consequence the first few months of the year were largely occupied in dewatering the land and repairing flood damage, and this, unfortunately, caused a delay of four to five months in the progress of the work, which, however, is now practically completed.

The principal items dealt with during the year have been the completion of the metalling of some 26 miles of access roads, the topping-up of 11 miles of stop-bank, and the completion of all drains. A water-supply over the whole block for stock-watering purposes has been designed and partly completed, and a further 25 miles of fencing have been erected.

Apart from drainage, pumping, and general maintenance of roads and drains, a small amount of topping-up of stop-banks, the completion of the water-supply, and the completion of fencing, yet remain to be done, and it is anticipated that this work will be completed during the next few months. One hundred and eighty men have been employed during the year.

IMPROVEMENTS TO PUBLIC SCHOOL GROUNDS.

Throughout the year an extensive programme was continued in connection with the Government's scheme for improving the grounds of public schools. The preparation of proposals and the execution of the works were under the control of the Public Works Department, but finance was provided by the Education Department and the Labour Department, the latter Department's contribution being met from the Employment Promotion Fund. An important feature of the year's activities was the provision of adequate play areas in many localities where previously few, if any, facilities existed for physical and recreational exercise.

In addition to excavating, draining, levelling, and grading large playing-grounds, assembly areas were metalled and sealed, while at a number of schools basketball and tennis-courts were also constructed. The planting of ornamental trees and shrubs, the erection of fences, and the permanent surfacing of paths, &c., have vastly improved the school amenities in numerous localities.

In the interests of the physical welfare of pupils, several swimming-baths were constructed under a special-subsidy basis granted by the Minister of Education whereby School Committees, assisted by local residents, contributed towards the cost of materials.

These general improvements were carried out at several hundred schools throughout the Dominion, and the results are greatly appreciated by teachers, pupils, and parents.

HARBOUR-WORKS.

Awanui Harbour Dredging.—As a result of the initial dredging carried out by the Department between August and December, 1937, vessels have been enabled to work the port without interruption, and the improved conditions have brought about an increase in trade. Regular sailings are of special importance in the export of butter, and to avert any risk of interruption a small amount of redredging was carried out in August, 1938, early in the export season. The annual revenue derived from a small harbour-improvement rate has exceeded the anticipated amount, and should prove more than sufficient to meet the full cost of any further dredging or other improvement to the port which may be needed in the future.

Mangonui Wharf.—The contract for this work was practically completed during the previous year. The principal work carried out during the current year has been the painting of the wharf shed. The wharf was formally opened by the Hon. the Minister of Public Works in February, 1939.

Te Kao Wharf, Parengarenga Harbour.—A wharf in the form of a breastwork 60 ft. long has been completed in the upper reaches of the Te Kao Channel, adjacent to the remote Native settlement of Te Kao. The work included the erection of a wharf shed, 25 ft. by 20 ft., and metalled-road access thereto.

Te Kopuru Wharf, Kaipara Harbour.—A contract was let in May, 1939, for the replacement of the present structure, which was in a precarious condition.

Waikokopu Harbour.—The control of this harbour has been carried out by the Wairoa Harbour Board on behalf of the Public Works Department. During the year 116 vessels worked the port, and a busy year was experienced, over 8,000 tons of general cargo and 150,000 super feet of timber being brought in, while about 106,000 carcasses of mutton, lamb, pork, &c., and a considerable quantity of general export business, was handled. Maintenance-work only has been carried out during the year.

Hicks Bay Wharf.—The engineering survey has been completed for the repairing or renewing of the approach to this wharf, and repairs to the actual wharf structure. Plans and estimates are in hand.

Homewood Wharf, Pelorus Sound.—The end span on this wharf has been raised, three new piles have been driven, redecking completed, new steps installed, and the wharf generally reconditioned.

Wharves in Sounds County.—Surveys have been carried out for wharves at Ship Cove and Te Mehia in Queen Charlotte Sound and at Tennyson Inlet in Pelorus Sound. Plans of Ship Cove and Tennyson Inlet wharves have been approved, and tenders will be invited shortly for the erection of both structures.

Karamea Harbour.—Repairs were carried out to the Harbourmaster's residence.

Little Wanganui Harbour.—The old wharf has been redecked, and extensions to the wharf, by filling in both tees to provide additional space for stacking timber, are in hand.

Okuru Harbour.—The erection of a new wharf-shed is in hand.

Jackson's Bay Harbour.—The construction of the wharf 202 ft. long and 16 ft. wide in hardwood, with a trestle approach 400 ft. long, and a launch-landing, were completed. A second-hand mooring-buoy was fixed in the bay.

Okarito Harbour.—Further work to open up the new entrance south of the training-wall was carried out, and was sufficiently effective to allow the port to be worked towards the end of the year, for the first time for many years.

Bruce Bay.—A survey for a new wharf has been carried out

Akaroa Wharf.—Minor repairs were carried out in consequence of damage done by H.M.S. "Wakakura."

Waikawa Slipway.—A slipway for the purpose of providing facilities for the overhaul of fishing-vessels in the Waikawa Harbour was erected during the year, and the work was almost completed by March, 1939.

Bluff Harbour: Fairchild Rock.—The Bluff Harbour Board co-operated with the Department in placing in position the automatic light and buoy at Fairchild Rock in the Bluff Harbour.

Lighthouses.

Cape Maria Van Dieman.—The erection of the new landing-crane to replace that damaged by a severe storm in June of last year has been completed, as has also the renewal of the cableway to the mainland, together with a new carrier and cage. Repairs to foundations of the tower were carried out during the period. Arrangements were made for the carrying-out of a survey in connection with the removal of the station to Cape Reinga, and the machinery, switchboard battery, radio-masts, &c., are on hand ready for the installation of the radio beacon and electrification.

Cape Brett.—Repairs were carried out to the landing-crane during the year.

Cuvier Island.—During the period, operations were commenced in connection with the electrification of the station and the provision of a radio beacon. The construction of the power-house, the installation of duplicate generating-equipment, the erection of two lattice-steel radio-beacon towers, and earth-mats, together with the electrification of the light, laying of cables, and the wiring of dwellings, were completed. The light is now functioning under electric automatic control, but owing to the non-delivery of materials, the installation of the radio-beacon equipment is not, as yet, complete. Twenty chains of access road, with the necessary culverting, were constructed, and the drainage of the residential area and the fencing of the power-house site undertaken.

Moko Hinau.—The erection of a power-house in connection with the installation of a radio beacon and the electrification of the station has been completed. The power-winch was moved 50 ft. uphill to facilitate the handling of power-house materials.

East Cape.—Repairs to plant at the lighthouse were carried out and an inspection and report made covering the matter of improving the difficult access to this lighthouse round the Pouretua Bluff. Several slips on the track were removed.

Matakaoa Point.—An inspection and report have been made on storm damage to the access track leading to the lighthouse, but no repair work has been carried out.

Portland Island.—A survey has been carried out with a view to improving tramway and road access from the landing to the lighthouse station.

Stephens Island.—The three cottages occupied by the keepers have been cleaned and repainted, and sundry maintenance-work carried out to exteriors. All plumbing-work has been put into good order, baths and basins installed, and overhaul and repairs to drains effected. All interior maintenance-work was carried out as required, and the buildings left in good order.

The roofs of both the wireless house and signal cabin have been repaired and painted.

The lighthouse tower, school, landing-shed, both engine houses, and dry store all received the necessary maintenance-work and were repainted.

The whole of the tram-line was overhauled, new sleepers put in and repacked, and the line left in good working-order.

During the period, the power-house for the electrification of the station and installation of a radio beacon were erected. Duplicate generating-equipment, switchboard, and battery were installed, the erection of two lattice-steel radio-beacon towers and an earth-mat, together with the electrification of the light, laying of cables, and wiring of dwellings, were completed. A short-wave aerial-mast was also erected. The light is now functioning under electric automatic control, but the installation of the radio beacon has been delayed pending the arrival of equipment. This equipment is now on hand, and installation work is under way.

Farewell Spit.—A hardwood-timber landing-stage, fabricated at the workshop, has been erected on site on this station.

Brothers Island.—A radio-telephone-communication aerial-mast and auxiliary gear, fabricated at the workshop, has been erected and an engine-shed supplied and installed. The davit for the south landing-crane has also been erected.

French Pass.—A signal-mast has been fabricated at the workshop for erection at this station.

Separation Point. An acetylene automatic light has been erected at this point ready to be put into operation. A crab winch and landing-crane have been erected, and a tramway laid from the crane to the base of the steel tower.

This light, with lantern and sun-valve mounted on the steel tower, is all complete with gas-cylinders, and only remains to be put into commission.

Cape Campbell.—The work of electrification and installation of a radio beacon was put in hand early in the period. The power-house was erected during the period 1937–38. Duplicate generating-equipment, switchboard, and battery have now been installed, and the electrification of the light, laying of cables, and wiring of dwellings all completed. Four umbrella-type aerials were erected from the tower, and an earth-mat laid round its base. The light is now functioning under electric automatic control, and the radio beacon is working to schedule.

Godley Head. During the period minor repairs were carried out to the fog-signal engines.

In order to make room for Defence Department activity in the vicinity of the lighthouse it has become necessary to move the light and the keeper's dwelling. After inspection of the locality a suitable site was chosen lower down the cliff, and preliminary survey work put in hand. As it is proposed to electrify this light when it is moved, estimates have been prepared covering both its removal and electrification.

These are at present under discussion with the Defence Department with a view to their participating in the cost of removal.

Centre Island.—Plans and specifications were prepared for the erection of three lighthouse-keepers' cottages at this station, and during the year all the necessary materials were purchased by this Department and conveyed to the Island. A contract was let in February last for the erection of the cottages, and it was anticipated that work would be in hand by the end of the period and completed by the middle of October next.

Puysegur Point.—A report on the condition of the three cottages, &c., at this station was prepared in July, 1938, and the necessary authority to effect repairs was subsequently issued. The materials were conveyed to Puysegur in December, but some difficulty was experienced in getting them from the landing to the site of the work. All materials are now on the site, and renovation work is in progress.

A reconnaissance survey of the access road from the landing to the lighthouse, a distance of approximately $1\frac{3}{4}$ miles, was made during the 1937–38 period, and an estimate of the work has been compiled. The construction of the road will probably be put in hand during 1939–40.

Tairoa Head.—During the year a new concrete building was erected for the fog signal, and repairs and renovations were carried out to the lighthouse and dwellings.

Jackson's Bay.—In connection with the proposed light at this point, a preliminary survey has been completed and tenders called for the supply of a lighthouse-tower, landing-crane, winches, and light equipment, including lens.

General.

A number of applications were received from local bodies and private people for approval of works involving marine interests. Among the various applications were the following:—

Foreshore Licenses.—Mangonui Harbour; Kaipara Harbour; Paremata; Queenstown, Lake Wakatipu; Wairoa River, Kaipara Harbour; Mercury Island; Kohukohu, Hokianga Harbour; Dargaville, Wairoa River, Kaipara Harbour; Dudding's Creek, Kaipara Harbour; Terakohe, Golden Bay; Awanui River, Wharf; Whangaroa Harbour;

Wharves and Jetties.—Lyttelton Harbour; Graving Dock, Lyttelton Harbour; Matakana Island, Tauranga Harbour; Hobson Wharf, Auckland Harbour; Queenstown, Lake Wakatipu; Tauranga Harbour; Sumpter Wharf, Oamaru Harbour; Awanui River; Haulashore Island, Nelson Harbour;

Boatshed, Skids, Slipways, &c.—Anderson's Bay, Otago Harbour; Colinswood, Otago Harbour; Karitane, Waikouaiti River (14); St. Mary's Bay, Auckland Harbour (2); Deborah Bay, Otago Harbour; Lower Portobello Bay, Otago Harbour; The Cove, Waverley, Otago Harbour (2); Picton; Broad Bay, Otago Harbour; Ponsonby, Auckland Harbour; Sulphur Bay, Northcote, Auckland; Evans Bay, Wellington Harbour; Smith's Bay, Ross Point, Otago Harbour; Roseneath, Sawyers Bay, Otago Harbour;

Breastworks and Retaining-walls. Wakefield Quay, Nelson; Punguru, Hokianga Harbour; Export Wharf, Auckland Harbour; Evans Bay, Wellington Harbour; Milford Swimming-pool, Wairau Creek Estuary; Helensville Creek, Kaipara Harbour; Panmure.

Reclamation.—Haven Road, Nelson Harbour; Panguru, Hokianga Harbour; Export Wharf, Auckland Harbour; Evans Bay, Wellington Harbour.

General.—Extension to Breakwater, Oamaru Harbour; anchorages and mooring-sites, Waipapa and Kerikeri Rivers, Bay of Islands; bridge, Narrows, Waikato River; bathing-enclosure, Motueka; filling in old bed of Waiarohia Stream, Whangarei; embankments and bridges, Western Shore, Otago Harbour; water-main, Tauranga Harbour; beacons, Davey Bank, Bluff Harbour; bridge, Whenuakite River.

ESTABLISHMENT OF AERODROMES AND LANDING-GROUNDS AND AIR-ROUTE FACILITIES.

The development of aerodromes, landing-grounds, air-route facilities, and Air Force stations has in recent years become a major national undertaking, and during the period under review considerable progress has been achieved. In particular, construction and development work in connection with the expansion of the Royal New Zealand Air Force has, as a defence measure, received special attention.

Civil Aerodrome Programme.

In pursuance of the policy adopted some years ago, development on civil aerodromes has been concentrated to provide fields to serve the established main trunk air routes and those routes which are expected to come into operation within the next few years. However, the necessity of providing for feeder services and odd fields serving particular localities has not been lost sight of. The end of this period finds the major portion of the programme well toward completion with much improved fields now available throughout the country from all viewpoints—larger available areas, improved surface conditions and drainage, clearer flying approaches, improved wireless facilities, and more satisfactory facilities for the handling of passengers and freight.

All construction work has been undertaken by the most expeditious and economical methods, utilizing a maximum of plant, while on most of the major undertakings the work has been carried out by private contractors under the supervision of the Department and to its designs.

During the period work was proceeding on a total of twenty new fields that had not previously been in use, while major improvements or extensions were in hand on eighteen existing fields and minor improvements on other grounds. The Government was also responsible for the maintenance of twenty-three landing-grounds either as Government emergency-landing grounds or as landing-grounds in remote localities, and continued maintenance after construction on thirteen fields prior to handing over to local controlling authorities.

Radio Aids to Air Navigation and Transport.—Under the guidance of the Aeradio Committee and in co-operation with the Radio Section of the Post and Telegraph Department much progress has been made with the installation of radio facilities to assist the safe and efficient operation of air services. During the year the number of aeradio-transmitting stations was brought up to fifteen, an addition of two. Aeradio-receiving and direction-finding stations are being provided at eleven aerodromes and although at the end of the period only one station was operating, all other stations are now awaiting the installation of equipment. A radio-approach beacon, to assist blind-flying approaches under conditions of bad visibility, has been installed at Taieri Aerodrome and is being operated experimentally.

To provide for the new trans-Tasman Air Service an entirely separate aeradio system is required not only to facilitate air to ground and ground to air communication, but also communication between terminals and the fixing of aircraft position by radio-direction finding. A short-wave-direction-finding station has been provided at Awarua, Southland, and an up-to-date station is being constructed at East Tamaki Head, Auckland. At the latter station temporary provision is being made initially, and a transmitting-station, a receiving-station, a medium wave Adcock DF station and a shortwave Adcock DF are being provided. Designs for the permanent buildings are in hand and will be proceeded with later. The main receiving-station will be known as "the Musick Memorial Aeradio Station" in memory of the late Captain Musick, of Pan American Airways, who pioneered the air route from America to New Zealand.

Trans-Tasman Terminal Base Auckland.—In preparation for the commencement of the Trans-Tasman Air Service later in 1939 work was placed in hand in January, 1939, to provide an air terminal base at Mechanics Bay, Auckland, to serve the flying-boats that will be operating the service. The erection of an administration building, a workshop block, and an engine-test house were commenced and completed during the period. The assembly and installation of equipment and the placing of moorings and landing-facilities are now well forward.

A hangar of sufficient dimensions to house one of the flying-boats that will be operating the service is being provided on reclaimed ground at the R.N.Z.A.F. Depot, Hobsonville. The foundations have been placed, and erection is proceeding.

Royal New Zealand Air Force Establishment.

Close co-operation has been maintained between this Department and the Air Department in the design and development of Air Force Stations. This year has again seen very extensive additions to the programme already adopted, and heavy and urgent demands have been made for designs and

construction in connection with these stations. The development on Air Force stations has become a major item in the Department's activities. A large building programme has been involved, and in some cases contractors have experienced great difficulty in obtaining sufficient trained craftsmen and regular material supplies to maintain progress to the schedule laid down.

Details of works carried out on R.N.Z.A.F. stations during the year are as follows:—

R.N.Z.A.F. Aircraft Repair Depot, Hobsonville.—The enlargement of the flying-field was completed and the new areas sown in grass. Additional field drainage was provided, and a landing-circle and name constructed in concrete.

Buildings were in course of erection as follows—Single airmen's barracks: Two additional wings added and additional messing and kitchen accommodation provided. Magazine stores: Nine bomb-stores and eight explosive-stores were erected, complete with earth traverses, tunnels, and service roads. Public-works office completed. Timber hangar (265 ft. by 156 ft.), completed. Equipment stores: Two completed, with further two stores in hand. Airmen's hutments: Two blocks in hand. Residences: Five residences acquired and re-erected on new sites. Guard-house: Under construction. Administration building: Under construction. Standby set, house and substation: Under construction. Aircraft repair shop: Under construction. Garages: Under construction. Seaplane hangar: Under construction.

Extensive additions to existing essential services such as sewerage, storm-water drainage, electrical supply, and water-supply are being proceeded with, together with improvements and extensions to station roads.

Recreation facilities provided during the year include a golf-course, tennis-courts, miniature rifle range, and N.C.O.'s club rooms.

The maintenance of all buildings, services, roads, grounds, and flying-field was carried out by the Department.

R.N.Z.A.F. Operation Station, Whenuapai.—Development of this station commenced during the year.

The grading, levelling, and drainage of the flying-field (413 acres) was commenced in January, 1939, and by 30th June, 1939, 448,763 cubic yards of spoil had been shifted, 170 acres sown down in grass, and 1,773 chains of subsoil drains placed.

The whole site of the aerodrome has been cleared of trees, fences, hedges, and structures; fourteen houses were removed from the area, and a new boundary fence erected.

New roadworks were put in hand to adjust the roading system of the district and improvements to the main highway between Brigham's Creek, Whenuapai, and Hobsonville were commenced. A start has been made in the formation and metalling of the internal roads.

Several miles of power-transmission lines were removed and new lines constructed clear of the aerodrome.

Foundation work for two large arched-concrete hangars and the airmen's barracks was commenced and is well forward.

Designs are being prepared for additional buildings and for all essential services.

R.N.Z.A.F. Operation Station, Ohakea.—Progress on the development of this station, which had little more than commenced at the beginning of this period, has been satisfactory and is generally up to schedule.

The contractor for the grading, levelling, and drainage of the flying-field (316 acres) made a late start, and progress is behind schedule. Most of the heavy excavation is completed, and 160 acres have been grassed and drained. The open-ring boundary drains are well forward.

All internal roads, except behind the hangars, have been formed, metalled, and kerbed and channelled, but are not yet sealed.

Sewerage reticulation is approximately 50 per cent. completed, while a start has been made with the septic tank and effluent-discharge main and percolating filter.

Storm-water drainage is approximately 50 per cent. completed, and the power-supply main has been brought to the station, though internal reticulation is not commenced pending the arrival of the cable.

A start has been made with the sinking of a 6-ft.-diameter well for the water-supply, and supply and reticulation pipes and pumps are on order. A contract has been let for the erection of a 100,000-gallon water-tower.

Roading, earthwork, drainage, and flood protection are in hand for the explosive area.

The following buildings are in course of erection—No. 1 arched concrete hangar is almost completed. No. 2 arched concrete hangar is well in hand. Administration block is practically completed. Officers' mess and quarters are nearing completion. Airmen's barracks: Two wings are completed and two wings are well in hand; the central block is nearing completion except for finishing work. Residences: The foundations for some thirty houses are completed and framing is now in hand. Standby set house: Foundations are completed. Public-works depot: This building has been completed.

R.N.Z.A.F. Flying Training School, Woodbourne (Blenheim).—During the period under review it was decided to proceed urgently with the provision of an advanced flying training school at the site of the old disused civil aerodrome at Woodbourne, near Blenheim.

In February, 1939, a contract was let for the reconditioning, smoothing, and regrassing of 200 acres of flying-field, and this was satisfactorily carried out before winter.

The erection of two large timber hangars (265 ft. by 156 ft.) was put in hand, and the framework of one hangar was completed at the end of the period.

Two airmen's dormitory blocks are nearing completion, while an airmen's mess, an officer's mess, and an officers' dormitory block are well forward.

Foundation and framing work have been commenced for the following buildings: Public Works depot; practice bomb store and gas building; latrines; fire-tender and ambulance garage; main store; headquarters building; navigation and education building; guard-house.

Good progress has been made in forming, metalling, and sealing internal roads, while a commencement has been made with sewerage reticulation, storm-water drainage, and water-supply for which a 4-ft.-diameter well, 60 ft. deep, has been completed.

R.N.Z.A.F. Flying Training School, Wigram.—Again at this station proposals have been adopted for a large increase in the establishment, and consequently an accelerated building programme has been proceeded with. The station is being developed as the permanent advanced Flying Training School, and will, when completed, provide for training four times as many trainees as formerly.

In consequence of the intended building programme, necessitating many alterations to the original layout, much work has been evolved in extending roads and essential services such as water-supply, sewerage, storm-water drainage, and electrical-power supply. This work has been carried out as it has become necessary. A tree-planting and landscaping programme was adopted and proceeded with in the appropriate season.

Work proceeded on the provision of an air-firing and bombing range at Lake Ellesmere and is now approximately 80 per cent. completed.

The following buildings were completed during the period and are now occupied: Ten residences for airmen, thirteen residences for non-commissioned officers, seven residences for officers, headquarters building, main store No. 1, oil-store, guard-house, water-tower, standby set house, sick-quarters, extension to the workshop block, P.W.D. depot, additional wing to main airmen's barracks, airmen's dormitory hutment, lubricant and inflammable store, 11,000 gallon tank for bulk fuel storage.

The following buildings are in the course of erection: Sergeants' mess and quarters, ration store, instructional block, officers' mess and quarters, car-shelters, timber hangar (265 ft. by 156 ft.), concrete hangars, Wigram type No. 3 and 4, main store No. 2.

Designs have been prepared for other additional buildings, and erection will be commenced at an early date.

Civil Aerodromes and Landing-grounds.

North Auckland District.—Engineering surveys were undertaken at the following sites: Kaikohe (two sites) Dargaville (alternative site), Parengarenga Harbour (for emergency seaplane alighting area).

Construction work was in hand as follows:—

Waipapakauri: 22 acres of the original field and a 35 acres extension were regraded and sown in grass to form a field of total area of 78 acres. 22 acres of low-lying area were drained by the placing of subsoil drains. The field will be available for use next summer.

Kerikeri: 55 acres were graded, levelled, and sown in grass, and are now available for use.

Rawene: An area of tidal flat is being reclaimed by stop-banking, and some 105 acres are being set aside for aerodrome purposes.

Whangarei: An area of 113 acres at Onerahi has been graded, levelled, and sown in grass and will be available for use next summer. Other work involved included the removal and re-erection of twenty-three residences, fences, and overhead service lines; the rearrangement of water-supply services to Onerahi Township and the provision of four new tennis-courts and the formation and metalling of 73 chains of new road, together with 148 chains of existing road.

Auckland District.—Engineering surveys were undertaken at the following sites: Coromandel, Whitianga, Raglan and Rukuhia.

Construction work was carried out as follows:—

Mangere: Additional subsoil drains were installed. A building was erected for the radio-receiving and direction-finding station.

Thames: An area of 77 acres was developed as an aerodrome and will be available for use next summer. A further 112 chains of subsoil drains were placed, and the surrounding stop-banks were raised and strengthened. 92 chains of runways 50 yards wide were formed and surfaced with shell and sand. A heavy growth of fescue was eradicated.

Great Barrier (Claris Aerodrome): This field was licensed and opened for use during the year. Further marram-grass was planted to arrest sand-drift, and a shelter-shed was erected.

Maintenance: The Department undertook maintenance of the Claris Aerodrome (Great Barrier Island) and of the Ngaruawahia Emergency-landing ground.

Tauranga District.—Sites were investigated at Whakatane, Te Kaha, and Waihau Bay.

Tauranga: The initial portion of this field was licensed and opened to traffic during the year. Work was commenced on an extension covering 130 acres, and for this 8,000 cubic yards of spoil have been shifted to date and 55 acres are ready for sowing. 125 chains of subsoil drains were placed on the original field, and an additional 1 mile of access road formed and metalled. A radio transmitting-station was provided and is operating.

Opotiki: This field of 109 acres was licensed and brought into use during the year. Obstructing power and telephone lines and hedges were removed, and 2 miles 6 chains of new fences placed.

Atiamuri Emergency-landing Ground: This field was graded, levelled, sown in grass, and fenced during the period. It will be available for use this coming summer.

Maintenance: The Department undertook the maintenance of the following fields: Tauranga, Opotiki, Taupo, and Rotorua, as well as the Galatea Emergency-landing Ground. Minor works were also attended to.

Gisborne District.—Sites were investigated at Rakuhia.

Construction was undertaken as follows:—

Gisborne: The western extension of 30 acres was brought into use during the year, and the southern extension of 51 acres and an area formerly occupied by the old hangar were graded, levelled, and sown in grass. A new hangar was erected by Union Airways, and a concrete apron and storm-water drainage system installed by the Department. A commencement has been made in deviating the obstructing main transmission line. A permanent radio transmission-station was provided and is operating, while the building has been erected for the receiving and direction-finding station.

Opoutama Emergency-landing Ground: Following flood damage last year, this field has been reconditioned and extended, and the flying-field now covers 30 acres.

Hawke's Bay District. Engineering surveys have been undertaken at Wairoa.

Construction work was carried out as follows:

Napier (Westshore): Building completed for radio-receiving and direction-finding station. Minor improvements effected.

Hastings: An area of some 10 acres was topsoiled and sown in grass.

Waipukurau: This field of 105 acres was completed during the year, and a comprehensive subsoil drainage system installed.

Maintenance: The Department carried out maintenance work on Napier, Hastings, Waipukurau, and Dannevirke Aerodromes and on Mohaka Emergency-landing ground.

Taumarunui District.—Te Kuiti: A great improvement to the drainage of this field was effected, and the extensions carried out last year were brought into use.

Taranaki District.—New Plymouth: The balance of the levelling of the extensions was completed and portion made available for use. The existing building and facilities were moved to a new site, and the new Te Arei Road was formed and metalled. The remaining areas not yet in use will be available next summer. The building for the radio-receiving and direction-finding station was completed and the area levelled and fenced off.

Stratford: It was found necessary to close this field from use, to resmooth and top-dress the surface, and to undertake further extensive subsoil drainage. This work is well forward, and the field should be available again late next summer.

Hawera: Obstructing overhead telegraph-lines were removed. A 100-ft.-diameter landing-circle and a loop road to the administration area were provided.

Wanganui: Improvements and extensions to the drainage system were undertaken by the Wanganui City Council.

Karioi: This field was maintained by the Department, and minor improvements were effected.

Wellington District.—Milson (Palmerston North): This field was handed over to the Palmerston North City Council as Controlling Authority after minor attention to the flying-field. A building for a radio-receiving and direction-finding station was erected, and road access and power-supply provided.

Feilding.—It was found necessary to undertake further subsoil drainage on this field, and 5,212 ft. of tile drains were installed and 42 acres were mole-drained. Fifty-five acres were rolled and top-dressed, and two new windsocks were installed.

Masterton.—The surface of this field having become very rough, the whole area was ploughed, smoothed by agricultural operations, and resown in grass. The field will be available again next summer.

Paraparaumu Emergency-landing Ground: A contract was let, and work has commenced in grading and levelling an area of 105 acres.

Rongotai (Wellington): The erection of a large wooden hangar was completed for the Department. Proposals have been framed both for temporary improvements and the permanent enlargement of this field. An experimental direction-finding station was erected and operated.

Nelson District.—Nelson: Work on this field was brought to completion during the year, involving shifting 205,000 cubic yards of spoil, making a total for the job of 805,000 cubic yards. Work extended over 107 acres, making a total of 158 acres surfaced. The field was brought into use during the year, but portion only of the area was available.

Other work entailed in this development include formation and metalling of roads, stone protection of batters, culverting, open drains, 81 chains of subsoil drains, and repairs and maintenance to the existing area.

A radio-receiving and direction-finding station was provided and is now operating.

Blenheim: A building was erected for the radio-receiving and direction-finding station. This field was controlled and maintained by the Department.

Takaka: The levelling and grassing of this field were completed. Thirty-eight acres were finished during the year, making the total area available 80 acres. A total of 113,000 cubic yards were shifted. Proposals for a drainage system were prepared.

Grassmere: Emergency-landing ground—stop-banking was completed.

Tophouse: Emergency-landing ground the work of levelling this field has commenced, and to date some 25,000 cubic yards have been completed.

Clarence: Emergency-landing ground—work was put in hand during the year and is nearing completion. To date 72,000 cubic yards have been shifted.

Maintenance: The Department undertook the maintenance of the following fields: Nelson, Blenheim, and Motueka Aerodromes, and emergency-landing grounds at Grassmere and Kekerangu.

Canterbury District.—Harewood (Christchurch): The City Council, with monetary assistance from the Government, has completed the development of the flying-field, and is now erecting an administration building. The building for the radio-receiving and direction-finding station was erected, and power and road access provided.

Timaru: The levelling and grassing of the flying-field has been completed and a comprehensive subsoil drainage system installed. The field is being left to consolidate. Considerable work for flood protection in the way of stop-banking and stream-diversion was carried out and completed. The main outfall culvert was extended and a pump-house erected.

Ashburton: Minor improvements to surface were undertaken.

Maintenance: The Department undertook maintenance at Wigram and Mount Cook Aerodromes and at Conway Emergency-landing Ground.

Westland District.—An engineering survey was undertaken at Karamea.

Minor improvements were carried out at the following fields: Wataroa, Waiho, Weheka, Karangarua, Mahitahi, Mussel Point, and Inchbonnie.

Westport: The greater portion of the original field at North Beach was top-dressed with spoil and resown.

A new landing strip at Carters Beach, 900 yards by 90 yards, was developed and sown down and opened to traffic. A radio-transmitting-station was provided.

Greymouth: Work proceeded on the extensions. All the ring-holding bank has been placed, and the dredged filling is nearing completion. A small area has been topsoiled.

Hokitika: Improvements to the surface, including the metalling of runways and an extension of the subsoil drainage system, were completed. A radio-transmitting-station was brought into operation and the building erected, with power laid on for the radio-receiving and direction-finding station.

Haast: The regrading and resowing of this field was completed and the ground brought into use.

Upper Okuru: The cross-landing strip has been regraded and is awaiting consolidation.

Jackson's Bay: A landing-strip, 500 yards by 50 yards, was formed and grassed, and the formation of a similar cross strip is nearing completion. A permanent radio-station was provided.

Maintenance: The Department undertook maintenance on the following fields: (*a*) As fields under development—Westport and Hokitika; (*b*) as fields in remote localities—Inchbonnie, Wataroa, Waiho, Weheka, Mahitahi, Haast, Upper Okuru, and Mussel Point.

Otago-Southland District.—A site was investigated at Tuatapere.

Waianakarua Emergency-landing Ground: This field of 67 acres was completed, sown in grass, boundary marked, and brought into use.

Taieri: The bituminous apron was replaced by a concrete one, and the vicinity drained. A building for the radio-receiving and direction-finding station was erected and power laid on, while a radio beacon with two marker beacons was installed and is operating experimentally. A wooden hangar for use by the R.N.Z. Territorial Air Force is under construction, and proposals are under consideration for the extension of the aerodrome.

Frankton (Queenstown): This field of 72 acres was graded, levelled, and sown in grass. It was opened for use during the period.

Gore: The whole of the field was smoothed off and rolled. Improvements were effected by deepening ditches, placing subsoil drains, and providing rabbit-proof fencing.

Invercargill: A large ring-drain is nearing completion, and subsoil drainage has been commenced. A commencement has been made with extensions. The original field should be available this coming summer.

Minor improvements were carried out on the following fields: Cromwell, Glenorchy, Ranfurly, and Balclutha.

The Department undertook the maintenance of the following fields: Waitaki, Glenorchy, Frankton, and Waianakarua.

General.

Removal of Obstructions surrounding Aerodromes.—Close watch is being maintained to ensure that the air approaches to all aerodromes are being kept clear of obstructions, and steps are being taken, under existing legislation, to cause the removal of existing obstructions. Much still remains to be accomplished in this direction.

"*Air Pilot*" *and* "*Notices to Airmen.*"—The Department has continued its service to airmen in compiling amendments and additions to the *Air Pilot*. A new edition was published during the year. In addition, information is collected regarding the condition of all aerodromes and landing-grounds, and pilots are advised immediately by "Notices to Airmen," issued by the Air Department, of all alterations and changes, especially those affecting the safe use of any particular field.

Aerial Surveys.—The Department supervises and places orders for all aerial survey work on behalf of Government Departments, and during the year many square miles of country were photographed for purposes of irrigation, drainage, river and erosion control, road location, forestry, soil survey and mapping.

Meteorological Service.—Regular observations of winds and meteorological phenomena are taken at many aerodromes and analysed in conjunction with the Meteorological Section of the Department of Scientific and Industrial Research.

Meteorological and Aeradio Station, Raoul, Island, Kermadecs.—During the year the temporary aeradio station was maintained and operated on this island and the personnel served with supplies and equipment. Owing to difficulty in arranging transport, a commencement of the erection of the permanent station had to be postponed, but arrangements are now finalized for the work to be undertaken in the present year.

Investigations in the Pacific.—During the year the Department was charged with making an investigation into matters pertaining to aviation among the islands of the Pacific. Preliminary surveys were undertaken and are now being followed up by engineering surveys.

PLANT AND MECHANICAL EQUIPMENT.

For the period under review the mechanization of all suitable construction works throughout New Zealand was completed, and the expenditure on plant has now reached a maximum, unless further major construction works are initiated; but even in that event some plant could be made available from some works now nearing completion. There is, of course, the necessity for replacing some items of plant that have operated over a period of only two to three years, working three shifts per day. This continuous service has had the effect of shortening the total life of the plant, necessitating gradual replacement of those items that are worn out through fair wear-and-tear. These replacements would ordinarily absorb some capital expenditure during the ensuing year, but as the Department has instituted plant-repair depots to take care of the maintenance of its modern machines, and as the maintenance efficiency of the depots throughout New Zealand develops, expenditure on replacement plant will be comparatively light. This arrangement should tend further to reduce the cost of operating the machines and obviate the need for early replacement.

Plant in Use.—The following works in New Zealand are equipped in varying degrees with suitable plant, which has been maintained in good order during the year:—

(1) Railway-construction works, including tunnelling and formation.
(2) Irrigation schemes: Excavating irrigation ditches and construction of dams.
(3) Roads and highway construction and maintenance under Public Works and Highways votes.
(4) Aerodromes: Construction of Defence and civil aerodromes and emergency-landing grounds.
(5) Electric-power-supply schemes: Construction and maintenance.
(6) Swamp-drainage and reclamation schemes.
(7) Harbour and river improvement and control works.
(8) Bridges and level-crossing elimination: Construction on highways, roads, and railways.
(9) Quarrying: Supply of road-metal and railway ballast.
(10) Transmission-lines: Construction of new extensions.
(11) Naval Defence: Construction of magazines and naval base extensions.
(12) Launch and barge transport.

Major items of plant number 4,336 machines, and include Diesel crawler tractors with angledozers, carry-all scrapers, rock-rooters, hauling-winches and allied equipment, Diesel crawler excavators and drag-lines, large Diesel stationary units, Diesel road-graders, Diesel compressors, Diesel locomotives, and Diesel winches. The total horse-power of these modern units approximates 36,000 b.h.p. The brake horse-power of several classes of these units are as follows: 295 Diesel tractors (20 b.h.p. to 100 b.h.p.), 15,000 b.h.p.; 171 Diesel graders, 6,400 b.h.p.; 73 Diesel excavators and drag-lines, 2,500 b.h.p.; 147 Diesel compressors, 4,600 b.h.p.; 52 Diesel locomotives, 1,800 b.h.p.

Public Works Designed Plant.—The modern Diesel road-graders, which were designed by the Department and manufactured in New Zealand, have continued to give highly efficient and economical service, and are proving to compare more than favourably with imported machines of a similar type. The contract let during the year for a further supply of these graders is nearing completion. The machines made under earlier contracts and which have now been in service for approximately three years are still giving very efficient service. The change-over from petrol-engines in some of these earlier machines to British Diesel engines has now been completed, and the wisdom of such a change is reflected in operating-costs, which have been considerably lowered, and in the increased standard of work performed. It is interesting to note here that the British Diesel engine selected is used extensively in England by many of the largest manufacturers of machinery as the power unit for a variety of other machines. This confirms that the Department's selection of this particular type of engine has been sound.

In order to meet the special requirements of conditions in New Zealand the Department originated a 200-gallon mobile oil-fired bitumen sprayer for lorry-mounting, and then called tenders throughout the world for the supply of such units. The tenders obtained from overseas, however, did not fully meet specified requirements, and the best quotation for local manufacture was accepted. Actually this offer was the most competitive of those received. Some of these machines have been completed, and in operation they are proving entirely satisfactory. The design of the equipment embodies all the latest development and is in advance of those types offered by standard manufacturers overseas.

Sales of Plant.—In keeping with the Department's established practice, any obsolete or worn-out items of plant are continually being disposed of by public tender. The Department's policy under its mechanization scheme of withdrawing from service any obsolete or worn-out machinery and replacing it with more modern machinery is reflected in the reduced overhead and maintenance costs.

Local Bodies.—County Councils and other local bodies in New Zealand have, during the year, purchased various types of modern road machinery through the Main Highways Board, and a considerable amount of equipment has been purchased on recommendations and specifications prepared by the Public Works Department.

Motor-vehicle Operations.—The increase in construction and maintenance works throughout New Zealand has necessitated a further increase in the number of motor-vehicles required to successfully supervise the large number of undertakings now in hand.

The following statements outline the operations of the Public Works and Main Highways motor-vehicle fleets for the year.

Table 1.

	Motor-vehicles.			
	At 1st July, 1938.	Sold.	Purchased.	At 31st March, 1939.
Cars	212	7	1	206
Light deliveries	296	10	98	384
Trucks (30 cwt. and over)	156	5	44	195
	664	22	143	785

Operating-costs for Year.

The costs shown include—
Running charges: Petrol, oil, grease, tires, tubes, repairs, and maintenance.
Standing charges: Interest at 4½ per cent. per annum and depreciation ranging from a minimum of 12½ per cent. to a maximum of 20 per cent. per annum on capital cost, this variation being governed by the type and mechanical condition of each vehicle and the conditions under which it operates; garage rent (5s. per week); registration and annual license fees.

Table 2.

Type of Vehicle.	Total Cost.	Total Mileage.	Cost per Mile.
	£		d.
Year 1936–37—			
Cars and light deliveries (10 cwt. to 15 cwt.)	53,159	4,032,349	3·16
Trucks (1 ton and over)	17,570	770,353	5·47
	70,729	4,802,702	3·53
Year 1937–38—			
Cars and light deliveries (10 cwt. to 15 cwt.)	76,887	5,399,170	3·42
Trucks (1 ton and over)	28,867	1,196,196	5·79
	105,754	6,595,366	3·85
Year 1938–39—			
Cars and light deliveries (10 cwt. to 15 cwt.)	103,082	6,577,271	3·79
Trucks (1 ton and over)	41,959	1,776,869	5·67
	145,041	8,354,140	4·17

Table 3.—Analysis of Table 2, showing Operating-costs in various Districts (Motor-vehicle Operations, 1938–39).

District.	Cars and Light Deliveries.				Trucks (1 Ton and over).			
	Number of Vehicles.	Mileage.	Total Cost.	Cost per Mile.	Number of Vehicles.	Mileage.	Total Cost.	Cost per Mile.
			£	d.			£	d.
Whangarei	28	329,012	5,335	3·89	7	104,270	2,322	5·34
Auckland	58	771,500	11,611	3·61	12	124,292	2,595	5·01
Tauranga	27	356,875	5,028	3·38	20	210,161	4,015	4·58
Gisborne	18	229,971	3,530	3·68	11	101,147	2,628	6·24
Taumarunui	16	177,982	3,355	4·52	10	92,628	2,524	6·54
Stratford	34	414,749	6,146	3·56	13	107,845	2,303	5·12
Napier	23	296,734	4,047	3·27	6	55,922	1,354	5·81
Wellington	45	425,085	6,986	3·94	10	53,404	1,621	7·28
Nelson	33	353,917	5,065	3·43	10	120,631	2,199	4·37
Greymouth	32	399,743	5,659	3·40	13	126,287	2,696	5·12
Christchurch	49	659,121	9,895	3·60	17	208,642	3,984	4·58
Dunedin	37	399,733	5,737	3·44	17	160,550	4,084	6·10
Total, general districts	400	4,814,422	72,394	3·60	146	1,465,779	32,325	5·29
Hamilton Electrical	53	439,772	8,274	4·51	10	56,279	1,807	7·70
Palmerston North Electrical	35	291,027	6,137	5·06	8	44,871	1,925	10·29
Christchurch Electrical	33	337,269	6,558	4·67	15	134,038	4,056	7·26
Southland Electrical	70	694,781	9,719	3·36	15	75,902	1,846	5·84
Total, electrical districts	191	1,762,849	30,688	4·18	48	311,090	9,634	7·43
Grand total, all districts	591	6,577,271	103,082	3·79	194	1,776,869	41,959	5·67

Note.—All vehicles that have operated for any part of the year are included—*i.e.*, vehicles purchased and sold during the period.

Total cost includes—

Running cost: Tires, tubes, fuel, lubricants, repairs, and maintenance.

Standing charges: Interest, depreciation, garaging (5s. per week), registration, and license fees.

Motor-vehicle Allowances.—The total amount paid to departmental officers at scale rates for use of their own motor-vehicles upon Government business comprises a large number of comparatively small sums for mileages run for the convenience of the Department where the transfer or purchase of a departmental vehicle was not warranted and the arrangement of hire was inexpedient:—

Year.	Total Allowances. £
1936–37	2,497
1937–38	4,564
1938–39	8,316

Motor-lorry Hire.—It frequently happens that in the matter of transport on a number of undertakings departmental motor-trucks cannot be transferred to meet requirements and the circumstances do not warrant the purchase of new vehicles. Therefore, where reasonable hire rates

and competitive tenders are available from local transport enterprises, motor-trucks are hired by the Department. The amounts paid to private owners of transport for the hire of motor-trucks on public works during the past three years are as follows :—

Year.	Amount. £
1936–37	191,003
1937–38	440,353
1938–39	816,889

The large increase for the last year is due to the substantial expansion of the Department's activities.

Plant Repair Depots.—The Department has now installed depots at the following places: Whangarei, Auckland, Helensville, Rotorua, Taumarunui, Gisborne, Napier, Wellington, Nelson, Greymouth, Temuka, Dunedin, Invercargill, and also on all major construction works. These shops provide necessary and adequate facilities for supervision and repair of plant in the field, whilst the New Zealand Government Railway Workshops are also utilized to a considerable extent.

The general increase of work necessary to maintain such a large quantity of plant is being satisfactorily handled by the depots throughout New Zealand, and this is reflected in the low average cost per cubic yard from the operation of machinery on construction and maintenance works. In its depots the Department has instituted the latest methods of welding equipment for building up tracks, &c., in addition to installing other precision tools and equipment. Where spare parts are unobtainable in New Zealand, and are urgently required, the Department arranges to manufacture these locally at prices which compare favourably with the imported article. The extension of the Department's activities along these lines does not enter into competition with manufacturing firms in New Zealand who are capable of undertaking such work. In general, the Department's policy is to keep the machines up to a high standard of efficiency by manufacturing either in Government depots or local workshops in preference to importing from overseas.

Services for other Departments.—During the year a number of other Government Departments availed themselves of the Public Works Department's facilities in respect of mechanical matters, and in many cases the Department executed mechanical work on their behalf, such as water-supply, heating and ventilating schemes, domestic mechanical services, pumping-schemes, equipment of aerodromes, supply of machine tools and workshop equipment, electrical installations, electric lifts, tractors, and lighthouse generating-sets.

The Departments concerned included Transport, Lands, Forestry, Native, Mines, Marine, State Housing, Defence, Naval, Mental Hospitals, Cook Islands, Tourist and Publicity, Agriculture, and Prisons.

Inspection and Supervision.—To ensure that the Department's plant is being maintained at a high standard the inspection and supervision of all plant items is regularly carried out in the field, and to this continued supervision can be attributed in no small measure the efficiency of the plant.

During the year a motor-vehicle was fitted up as a travelling laboratory and equipped with testing instruments. This has provided the latest scientific methods of testing machine efficiency in the field and has proved a big advantage.

General.—The organization necessary to handle the maintenance and operation of the Department's plant has been adjusted during the year to cope with the number of machines and the increased volume of work. The Department successfully dealt with many problems which arose, and no serious defects or breakdowns occurred during the year. At the conclusion of the year under review the plant remains in excellent order for a further period of continued low cost operation.

NAVAL AND DEFENCE WORKS.

During the period covered by this report further construction work has been carried out in connection with the Government's programme for naval and military defence.

TRAMWAYS.

Auckland.—During the year three new cars, Nos. 249, 250, and 251, were placed in service after being tested by this Department. Two new trolly-buses were inspected and passed for service for the Farmers' Trading Co., Ltd.

Thirty chains of new tram-line, with sidings, were constructed in Green Lane, giving access to Alexandra Park and Epsom Showgrounds.

New Plymouth.—The triangular junction at the corner of Liardet and Devon Streets, which had been left for turning cars, has now been removed, and a turning-loop installed at the Tramway Depot instead.

Car No. 10 was converted for one-man control.

Wellington.—Cars numbered 234, 235, 236, 237, and 238 were inspected and certificates issued.

Cars 183 and 203, which had been in collision, were inspected, but no defects which might have caused the collision were discovered.

Duplications of track between Fancourt Street and Reading Street, Karori, and between St. Mary's Street and the entrance to the Botanical Gardens, were inspected and passed for use.

A private timber tramway at Otaki Forks was inspected, and requirements as to future maintenance were laid down.

Christchurch.—The relaying of the track on the Riccarton route was completed during the year.

Tracks have been relaid, with minor improvements, in Cathedral Square, in Colombo Street between the Square and Armagh Street, in Cashel Street from High Street to a little beyond Fitzgerald Avenue, and at the western end of Moorhouse Avenue.

The Cranford Street line is being reconstructed between Bealey Avenue and Edgeware Road, a double track replacing a single track with several loops.

Dunedin.—Within the period under review, two accidents, necessitating inspection, occurred, but in both cases the car equipment was found satisfactory.

DESIGNING OFFICE.

The volume of work requiring attention by the Design Office has in no way diminished and, if anything, the demands on the staff have been even greater than during the preceding year. It has been possible to undertake only urgent work, and many matters of importance, but of lesser urgency, have had to be held over on account of the continued shortage of trained staff.

The major proportion of the urgent work has been connected with structures and services for the Royal New Zealand Air Force Stations, and bridges for railway-lines at present under construction. Plans for a number of main-highway bridges have also been prepared, but a considerable number have had to be deferred in the meantime to allow other work, mentioned above, to proceed.

Among the railway bridges designed is the reinforced-concrete viaduct which will carry the Waikokopu–Gisborne Railway over the lower crossing of the Waiau Stream. This viaduct includes an arch span of 180 ft., the rail level being 127 ft. above the stream.

Several important structures for other Departments have been designed, including a large reservoir required by the Tourist Department for Rotorua.

In connection with the forthcoming Centennial Exhibition a commencement was made about the middle of the year with the preparation of models of some of the more important structures designed by the Department in recent years. The most striking of these is a representation of the Mohaka Viaduct on the Napier–Wairoa Section of railway, to a scale of quarter of an inch to a foot, giving a model 8 ft. high and 21 ft. long.

The checking of the designs of bridges for roads and main highways, prepared in district offices and by local-body and consulting engineers, was carried out as usual, and, in addition, proposals for the Local Government Loans Board and the Marine and other Departments were examined and reported upon.

During the year the number of proposals submitted for examination and checking totalled 418, compared with 330 for the previous year.

PUBLIC BUILDINGS: MAINTENANCE.

The maintenance of public buildings throughout the Dominion has been carried out by the Department. More particular reference to activities in this connection is included in the annual report of the Government Architect.

PUBLIC-BUILDINGS WORKS AND ELECTRICAL OPERATIONS.

Details of public-buildings works and of the operations of the State hydro-electric undertakings are contained in the separate reports, included herewith, by the Government Architect and the Chief Electrical Engineer.

I have, &c.,

J. WOOD, M.Inst.C.E.,
Engineer-in-Chief.

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 for the year ended 30th June, 1939.

During the period plans were prepared for 423 buildings of an estimated total value of £1,891,459, and 291 contracts, totalling £648,829 have been let. Fifty-one other contracts to the value of £280,134 for buildings designed prior to 30th June, 1938, have also been let, making the total value of building contracts let during the year £928,963. In addition, contracts for mechanical equipment totalling £43,186 have been let.

In addition to the above totals for work designed in this branch, buildings have been designed in connection with railway-construction, main-highway works, hydro-electrical works, and other activities of this Department, which are referred to in the other sections of this report, and a large amount of minor additions, alterations and repairs, and general maintenance of public buildings has been carried out by District Offices, including work in connection with fitting up accommodation and the provision of furniture and fittings for expanding office requirements for other Departments.

The work of this branch continues to increase. From the beginning of this year all my staff has been brought under one roof in the temporary building in Whitmore Street, thus enabling a more efficient organization of activities to be inaugurated, but the continued shortage of competent draughtsmen has restricted the output.

A wider use of local products has been possible, and designs and finishes have been evolved to enable the maximum use to be made of New Zealand materials and manufactures. Both manufacturers and merchants have responded to the changed conditions with an enthusiasm which is gratifying, and a surprising number of products formerly imported are now being made locally, and, with few exceptions, are quite up to the standard of imported articles.

The prevailing shortage of skilled craftsmen is reflected in higher prices and a smaller number of tenders being received, but by proportioning the work in different areas, as far as possible, to the number of men available there have been few instances where no tenders were received. Despite the adverse conditions as to labour, the general standard of workmanship and finish has been reasonably maintained, but difficulty is being experienced in getting buildings erected up to time.

Appended is a schedule of works, which includes maintenance work and minor contracts prepared in the various District Offices.

VICE-REGAL.

Auckland.—Repairs, renovations, and general maintenance were attended to.

DEPARTMENT OF AGRICULTURE.

Auckland.—At the Ruakura Farm of Instruction a dairyman's cottage was built and a laboratory building and a stock overseer's cottage are in course of erection. Alterations and extensive additions were made to the farm office. A shed, yards, and cottage were built at the Karamu Experimental Farm to enable experiments in facial eczema to be carried out. At Mount Albert Plant Research Station a large laboratory building was erected, two glasshouses are in course of erection, and an insectary has been commenced. Renovations were undertaken at the Te Kauwhata Horticultural Station.

Taumarunui.—Renovations, repairs, and additions were effected to one cottage.

Tauranga.—A laboratory building, together with sheep-yards and holding-pens, were built at the Mamaku Experimental Farm.

Stratford.—New dining and staff quarters were built at Flock House, Bulls.

Wellington.—The new laboratory building at Wallaceville and a new dormitory block at Feilding Agricultural College are approaching completion.

Nelson.—A tobacco-redrying-plant building was completed at Motueka, and alterations and maintenance repairs were carried out at three buildings.

Christchurch.—Renovations and repairs were effected at three buildings.

Dunedin.—Repairs and renovations were undertaken at nine buildings.

Greymouth.—A cottage, storage shed, and milking-shed were built at Westport.

AIR DEPARTMENT.

Auckland.—At the Royal New Zealand Air Force Base, Hobsonville, two wings were added to the single airmen's barracks and the messing accommodation and kitchen were added to; twelve bomb-stores, two large equipment stores, and a timber hangar were completed; a Public Works office

was built, and a commencement was made to erect two additional equipment stores, a guard-house, administration building, garages, standby-set house, aircraft-repair shop, and a seaplane-hangar. To allow of building extensions three houses were shifted. Two houses were moved from Whenuapai to Hobsonville. At Mangere Aerodrome an anemometer mast and building were erected. At the trans-Tasman Air Terminal administrative buildings, workshops, and a test-house were built. A radio transmitting and receiving station was built at East Tamaki.

Tauranga.—A transmitting-station and implement-shed were erected at Tauranga Aerodrome, and an anemometer-house was built at Rotorua.

Gisborne.—A radio receiving-station and a transmitting-station were completed at the Gisborne Aerodrome, and an anemometer-house is in course of erection.

Stratford.—An aeradio-station and an anemometer-house were built at the New Plymouth Aerodrome.

Napier.—A receiving-station and a cottage for the aeradio operator were erected.

Wellington.—At the Royal New Zealand Air Force Station, Ohakea, the administration block and the public-works office and depot were completed, the officers' mess and quarters and the airmen's barracks are approaching completion, a standby set-house is in course of erection, and a commencement was made with the erection of thirty-one residences. A radio receiving-station was built at Milson Aerodrome, Palmerston North.

Nelson.—An aeradio-station was completed at the Nelson Airport. At Blenheim a commencement was made with the erection of two timber hangars, airmen's dormitories, officers' and sergeants' mess and dormitories, airmen's mess, institute, headquarters, navigation and education block, workshops, main store, M.T. shed, lubricant and inflammable store, guardhouse, practice bomb store and gas building, a building containing laundry, barber's shop, tailor and cobbler shops, also a ration store, latrines, sick-quarters, and a building for fire-tender and ambulances.

Christchurch.—Quarters were fitted up in McKenzie's Building, Christchurch, for the R.N.Z.A.F. Training Squadron. At Wigram Aerodrome the following buildings were completed: Twenty-eight single-unit and one double-unit residences, guardhouse, sick-quarters, airmen's dormitory No. 5, administrative building, water-tower, standby-set house, main store No. 1, ration store, P.W.D. offices, store and garages, and alterations to workshops. The sergeants' mess, a temporary timber hangar, instructional building, four car shelters, store No. 2, gas-chamber, officers' mess and quarters, lubricant and inflammable store are approaching completion, and a start has been made with an engine-test house, hangars 3 and 4, and alterations to the airmen's kitchen. A transmitting-station was built at Harewood Aerodrome.

Dunedin.—At Taieri Aerodrome an aeradio receiving-station and radio and marker beacon buildings were built, and a temporary timber hangar is in course of erection.

Greymouth.—A radio transmitting-station and a receiving-station were built at Hokitika Aerodrome, and a temporary wireless building was erected at Westport.

Army Department.

Whangarei.—Renovations and repairs were effected at two buildings.

Auckland.—Three additional magazines were built at the Ngaruawahia Mobilization Base, alterations and renovations were carried out at Narrow Neck and the Artillery Yard, additions and renovations were made at North Head, minor repairs were attended to at Motutapu Island, and alterations and repairs were executed at six drill-halls.

Tauranga.—The Defence Office at Te Puke was renovated.

Stratford.—Repairs and renovations were effected at two buildings.

Napier.—Five buildings were repaired and renovated.

Wellington.—At Fort Dorset and Palmer Head searchlight emplacements, magazines, stores, shelters, and an engine-room were constructed. At Trentham a lavatory block was built, a large ordnance store is nearly finished, a timber-store in connection with the carpenters' shop, and extensions to an ordnance store are about half-finished.

Nelson. Additions, renovations, and repairs were effected to two buildings.

Christchurch. A commencement was made with new forts at Godley Head and the fortifications at Battery Point are nearly complete. The erection of a new ordnance store was started at Burnham, and the ordnance store mentioned in last year's report was completed. Four residences for officers were also erected, and renovations and repairs were carried out at one building.

Dunedin.—One building was altered and two were renovated and repaired.

Greymouth.—Repairs and renovations were made to three buildings.

Education Department.

Whangarei.—Painting renovations were attended to at the Whangarei Boys' High School.

Auckland.—Maintenance repairs and renovations were effected at four buildings.

Stratford.—Extensive additions, consisting of new class-rooms, cookery-rooms, woodwork shops, &c., are being made to the Technical High Schools at Hawera and Stratford.

Napier.—New class-rooms and laboratories were built at Dannevirke, and additions were made to the Hastings High School.

Wellington.—The additions to the Feilding Technical High School were finished.

Nelson.—Additions to Marlborough College at Blenheim are in hand, a commencement was made to erect a new Art Block at the Richmond Special School for Girls, renovations and repairs were effected at three buildings, and maintenance at one building was attended to.

Christchurch.—A motor-garage and tool-shed were built at the Burwood Girls' Home, renovations and repairs were effected at six buildings, alterations made to one, and additions made to three buildings.

Dunedin.—A detached class-room is in course of erection at the Otekaike Special School. Two buildings were renovated and repaired.

Health Department.

Whangarei.—Renovations were made to one cottage.

Auckland.—Maintenance and renovation of ten buildings were attended to and twenty portable hutments were made for Maori tuberculosis patients.

Tauranga.—Additions were made to the nurses' cottage at Murapara.

Gisborne.—Twelve portable hutments were made for tuberculosis patients. Alterations and renovations were effected at one building.

Stratford.—A nurse's cottage was built at Pipiriki, and office accommodation at New Plymouth was transferred.

Wellington.—The new Dental Clinic is approaching completion.

Christchurch.—The new Male Pavilion at the Queen Mary Hospital, Hanmer, is well on the way to completion. Renovations and repairs were effected at two buildings, and additions and alterations were made to one building.

Greymouth.—The annexe to the Nurses' Home and the new medical and maternity wing at the Greymouth Hospital were completed.

Dunedin.—Maintenance to the St. Helens Hospital, Invercargill, was attended to.

Justice Department.

Whangarei.—The erection of the Whangarei Law Courts was commenced. Additions and renovations to three buildings were carried out.

Auckland.—At the Waikeria Borstal Institution improvements have been carried out and a commencement made to erect two residences. Repairs and renovations were effected to twelve courthouses.

Taumarunui.—Three courthouses were repaired and renovated.

Tauranga.—Alterations were made to one building and renovations carried out to another.

Gisborne.—Renovations and repairs were effected at one building.

Stratford.—Repairs and renovations were executed at nine buildings.

Napier.—Four buildings were renovated and repaired.

Wellington.—Additions were made to one building.

Nelson.—The new courthouse at Blenheim was completed; renovations and repairs were effected at six buildings.

Christchurch.—A new staff cottage was built at Paparua Prison and a new store built at Addington Reformatory, the old courthouse at Geraldine was fitted up as police offices. Additions and alterations were made to one building and repairs and renovations were carried out to five buildings.

Dunedin.—The new courthouse at Invercargill is approaching completion and repairs and renovations were effected at seven courthouses.

Greymouth.—Acoustical correction was carried out at the Greymouth courthouse, a new courthouse was erected at Wataroa, repairs were effected at Westport, and outhouses built at Reefton.

Mental Hospitals.

Avondale.—Repairs, renovations, and sundry alterations and additions were attended to.

Kingseat.—A new hospital block, Medical Superintendent's residence, mortuary, workshops, and garages were completed; villas 7 and 8 are approaching completion, and a commencement has been made with the erection of a Nurses' Home.

Tokanui.—A new slaughterhouse and boiling-down shed, Public Works Department store, accommodation for workmen, and an apple-storage shed were built. Sundry alterations were effected, and repairs and renovations generally carried out.

Porirua.—An assistant Medical Officer's residence was built and a new butchery and bakery erected.

Ngawhatu.—The Nurses' Home is nearly finished, and a start was made to build three male villas. Renovations generally were attended to.

Sunnyside.—Repairs and renovations were made to one building, one was altered, and additions made to two.

Seacliff.—A new surgery and sick-bay were erected at F. 4 ward, and a new occupational block and hairdressing saloon erected. F. 3 wing was demolished, fire damage to F. 1 dining-room was made good, and extensive renovations and repairs generally were carried out.

Hokitika.—Villas 4 and 7 are in course of erection, villa 1 was renovated internally, villa 6 painted externally, new piggery building was erected, and general maintenance carried out.

National Broadcasting and Commercial Broadcasting Services.

Napier.—The transmitting-station and a residence were erected and the studio fitted up at Napier.

Christchurch.—For 3YA, repairs and renovations were carried out at Gebbies' Pass, a receiving-station was built at Teddington, and the studio at Christchurch reconstructed. The original studios for 3ZB were reconstructed.

Dunedin.—The transmitting-station for Invercargill was completed, and studios fitted up in Invercargill.

Greymouth.—The studio for 3ZR was fitted up at Greymouth.

Native Department.

Whangarei.—One hundred and thirty-nine houses, eleven huts, and thirty-two milk-sheds were completed, sixty-nine houses, eighteen huts, and thirteen milk-sheds are in hand, the renovation of eleven buildings was carried out and of ten buildings is in hand.

Auckland.—Sixty-three cottages and seventeen huts were built. New office accommodation was fitted up at Hamilton, and repairs and renovations effected to the Maori Hostel, Auckland.

Taumarunui.—Twenty-two cottages were built, five are in course of erection, and repairs and renovations were carried out to twelve cottages.

Tauranga.—One hundred and thirty-five cottages and two hundred and twenty-seven other buildings were erected, and fifty-two cottages and ten other buildings are in course of erection.

Gisborne.—Twenty-four houses were built, six are in course of erection, one was repaired, three were renovated, and three were altered.

Stratford.—One house was built.

Navy Department.

Auckland.—At the Naval Base, Devonport, No. 2 machine-shop was completed and No. 3 machine-shop is in course of erection. A new wireless station and a fire-fighting-equipment store were built, and an aviation-spirit store is in course of erection. At Kauri Point, K2 store, office, laboratory, an ammunition store, and a proof yard were built, and a water-tower is nearing completion.

Christchurch.—Alterations and renovations were carried out to the R.N.V.R. Headquarters, Christchurch.

Police Department.

Whangarei.—Repairs and renovations were carried out to five buildings and additions and renovations were effected at one building.

Auckland.—A new police-station and residence were built at Ellerslie, and a new police-station and residence are under construction at Papakura. General maintenance, renovations, and repairs were effected at thirty-four buildings.

Taumarunui.—A new police-station was built at Manunui, and a combined police-station and courthouse was erected at Tokaanu. A building was purchased at National Park and an office fitted up. Renovations and repairs were made to three buildings.

Tauranga.—A new residence was built at Katikati, and a new residence, office, &c., are being erected at Whakatane. Repairs and renovations were carried out at three buildings and alterations made to one.

Gisborne.—Repairs and renovations were effected to three buildings, and additions and alterations were carried out to three.

Stratford.—A new office and residence were erected at Manaia, a new office block is in course of erection at Waitara, and repairs and renovations were effected at seven buildings.

Napier.—Renovations and repairs were made to six buildings.

Wellington.—The new police-station at Moera was completed, and the new police-station at Palmerston North is approaching completion.

Nelson.—Renovations and repairs were attended to at ten buildings.

Christchurch.—New police-stations and residences were erected at Linwood and Pleasant Point, and a new garage built at Southbridge, twelve buildings were repaired and renovated, two were altered, and two were added to.

Dunedin.—New police-stations were erected at St. Clair and Balclutha, and police-stations are in course of erection at Mosgiel, Roslyn, Oamaru, and Oturehua. Renovations and repairs were carried out at thirty-two buildings.

Greymouth.—A new police-station was built at Wataroa, and repairs and renovations were effected at nine buildings and repairs made to seven buildings.

Post and Telegraph Department.

Whangarei.—A new residence for the Postmaster at Okaihau was completed, and extensive additions to the post-office are in hand. Alterations and additions were made to five buildings.

Auckland.—A commencement was made with the additions to the Chief Post-office, Auckland. A commencement was made with the erection of a Postmaster's residence at Papakura, and an automatic telephone-exchange at Avondale. Additions and alterations were carried out to seven buildings, and repairs and renovations were effected at three buildings.

Taumarunui.—Minor repairs and renovations were attended to.

Tauranga.—New bachelors' quarters were built at Te Teko, and a new garage and line-store erected at Whakatane. Renovations were made to three buildings, and additions made to two.

Gisborne.—The erection of the new automatic telephone-exchange at Gisborne is about half-completed. Alterations were made to the Chief Post-office, Gisborne, and renovations and repairs were carried out at three buildings.

Stratford.—Extensive alterations and additions are being made to the post-office at Ohingaiti.

Napier.—A new residence was built for the Postmaster at Wairoa. Repairs and renovations were effected at three buildings.

Wellington.—The additions to the Palmerston North post-office are approaching completion. Additions and alterations were made to two buildings, and alterations and repairs carried out at one building.

Nelson.—New garages and a lineman's shed were built at Motueka, and alterations were made to two buildings and repairs effected at one.

Christchurch.—New post-offices at Belfast and Little River, a new Postmaster's residence at Waiau, new garage, store, and offices at Amberley, new telephone-exchange and new line-store and garages at Geraldine were erected; repairs and renovations were carried out at seven buildings, additions made to three, and alterations effected at four buildings.

Dunedin.—Sundry renovations and repairs were effected at the Chief Post-office, Dunedin, and alterations made to accommodate State Departments. Extensive alterations and additions to the Oamaru Post-office were completed, the erection of the new post-office at Invercargill is well under way, and a new residence was built at Poolburn. Repairs and renovations were effected at seven buildings and additions made to two.

Greymouth.—Alterations, additions, renovations, and repairs were carried out to five buildings.

SOCIAL SECURITY DEPARTMENT.

Taumarunui.—Offices in leased premises were fitted up.

Tauranga.—Extensive alterations were made to the Royal Mail Building at Rotorua for office accommodation, and alterations made to the Government Buildings at Tauranga for a similar purpose.

Gisborne.—Alterations and renovations were carried out to leased premises for office accommodation.

Stratford.—Offices were fitted up at Hawera, New Plymouth, Stratford, and Wanganui.

Wellington.—A new building was erected in Aotea Quay to replace the structure destroyed by fire in Aitken Street. In this connection a record was established for speed in erection; a start was made on the 3rd February, 1939, the building was completed on the 27th March, and was in occupation on the 1st April, 1939.

Christchurch.—Alterations were made to three buildings for office accommodation.

Dunedin.—Extensive alterations and additions were made to the old money-order office at Oamaru, and an old disused building at Alexandra was altered and renovated for office accommodation. Renovations and alterations were carried out at Invercargill, Gore, and Riverton.

Greymouth.—Offices were fitted up at Greymouth, Westport, and Hokitika.

TOURIST AND PUBLICITY DEPARTMENT.

Taumarunui.—The kitchen and servery at The Chateau were remodelled. Three small sheds were built, and miscellaneous repairs and renovations were attended to.

Tauranga.—Extensive alterations and renovations were carried out at the main bath building, Rotorua.

Dunedin.—A lighting-plant was installed in the Milford Sound Hostel, and minor alterations elsewhere were carried out.

MISCELLANEOUS.

Whangarei.—Alterations, renovations, and repairs were carried out to four buildings for the Marine Department, and renovations made to one building for the Forestry Department.

Auckland.—The foundations and steel frame of the new departmental building in Jean Batten Place were completed. Additions were made to three buildings, and six cottages were erected in Ellicott's Block for the Lands Department.

Tauranga.—Alterations and additions were made to four buildings, and sundry renovations and repairs were attended to.

Gisborne.—Repairs and renovations were effected at one building, and three buildings were altered and added to.

Stratford.—A new Public Works Office and garage were built at Taihape.

Napier.—The new Government Building at Napier was completed, a plant depot and workshop was built at Napier, and departmental buildings were erected at Wairoa.

Wellington.—The Government Life Insurance Building is practically completed, the foundations and steel framework of the new departmental block in Stout Street were completed, additions were made to the Public Works Department building at Rongotai, the Customs Building was strengthened, the plant depot at Hinemoa Street was completed, additions were made to the Meteorological Office at Kelburn, and additions on the roof of Parliament Buildings are in course of erection. The temporary building in Aitken Street which was nearly finished was totally destroyed by fire on the 2nd February, 1939. Two residences were purchased for Ministers of the Crown. The old museum and sundry residences in Sydney Street were demolished. Alterations, renovations, and repairs were carried out to eleven buildings and additions made to one.

Nelson.—The new Government Life Insurance Building at Nelson is approaching completion, two cottages were built for the State Forest Service at Golden Downs, and kilns, store, glasshouses, and sheds were completed at Riwaka for the Scientific and Industrial Research Department. Repairs and renovations were effected at five buildings, alterations carried out at three, and maintenance attended to at four buildings.

Christchurch.—A new building is being erected for the Wheat Research Institute. Additions were made to four buildings, renovations and repairs effected at twelve and alterations made to one building. The erection of "The Sign of the Takahe" is proceeding steadily.

Dunedin.—At Tairoa Head a new building is being built for a fog signal, and renovations and repairs were effected to the lighthouse and dwellings. The State Fire Insurance Building at Invercargill was completed, the old Lands Department building at Dunedin was converted and renovated for other Departments. Renovations and repairs were carried out at two buildings.

Greymouth.—A carpenters' workshop and garage were built at Greymouth, renovations and repairs were carried out at six buildings and alterations made to one.

Generally.—The progress of buildings generally has been handicapped by the shortage of skilled tradesmen. Much alteration work has been carried out in connection with extended accommodation for other Departments. The departmental workshops have been fully occupied, and a great deal of furniture has been made by outside firms for the Department. In connection with country maintenance it has been difficult to get quotes owing to the amount of other work offering.

In conclusion, I wish to express my appreciation of the co-operation of the District Offices and the continued loyalty and industry of the staff.

I have, &c.,

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 :—

GENERATING-SCHEMES IN OPERATION.

NORTH ISLAND ELECTRIC POWER SYSTEM.

1. Capital Outlay.

At the close of the year 1938–39 the total capital outlay was £9,264,384, representing assets in operation, and £446,171, representing assets not in operation, giving a total capital outlay of £9,710,555, and Table II gives an analysis of this amount.

2. Financial Results.

The total revenue for the year amounted to £1,127,132 and working-expenses £200,438, which resulted in a gross profit of £926,694, equal to a return of 10·06 per cent. on the average capital in operation (£9,208,227).

After paying interest (£353,676), depreciation (£7,228), the departmental proportion of the capital charges on King's Wharf Station (£33,547) and cost of raising loans, &c., amounting to £2,073, there was a net profit of £530,170.

Comparative figures for the year ending 31st March, 1938, are as follows: Revenue, £978,492; working-expenses, £177,545; interest, £349,816; depreciation, £50,725; and King's Wharf charges, £37,593—with a net profit of £360,662.

The accumulated Depreciation Reserve and Sinking Funds as at 31st March, 1939, amounted to £1,783,971. Table I gives full particulars of financial results as well as other relevant statistical information.

3. General.

The units generated and purchased totalled 935,237,791 for the system. Units actually sold totalled 835,943,799 and units used for station auxiliaries, &c., totalled 7,997,884.

The balance of 91,296,108 units represents transmission and distribution losses amounting to 9·76 per cent. of the total output.

The maximum load on the system was 174,880 kW. and the annual load factor 61·05 per cent. The total connected load was 1,217,968 kW., and the demand factor or ratio of maximum load to connected load was 14·36 per cent.

4. Construction, Operation, and Maintenance.

A. HAMILTON DISTRICT.

(1) CONSTRUCTION.

(*a*) POWER-STATIONS.

Arapuni.—Work on the extensions under the control of the General Branch was brought to a close in August, 1938, with the completion of a new blacksmith's shop and approach road, and the erection of precast panelling and lamp standards on the access road to the power-house. A concrete float chamber and platform for the water-level recorder in the spillway was completed, and a 5-ton stop-log gantry crane also was erected.

The inclined lift was completed towards the end of the year.

The Stratford 110 kV. line and No. 5 line to Penrose were changed over to the outdoor steel structure extensions in June, and the new Edgecumbe 110 kV. line was connected up in January. A temporary 50 kV. O.C.B. has been installed to control supply to the new Edgecumbe line which is being operated at 50 kV. pending the installation of 110 kV. equipment at Edgecumbe.

Horahora.—A booster transformer was put into service on 11 kV. supply to the Cambridge area on 10th October.

(*b*) SUBSTATIONS.

Penrose.—A fourth 110/22 kV. transformer bank, of 30,000 kVA. capacity, was put into service on 7th April, 1938. Four 6666 kVA. transformers for the second synchronous condenser have been dried out and placed in position; work is proceeding on the foundations for the new condenser.

Merz Price protective equipment was installed on the two 22/50 kV. transformer banks in May.

Bombay.—Six new 110 kV. O.C.B.'s were put into service.

Seven new 1000 kVA transformers fitted with automatic on-load, tap-changing equipment are being made ready for the replacement of the existing 500 kVA transformers 50/11 kV. banks.

Garages were erected at four cottages.

Hamilton.—Work is proceeding on the replacement of the existing 11 kV. switchgear by new ironclad switchgear and metering equipment. A garage was erected at Cottage No. 2.

Takapuna.—The existing O.C.B.'s on the 11 kV. incoming and outgoing feeders were replaced by new truck-type O.C.B.'s on 4th December, and two booster transformers were put into service on 20th March, 1939.

Henderson.—New truck-type O.C.B.'s were installed in place of the existing O.C.B.'s on the 11 kV. incoming and outgoing feeders on 8th April, 1939. Garages were erected at three cottages.

Tahekeroa.—Work has commenced on the installation of a booster transformer.

Marercetu.—A 50 kV. lightning arrester fitted with surge counters was installed on 29th December, and a booster transformer was put into service on 16th April, 1939. A relief operator's bach and a communal garage were erected.

Maungatapere.—A new 11 kV. feeder was put into service in March, and a booster transformer was put into service on 23rd April, 1939. Two garages were erected.

Kerepeehi.—A garage was erected for the relief operator, and a start was made on the installation of a booster transformer.

Waikino.—Work is in progress on the building of three new cottages. A new panel was erected on the control board for the mounting of additional relays for the Paeroa 50 kV. line O.C.B.

Waihou.—A booster transformer was installed on 9th March, 1939. A garage was built for the operator.

Matamata.—A booster transformer was installed on 16th March, 1939.

Te Awamutu and Hangatiki.—Two garages were erected at Te Awamutu, and two at Hangatiki.

Ngongotaha.—A new 50 kV. O.C.B. for the second 750 kVA. transformer bank, and two 11 kV. earthing transformers from Edgecumbe and Waiotahi were put into service on 1st September. The old earthing transformer is being held as a spare. The switchroom has been extended to accommodate the 11 kV. switchgear that is being taken out of service at Hamilton. Two garages and a relief operator's bach were erected.

Rotoiti.—An automatic reclosing, pole mounting, 6·6 kV. O.C.B., was installed in October.

Edgecumbe.—A fourth 11 kV. feeder O.C.B. was installed and put into service by the Bay of Plenty Power Board on 1st August, when supply was commenced to the Whakatane Borough Council.

Waiotahi.—A third 11 kV. feeder O.C.B. was installed by the Bay of Plenty Power Board in May, 1938, and is being held as a spare. A lineman's cottage and relief operator's bach were completed in September.

Ongarue.—A new 2250 kVA. 110/11 kV. substation to supply the Taumarunui area was completed in April, 1939.

(*c*) TRANSMISSION AND DISTRIBUTION LINES.

Arapuni–Edgecumbe 110 kV. Line.—Pole-erection was commenced in April, 1938, and construction was practically completed by the following April. Jumpers were run to connect up the new line to the old 50 kV. line at Hamurana, and the Arapuni–Hamurana section was put into service at 50 kV. on 22nd January to provide alternative means of supply to Edgecumbe and Waiotahi substations.

Arapuni–Penrose 110 kV. Tower-line No. 2.—Route plans were completed, and tower-erection was commenced in March, 1939. It is expected to have the line completed by the middle of next year.

Penrose–Henderson 110 kV. Line.—The proposed line was traversed and sectioned, a schedule of towers was prepared, and railway and tidal water crossings and the joint use of towers by the Department and the Auckland Power Board were investigated. A substation-site was selected at Mount Roskill and a legal survey made.

Arapuni–Stratford 110 kV. Line.—Two new linemen's cottages were completed at Tangarakau Depot in July.

Arapuni–Bunnythorpe 110 kV. Line (Ongarue–Ohakune Section).—A survey party was started on the location of the proposed line in the rough bush country between Pokaka and National Park in March.

Maungatapere–Kaitaia 50 kV. Line.—Survey-work was resumed in August. The pegging of structure positions has been completed, and a start made on the cartage of poles to sites. All poles on hand at depots were sterilized with an oxy-acetylene flame. Substation-sites were selected at Kaikohe and Kaitaia and legal surveys made.

Ongarue–Taumarunui 11 kV. Line.—The construction of a double-circuit line was commenced in November and was completed in April, 1939.

Taumarunui–Manunui 11 kV. Line.—Route plans were completed, and poles were carted to sites. A start was made on the erection of poles in April, 1939.

(*d*) WAIKATO RIVER POWER SURVEY.

Surveys and investigations were resumed in relation to further power schemes on the Waikato River, particularly with regard to a proposed dam-site at Karapiro, near Cambridge, and a project to install control gates at Taupo to control the flow of water into the Waikato River and also to increase the storage-capacity of the lake.

Sub-surface investigations were made on the proposed site at Karapiro, gauges were installed at selected points of the river, and levelling was completed from Arapuni to Cambridge. Work on the Karapiro Scheme was taken over by the General Branch in November, and a survey party proceeded to Taupo, where investigations are in progress in connection with a diversion channel in the vicinity of the bridge and a diversion tunnel at Otaranga. A number of test bores have been drilled on each site, and various sections of the river, and also low-lying areas at Tokaanu, have been traversed. Proposed dam-sites were investigated at Ohakuri and Whakamaru also.

(2) OPERATION AND MAINTENANCE.

(*a*) POWER-STATIONS.

Arapuni.—The four original generators became very dirty while construction work on the power-house extensions was in progress, but it was not practicable to shut down the units for complete overhaul until Nos. 7 and 8 units were available for service. No. 4 unit was dismantled in April May before the winter loading set in, and Nos. 3, 2, and 1 units were dismantled in turn in the following summer. The ventilating-slots on each machine were found to be badly blocked with dust deposits, and a group of six-turn coils was found defective on No. 2 unit. The turbine runner on No. 1 unit was replaced by a reconditioned spare.

One of the transformers in an 11/110 kV. bank was damaged by a short circuit between turns on the L.T. winding in June, and both the L.T. and H.T. windings were replaced. Heavy deposits were found on the windings, and an inspection of the other 11/110 kV. transformers showed that all but one had similar heavy deposits on the windings. This deposit has now been fairly definitely explained as an exudation of excess varnish.

A total interruption to system supply was caused on 23rd April, 1938, by the breakdown of a 110 kV. O.C.B. bushing. In addition, there were two 50 kV. C.T. bushing failures during the year. The bushings and contacts on the original 110 kV. and 50 kV. O.C.B.'s are being replaced by equipment of a later type; bushings have been replaced on five 110 kV. O.C.B.'s.

The maximum load on the station was 110,000 kW. and the output for the year was 585,779,100 units. Corresponding figures for the previous year were 93,200 kW. and 512,604,700 units.

Horahora.—An 11 kV. C.T. failure occurred in August, and a flashover on an 11 kV. O.C.B. was caused by a bird in January. The 11 kV. induction regulator was removed in September preparatory to the installation of a booster transformer. Two 50 kV. O.C.B. bushings were replaced following low tests. One of these and another with a broken porcelain shell are being reconditioned.

Penrose Diesel Plant.—The plant was given a short maintenance run each week and was put on load for two days at the end of March.

(*b*) SUBSTATIONS.

Penrose.—A 22 kV. single-core cable-box broke down in June, and a flashover occurred inside a 50 kV. O.C.B. in July. The original 110 kV. O.C.B.'s on two banks were completely dismantled, and the concrete pads were altered to take two new O.C.B.'s. A defective 50 kV. strain insulator and eleven cracked 110 kV. pillar insulators were replaced. A 110 kV. pillar insulator that broke off when an isolating link was operated, and two other pillar insulators that were damaged by the falling insulator were also replaced.

Bombay.—The transformers in one 110/50 kV. bank were completely overhauled. Six defective 110 kV. post insulators were replaced. Alterations were made to No. 3 cottage.

Hamilton.—Two 110 kV. transformer bushings that were found defective by testing, and nine cracked 110 kV. pillar insulators, were replaced. Following low tests on a number of bushings on the four 110 kV. line O.C.B.'s the O.C.B.'s have been taken out of service pending further investigations.

Supply to Ruakura State Farm was taken over by the Central Waikato Electric-power Board on 23rd December.

Takapuna.—The 5 kVA. local service transformer was replaced by a new 25 kVA. transformer when the new 11 kV. O.C.B.'s were installed in December. Four defective 50 kV. strain insulators were replaced.

Henderson.—No. 1 11 kV. incoming feeder O.C.B. was damaged by a flashover in June. A transformer 50 kV. bushing broke down in September, and a flashover was caused by a cat on the 50 kV. structure in December. Two four-unit strings and two five-unit strings of insulators on the 50 kV. structure were replaced on account of defective units.

Tahekeroa.—A flashover on a 50 kV. O.C.B. bushing was caused by lightning in September.

Marercta.—Fatal injuries were received by a relief operator on 27th January when he made accidental contact with the arcing horn of a 50 kV. O.C.B. bushing.

Kerepeehi.—The insulators on a 50 kV. lightning arrester were replaced.

Waikino.—An 11 kV. C.T. failed in October, and a broken hold-on catch on a 50 kV. bus sectionalizing O.C.B. caused a station outage in March. No. 2 50 kV. O.C.B. on the incoming line tripped in February, but nothing was found to account for the tripping.

Waihou.—A third overcurrent relay was installed on each of three 11 kV. outgoing feeder panels.

Matamata.—The garage was altered to provide living-quarters for the relief operator.

Te Awamutu.—The C.T.'s on the 11 kV. incoming feeder O.C.B. were replaced by reconditioned C.T.'s, and three defective 50 kV. insulators also were replaced.

Hangatiki.—Three defective 50 kV. insulators were replaced.

Ngongotaha.—The source of unusual radio interference was traced to a bank of 50/6·6 kV. transformers, and an investigation showed that a number of strands of the H.T. and L.T. leads in one of the transformers had been burned through. A 50 kV. transformer bushing was found defective during testing, and was replaced.

Rotoiti.—The original 100 kVA. three-phase 50/6·6 kV. transformer damaged by lightning on 17th February, 1938, was repaired and connected up in parallel with the existing 100 kVA. transformer in May, 1939.

Edgecumbe and Waiotahi.—The 50/5 C.T.'s on the 11 kV. incoming and metering O.C.B.'s at each substation were replaced by C.T.'s of 100/5 ratio.

Maungatapere, Huntly, and Mamaku.—These substations gave satisfactory service throughout the year.

11 kV. Substations.—Metering equipment was installed on the 11 kV. side of the transformer at the New Zealand Co-operative Dairy Co. substation at Frankton in October, when a new supply contract came into force.

The other two 11 kV. substations at Hautapu and Grand junction gave satisfactory service throughout the year.

General.—Tests were carried out on all 110 kV. and 50 kV. bushings during the year. Each bushing is being fitted with a numbered metal plate for identification purposes.

(*c*) TRANSMISSION AND DISTRIBUTION LINES.

(i) *110 kV.*

Arapuni–Penrose.—No trouble was experienced on the tower-line circuits, but on the wood-pole line a pole was damaged by lightning in April, flashovers occurred between the 110 kV. line and the earth-wire during a storm in May, a defective 52 ft. pole broke off at the ground-line during a gale in July, and a conductor came adrift from a string of insulators in September due to the shearing of a cotter-pin on a suspension clamp. The earth-wire was dismantled from a further 203 poles, but it has yet to be removed from about fifty poles.

Arapuni–Stratford.—A pole was shattered by lightning in July, and a flashover was caused by lightning in December.

(ii) *50 kV.*

Penrose–Takapuna.—A conductor was burned through in July when a flashover occurred between the 50 kV. line and the top earth-wire. Subsequently the top earth-wire was dismantled from a further fifteen towers.

Henderson–Maungatapere.—Flashovers between the 50 kV. line and the telephone-line were caused by a telephone insulator coming adrift from a span-breaker during a storm in August, and again in January. An outage of approximately 19½ hours occurred during exceptionally stormy weather in September, when a pole and two strings of suspension insulators in an inaccessible position on an exposed hill-top were shattered by lightning. Difficulty in locating the fault at night, and difficulty in transporting material to the site and in effecting repairs in the face of winds of strong-gale force, together with heavy rain, all contributed to the time required to restore the line to service.

Bombay–Kerepeehi.—Lightning caused a flashover on four poles in April and on one pole in September, but no material damage was done. Two conductors were burned through by a flashover caused by a bush fire in hilly country in March.

Waikino–Aoangatete.—Flashovers occurred between the 50 kV. line and the telephone-line during a storm in May, and a 42 ft. pole was damaged by a scrub fire in February.

Horahora–Matamata.—The tops of tower stubs were treated with a rust-preventative, and corroded tower members were strengthened.

Horahora Hamilton and Mystery Creek–Te Awamutu.—A number of poles fitted with earth guards were converted to flat-top type having double crossarms, and insulators, to enable the earths to be dispensed with.

Te Awamutu–Hangatiki.—Outages were caused by a flashover between the 50 kV. line and the telephone-line during a storm in August, and by a broken conductor in December.

Arapuni–Ngongotaha.—An outage occurred in April, but nothing was found to account for it. An insulator on an A.B.S. was shattered by lightning in December.

Ngongotaha–Edgecumbe.—A conductor was burned through by a flashover on the take-off structure at Rotoiti in April, caused by a broken binder, and an outage was caused by a broken conductor in January.

Edgecumbe–Waiotahi.—The line was fouled by a haystacker in January.

Kerepeehi–Waikino, Matamata–Paeroa, Hamilton–Huntly, Arapuni–Horahora, Arapuni–Edgecumbe.—No trouble was experienced on any of these lines during the year.

(iii) *11 kV.*

Horahora North and South Feeders.—Outages were caused in July by a flashover on an 11 kV. metering C.T. at Leamington due to a rat, and a flashover on an A.B.S. at Leamington when the A.B.S. was opened; in September by the breakdown of an 11 kV. pin insulator; and in November by a cross-arm being set alight and burned through due to a defective insulator.

Waikino-Waihi.—A number of corroded steel-tower members were replaced by reconditioned parts.

Arapuni Village.—Five new 30 ft. poles were erected for service lines.

Grand Junction Tap and Hamilton–Frankton.—These lines gave satisfactory service throughout the year.

(iv) *General.*

Maintenance.—Routine patrol and maintenance work was carried out on the various lines and access tracks, live-line testing of insulators was carried out on the 110 kV. and 50 kV. lines, poles were tested by boring, and grub-holes in poles were cleaned out and filled with compound.

Insulator Replacements.—The results of live-line testing are as follows:—

	110 kV. Units.	50 kV. Units.	50 kV. Pin.
Number tested	49,065	11,393	13,852
Number defective by test	1	..	187
Number defective by inspection	2	8	34

Total number tested, 74,310; total number defective, 232; percentage defective, 0·312.

Of the 221 defective 50 kV. pin insulators all but four were part of shipments of two makes purchased in 1920 and 1924–25 respectively, and which are being replaced whenever opportunity permits. Twenty-seven defective 50 kV. pin insulators were replaced with the use of live-line tools.

In addition to the insulators listed above, twelve cracked pin insulators and one that failed in service were replaced on 11 kV. lines.

Pole Replacements.—Fifty-two defective poles consisting of twenty 52 ft., one 50 ft., one 45 ft., sixteen 42 ft., three 38 ft., and eleven 25 ft. poles were replaced. Of this number, twenty-one I.B. and fifteen M.A.H. poles had decayed heartwood, five I.B. and five M.A.H. poles had decayed or extensive knot-holes, three silver-pine poles were damaged by fire, two I.B. poles were shattered by lightning, and one I.B. pole was replaced on account of slimness.

(*d*) TESTING.

In addition to the routine testing of instruments, meters, relays insulators, &c., installation tests were made on new equipment at Arapuni, Horahora, Penrose, Bombay, Henderson, Takapuna, Marereta, Maungatapere, Waihou, Matamata, Ngongotaha, and Rotoiti, and a preliminary test was made on the on-load tap changing transformers and control gear for Ongarue. Tests were made on all 110 kV. and 50 kV. bushings, and check tests were made on a number of bushings with the Schering Bridge.

Work carried out at Arapuni included current-meter and salt-efficiency tests on No. 7 turbine; tests for speed of response of regulators, and open and short-circuit characteristics of Nos. 7 and 8 generators; and pressure tests on No. 2 generator windings after the completion of repairs.

(*e*) GENERAL.

System Operation.—For normal operation Arapuni Power Station was run continuously in parallel with the Mangahao–Waikaremoana system. Assistance was given by Horahora Power Station for one load shift daily five days a week, with the exception of holidays, until 9th January, when the running-time was increased to one load shift every day to improve voltage regulation on the Waihou line.

Owing to lack of rain Arapuni was called on to give a considerably increased supply over the Stratford line in February to assist the southern stations in conserving water, and Horahora running-time was increased to twelve load shifts a week on 2nd February, and to continuous operation on 5th April.

The Penrose Diesel plant was put on load for two days in March, and King's Wharf steam-station was put on load on 5th April and has continued to operate as required by Arapuni. The heavy loading on Arapuni, together with a decreased flow in the Waikato River, resulted in the level of water in the headrace at Arapuni being below the spillway crest for several weeks.

Assistance has been given to McLaren's Falls supplying Tauranga Borough Council on five to seven days a week, as required, since July, 1938.

Load.—The units generated at Arapuni, Horahora, and Penrose totalled 607,263,950, an increase of 10·8 per cent. over the total output in the previous year. Units actually sold (within the district) totalled 450,205,766; net supply to the southern system totalled 105,713,550 units; and units used by auxiliaries totalled 3,370,020. The balance of 47,974,614 units represents transmission and distribution losses amounting to 7·90 per cent. of the total output.

The maximum load on the generating-plants was 120,000 kW., compared with 96,856 kW. in the previous year, and the maximum load excluding supply to the southern system was 100,920 kW., compared with 84,140 kW. in the previous year. The average load factor was 57·77 per cent.

The total connected load increased from 500,795 kW. to 598,707 kW., and the demand factor or ratio of maximum load to connected load, excluding supply to the southern system, was 16·86 per cent.

Troubles on Department's System.—The following table gives an analysis of troubles on the Department's System for the last three years:—

Description.	Year ending 31st March, 1937.	1938.	1939.
6·6 or 11 kV. lines—			
(1) Defects	..	1	3
(2) External causes	1	3	..
33, 50, or 66 kV. lines—			
(3) Defects	3	5	10
(4) External causes	4	2	3
110 kV. lines—			
(5) Defects	..	..	3
(6) External causes	3	..	..
(7) Lightning	20	11	6
(8) Storms, nature of trouble not discovered	1	2	..
(9) 5, 6·6, 11, or 22 kV. apparatus	8	12	6
(10) 33, 50, or 66 kV. apparatus	3	6	8
(11) 110 kV. apparatus	1	3	2
(12) Generators or synchronous motors	..	..	1
(13) Relays	..	..	1
(14) Control circuits and batteries	3	..	..
(15) Operation: Mistakes	4	3	8
(16) Operation: Accidents	2	3	2
(17) Other causes	1	..	4
(18) Cause unknown	2	..	2
Totals	56	51	59

Circuit miles of transmission lines in operation: 11 kV., 71·14; 33 kV., Nil.; 50 kV., 431·36; 66 kV., nil; 110 kV., 491·92.

Number of substations in service: 11 kV., 3; 33 kV., nil; 50 kV., 17; 66 kV., nil; 110 kV., 3.

Number of consumers: Bulk, 12; wholesale, 5.

B. PALMERSTON NORTH DISTRICT.

1. Construction.

(*a*) power-stations.

Mangahao Power-house and Headworks.—During the year six new cottages with garages, one five stall, one two-stall, and two single garages, and a new boat-house at No. 1 dam were erected.

A site for cottages at No. 1 dam was investigated.

Two three-phase 11/11 kV. auto-transformers with auto tap-changing equipment have been ordered to replace induction regulators at present supplying the Horowhenua Electric-power board.

Waikaremoana Power-house and Headworks.—New buildings erected during the year were as follows: 6 garages and 1 single men's quarters.

Work has commenced on the erection of a new social-hall and on a departmental stable.

The pipe-line for No. 3 unit was completed, and the erection of this unit is nearing completion.

A substation was designed for the lower development at Piripaua, and erection has commenced.

Air-conditioning equipment was installed to condition the air-supply to the control-room.

At Piripaua five cottages with garages were erected.

Tenders have been called for a 10,000 kVA. 110/50 kV. transformer bank as an alternative supply for the Gisborne–Wairoa line, and for a 1,000 kVA. 110/11 kV. transformer bank with 11 kV. structure to supply the lower development and all existing 11 kV. load.

(*b*) substations.

Bunnythorpe.—The necessary increase in transformer capacity has been investigated, and orders placed for two three-phase, 7,500 kVA. tap-changing-on-load banks with one spare single-phase unit.

Dannevirke.—Two new bays of steelwork have been ordered for the Woodville–Napier line duplication. Two private garages were built for Nos. 2 and 3 cottages.

Gisborne.—At this substation one cottage, three single garages, and a single men's quarters were erected during the year.

A new distribution board was installed.

Hawera.—Special voltage relays were fitted to the 11 kV. switchgear.

One two-stall and three single garages were erected.

Khandallah.—The new 110 kV. bay was erected, and the 20,000 kVA. bank has arrived and is practically ready for service. The existing 11 kV. switch and operating gear was replaced by new apparatus of larger rupturing capacity.

Mangamaire.—The erection of one cottage and one two-stall and four single garages is almost completed.

The ground has been levelled in preparation for addition to the existing steelwork for the second transformer bank.

Marton.—Preparations are in hand for the replacement of the existing transformer bank by one ex-Bunnythorpe and replacement of existing 110 kV. switchgear.

Masterton.—One cottage with single garage is under construction, and two single garages have been built.

Switchgear and steelwork necessary for the Khandallah–Masterton line take-off has arrived and work of erection is proceeding.

Melling.—110 kV. switchgear and steelwork for the Khandallah–Masterton line have been erected.

A single men's quarters were built.

Napier.—Construction consists of the building of one cottage with a garage and four single garages.

New Plymouth.—Arrangements for the new substation building are in hand.

A new transformer bank of 7,500 kVA. has been ordered.

Opunake–Te Kiri.—Contour plans and levels for this substation are being prepared.

Paraparaumu.—One two-stall private garage was erected.

Stratford.—Tenders have been called for a 10,000 kVA. 110/50 kV. and a 5,000 kVA. 50/33 kV. bank to replace the existing transformers. Requirements of new steelwork and switchgear were investigated.

One three stall garage and a tool-shed were constructed.

Taihape.—The site for this substation has been fixed at a point one mile and a half south by road from Mataroa Railway-station.

Waipawa.—Three single garages were erected.

A new service board was completed and wired. Drainage of substation land was attended to and old P.T. pads removed.

A contract has been let for new 110 kV. switchgear for the Woodville–Napier line duplication.

Wanganui.—Four private garages were completed and additional field drains were laid. A well-pump was installed, water-tank and stand erected, and pipes were laid, these arrangements completing the new water-supply to cottages.

Woodville.—Two single garages were erected.

A new control-room has been built and is being wired.

Arrangements have been made with the Dannevirke Electric-power Board for the Department to give a second point of supply at Woodville.

(*c*) PATROL DEPOTS.

Akatarawa.—Two cottages, single men's quarters, and one two-stall private and one two-stall official garages have been almost completed.

Kotemaori.—Two cottages, single men's quarters, and two single private and one two-stall official garages are under construction.

Ruakituri.—Two cottages, single men's quarters, one stable, and two single private and one two-stall official garages are under construction.

(*d*) TRANSMISSION LINES.

(i) *110 kV. Lines.*

Khandallah–Masterton.—Construction work on this line has started. The steelwork has been delivered and up to 1st July, 1939, 83 towers have been erected. Contracts have been let for the erection of poles for the telephone-line.

Woodville–Napier Duplication.—Survey is now completed and all field plans have been drawn. Preparation is being made to call tenders for pole-erection on the Napier–Waipawa section.

Stratford–Te Kiri.—Seventeen miles of this line have now been surveyed, leaving three miles to complete this work.

Bunnythorpe–Ongarue.—Survey of this line has started. One party has fixed detailed location from Ongarue to National Park and is now working in the bush section at Erua and Pokaka, and another party is quartered at Mangaonoho, near Hunterville.

Tuai–Piripaua.—Survey is complete and plans have been drawn.

(ii) *11 kV. Lines.*

Tuai–Piripaua.—This line and a telepone-line have been erected.

Piripaua–Waihi.—This line, for supply of power to settlers in the Waikaretaheke Valley, has been surveyed and drawings are being prepared.

(iii) *400 Volt Lines.*

Tuai–Onepoto.—A two-phase line was run from the surge chamber to the power-house for pipe-line and street lighting.

Tuai Village.—Both service and street-lighting lines have been extended.

Lower Development Camp 1.—The line to the camp has been completed, and house-servicing and street-lighting is proceeding.

Lower Development Camp 2.—In the course of erection.

Kaitawa Control Line.—Extra cable was run from the surge chamber to the weir.

Mangaore Village.—Extensions have been made to the service lines and street-lighting of this village.

(*c*) GENERAL.

Accommodation.—In general, building-construction as carried out during the year comprised work in garages as complementary to the various staff houses built the previous year.

Land is being leased for single men's quarters at Wairoa, and a site has been investigated for cottages at No. 1 dam, Mangahao.

Palmerston North.—A two-stall private garage was built for the departmental cottages in Cuba Street.

2. Operation and Maintenance.

(*a*) POWER-STATIONS.

Waikaremoana.

Headworks.—Two periods of flooding occurred in the early part of the year, and high-lake levels persisted until the rainy season in July, when the level reached 2024·2 —the highest level recorded since 1922, when the recording of levels was first commenced.

The rainfall for the year registered at Onepoto was 99·73 in. and the evaporation 40·33 in.

During the period of high lake-levels 2 ft. of the timber bulkheads at the Kaitawa spillway were removed for the entire 100 ft. and were replaced later when the river flow decreased.

Trouble was experienced due to driftwood, but was overcome by placing an extra net of 2 in. mesh across the tunnel entrance.

The integrating meter for measuring waste water over the Kaitawa weir was replaced during the year.

No. 3 surge-chamber gate was overhauled and painted in preparation for use on the new pipe-line.

Power-house.—The cooling water header boxes were replaced on all the main transformers, and two 6,666 kVA. and two of the main 50 kV. transformers were completely overhauled.

Overhaul of all 110 kV. bushings and current transformer bushings is proceeding.

Explosion vents were fitted to all transformers.

The erection of new 400 volt switchgear, which replaced the original equipment, was completed, and new exciters were installed on Nos. 4 and 5 auxiliary machines.

Reliability of Generating-units.—The operation of the main generating-units at Tuai was satisfactory throughout the year. Minor trouble was experienced for a short period due to driftwood entering the turbines during the flood period and affecting the balance of the machines.

Mangahao.

Headworks.—No serious floods occurred during the year, but heavy rain on several occasions brought down minor slips which necessitated a certain amount of work in keeping access roads clear.

The total rainfall recorded at No. 1 dam was 144·47 in., rain being recorded on 221 days. Rainfall recorded at other points for the year was No. 2 dam, 129·68 in.; No. 3 dam, 98·06 in.; and at the power-station 48·50 in. The total amount of surplus water recorded at No. 2 dam was 8,879,000,000 cubic feet.

General repairs of buildings and painting and maintenance of all apparatus has been carried out.

Check Survey of Sedimentation: Upper Mangahao Basin.—This was carried out in February while the lake was at a low level.

A previous check was made in 1935 for the 1933–35 period, but since this investigation intensive storms and record floods in 1936 and 1937 have occurred, uprooting considerable areas of forest in the Mangahao watershed, and materially increasing the total deposits.

Results show that this basin will be approximately half full in 1947 if the average rate of sedimentation over the last six years is maintained in the next eight.

Power-house.—Operation of all equipment in the power-station has been satisfactory during the year.

Following tests on all 110 kV. bushings, one bushing was removed from the Wellington West line O.C.B. and forwarded to Bunnythorpe for reconditioning.

New 11kV. switchgear of increased rupturing-capacity, which is to replace the original switchgear, arrived at the end of the year, and a start has been made on the installation of this equipment.

The ship telegraph signalling-system was dismantled in preparation for the installation of a loud-talking telephone system for communication between the control-room and other parts of the station building.

Reconstruction prior to rewiring of the main control board was completed.

All generator reactances were cleaned out and new breathers fitted. Two transformers of the main 110/11 kV. banks were overhauled.

Reliability of Generating-units.—The operation of the main generating-units at Mangaore was satisfactory throughout the year, and the records of reliability as compiled for previous year's have been kept up to date.

(*b*) SUBSTATIONS.

Bunnythorpe.—Operation was satisfactory throughout the year.

During the year several cracked post insulators were changed.

The automatic-telephone-exchange equipment was overhauled.

Dannevirke.—One interruption of importance occurred on the 12th November, when an earthquake release clamp pulled off in a heavy gale.

A general renovation and painting of buildings was completed during the year.

Gisborne.—This substation gave satisfactory operation during the year.

400 volt and telephone-line renewal work was carried out and a new distribution board installed.

Hawera.—In December a fault on Power Board bus-bars due to lightning caused an interruption, during which the main 11 kV. switch was cleaned out.

Khandallah.—Modifications were made to the 11 kV. switchgear. An adjustable platform truck was made for the handling of potential transformers of various sizes. Burning was found in the amortisseur windings of the synchronous condenser and repaired.

Mangamaire.—Operation was satisfactory throughout the year.

In November a change over was made from No. 2 to No. 1 bank, when all No. 2 switchgear was overhauled. One 110 kV. O.C.B. bushing was replaced.

Masterton.—In November a flashover on an 11 kV. bushing to conservator tank occurred. One H.T. and one L.T. bushing were replaced. Taps on the transformers have been altered and are now in the position for maximum volts.

Marton.—One interruption occurred during the year, when a H.T. fuse blew on the 29th June due to the inability of the station battery to trip the 11 kV. switchgear. The battery was replaced. A new traverser truck was received.

Melling.—This substation gave satisfactory service during the year.

Napier.—An overhaul of several transformers was made. Several cracked post insulators were replaced.

New Plymouth.—Operation at this substation was satisfactory during the year.

Metering was altered to meet conditions of the new power contract with the New Plymouth Borough Council.

Okato and Opunake.—Both substations were regularly inspected and gave satisfactory operation. In April faulty operation of reclosing-gear occurred, and was found to be due to reclosing relay resetting too soon.

Papaparaumu.—This substation gave satisfactory service during the year.

Stratford.—A fault occurred in February in the condenser main switch cubicle due to a mouse.

All transformers and switchgear have been scraped and painted. Special earth-leakage relays were fitted. The Merz-Price potential transformers in the synchronous condenser switchgear were replaced. A ringing repeater has been installed on the high-tension telephone.

Waipawa.—A new local service board was fitted up and put into service, and O.C.B.s have been overhauled.

Wairoa.—During the past year transformers were overhauled. A new 11 kV. bus was installed.

Wanganui.—This substation gave satisfactory performance during the year.

Woodville.—One fault occurred during July on an A.B.S. and was repaired. Four post insulators were replaced.

(*c*) TRANSMISSION-LINES.

(i) *110 kV.*

Mangahao–Khandallah Duplicate Lines.—Throughout the year a pole-to-pole inspection and overhaul was carried out; a number of insulator units were changed.

In November a complete shutdown took place when an aeroplane damaged both east and west lines, and in January a special patrol and cleaning were carried out when salt spray trouble caused serious interruption to supply. Arrangements have been made to reinsulate the west line, Mangahao–Paekakariki, to endeavour to overcome the salt trouble.

On the telephone-line a general overhaul and rewiring was carried out. Between Mangaore and Otaki River the line was rewired with No. 6 copperweld on the twist system. This will eventually be carried on to Paekakariki, so that the whole line will then be copperweld.

Four interruptions on the telephone-line during the year were due to break on a transposition near Orchard, broken wires at Horokiwi and Brandon Hut, and a faulty transposition near Manakau.

Khandallah–Melling.—This line gave satisfactory service during the year.

Mangahao–Bunnythorpe Duplicate Line.—This line operated satisfactorily.

A pole-to-pole inspection and overhaul was carried out, and pole-capping was completed. A deviation was made in the line at the main North Trunk Railway line by Palmerston North. Further work was done on the Manawatu River protection groynes.

A general overhaul and rewiring of the telephone-line was carried out, cadmium copper (with cork dampers) replacing copperweld on the Manawatu River–Bunnythorpe section.

Bunnythorpe–Marton–Wanganui.—This line gave satisfactory service throughout the year. An overhaul was completed from last year and the fitting of "Armour rods" to all suspension clamps finished. Protective work was done at the Oroua River crossing.

Telephone Line: Three faults occurred, two from broken crossarms near Bonny and the other from slack wires at Marton twisting.

Work on the line for the year included a general overhaul and retensioning of wires.

Wanganui–Hawera Stratford.—The reliability of this line for the year was good. Some guy fences were erected and a cage was completed at Tangahoe River.

Faults on the telephone were as follows: A faulty switch at Maxwell's hut, a broken binder and a broken insulator at Tangarahau hut, a broken wire between Patea and Waverley, and wires twisting between Dawes and Waverley due to an insulator becoming free.

The line was overhauled in the Hawera section.

Stratford–Pohokura.—One fault occurred in this line in a heavy north-west gale.

A pole-to-pole inspection was carried out between Stratford and Quarry Road.

Four faults occurred on the telephone-line—two during a storm on the 9th August, one in Pohokura hut, and the other when wires twisted between Stratford and Tahora.

Bunnythorpe–Woodville.—General patrol work was carried out, and the line gave satisfactory service during the year.

One interruption occurred on the telephone-line when wires became twisted at Summit hut.

Woodville–Masterton.—This line also gave satisfactory service during the year. A pole-to-pole inspection was completed, and a general overhaul is proceeding. Defective insulators were changed.

Arrangements have been made to reinsulate part of this line with insulators of higher form-factor to prevent trouble with salt. At the same time vibration dampers will be installed.

Telephone line: No interruptions from line failures occurred during the year. A general overhaul is being done—portions of copperweld and copper sleeve joints are being cut out. A new combined section of telephone and 11 kV. Power Board line is now in service. Galvanized-iron wire was used.

Napier–Waikaremoana Duplicate Line.—Satisfactory service was obtained from this line. Little damage was done to it from the floods of last April.

Investigations were carried out to determine the suitability of festoon dampers for reducing line vibrations.

The telephone-line suffered considerably from the floods—three poles were washed away at the Esk River. During the year two faults occurred at Kotemaori and two from branch lines at Pihanui and Putere. The line was deviated to avoid blue-gum plantation at tower 186.

Woodville–Dannevirke–Waipawa Napier.—This line operated satisfactorily throughout the year. A pole-to-pole inspection is being carried out and poles capped. Several defective insulators in the Dannevirke–Waipawa section were replaced. An overhaul of the telephone-line is also being done.

Interruptions on the line were due to faults as follows: A joint pulling out in a gale, Woodville section; an insulator coming off near Matamau and wires contacting; line down with snow near Kopua; wires twisted between Dannevirke and Taradale.

(ii) *50 kV. Lines.*

Stratford–New Plymouth.—One fault occurred from a broken binder and was repaired. Besides general patrol, work has consisted of the installation of guy insulators and fences.

There was one fault on the telephone-line from a broken wire.

Waikaremoana–Gisborne.—A heavy gale in August caused much damage to this line, binders and guys being pulled loose, fifteen insulators were chipped, and poles were blown over. An insulator became unhooked, the crossarm was burnt off, and the pole top damaged.

Two other interruptions occurred during the year when an east line conductor came adrift, the insulator top being chipped off, and when an insulator was shattered by lightning in February.

Three interruptions occurred on the telephone-line.

Waikaremoana–Wairoa.—This line gave satisfactory service during the year. The floods of April fortunately caused little damage to the line. A deviation was made at Piripaua to avoid the canal at the new power-station. Twenty-three poles were fitted with 12 ft. crossarms by the "live-line" gang.

(iii) *Distribution.*

11 kV. Lines.—All lines gave satisfactory service throughout the year. An overhaul was made of the Lake House line at Tuai.

3·3 kV.—The Mangaore–Arapeti and Arapeti–No. 1 dam lines also operated satisfactorily during the year.

400 Volt.—Lines at both Mangaore and Tuai gave satisfactory service, and have been extended.

(iv) *General.*

(1) *Lightning Storms.*—Sixteen lightning storms were reported during the year, and eight of these caused disturbances on the system. Five of these caused flashovers. No. 8 O.C.B. Stratford opened up twice on earth leakage from storms north of Ongarue, and at Ruakituri lightning caused No. 8 O.C.B. Tuai and Gisborne 11 kV. switch to open.

(2) *Special Maintenance.*—The "live-line" gang was encamped for the major portion of the year at Bunnythorpe. During that time and early in the year the overhaul of the Bunnythorpe–Wanganui and Bunnythorpe–Woodville lines was completed, and then an overhaul was made of the Manawatu River–Bunnythorpe section of the main line and telephone-line and of the Bunnythorpe–Wanganui telephone-line. Other work consisted of improvements to the Manawatu and Oroua River protection groynes, deviations to the main line at the Palmerston North railway crossing and between Campbell's hut and the Manawatu River, and finally help was given to the cleaning of structures at Bunnythorpe, Woodville, Dannevirke, and Waipawa Sub-stations. In November the gang was shifted for construction work on the Khandallah–Masterton line.

The other special-maintenance gang, located at Mangaore, has confined its work to the Khandallah–Mangahao and a portion of Mangahao–Bunnythorpe lines. The reconditioning of both

telephone-lines has been the major work of the year, whilst work in the respect of checking poles for weights, guys, inspection of conductors, and the changing of insulators has been done on the Khandallah–Mangaore line. This gang has now been transferred to the construction of Khandallah–Masterton line.

(3) *Khandallah High-tension Testing-set.*—The usual retests were made of insulators found defective by live-line testing. In addition, porosity, puncture, and flashover tests were made of sample insulator units, porosity tests of Post and Telegraph insulators, flashover tests for special strain insulators, and comparison tests were made on two types of insulators.

(4) *Insulator Deterioration.* Live-line testing of all insulators in service was carried out during the year, with the following results:—

	Pin.	Strain.	Suspension.
Total number tested—			
110 kV.	..	22,915	90,016
50 kV.	3,399	1,812	1,194
Number defective—			
110 kV.	..	32	346
50 kV.	20	..	..
Percentage defective—			
110 kV.	..	0·1396	0·384
50 kV.	0·590	..	..

Total 110 and 50 kV. strain and suspension units tested	115,937
Total defective	378
Percentage defective	0·326

(*d*) COMMUNICATION SYSTEM.

The high-tension telephone equipment at the power-station and substations was periodically tested and inspected by the testing department.

Most of the apparatus for the signalling-system at Mangahao Power-station has been delivered. The double-channel amplifier was satisfactorily tested in the testing laboratory. The question of obtaining seasoned timber for the new control-room desk-table will probably cause some delay in completing the final installation, involving the above signalling-system, changeover of radio receivers, and telephone-exchanges.

A ring selector was added to the high-tension code exchange at Mangahao Power-station.

An analysis of operation of the radio-telephone channel between Mangahao and Tuai was incorporated in a report to the Post and Telegraph Department concerning the suggested provision of an additional wave-length to cover the short day-time period during which reception is erratic. Generally, the operation of the radiophone channel has been satisfactory.

(*e*) TESTING.

Maintenance tests were carried out on all departmental revenue and statistical demand metering-equipment, indicating and graphic instruments, 110 kV.-50 kV.-11 kV. relays, batteries, and charging equipment, &c., at the two power-stations and eighteen substations.

Prior to taking over 11 kV. switchgear at substations, maintenance tests were made on Power Board relays and panel equipment at Melling, Dannevirke, Waipawa, Mangamaire, Paraparaumu, Gisborne, and Hawera.

A considerable amount of repair and electrical testing-work, involving recoverable charges, was carried out for the outside supply authorities and others.

Miscellaneous testing-apparatus has been manufactured locally to facilitate testing-work generally.

Acceptance and installation tests were made on new equipment prior to being connected into service at the power-stations and substations.

The routine six-monthly Megger tests made by the field staffs on all system apparatus were graphed and analysed, and further action taken where necessary. "Hipot" stick tests were made on practically all of the system 110 kV. and 50 kV. bushings. Eight doubtful bushings were removed from service for overhaul.

The question of replacement relays has received consideration, both in connection with the system expansion and modernizing the existing protective apparatus. Additional relays were ordered, and new replacement relays were delivered for the Khandallah 11 kV. panels.

A periodical load survey was made at the respective points of supply throughout the system. Owing to growth of load, higher ratio current transformers were installed at three substations, and provision made for some others.

Special field tests on protective apparatus involved in certain system interruptions have been conducted and reports submitted.

A large volume of miscellaneous repairs and tests involving 110 kV. liquid fuses, demand printometers, contactors, meters, instruments, and relays, &c., were made in the testing laboratory.

The testing instruments and equipment have been maintained in a satisfactory state.

(*f*) GENERAL.

(1) *Load.*—The maximum load on the system was 76,250 kW., as compared with 61,120 kW. for last year and 55,160 kW. for the year ending 31st March, 1937. However, if the output of Evans Bay Power-station is included, this year's maximum demand was 85,550 kW., as compared with 71,730 kW. last year and 63,100 kW. the previous year. The total output for the year was 434,016,391 units, or 435,594,691 units including Evans Bay output.

The following table gives a comparison of output and demand for the past three years: —

	Year ended 31st March,		
	1939.	1938.	1937.
System maximum demand (kW.)	76,250	61,120	55,160
System maximum demand, including Evans Bay Power-station	85,550	71,730	63,100
Percentage increase over previous year	19·3	13·7	14·5
System output (units)	434,016,391	359,173,934	305,808,079
System output, including Evans Bay output (units) ..	435,594,691	362,274,223	307,580,890
Percentage increase over previous year	20·2	17·8	12·0
Annual load factor	58·1	57·7	55·6

The Mangahao-Waikaremoana system was operated in parallel with the Arapuni system throughout the year, and the following table gives details of the interchange of power for the past three years:—

	Year ended 31st March,		
	1939.	1938.	1937.
From Arapuni—			
Maximum demand (kW.)	36,000	27,190	20,840
Units supplied	106,042,550	108,730,936	52,858,752
To Arapuni—			
Maximum demand (kW.)	15,720	13,920	6,620
Units supplied	329,000	53,727	98,788

(2) *Reliability of Supply.*—During the year, with the exception of the period 17th to 28th January, when there were extensive interruptions to supply due to salt-spray trouble on the Mangahao-Khandallah lines, there were a total of forty faults on the Department's system which caused interruptions to consumers' supply. There were also fourteen faults on the Department's system during the same period that were cleared without interruptions to consumers.

The average number of accidental interruptions to each of the twenty consumers was 4·75 and the average duration was 11·3 minutes. The total average duration to each consumer was 53·8 minutes.

During the period 17th to 22nd January, 1939, inclusive, practically continuous westerly winds of gale force were experienced, and a considerable number of interruptions, due to flash-over on the main lines south of Mangahao, were caused by accumulation of salt deposit on the insulator units. During this period there were twelve major shutdowns, which resulted in a total of eighty-four interruptions of a total duration of 44 hours 15 minutes. There were also four faults caused by the same trouble that were cleared without interruptions.

In view of the serious inconvenience and considerable expense caused by this trouble, a careful investigation has been made into the performance of insulators under salt-spray conditions, and it has been decided to reinsulate both Wellington lines. This, combined with the fact that probably before the end of this year the Melling–Masterton section of the main line will be completed, should reduce the possibility of future trouble from this source.

With reference to prearranged interruptions, the total average duration of such interruptions to each consumer was 6 hours 3 minutes.

In practically every case of both prearranged and accidental interruptions the New Plymouth Borough Council and South Taranaki Electric-power Board were able to carry all or portion of their own load.

(3) *General.*—The load during the winter months of the year under review was very heavy, and for the year the percentage increase in maximum demand and output set new record levels for the district.

Heavy loadings during the winter months, severe floods in the Hawke's Bay Province early in the year, salt-spray trouble in January of 1939, and continued dry weather resulting in low lake-levels at Mangahao and Waikaremoana have called for careful attention and considerable effort on the part of both operating and maintenance staffs in the discharge of their duties. The staff are to be complimented on the service that they gave during these times, and special mention can be made of those who worked long hours under trying conditions during the Hawke's Bay flood and the salt-spray trouble.

SOUTH ISLAND ELECTRIC-POWER SYSTEM.

INTRODUCTORY.

The past year ending 31st March, 1939, was the twenty-fourth year of operation of the Lake Coleridge undertaking and the fourth complete year of operation of the Waitaki Scheme. It also represented the first year of operation since taking over the Arnold River Scheme.

The first two stations mentioned have been in parallel throughout the period, with the third station as part of the system after the completion of the West Coast lines early in March last. Actually before the West Coast lines were completed the Dobson Diesel station and the Arnold River Scheme had been running jointly to supply the West Coast load.

With the completion of the transmission-line from Half-way Bush Substation to Gore on 20th December, 1938, the system has been able to combine with Monowai to supply additional power to Southland.

1. Capital Outlay.

The capital outlay at 31st March was £6,654,048, of which assets to the value of £266,778 were not in operation.

In Table II will be found an analysis of the capital outlay.

2. Financial Results.

The total revenue for the year was £561,451, and working-expenses totalled £187,835, making a gross profit of £373,616, which equals a return of 5·98 per cent. on the average capital outlay in operation (£6,247,478).

The interest-charge for the year was £231,060, which, together with depreciation (£82,617) and the cost of raising loans (£1,404) was met from revenue, leaving an amount of £58,535, of which £54,961 is available for arrears in Sinking Fund Account.

The accumulated depreciation reserve and sinking funds at the 31st March, 1939, amounted to £988,640, and the General Reserve Fund £87,199.

Table I gives full particulars of the financial results and also statistical returns of operations for the year.

The detailed operating-costs given in Table III show that the total cost per unit generated for the year was 0·1381d., compared with 0·1109d. for the previous year, an increase of 24·53 per cent. The reason for this comparatively large increase was due in part to an increased expenditure of approximately £6,000 at Lake Coleridge to cover switchgear and tunnel repairs and the Dobson Diesel working-expenses of £26,300 for the 7,794,010 units generated.

In Table V are given the gross financial results of the distribution of power from the combined stations, and of the local supply authorities and other consumers connected to the Government supply system.

3. General.

The total units generated and purchased (including West Coast and Southland) were 326,326,230, representing an increase of 18·97 per cent. on those of last year. Of these units, 281,708,949 were sold, while 3,904,827 were otherwise accounted for. The balance of 40,712,454 units represents transmission and distribution losses and amounted to 12·48 per cent. of the units generated.

The maximum system load increased from 59,380 kW. to 69,610 kW., an increase of 17·23 per cent. The average load factor (not including West Coast and Southland) was 51·5 per cent.

A. CHRISTCHURCH DISTRICT.

4. Construction, Operation, and Maintenance.

(1) CONSTRUCTION.

(*a*) *Power-stations.*

Lake Coleridge Power-station.—The installation of the 66 kV. switchgear, including two 66 kV. O.C.B.'s (ex Timaru and Ashburton) which were required in connection with the West Coast supply, was completed and the gear livened up in March last.

On the 11th June of last year considerable leakage was noted at No. 1 tunnel adit, and as the flow steadily increased for the first few days a constant watch was set and was continued well into the spring. In September a well-sinking plant was engaged to put down 2½ in. bores with the intention of tapping the leakage, but, although many bores were attempted, only three reached full depth. A decision to commence grouting was reached, and work commenced late in December. The tunnel was shut down for three weeks, during which time 3 chains, commencing from the outlet end, were grouted, with successful results.

The erection of six staff cottages, seven garages, and a social hall was commenced in July last, but somewhat slow progress has been made. To date, three of the cottages and the social hall have been completed.

Waitaki Power-station.—The steelwork for the extension of the outdoor station was received at the station and sorted.

Six main transformers and accessories for the extensions were also received.

The erection of three new staff houses was commenced, and these are now well under way.

Arnold Power-station.—The 33 kV. outdoor structure was replaced by a 66 kV. structure and a 3·3/66 kV. bank of transformers installed.

Repairs to the dam were undertaken by the General Branch, which work has now been satisfactorily completed. Repairs were also effected to the tail-race, tunnel, surge chamber, and penstocks.

(*b*) *Substations.*

Addington Substation.—Two new 20,000 kVA. 66/11 kV. transformer banks, which are replacing two of the three existing 12,000 kVA. banks, were received, and work is proceeding on their drying out and installation.

Hororata and Point Substations.—No construction work was done.

Ashburton Substation.—Four 110 kV. O.C.B.'s were installed, in place of the existing 66 kV. O.C.B.'s.

Timaru Substation.—Six 110 kV. O.C.B.'s were installed in place of the existing 66 kV. O.C.B.'s. A new 7,500 kVA. 110/11 kV. transformer bank was also installed. This replaced the existing 5,300 kVA. 66/11kV. bank.

Pending the shifting of the auto-transformers to Hororata, this substation has been arranged with the top bus at 110 kV. and the bottom bus at 66 kV., while a temporary 66 kV. bus has been erected to allow separation of the two transmission lines to Ashburton if required.

Glenavy Substation.—An induction regulator was installed to control the local supply.

Oamaru Substation.—One new staff cottage was erected complete and is now in occupation.

Palmerston Substation.—Work on this substation was commenced during the year, and completed as follows: Two four-pole structures in Oamaru–Dunedin line, each with line air-break and earthing-switches. Pole-structure with transformer air-break switch and 110 kV. liquid fuses; 2,250 kVA. 110/11 kV. transformer bank with automatic tap-changing gear. 11 kV. O.C.B. in outdoor cubicle, metering-gear, and temporary induction regulator.

Supply was given through this station to the Otago Electric-power Board in May, 1939, and serves in part of their northern area, in particular to Macrae's Flat and Ranfurly. All the Power Board's northern supply will be drawn from this substation when their contract with the Dunedin City Council expires in 1941.

Half-way Bush Substation.—The erection of a new bay of steelwork to provide for the line to Southland was completed. As well, two 110 kV. O.C.B.'s, new control and relay panels, and a 110 kV. potential transformer were installed. Supply was given through this station to Gore on 3rd January, 1939, and, after minor adjustments, to Southland.

Two new cottages were erected complete and are now in occupation.

Smith's Road Substation.—This 33 kV. substation, which supplies power to the Springs-Ellesmere Power Board, was completed during the year and livened up in December.

Motukarara Substation.—This substation, also at 33 kV., was completed and livened up in February for supply to the Banks Peninsula Power Board.

Southbrook Substation.—A new O.C.B. structure was erected in connection with the 33 kV. line to North Canterbury.

(*c*) *Transmission-lines.*

The main transmission-line work has been in connection with the lines to the West Coast. This is detailed under section (*g*) below.

Work was commenced on the new 33 kV. line from Southbrook to Culverden, and at the end of May, 1939, 211 poles, or 18 miles of the 50 miles, had been erected completed except for wiring.

Poles were distributed at different stations along the route, and all other material is on order for the new Timaru–Ashburton 110 kV. line.

(*d*) *Telephone System.*

No new construction work was done, except on the West Coast, which is detailed below.

(*e*) *Test Department.*

66 kV. and 11 kV. O.C.B.'s, together with their protective equipment and control panels, were installed at Dobson and Arahura. 66/11 kV. tap-changing transformer banks were also installed at Dobson and Blackwater.

Control equipment for supply to a dredge was installed at Kanieri.

Two voltage regulators were installed for temporary regulation of voltage to the Grey Electric-power Board.

The major breakdown of switchgear at Coleridge Power-station in June involved urgent repair and reconstruction of equipment, and this was done as expeditiously as possible.

Protective equipment was installed, tested, and put into operation on the supply to Southland and the West Coast.

During the year 326 tests and reports were made and 100 drawings completed.

A total of 70 repair and test orders were executed on behalf of other Government Departments and local supply authorities.

(*f*) *Survey.*

The location and final pegging of the Southbrook–Culverden 33 kV. line was completed.

Preliminary locations of the routes for the new transmission-lines from Highbank to Hororata and the second Timaru–Ashburton lines are in hand.

A 3·3 kV. line was pegged from Sumner to Godley Head, a distance of three miles, ready for erection for the Defence Department.

(*g*) *West Coast Electrification.*

In March, 1939, the West Coast system was paralleled with the Waitaki–Coleridge system, and, apart from minor interruptions, the two have been running together quite satisfactorily ever since.

The bulk of the construction work has now been completed, and the year's activities have been confined to the following:—

Transmission-lines.—The 66 kV. line was completed from Otira to Arahura and from Kaiata to Dobson. The latter included two and three-quarters miles of 33 kV. line converted to 66 kV.

Twenty-eight miles of line were constructed between Dobson and Blackwater, and eight miles between Dobson and Arnold. The latter consisted in the most part of a 33 kV. line converted to 66 kV.

Of the 11 kV. distribution lines eight miles were constructed from Arahura to the Arahura and Kanieri dredges. A short length of single-circuit line was constructed to connect the Grey Power Board's system to the site of the Ngahere Substation. Approximately two miles of double-circuit 11 kV. line was constructed from Otira Substation to the tunnel portal.

Telephone-lines.—During the year a telephone-line was constructed over Arthur's Pass to Otira to form an alternative route to the line through the tunnel and to serve as a patrol-line.

Another line from Jacksons to Arahura approximately thirty miles is under construction.

Substations.—Dobson: This 66/11 kV. substation was completed and put into service in October. Nine panels were added to the 11 kV. switchgear and the Power Board feeders gradually changed over from Kaiata Substation, the latter now being out of service.

Arahura: First livened up and went into service in November last. Since then four 66 kV. O.C.B.'s have been erected, together with the necessary control gear and relays, and placed in service. The 5,000 kVA. synchronous condenser was erected complete and put into service in May, 1939.

This completes the major work at this substation, but a good deal of work has yet to be done on the grounds.

Blackwater: Construction work at this substation was completed during the year, and it was put into service in October, supplying power to the Grey Electric-power Board and the Grey River dredge.

Ngahere: This substation was partially built, sufficient to permit the 66 kV. lines in and out to be connected to their proper switches. The major part of the construction work has yet to be done and this is now in hand.

(*h*) *Wigram Aerodrome.*

Extensive low-tension underground reticulation was carried out and is continuing to be extended A 450 kVA. transformer bank was installed for temporary supply, and work is proceeding on the necessary adjustments and testing of the switchgear.

(2) Operation and Maintenance.

(*a*) *Power-stations.*

General.—During the year the Lake Coleridge and Waitaki stations operated in parallel satisfactorily with Waipori in parallel as required. In December Monowai was paralleled and, after satisfactory voltage adjustments, has since operated as part of the system. In March the West Coast system was paralleled with Coleridge, the Diesels at Dobson being first used, and later Arnold River Station. The two systems have operated quite satisfactorily, the Diesels now being shut down, but are ready to be brought in as required to ease the system peaks.

Lake Coleridge Power-station.—A very heavy flood in the Harper River in April, 1938, caused considerable damage to the eastern end of the main diversion groyne at the Harper intake, and destroyed two of the protective groynes a short distance below the main groyne. Repair work, due to adverse conditions, has been slow, but it is now well in hand. The extremely dry conditions for the first three months of this year have made it necessary to turn the full river flow into the lake and, as well, to construct a bag dam at the gates. Now that construction has been completed at the Harper intake the maintenance staff has been reduced to three men.

The Acheron diversion was in use for about five months during the year.

The lake-level caused slight anxiety in May of this year, due to its fall to 1,666·525 ft. but, due to heavy rains, the level is rising again, that at the end of May being 1,666·9 ft.

An explosion occurred in a section of the 6·6 kV. indoor switchgear in June. Extensive damage was caused to the control cables, excitation leads and 6·6 kV. cables, while rendering all 7,500 kW. machines inoperative. The work of repair was undertaken by the Test Department, while later the walls of the switch gallery and control-room were cleaned and distempered.

No. 1 unit was shut down in August for removal and renewing of the rubber packing-rings and welding of the scored parts of the piston and sleeve and internal body of the main valve. At the same time the turbine was opened up for general inspection.

No. 2 unit, which was shut down in February, was recommissioned in June of last year, after steel protecting-rings had been fitted to the runner. In December one of the guide-vanes of this unit was broken, causing severe damage to the runner blades. This was repaired by welding.

Considerable trouble was experienced due to foreign matter becoming lodged in the turbine guide-vanes of Nos. 4, 5, 6, and 8 machines, several gate-operating links being broken.

New bronze rings were fitted to the main gate of No. 8 unit. This unit was shut down on another occasion to reduce side clearance of gates.

Waitaki Power-station.—The average monthly river-flow varied from 26,300 cusecs to 5,010 cusecs.

The automatic lake-level recorders at Lakes Ohau, Pukaki, and Tekapo were inspected periodically.

Routine maintenance-work has otherwise been carried out, both the main and the auxiliary generating-sets operating quite satisfactorily throughout.

(*b*) *Substations.*

Addington.—At Addington a considerable amount of transformer and switchgear fitting, altering, and repairing was carried out for substations, chief of which was—

A bank of 5,000 kVA. transformers was dried out for Smith's Road.

A bank of 5,000 kVA. 66/33 kV. transformers for Addington was dried out and erected on pads ready for connecting up.

Work is proceeding on the drying-out of two 20,000 kVA. 66/11 kV. banks for Addington.

A number of 66 kV. O.C.B.'s, ex Timaru and Ashburton, were reconditioned for use on the West Coast.

The switchgear and condensers have operated satisfactorily throughout.

Oamaru.—A new control battery was installed.

Half-way Bush.—New blades were fitted to all 33 kV. switches due to heating troubles.

Dobson.—Silting-up of the cooling-water tubes to the engines was remedied by the fitting of water-jets to clear the silt. Maintenance-work has been satisfactorily carried out on the four Diesel engines.

(*c*) *Transmission-lines.*

The condition of the main transmission-lines was maintained satisfactorily, the necessary inspection and replacements having been carried out.

During the year there was one interruption of nine minutes to main supply at Addington Substation on 25th December, due to lightning striking the busbars at Hororata.

Due to insufficient road width, a section of the 11 kV. line to Sumner was removed from the causeway and rebuilt on the seaward side.

All insulators on the system were buzz-stick tested, and of a total of 112,590 tested, 623 were found to be defective.

Six poles and eleven insulators were replaced under live-line conditions, the total number of defective poles replaced being 60.

The charring treatment of poles for the North Canterbury line has been undertaken with satisfactory results.

(*d*) *Test Department.*

O.C.B. and relay maintenance was carried out wherever possible, and the work will be back to schedule in the near future.

The quarterly tests of switchgear at Addington and Timaru were conducted.

All insulators removed from transmission-lines after field tests were tested prior to their being destroyed.

Regular inspection of electrical installations supplied direct from our reticulation has been kept up to schedule.

(*e*) *Analysis of Trouble on System.*

The following table gives an analysis of troubles experienced during the year under review:—

Reference.	Description.	Number.
1	3·3, 6·6, or 11 kV. lines: Defects	3
2	3·3, 6·6, or 11 kV. lines: External causes	15
3	33, 50, or 66 kV. lines: Defects	5
4	33, 50, or 66 kV. lines: External causes	5
5	110 kV. lines: Defects	8
6	110 kV. lines: External causes	..
7	Lightning	5
8	Storms: Nature of trouble not discovered	..
9	3·3, 6·6, 11, or 22 kV. apparatus	5
10	33, 50, or 66 kV. apparatus	3
11	110 kV. apparatus	3
12	Generators or synchronous condensers	..
13	Relays	..
14	Control circuits or batteries	..
15	Operation: Mistakes	1
16	Operation: Accidents	..
17	Other causes	1
18	Cause unknown	3
	Total	57

Circuit miles of transmission line in operation at end of year: 11 kV., 92 miles 1·5 chains; 33 kV., 65 miles 50 chains; 66 kV., 597 miles 4 chains 110 kV., 258 miles 78 chains. Number of substations in operation at end of year: 11 kV., 24; 33 kV., 3; 66 kV., 8; 110 kV., 4.

3. Rainfall and Lake-Levels, Year ending 31st March.

The maximum flow at Waitaki for the year was 26,800 cusecs on 15th April, while the minimum flow was 5,100 cusecs on 5th August.

Lake Coleridge rainfall was 42·08 in.; Harper rainfall was 41 in.; Waitaki rainfall was 22·10 in.

Lake Coleridge lake-level at 31st March was 1,669·6 ft.

B. INVERCARGILL DISTRICT.

1. Capital Outlay.

The assets in operation at 31st March represented a capital outlay of £1,625,448 and £966 representing assets not in operation, giving a total capital outlay of £1,626,414.

The capital outlay during the year, including that not in operation as at 31st March, was £105,714.

2. Gross Revenue.

	£
Domestic units sold	64,717
Commercial (business premises, motors for rural power, and street lighting)	29,448
Industrial	29,245
Bulk for resale	23,035
Miscellaneous services	3,542
Total	£149,987

3. Consumers and Tariffs.

Consumers increased by 575.

Connected load increased by 5,155 kW.

Consequent upon the Government taking over in October, 1936, the undertaking of the former Southland Electric-power Board, a reduction was immediately made in the retail price of electricity by reducing the high-rate units from 7d. to 6½d., meter rents were abolished, and at the same time the further imposition of land rates was remitted.

In March, 1939, the Hon. the Minister of Public Works made the following pronouncements:—

(1) A substantial reduction in the Department's retail electricity rates throughout the whole of Southland. The reductions commenced as from the beginning of each consumer's "guarantee" year falling after 1st March, 1939, and apply to all retail, domestic, and farm-users, and to all consumers on the then-existing standard tariff, but will not apply to bulk purchasers nor to wholesale industrial consumers operating under special contracts.

(2) That the Department would abide by the award of the Arbitrator in the matter of an arbitration between the Borough of Gore and the Minister (as successor to the Southland Electric-power Board), and authorized the payment of refunds to Gore electricity consumers on a basis which had been decided upon as fair and reasonable to all parties.

4. Construction, Operation, and Maintenance.

(1) Construction.

(*a*) *Power-station and Headworks.*

Owing to the extremely dry summer of 1937–38 and the consequent falling in level of Lake Monowai it was found necessary to deepen the channel leading from the lake to the control gates. A drag-line excavator worked by a tractor was put into operation, and a considerable amount of blasting of old tree-stumps was found necessary. The work done on this channel made possible a greater draw-off from the lake during the low levels reached in May and June.

A petrol-driven generator set was installed in the power-house to enable the pipe-line intake gate to be raised in the event of a complete shutting-off of water to the power-house. New explosion pots and bigger tanks were fitted to all 66 kV. O.C.B.'s. The erection of two new houses and a communal garage is nearly completed.

(*b*) *Substations.*

Gore Substation.—A complete new steel structure was erected at this substation, together with the necessary switchgear and protective equipment. A 15,000 kVA. 110/66 kV. autotransformer bank for linking Monowai with the Coleridge-Waitaki system was installed. An existing 2,250 kVA. 66/11 kV. bank with fixed taps was replaced with a 5,000 kVA. on-load tap-changing bank. A new workshop and electric crane were erected.

Winton Substation.—New explosion pots were fitted to the 66 kV. O.C.B.'s at the substation. The distribution depot layout at this substation was rearranged and improved.

Ohai Substation.—A complete substation was erected with 66 kV. A.B. switches and a 750 kVA. 66/11 kV. transformer bank to give supply to the coalfields in this area. 11 kV. automatic reclosing switchgear has been delivered, but has yet to be installed.

Invercargill Substation.—A start was made by the contractor with erection of three staff cottages; one previously existent at this substation was totally destroyed by fire during the year.

A new 4,500 kVA. transformer bank to run in parallel with the existing bank of the same capacity has been ordered, together with new 11 kV. switchgear.

(c) *Transmission-lines.*

Half-way Bush – Gore 110 kV. Line.—This line was completed and put into service on 20th December, 1938. Clean-up work is proceeding and some weights require hanging.

Monowai–Winton 66 kV. Duplicate Lines.—Complete new crossings were constructed at the Aparima River for these lines.

(d) *Telephone System.*

The trunk-telephone system existent in the Waitaki-Coleridge system was extended into this district and is complete as far as Invercargill office and substation. The majority of the line is run on the Railway Department's poles, except for the Half-way Bush – Wingatui and the Crichton–Waipahi sections, which were constructed by this Department. The Invercargill–Winton section on the Railway Department's lines is under way, and material is ordered for the Winton–Monowai section, which will be across country.

Test boxes and watertight phone-boxes have been installed between Half-way Bush and Invercargill.

(e) *Distribution.*

Thirty-four miles of 11 kV. lines were erected and 5 miles 32 chains removed. Fourteen miles forty chains of 3·3 kV. line were removed. Twenty-six miles of 400/230 volt lines were erected, and 20 miles 72 chains removed. Forty-five new transformers were erected of a total capacity of 746 kVA.

(2) Operation and Maintenance.

(a) *Power-station and Headworks.*

In April, 1938, a floating log caused damage to the flash boards and about half the length of the crest of the spillway weir.

Continued dry weather throughout the late summer and autumn resulted in a very low level being reached with Lake Monowai, being 7 ft. 11 in. below normal on the 24th May, 1938. In the middle of April restrictions were found necessary, even though the Invercargill City steam-plant was in full operation. The restrictions were continued until the end of June and consisted generally of the daily cutting-out of 11 kV. feeders at the substations for scheduled periods. Several of the industries co-operated by working night shifts instead of during the day. Street lighting was dispensed with except on the tram routes in Invercargill, and a very fine response was received from shopkeepers to an appeal for a reduction in display lighting.

The low lake-level produced a twofold effect in that not only was the unit consumption required to be kept down, but the maximum demand on the station was considerably reduced owing to the fact that the flow through the control gates was insufficient for the full capacity of the plant.

Trials were made of paralleling the Waitaki-Coleridge system with the Monowai system late in December, but as voltage adjustments on the two systems were necessary it was decided that until these could be made Waitaki should carry the Gore Substation load only in this district. This was taken over by Waitaki on 4th January. Parallel running of the two systems was not accomplished until 8th May, 1939.

An improvised system of frequency control at Monowai was instituted in January and proved quite satisfactory. The master clock ordered has since been delivered and is to be installed shortly.

General routine maintenance of the Monowai plant has been carried out and switchgear numbering completed.

(b) *Substations.*

Complete overhauls of the 11 kV. switchgear in Winton, Gore, and Invercargill Substations have been carried out. The supply to Ohai Substation was interrupted on the 8th February when a 66 kV. bushing failed on the main bank. On the 18th two 66 kV. fuses were blown at this substation, apparently by lightning.

On the 7th February the 11 kV. switchgear at Gore failed to clear a heavy feeder fault, with, fortunately, very little damage. The old 66/11 kV. bank has been connected in as a set of current-limiting reactors pending the delivery of new 11 kV. switchgear. Improved tanks were fitted meanwhile.

(c) *Transmission-lines.*

Extensive overhaul work has been carried out on the Gore–Winton 66 kV. line, a number of poles being replaced. The Winton–Invercargill 66 kV. line was also given urgent attention in the matter of pole replacements, as three poles broke between October and January, two of them causing outages. Fires caused outages on the Winton–Gore section in October and November, and one pole required replacement as a result.

The Half-way Bush – Gore 110 kV. line tripped once in January as a result of a riser working loose and falling on the line side of the Gore structure. Fire damaged the Monowai–Winton south line in May.

(d) *Distribution-lines.*

Overhaul work on a section-by-section basis has been commenced on the 11 kV. and low-tension lines. New constructions giving better wire-spacing have been adopted, and also a new method of mounting transformers. A large number of the 11 kV. fuse-bases have been replaced with a consequent reduction in the number of feeder interruptions from fuse-base faults. Regrouping of consumers is being carried out as opportunity offers to give improved voltage conditions, in most cases extra transformers being erected.

(*e*) *Consumers' Installations.*

Contracts were let to change over those consumers' installations which were on the old fused neutral system to the multiple-earthed neutral system, and this work is nearing completion. Satisfactory progress is being maintained with the re-inspection work.

(*f*) *General.*

Overhauling distribution transformers in the field was continued during all but the winter months, a new lorry having been delivered for this work and improved handling facilities provided. Besides being engaged on construction work the workshops staff has carried out transformer overhauls and the making up and repairing of distribution equipment.

Earth-testing has been organized on a basis commensurate with the requirements of the Electrical Supply Regulations 1935.

Test-work consisted of investigation into voltage complaints, checking transformer loading for the distribution department, testing of rubber gloves, relays, and over 1,500 consumers' meters.

(*g*) *Units generated and purchased.*

Generated at Monowai	25,597,100
Generated at Waitaki and supplied to Southland	1,710,570
Generated by steam (Invercargill)	2,889,484
Units obtained from other sources	1,286,916
Total	31,484,070

Of these, 23,694,225 were sold; the balance, representing losses, totalled 7,789,845, or 24·74 per cent. of the total units.

DESIGN OFFICE.

A. Electrical Section.

(*a*) *Introductory.*

The year under review was one of exceptional activity in design work in connection with the various hydro-electric systems.

The wider use of electricity for primary and secondary industries, domestic heating and cooking, general heating and traction, along with higher standards of artificial illumination and a continued decrease in the average price per unit, have all contributed to an accelerated growth of load in both Islands.

In 1938 the peak load approached the installed generating-capacity in the South Island and exceeded it in the North Island, and as no additional generating-plant has since gone into commission it has been necessary to call on fuel-plants in the latter to assist in carrying the load this winter. The position has been somewhat accentuated by the increased demand due to the unusually cold winter, and also by depleted water-power resources following a very dry summer.

(*b*) *Hamilton District.*

Arapuni Power-station.—Drawings were prepared for tendering purposes for two additional generating-units and associated equipment. These units, which will be Nos. 5 and 6 of the ultimate development, will each include a Francis turbine rated at 30,000 b.h.p., and an 11 kV. alternator rated 21,600 kilowatts at 0·9 power factor. Each generator will be direct coupled to a 24,000 kVA 11/110 kV. transformer bank, all switching being carried out on the 110 kV. side. The addition of these units will increase the installed generating-capacity of the station to its ultimate capacity of 146,700 kilowatts. Drawings were prepared for tendering purposes for the two 24,000 kVA. 11/110 kV. transformer banks, and for the 110 kV. switchgear and steelwork. The latter includes controlling switchgear for outgoing transmission-lines to Edgecumbe and Bunnythorpe substations in addition to switchgear for the new generators. Specification was prepared for air-conditioning equipment for the control-room, and alternative designs for the air-circulating arrangements.

Belmont Substation.—The existing 50 kV. lines to Takapuna are to be extended to a new substation at Belmont to provide an additional source of supply to the Waitemata Power Board. The initial equipment for this substation will include two 5,000 kVA. 50/11 kV. transformer banks. A preliminary layout drawing of the substation was prepared, and drawing of proposed transformer banks for tendering purposes. The transformers will be fitted with automatic on-load tap-changing equipment.

Bombay Substation.—Drawings were prepared for tendering purposes for one 10,000 kVA. 110/50 kV. and two 3,000 kVA. 50/11 kV. banks of transformers. The latter, which will replace existing 1,500 kVA. banks, are fitted with automatic, on-load, tap-changing equipment.

Edgecumbe Substation.—An arrangement drawing, as well as a preliminary layout-drawing, was prepared for temporary supply at 50 kV. from the new 110 kV. Arapuni-Edgecumbe transmission line.

Hamilton No. 1 Substation.—Floor and foundation details were prepared for the 11 kV. iron-clad switchgear which is to replace existing switchgear of insufficient rupturing-capacity for present-day requirements.

Hamilton No. 2 Substation.—A drawing was prepared for tendering purposes for a 10,000 kVA. 110/50 kV. bank of transformers.

Henderson Substation.—Extensive alterations and extensions to this substation are involved as a result of the decision to supply it at 110 kV. from two new lines from Penrose. The new equipment will include one 10,000 kVA. bank of 110/50 kV. transformers, terminal switchgear for 110 kV. lines from Penrose, and 110 kV. and 50 kV. switchgear for the transformer bank, together with all necessary steelwork for switchgear and accessories. The outgoing lines to Takapuna and North Auckland respectively will continue to be supplied at 50 kV. from this substation, but provision is being made for extending the 110 kV. lines to North Auckland at a later date. Preliminary layout drawings were prepared for the extended station, and drawings and specifications for the new 110 kV. switchgear and steelwork for tendering purposes.

Preliminary drawings were prepared for the 110/50 kV. transformers, and for a new transformer house for handling them. Foundation drawings were prepared for two new 3,000 kVA. banks of 50/11 kV. transformers and controlling 50 kV. switchgear and steelwork. The new transformers are fitted with automatic on-load tap-changing equipment.

Huntly Substation.—Drawings were prepared for tendering purposes for additional 50 kV. switchgear and steelwork for a second 2,250 kVA. 50/11 kV. transformer bank.

Kaikohe Substation.—Drawings of proposed 50 kV. switchgear and steelwork and a preliminary layout drawing of switchgear and equipment on site were prepared. The initial equipment will include 50 kV. switchgear for incoming line from Maungatapere, outgoing line to Kaitaia, and for 750 kVA. bank of 50/11 kV. transformers.

Kaitaia Substation.—Drawings of proposed 50 kV. switchgear and steelwork and a preliminary layout drawing of switchgear and equipment on site were prepared. The initial equipment will include a 750 kVA. bank of transformers and terminal switchgear for the line from Kaikohe.

Ongarue Substation.—Drawings were prepared showing arrangement of equipment, details of transformer foundations, and terminal structures for lines. The initial equipment includes a 2,250 kVA. 110/11 kV. transformer bank with on-load tap-changing equipment.

Mount Roskill Substation.—A preliminary layout drawing of buildings and outdoor equipment on site was prepared. The initial equipment will include one 30,000 kVA. bank of 110/22 kV. transformers.

Penrose Substation.—Drawings were prepared for tendering purposes for additional 110 kV. switchgear and steelwork to control two 110 kV. lines to Henderson and three additional 110 kV. lines from Arapuni. Layout, foundation, and detail drawings were prepared for the 20,000 kVA. synchronous condenser and associated equipment. A traverser truck was designed for handling the 20,000 kVA. 22/11 kV. transformer bank for the condenser.

Tahekeroa Substation.—Foundation drawings were prepared for a 2,250 kVA. bank of 50/11 kV. transformers.

Takapuna Substation.—Drawings and specifications were prepared for tendering purposes for new 50 kV. switchgear and steelwork to control the two 50 kV. lines from Henderson, two outgoing lines to Belmont, and two 50/11 kV. transformer banks. The existing switchgear and steelwork, which was designed for a terminal station, will be used for Belmont Substation.

General.—Arrangement and foundation drawings were prepared for the boosting transformers and their switchgear cubicles which are being installed at Edgecumbe, Kerepeehi, Mareretu, Matamata, Maugatapere, Ngongotaha, Tahekeroa, Takapuna, Waihou, and Waiotahi. These boosting transformers are fitted with automatic on-load voltage-regulating equipment.

(*c*) *Palmerston North District.*

Mangahao Power-station.—As the load on the Horowhenua feeders is approaching the limit of the capacity of the existing induction voltage regulators these are to be replaced by boosting transformers with automatic on-load voltage-regulating equipment, each of which will have a through capacity of 3,000 kVA. A preliminary layout drawing was prepared for the boosting transformers and associated switchgear.

Waikaremoana Main Development.—In connection with the installation of the third main generating-unit, layout, foundation, and detail drawings were prepared for the generating-unit, machine auxiliaries, 11/110 kV. step-up transformer bank, 11 kV. and 110 kV. switchgear, control panels and cables. Drawings and specifications were prepared for tendering purposes for new 11 kV., 50 kV., and 110 kV. switchgear to provide for 11 kV. and 110 kV. lines to Lower Development and a 110/50 kV. transformer bank with provision for adding switchgear for future lines and generating-units at a later date. No. 3 generating-unit has a rated capacity of 20,000 kW. at 0·9 power factor.

Waikaremoana Lower Development.—This power-station, which will contain two generating-units each rated 20,000 kW. at 0·9 power factor, is being arranged for supervisory control from the Main Development. To simplify the control arrangements each main unit will have its own auxiliary generating unit which will supply power for operating essential auxiliaries and also excitation for the main unit. Each unit will have its own bank of 11/110 kV. transformers and its own 110 kV. transmission-line to the Main Development, where it will be synchronized manually with the general system. Power for the staff village, lighting, and station services other than essential machine auxiliaries will be supplied by a service transformer from an 11 kV. line from the main development. Drawings and specifications for tendering purposes were prepared for main and auxiliary generating-units, switchgear and supervisory control equipment, main transformers, 110 kV. switchgear, water rheostat, control gear and switchgear, 80-ton crane, steel windows, and motor-operated roller-shutter doors, and oil-handling equipment and storage-tanks. The major part of the detail design work for the power-station building other than machine foundations was carried out.

Bunnythorpe Substation.—A drawing was prepared for tendering purposes for two 7,500 kVA. banks of 110/11 kV. transformers with on-load voltage-regulating equipment to replace the present 4,500 kVA. banks.

Khandallah Substation.—Layout and foundation drawings were prepared for the 20,000 kVA. bank of 110/11 kV. transformers, and the 110 kV. switchgear and steelwork to control this bank and the incoming transmission-line from Masterton. A layout drawing was prepared for the control and relay panels for the 110 kV. switchgear.

Gisborne Substation.—A drawing was prepared for tendering purposes for a 7,500 kVA. bank of 50/11 kV. transformers with on-load voltage-regulating equipment. A design was prepared for alterations to the traverser truck to increase its carrying-capacity to the loading of the larger transformer.

Marton Substation.—The capacity of this substation is to be increased to 4,500 kVA. by the transfer of an existing bank of that capacity at Bunnythorpe and the present temporary wood-pole structure for the 110 kV. switchgear is to be replaced by a steel structure with line-sectionalizing switchgear in addition to switchgear for the transformer bank. Drawings and specifications were prepared for tendering purposes for 110 kV. switchgear and steelwork, and a traverser truck for handling the transformers was designed.

Mangamaire Substation.—Drawings and specifications were prepared for tendering purposes for 110 kV. switchgear, and steelwork for a second 1,500 kVA. three-phase transformer.

Masterton Substation.—Foundation drawings were prepared for 110 kV. switchgear and steelwork for controlling the new Masterton-Melling transmission-line.

New Plymouth Substation.—A drawing was prepared for tendering purposes for a 7,500 kVA. bank of 50/11 kV. transformers to be fitted with on-load voltage-regulating equipment. It is proposed to run duplicate 11 kV. cables from this bank to the New Plymouth Borough Council switchgear with quick changeover arrangements to facilitate restoration of supply in the event of a cable breakdown. Drawings and specifications were prepared for a reinforced-concrete transformer-house to handle the transformers and for a 25-ton one-motor electric crane with which the transformer-house will be equipped.

Stratford Substation.—To provide for extensions of supply from this substation additional outdoor switchgear is being installed to control a second bank of 110/50 kV. transformers of 10,000 kVA. capacity, two 50 kV. lines and a 5,000 kVA. bank of 50/33 kV. transformers. One 50 kV. line will replace the present temporary switching-arrangements for the New Plymouth line, and another is for the new 50 kV. line to Opunake. Drawings were prepared for tendering purposes for the 10,000 kVA. transformer bank and control panels for the outdoor switchgear, and drawings and specifications for the outdoor switchgear.

Kotemaori and Ruakituri Patrol Stations.—Detail drawings and specifications were prepared for tendering purposes for cottages, wagon-garages, and stables.

Akatarawa Linemen's Depot.—Detail drawings and specifications were prepared for cottages, single men's quarters, and garages.

Woodville Switching-station.—A proposed arrangement drawing was prepared for a 110/11 kV. three-phase step-down transformer to give supply to the Dannevirke Power Board at this station. Drawings and specifications were prepared for tendering purposes for a reinforced-concrete switchroom building.

(*d*) *Christchurch District.*

Lake Coleridge Power Station.—To meet future operating requirements the 66 kV. switchgear is to be replaced by new equipment of greater rupturing-capacity. The three large generating-units will each be permanently connected to a bank of 6·6/66 kV. step-up transformers and the smaller generating units will be connected in two groups to two other banks of transformers. Except for paralleling small machines within a group, all switching and synchronizing will be carried out at 66 kV., thus obviating the necessity for high-rupturing duty 6·6 kV. switchgear. The whole of the new switchgear and the step-up transformers will be out of doors, thereby freeing considerable space indoors for maintenance-work and storage. Drawings and specifications were prepared for tendering purposes for the new switchgear and steelwork.

Highbank Power-station.—This power-station, which will utilize surplus water from the Rangitata Irrigation Scheme, will include one main generating unit of 25,200 kW. capacity at 0·9 P.F. auxiliary generating-unit to supply machine auxiliaries and excitation and 28,000 kVA. bank of 11/66 kV. transformers. The village and station services other than machine auxiliaries will be supplied from a 66,000/400 V. service-transformer bank. The generating-unit will have the highest output of any installed in the Dominion to date. Initially the station will be arranged for attended operation, but provision is being made for supervisory control from Hororata at a later date. Drawings and specifications were prepared for tendering purposes for main and auxiliary generating-units, 66 kV. switchgear, low-voltage switchgear and control equipment, main and service transformer banks, water rheostat and control equipment, 90-ton crane, and oil storage and handling equipment.

Waitaki Power-station.—In connection with the installation of Nos. 3 and 4 generating-units, drawings and specifications were prepared for power and control cables, cable-boxes, outdoor distribution boxes, and control gear for headgates. Foundation drawings were prepared for 110 kV. outdoor switchgear and steelwork.

Otira Substation.—Drawings and specifications were prepared for tendering purposes for staff cottages and garages and two-stall departmental garage.

Drawings and specifications were prepared for a reinforced-concrete switchroom building.

A special traverser truck with N.Z.R. standard buffer and coupling gear was designed for hauling the transformers with a locomotive.

(*e*) *Invercargill District.*

Invercargill Substation.—Drawings and specifications were prepared for new 11 kV. switchgear to replace existing gear of insufficient rupturing capacity for future requirements. A drawing was prepared for tendering purposes for a new 4,500 kVA. bank of 66/11 kV. transformers.

Dacre Substation.—Arrangement drawings were prepared of equipment for this substation which will supply the broadcasting station.

(*f*) *General.*

Drawings and specifications were prepared for rectifier chargers of the copper-oxide type for Blackwater, Culverden, Marton, Otira, Ohai, Smith's Road, Southbrook, Waipara, Wanganui, and Arnold Substations.

Inspection of the completed chargers which are of local manufacture was carried out.

Inspection of locally-made equipment, including distribution transformers, outdoor switchgear and metering cubicles, 230/32-volt transformers, and electric refrigerators was carried out as required.

Concrete-pole Factory, Winton.—Detail drawings and specifications were prepared for pole-factory building and equipment. Further tests were carried out on sample concrete poles.

Specifications were prepared, and design work for electrical equipment carried out as required, for Mechanical Branch and other Departments. A major item under this heading was design work for electrical installations for aerodromes.

Registration certificates were prepared, and draughting work carried out as required, for the Wiremen's Registration Board.

The plotting of operating data for the various systems, including lake-level and river-flow data, maximum loads, and weekly output for generating-stations, maximum demands and consumption of energy for Local Supply Authorities, and other major consumers was continued throughout the year.

Transmission-lines.

Work done includes details of structures, sag and tension charts, strength charts for structures, assembly drawings, details of special foundations for steel towers, hardware details, &c.

Other work dealt with was in connection with the deviation of the 11 kV. line through the Ngahauranga Gorge, also various technical matters pertaining to power-lines generally.

B. Hydraulic Section.

Project work: North Island.

Investigation of the whole resources of the Waikato River was completed and a comparison made of different modes of development; whether development should follow the course of the river or whether a tunnel should be used to divert the water of Lake Taupo from the North West corner of the lake due north to the junction of the Mangakino with the Waikato river.

A study of the conditions favoured development round by the river. In consequence a number of sites have been selected for development and a contract has been entered into to bore and determine the suitability of the rock foundations at three sites between Arapuni and Orakei Korako.

Tests by means of bores and shafts have been made at Karapiro, a few miles above Cambridge on the Waikato River, and it is expected that these will soon be far enough advanced to allow proposals to be prepared for a plant to develop 75,000 kW. to 80,000 kW. This development will submerge and absorb Horahora.

In connection with the further development of Arapuni to its designed capacity it has been necessary to consider some measure of control of the flow from Lake Taupo in order that flood-water, which would normally flow to waste during the summer months, may be saved to assist in meeting the winter peak load.

Proposals were prepared for control gates near Lake Taupo and for deepening the river for about three miles from the lake.

Project Work: South Island.

Exploratory excavations have been carried out at Lake Tekapo to determine the suitability of the ground for works there. A shaft was sunk near the lake, and a heading from the surge chamber site was driven. These show that the country is quite suitable for a tunnel and power-station, the first works to be constructed.

Tests to determine the best location for the control dam, which will be built later, are not yet complete.

Ten-year Plan.

In view of the continued rapid increase in the demand for power, a schedule for the future, to include all works which should be completed or commenced during the next ten years, was prepared for both Islands.

Hydraulic and Civil Engineering Design.

Hydraulic and Civil Engineering design includes:—

Arapuni. Further penstocks and other works in connection with the completion of the power-station. Removal or reduction of the sand-bar to increase the capacity of the tail-race.

Waikaremoana Lower Development.—Most of the design work for this development is complete, the balance will be completed as essential data become available.

Highbank.—This station has been located and the principal features worked out. Details of the headworks have yet to be designed.

Tekapo. Proposals are being prepared for the tunnel and power scheme, those for the dam will be undertaken later.

Arnold River.—The surge-chamber at Arnold River was redesigned and other works carried out to improve the efficiency of the plant. In consequence, a substantial increase in power has been obtained. This will be further increased when the crest gates on the dam, raising headwater by up to 10 ft. are in operation.

Monowai.—Arrangements have been made to shut this plant down in the spring for inspection and overhaul, and especially for some strengthening and sealing work in the base of the surge-tower.

Waitaki.—Additional gates and screens are being obtained for the two new units to be delivered this year, and for the fifth and last unit to be procured a few years later.

Hydrology.

As usual, records of river-flow have been kept and recorded. The past year has generally been one of low run-offs; notably in the case of Lake Taupo, which fell to 0·8 ft., the lowest recording since 1915. The shortage of water has been mainly responsible for the large amount of power that has been obtained from fuel-stations in the North Island.

STATISTICAL TABLES.

The statistical tables relating to all electric-supply authorities in the Dominion, which tables have hitherto been incorporated in this publication, are to be issued as an appendix to the reprint of the Chief Electrical Engineers' annual report.

ELECTRIC-POWER BOARDS.

There are now forty-five electric-power districts constituted, and forty-one Electric-power Boards (including Westland Power, Ltd., operating under delegated license) are actually carrying out the distribution and sale of electrical energy (August, 1939). The total area covered is 71,816 square miles, or 69·4 per cent. of the total area of the Dominion (103,415 square miles); the total population concerned is 973,900, or 59·95* per cent. of the total population (1,624,714) of the Dominion; and the unimproved value of the land included in the electric-power districts and outer areas is £229,272,138 or 79·8 per cent. of the total unimproved value of the Dominion (£287,844,804).

So far only one of the four main cities—viz., Auckland—has been included in the inner area of an electric-power district, but of the secondary centres the cities of Wanganui and Palmerston North, and the boroughs of Timaru, Napier, Hastings, Blenheim, Greymouth, Gisborne, and Oamaru are included. The advantage of Power Board organization is more obvious to rural than to urban ratepayers, and yet the above position indicates that some of the more important centres have realized that it is to their advantage generally to be associated with the country in undertaking the work of reticulation of electric power on a comprehensive scale.

* The lower percentage as shown this year compared with that of previous years is accounted for by the fact that the assistance of the Government Statistician has been invoked to supply accurate population figures from the latest census returns as a check against those hitherto scheduled as being correct.

The total amount of the loans authorized by the forty-one districts (including Bay of Islands not yet in active operation) which have taken polls is £14,162,202. The population of the districts concerned is 911,700 (including the population of separately licensed boroughs forming part of the electric-power district and represented on the power board), so that the loans authorized amount to £15·54 per head of population, as compared with £13·74 last year. The unimproved valuation of the districts is £210,215,311, the loans authorized amounting to 6·74 per cent. of the unimproved rateable value of the lands pledged as security for the loans. The aggregate voting at the polls totalled 76,957 for and 13,942 against the respective loan proposals.

The total capital outlay by the forty Boards which are in operation is £14,328,671, practically all of which is on works in service. The gross revenue from the sale of electricity by these Boards was £2,846,053. The general result is a profit over the whole business of the Power Boards of £206,880 for appropriation to reserve funds, &c., after paying working-expenses and capital charges for interest, sinking fund, and depreciation.

During the last year four of the Boards struck a general rate, which was collected in two cases, and the following table gives details of the rates levied and collected:—

RATES COLLECTED BY ELECTRIC-POWER BOARDS FOR YEAR ENDED 31ST MARCH, 1939.

Name of Board.	General Rate.		Availability Rate.		Special Rates.		Total Amount collected.
	Levied.	Collected.	Levied.	Collected.	Levied.	Collected.	
	d.	£		£	d.	£	£
Banks Peninsula ..	0·02 and 0·16	2,284*	..	..	..	..	2,284*
Malvern	$\frac{7}{32}$	1,877*	..	..	..	..	1,877*
Marlborough ..	..	..	..	82*	..	..	82*
Manawatu-Oroua ..	..	9*	..	..	..	..	9*
Otago	..	76*	..	..	..	..	76*
Taranaki	..	..	..	26*	..	..	26*
Waimea	$\frac{1}{15}$	10*	..	..	..	..	10*
Wairere	$\frac{1}{4}$ and $\frac{7}{16}$	20*	..	..	..	..	20*
Wairoa	..	135*	..	..	..	..	135*
Totals, 1939 ..	..	4,411	..	108	..	..	4,519
„ 1938 ..	..	5,935	..	153	..	..	6,088

* Includes arrears for previous years.

LOCAL ELECTRIC-SUPPLY SYSTEMS.

Including the eight Government plants, there are now (31st March, 1939) thirty-nine public electric-power stations operating in the Dominion with forty-eight classified as standby stations.

Ninety-one local electric-supply authorities are directly engaged in the retail sale of electricity, and the following table shows the proportion using Government-generated power:—

Class of Local Authority controlling Electric-supply System.	Using Government Supply (65).			Using Non-Government Supply (26).
	Wholly.	Partial.	Total.	
Power Board	30 (*a*) §	3 (*b*) (*d*) §	33	7 (*c*) §
City Council operating own reticulation ..	3 (*e*)	2 (*f*)	5	1 (*g*)
Borough Council operating own reticulation	15 (*h*)	5 (*i*)	20	8 (*j*)
County Council operating own reticulation	2 (*k*)	..	2	3 (*l*)
Town Board operating own reticulation ..	2 (*m*)	1 (*n*)	3	..
Company	..	..	..	5 (*o*)
Private	..	..	..	2 (*p*)
Tourist Department (Rotorua)	1	..	1	..
Public Works Department, Southland ..	1 (*q*)	..	1	..
	54	11	65	26
			91	

For notes, see next page.

§ Included in these respective areas are the following cities, boroughs, and town districts :—

(*a*) Taking whole Supply from Government.					(*b*) Taking partial Supply from Government.		(*c*) Using Non-Government Supply.	
Cities (2).	Boroughs (65).		Town Districts (39).		Boroughs (8).	Town Districts (3).	Boroughs (6).	Town Districts (2).
Auckland.	Akaroa.	Ngaruawahia.	Bulls.	Te Karaka.	Balclutha.	Manaia.	Alexandra.	Tahunanui.
Wanganui.	Ashburton.	Northcote.	Ellerslie.	Te Kauwhata.	Eltham.	Normanby.	Blenheim.	Takaka.
	Birkenhead.	Oamaru.	Glen Eden.	Tinwald.	Hawera.	Clinton.	Cromwell.	
	Brunner.	Onehunga	Havelock North.	Tuakau.	Kaitangata.		Motueka.	
	Cambridge.	One Tree Hill.	Helensville.	Turua.	Lawrence.		Richmond.	
	Carterton.	Opotiki.	Henderson.	Waiuku.	Milton.		Roxburgh.	
	Dannevirke.	Opunake.	Hikurangi.	Warkworth.	Palmerston South.			
	Dargaville.	Otahuhu.	Howick.	Waverley.				
	Devonport.	Otaki.	Hunterville.		Waikouaiti.			
	Eastbourne.	Pacroa.	Johnsonville.					
	Eketahuna.	Pahiatua.	Kamo.					
	Featherston.	Petone.	Kihikihi.					
	Feilding.	Pukekohe.	Leamington.					
	Foxton.	Runanga.	Leeston.					
	Geraldine.	Shannon.	Mangaweka.					
	Gisborne.	Takapuna.	Manunui.					
	Greymouth.	Taumarunui.	Manurewa.					
	Greytown	Te Awamutu.	Mercer.					
	Hampden.	Te Aroha.	Ohaupo.					
	Hastings.	Te Kuiti.	Onerahi.					
	Huntly.	Temuka.	Ormondville.					
	Levin.	Thames.	Otorohanga.					
	Lower Hutt.	Timaru.	Papakura.					
	Martinborough.	Upper Hutt.	Papatoetoe.					
	Marton.	Waihi.	Patutahi.					
	Masterton.	Waimate.	Pleasant Point.					
	Matamata.	Waipawa.	Putaruru.					
	Morrinsville.	Waipukurau.	Raglan.					
	Mt. Albert.	Wairoa.	Rongotea.					
	Mt. Eden.	Whakatane.	Southbridge.					
	Napier.	Woodville.	Taradale.					
	New Lynn.							
	Newmarket.							
	New Plymouth							

See Table on page 98.

(*d*) South Taranaki, Taranaki, and Otago (through Public Works Department and also Dunedin City Corporation).
(*e*) Palmerston North, Christchurch (including New Brighton Borough), Invercargill.
(*f*) Wellington, Dunedin (including St. Kilda, Port Chalmers, West Harbour, Green Island, and Mosgiel Boroughs and Outram Town District).
(*g*) Nelson.
(*h*) Bluff, Hamilton, Kaiapoi, Lyttelton, Napier¶, New Plymouth¶, Rangiora, Riccarton, Sumner, Taumarunui¶, Te Aroha¶, Thames¶, Timaru¶, Wairoa¶, Whakatane¶.
(*i*) Waitara, Inglewood, Stratford, Patea, Taihape.
(*j*) Ohakune, Picton, Queenstown, Raetihi, Tauranga, Te Puke, Westport, Whangarei.
(*k*) Heathcote, Waimairi.
(*l*) Kaikoura, Murchison, Uawa.
(*m*) Mangaweka, Manunui.
(*n*) Kaponga (through Taranaki Power Board).
(*o*) Included boroughs (Hokitika, Kumara, Whangarei).
(*p*) Rawene, Kohukohu.
(*q*) Includes seven boroughs (Bluff (also scheduled under (*h*)), Gore, Mataura, Riverton, South Invercargill, Tapanui, Winton), and five town districts (Edendale, Lumsden, Nightcaps, Otautau, Wyndham).

¶ Also scheduled under (*a*).

Summary of Numbers of Cities, Boroughs, and Town Districts.

	North Island.			South Island.		
	Cities.	Boroughs.	Town Districts.	Cities.	Boroughs.	Town Districts.
Number	4	68	48	4	49	14
Electricity available in	4	68	42	4	46	14
Government supply available in	4	62	37	3	35	10
Taking whole supply from Government ..	3*	56	35	2	23	9

* Wellington City takes practically the whole of its supply, although listed as "partial supply."

Public electric supply is not yet available in the following boroughs and town districts (Kohukohu Town District has partial private supply): —

Boroughs.	*Town Districts.*	
Arrowtown (South Island).	Clinton (South Island).*	Kawhia (North Island).†
Naseby (South Island).	Kaikohe (North Island).‡	Kohukohu (North Island).
Ross (South Island).	Kaitaia (North Island).‡	Ohura (North Island).
	Kawakawa (North Island).‡	Russell (North Island).‡

* To be reticulated for electric supply from Otago Power Board. † To be reticulated for electric supply from Te Awamutu Power Board. ‡ To be reticulated for electric supply from Bay of Islands Power Board.

During the year Wilson's (N.Z.) Portland Cement Co. placed an order for an additional 1,000 kW. 2,200-volt generator for its hydro station at Wairua Falls. The unit will bring the installed capacity up to 3,000 kW.

Murchison County Council and Kaikoura County Council each supplemented their respective generating-capacities by the installation of a Diesel unit rated at 150 b.h.p (100 kVA.).

The hydro-electric generating-stations operated by Taumarunui Borough Council and Whakatane Borough Council have been shut down and in each case bulk supply is now being obtained from the Government system.

The Diesel generating-set of the Ashburton Electric-power Board went out of commission in May, 1938, due to a broken crank-shaft, and is not likely to be reinstated.

The total installed capacity (excluding standby plant) is at present 279,926 kW.

The proportion of installed plant as at 31st March, 1939, is as follows: —

	Stations.	Kilowatts.	Proportion per Cent.
Water-power (excluding 15 standby installations)	34	278,841	99·64
Steam-power (excluding standby plants at Portland (3,190 kW.), Auckland (41,460 kW.), Wanganui (500 kW.), Wellington (24,000 kW.), Invercargill (1,000 kW.), Waihi,* Huntly (1,500 kW.), Dunedin (1,875 kW.), Christchurch (1,500 kW.), Nelson (500 kW.), Hokitika (625 kW.): totalling 76,150 kW., 10 stations)	1	750	0·27
Gas-power (excluding standby plants at Palmerston North (816 kW.), Westport (210 kW.), Kaikoura (37 kW.), Taihape (75 kW.): totalling 1,138 kW., 4 stations)	0	..	..
Oil-power (excluding standby plants at Penrose (3,750 kW.), Dobson (5,760 kW.), Palmerston North (2,000 kW.), Dunedin (860 kW.), Blenheim (1,356 kW.), Hastings (1,087 kW.), Gisborne (980 kW.), Napier (400 kW.), Thames (262 kW.), Opunake (148 kW.), Ohakune (113 kW.), Hawera (485 kW.), Oamaru (192 kW.), New Plymouth (350 kW.), Hokitika (Kanieri) (150 kW.), Hokitika (200 kW.), Motueka (110 kW.), Patea (64 kW.), Reefton (60 kW.), Queenstown (128 kW.), Murchison (80 kW.), Kohukohu (9 kW.): totalling 18,544 kW., 22 stations)	5	335	0·12
Totals	39	279,926	100·00

* 1,640 kW. plant partially dismantled at present.

The number of consumers supplied has increased from 388,580 to 407,316, an increase of 18,736, or 4·83 per cent. for the year.

The total population included in the various electric-supply areas is 1,490,790, or 91·75* 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 now exceeds the allocation of 0·15 kW., or 0·2 horse-power, per head of population, the original basis of the design of the Government schemes.

The units sold per head of population supplied were 744, as compared with 659 last year.

The total length of transmission and distribution line in service is 25,982 route-miles, as compared with 24,407 last year, an increase of 1,575 miles, or 6·46 per cent. This fact would seem to indicate that there is a steady demand for the extension of electric lines to meet the requirements of the rural areas. The number of consumers per route-mile is 15·67, as compared with 15·92 last year.

* The lower percentage as shown this year compared with that of previous years is accounted for by the fact that the assistance of the Government Statistician has been invoked to supply accurate population figures from the latest census returns as a check against those hitherto scheduled as being correct.

The sales per route-mile of line were 42,700 units, and the gross revenue £242*. The units are greater than last year (40,100), and there is an increase in revenue as against £233 last year, due to a general reduction in selling-rates and to load-building campaigns. This increase can also be attributed to a decided improvement in the economic conditions which have prevailed during the past three years, and an examination of the table under "Growth of Load" reveals interesting figures in connection with "Electric Cooking and Electric Water-heating" for the 1925–39 period.

Out of the ninety-one distributing authorities (including Public Works Department, North Island and South Island systems, and excluding Ross Borough), eighty-one showed a profit for the year amounting to £1,139,681, and ten showed a loss amounting to £12,745. The gross revenue (including bulk sales, but excluding rates) was £6,296,336, and the general result is a profit for the whole Dominion of £1,126,936 after paying working-costs (£3,232,977) and capital (interest, sinking fund, and depreciation exchange, &c.) charges (£1,936,413) at the rate of 5·18 per cent. on the total capital outlay of £37,367,664. This shows a net profit of 3·02 per cent., as compared with 2·47 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 91·7 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. It should be noted that the method of compilation and computation adopted for the following table is slightly different to that of years previous to 1933:

		Water.	Steam.	Gas.	Oil.	Total.
1. Number of main stations	No.	34(*a*)	1(*b*)	..	6(*c*)	41
2. Installed capacity (main plant)	kW.	278,841	750	..	335	279,926
3. Number of standby plants	No.	15(*d*)	10(*e*)	4(*f*)	22(*g*)	51
4. Installed capacity (standby plant)	kW.	3,684	76,150	1,138	18,544	99,516
5. Number of consumers	No.	403,033	3,428	..	855	407,316
6. Connected load	kW.	1,892,730	11,060	..	1,177	1,904,967
7. Units generated	No.	1,387,664,766	17,490,728	206,709	10,787,220	1,416,149,423
8. Units sold to consumers	No.			1,108,836,138		
9. Percentage of non-productive units	%			21·70		
10. Total operative capital (including distributing systems and standby plant)	£			37,367,664		
11. Total capital per kilowatt installed (including distributing systems, &c.)	£			98·45		
12. Annual working-costs	£			1,593,677†		
13. Annual working-cost per unit under section 8	d.			0·345		
14. Annual capital costs (interest, sinking fund, and depreciation)	£			1,936,413		
15. Annual capital cost per unit under section 8	d.			0·420		
16. Annual capital costs as percentage of capital	%			5·18		
17. Total annual costs (section 12 plus section 14)	£			3,530,090		
18. Total annual cost per unit under section 8	d.			0·765		
19. Total annual revenue (from retail sale of electricity)	£			4,536,461		
20. Average revenue per unit (from sections 19 and 8)	d.			0·982		
21. Gross revenue (excluding rates and bulk sales)	£			4,656,299		
22. Net profit (section 21 less section 17)	£			1,126,209		
23. Ratio working-costs to gross revenue (section 12 and section 21)	%			34·22		

* This figure is distinct from that of £238, which is compiled on revenue from sale of electricity only. † After deducting cost of power purchased in bulk.

NOTES:—

MAIN STATIONS.

(*a*) Hydro-electric: Arapuni, Horahora, Mangahao, Waikaremoana, Coleridge, Waitaki, Monowai, Arnold River, Golden Bay, Marlborough, Opunake, Otago Central, Tararuki, Teviot, Waimea (2), Waitekc, Kouarau, Dunedin, New Plymouth, Queenstown, Raetihi, Ross, Taihape, Tauranga (2), Westport, Kaponga, Murchison, Kerikeri, Kanieri, Reefton, Waicua Falls, Westland Power, Ltd. Total, 34.
(*b*) Steam: Nelson. Total, 1
(*c*) Oil: Picton, Kaikoura, Oawa, Rawene, Kohukohu, Reefton. Total, 6.

STANDBY PLANT.

(*d*) Hydro-electric: Akaroa, Fairlie, Hawera, Havelock North, New Plymouth, Oamaru, Ohakune, Patea, Picton, Raetihi, Rotorua, Taumarunui, Te Aroha, Thames Whakatane. Total, 16.
(*e*) Steam: Huntly, Auckland, Wanganui, Christchurch, Dunedin, Invercargill, Nelson, Wellington, Portland, Westland Power, Ltd. Total, 10.
(*f*) Gas: Palmerston North, Taihape, Westport, Kaikoura. Total, 4.
(*g*) Oil: Penrose, Dobson, Hastings, Blenheim, Opunake, Gisborne, Hawera, Kohukohu, Motueka, Murchison, Oamaru, Dunedin, Palmerston North, Napier, New Plymouth, Ohakune, Patea, Thames, Kanieri, Reefton, Westland Power, Ltd., Queenstown. Total, 22.

BROKEN WIRES AND POLES.

There were 1,517 broken wires reported by electric-supply authorities, with 126,097 miles of conductor erected. The corresponding figures for the previous year were 1,386 broken wires and 119,432 miles of conductor in use.

Trees were again the principal cause of the breaks, and accounted for 27 per cent. of the total, as against 29·4 per cent. for 1938.

The following table has been prepared to show the various factors which have been reported as responsible for broken wires during the past six years :—

Causes of Breakages of Wires.

Note.—Percentages less than 1 per cent. of total are not shown.

Reported Causes.	Total for Six Years.	1934.		1935.		1936.		1937.		1938.		1939.	
		Number.	Per centage of Total.	Number.	Per centage of Total.	Number.	Per centage of Total.	Number.	Per centage of Total.	Number.	Per centage of Total.	Number.	Per centage of Total.
Trees	2,949	262	27	319	27	1,341	47	370	28	255	29	402	27
Wires contacting	1,585	172	18	206	17	361	13	367	28	188	22	291	19
Gales	723	110	11	108	9	171	6	105	8	51	6	178	12
Binder-failure	794	128	13	154	13	163	6	105	8	79	9	165	11
Insulator-failure	223	13	1	4	..	13	..	52	4	40	5	101	7
Poles broken	266	39	4	34	3	89	3	36	3	19	2	49	3
Poles hit by vehicles	232	39	4	39	3	40	1	48	4	32	4	34	2
Corrosion	97	15	2	11	..	5	..	15	1	11	1	40	3
Short circuit	47	..	..	..	..	..	..	1	..	13	2	33	2
Roofing-iron	139	4	..	..	..	90	3	12	..	8	..	25	2
Birds	92	9	1	13	1	11	..	18	1	20	2	21	1
Joint failure	140	12	1	30	2	22	..	29	2	28	3	19	1
Overstress	50	..	..	4	..	12	..	16	1	4	..	14	..
Snow	479	..	..	111	9	348	12	5	..	2	..	13	..
Span-breaks	13	..	..	..	..	..	..	..	..	..	..	13	..
Vibration	126	1	..	30	3	44	2	22	2	17	2	12	..
Blasting	31	1	..	7	..	6	..	2	..	7	..	8	..
Lightning	35	2	..	7	..	11	..	7	..	2	..	6	..
Contacting earth-guard	28	6	..	3	..	7	..	2	..	5	..	5	..
Opossums	9	1	..	..	..	1	..	1	..	1	..	5	..
Bad workmanship	85	25	3	19	2	17	..	6	..	10	1	8	..
Jumper-failure	18	1	..	4	..	2	..	6	..	1	..	4	..
Haystacker	41	9	1	10	..	5	..	5	..	5	..	7	..
Radio-mast	39	5	..	12	1	12	..	4	..	2	..	4	..
Football	4	..	..	..	..	1	..	..	..	..	..	3	..
Threshing-mill	10	2	..	1	..	1	..	3	..	..	..	3	..
Crane	9	..	..	2	..	..	..	1	..	3	..	3	..
Kite	8	..	..	3	..	1	..	..	..	2	..	2	..
Falling pole	3	1	..	..	..	..	..	..	..	..	..	2	..
Loaded lorry	5	..	..	2	..	1	..	..	..	..	..	2	..
Wire over line	13	7	..	3	..	1	..	..	..	..	..	2	..
Falling chimney	2	..	..	..	..	1	..	..	..	..	..	1	..
Ladder	1	..	..	..	..	..	..	..	..	..	..	1	..
Scrub fire	27	1	..	4	..	2	..	3	..	14	2	3	..
House fire	32	15	2	..	..	2	..	13	1	1	..	1	..
Flood	7	..	..	2	..	3	..	..	..	..	..	2	..
Rifle-shot	7	..	..	..	..	..	..	..	..	6	..	1	..
Landslip	7	..	..	4	..	1	..	1	..	..	..	1	..
Aeroplane	5	2	..	..	..	1	..	1	..	..	..	1	..
Ship's mast	6	..	..	..	..	2	..	1	..	3	..	..	..
Cut by slasher	11	2	..	2	..	2	..	4	..	1	..	..	..
Earthquake	26	26	3	..	..	..	..	..	..	..	..	..	..
Tram-trolley pole	14	1	..	3	..	..	..	7	..	3	..	..	..
Failure under-ground cable	4	2	..	2	..	..	..	..	..	..	..	..	..
Excessive sag	1	1	..	..	..	..	..	..	..	..	..	..	..
Straw blown on line	1	1	..	..	..	..	..	..	..	..	..	..	..
Contact with roof	6	2	..	1	..	..	..	3	..	..	..	..	..
Frost	17	11	1	..	..	1	..	1	..	4	..	..	..
Broken by workmen	2	1	..	1	..	..	..	..	..	..	..	..	..
Cross-arm burnt or broken	4	4	..	..	..	..	..	..	..	..	..	..	..
Contact with stay wire	8	1	..	3	..	1	..	3	..	..	..	..	..
Animals rubbing poles	3	2	..	..	..	1	..	..	..	..	..	..	..
Fouled by excavator	1	1	..	..	..	..	..	..	..	..	..	..	..
Sea erosion	2	1	..	..	..	1	..	..	..	..	..	..	..
Contact with pole	9	..	..	3	..	2	..	4	..	..	..	..	..
Contact with P. and T. lines	12	..	..	1	..	10	..	1	..	..	..	..	..
Contact with P.W.D. lines	6	..	..	..	..	3	..	3	..	..	..	..	..
Fouled by building material	15	4	..	1	..	8	..	2	..	..	..	..	..
Storm damage to buildings	26	..	..	..	..	19	..	7	..	..	..	..	..
Unknown	179	31	3	37	3	17	..	33	2	29	3	32	2
Totals	..	973	..	1,200	..	2,853	..	1,325	..	866	..	1,517	..

Total breakages reported for six years = 8,734, of which trees were responsible for 33·75 per cent.

The 60 "causes" assigned by reporting authorities as scheduled above are many and varied. It is quite possible that different reporting authorities have different ways of expressing the same thing, as, for instance, "wires contacting" may be synonymous with "short circuit," or, to take another instance, "span breaks" with "overstress" or "joint failure." It is hoped that the publication of this table will be of some interest to supply authority engineers in general.

As regards broken poles, 406 instances were reported for the year, of which 239, or 58·8 per cent., were New Zealand blue-gum.

For 1938 the total number of broken poles reported was 323, and it is still evident that electric-supply authorities who experimented with New Zealand blue-gum and nondescript Australian hardwoods during the past decade are now being called upon to make replacements sooner than the anticipated life of fifteen years for poles used on distribution lines.

ACTUAL MILEAGES AND SIZES OF OVERHEAD CONDUCTORS IN USE AT 31ST MARCH, 1939.

Size of Conductors (S.W.G.).	Copper.		Aluminium.		Galvanized Steel.		Galvanized Iron.		Copperweld.		Steel-cored Aluminium.		Bronze.		Total Breakages.
	Miles.	Breakages.	Miles.	Breakages.	Miles.	Breakages.	Miles.	Breakages.	Miles.	Breakages.	Miles.	Breakages.	Miles.	Breakages.	
7/22 ..	12	3	..	..	..	..	..	..	..	..	..	..	..	..	3
7/20 ..	6,786	309	..	..	..	..	..	..	..	..	..	..	..	..	309
7/18 ..	14,264	633	..	..	..	..	..	..	..	..	..	..	..	..	633
7/17 ..	3,296	37	..	..	..	..	..	..	..	..	..	..	..	..	37
7/16 ..	26,458	266	49	..	301	3	103	..	8	..	177	..	..	..	269
7/15 ..	110	4	..	..	..	..	..	..	..	..	259	..	..	..	4
7/14 ..	13,470	74	24	8	19	..	7	..	..	..	1,087	..	..	..	82
7/13 ..	1,210	1	..	..	3	..	4	..	..	..	163	..	..	..	1
7/12 ..	645	..	152	1	11	..	..	..	18	..	30	..	..	..	1
7/11 ..	4	..	..	..	..	..	..	..	..	..	73	..	..	..	..
7/10 ..	66	..	37	..	..	..	..	..	..	..	51	..	..	..	..
7/9 ..	640	..	3	..	5	..	..	..	..	..	..	..	..	..	..
7/8 ..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..
19/18 ..	407	14	..	..	..	..	..	..	..	..	..	..	..	..	14
19/17 ..	692	7	..	..	..	..	..	..	..	..	..	..	..	..	7
19/16 ..	1,849	10	..	..	..	..	..	..	..	..	..	..	..	..	10
19/15 ..	201	2	..	..	..	..	..	..	..	..	..	..	..	..	2
19/14 ..	726	3	..	..	..	..	..	..	..	..	..	..	..	..	3
19/13 ..	3,110	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19/12 ..	832	..	..	..	2	..	..	..	..	..	..	..	..	..	..
19/10 ..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
37/16 ..	67	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/15 ..	403	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/14 ..	120	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/13 ..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37/12 ..	77	..	..	..	..	..	..	..	..	..	227	..	..	..	..
66/13 ..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	2,403	119	..	..	2	..	86	..	12	..	..	..	..	..	119
11	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	9,399	403	..	2	112	1	222	..	423	12	..	..	30	..	418
8	13,773	190	..	..	5,482	43	5,326	58	733	2	..	..	..	..	283
7	759	12	..	..	..	..	290	..	92	..	..	..	..	..	12
6	288	3	..	..	127	..	147	..	165	7	..	..	..	..	10
5	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..
4	593	..	..	..	..	..	..	..	79	..	2	..	..	..	..
2	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..
0	74	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2/0 ..	..	..	10	3	..	..	..	..	..	..	59	..	..	..	3
3/0 ..	4	..	..	..	..	..	..	..	..	..	399	..	..	..	..
3/12 ..	155	1	14	..	9	..	..	..	..	..	..	..	..	..	1
3/11 ..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..
3/10 ..	27	..	3	..	..	..	..	..	..	..	..	..	..	..	..
3/9 ..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..
3/8 ..	..	..	4	1	..	..	..	..	..	..	..	..	..	..	1
4/16 ..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4/14 ..	..	..	..	..	253	1	..	..	..	..	..	..	..	..	1
5/14 ..	..	..	..	..	210	1	..	..	..	..	..	..	..	..	1
6/·144 ..	..	..	..	..	..	..	..	..	..	..	19	2	..	..	2
7/·167 ..	..	..	..	..	..	..	..	..	..	..	639	..	..	..	..
Miscellaneous	83	11	161	2	..	..	2	..	12	..	58	..	..	..	13
Telephone-wires	195	..	..	..	1,060	..	906	..	2,915	..	..	..	..	..	..
Totals ..	103,334	2,102	465	17	7,596	49	7,093	58	4,366	21	3,243	2	30	..	2,249

Grand total, 126,097 miles.

No returns of conductor mileages received from Auckland and Christchurch.

GROWTH OF LOAD.

The total connected load at end of the year under review was 1,904,967 kW., compared with 1,676,689 for 1938, an increase of 228,278 kW., or 13·6 per cent.

Statistics pertaining to the increasing use of electric ranges, electric water-heaters, and milking-machines have been collected and scheduled for some years past, and from the following table will be seen the annual growth which has taken place in each class: —

Year.	Route-miles of Line in Service.	Consumers.	Annual Increase.	Electric Ranges.	Annual Increase.	Electric Water-heaters.	Annual Increase.	Electrically-driven Milking-machines.	Annual Increase
		Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.
1925 ..	6,011	148,699	..	1,526	..	..	..	3,581	..
1926 ..	12,454	192,392	29·3	4,671	205·0	6,654	..	4,856	35·8
1927 ..	14,975	228,345	18·7	9,511	104·0	14,160	113·0	6,738	38·8
1928 ..	17,063	243,795	6·8	15,766	66·0	21,513	52·0	8,514	26·3
1929 ..	17,759	266,306	9·2	20,254	28·5	29,257	36·0	10,161	19·4
1930 ..	19,128	284,235	6·7	25,997	28·3	37,564	28·5	11,922	17·3
1931 ..	19,636	300,809	5·9	29,480	13·2	42,803	13·9	13,656	14·5
1932 ..	20,251	309,360	2·8	31,973	8·5	45,796	7·1	14,163	3·7
1933 ..	20,585	322,997	4·4	33,998	6·4	48,070	5·0	15,913	12·4
1934 ..	20,996	334,593	3·6	36,081	6·2	50,272	4·6	16,992	6·8
1935 ..	21,707	342,334	2·3	39,730	10·1	53,635	6·7	17,200	1·2
1936 ..	22,424	355,973	4·0	44,837	12·9	58,864	9·8	18,458	7·4
1937 ..	23,322	371,027	4·2	53,402	19·1	67,049	13·9	20,275	9·8
1938 ..	24,407	388,580	4·7	64,408	20·6	77,353	15·4	22,711	12·4
1939 ..	25,982	407,316	4·8	78,702	22·4	91,711	18·6	24,851	9·4

The total increase in route-miles of line for the above fourteen-year period is 334 per cent.

CONDENSED REVIEW OF ELECTRICAL PROGRESS.

During the year the statistical records collected over the past fifteen years have been condensed into graph form, and the graphs below contain the following information as at the end of each financial year from 1925 to 1939 inclusive: —

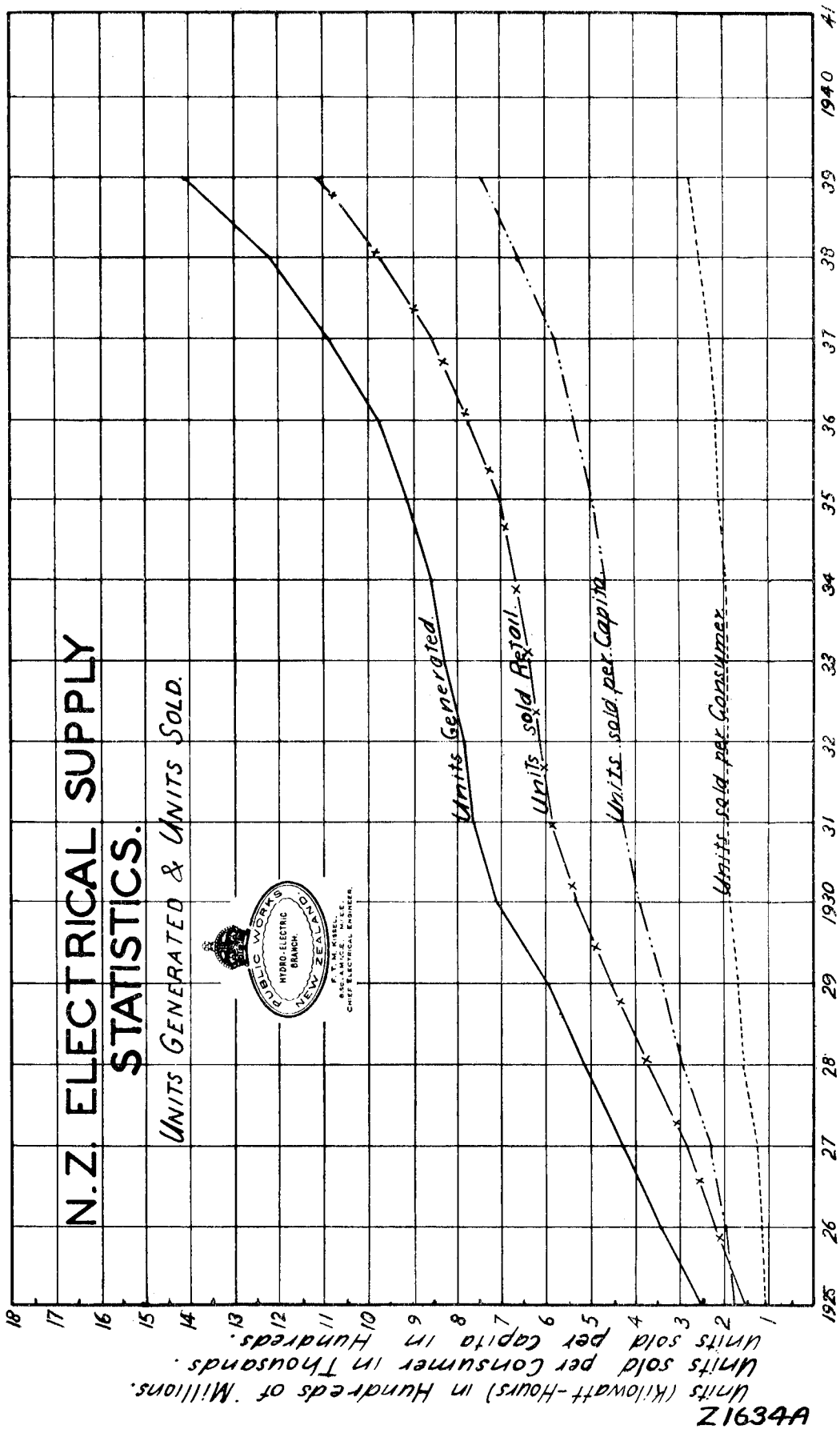
Graph No. 1.—(*a*) Number of units generated; (*b*) number of units sold (retail); (*c*) number of units sold per consumer (average); (*d*) number of units sold *per capita* (average).

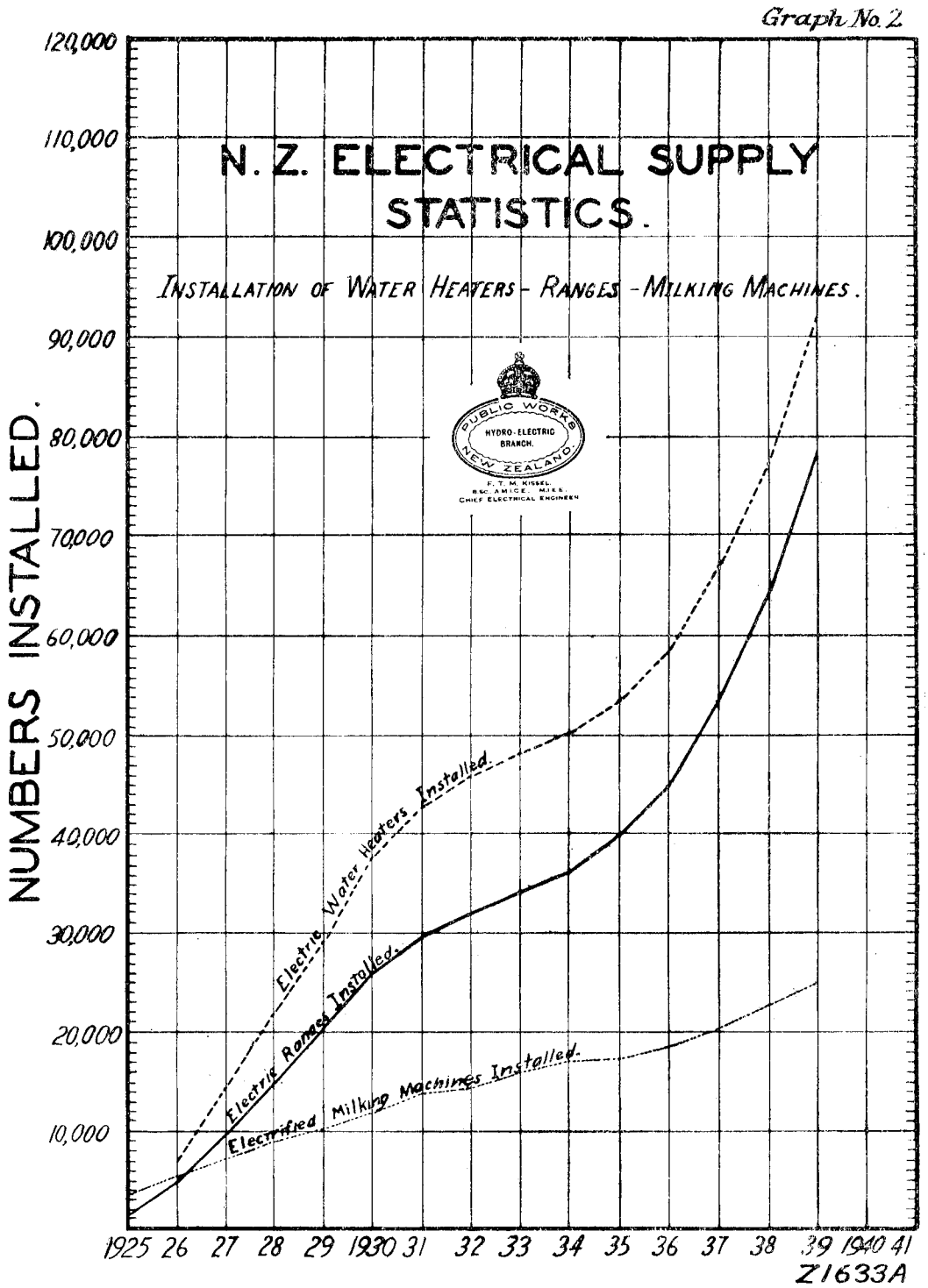
Graph No. 2.—(*a*) Number of electric water-heaters installed; (*b*) number of electric ranges installed; (*c*) number of electric milking-machines installed.

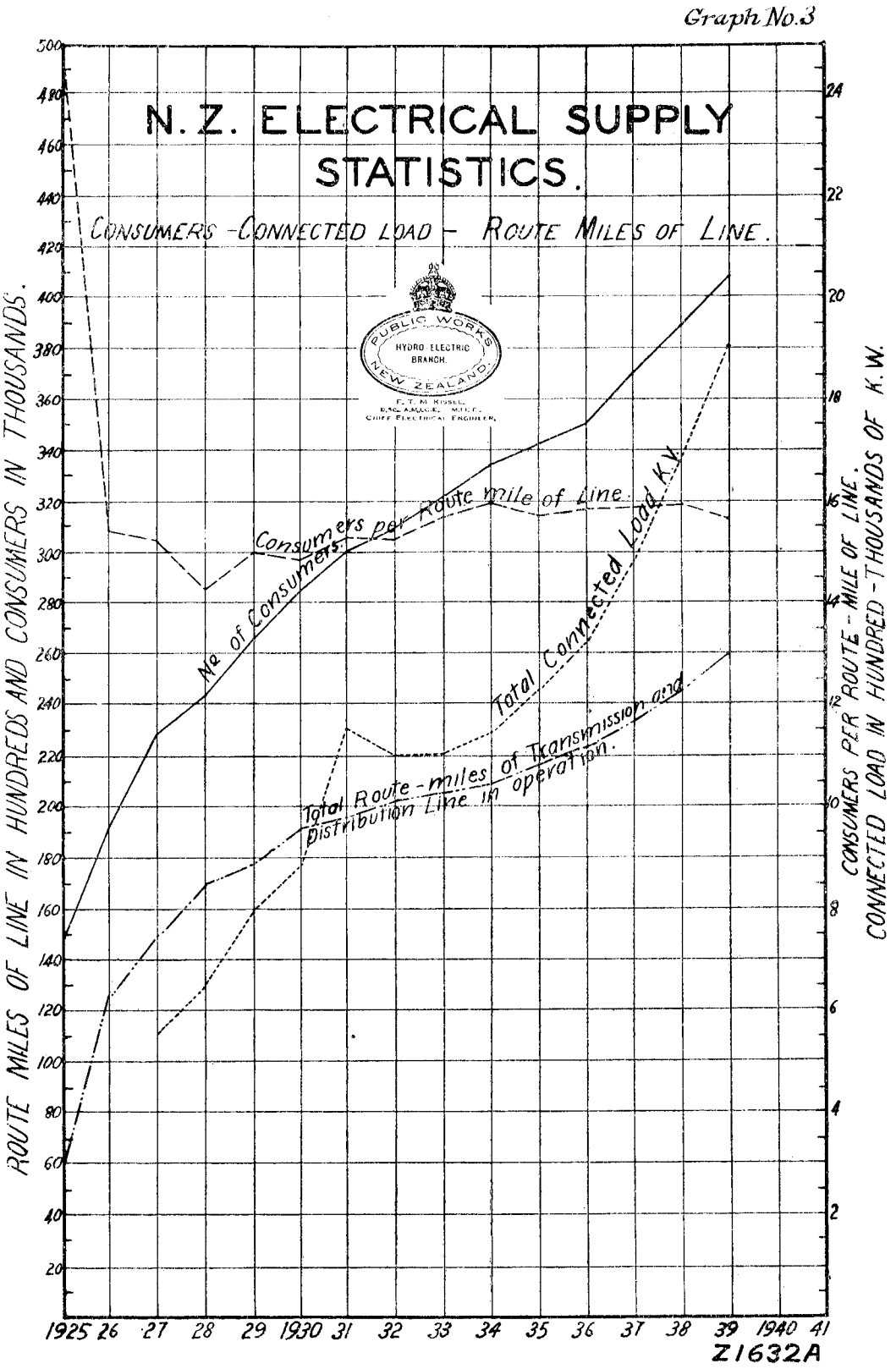
Graph No. 3.—(*a*) Number of consumers per route-mile of line in operation; (*b*) number of consumers supplied; (*c*) number of route-miles of line in operation; (*d*) total connected load, in kilowatts.

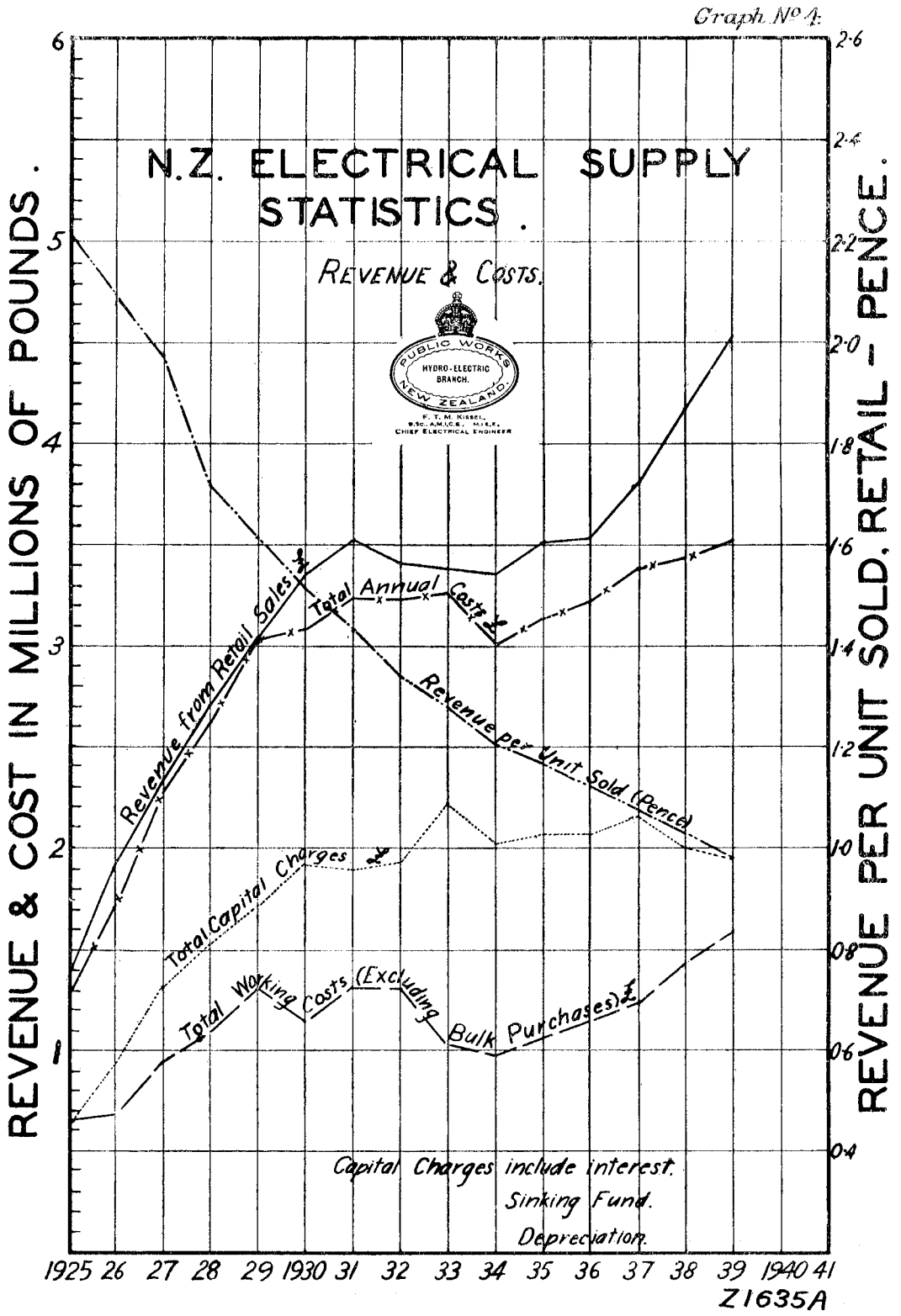
Graph No. 4.—(*a*) Revenue received from retail sales of electricity (pounds); (*b*) total working-costs (excluding bulk purchases) (pounds); (*c*) total capital charges (pounds); (*d*) total annual costs (pounds); (*e*) average revenue per unit sold (pence).

Graph No 1


N.Z. ELECTRICAL SUPPLY STATISTICS.
UNITS GENERATED & UNITS SOLD.
PUBLIC WORKS NEW ZEALAND
HYDRO-ELECTRIC BRANCH
F. T. M. KISSEL, B.SC.A.M.I.C.E. M.I.E.E. CHIEF ELECTRICAL ENGINEER.
Units Generated.
Units sold Retail.
Units sold per Capita.
Units sold per Consumer.
Units (Kilowatt-Hours) in Hundreds of Millions.
Units sold per Consumer in Thousands.
Units sold per Capita in Hundreds.
Z1634A
1925 26 27 28 29 1930 31 32 33 34 35 36 37 38 39 1940
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18


Graph No. 2
N. Z. ELECTRICAL SUPPLY STATISTICS.
INSTALLATION OF WATER HEATERS - RANGES - MILKING MACHINES.
PUBLIC WORKS
HYDRO-ELECTRIC BRANCH.
NEW ZEALAND.
F. T. M. KISSEL, B.SC. A.M.I.C.E., M.I.E.S.
CHIEF ELECTRICAL ENGINEER
NUMBERS INSTALLED.
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
Electric Water Heaters Installed.
Electric Ranges Installed.
Electrified Milking Machines Installed.
1925 26 27 28 29 1930 31 32 33 34 35 36 37 38 39 1940 41
Z1633A


Graph No. 3
N. Z. ELECTRICAL SUPPLY STATISTICS.
CONSUMERS - CONNECTED LOAD - ROUTE MILES OF LINE.
PUBLIC WORKS
HYDRO ELECTRIC BRANCH.
NEW ZEALAND.
F. T. M. KISSELL
B.SC. A.M.I.C.E. M.I.E.E.
CHIEF ELECTRICAL ENGINEER.
No of Consumers.
Consumers per Route mile of Line.
Total Connected Load K.V.
Total Route-miles of Transmission and Distribution Line in operation.
ROUTE MILES OF LINE IN HUNDREDS AND CONSUMERS IN THOUSANDS.
CONSUMERS PER ROUTE-MILE OF LINE.
CONNECTED LOAD IN HUNDRED-THOUSANDS OF K.W.
500 480 460 440 420 400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20
24 22 20 18 16 14 12 10 8 6 4 2
1925 26 27 28 29 1930 31 32 33 34 35 36 37 38 39 1940 41
Z1632A


Graph No 4.
N.Z. ELECTRICAL SUPPLY STATISTICS.
REVENUE & COSTS.
PUBLIC WORKS
HYDRO-ELECTRIC BRANCH.
NEW ZEALAND.
F. T. M. KISSEL, B.Sc., A.M.I.C.E., M.I.E.E.
CHIEF ELECTRICAL ENGINEER
REVENUE & COST IN MILLIONS OF POUNDS.
REVENUE PER UNIT SOLD, RETAIL - PENCE.
Revenue from Retail Sales £
Total Annual Costs £
Revenue per Unit Sold (Pence)
Total Capital Charges £
Total Working Costs (Excluding Bulk Purchases) £
Capital Charges include Interest.
Sinking Fund.
Depreciation.
1925 26 27 28 29 1930 31 32 33 34 35 36 37 38 39 1940 41
Z1635A

In studying the above graphs it should be remembered that they represent a composite review of the electric-supply business as a whole, and the appropriate statistics appertaining to the Public Works Department have therefore been combined with those of all the other electrical supply authorities in the Dominion. It is hoped that the publication of these graphs will continue to be of interest to the various electric-supply authorities throughout New Zealand, without whose valued co-operation in furnishing the requisite statistics each year it would not have been possible to compile the information now presented in graph form.

ELECTRICAL SUPPLY AND ELECTRICAL WIRING REGULATIONS.

During the past year numbers of 6-volt, 12-volt, and 18-volt portable electric-lighting plants have been installed in territories not readily accessible to public electric-supply systems. Under the Electrical Wiremen's Registration Act the services of a registered wireman are not necessary to install the wiring where the voltage does not exceed 20 volts, but this does not include exemption from the requirements of the Electrical Wiring Regulations issued under the Public Works Act, Some modification of the standard Electrical Wiring Regulations was deemed necessary in such cases, and the Regulations Advisory Committee has prepared regulations defining the requirements to be observed by persons installing such sets with a rating not exceeding 500 watts. These regulations were gazetted on 13th January, 1938.

LICENSES AND PERMITS ISSUED.

The following water-power and electric-line licenses (46) and permits (12) have been issued during the period between 1st July, 1938, and 30th June, 1939:—

(1) *Licenses* (40): Wanganui-Rangitikei Electric-power Board; Ashburton Electric-power Board; Tararua Electric-power Board; H. Sagar, Longford; G. B. Nichol, Clarks; E. A. Gray, Horeke; Waimea Electric-power Board; J. A. McCaughan, Kingston; J. Kelland, Omarama; R. E. Vincent, Ohau Downs; D. S. Musker, Uruti; T. W. McLean, Waimumu; R. H. Rhodes, St. Andrews; Heathcote County Council (amendment); Blackwater Mines, Waiuta; Hume Electric-power Co. (amendment); Invercargill City Council; D. C. Aubrey, Pembroke; S. de Filippi, Koiterangi; W. J. Wallace, Ross; Grey River Dredging Co., Ikamatua; Kildare Consolidated Gold-mining Co., Ranfurly; Sullivan Bros., Weheka (amendment); M. A. Wall, Matakitaki; Bay of Islands Electric-power Board; Karamea Co-operative Dairy Factory Co.; Mangonui County Council; W. E. Barker, Mount Harper; E. A. Robson, Waiau; Westport Coal Co., Westport; T. Hurley, Tokaanu; L. Keys, Kohukohu (amendment); A. R. Weenink, Te Taho; H. Holt, Puketona; H. C. Miller, Longford; Waitomo Electric-power Board; P. and R. Diserens, Gowan Bridge; Waikakaho Deep Lead, Ltd., Blenheim; A. W. Gunn, Wataroa; Wairere Electric-power Board (amendment).

(2) *Revocations* (5): P. R. Sargood, Pembroke; D. H. Rutherford, Makuri; C. S. Hammond, Taihape; F. Excell, Raurimu; Grey Electric-power Board (Arnold River).

(3) *Assignment* (1): W. Patterson to G. Kellow, Reefton.

(4) *Permits* (12): J. Hutchinson, Otoko; K. O. and C. E. Jones, Kongahu; I. O. Buchanan, Hororata; McFarlane Estate, Culverden; L. A. Savill, Peria; R. C. Taylor, Harapepe; A. C. Williams, Te Parae; M. S. Alpass, Makuri; C. R. Brereton, Motueka; H. Fox, Waipiro Bay; L. Eyles, Woodstock; J. G. Armstrong, Kaikoura.

INSPECTION OF ELECTRIC LINES, ALSO PRIVATE GENERATING-PLANTS.

The annual departmental inspection of the electric lines in operation was carried out in the case of supply authorities last year, and any defects or breaches of the regulations which came under notice were duly notified to the supply authorities concerned. These inspection activities of the Department undoubtedly tend towards the maintaining of a high standard, and the general willingness on the part of the supply authorities to co-operate in a general observance of the regulations governing such matters is of great assistance to this Department.

The following supply authorities have notified extensions to electric lines in their respective districts during the year: —

Power Boards—
Ashburton.
Auckland.
Banks Peninsula.
Bay of Islands.
Bay of Plenty.
Cambridge.
Central Hawke's Bay.
Central Waikato.
Dannevirke.
Franklin.
Grey.
Hawke's Bay.
Horowhenua.
Hutt Valley.
Malvern.
Manawatu-Oroua.
Marlborough.
North Auckland.
North Canterbury.
Opunake.
Otago.
Otago Central.
Poverty Bay.

Power Boards—*continued.*
South Canterbury.
South Taranaki.
Springs-Ellesmere.
Taranaki.
Tararua.
Tauranga.
Te Awamutu.
Teviot.
Thames Valley.
Wairoa.
Waitomo.
Waimea.
Wairarapa.
Wairere.
Waitaki.
Waitemata.
Wanganui-Rangitikei.

Cities—
Christchurch.
Dunedin.
Invercargill.
Nelson.
Palmerston North.

Cities—*continued.*
Wellington.

Boroughs—
Bluff.
Hamilton.
Napier.
New Plymouth.
Riccarton.
Taumarunui.
Thames.
Wairoa.
Waitara.

Town Boards—
Kaponga.

County Councils—
Nil.

Companies—
Bruce Bay Timber Co.
Martha Gold-mining Co.
Graham Bros., Waiho.

Public Works Department—
Southland Electric Supply System.

It is not generally known that under the Electrical Wiremen's Registration Amendment Act, 1928, it is mandatory to give notice of the installation of private electric plants, and provision is made for the inspection of these plants before same are placed in service. During the year inspections of such plants have been made as opportunity offered.

ELECTRICAL ACCIDENTS.

During the year there were reported to the Department forty-nine electrical accidents, involving the loss of human life in seventeen instances. Corresponding figures for 1938 were thirty-eight and eight respectively.

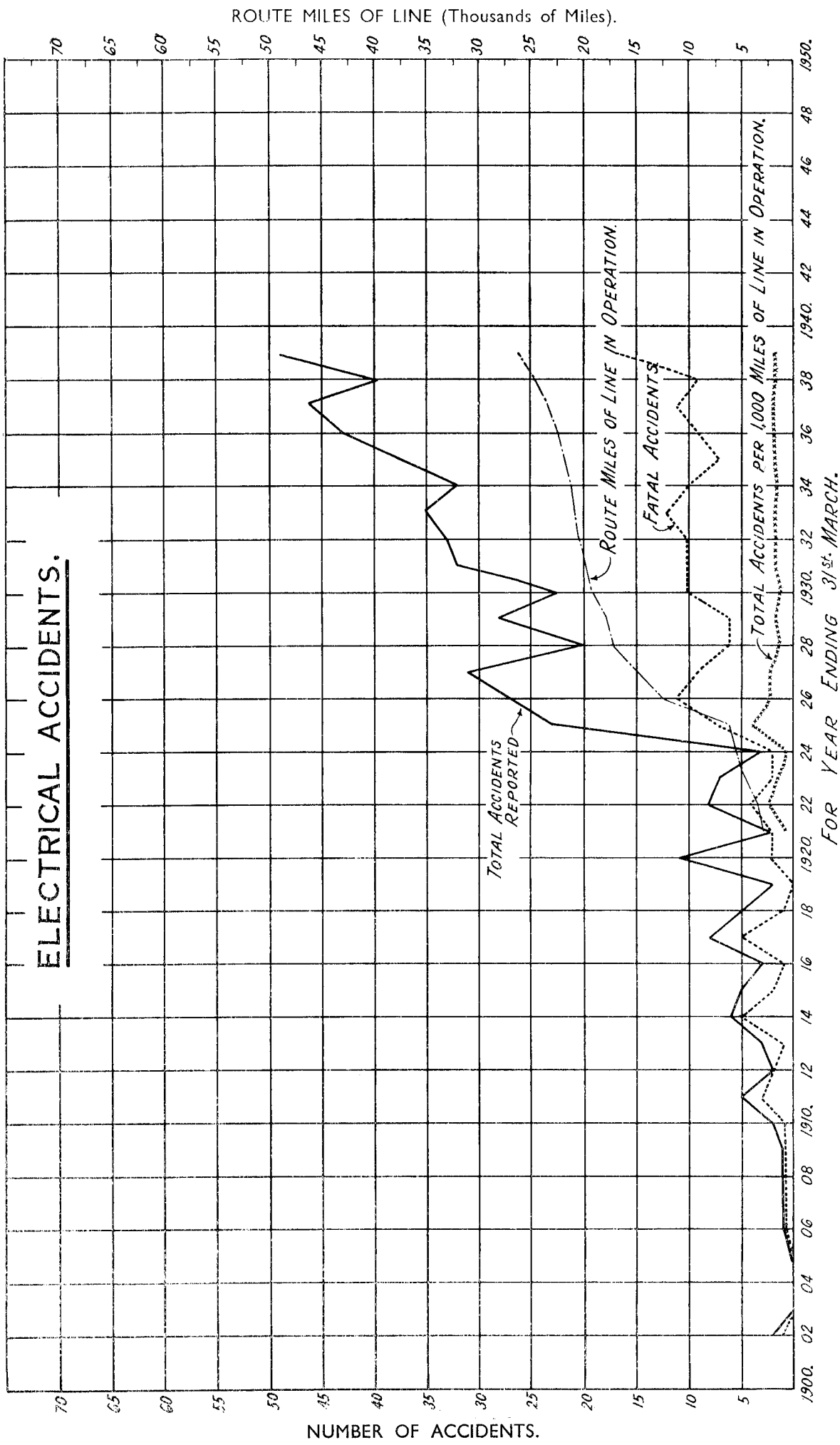
This year's electrical accidents resulted in injuries (fatal and otherwise) to the following:—

Electrical employees	21
Other tradesmen	6
General public	13
Stock	9
Total	49

The following is a summary of electrical accidents for the past seven years—viz., 1933 to 1939:—

Classification.	1933.		1934.		1935.		1936.		1937.		1938.		1939.		Total Accidents.	Total Fatalities.
	Total.	Fatal.	Total.	Fatal.	Total.	Fatal.	Total.	Fatal.	Total.	Fatal.	Total.	Fatal.	Total.	Fatal.		
Electrical employees	15	2	12	2	17	2	13	2	15	..	12	3	21	8	105	19
Other tradesmen ..	9	4	1	..	3	..	10	1	6	2	9	1	6	4	44	12
General public ..	7	6	19	8	17	5	20	6	23	9	16	4	13	5	115	43
Stock	8	..	1	..	8	..	9	..	3	..	3	..	9	..	41	..
Totals ..	39	12	33	10	45	7	52	9	47	11	40	8	49	17	305	74

The following graph has been prepared to show the incidence of electrical accidents, and although such occurrences are regrettable, the curves indicate that as the risk of exposure to accident increases with the electrical development of the Dominion as represented by the erection of additional miles of reticulation and additional users are connected up, the ratio of accidents to additional risks is fortunately not increasing.


ELECTRICAL ACCIDENTS.
ROUTE MILES OF LINE (Thousands of Miles).
NUMBER OF ACCIDENTS.
TOTAL ACCIDENTS REPORTED
ROUTE MILES OF LINE IN OPERATION.
FATAL ACCIDENTS
TOTAL ACCIDENTS PER 1,000 MILES OF LINE IN OPERATION.
FOR YEAR ENDING 31ST MARCH.
70 65 60 55 50 45 40 35 30 25 20 15 10 5
1900. 02 04 06 08 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50.

ELECTRICAL FIRES.

During the year there were 23 fires attributed to electrical causes and reported to the Department by the electrical supply authorities, as per list below.

The sources of this year's electrical fires included the following:

Electric irons	5
Radiators	2
Water-heaters boiling dry	1
Other electrical appliances	1
Defective installations	9
Defective radio installation	1
Contacts between overhead lines	3
Lightning	1
Totals	23

The following is a summary of causes of electrical fires for the seven-yearly period, 1933–39:—

——	1933.	1934.	1935.	1936.	1937.	1938.	1939.	Totals.
Electric irons	4	12	8	8	7	3	5	47
Electric radiators	2	..	1	2	..	1	2	8
Other electrical appliances	2	3	6	4	6	6	1	28
Defective installations	4	11	7	12	3	9	9	55
Defective flexible cords	..	..	..	..	3	..	..	3
Defective radio installations	1	..	..	..	1	..	1	3
Bedding in contact with lamp	..	..	..	..	1	..	..	1
Contact between distribution and service lines	..	..	..	..	1	..	3	4
Lightning	..	..	..	..	1	..	1	2
Soldering-iron	..	..	..	1	..	..	..	1
Rats	..	..	..	..	..	2	..	2
Transformer-oil overheating	..	..	..	..	..	1	..	1
Water-heating appliances boiling dry	..	..	..	..	..	2	1	3
Totals	13	26	22	27	23	24	23	158
Number of consumers	322,997	334,593	342,334	355,973	371,027	388,580	407,316	..

REGISTRATION OF ELECTRICAL WIREMEN.

Eighteen full-day meetings of the Board were held during the year ended 31st March, 1939. This is the largest number of meetings in any year since the year the Act came into operation, when thirty-two meetings were held in order to register the wiremen who were operating at that time.

The shortage of wiremen which has been noticeable for the last two or three years still continues, and has been accentuated temporarily by work undertaken in connection with the Centennial Exhibition. To assist in relieving the position several wiremen from Great Britain, Australia, Canada, and Europe arrived during the year. One hundred and fifteen wiremen were granted full registration during the year, and ninety-seven were granted limited registration. To avoid the delay caused by waiting for a meeting of the Board in those cases where a person did not have the usual opportunity to make an application, the Act was amended in 1926 to provide that an authority to carry out electrical work could be issued on the approval of two members of the Board, pending the determination of the Board with respect to the application. Fifteen of these authorities were issued during the year to wiremen who had found work before the subsequent meeting of the Board.

To assist further in relieving the shortage it was decided to set up two comprehensive classes of electrical servicemen under limited registration, and this had the additional advantage of reducing the number of types of registration by grouping together several types. Both classes include—

The replacement of fuse-links,

The connection and replacement of flexible cords and the earthing of appliances,

and one class also includes—

The disconnection and reconnection of appliances and the assembly and repair of appliances.

The classes of ratings in the Royal Navy to whom registration is granted were given further careful consideration, and these have been extended. Electrical artificers, leading torpedomen, and torpedo-gunners' mates have been eligible for some years for full registration after passing the wiremen's examination. Leading telegraphists are now eligible for limited registration for electrical work in

connection with radio-sets after passing an examination for radio servicemen and one for electrical servicemen or electrical wiremen. Seamen torpedomen are now eligible for limited registration as electrical servicemen after passing the electrical servicemen's examination or that for electrical wiremen. Two years' experience as a seaman torpedoman is now accepted as being equivalent to twelve months' experience in the work of an electrical wireman.

In all cases it is necessary to have a minimum of three years' experience and to have attained the age of nineteen years before registration can be granted.

Consideration was also given again to the granting of registration to apprentices who had received their training in connection with electric tramways, and it has been agreed that three years of such training will be accepted as equivalent to two years' training in the work of an electrical wireman.

It is interesting to note that the first limited registration in connection with the installation and maintenance of supervisory control wiring and apparatus on supply lines was granted during the year.

The registration of persons whose mother-tongue is not English has presented some difficulty, but an endeavour is being made to enable these wiremen to be employed under the direct supervision of registered wiremen pending the passing of the ordinary half-yearly examination. Before being granted permission to work with a wireman a test for knowledge of English and general knowledge of electrical work has to be passed.

Further consideration was given to the cases of six persons whose applications had been declined, as it appeared their experience had not been gained in accordance with the Act. Careful investigation by the Apprenticeship Committees in the districts concerned produced sufficient information to make it possible to register five of the persons involved. Thirteen proposed contracts for adult apprentices were referred to the Registration Board by the Department of Labour to ascertain whether previous experience was satisfactory and could be counted for the purposes of registration. It was ascertained in one case that the previous experience was sufficient for registration and no further apprenticeship was necessary. A number of other cases were referred to the Board by the individuals concerned.

The question of making an allowance for time served in other branches of the electrical trade was discussed and the general principle laid down that at least two years' experience in the wiring branch is necessary.

Apprentices who had received five years' training chiefly in repair and maintenance work came under review. This work includes a fair proportion of wiring, but it is considered some further experience in wiring is necessary and this has been fixed at a minimum period of six months.

Numerous requests for rulings on their experience were received from persons who wished to obtain registration after passing the examination.

The duties of an Inspector of Electrical Wiring are important and responsible ones, and the Act stipulates that the Board must be satisfied that the person who is to be registered as an Inspector is competent to inspect and test electrical wiring work. The proposed appointment in a few cases of wiremen who had been registered as such for only a few months, others who were considered to be too young, and others who had previously had their registration certificates endorsed for defective work, resulted in the matter again coming under consideration. The conclusions arrived at were that no person should be eligible for registration as an Inspector if he had been registered as an electrical wireman for less than five years, if he was less than twenty-five years of age, or if his registration certificates had been endorsed for defective work during the previous five years.

The results of the wiremen's examinations show that the candidates would benefit materially from more training at technical schools. The examiners continue to report very unsatisfactory results in the written part of the examination for electrical wiremen and point out that the results seem to indicate that the candidates made little or no effort towards technical training or a working knowledge of the regulations. Carelessness, bad writing, bad spelling, exceptionally bad sketching and setting-out of work were characteristic of a large number of papers, and generally the arithmetic was weak.

The workmanship in the practical part of the wiremen's examination continues at a reasonably good standard, but care in working to given measurements was still lacking. Bending and setting is still unsatisfactory, and cutting and screwing were only of an average standard; many candidates attempted to work with badly-worn vices and dies, and there was an excessive use of round files for cleaning the ends of conduit: the regulations lay it down that the ends of conduit shall be reamed out, not filed out. The earthing was of a fairly good standard, but some candidates failed to clean properly the earth connections, and others failed to tighten up the earthing-clips. The correct phasing of screw lamp-holders still requires more attention, although an improvement was shown. Very few candidates obtained full marks for the connecting-up of the ceiling-roses. The tightening-up of the locking-rings on lamp-holders still leaves much to be desired. The connecting of the flexible cord to the plug was very poorly carried out. Much more training in tying conductors to insulators is required, and it was evident that many candidates had never done this class of work. The stripping of the conductors was again very good, but the insufficient heating of the solder in the cable-sockets was the cause of loss of marks.

The first examination for electrical servicemen was held in March, and the results are very gratifying. The examiners in the written part comment on the neat setting out, the good writing and sketching, and the intelligent manner in which the questions were answered.

The examiners in the practical part of the servicemen's examination stated that the percentage of completed exercises and the workmanship were unexpectedly high. The appliance connector in the majority of cases was satisfactorily attached to the flexible cord, but in some cases it was very badly done. Some candidates were undecided as to the use of the locks provided for the flexible cords in the accessories. Some candidates require much more training in the art of jointing and soldering.

The questions in the written part deal mainly with wiring regulations, and the practical test deals mainly with the attachment of flexible cords to accessories, the earthing of appliances, and the making of joints and connections. A pass in either part of the wiremen's examination exempts a candidate from that particular part in the servicemen's examination.

A further examination of Radio Inspectors and radio mechanics in connection with the reduction of interference with radio reception was held.

Tables giving details of length of service, technical training, and the number of times the candidate sat have been in use by the Board for some years, and it was decided to send copies of these to the technical schools for the information of instructors in electrical work.

The reports of breaches of the Act do not in many cases contain all the necessary information, although suggestions in connection with their preparation are contained on the back of the report forms and also in a letter sent to every Inspector when he is registered. To assist further in obtaining satisfactory reports a letter setting out the individual breaches of the Act and the regulations which had been reported was forwarded to each Inspector.

The position in regard to luminous-discharge-tube signs and outline lighting is far from satisfactory, and was brought under the notice of the Electrical Supply Authorities.

Reports were received that in some cases labourers were doing wiring, and holders of limited registration were assisting wiremen to carry out installation work, thus working outside the limits of their registration.

The employment of electricians in mines appears to have now been established on a satisfactory basis, and presumably all of these are now registered. Three requests for information as to the training of apprentices for electrical work in mines were received. In two cases the facilities available were considered insufficient, but in the other case it was agreed that an apprentice could receive satisfactory training and be able to secure registration as a wireman after passing the examination for wiremen.

Provision is made in the Act for the removal of an endorsement after twelve months have elapsed from the time the endorsement was made. From the time the Act came into force in 1926 up to the end of March, 1939, 100 endorsements for defective work have been made and 51 have been removed. Only three certificates were endorsed during the current year, so that 48 endorsements have been on for over twelve months, and no doubt a large number of these would be removed if the holders of the certificates would make the necessary application.

The Electrical Wiremens Registration Regulations 1929 were slightly amended in 1934 and again in 1935, and are now somewhat difficult to follow. It is therefore proposed to consolidate these and to have them reprinted. The opportunity to make several further necessary amendments will be availed of.

A circular letter setting out the need for every care on the part of those engaged in the building trade to see that no earthing lead is damaged or disconnected during alterations and repairs to a building was printed, and copies sent to the Electrical Supply Authorities for distribution to tradesmen engaged in the building and plumbing trades.

The statistics for the year ended 31st March, 1939, are set out below (the figures in parentheses are for previous year):—

	Number.	
Registrations—		
Inspectors	54	(60)
Wiremen—		
Full registration	115	(120)
Limited registration	97	(64)
Provisional licenses	34	(20)
Examinations—		
Wiremen's—		
Candidates—		
Written part	449	(379)
Practical part	311	(323)
Passed—		
Written part	110	(154)
Practical part	164	(180)
Highest marks—		
Written part	89	(89)
Practical part	91	(91)
Servicemen's—		
Candidates—		
Written part	108	..
Practical part	82	..
Passed—		
Written part	54	..
Practical part	52	..
Highest marks—		
Written part	84	..
Practical part	91	..
Defective work reports	17	(99)
Endorsements made	3	(7)
Endorsements removed	3	(9)
Breach of Act reports	102	(125)
Prosecutions authorized	59	(66)

I have, &c.,

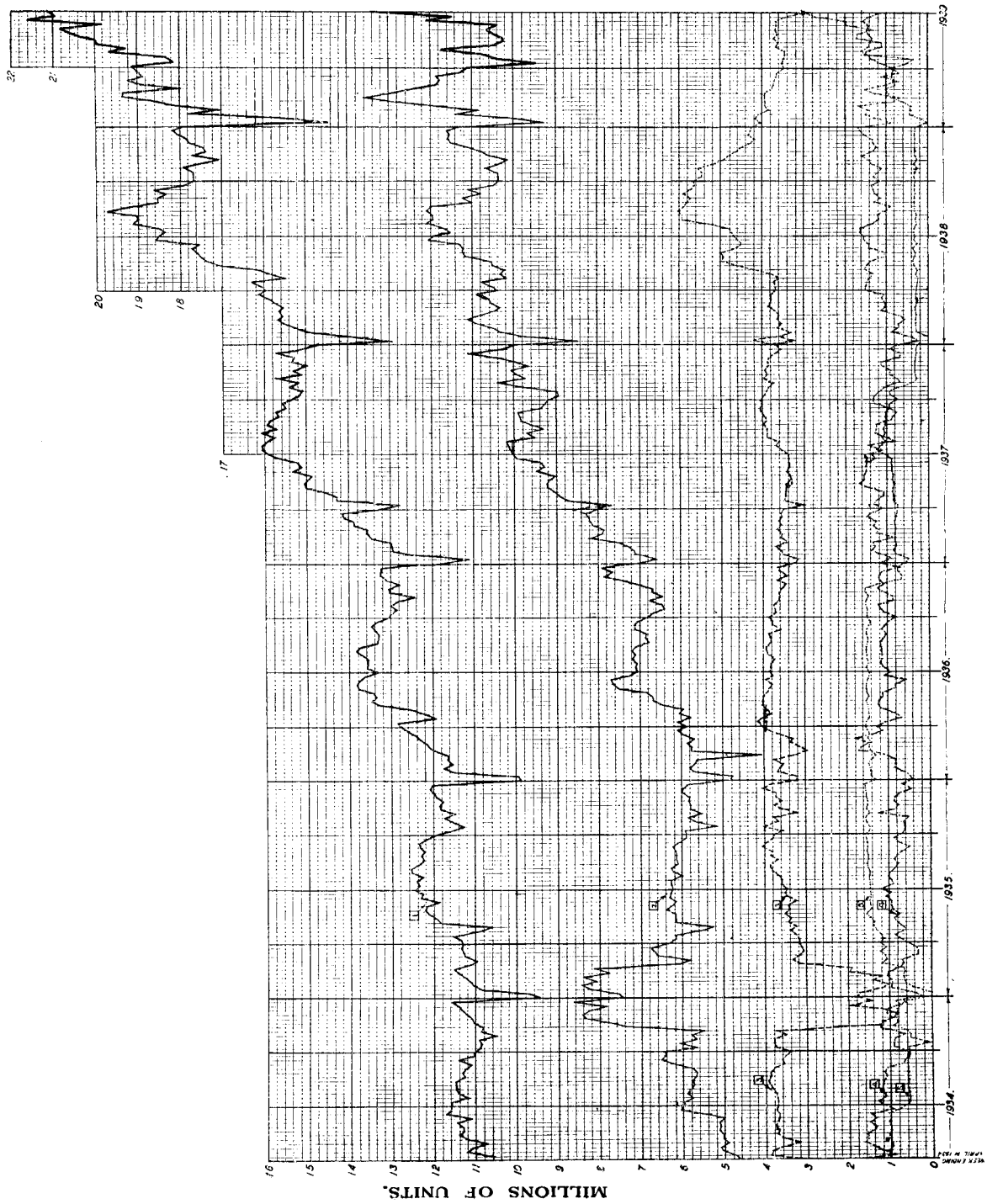
F. T. M. Kissel, B.Sc., M.I.E.E., A.M.I.C.E.,
Chief Electrical Engineer.

NORTH ISLAND POWER SYSTEM.

UNITS GENERATED PER WEEK.

CURVES:

1. NORTH ISLAND SYSTEM.
2. ARAPUNI POWER STATION.
3. WAIKAREMOANA POWER STATION.
4 MANGAHAO POWER STATION.
5. HORAHORA POWER STATION.



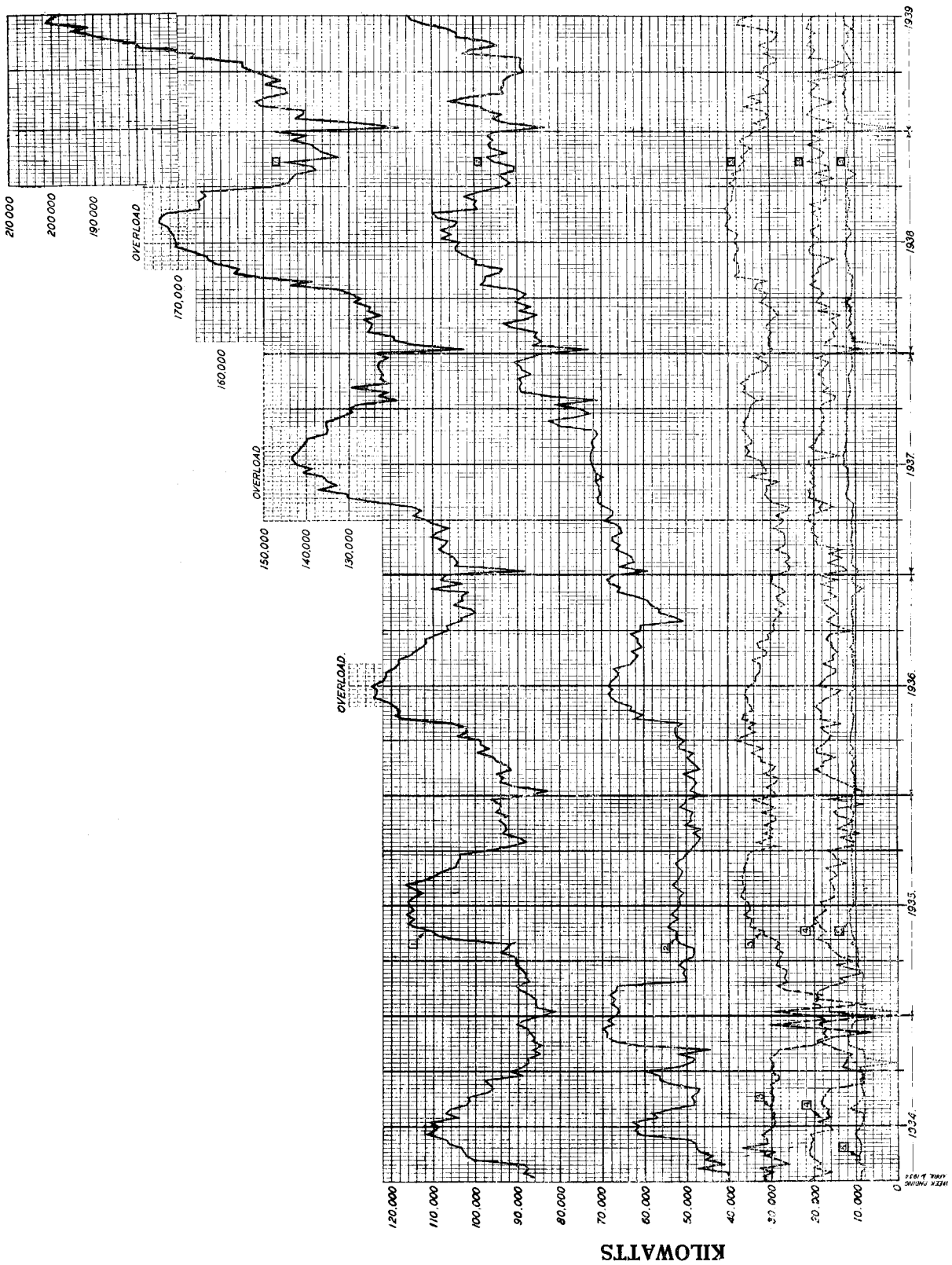
NORTH ISLAND POWER SYSTEM.

MAXIMUM WEEKLY LOADS.

CURVES :

1. NORTH ISLAND SYSTEM.
2. ARAPUNI POWER STATION.
3. WAIKAREMOANA POWER STATION.
4. MANGAHAO POWER STATION.
5. HORAHORA POWER STATION.

PLANT CAPACITY INSTALLED: MAIN PLANT, 169,652 kW.; STANDBY PLANT, 40,750 kW.

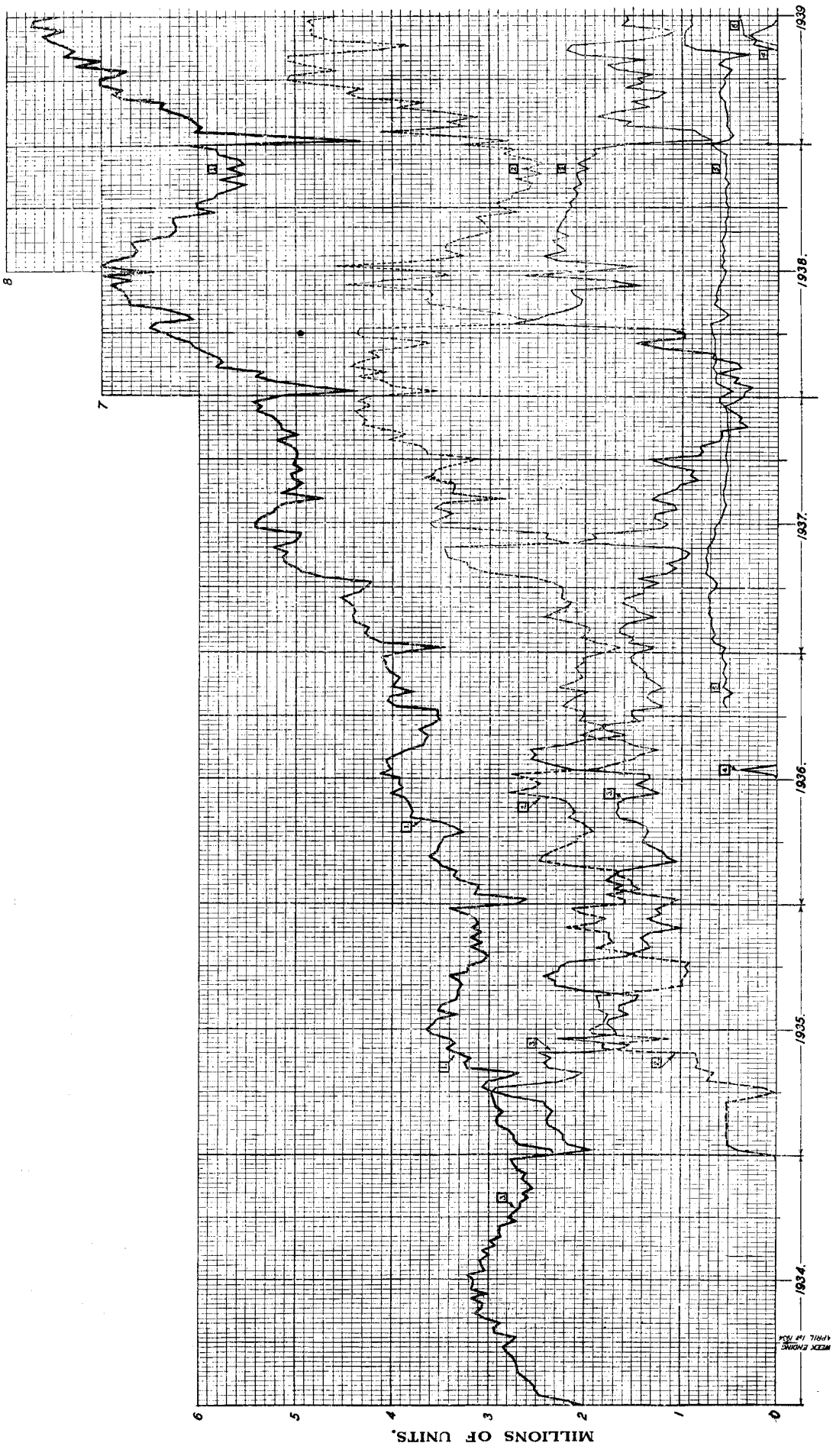


SOUTH ISLAND POWER SYSTEM.

UNITS GENERATED PER WEEK.

CURVES:

1. *SOUTH ISLAND SYSTEM.*
2. *WAITAKI POWER STATION.*
3. *LAKE COLERIDGE POWER STATION*
4. *SOUTH ISLAND DIESEL STATION.*
5. *MONOWAI POWER STATION.*
6. *ARNOLD RIVER POWER STATION.*



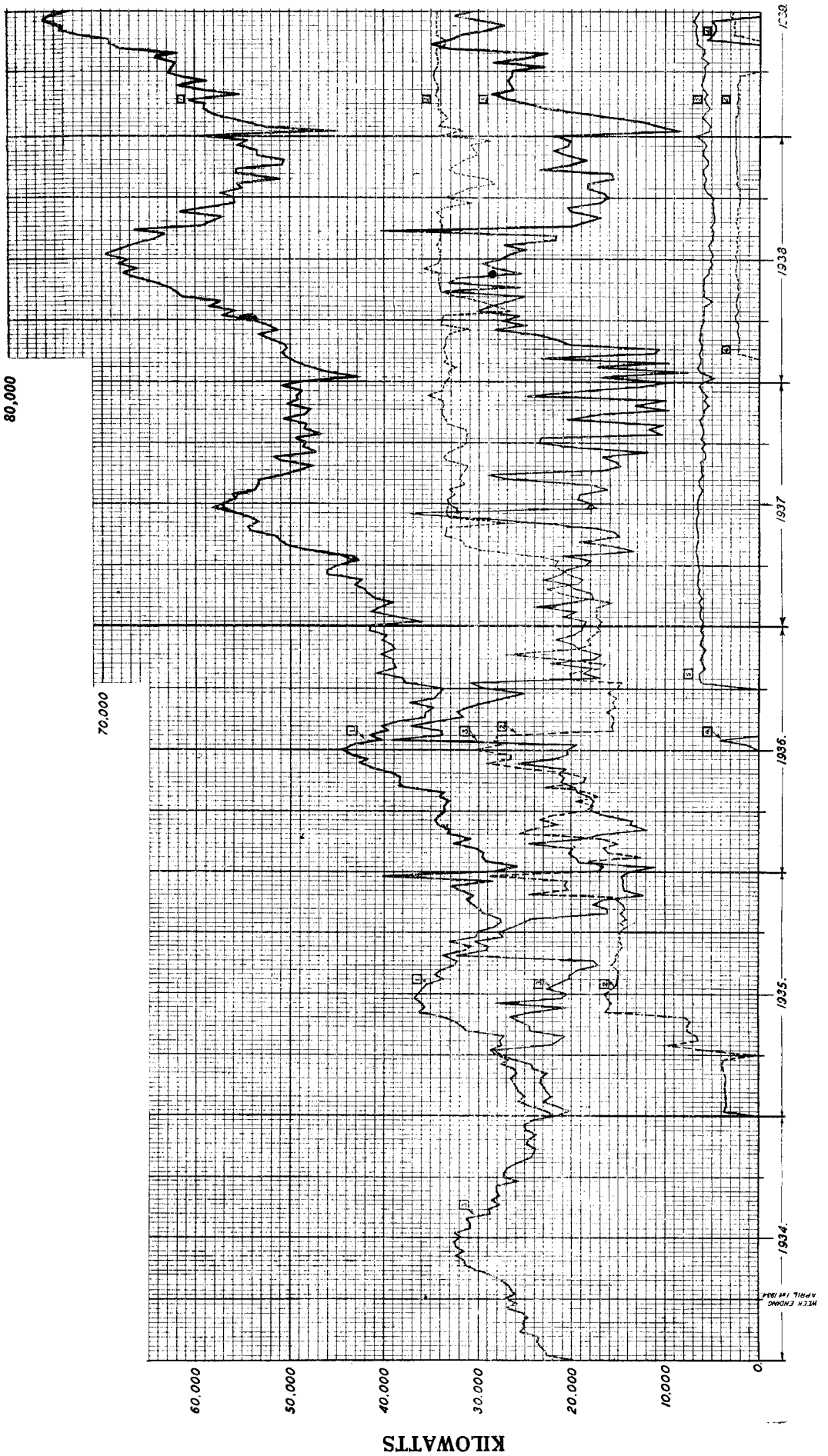
SOUTH ISLAND POWER SYSTEM.

MAXIMUM WEEKLY LOADS.

CURVES:

1. *SOUTH ISLAND SYSTEM.*
2. *WAITAKI POWER STATION.*
3. *LAKE COLERIDGE POWER STATION.*
4. *SOUTH ISLAND DIESEL STATION.*
5. *MONOWAI POWER STATION.*
6. *ARNOLD RIVER POWER STATION.*

PLANT CAPACITY INSTALLED: MAIN PLANT, 73,560 kW.; STANDBY PLANT, 6,760 kW.



INDEX TO TABLES.

YEAR ENDED 31ST MARCH 1939.

TABLE 1.—SUMMARY OF FINANCIAL AND OPERATING STATISTICS FOR NORTH ISLAND AND SOUTH ISLAND ELECTRIC-POWER SYSTEMS FOR THE YEAR ENDING 31ST MARCH, 1939.

NOTE.—"North Island system" includes Arapuni–Horahora–Mangahao–Waikaremoana all interconnected. "South Island system" includes Lake Coleridge–Waitaki–Southland–Arnold River (Westland) all interconnected.

(*a*) Financial.

	1938–39 (Fifth Year).
(1) Capital outlay—	£
Assets in operation—	
North Island system	9,264,384
South Island system	6,387,270
Total assets in operation	15,651,654
Assets not in operation—	
North Island system	446,171
South Island system	266,778
Total assets not in operation	712,949
Total capital outlay	16,364,603
(2) Revenue for year—	
North Island system	1,127,132
South Island system	561,300*
Total revenue for year	1,688,432
(3) Costs—	
Working-costs—	
North Island system	200,438
South Island system	187,794†
Total working-costs for year	388,232
(4) Capital charges—	
Interest—	
North Island system	353,676
South Island system	231,060
Cost of raising loans, &c.—	
North Island system	2,073
South Island system	1,404
(4) Capital charges—*continued.*	
Depreciation—	
North Island system	7,228
South Island system	82,617
Half capital charges, King's Wharf Station	33,547
Total capital charges for year	711,605
(5) Total costs for year	1,099,837
(6) Net profit or loss for year—	
North Island system	*Cr.* 530,170
South Island system	*Cr.* 58,535
Total **profit** for year	588,705
(7) Accumulated Depreciation Reserve—	
North Island system	1,042,933
South Island system	637,799
Total Depreciation Reserve	1,680,732
(8) Accumulated Sinking Fund Reserve—	
North Island system	741,038
South Island system	350,840
Total Sinking Fund Reserve	1,091,878
Arrears in Sinking Fund payments not yet appropriated	558,076
(9) General Reserve—	
North Island system	Nil.
South Island system	87,199

* Excludes £151 revenue from rates. † Excludes £41 commission paid for collecting rates.

(Continued on next page.)

TABLE I.—SUMMARY OF FINANCIAL AND OPERATING STATISTICS FOR NORTH ISLAND AND SOUTH ISLAND ELECTRIC-POWER SYSTEMS FOR THE YEAR ENDING 31ST MARCH, 1939—*continued.*

NOTE.—"North Island system" includes Arapuni–Horahora–Mangahao–Waikaremoana all interconnected. "South Island system" includes Lake Coleridge–Waitaki–Southland–Arnold River (Westland) all interconnected.

(*b*) Operating Results.

	1938–39 (Fifth Year).
Maximum load (kilowatts)—	
North Island system	174,880
South Island system	69,610
Average load (kilowatts)—	
North Island system	106,762
South Island system	37,450
Average load factor—	Per Cent.
North Island system	61·1
South Island system	53·8
Units output—	Units.
North Island system	935,237,791
South Island system	326,326,230
Combined	1,261,564,021
Units distributed—	
Units sold—	
North Island system	835,943,799
South Island system	281,708,949
Combined	1,117,652,748
Units unsold (station auxiliaries, &c.)—	
North Island system	7,997,884
South Island system	3,904,827
Combined	11,902,711
Total units distributed, North Island system	843,941,683
Total units distributed, South Island system	285,613,776

Line losses—	Units.	Per Cent.
Transmission—		
North Island system	90,424,393	9·66
South Island system	29,904,966	9·12
Combined	120,329,359	..
Distribution—		
North Island system	871,715	0·093
South Island system	10,807,488	3·32†
Combined	11,679,203	..
Total line losses, North Island system	91,296,108	9·76
Total line losses, South Island system	40,712,454	12·41†

	1938–39 (Fifth Year).
Revenue—	
Per kilowatt (system maximum)—	£
North Island system	6·47*
South Island system	8·07*
Per unit generated—	d.
North Island system	0·289
South Island system	0·413
Per unit distributed—	
North Island system	0·321
South Island system	0·472
Per unit sold—	
North Island system	0·324*
South Island system	0·478*
Working-costs—	
Per kilowatt (system maximum)—	£
North Island system	1·15
South Island system	2·70
Per unit generated—	d
North Island system	0·0515
South Island system	0·1381
Per unit distributed—	
North Island system	0·0570
South Island system	0·1578
Per unit sold—	
North Island system	0·0576
South Island system	0·1600
Capital charges—	
Per kilowatt (system maximum)—	£
North Island system	2·27
South Island system	4·53
Per unit generated—	d.
North Island system	0·1018
South Island system	0·2318
Per unit distributed—	
North Island system	0·1128
South Island system	0·2649
Per unit sold—	
North Island system	0·1139
South Island system	0·2683
Total costs—	
Per kilowatt (system maximum)—	£
North Island system	3·42
South Island system	7·23
Per unit generated—	d.
North Island system	0·1533
South Island system	0·3699
Per unit distributed—	
North Island system	0·1698
South Island system	0·4227
Per unit sold—	
North Island system	0·1715
South Island system	0·4283

* Based on gross revenue. For corresponding figures, based on revenue received from sale of electricity only, see Table XIII. † Retail distribution losses in Southland area 24·74 per cent.

Table II.—Analysis of Capital Outlay as at 31st March, 1939.

North Island System.	£	South Island System (including Southland and Arnold River.)	£	Combined Totals. £
Headworks and power-stations—		Headworks and power-stations—		
Land, fencing, and roading—		Land, fencing, and roading—		
Arapuni	110,803	Coleridge	24,385	
Horahora	3,208	Waitaki	48,441	
Mangahao	72,130	Southland	12,226	
Waikaremoana	67,303	Arnold River (Kaimata)	1,299	
				339,795
Headworks—		Headworks—		
Arapuni	1,284,954	Coleridge	519,712	
Horahora	151,528	Waitaki	1,076,066	
Mangahao	848,914	Southland	86,770	
Waikaremoana	148,677	Arnold River (Kaimata)	87,115	
				4,203,736
Generating-station, buildings, and village—		Generating-station, buildings, and village—		
Arapuni	426,725	Coleridge	93,176	
Horahora	61,064	Waitaki	461,766	
Mangahao	180,203	Southland	41,129	
Waikaremoana	183,865	Arnold River (Kaimata)	7,692	
				1,455,620
Generating plant and machinery—		Generating plant and machinery—		
Arapuni	687,746	Coleridge	170,527	
Horahora	96,425	Waitaki	196,617	
Mangahao	197,367	Southland	59,892	
Waikaremoana	244,330	Arnold River (Kaimata)	21,270	
				1,674,174
Auxiliary stations (three)—Penrose, Huntly, Grand Junction	81,899	Auxiliary station (one)—Dobson (ex Lyttelton)	128,353	210,252
Transmission and distribution—		Transmission and distribution—		
Primary distribution—		Primary distribution—		
11 kV. lines	51,484	11 kV. lines	528,909	
33 kV. lines	..	33 kV. lines	30,750	
50 kV. lines	392,618	50 kV. lines	..	
66 kV. lines	..	66 kV. lines	581,866	
110 kV. lines	1,301,054	110 kV. lines	326,624	
Secondary distribution	..	Secondary distribution	305,944	
				3,518,929
Substations—		Substations—		
11 kV. substations	15,773	11 kV. substations	..	
33 kV. substations	..	33 kV. substations	43,284	
50 kV. substations	267,995	50 kV. substations	..	
66 kV. substations	..	66 kV. substations	351,211	
110 kV. substations	871,381	110 kV. substations	250,303	
				1,774,947
General—		General—		
General offices, garages, stores, and other accommodation	59,825	General offices, garages, stores, and other accommodation	22,038	
Telephone services	5,283	Telephone services	30,437	
Explorations and preliminary surveys; engineering, office, and general expenses; charges and expenses of raising loans	931,039	Explorations and preliminary surveys; engineering, office, and general expenses; charges and expenses of raising loans	652,102	
Interest during construction	963,962	Interest during construction	482,198	
		Pole factory (incomplete)	966	
				3,187,150
Grand totals	9,710,555		6,654,048	16,364,603

Table III.—Operating or Working Costs for Year ended 31st March, 1939.

	North Island System.				South Island System (including Southland and Arnold River.)			
	Cost.	Cost per Unit.			Cost.	Cost per Unit.		
		Generated.	Distributed.	Sold.		Generated.	Distributed.	Sold.
	£	d.	d.	d.	£	d.	d.	d.
(*a*) Headworks and power-stations	49,258	0·0127	0·0140	0·0142	40,571	0·0300	0·0343	0·0348
(*b*) Auxiliary stations	126	..	..	..	26,301	0·0193	0·0221	0·0224
	49,384	0·0127	0·0140	0·0142	67,052	0·0493	0·0564	0·0572
(*c*) Transmission and distribution—								
Primary distribution	32,330	0·0083	0·0092	0·0093	20,108	0·0148	0·0169	0·0171
Secondary distribution	..	..	..	..	13,320	0·0098	0·0112	0·0113
(*d*) Substations	30,854	0·0079	0·0088	0·0089	17,949	0·0132	0·0151	0·0153
(*e*) Management and general—								
General expenses	1,898	0·0005	0·0005	0·0005	9,871	0·0073	0·0083	0·0084
Management	61,548	0·0158	0·0175	0·0177	54,916	0·0404	0·0461	0·0468
Total costs (*a*) to (*e*)	176,014	0·0452	0·0500	0·0506	183,216	0·1348	0·1540	0·1561
(*f*) Power purchased	13,891	0·0036	0·0040	0·0040	4,140	0·0030	0·0035	0·0035
(*g*) Standby provision	10,533	0·0027	0·0030	0·0030	438	0·0003	0·0003	0·0004
Total costs (*a*) to (*g*)	200,438	0·0515	0·0570	0·0576	187,794	0·1381	0·1578	0·1600

North Island System.		*South Island System.*	
Units generated	935,237,791	Units generated	326,326,230
Units distributed	843,941,683	Units distributed	285,613,776
Units sold	835,943,799	Units sold	281,708,949

Table IV.—North Island Electric-power System.—Gross Financial Results of Distribution of Energy for the Year ended 31st March, 1939.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue. From Sale of Electrical Energy. Retail.	Revenue. From Sale of Electrical Energy. Bulk (for Resale).	Revenue. Rates.	Revenue. Trading Account.	Revenue. Other Sources.	Revenue. Total.	Expenditure. Paid for Electrical Energy.	Expenditure. Working-costs and Management.	Expenditure. Interest.	Expenditure. Depreciation.	Expenditure. Sinking Fund.	Expenditure. Principal Repayment.	Expenditure. Exchange.	Expenditure. Other Expenditure.	Expenditure. Total.	Balance. Profit. Appropriated to Reserves.	Balance. Profit. Unappropriated.	Balance. Loss.	No.
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	
(A) Receiving Bulk Supply direct from Public Works Department.																					
1. Public Works Department	414	9,710,555	49,006	1,066,246	..	..	11,880	1,127,132	24,424	176,014	353,676	7,228	..	..	..	35,620	596,962	530,170	..	..	
	..	..	..	..	..	..	..	..	..	..	(17,508*)	(4,048*)	(10,529*)	..	..	(1,463*)					
2. Auckland Power Board	61,227	3,628,550	770,193	..	..	7,310	777,503	293,250	168,142	109,135	35,453	63,486	..	26,133	1,238	696,837	4,360	76,306	..	2	
3. Bay of Islands Power Board	..	25,223	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
4. Bay of Plenty Power Board	1,994	217,751	46,673	1,231	..	2,535	731	51,170	15,651	12,794	8,624	..	3,322	..	..	185	40,576	10,594	..	..	4
5. Cambridge Power Board	1,638	111,241	23,035	25	..	125	246	23,431	8,968	7,011	4,101	..	1,998	263	..	..	22,341	..	1,090	..	5
6. Central Hawke's Bay Power Board	2,026	186,640	27,615	..	..	265	144	28,024	9,537	7,598	6,409	337	178	3,878	..	..	27,937	38	49	..	6
7. Central Waikato Power Board	6,556	467,621	84,289	56	..	326	867	85,538	35,280	18,635	17,457	349	6,709	3,363	..	256	82,049	..	3,489	..	7
8. Dannevirke Power Board	3,097	235,452	34,943	..	..	322	195	35,460	9,630	9,339	9,341	195	3,746	678	..	..	32,929	1,259	1,272	..	8
9. Franklin Power Board	4,971	354,157	67,936	..	..	1,084	1,241	70,261	28,431	14,054	14,914	..	5,367	986	..	318	64,070	6,191	..	..	9
10. Hamilton Borough Council	5,269	67,228	47,243	..	..	..	164	47,407	16,991	10,258	1,594	..	2,516	..	..	62	31,421	13,924	2,062	..	10
11. Hawke's Bay Power Board	8,322	477,962	91,893	20,719	..	..	32	112,644	51,012	21,050	20,047	87	2,000	8,331	..	..	102,527	5,810	4,307	..	11
12. Horowhenua Power Board	5,511	259,138	54,479	..	..	815	821	56,115	26,718	14,497	8,730	..	163	6,468	..	..	56,576	..	..	461	12
13. Hutt Valley Power Board	14,486	380,726	135,434	..	..	745	1,759	137,938	69,006	30,072	16,454	4,331	1,300	4,358	..	..	125,521	..	12,417	..	13
14. Manawatu-Oroua Power Board	5,654	505,935	77,540	30,240	9	394	257	108,440	51,180	21,509	21,121	180	7,841	1,382	..	..	103,213	..	5,227	..	14
15. New Plymouth Borough Council	7,063	362,251	81,722	10,716	..	2,888	1,273	96,599	26,599	38,337	11,228	500	1,435	5,442	504	..	84,045	12,096	458	..	15
16. North Auckland Power Board	2,964	212,136	30,919	..	..	4,337	999	36,255	11,452	5,455	6,045	8,752	..	1,009	..	1,413	34,126	..	2,129	..	16
17. Opunake Power Board	1,228	113,456	16,234	2,800	..	114	21	19,169	4,920	5,445	3,619	200	2,179	64	..	..	16,427	2,385	357	..	17
18. Poverty Bay Power Board	5,922	351,738	71,574	..	..	142	1,217	72,933	20,104	26,381	13,380	2,240	12,716	..	..	..	74,821	..	..	1,888	18
19. Rotorua (Tourist Department)	2,814	87,520	29,763	..	..	..	724	30,487	10,189	9,862	4,210	1,684	1,684	..	..	..	27,629	2,858	..	..	19
20. South Taranaki Power Board	3,838	240,186	49,074	2,348	..	113	470	52,005	15,794	14,435	8,940	2,916	3,806	2,755	..	..	48,646	2,942	417	..	20
21. Taranaki Power Board	2,920	515,900	45,439	12,402	26	133	524	58,524	5,981	17,409	18,931	..	..	9,357	..	..	51,678	3,622	3,224	..	21
22. Tararua Power Board	2,014	201,583	29,311	..	..	863	292	30,466	9,314	7,651	7,361	768	2,179	1,861	..	..	29,134	280	1,052	..	22
23. Taumarunui Borough Council	1,160	69,702	13,414	359	..	32	93	13,898	..	4,864	2,099	..	1,250	..	..	..	8,213	4,713	972	..	23
24. Te Awamutu Power Board	2,502	227,505	40,508	..	..	66	327	40,901	14,529	11,364	7,187	..	3,130	503	..	180	36,893	55	3,953	..	24
25. Thames Valley Power Board	9,586	883,185	132,666	8,735	..	546	1,393	143,340	55,502	35,852	32,919	..	6,393	11,422	..	179	142,267	1,062	11	..	25
26. Wairarapa Power Board	5,858	380,024	63,943	4,088	..	2,041	1,125	71,197	22,656	18,574	14,822	4,840	6,025	631	..	..	67,548	..	3,649	..	26
27. Wairoa Power Board	512	71,012	13,711	6,094	135	..	195	20,135	11,693	3,184	2,967	662	700	997	..	..	20,203	..	..	68	27
28. Waitemata Power Board	14,452	586,807	124,704	..	..	555	1,710	126,969	49,556	31,972	20,722	1,774	2,708	9,274	694	2,334	119,034	7,750	185	..	28
29. Waitomo Power Board	1,741	118,829	25,860	..	..	1,035	81	26,976	10,209	6,416	5,122	2,757	1,456	1,016	..	..	26,976	..	..	..	29
30. Wanganui-Rangitikei Power Board	11,568	580,534	128,498	2,103	..	..	2,446	133,047	49,982	24,115	22,267	6,776	2,090	10,933	..	..	116,163	9,849	7,035	..	30
31. Wellington City Council	39,507	1,448,885	375,842	13,851	..	..	6,285	395,978	140,866	140,414	20,771	5,675	4,931	..	7,174	..	319,831	61,782	14,365	..	31
Sub-totals of (A) ..	236,814	23,079,432	2,783,461	1,182,013	170	19,476	44,822	4,029,942	1,099,424	612,703	794,193	87,704	151,308	84,971	34,505	41,785	3,206,593	681,740	144,026	2,417	..
(B) Receiving Supply through Bulk Supply Purchasers in Section A.																					
(Subsidiaries.)†																					
1. Inglewood Borough Council (21)	447	9,335	4,602	..	..	..	..	4,602	1,999	1,327	310	50	340	156	..	..	4,192	410	..	..	1
2. Kaponga Town Board (21)	420	17,498	6,275	..	90	260	267	6,892	1,546	2,643	585	..	368	154	..	..	5,296	1,506	90	..	2
3. Mangaweka Town Board (30)	150	5,511	1,294	..	150	115	56	1,615	367	766	91	..	22	..	..	..	1,246	219	150	..	3
4. Manunui Town Board (23)	182	3,166	1,078	..	..	..	..	1,078	359	300	149	..	105	..	..	..	913	..	165	..	4
5. Napier Borough Council (11)	4,713	133,842	49,736	..	..	4,142	942	54,820	20,049	14,981	5,696	1,702	1,683	..	..	..	44,111	10,106	603	..	5
6. Palmerston North City Council (14)	6,533	276,367	69,701	1,630	..	865	297	72,493	30,240	9,193	7,314	5,561	3,433	..	..	..	55,741	16,119	633	..	6
7. Patea Borough Council (20)	474	21,502	6,791	..	..	120	..	6,911	2,348	2,291	631	128	156	140	..	..	5,694	1,217	..	..	7
8. Stratford Borough Council (21)	1,219	33,604	15,353	..	..	..	6	15,359	6,738	3,359	1,873	246	1,178	182	..	..	13,576	1,783	..	..	8
9. Taihape Borough Council (30)	664	10,828	6,336	..	..	109	86	6,531	691	4,108	608	517	116	..	..	..	6,040	20	471	..	9
10. Te Aroha Borough Council (25)	780	18,648	8,023	..	..	..	1,928	9,951	4,174	4,720	281	44	55	134	..	172	9,580	371	..	..	10
11. Thames Borough Council (25)	1,245	33,438	12,998	..	..	..	29	13,027	4,520	5,118	452	120	140	..	..	81	10,431	1,032	1,564	..	11
12. Wairoa Borough Council (27)	769	12,550	10,954	..	..	..	48	11,002	6,094	2,023	611	..	401	..	..	..	9,129	700	1,173	..	12
13. Waitara Borough Council (21)	585	9,876	5,429	..	480	..	25	5,934	2,118	2,227	497	58	..	420	..	..	5,320	134	480	..	13
14. Whakatane Borough Council (4)	627	39,903	9,041	..	..	59	153	9,253	1,231	2,485	1,534	634	861	..	..	..	6,745	2,508	..	..	14
Totals	255,022	23,705,500	2,991,072	1,183,643	890	25,146	48,659	4,249,410	1,181,898	968,244	814,825	96,764	160,166	86,167	34,505	42,038	3,384,607	717,865	149,355	2,417	..

* Half capital charges King's Wharf Station, paid by Department (included in P.W.D. figures but shown separately for reference purposes).

† The number appearing after the name of each subsidiary B class supply authority refers to the A class supply authority from which it receives supply.

Gross profit, £864,803; rates collected, £890; net profit, £863,913. Ratio of working-expenses to revenue = 50·60 per cent. Ratio capital charges to capital outlay = 5·03 per cent.

Table V.—South Island Electric-power System.—Gross Financial Results of Distribution of Energy for the Year ended 31st March, 1939.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue.						Expenditure.									Balance.		
			From Sale of Electrical Energy.		Rates.	Trading Account.	Other Sources.	Total.	Paid for Electrical Energy.	Working-costs and Management.	Interest.	Depreciation.	Sinking Fund.	Principal Repayments.	Exchange.	Other Expenditure.	Total.	Profits.		Loss.
			Retail	Bulk (for Resale).														Appropriated to Reserves.	Unappropriated.	
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
(A) Receiving Bulk Supply direct from Public Works Department.																				
1. Public Works Department ..	11,601	6,654,048	178,014	372,280	..	..	11,157	561,451	7,372	180,463	231,060	82,617	..	..	..	1,404	502,916	58,535	..	..
2. Ashburton Power Board ..	4,585	363,127	57,781	..	..	712	1,088	59,581	19,256	10,783	15,755	1,332	7,838	..	..	..	54,964	49	4,568	..
3. Banks Peninsula Power Board ..	1,099	104,364	14,363	..	2,284	299	397	17,343	4,806	6,901	4,207	..	2,223	..	..	..	18,137	..	..	794
4. Bluff Borough Council ..	569	6,805	5,292	..	..	..	417	5,709	2,771	1,487	296	..	245	..	..	..	4,799	791	119	..
5. Christchurch City Council ..	32,720	941,479	282,476	13,171	..	3,118	459	299,224	153,319	87,782	12,066	25,225	2,510	..	1,083	..	281,985	15,000	2,239	..
6. Dunedin City Council	30,018	1,760,873	270,881	14,240	..	..	2,286	287,407	33,087	77,504	50,871	1,650	28,218	..	3,555	..	194,885	92,522	..	..
7. Grey Power Board	4,551	183,642	63,429	..	..	510	626	64,565	28,634	13,666	8,867	..	7,774	210	..	..	59,151	2,240	3,174	..
8. Heathcote County Council ..	988	22,938	12,072	..	..	..	62	12,134	6,309	3,105	595	1,576	549	..	..	..	12,134	..	..	..
9. Invercargill City Council ..	6,629	156,389	52,393	7,372	..	..	1,641	61,406	20,262	20,871	4,376	1,414	..	2,612	..	..	49,535	11,871	..	..
10. Lyttelton Borough Council ..	1,001	13,793	8,143	..	..	61	..	8,204	3,638	2,286	260	145	90	..	..	..	6,419	1,785	..	..
11. Malvern Power Board ..	756	74,818	8,516	..	1,877	199	194	10,786	2,498	3,854	3,174	..	1,130	..	..	..	10,656	..	130	..
12. North Canterbury Power Board	2,906	211,509	32,705	3,916	..	210	993	37,824	14,733	10,348	7,332	..	4,221	209	..	..	36,843	330	651	..
13. Riccarton Borough Council ..	1,691	25,375	12,649	..	..	396	..	13,045	7,485	2,943	229	30	156	..	..	..	10,843	1,148	1,054	..
14. South Canterbury Power Board	5,061	367,492	48,513	22,414	..	449	2,513	73,889	37,144	10,839	12,994	3,954	6,935	..	..	..	71,866	2,023	..	..
15. Springs-Ellesmere Power Board	2,866	168,101	34,713	..	..	201	235	35,149	15,282	8,813	6,085	..	3,189	13	..	..	33,382	..	1,767	..
16. Sumner Borough Council ..	1,132	16,894	7,164	..	..	..	..	7,164	3,791	1,900	292	421	108	..	..	..	6,512	..	652	..
17. Waitaki Power Board ..	4,661	212,124	46,306	..	..	1,978	815	49,099	18,806	11,208	8,334	1,704	3,454	956	..	..	44,442	3,976	681	..
Sub-total of (A)	112,834	11,283,771	1,135,410	433,393	4,161	8,133	22,883	1,603,980	379,193	454,753	366,793	126,068	68,640	3,980	4,638	1,404	1,399,469	190,270	15,035	794
(B) Receiving Supply through Bulk-supply Purchasers in Section (A).																				
*(Subsidiaries.)**																				
1. Kaiapoi Borough Council(12) ..	527	12,901	3,448	..	..	211	196	3,855	1,409	1,555	275	215	156	..	..	..	3,610	..	245	..
2. Otago Power Board(6) ..	4,591	326,054	48,165	..	76	..	..	48,241	14,240	10,406	12,987	5,139	3,458	831	..	..	47,061	..	1,180	..
3. Rangiora Borough Council(12) ..	780	10,533	6,659	..	..	196	79	6,934	2,507	2,681	107	751	110	..	..	..	6,156	243	535	..
4. Timaru Borough Council(14) ..	5,088	115,639	50,065	..	..	..	71	50,136	22,414	14,395	1,970	..	3,302	..	..	..	42,081	5,022	3,033	..
5. Waimairi County Council(5) ..	3,913	71,483	26,316	34	75	..	80	26,505	13,665	5,029	1,316	4,458	1,389	..	..	..	25,857	573	75	..
Totals	127,733	11,820,381	1,270,063	433,427	4,312	8,540	23,309	1,739,651	433,428	488,819	383,448	130,631	77,055	4,811	4,638	1,404	1,524,234	196,108	20,103	794

* The numbers appearing after the names of the subsidiary B class supply authorities refer to the A class supply authority from which main supply is received.

Gross profit, £215,417; rates collected, £4,312: net profit £211,105. Ratio working-expenses to revenue = 53·01 per cent; ratio capital charges to capital outlay = 5·09 per cent.

TABLE VI.—ROUTE-MILES OF LINE OPERATED BY THE PUBLIC WORKS DEPARTMENT, AS AT 31ST MARCH, 1939.

NORTH ISLAND SYSTEM.

Voltage	110 kV.		50 kV.		11 kV.			3 kV.		Total Route-miles,
Number of Circuits	1.	2.	1.	2.	1.	2.	3.	4.	1.	
Miles	556·77	258·62	447·40	45·48	16·74	35·56	0·18	4·55	6·62	1,369·92

SOUTH ISLAND SYSTEM.

Voltage	110 kV.		66 kV.			33 kV.		11 kV.				6·6 kV.	3 kV.	L.T.	Total Route-miles,
Number of Circuits	1.	2.	1.	2.	3.	1.	2.	1.	2.	3.	4.	1.	1.	..	
Miles	208·82	41·08	636·42	4·18	2·17	37·34	..	1,731·80	80·62	10·00	5·49	3·80	23·61	570·55	3,355·88

Actual Mileages and Sizes of Overhead Conductors in use in connection with above Lines.

	North Island System.						South Island System.					
—	Copper.	A.C.S.R.	Galvanized Iron.	Copperweld.	Cadmium Copper.	Total Miles.	Copper.	Aluminium.	A.C.S.R.	Galvanized Iron.	Copperweld.	Total Miles.
1/·104..	..	..	..	..	..	..	56	..	..	..	..	56
1/·112..	..	..	..	..	307	307	..	..	..	..	..	..
1/·128..	..	..	..	93	..	93	427	..	..	..	..	427
1/·160..	..	..	244	448	..	692	4,031	..	..	2,987	14	7,032
1/·176..	..	..	..	..	..	..	757	..	..	..	..	757
1/·192..	..	..	..	..	..	..	..	..	..	..	..	..
1/0 ..	72	..	..	..	..	72	..	..	..	..	..	..
2/10 ..	..	..	..	..	..	..	12	..	..	..	..	12
3/0 ..	..	..	..	..	..	..	..	..	399	..	..	399
7/·036..	..	..	..	..	..	..	74	..	..	..	..	74
7/·044..	1	..	..	..	..	1	67	..	..	..	..	67
7/·052..	..	..	..	..	..	..	3	..	..	..	..	3
7/·064..	70	..	..	..	..	70	278	5	..	..	..	283
7/·080..	668	..	..	..	..	668	1,022	1	..	..	..	1,023
7/·092..	..	..	..	..	..	..	967	..	..	..	..	967
7/·104..	209	..	..	..	..	209	191	11	..	..	..	202
7/·128..	..	..	..	..	..	..	..	..	..	..	..	..
7/·135..	..	..	..	..	..	..	567	161	..	..	..	728
7/·167..	..	635	..	2	..	637	..	..	..	..	4	4
7/·182..	..	..	..	..	..	..	..	..	..	..	8	8
19/·052..	7	..	..	..	..	7	..	..	..	..	..	..
19/·064..	434	..	..	..	..	434	38	..	..	..	..	38
19/·072..	2	..	..	..	..	2	..	..	..	..	..	..
19/·080..	..	..	..	..	..	..	5	..	..	..	..	5
19/·092..	2,025	..	..	..	..	2,025	1,074	..	..	..	..	1,074
19/·104..	630	..	..	..	..	630	34	..	..	..	..	34
37/·072..	360	..	..	..	..	360	..	..	..	..	..	..
37/·092..	17	..	..	..	..	17	..	..	..	..	..	..
37/·102.	..	..	..	..	..	..	..	..	227	..	..	227
Totals	4,495	635	244	543	307	6,207*	9,603	178	626	2,987	26	13,420†

* Includes 1,077 miles of telephone line conductors.

† Does not include 1,664 miles of telephone line conductors.

TABLE VII.—SAMOAN ADMINISTRATION (APIA). STATISTICS FOR YEAR ENDED 31ST MARCH, 1939.

Installed in December, 1928.

Statistical.	1935.	1936.	1937.	1938.	1939.
Installed capacity (hydro) ..	80 kW.	80 kW.	80 kW.	80 kW.	80 kW.
Installed capacity (oil)	..	45 kW.	45 kW.	45 kW.	45 kW.
Static head	192 ft.	192 ft.	192 ft.	192 ft.	192 ft.
Generating voltage	2,200 volts	2,200 volts	2,200 volts	2,200 volts	2,200 volts.
Supply voltage	220/110 volts	220/110 volts	220/110 volts	220/110 volts	220/110 volts.
Number of consumers (domestic) ..	214	256	294	275	244
Number of consumers (commercial)	74	82	85	113	86
Units generated (hydro) ..	200,911	208,429	223,162	237,148	285,207
Units generated (oil)	..	..	..	..	11,757
Units sold	164,912	165,031	186,310	205,058	234,674
Units non-productive	17·9 per cent.	20·8 per cent.	16·51 per cent.	13·53 per cent.	20·97 per cent.
Maximum load	70 kW.	65 kW.	74 kW.	77 kW.	79 kW.
Connected load	234 kW.	238 kW.	321 kW.	337 kW.	370 kW.
Average load factor	32·9 per cent.	36·4 per cent.	34·45 per cent.	35·17 per cent.	42·75 per cent.
Demand factor	29·8 per cent.	27·3 per cent.	23·05 per cent.	22·85 per cent.	21·43 per cent.
Route-miles of reticulation—					
Overhead	10¼	10½	10½	11½	11½
Underground..	6¾	6¾	6¾	7	7

Financial.	1935.	1936.	1937.	1938.	1939.
	£	£	£	£	£
Capital outlay	21,563	23,325	23,832	22,862	24,002
Loan liability	13,331	12,171	10,748	7,769	6,771
Revenue from sale of electricity ..	3,548	3,755	3,982	4,641	4,899
Revenue, miscellaneous	330	317	815	719	924
Working-expenses	1,053	1,075	1,221	1,291	2,153
Capital charges	1,228	1,233	1,755	1,784	2,027
Total annual costs	2,281	2,308	2,976	3,075	4,180
Profit	1,597	1,764	1,821	2,285	1,643
Accumulated Depreciation Reserve ..	7,895	9,128	10,366	11,416	13,079
	d.	d.	d.	d.	d.
Average revenue per unit sold	5·20	5·45	5·13	5·43	5·01
Average working-cost per unit sold ..	1·53	1·57	1·57	1·51	2·20
Average total cost per unit sold ..	3·30	3·36	3·83	3·60	4·27
	£	£	£	£	£
Capital outlay per £1 of revenue ..	6·35	5·73	4·97	4·27	4·90
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Ratio working-expenses to gross revenue	29·75	26·40	25·45	24·10	36·97
Ratio capital charges to capital outlay ..	5·68	5·29	7·36	7·81	8·44
Ratio net profit to capital outlay ..	7·38	7·57	7·64	10·0	6·85

APPENDIX E.

FIFTEENTH ANNUAL REPORT OF THE MAIN HIGHWAYS BOARD.

The Hon. Minister of Public Works.

Sir,—

In accordance with the requirements of section 24 of the Main Highways Act, 1922, the Main Highways Board has the honour to submit its fifteenth annual report for presentation to Parliament.

The report covers the period from 1st April, 1938, to the 31st March, 1939, though a number of matters referred to are subsequent to the latter date and are included for convenience and completeness of record.

General.

The present length of main highways maintained or subsidized by the Board is 12,206 miles, and particulars of expenditure for the year ended 31st March, 1939, as well as a detailed statement of the position of various works, are shown later in this report. Of the total length of main highways 3,976 miles have been classified as State highways, concerning which special reference is made in another part of the report.

The total expenditure from the Main Highways Account for the financial year ended 31st March, 1939, amounted to £5,185,803, compared with £4,113,046 for the year immediately preceding. The expenditure figures for the year 1937-38 constituted a record in the Board's history up to that period, and it will be seen from the expenditure figures for the year 1938–39 that this has now been exceeded by no less a sum than £1,072,757. Major improvement works have been responsible for a large proportion of this increase, but extensive flood-damage repairs on the East Coast of the North Island and on the West Coast of the South Island placed an added burden on the available funds, together with a large addition to the length of bridging completed.

An increase in the consumption of petrol by motor-vehicles and in the registration of motor-vehicles themselves indicated that the volume of traffic on main highways is still mounting up.

Legislation.

Section 3 of the Finance Act, 1938, empowered the Minister of Finance to borrow up to an additional amount of £1,500,000 for the purposes of construction or reconstruction of main highways. The total loan authority for highways now amounts to £9,500,000.

Finance.

The actual income of the Main Highways Account from revenue sources for the financial year 1938-39 amounted to £2,844,939. The total below shows how this amount is made up, and also the corresponding figures over the previous nine years. In addition to this amount, £2,675,600 was borrowed for main highways. The annual loan charges against the Main Highways Account increased from £338,494 for the year 1937-38 to £439,541 for the year 1938-39:

—	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.
	£	£	£	£	£	£	£	£	£	£
Transfer from Consolidated Fund	35,000	*	*	*	*	*	*	*	*	
Proceeds of tax on tires and tubes collected through the Customs Department	155,722	129,188	84,649	63,253	62,979	91,693	93,308	138,894	158,526	149,017
Registration and license fees of motor-vehicles, &c.	378,135	397,139	372,224	354,216	354,444	355,990	397,606	545,763	523,853	575,170
Motor-spirits tax ..	873,369	1,219,209	1,231,202	644,126	669,868	970,506	1,449,125	1,697,942	1,918,486	2,083,278
Mileage-tax ..	..	..	..	..	1,133	1,284	1,616	3,290	6,162	7,474
Totals ..	1,442,226	1,745,536	1,688,075	1,061,595	1,088,424	1,419,473	1,941,655	2,385,889	2,607,027	2,814,939

* Further transfers abolished by amending legislation.

It will be noted that income from revenue sources for the year 1938–39 was £207,912 greater than the previous highest figure for the year immediately preceding.

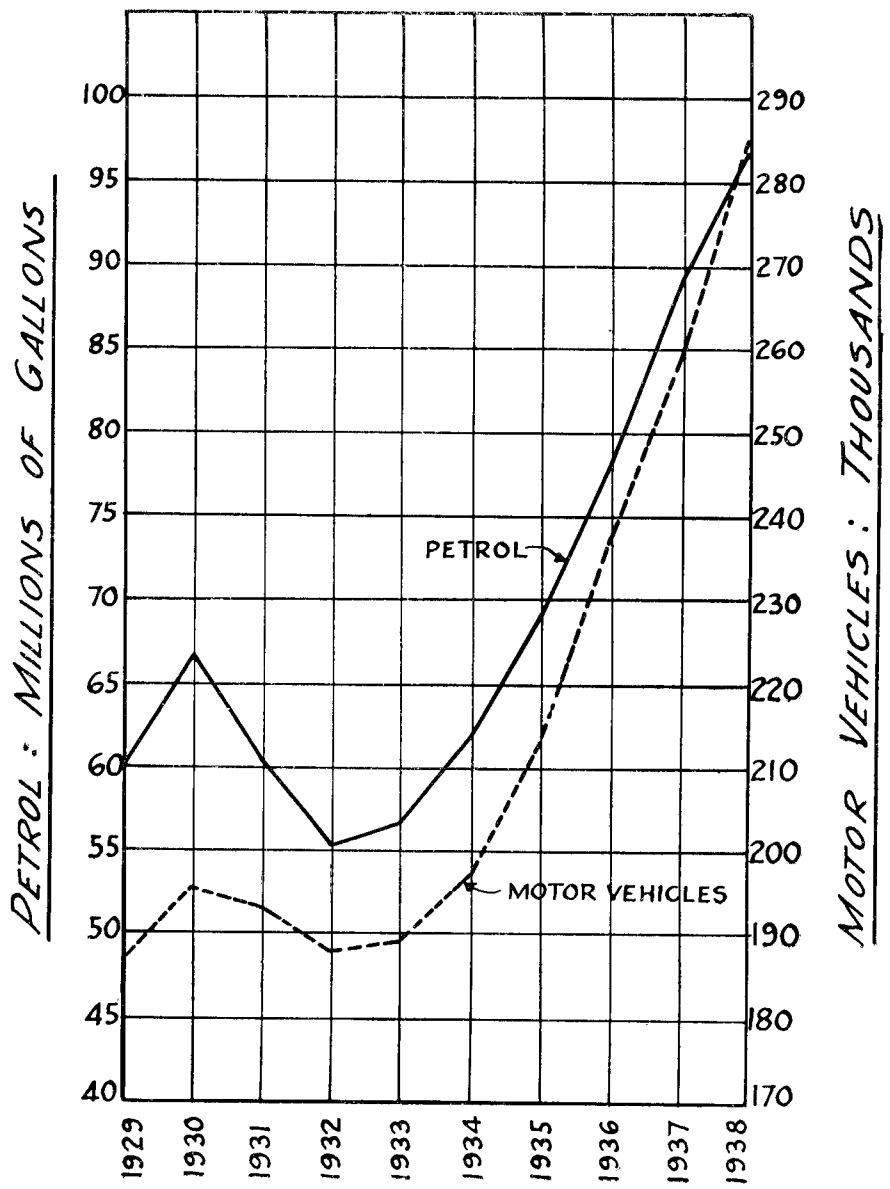
The receipts from Customs tax on tires and tubes show a decrease of £9,509.

The registration, license fees, &c., constitute a record to date, being £51,317 in excess of last year's figure and £29,407 above the previous highest total, which was in the year 1936–37.

The proceeds from the motor-spirits tax were also very much higher for the year 1938–39, being £164,792 greater than the previous year's total, and represents the largest sum which has been credited to the Main Highways Account from this source in any one year.

The revenue for the year 1938–39 which was derived from the mileage-tax levied on motor-vehicles using other than motor-spirits and trackless trolly-omnibuses again showed an increase, being £1,312 greater than for the year immediately preceding, and the highest for any one year to date.

The following graph shows the amount of petrol on which duty was paid during the last ten calendar years, together with the number of motor-vehicles (excluding trailers) licensed at the 31st December of each year. These figures are useful as providing an index of maintenance and construction requirements arising from the actual use of motor-vehicles on the highways:



The petrol-consumption shown in the graph relates to the gross amount in respect of which taxation is initially paid, and therefore actually includes a quantity of petrol on which a portion of the tax is later rebated.

The rebate applies to certain internal-combustion machines, &c., which do not use the public highways. However, the proportion of petrol consumed by such machines, &c., is fairly constant, so that the graph indicates to a sufficient degree of accuracy the number of licensed motor-vehicles in relation to their usage of the roads.

The following is a summary of expenditure from the Main Highways Account for the year ended 31st March, 1939:—

	£	Expenditure. £
Maintenance—		
North Island	908,251	
South Island	403,089	
		1,311,340
Renewals—		
North Island	146,349	
South Island	33,689	
		180,038
Construction and Improvements—		
North Island	1,750,155	
South Island	1,128,153	
		2,878,308
Administration and general charges		167,564
Loan charges (including commutation of toll-gate charges and of Hutt Road fees)		439,541
Subsidy on rates		209,012
		£5,185,803

An analysis of the expenditure for 1938–39 by the Board and by local authorities on **maintenance** of main and State highways as distinct from renewals, construction, 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	908,251	99,701	1,007,952	90·11	9·89
South Island	403,089	53,029	456,118	88·37	11·63
Total	1,311,340	152,730	1,464,070	89·57	10·43

An analysis of the actual expenditure by the Board on maintenance in each Island, as compared with the number of motor-vehicles in each Island at the 31st March, shows the following comparisons for the last ten years in percentages:—

——	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35	1935–36.	1936–37.	1937–38.	1938–39.
North Island—										
Maintenance expenditure	62·30	59·23	62·31	62·84	63·80	65·44	64·80	66·82	66·46	69·26
Motor-vehicles ..	63·63	63·84	63·77	63·78	63·94	64·31	64·84	65·30	65·70	65·89
South Island—										
Maintenance expenditure	37·70	40·77	37·69	37·16	36·20	34·56	35·20	33·18	33·54	30·74
Motor-vehicles ..	36·37	36·16	36·23	36·22	36·06	35·69	35·16	34·70	34·30	34·11

NOTE.—Prior to 1936–37 these percentages relate rather to expenditure from the Revenue Fund, but as from 1st April, 1936, true maintenance figures have been recorded.

The following table shows an analysis of expenditure for the year 1938–39 by the Board and by local authorities on **renewals** in respect of main and State highways:—

——	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	£	£	£		
North Island	146,349	16,414	162,763	89·92	10·08
South Island	33,689	2,248	35,937	93·74	6·26
Totals	180,038	18,662	198,700	90·61	9·39

An analysis of the Board's expenditure and the expenditure by local authorities for the year 1938–39 on **improvements and construction** shows the following position in respect of main and State highways :—

—	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	£	£	£		
North Island	1,750,155	85,556	1,835,711	95·34	4·66
South Island	1,128,153	30,141	1,158,294	97·4	2·6
Totals	2,878,308	115,697	2,994,005	96·14	3·86

The following tabulation shows the amounts which have been provided by the Board and the local authorities on maintenance, renewals, and construction during the last ten years in respect of the complete highways system :

—	1929–30.	1930–31.	1931–32.	1932–33.	1933–34	1934–35.	1935–36.	1936–37.	1937–38.	1938–39.
	£	£	£	£	£	£	£	£	£	£
Maintenance by Board ..	1,049,249	872,577	849,734	600,324	674,026	932,675	1,190,179	900,731*	1,074,112*	1,311,340*
Maintenance by local authorities	375,849	317,839	215,568	168,466	187,735	226,554	284,423	196,023*	153,443*	152,730*
Construction by Board ..	1,007,957	667,902	361,969	159,323	198,295	325,483	428,084	1,501,261†	2,318,600†	3,058,346†
Construction by local authorities	203,148	150,984	94,973	43,181	55,997	57,975	78,263	103,260†	108,225†	134,359†
Totals	2,636,203	2,009,302	1,522,244	971,294	1,116,053	1,542,687	1,980,949	2,701,275	3,654,380	4,656,775
Percentages.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent.	Per Cent.	Per Cent.
Maintenance by Board ..	73·6	73·3	79·8	78·1	78·2	80·5	80·7	82·1	87·5	89·6
Maintenance by local authorities	26·4	26·7	20·2	21·9	21·8	19·5	19·3	17·9	12·5	10·4
Construction by Board ..	83·3	81·6	79·2	77·6	77·0	84·9	84·5	93·6†	95·5†	95·8†
Construction by local authorities	16·7	18·4	20·8	22·4	23·0	15·1	15·5	6·4†	4·5†	4·2†

*These figures represent true maintenance expenditure, whereas in preceding years expenditure under the Revenue Account was shown. †These figures and percentages relate to renewals and construction; previously renewals have been absorbed in both maintenance and construction.

The maintenance figure in the above tabulation excludes indirect charges such as supervision and interest, but includes the cost of flood-damage restoration. It will be noted that expenditure on constructional work was approximately £750,000 greater than in the previous year, and, further, that the proportion found by local authorities still continues to diminish.

The following statement shows the total expenditure by the Board in each Island on both maintenance and construction for the financial year ended 31st March, 1939, the latter including renewals. The figures take into account administration charges, but exclude interest on highways loans :—

—	Expenditure on Maintenance.	Expenditure on Renewals and Construction.	Total Expenditure in each Island.	Percentage of Expenditure in each Island.
	£	£	£	
North Island	943,082	1,969,229	2,912,311	65·51
South Island	418,544	1,206,395	1,624,939	34·49
Totals	1,361,626	3,175,624	4,537,250	100·00

Maintenance.

The total maintenance expenditure by the Board and by local authorities amounted to £1,464,070, as against £1,227,555 the previous year.

The increase is therefore £236,515, and the average cost per mile has risen from £101·2 in 1937–38 to £119·9 in the year under review. This is mainly accounted for by extraordinary flood damage, the repair of which came to charge almost entirely during the period.

The cost of restoration of flood damage is as follows:—

	£
Gisborne District	46,100
Napier District	122,032
Greymouth District	20,503
Nelson District	10,433
Local bodies' (estimated) share	5,000
	£204,068

Charges in connection with the renewal of bridges lost on the East Coast of the North Island during the flood have still to be met, and when the total cost of the damage is assessed it will be found to be little short of the total damage during the Murchison and Napier earthquakes, when the cost of restoration of highways was £280,000.

The sealing of highways, particularly the arterial routes, should result in a general reduction of maintenance-costs, and the downward trend should, before long, become evident.

There are, however, several factors operating in the meantime to offset the accrued benefits. These factors may be summarized as follows:—

(1) Although sealing saves the surface wear, much of the formation is still very "green" and will take a year or two in which to stabilize. In the meantime, due to the accelerated programme, more than the normal quantity of slips may be expected.

(2) There is 77 per cent. of the highway system unsealed, and with the ever-increasing number of vehicles operating increased expenditure can be expected on gravelled surfaces until such time as the motor-vehicle-saturation point is reached. The proportion of motor-vehicles to population is now one to five, the number of vehicles having increased from 287,350 to 305,828 during the year.

(3) The local bodies, having been relieved of the trunk routes, are concentrating, as far as their funds will permit, on improved maintenance on the highway feeder routes, with consequent increased subsidy payments from the Board.

(4) During sealing operations it is necessary to intensify maintenance where there is any delay between the time of completion of the metal surface and the application of the bituminous material, and, of course, the greater the programme in any one year, the greater will be the maintenance in this direction. A regulation providing for reduction of speeds during reconstruction is urgently required.

(5) With the taking-over of the State highways, many sections on which reseals and smoothing coats were overdue were given attention.

Considering the system as a whole, there has been a general all-round improvement in road surfaces. The great majority of complaints have referred to the unpleasant conditions experienced by motorists during reconstruction. Most motorists, however, recognize that these conditions are temporary and unavoidable, and that it is only a matter of exercising a little care and patience when travel comfort will be greatly increased. Too much cannot be said in deprecation of that small section of motorists who "hog" the road at all times. They are a danger to themselves and other road-users. They are most unfair to the workmen, and have no regard for the Board's equipment, their own machines, or any extra construction costs which their action might entail.

TABLE 1.—MAINTENANCE OF MAIN HIGHWAYS (INCLUDING BRIDGES).

Highway District.	Length Maintained.	Board.	Local Authorities.	Total.	Expenditure Average per Mile per Annum. 1938–39.	1937–38.	1936–37.	1935–36.	1934–35.	1933–34.	1932–33.	1931–32.	1930–31.	1929–30.
	M. ch.	£	£	£	£	£	£	£	£	£	£	£	£	£
1. Auckland North	825 25	72,430	10,672	83,102	100·7	115·1	93·2	110·1	97·9	71·6	61·2	79·2	83·4	115·7
2. Auckland South	1,452 72	160,391	27,312	187,703	129·2	126·2	119·3	181·4	141·1	124·6	106·9	145·3	175·8	214·3
3. Tauranga	718 33	110,308	3,749	114,057	158·8	128·4	84·3	153·1	87·1	72·9	61·9	70·7	80·4	90·7
4. Gisborne	394 25	97,167	7,907	105,074	266·5	215·2	182·9	178·1	164·9	106·4	96·3	117·3	163·5	189·5
5. Napier	737 66	195,282	15,441	210,723	285·6	99·6	82·4	138·9	117·7	81·4	79·3	75·9	121·2	146·7
6. King-country	602 25	61,946	6,126	68,072	113·0	95·3	116·5	89·2	99·7	70·8	57·1	70·0	85·8	115·7
7. Taranaki	473 20	53,114	4,678	57,792	122·1	94·7	104·1	123·4	102·5	83·8	84·5	125·2	136·0	172·8
8. Wanganui	539 25	77,093	6,229	83,322	157·1	152·5	115·9	122·0	87·5	80·8	66·0	101·0	126·7	176·1
9. Wellington West	503 71	45,182	8,065	53,247	105·7	102·9	121·9	164·1	124·7	106·0	110·8	149·8	179·0	224·3
10. Wellington East	504 39	35,338	9,522	44,860	88·9	89·4	108·0	175·3	181·3	114·9	91·4	128·6	141·6	159·0
Totals, North Island	6,743 01	908,251	99,701	1,067,952	149·5	119·7	109·0	143·2	118·3	91·3	81·0	104·5	124·8	155·8
11. Nelson	696 36	69,377	6,167	75,544	108·5	99·2	80·3	116·8	101·1	74·1	66·6	103·6	82·0	112·8
12. West Coast	543 14	79,992	5,483	85,475	157·4	145·5	141·8	214·5	142·6	110·8	104·1	136·7	122·4	166·8
13. Canterbury North	364 10	27,319	3,193	30,512	83·8	92·8	64·3	62·8	55·7	58·3	50·0	55·4	72·6	99·7
14. Canterbury Central	750 41	45,008	8,431	53,439	71·2	63·1	54·6	81·1	55·2	50·9	50·2	76·5	75·2	77·3
15. Canterbury South	822 58	40,811	7,130	47,941	58·3	52·6	54·0	96·7	66·9	59·3	67·0	78·7	88·0	89·6
16. Otago Central	843 50	49,035	7,037	56,072	66·5	53·8	49·5	70·1	75·1	50·3	46·4	52·8	36·4	73·9
17. Otago South	523 74	41,431	6,204	50,635	96·6	76·5	62·8	97·8	84·6	73·8	72·8	99·5	90·8	108·1
18. Southland	918 57	47,116	9,384	56,500	61·5	74·8	57·2	57·1	53·9	44·4	41·6	43·2	58·7	57·9
Totals, South Island	5,463 20	403,089	53,029	456,118	83·5	77·9	67·5	96·2	77·6	62·7	60·3	77·4	75·8	94·1
Totals, Dominion	12,206 21	1,311,340	152,730	1,464,070	119·9	101·2	90·5	122·4	100·3	78·5	70·7	92·5	103·1	128·6

Flood Damage.

The cost of flood damage is referred to above. The major flood which occurred was confined to the Napier and Gisborne districts. The greatest rainfall intensity was reached on the area to the North East of Napier, where the storm lasted for seventy-two hours, and gauged up to 32 in.

Many bridges between Napier and Wairoa were swept out to sea, and nearly every culvert was lost or damaged.

Landslides, starting almost from the tops of the ridges, were carried down the hillsides, often taking the roadway before them, so that sections of the highway were completely obliterated, necessitating the using of back-country roads for detours. On the lower country considerable siltation occurred. A new section of paving in the lower Esk Valley was buried under 5 ft. to 6 ft. of silt, and as a consequence a new pavement will require to be built at the higher level.

The Waitangi Washout Bridge, a new reinforced-concrete structure of twenty-two 40 ft. spans, was damaged considerably. Six of the middle spans slumped as much as 6 ft. when the piers were underscoured. The extent of the scour can be gauged from the fact that the piles were all driven 40 ft. to 45 ft. below the orginal stream-bed. Repairs were effected by driving longer piles through the deck to support the superstructure at the original levels. The other bridges lost were mostly of the older types, though they still had a fair residual life.

Construction, Reconstruction, Improvements, and Renewals.

The expenditure on the first three items, covering construction, reconstruction, and improvements in general, was £2,878,308, compared with £2,180,327 for the previous year, while that on renewals, which mainly applies to the renewal of existing bridges and culverts over 36 square feet in area, was £180,038, as against £138,274.

The principal items under this heading are particularly referred to under the districts concerned. A summary of the work completed is as follows:—

Formation	490 miles 62 chains.
Metalling and gravelling	187 miles 67 chains.
Dustless surfacing (mileage added)	384 miles 49 chains.
Bridges	25,561 ft.

With regard to the extension of dustless surfacing, despite somewhat unfavourable weather conditions in the earlier part of the season, a record was achieved by the surfacing of 385 miles of highway, as compared with 288 miles in the previous year. The Board had, as a matter of policy, decided to give special attention to the sealing phase of its work, and it is satisfactory to note the substantial increase in the mileage completed. The total mileage of dustless surfacing is now 2,800 miles, or approximately 23 per cent. of the State and main-highway mileage.

As was to be expected, however, this greater mileage of sealing appears to have had the effect of increasing the demand for more.

The Board has been inundated with requests for the sealing of highways through towns and villages, and also from church authorities, School Committees, and from business people who are suffering from the dust nuisance.

The seriousness of this nuisance is recognized, and, while the Board has given preference in the matter of the sealing of the State and main highways through townships, there is a limit to which sealing can be extended in a patchwork manner.

Each individual request by itself may not entail a very considerable outlay, but in nearly every case the unit cost would be out of all proportion to the benefits obtained. On occasion the cost of transporting the necessary plant to an isolated section could be greater than the rest of the work.

It is therefore desirable that sealing should as far as possible be taken "in a face" according to a planned programme, that those sections which are most economically justifiable be undertaken first, and that various sections should be done in reasonably long lengths in order to spread the overhead and reduce unit costs to a minimum.

The bridge-construction programme has established another record, no less than 25,561 ft., or 4 miles 66 chains, of bridging having been opened for traffic during the financial year. This is more than double the length completed during any previous year. The programme included such notable bridges as the Rakaia Bridge, 5,760 ft., and the North Rangitata Bridge, 2,122 ft., in Canterbury, also the Whirokino Bridge, 3,600 ft., across the Manawatu flood-plain near Foxton.

Table 2.—Construction Work completed during Year 1938–39.

Highway District.	Formation and Widening.	Gravelling and Metalling.	Tar and Bituminous Sealing.	Road- and Plant-mix Bituminous Surfacing.	Bituminous Macadam (Penetration).	Portland Cement Concrete.	Bridges.	Engineering Surveys.
	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	Ft.	M. ch.
1. Auckland North	23 18	21 18	6 72	..	..	..	1,963	46 1
2. Auckland South	128 55	73 57	101 15	7 18	..	..	2,232	72 26
3. Tauranga	36 69	24 76	4 51	..	..	..	1,449	4 11
4. Gisborne	9 2	1 0	3 70	..	..	..	481	13 6
5. Napier	24 54	23 49	16 43	2 35	..	..	1,315	51 25
6. King-country	19 32	15 22	8 40	..	..	..	278	36 73
7. Taranaki	20 59	5 7	5 41	0 54	2 0	..	909	..
8. Wanganui	22 9	0 35	26 79	..	..	..	746	22 31
9. Wellington West	26 40	2 9	19 12	8 1	..	..	4,474	19 43
10. Wellington East	16 35	0 38	16 17	1 60	..	..	268	17 43
11. Nelson	28 26	10 36	23 40	..	..	..	528	48 57
12. West Coast	21 64	2 37	24 14	..	..	..	1,364	50 30
13. Canterbury North	5 11	0 17	5 33	..	..	..	..	13 11
14. Canterbury Central	5 40	2 30	10 14	10 28	..	..	288	23 14
15. Canterbury South	8 42	1 40	12 32	13 40	..	..	8,284	6 32
16. Otago Central	45 50	1 2	29 63	0 75	..	..	375	31 30
17. Otago South	24 52	0 14	21 57	21 22	..	..	90	..
18. Southland	23 44	1 60	20 32	0 38	..	..	517	12 12
	490 62	187 67	357 5	66 51	2 0	..	25,561	468 45

Table 3 below shows the extent and types of work carried out on the main highways system by the Board and local authorities each year since the Board commenced active operations in 1924 :—

Year.	Formation and Widening.	Gravelling and Metalling.	Tar and Bituminous Sealing.	Road-and-Plant-mix Bituminous Surfacing.	Bituminous Macadam (Penetration).	Bituminous Concrete.	Portland-cement Concrete.	Bridges.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Ft.
1924–25.. ..	19	63	6	..	6	..	..	2,434
1925–26.. ..	45	88	16	..	45	4	6	5,168
1926–27.. ..	174	151	35	..	38	12	16	6,408
1927–28.. ..	173	133	83	..	34	..	6	7,760
1928–29.. ..	224	185	122	..	51	14	11	9,482
1929–30.. ..	173	179	133	..	39	31	12	7,547
1930–31.. ..	130	128	95	..	41	14	9	11,175
1931–32.. ..	139	69	129	..	32	9	3	4,062
1932–33.. ..	56	45	72	..	8	..	..	3,178
1933–34.. ..	44	28	75	..	7	..	1	4,988
1934–35.. ..	113	69	172	27	3	..	2	6,641
1935–36.. ..	152	98	245	91	2	..	..	8,718
1936–37.. ..	272	131	184	67	3	..	..	9,575
1937–38.. ..	329	241	282	49	..	..	..	11,106
1938–39.. ..	491	188	357	67	2	..	..	25,561
Totals ..	2,534	1,796	2,006	301	311	84	66	123,803

TABLE 4.—LENGTHS OF MAIN HIGHWAYS METALLED AND SURFACED SINCE INCEPTION OF BOARD'S OPERATIONS (9TH JUNE, 1924).

At close of Period ending	Total Main Highways.	Type of Surface.			Dustless Surfacing added during Year.	Percentage of Dustless Surfacing to Total Main Highways.
		Pumice and Clay.	Gravel and Macadam.	Dustless Surfacing.		
	Miles.	Miles.	Miles.	Miles.	Miles.	
9th June, 1924 ..	5,954	1,535	4,171	248	..	4·2
31st March, 1925 ..	5,954	1,472	4,222	260	12	4·4
„ 1926 ..	6,272	1,384	4,557	331	71	5·3
„ 1927 ..	6,391	1,233	4,726	432	101	6·8
„ 1928 ..	6,608	1,100	4,953	555	123	8·4
„ 1929 ..	10,403	915	8,735	753	198	7·2
„ 1930 ..	10,408	736	8,705	967	214	9·3
„ 1931 ..	10,419	608	8,685	1,126	159	10·8
„ 1932 ..	10,846	539	9,009	1,298	172	12·0
„ 1933 ..	10,878	494	9,005	1,379	81	12·7
„ 1934 ..	10,974	466	9,047	1,461	82	13·3
„ 1935 ..	11,557	397	9,494	1,666	205	14·4
„ 1936 ..	12,048	390	9,715	1,943	277	16·1
„ 1937 ..	12,114	353	9,634	2,127	184	17·6
„ 1938 ..	12,136	332	9,389	2,415	288	19·9
„ 1939 ..	12,206	295	9,111	2,800	385	22·9
Percentage at 31st March, 1939	100	2·4	74·7	22·9	..	..

A general description of the more important highway activities in each district is given hereunder :—

Whangarei District.

Since the completion of the metalling of the 1,000 miles of highway some years ago in what was formerly known as "the roadless north," the Board has centred its activities principally on two main classes of improvement work—namely, the alleviation of flooding, and the renewal of the large number of obsolete one-way timber bridges in this district.

The flood-embankment and deviation work has now reached a stage practically ensuring that hold-ups from this cause are obviated and the possibility of any township being isolated is very remote, both of which conditions were of frequent occurrence; while the bridge-programme is also well advanced, twenty-five bridges being erected during the year, as well as two overbridges. The latter complete the elimination of all level crossings on the State highway between Auckland and Whangarei.

At the same time reconstruction and widening have made good progress, and the sealing stage has been reached on several lengths.

On the Whangarei–Awanui State highway reconstruction is in hand or complete between Awanui and Kaitaia, and at Ohaeawai, Moerewa, Kawakawa–Waiomio, Waiotu Hikurangi, and Hikurangi–Kamo.

Flood embankments at Kawakawa and Waiomio and a 65-chain deviation and bridge at Hukerenui, serving the same purpose, have been carried out.

The Whangarei–Dargaville State highway has been improved by the reconstruction of Steven's Hill, and a 1¼-mile length on the Maungatapere Flat. This section has been sealed since the close of the year, completing a continuous sealed surface between Whangarei and Maungatapere.

Reconstruction is in hand on a tortuous length in the Wheki Valley, also a 200 ft. bridge over the Awakino River.

On the Dargaville–Maungaturoro State highway reconstruction of 6 miles to Mititai was completed, of which 1¾ miles have been sealed, also a mile at Ruawai. Reconstruction is in hand in the Paparoa Township, and two bridges have been erected. Forty chains at Maungaturoto Railway has been formed and metalled.

On the Waipu highway the existing bitumen surfacing has been shouldered to a completed length of 4¾ miles, and the section through the township to the Waipu Gorge has been reconstructed and primed.

The Brynderwyn Deviation on the Birkenhead–Maungaturoto State highway is well towards completion, and on the connecting link southward to Topuni 5½ miles of formation and metalling were carried out. Many dangerous bends in the existing road have been avoided by short deviations. Two bridges were erected near the Kaiwaka Township, and three between Kaiwaka and the Pukekaroro Junction. Work on the subsidized highways has consisted principally of bridging, the most important being Lowe's Bridge, 155 ft. long, on the Waimamaku–Ohaeawai highway.

Reconstruction and sealing was undertaken on a ¾-mile length through the Kaeo Township, and improvements are under way near Mort's Bridge, both these works being on the Waimate–Mangonui highway.

On the Lake Omapere–Maungatapere highway a 3-mile length of the Te Pua section was formed and metalled.

Auckland District.

An extensive programme has been carried out in this district, no less than 100 miles of initial sealing having been applied, in addition to 7¼ miles of plant-mix and similar coatings on reconstructed lengths and worn-out surfaces. In addition, a total length of 2,012 ft. of bridges, including four overbridges, were erected or brought to completion during the year.

Reconstruction of the Birkenhead–Maungaturoto State highway between Albany and Massey Road was continued, 4 miles of sealing being applied, and the 62 ft. Dairy Flat Bridge put in hand.

The 2-mile length through Warkworth was metalled and sealed; and some improvement work carried out on the Rodney County section.

On the Auckland–Helensville State highway reconstruction between Lincoln Bridge and Helensville has been continued, 6¾ miles of formation and metalling and 4½ miles of sealing being carried out, and the Taiapa Bridge erected. Heavy metalled shoulders are being applied to widen the concrete pavement between the Whau Bridge and Henderson, and the approaches to the proposed overbridge at Helensville are well advanced. Reconstruction in this township is also in progress.

The Auckland–Hamilton State highway has required but little attention as to the surfacing; 2 miles of smoothing-coat were, however, applied between Mercer and Ohinewai, and 6 miles of shoulders constructed on the Bombay Deviation.

On the Hamilton – Te Kuiti highway the Waipa County section is now completely reconstructed and surfaced, 2¾ miles being sealed during the year and a light seal-coat applied over 5 miles of plant-mix. Widening is in hand in the Te Awamutu Borough, and a "traffic filter" is being installed at the highway intersection in the centre of the town.

In the Otorohanga County the metalling and sealing of 6¾ miles were completed, and a further 3¾ miles are under construction. The 140 ft. Mangaorongo Stream Bridge was erected.

The reconstruction of the Pokeno-Paeroa highway was continued, and formation is now complete up to 18 miles. From Pokeno 6½ miles of two-course metalling were carried out, and a similar length received a priming-coat.

On the Hauraki Plains County length, 65 chains were reconstructed and sealed, while the existing surfacing between Ngatea and Paeroa was widened over a length of 10½ miles.

Between Thames and Paeroa 4½ miles were sealed, completing this highway, and a footbridge erected at the Kaueranga River crossing.

On the Paeroa–Whakatane highway construction was continued between Karangahake and Waikino, 24 chains being completed; 3¼ miles were sealed, and extensive flood-damage in the Karangahake Gorge made good.

Between Hamilton and Paeroa 3½ miles of plant-mix smoothing-coat were laid, and the Piako overbridge, 140 ft. long, completed.

The Hamilton–Rotorua highway is now completely sealed except for a short length in Cambridge. Work during the year comprised 6½ miles of formation, 11½ miles of metalling, and 16 miles of sealing.

The Karapiro Bridge, in Cambridge Borough, 220 ft. long, was completed, and the approach-work is in hand. The Tirau Subway, with its approaches, was completed.

The highways under local-body administration are being very generally improved, many being under reconstruction for sealing. These include the Wairau, Parkhurst, Kumeu–Albany, and Henderson–Kumeu in the northern subdivision of the district.

South of Auckland reconstruction between Papakura and Clevedon is in progress, 5½ miles being nearly ready for sealing, and a short length has been treated in the Clevedon Township; ¾ mile was also sealed in the Howick division of the Howick-Manurewa highway.

The reconstruction and sealing of 2 miles of the Te Kauwhata – Waitakaruru highway is nearing completion.

On the Drury – Waiuku – Kohekohe highway work is in progress between Runciman and Paerata, 2 miles being sealed, while between Pukekohe and Puni 5¾ miles were primed, of which 2½ miles received a seal-coat. Four bridges and a large culvert were constructed on this highway.

On the Piako County section of the Tahuna–Ohinewai highway 4¼ miles were reconstructed, and a 5-mile contract is in hand on the Waikato division.

On the Pukekohe – Glen Murray highway reconstruction is in hand along the river on the Franklin County section, and this Council has also some heavy work in progress on the Pukekohe–Bombay highway.

Reconstruction and sealing have been carried out over 3 miles of the Waikato division of the Taupiri–Morrinsville highway, and the Taupiri overbridge completed, except for some adjustment of access at the approaches. In the Piako County 6 miles are under construction, 3 miles having been metalled during the year.

On the Hamilton–Raglan section reconstruction was continued in the Raglan County, 4¼ miles being sealed, and a second coat applied over 5¾ miles of the Waipa division.

The Puniu overbridge on the Te Awamutu – Bartons Corner highway was completed, and a length of 4½ miles reconstructed on the Te Awamutu – Cambridge link. The 92 ft. Mangati Bridge was erected on the Te Awamutu – Pirongia highway.

The Hamilton–Tauhei highway was improved by the sealing of 40 chains and the metalling of a further length of 3½ miles.

The 150 ft. Kaniwhaniwha Bridge on the Horotiu–Te Rore highway was erected and its approaches completed.

Ninety chains of the Frankton–Pirongia highway were sealed, and a further 4 miles are in hand. The Morrinsville–Ngarua highway is now completely surfaced, 1¾ miles being added this year.

Reconstruction and sealing are in progress on the Waipa County division of the Kihikihi–Putaruru highway.

The sealing of the Piako County length of the Te Aroha – Waharoa highway was completed, and 2¾ miles reconstructed and sealed on the Ngatea–Waharoa highway, between Kiwitahi and Walton.

Sealing is being widened on the Pairere–Kaimai highway, and a reconstruction contract has been let for 5¾ miles from Pairere Junction to Hinuera.

On the Waitoa–Taupo highway work is in hand south of Tokoroa, 10¼ miles of formation and 4¾ miles of sealing being completed. The overbridge at Hamlin's was erected, and that at Putaruru South is in progress.

A contract for the reconstruction and sealing of 3 miles of the Waihi Beach highway is in hand. On the Pipiroa–Coromandel highway 3¼ miles were sealed in the Hauraki Plains County division, and sea-wall protective work continued in the Thames County. The 138 ft. Tapu Bridge was erected, and the sealing between Waiau Bridge and Coromandel completed.

The Coromandel – Mercury Bay highway was closed by flood damage for a short period, but repairs are now complete, and 4¾ miles from Whitianga to Kaimarama were sealed.

Tauranga District.

Reconstruction of the State highways has been appreciably advanced, and the sealing programme commenced. On the Paeroa–Whakatane highway, 1 mile was sealed at Kaituna and a similar length at Whakatane, while 5¼ miles were reformed between Maniatutu and Matata. The Koutu overbridge at Rotorua was completed, &c., 3 miles of heavy formation carried out at Lake Rotorua on the Rotorua–Whakatane highway, and 2½ miles of metalling near Whakatane.

Reconstruction was commenced between Whakatane and Taneatua, and a 60 ft. bridge erected in the Waioeka Gorge.

Reconstruction was continued over ¾ mile on the Rotorua–Taupo highway, and south of Taupo the 80 ft. Waitahanui Bridge was erected. The Rangataiki Bridge on the Taupo–Napier highway is nearing completion.

Reconstruction was continued on the Waitoa–Taupo highway, 8½ miles being completed and metalled.

On the Tauranga–Matamata highway the reconstruction on the Kaimai Hills was continued, 3¾ miles being completed, 2 miles primed, and 1½ miles sealed. The Boulder and Beacon Creek bridges 120 ft. and 200 ft. in length respectively, were completed.

The Opotiki – Te Araroa coastal route is being considerably improved, 5 miles of reconstruction and seven bridges being completed during the year.

Two miles of second-coat sealing were carried out in the Mount Maunganui Township, and preparation work is in hand between Rotorua and Lake Tarawera.

Gisborne District.

Construction works throughout this district were retarded in the normally active pre-winter period, April to early June, by the wide-spread need for concentrating on restoration of storm damage. The 1938–39 summer and autumn were favourable in the main, however, and enabled good progress to be made with some important works.

On the Whakatane–Gisborne State highway the Waikohu Deviation of approximately 1 mile, including two substantial two-way bridges, was completed. This eliminates two level crossings and provides greatly improved alignment.

The renewal of the Waipaoa River Bridge at Kaitaratahi, of six 90 ft. steel-girder spans, was practically completed, and the approaches were let by contract.

On the Gisborne – Te Araroa State highway the bulk of the reconstruction and sealing of 5½ miles near Tatapouri was completed, leaving only a few unstable sections between Gisborne and Tolaga Bay unsealed.

The Raponga Bridge, 43¾ miles from Gisborne, was rebuilt with substantial approaches. The old bridge was a narrow structure on bad alignment and subject to immersion in floods.

Eighty-two miles from Gisborne a ¾-mile deviation was constructed, which removes the need for traversing the Mangakino Stream bed, a troublesome section after heavy rains.

One hundred and thirty-eight miles from Gisborne on the Opotiki – Te Araroa section of the coastal route, the 300 ft. Whangaparaoa River Bridge was practically completed at the end of the year.

On the Gisborne to Wairoa via Morere Highway, a decided improvement was made in the reconstruction of the Mangakaiwharangi No. 2 Bridge to two-lane standard and on improved alignment. This bridge is designed to pass the highway traffic under the railway bridge which is about to be built.

Substantial progress was made with the renewal of the Mangakaiwharangi Bridge No. 1, which will eliminate a very awkward bridge approach and obviate another level crossing on the new railway.

On the Gisborne–Napier, via Hangaroa, State highway, steady progress was made last summer with reconstruction and preparation for sealing, the lengths concerned being 2 miles at Waeranga-o-kuri, and 3 miles south of Hangaroa Turnoff.

A considerable amount of work was done in reconstructing and preparing lengths for sealing on the other highways radiating from Gisborne.

Napier District.

As a result of the record flood in April, 1938, in which the Napier–Gisborne and Napier–Taupo State Highways were completely blocked by slips, and most of the bridges up to Wairoa destroyed, construction works in this district were considerably set back. Restoration measures have on some sections necessitated the formation of a new road on the surface of the silt-deposit, and relocation and regrading on many other lengths.

The Taupo–Napier highway has been put into fair order again, and reconstruction work continued. On the Runanga deviation 1¾ miles have been formed, and ¾ mile widened on the lengths north and south of Baker's Deviation. This deviation, which comprised a major pumice cutting, was completely destroyed by the storm, and the original route has been temporarily reverted to.

Between Eskdale and the Mohaka Bridge extensive cuts and fills have been completed, a length of 4 miles being improved or deviated.

The Eskdale section was entirely reinstated at a higher level on the silt-bed, and the Esk Valley route widened up to Te Pohue.

The State highway to Wairoa, on which the damage was particularly heavy, is still under restoration, though by means of deviations, slip-removal, and temporary bridging it was made available for traffic in about a month after the flood. The old route was fully restored before Christmas, though several permanent bridges are still to be erected.

The reconstruction programme has been resumed, work being in hand between Tangoio and Te Ngaru Bridge, and beyond Waikare. McKenzie's Deviation on the latter section has been completed, effecting a major improvement, and Begley's Deviation is nearing completion.

On the Napier – Palmerston North highway the principal item of damage was the scouring-out and subsidence of several spans of the Waitangi Washout Bridge, recently erected. Repair-work, including heavy pile-driving, was put in hand, and the bridge completely restored in September, 1938.

The surfacing between Napier and Pakipaki also required extensive renewal.

The principal construction works on this highway have comprised level-crossing eliminations, of which two were dealt with by the 1¾-mile Maharahara Deviation, two by overbridges at Waipukurau and Mangamanaia, while another at Papatawa is well in hand.

The reconstruction of obsolete lengths of original sealing has been undertaken, the principal being in Waipawa and Woodville Boroughs, a 2-mile length near Matamau, and 3¾ miles near Tahoraiti. Five stream-bridges were erected, three of which were on level-crossing-deviation works.

A length of 1 mile on the Woodville–Masterton highway has been reformed, and a new sealing-coat applied.

Various country highways were damaged by the flood, chiefly in regard to surfacing, though some bridges also suffered.

Sealing was carried out over 1½ miles of the Otane – Tuki Tuki, 2 miles of the Waipawa–Tikokino, and 1½ miles of the Waipawa – Onga Onga highways.

On the Dannevirke–Waipukurau highway, 2½ miles of sealing are in hand in the Waipukurau County, and 90 chains were completed in the Patangata division, also 50 chains of reconstruction in the Dannevirke County.

Three miles and three-quarters of plant-mix smoothing-coat were applied over a deteriorated length of sealing on the Hastings–Maraekakaho highway.

On the Waipawa–Pourerere highway, 1¼ miles were sealed in the Waipawa County, and the Patangata County completed a 2½-mile length.

On the Woodville–Tamaki highway, 1¾ miles were sealed, and two small bridges erected.

Several shorter lengths on other highways were also sealed by the local bodies concerned.

The Whakatu Overbridge on the Farndon – Paki Paki highway was completed.

The Frasertown – Lake House highway was completely blocked by slips for some time, a period of six months elapsing before normal conditions were restored. Special attention has been given to metalling and the strengthening of bridges to carry the heavy loading in connection with the Tuai Power-house plant extension.

On the Rotorua-Waikaremoana highway reconstruction has proceeded, 1½ miles being widened and a considerable length metalled.

Taumarunui District.

The difficulties associated with road-construction in heavy steep papa country have in earlier years retarded the full development of the arterial highways in this district by comparison with others, but of recent years good progress has been made, and during the period covered by the report a considerable amount of construction has been carried out. At the end of the year a total length of 22 miles was under contract for sealing. On the Hamilton – Te Kuiti length, 2 miles were formed and metalled, and between Te Kuiti and Pio Pio 5¾ miles were advanced to the sealing-stage, while farther south a length of 1 mile was reconstructed.

Between Te Kuiti and Taumarunui, 5½ miles were formed and metalled. Contracts for sealing 6¾ miles on this section and a similar length south of Taumarunui are in hand. In the Manunui Township 2½ miles have been sealed.

Top-course metalling was undertaken over 15 miles of the National Park – Taupo highway.

The subway at Short Street, which eliminates the level crossing in the Taumarunui Borough has been practically completed, and the overbridge at the Spiral is well advanced towards completion.

The 9-mile unmetalled length of the Pio Pio – Tatu highway is under construction, formation being more than half-completed and 1 mile metalled. Improvement-work is also in progress on the Caves – Lemon Point, Stratford–Taumarunui, and other secondary highways; a number of short bridges have been erected, and some heavy river-protection work is in hand between Manunui and Piriaka.

Stratford District.

On the arterial highway the improvement of the Mount Messenger section is in hand, and the Mimi Valley, Mangamaeho, and Pa Hill Deviations have been continued. Preliminary work on the Mangamaeho-Uruti section has been commenced. Reconstruction is in progress between Waitara and New Plymouth, 4 miles having been formed and 1 mile sealed. This length, by reason of its situation, is regarded as one of the most necessary works in the district.

Reconstruction is also in progress between New Plymouth and Hawera, and the numerous open railway crossings on this section are being rapidly eliminated, the three standard methods, by deviation, subway, and overbridge, being all in evidence. A new bridge, 150 ft. in length, was erected over the Waiwakaiho River, and one of 105 ft. over the Kahouri Stream is well advanced.

South of Hawera the 6¼-mile length down to Mokoia has been reconstructed and sealed, and the 150 ft. Manawapou Bridge at the district boundary erected.

On the Opunake coastal highway a 50-chain deviation is in hand, by means of a cutting through the Oakura Hill, and a similar length has been reconstructed and sealed near the Okato Township. The 112 ft. Okahu Stream bridge was erected.

A further 4 miles have been metalled on the Stratford–Taumarunui highway, and further work is in hand, the upper end of this highway being the only unmetalled length in the district.

Subsidiary highways are receiving a good deal of attention by the respective County Councils, chiefly by way of widening and improving existing pavement, and, in some cases, extension of sealing.

Wanganui District.

State highways in this district have shown very active progress during the year particularly on those leading inland. Reconstruction was continued on the National Park Wanganui (Pārapara) highway, 7¼ miles being formed and metalled and a sealing programme of the same length entered upon, 2½ miles of first-coat being completed. It is proposed to commence improvements on the Waimarino County section this year. On the Taihape route a length of 20 miles, on which the original metalling had been extensively reconditioned and added to, received a first-coat of tar, while 6½ miles of construction and 8½ miles of metalling were carried out. Three bridges were erected, as well as the Vinegar Hill overbridge, the approaches to which, including a small stream bridge, have yet to be formed as part of the reconstruction of this section. The Cliff Road subway was completed, and the Greatford overbridge approaches are nearing completion.

On the Hawera – Wanganui highway 70 chains on the Whenuakura Hill were reconstructed, 52 chains sealed on the Waitotara Hill, and 4½ miles of second-coat applied between Maxwell and Kai Iwi.

The Kai Iwi overbridge was completed, and the relocation of the hill section just north of Wanganui put in hand.

On the Turakina–Cliff Road highway the 2-mile length between Marton and Cliff Road was reconstructed and sealed, and the Bonny Glen overbridge erected. The Wellington Road subway in Marton was also completed. Between Raetihi and Ohakune a 2-mile length was reconstructed and sealed by the Waimarino County, and contracts are in hand for two short bridges in Ohakune Borough.

On the Rapanui highway, leading to Kai Iwi Beach, the Waitotara County Council has let a contract for reconstructing and sealing a 5-mile length. The Wanganui River (left-bank) highway was improved over a further 1¾ miles at the Pipiriki end, and several lengths were sealed on secondary highways in Patea and Wanganui Counties.

Wellington West District.

The State highways in this district have been improved mainly by isolated works of considerable magnitude. Chief among these is the Whirokino Deviation, with its ¾-mile bridge, which is now complete and in use by traffic, removing the bugbear of flood interruptions on this highway, which is one of the most important in the Dominion. Its remaining associated work, the new bridge over the Manawatu River itself, will be undertaken in the near future, and will be of great value from the aspect of safety and convenience of traffic. Even more impressive, though not yet complete, are the Ngahauranga Gorge reconstruction and the Paekakariki Hill alternative sea-level road, though the latter is not yet declared a main highway and is not financed by the Board, but it will, of course, become part of the arterial route to the north.

The Ngahauranga Gorge work will provide an adequate four-lane approach to the capital, saving incidentally ½ mile in distance. In its length of 1¾ miles is involved 520,000 cubic yards of rock-excavation, of which 336,000 cubic yards had been completed at the end of the year; the balance is now almost accounted for, as well as a very large amount of creek-diversion by tunnelling, culverting, &c., and the actual roadwork is well in hand. Extensive reconstruction is being undertaken to modernize the 3¼-mile Ngahauranga – Petone section of the Hutt Road, as one of the principal works of the current year.

Overbridges were completed at the Manukau and Paraparaumu level railway-crossings, the approaches to the Porirua overbridge were surfaced, and plans are in hand for eliminations at Ohau, Waikanae, and McKay's, north of Paekakariki.

The Foxton Borough section, which was in bad condition, was reconstructed, and 6¾ miles of smoothing-coat applied on the Horowhenua County section.

On the Napier – Palmerston North highway the Manawatu Gorge section is under reconstruction, with the object of obtaining the maximum possible traffic-width: and 1½ miles near Palmerston North have been rebuilt and primed.

The 368 ft. Awahuri Bridge on the Sanson – Palmerston North highway was completed, and the Ashhurst overbridge on the Greatford–Ashhurst highway put in hand, together with 1¼ miles of approach roads. Reconstruction was continued between Palmerston North and Shannon, and the standard of this section has been materially improved; the sealing of some portions has already been undertaken.

A contract has been let for the Longburn overbridge and the work commenced.

Improvements, including in most cases sealing, have been carried out on many of the subsidized highways, including the Foxton Beach, Foxton–Shannon, Ashhurst–Pohangina, Longburn–Rongotea, Te Horo – Waihoanga, and Upper Hutt – Waikanae highways.

Wellington East District.

On the State Highway between Woodville and Upper Hutt the principal works have been the completion of the Eketahuna subway (except for approach metalling) and the construction of a ½-mile deviation in Featherston Borough. Work was commenced on the improvement of the Greytown Borough section, and some curve-easing and smoothing-coat work carried out north of Carterton. The decking of the 1,200 ft. Ngawapurua combined road-rail bridge near Woodville is being brought up flush with the rails, greatly facilitating highway traffic.

On the Pahiatua–Akitio highway the widening of 5 miles of the tortuous Makuri Gorge is in hand, 1¼ miles being completed. Widening was also undertaken over 1¼ miles of the Eketahuna–Alfredton highway, two bridges constructed, and 2½ miles reconstructed and sealed on the Eketahuna–Nireaha highway. On the Masterton–Castlepoint highway, 1½ miles were sealed, and the 2-mile Weraiti Deviation on the Masterton–Stronvar highway practically completed, as well as 90 chains of reconstruction and sealing. On the Martinborough–Masterton highway 3 miles of similar work were carried out. The 170 ft. Wainuioru Bridge on the Tuparupuru – Te Wharau highway is nearing completion. In the Featherston County, 6 miles were sealed on the Martinborough – Lake Ferry highway and 3¼ miles reconstructed on the Featherston – Pigeon Bush highway, half of which was primed. Shorter lengths on other highways were also improved.

Nelson District.

The programme of works instituted on the inception of the State highway system is now showing appreciable results, particularly in the district adjacent to Blenheim and in the Moutere area. A total length of 23½ miles has received a sealing-coat.

Reconstruction has been in progress on the Elevation – Para, Spring Creek – Blenheim, and Blenheim–Dashwood sections, 3¼ miles being sealed during the year, also ½ mile in Picton Borough.

The deviation eliminating the Spring Creek and Tuamarina railway-crossings, which includes the 960 ft. Wairau Bridge and a bridge over Spring Creek, is in hand, and two railway-crossings at Riverlands have been dealt with by means of a ½-mile deviation.

Farther south, the Mirza Creek Bridge was built, and sealing carried out in Seddon Township. Reconstruction has been commenced on the Lion's Back section, and a contract has been let for the 300 ft. Kekerangu Bridge.

On the Blenheim–Nelson highway 6½ miles were sealed between Blenheim and Renwicktown, and reconstruction is practically completed up to Kaituna. The major improvements on the Wangamoa Hill and Valley sections have been continued, a further 2¼ miles being completed. On the Richmond–Collingwood highway the Appleby overbridge of three 30 ft. spans was completed, and the sealing of 9¾ miles between Upper Moutere and Motueka carried out. At the Riwaka Bridge a flood-opening of two 20 ft. spans was constructed in the approach-bank, which was also raised and widened. On the Moutere Hill 3¼ miles were reconstructed, and the improvement of the 16-mile Takaka Hill section practically completed. Reconstruction work is in hand between Takaka and Onekaka.

Between Kohatu and Korere, on the Nelson-Westport highway, 1¾ miles are being reconstructed the work including the elimination of two open fords by large culverts. Widening and improvements to grade and location were continued on the Hope Saddle-Eight Mile length, 3½ miles being accounted for. Sealing is being carried out in the Murchison Township, and retaining-walls erected to widen points in the Buller Gorge. Reconstruction between Kawatiri and Owen Junction is in hand. Over 10 miles of protective fencing has been erected on this and the other State highways in this district.

On the County highways considerable progress has been made, including the reconstruction for sealing of 2 miles on the Spring Creek—Raranga, 1¼ miles on each of the Picton-Havelock and Blenheim Aerodrome, and 1 mile on the Renwicktown-Hope Junction highway, the sealing-coat having been applied on the latter. The 210 ft. Hodder River suspension bridge was completed and the 250 ft. Taylor River Bridge is in hand.

Greymouth District.

On the Nelson-Westport State highway widening and improvements have been continued on the Buller Gorge section, and also on the Pakihi section near Westport. At Inangahua Junction a length of 1 mile has been sealed, also two short lengths through the railway-construction camps at Tiroroa and Blackwater.

On the Inangahua-Greymouth State highway improvements were continued northwards from Greymouth to Ahaura. This work involves several important deviations to eliminate narrow and tortuous descents into gullies, two of which have been completed. Formation on the deviation at Nelson Creek, which will reduce the distance between Greymouth and Reefton by 1 mile, is nearing completion, and the construction of a 200 ft. bridge over Nelson Creek is in hand. At Callaghan's, formation is well in hand, and a contract has been let for a 60 ft. bridge over the Creek.

The improvements between Stillwater and Ngahere were completed during the year, and the length prepared for sealing.

Sealing was completed over 2 miles through the Ikamatua Settlement, between the school and the Big Grey Bridge, 29 chains through Ahaura, and two shorter lengths farther south.

One mile of protective fencing was erected.

On the Greymouth-Weheka State highway improvements have been continued southwards from Hokitika, and work is in hand on a length of 7½ miles south of the Kaniere Bridge. Of this length, 5¼ miles of formation have been completed, and 1 mile 6 chains sealed. Further improvements have been carried out near the Kokatahi Track north of Ross; a 70-chain deviation has been completed in Ross Borough, to eliminate the steep and narrow road over Mont d'Or Hill; 2¼ miles through Hari Hari have been widened; and a deviation is under construction near Wataroa, where the highway is threatened with erosion by the Wataroa River.

The 51-chain South Beach Deviation, Greymouth, which eliminates two level railway-crossings, was sealed; and a deviation, including a 40 ft. bridge over the Nelson Creek and an overbridge, to eliminate a railway-crossing of bad visibility, is well in hand. The overbridge at Kaihinu was completed, the approaches sealed, and the approaches to the New River Bridge were also sealed.

Near Weheka a bridge of two 50 ft. spans, with approaches and protective works, has been constructed over the Hare Mare Stream, disposing of the last remaining bad ford on this highway.

On the Arthur's Pass—Kumara Junction highway the year's work has been principally connected with bridging. A bridge of six 44 ft. spans was erected over Rough Creek in Arthur's Pass Township, two large culverts with improved approaches were constructed at O'Neill's and Nelly's Creeks, and a further culvert is in hand.

Between Kumara and Kumara Junction 3¼ miles were sealed.

Widening and regrading have been carried out on several lengths between Westport and Ngakawau.

A 30 ft. bridge over Kiwi Creek was erected and the construction of a 360 ft. bridge at Ngakawau in place of the combined bridge is in hand.

The approaches to the Waimangaroa Overbridge were completed, and a 1 mile deviation between Waimangaroa and Birchfield to eliminate two crossings was completed.

The formation of a deviation at Kongahu, to remove the highway from damage by foreshore erosion, was completed.

On the Westport–Greymouth coast highway widening and straightening have been continued between Charleston and Punakaiki.

At Barrytown considerable trouble has been experienced as a result of continued beach-erosion, and the rock-facing has proved insufficient to protect the highway. Plans have been prepared for a 2½-mile deviation inland from the beach.

Between Greymouth and Runanga, the Camp overbridge and approaches have been completed, the Cobden overbridge has also been completed and opened for traffic, while the approaches, which are in use, are nearing completion. The highway from this overbridge to Runanga has been sealed for a length of 3½ miles.

Between Reefton and Maruia heavy floods in April practically destroyed the highway over a length of 10 miles. Restoration work occupied several months, and improvements have been continued, nearly 12 miles being completed except for top-course metalling. Three bridges are under construction, a water-drive has been completed, and a considerable amount of protective work carried out.

The Westland County Council has sealed a total length of 2¼ miles on secondary highways.

Canterbury District.

Improvements to the State highway in the northern portion of the district are being carried out in conjunction with the construction of the South Island Main Trunk Railway, which in many places will necessitate new alignment. This is particularly so at Goose Bay, where the highway is being deviated across the bay, with the railway following the old road-line. North of Kaikoura new bridges and deviations have been arranged for.

Between Oaro and Parnassus 1 mile of widening, &c., has been carried out.

In the Cheviot and Waipara Counties the State highway is being reconstructed, the grades being eased where necessary and curves formed to a minimum radius of 10 chains. During the year 3½ miles were completed, and it is expected that 8 miles, which includes the Cheviot and Parnassus Townships, will be sealed during the current year.

On the inland route between Waipara and Kaikoura, the Weka Pass Deviation, which eliminates a steep hill and several bad corners, has been completed ready for sealing, and a contract has been let for an 80 ft. bridge. The township sections at Rotherham, Waiau, and Hanmer were sealed.

On the arterial route to the West Coast, plant-mix paving has been continued to Kirwee and completed in Darfield Township. At Porter's Pass a section of 4 miles has been widened and the alignment improved. On the Lake Lyndon side of the pass considerable deviation from the former alignment has been made, and the highway round Lake Pearson has been realigned and widened. Contracts for two bridges over the Craigieburn Stream have been let. Between Cass and the Waimakariri River widening and curve improvement have been completed for 1½ miles.

Contracts were let for plant-mix paving of the Summit Highway from Evans Pass to Dyer's Pass, and for sealing the extension to Gebbies' Pass. This work was finished in May last, and Canterbury now has a sealed scenic drive of 18 miles along the crest of the Port Hills.

The highway from the Kiwi to Governor's Bay was also paved. Between Lyttelton and Governor's Bay the widening and realignment have been completed and the section is being metalled.

Reconstruction of the highway to Akaroa is proceeding, and during the year work has been carried on between Birdling's Flat and Little River along Lake Forsyth. Considerable improvement to the alignment has been made, mainly by large fills running across swampy sections near the lake. A contract has been let for sealing the section from Motukarara to Kaituna and in the Little River Township.

In Akaroa County 29 chains of widening and 7 chains of deviation were completed on the Duvauchelle – Robinson's Bay section.

The overbridge at Prebbleton has been completed, thus eliminating a dangerous railway-crossing on the highway to Southbridge. Sealing has been extended in Ellesmere County, and the contract in hand will give a full-length sealed highway from Christchurch.

Plans for the overbridge at Sockburn are nearly completed, and land has been acquired. To obviate stock having to use the overbridge, arrangements have been made for the erection of a separate overbridge for stock and a by-pass.

Further work on the State highway to Timaru was the completion of the Rakaia Bridge, 5,762 ft. long, which replaces the old combined road-rail bridge erected in 1873. A contract was also arranged for the Rakaia overbridge, which is just north of the river bridge.

Work has proceeded steadily on the Rangitata Deviation, which includes bridges over the two branches of the river, new road-formation, and 21 miles of metalling and sealing. The 2,122 ft. bridge over the north branch was completed, and the 1,042 ft. bridge over the south branch was well advanced at the end of the year. This has since been completed and the deviation opened to traffic. The deviation has been planned to obviate open railway crossings, and the new road follows on the east side of the railway, the only overbridge required being at Winchester. Plans for the overbridge have been prepared, and sealing contracts are in hand for 16 miles.

Bridging and sealing have been completed on the State highway in Waimate County, and extensive repairs carried out to the wooden bridge over the Waihao River.

The sealing of the Pleasant Point – Cave section and of the Albury and Fairlie Township section on the arterial highway to Cromwell has been completed. A contract has been let for a deviation and bridging at Albury to eliminate the three narrow timber bridges.

Otago District.

With the reconstruction carried out on the Timaru–Dunedin highway during the past year the requirements of present-day traffic are steadily being provided for. The whole length from the Waitaki River to Dunedin is now sealed, with the exception of the approaches to the overbridge at Palmerston. Several further improvements are contemplated, notably a deviation at Maheno to eliminate a level railway-crossing and a length subject to flooding, and an overbridge at Waikouaiti. A number of bridges also remain to be renewed.

During the year contracts were let for the renewal of the 100 ft. Kakaho Bridge north of Hampden, and the 95 ft. Kuri-iti Bridge in Hampden Borough. Work on the first named was well advanced by the end of the year.

The 7¾-mile length between Hillgrove and Shag Point was completed and sealed, and the final coat applied on the Palmerston–Merton section of 12½ miles.

The Palmerston level crossing was eliminated by an overbridge of four 50 ft. spans, and a 72 ft. bridge erected over the Pleasant River.

On the Timaru–Cromwell highway the Lindis Pass – Tarras construction is being carried out in two sections—namely, Lindis Downs where a 7-mile deviation is in progress, and at Lindis Pass where a length of 25 miles leading over the pass is being improved.

A total of 9¼ miles of formation were completed during the year, making the total 21½ miles to date, on the greater part of which the base-course has been laid. The remaining work is of a lighter nature, and the formation will be to a great extent carried out with the power-grader.

A length of "dust-laying seal" has been applied to the main highway in front of the Cromwell Hospital.

On the Milton–Queenstown highway 2¾ miles between Alexandra and Clyde have been prepared and sealed, and sealing was also carried out in the Clyde and Alexandra Townships. At Muttontown Gully, where a deviation is to be constructed, 2½ miles have been left unsealed.

The 12½-mile Clyde Cromwell section has been reconstructed and sealed, the work including the erection of the 95 ft. Leaning Rock Creek Bridge.

A footpath is being constructed between Cromwell Railway-station and Cromwell. From Cromwell to the Hospital Turnoff, 1½ miles have also been primed and sealed.

From the Hospital Turnoff to Queenstown, a length of 36¾ miles of reconstruction is in hand. Improvements were started at the Cromwell end of the Kawarau Gorge, and by the end of the year the greater part of the Gorge section had been completed except for the top-course metal. A ½-mile length of "dust-laying seal" was applied in the Queenstown Borough.

On the Queenstown–Invercargill highway, improvements between Frankton and Kingston consist of widening the 10¾-mile section between Lumber Box and Staircase Creeks. Five miles of formation have been completed.

Contracts were let for a further section of the Pukeuri–Kurow highway between Horse Gully Road and Bortons. Work was commenced on a 7¾ mile length, and at the end of the year 6 miles of metalling had been completed and 2½ miles primed.

Reconstruction of the Leith Valley highway by means of a deviation through Pigeon Flat has been continued. The whole length of 5½ miles has been fenced and culverted, and formation is well advanced, 3¼ miles being completed.

Between Kyeburn and Middlemarch the construction of a 35-chain deviation, to eliminate two level railway crossings near Kokonga, has been commenced.

The Hawea – Haast Pass highway is being widened and improved over a length of 3 miles along the lakeside section.

The reconstruction of the county section of the Port Chalmers – Aramoana highway, 5¾ miles in length, is in progress, 2½ miles being completed. Renewal of the seawall is the main feature of the work, and the widening is being carried out by re-erecting the wall farther out in the harbour.

On the Dunedin–Gore State highway satisfactory progress was made with the reconstruction between Milton and Clinton, the ½-mile deviation between Lovells Flat and Balclutha being completed, also a further length of 12 miles between Balclutha and Clinton. This formation included three deviations aggregating 2 miles of new formation, on straight alignment avoiding several tortuous sections of the existing highway. Curves have been eased to a minimum radius of 10 chains.

Between Clinton and Waipahi the approaches to the Wairuna overbridge have been commenced, using spoil from railway-works in the vicinity.

Two short bridges were erected at Kaihiku.

Sealing carried out during the year comprised 9½ miles between Milton and Balclutha, which completes this section, and a further length of 2 miles immediately south of Balclutha. In addition, 2½ miles received a priming-coat. In Green Island Borough the shoulders were widened to the kerb-line and primed through the business area. Bituminous plant-mix smoothing-coats were laid over lengths totalling 15 miles between Green Island and Milburn.

On the Milton–Queenstown highway a 3-mile length from Clarksville towards Glenore was reconstructed and sealed. Improvements on the length between Mount Stuart and Round Hill were continued, and good progress made in difficult country. Formation is practically complete to Round Hill, a total length of 5¾ miles of formation and 1½ miles of metalling being completed. A ¾-mile length in Lawrence Borough was reshaped and sealed, thus completing the borough section.

In Roxburgh 1½ miles of preparation and sealing were carried out.

On the Middlemarch highway the reconstruction and sealing of 7½ miles between Mosgiel and West Taieri Church, commenced the previous year, were completed.

Reconstruction of the Dunedin–Duke's Road Highway, leading to the Taieri Aerodrome, was continued during the year and the work substantially completed, 1½ miles of formation, 3 miles of base-course, and 2 miles of two-course metalling being accounted for. The priming and sealing is expected to be finished during the current year.

Short lengths were prepared and sealed on several of the lesser highways in this district, and a smoothing-coat applied on a 6-mile section between Collingwood and Portobello.

Southland District.

The reconstruction and sealing of the main arterial route from Dunedin to Invercargill has proceeded throughout the year, 17 miles having been sealed and an additional 25 miles prepared for next season, when it is expected that all unsealed gaps will be completed.

The deviation between Pukerau and McNab, to eliminate flooding, has been completed except for one bridge, and reconstruction to the county boundary north of Pukerau is also completed. The Otikerama overbridge near Pukerau is under construction.

Reconstruction between Brydone and Dacre has been completed, and a seal-coat applied between Dacre and Kennington.

Reconstruction between Invercargill and Bluff has been continued and 5½ miles sealed, and a contract has been let for an overbridge at Greenhills.

On the Queenstown Invercargill State highway the Lowther Deviation, which eliminates two level railway crossings, has been completed by the erection of 110 ft. of bridging, and a length of 6½ miles was reconstructed on the Caroline Dipton-Benmore section.

Sealing was applied in Lumsden Township and Winton Borough. Flood-alleviation works at Mandeville on the Gore Lumsden highway are in progress.

On the Lumsden – Te Anau – Milford Sound highway, work has proceeded at the Hollyford end, including the Homer Tunnel in which, in spite of the four months' interruption by winter conditions, the heading was advanced by 1,216 ft., leaving 1,587 ft. to complete.

On the approach road, construction work is nearing completion. One mile of formation, 3¾ miles of gravelling, and 85 ft. of bridging were carried out during the year.

At the Milford End 50 chains of bush-clearing, 1¼ miles of formation, 142 ft. of bridging, and 2½ miles of base-course have been completed. This work is in a forward state, and access by good track to the tunnel-portal should be possible by the time the heading is through.

Much useful work was carried out on comparatively short sections of county highways, one of the principal items being the reconstruction and sealing of 1¾ miles of the North Invercargill – Waikiwi highway.

Elimination of Level Railway Crossings.

During the past year £258,484 was spent on the elimination of level railway crossings, bringing the total to date to £654,699.

The following table shows the progress to 31st March, 1939, as compared with progress to 31st March, 1938:—

	As at 31st March, 1938.	As at 31st March, 1939.
Work completed	50	90
Contracts let and/or work in hand	56	30
Proposals completed	5	4
Proposals in hand	42	35
Surveys, &c., in hand	38	26
Investigated and deferred	28	35
	219	220

The programme is proceeding at a rate which bears a reasonable relation to the Board's expenditure as a whole, though more progress might have been made had extra design and field staff been available and supplies of reinforcing steel been more readily obtainable.

Some of the eliminations of lesser importance have been undertaken somewhat ahead of their turn simply because plans of structures already completed have been readily adapted to meet the particular case. On the other hand, a few eliminations of first importance call for special treatment and are still awaiting survey and design.

Amongst these might be mentioned the Waikanae and Ohau overbridges in the Wellington district. Both of these overbridges are close to stream-crossings, and in each case comprehensive design is required. In the case of the Waikanae railway-crossing, further surveys and investigation work are in hand in order that alternative solutions eliminating this crossing can be considered.

State Highways.

During the period the major reconstruction activities have been on the State highways, though the Board has indicated to local authorities that it is prepared to meet all of the reasonable requirements of secondary or feeder highways in order that, as far as possible, the improvement of the system as a whole will synchronize.

There has been an inclination on the part of some to suggest that too large a proportion of the funds available is being spent on the State system. However, there is no gainsaying the fact that the routes which now form the State system did have first call on county finance while they were under the control of the counties, and the Board could not, under any set of circumstances, allow feeder routes to take preference over the main arteries which are carrying by far the greater bulk of the traffic.

As the trunk routes are completed, the funds will, it is anticipated, admit of an accelerated programme on the secondary routes, though it must be borne in mind that the scope of the improvements to these routes must always be considered in relation to the traffic densities and general requirements.

Visit of Inspection to the South Island and Contact with Local Bodies and Automobile Associations.

In accordance with the Board's usual practice, contact has been maintained with local bodies and automobile associations interested in the control of main highways, and during the year tours of inspection were made to the southern portion of the South Island during the latter part of January and early February, and the northern part of the same Island was inspected towards the end of April.

Opportunity was taken to inspect major works in progress, and several programmes for future improvements were considered in conference, in addition to which local problems brought forward by the different local-body and automobile association representatives were discussed and the Board's general policy outlined.

It was gratifying to the Board to find during its recent tour that the general standard of maintenance on the highways traversed was very good indeed.

The replacing of one-way bridges on the principal main highways as part of the Board's programme and the magnitude and urgency of this work was very evident to the Board during recent inspections. This question will continue to be dealt with as fast as design can be arranged and finance made available.

The Board found evidence throughout its tours of continued good will and co-operation between the Board, the local authorities, and the motor organizations. Almost universally the last mentioned kept in close touch with the Board's representatives on highway matters of local import, and their views as representative of the road-users are often of great assistance.

Of particular gratification were the expressions from both local bodies and motorists of the high esteem in which the Board's representatives (the District Engineers of the Public Works Department) are held, and of the assistance and advice received from their officers.

In the course of the tours several important outstanding matters were the subject of discussions, and decisions finally arrived at of a satisfactory nature.

Measures to promote Road Safety.

The Board has continued to give active assistance and co-operation to the New Zealand Road Safety Council with regard to measures calculated to make the highways system as safe as possible.

It is significant that while the percentage of accidents in urban areas has increased and on settlement roads has remained stationary that on highways has shown a reduction of 18½ per cent.

The prime consideration for promoting road safety is the geometrical layout. This aspect requires careful consideration to see that curves are properly transitioned and bear a suitable relationship to adjacent sections of highways. For instance, a 7-chain-minimum-radius curve joining two long flat tangents would be positively more dangerous than, say, a 3-chain-minimum-radius curve in rough topography. The same conditions apply to vertical curves at the junctions of different gradients.

All the other amenities, such as adequate paving width, shoulder width, superelevation, &c., are given due attention.

During the period some £12,179 has been spent on guard-fences. It has been estimated that 4 per cent. of the total length, or 500 miles, of guard-fencing is required on the highway system, and this is proceeding regularly as the more dangerous sections are reconstructed and placed on their permanent alignment. On certain sections in rough country where aesthetic considerations do not weigh, strong sheep-proof fences have been erected on the edge of the formation to serve the dual purpose of farm and guard fence. From the farmers' point of view this type often provides the only suitable fencing-line.

The painting of white lines to demarcate the traffic lanes, the placing of direction signs, and the printing of short, simple warning-notices on the pavement itself, are being energetically continued by the maintenance organizations.

Standard drawings and specifications for the guard-fences have been distributed; but, as regards the white-posting of highways, the topographical and other conditions vary so widely throughout New Zealand that no hard-and-fast rules can be laid down.

The clear definition of road-edges at curves is very valuable, but as an aid to night-driving, particularly under foggy conditions or when passing opposing vehicles, white posts also should be placed along straight sections of road. On curves, posts serve the double purpose of showing that a curve exists, and both by day and by night they indicate the radius or sharpness of the alignment. The motorist may not be conscious of this latter fact, but there is no doubt that a suitably defined curve does give a driver a mental picture of the speed at which that section of road can be negotiated. White posts and white lines are being extended as rapidly as funds permit.

During the year the Board took the opportunity of testing out a new method of advising motorists as to road edge and alignment. In this case the carriage-way is defined by a system of special reflectors mounted on posts. The reflectors are moulded from a kind of clear synthetic resin, and for the limited period of observation proved very effective. As a more extended and comprehensive test, sufficient of these markers for some 18 miles of highway have been ordered.

Special consideration has been given to the construction of footpaths adjacent to boroughs or where the conditions are of an urban character. One of the essential requirements is that footpaths should be sealed in order to ensure their use.

The Board also considered the question of cycle-tracks and has adopted as a general rule the policy of constructing such tracks where the motor-vehicle density has reached sixteen hundred on the average day.

In this connection, however, many difficulties are presenting themselves, not the least of which is the inadequacy of the 66-ft.-wide road reserve to make room for the segregation of the various road-users.

The greatest densities of traffic occur on the sections adjacent to the major centres, where it is necessary to face up to the world-wide problem of the high cost of providing extra width of right-of-way.

Improving Visibility at Corners and Intersections.

Collisions at intersections are found to be one of the most prolific sources of traffic accidents, and special subsidies have been made available for the improvement to corner visibility.

Generally the rates of subsidy have been fixed as follows:

Improvement at Junction of	Subsidy rate.
State highway with main highway	£6 for £1.
State highway with county road	£2 for £1.
Main highway with main highway	£3 for £1.
Main highway with county road	£1 for £1.

Already proposals have been submitted in some of the most urgent cases not only for the taking of the land, but also for the setting-back of the fences and reconstructing the road at the intersection on easier curvature.

In other cases the acquisition of the land has been proceeded with in anticipation of the actual improvement work being carried out as funds allow or circumstances require.

Lighting on Main Highways.

As indicated in last report, an Advisory Committee on Highway Lighting was set up to recommend the system of lighting that should be adopted on the several sections of highway which carry an average of more than 2,500 vehicles per diem.

The Hutt Road between the Thorndon Ramp and Petone has been given prior claim, firstly, because it has the greatest density of traffic; secondly, because the work of providing a dual carriageway is already in hand; and, thirdly, because the extra traffic incidental to the Centennial Exhibition demands that special precautions be taken to avoid night accidents to the many visitors who may not be familiar with the routes approaching Wellington.

When considering the system that should be adopted, the Advisory Committee was somewhat restricted in its deliberations on account of the confusion that might be caused to the navigation lights of the harbour and the signal lights of the railway, which parallels the road, if gaseous-discharge lamps of the sodium or mercury type were adopted.

Attention was therefore confined to the incandescent types, from which a satisfactory system has been evolved, when considered from the point of view of pavement brightness, glare, variation of light intensity, and general economy.

The greatest difficulty encountered in the design of the system was met when the committee reached the point of considering the details of installation. There are already three pole-lines along the road the Railway telegraph-line on the eastern boundary, the Post and Telegraph line some 20 ft. therefrom, and the power-line supplying the Hutt Valley Power Board on the western side of the road.

It is proposed to suspend a staggered system of lighting between the telegraph poles on the one side of the carriage-way and the power-poles on the other, but before the power-lines can be interfered with it will be necessary to clear three feeders from the arms on one side of the power-poles and arrange alternate supply to the Power Board through the Melling Substation. The material required for the installation has now been ordered, and it is hoped to have it in operation before the end of the year.

The committee will now be in a position to consider the lighting of that section of No. 7 State Highway between Auckland and Papakura, though it would appear that the correct procedure would be to install the lighting system in stages as the widening work proposed is carried out.

In view of the importance of this matter the Board has purchased a Luckiesh and Moss visibility meter, also a street-lighting photometer, in order that values can be ascertained under varying conditions.

Signposting, Centre-line Marking, etc.

A £3 for £1 subsidy was provided on the cost of signposting carried out on main highways by Automobile Associations during the year ended 31st March, 1939, as in previous years, involving an expenditure of £4,277 from the Main Highways Account. Up to the date mentioned the amount contributed by the Board towards this work totalled £22,896.

Where the Board or local authorities erected signs required by regulation, or for traffic safety, the expenditure incurred was treated as ordinary maintenance, as also was the cost of centre-line marking.

Residential Accommodation for Regular Maintenance-men.

During the past year further progress has been made in the provision of up-to-date accommodation for maintenance-men engaged on State highways under the direct control of the Board. Standard designs of cottages for single and married employees have been adopted for general use throughout the Dominion, but if local conditions warrant a departure from these designs buildings more suitable to the location are erected. As far as practicable, married surfacemen are located in centres where schooling facilities are available for their families, and single men in the more remote localities.

Proposals for additional accommodation are under consideration, and arrangements are in train for the acquisition of suitable building-sites.

State Highways Depots.

For the efficient organization of maintenance gangs on State highways careful consideration has been given to the establishment of depots at suitable locations on the highway system. To provide for the housing of road-graders, lorries, maintenance tar-sealing plant, and other machinery buildings and multiple garages have been erected and fitted with the necessary tools and equipment to enable minor plant repairs to be undertaken on the spot. Stores of fuel oil, motor-spirits, and spare parts are also kept in stock to obviate any delay in the operation of the plant, this being most essential in those districts where dustless paving has not yet been provided and where constant grading is necessary to maintain roads in correct shape.

Temporary depot buildings are being provided in some districts until such time as planned sealing programmes have been completed, when permanent depots will be established in localities most suitable for the effective maintenance of highways under the control of the Board.

Beautification of Highways.

Continued public interest is being shown in the beautification of highways, and the Board is deeply interested in any amenity of this nature which will add to the enjoyment of road-users generally.

There is ample evidence before the Board to show that there is a number of interested societies and local bodies who are keen to proceed with the work, but in most cases some financial assistance is desired, and if the scheme is to be carried out to the best advantage co-ordination of effort is essential.

Approval has already been given in a number of cases to the planting of trees along suitable stretches of road reserves after the Board has first satisfied itself that the growth of these trees would not constitute a future danger to the travelling public.

The many urgent improvement works still requiring attention on highways do not permit of any of the Board's funds being made available for the beautification of the countryside at the present time, but as soon as the Board feels it is in a position to do so careful consideration will be given to the appointment of an expert officer to the Board's staff with the necessary knowledge and administrative ability to be responsible for the proper co-ordination of all work proposed by beautifying societies, local bodies, and other bodies interested and desirous of improving the appearance of our highways.

If the scheme is to be a success, the Board realizes that such an appointment is necessary in the interests of efficiency and uniformity, and in order that any work proposed may be considered in relation to a comprehensive plan.

Advances to Local Authorities.

In many instances during last financial year local authorities found that they were unable to raise loans from outside sources for the purpose of financing their share of the cost of urgent and desirable works required on main highways. Taking advantage of the powers conferred upon it by special legislation, the Board advanced to local bodies, on short-term loans, the amounts required in such cases.

The number of loan agreements entered into during the year was fifteen, the amount advanced being £26,497, as compared with twenty-one agreements totalling £28,801 19s. 3d. for the year 1937–38.

The total principal advanced up to 31st March, 1939, was £296,089 8s. 11d., the amount outstanding at the date mentioned being £106,461 2s. 1d.

Plant.

The facilities provided by the Board to enable local authorities to acquire plant under the hire-purchase system were taken advantage of to a greater extent than formerly, the purchases for 1938–39 under this heading amounting to £46,835. This showed increases of £10,420 and £31,141 for the years 1937–38 and 1936–37 respectively.

Since the inception of the scheme, plant to the value of £288,168 has been purchased, of which amount £67,058 was outstanding at 31st March, 1939.

The items purchased during the year under the hire-purchase system were: Graders, 15; trucks, 15; tractors, 2; excavators, 2; crusher, 1.

In addition to the above, the Board, for its own use, purchased the following items of plant: Graders, 49; tractors, 43; motor-lorries, 31; power-control winches, 23; angle-dozers, 17; crushers, 17; compressors, 17; road-rollers, 14; road-sweepers, 11; pump and engine, 10; concrete-vibrators, 7; excavators, 7; bitumen-sprayers, 6; concrete-mixers, 6; snow-ploughs, 5; road-planers, 5; machine rock-drills, 5; electric-motors, 4; scarifiers, 4; winch and oil-engines, 4; metal screens, 3; oil-engines, 3; power motors, 3; scrapers (carry-all), 3; trailers, 3; road-markers, 2; bull-dozer, 1; conveyor, 1; generator set (50 kW.), 1; lathe, 1; motor-car, 1; steam-hammer, 1; pile driving monkey, 1; revolving scraper, 1.

Testing of Highway Materials.

Owing to delay in delivery of the equipment no tests have yet been made with the Los Angeles abrasion machine. However, the machine has now arrived, and it is hoped to commence testing at an early date.

Since the samples of rock and stone submitted during the year could not be tested for wear in the Los Angeles machine, the Petrological Laboratory examined the samples microscopically and

conducted the usual tests for abrasion, hardness, toughness, absorption, and, in some cases, for crushing-strength. These tests not only served as a check on the quality of aggregates supplied by contractors, but also, in conjunction with geological reports, have been of considerable aid to field engineers in their selection of quarry-sites.

A large number of soil tests was carried out and research continued in regard to base- and top-course materials, subgrade soils, sealing-chips, and concrete aggregates.

As a result of research and experiments, many aggregates and soils which in the past have been looked upon as being unsatisfactory roading-materials can now be treated to provide satisfactory service as subgrades or as metal crusts. Laboratory work often indicates methods of blending and "humouring" by which satisfactory stable aggregates can be produced from what would otherwise be unstable ingredients.

Many districts have been supplied with equipment for testing and analysing materials, and the other districts will be supplied with similar equipment from time to time in order that the routine examination of their local materials can be undertaken. This would leave the central laboratory more freedom to undertake check tests and research work.

An interesting investigation was conducted during the year with the object of developing methods of improving the adhesion between bituminous binders and certain mineral aggregates which in the past have not been satisfactory in this respect. It was found in the case of some aggregates that a thin coating of cement-wash greatly decreased the tendency for sealing-chips to "whip-off" under traffic. Some cheaper method was sought, with the result that a marked improvement in adhesion was often obtained by pretreating the aggregate with a very low percentage of certain light distillates, and, in some cases, satisfactory and still cheaper results were achieved by adding the distillate to the bituminous binder. Further research is being continued in this direction.

In addition to carrying out a large number of routine identification tests of bituminous materials, the Dominion Analyst has conducted during the year other important examinations on behalf of the Board.

A very fine piece of new apparatus by which the ductility of bituminous materials will be determined with the minimum of personal control was recently purchased and is about to be put into operation. It is expected that this machine will play an important role in the examination of sealing-binders. Another interesting and valuable piece of equipment for ascertaining the lability index of emulsions has been built and assembled by the laboratory staff. This will allow of a number of determinations at the one time and will go far to eliminate the personal factor. The purchase of other equipment for the testing of soils is being arranged.

In connection with the fluxing and cutting-back of asphaltic products it has been found that with a particular base material the percentage of flux oil or cutting distillate is inversely proportional to the logarithm of the viscosity of the mixture. In other words, the plot of the percentage of flux or light distillate against the logarithm of the viscosity is a straight line. A knowledge of this relationship allows of a proportioning forecast of considerabe precision. Given two points on a semi-logarithmic graph the amount of a particular light distillate to be added to an asphalt or a road oil to produce a certain desired viscosity is readily determined. It is also probable that supplementary graphic methods could be applied to the manipulation of two fluxes simultaneously, but so far this has not been attempted.

The Board's technical staff and the Dominion Analyst have been closely co-operating in an effort to develop tests which will be an indication of the durability of asphaltic binders. This problem is exercising the minds of roading authorities throughout the world. As far as the usual thin bituminous carpets laid in New Zealand are concerned it would appear that soft binders which possess low susceptibility to temperature change, and which retain their ductility, are to be desired. Based upon a certain amount of preliminary investigation and results, a series of tests will shortly be undertaken, which, it is hoped, will be an indication of weathering and loss of ductility in service.

With the new and improved methods of extracting oils and light distillates from the crude product of the oil-well, with possible injury to the residual constituents which are depended on for roading purposes, and considering the new and various sources from which our asphaltic binders are supplied to-day, the urgent need for durability tests will be appreciated. The stage has been reached where the service of thin bituminous carpets depends upon the "life" of the binder, and not upon the mineral aggregate, hence the importance of ensuring that only the best asphaltic materials are being used.

Highway Engineering and Design.

The past year has been a period of considerable progress in design and construction methods, and of accelerated activity in a programme of widespread improvement to the highways of New Zealand. Every effort has been made to provide an adequate system of road communication with all practicable facilities for the free, orderly, and safe flow of traffic.

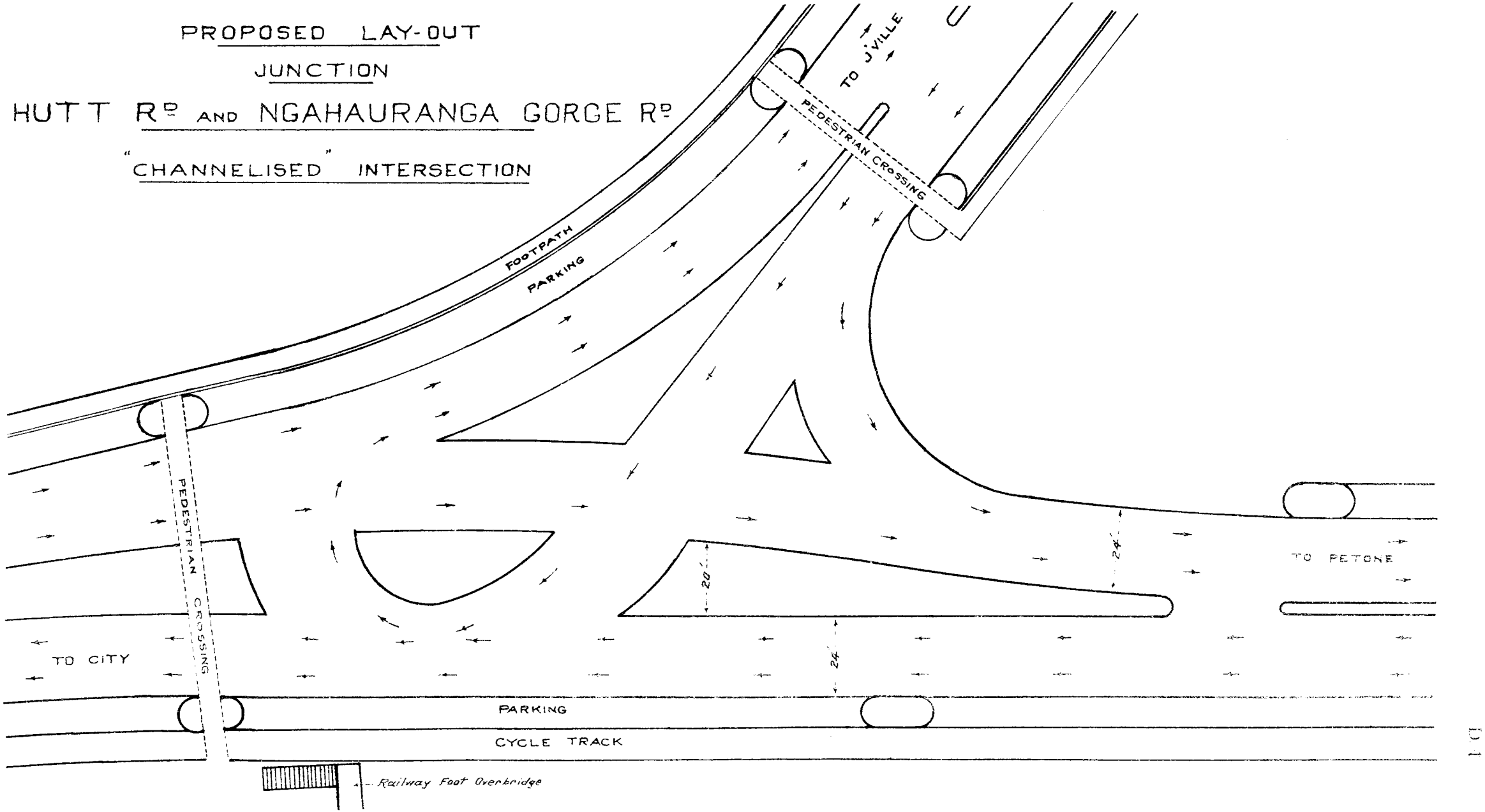
The Board is faced with the building of new highways to meet the demand of present-day and future traffic, and with the adaptation of existing roads to meet modern conditions. This means that highway engineering standards must often be based upon compromise between many factors, but a thorough knowledge of certain principles and highway requirements is essential before a reasonable adjustment between the large number of factors involved can be reached. With this in mind the Board continues to pursue an energetic policy of research and investigation into the many problems which remain to be solved.

PROPOSED LAY-OUT

JUNCTION

HUTT Rd AND NGAHAURANGA GORGE Rd

"CHANNELISED" INTERSECTION



The development of road transport has been so rapid that, even with the comparatively sparse population of New Zealand, the traffic density in some instances has become such that two-lane roads will no longer meet requirements. The Hutt Road, with its eight thousand vehicles per day, with peaks of twelve thousand, and the Ngahauranga Gorge Road, both adjacent to Wellington, are in the category where two lanes are no longer adequate.

These roads are being realigned and reconstructed as four-lane highways with central dividing-strips, separate ways for pedestrians, stock, and cyclists, and with parking-space clear of the carriage-ways, which is essential if the road is not to be narrowed to a two-lane standard by stationary vehicles. When these works are completed within the next few months two important sections of highway will have become adequate for their traffic densities with the maximum of safety. Statistics from overseas countries conclusively demonstrate that the physically divided multiple-lane type of highway, in which each track is confined to traffic proceeding in one direction only, and in which parking-space is provided clear of the carriage-ways, not only improves the traffic-flow and increases the capacity, but also very definitely reduces the dangers of motoring.

The State highways approaching Auckland and Christchurch are now being designed as divided multiple-lane highways to provide segregation of different classes of traffic, and an extra outlet to the north of Dunedin is under construction.

Road and street intersections give much cause for serious thought. They not only cause serious interruptions in the free flow of traffic, but they are also critical and potential danger-points. Separation of the road grades by subways and overbridges is the satisfactory and ultimate solution of the problem, but the high cost of this method of treatment generally precludes its adoption. In the meantime it is the Board's aim to provide adequate sight-distances at intersections and junctions in rural areas; and, where traffic intensities are greater, the "roundabout" or the "channelized" type of traffic-filter which regulates traffic flow, and will provide a measure of protection which is not present with wide open spaces where uncontrolled operation of vehicles causes much confusion. In these latter types of layout the area of conflict between different streams of traffic is much too large, and is consequently a prolific source of accidents.

In towns and built-up areas, where speeds are restricted to 30 miles per hour, minimum sight-distances at intersections of 120 ft., with a preference for 150 ft., should be provided. Allowing only half a second reaction time, the stopping-distance of a car at 30 miles per hour on an average wet bituminous surface, with a coefficient of friction of 0·3, is approximately 120 ft. In business portions of a town such sight-distances will usually be quite impracticable, but, owing to the density of traffic, speeds in shopping and commercial localities will necessarily be much below 30 miles per hour, and stopping-distances will be correspondingly less. On rural highways, where 60 miles per hour may obtain, the stopping-distance on the average wet bituminous surface may be 7 chains, so that sight-distances of at least 500 ft. should be the aim.

The "roundabout" type of intersection, the merit of which lies in the "interweaving" capacity of the units of converging traffic-streams at a moderate speed, is generally much less costly than the overbridge or "clover-leaf" treatment, but even the "roundabout" occupies a large area of land the acquisition of which is often impracticable. Representations are occasionally made to the Board that a small circular island "roundabout" should be installed at intersections, but small circular islands do not serve the functions of a "roundabout," which must primarily be large enough in diameter to provide sufficient space for a vehicle to gradually weave through the traffic into its proper outgoing lane. In the case of a properly designed "roundabout" there is no direct right-angle crossing of opposing lanes of traffic. With the small circular island, however, there is insufficient space to make the gradual interweaving movement and, compared with the plain intersection, the points of conflict may be increased.

At "channelized" intersections traffic is segregated into directional lanes by the installation of islands which clearly indicate the channels for the movement of vehicles in every desired direction, It is a first essential that the design should be simple and that motorists should be guided into their correct paths without hesitation or doubt. Well maintained and readily visible directional signs, particularly on the pavement itself, are often necessarily a part of the "channelized" system, but such signs must be quite clear in meaning and carefully placed.

The junction of the Hutt Road and Ngahauranga Gorge Road, both of which are multiple lane highways with a central dividing strip, is being laid out on the "channelized" principle so that, if necessary, at a future date a modified "clover-leaf" layout can be adopted. The dividing strips are gradually widened out until a width of at least 20 ft. is attained at the intersection. The traffic-lanes are then, as it were, cut through the widened strips to form islands separating the various paths in such a way that vehicles make a direct crossing of traffic moving in one direction only. The islands of 20 ft. width allow space for pausing or taking refuge before moving on to the next stream of traffic.

No general rules can be laid down to ensure an ideal condition for all road junctions and intersections. Each particular crossing has its own problems and requirements and must be considered accordingly, but there are certain first principles which should be the basis of any treatment. There should be adequate sight-distance at plain intersections for speeds which are likely to obtain, and at the more important crossings the layout should be, firstly, so simple that even strangers have no doubt as to the path to be followed, and, secondly, such that the points and areas of conflict are reduced to a minimum.

Another aspect of geometrical layout to which the Board has given special study and consideration is the treatment of horizontal curves. In the interest of the safety and the comfort of motorists, and the unhampered flow of traffic, new roads must be laid out with curves and superelevations to suit present and future traffic requirements, and old obsolete roads must be brought up to a similar standard.

It is realized that for present-day speeds it is of prime importance that horizontal curves should be laid out as properly designed transitions, so that at constant speed there is uniform rate of application of centrifugal force with no shock or impact as the vehicle passes from the straight to the curve. Under the speeds which have obtained until recently the design of curves was not of the same significance, but for even average present-day rates of road-travel, curve layout is of vital importance in the interests of safety.

With an appreciation of the advantages of properly designed transition curves, the Board has prepared and distributed tables and instructions for the setting-out of horizontal curves along these lines.

While there is general agreement among roading authorities of the world as to the necessity for transition curves to meet the requirements of modern traffic, there is some difference of opinion as to the constants which should be used. The Board has adopted a rate of change of radial acceleration (rate of change of direction) of 1·5 ft. per second per second in a second, and a limiting value for the centrifugal ratio of $\left(\frac{P}{W}\right)$ of $\frac{1}{4}$. The maximum superelevation remains at $1\frac{1}{2}$ in. per foot of width or $\frac{1}{8}$ which has been the maximum value used in connection with circular arcs. It will be noted that the superelevation is 50 per cent. of the centrifugal ratio.

The above constants or approximations thereto are the rule in many overseas countries. These values obtain irrespective of speed, but as a result of investigation and experience by the Board it would seem that there could with advantage be some modification of these constants. For instance, the testing of curves for speed-values has indicated that the rate of change of radial acceleration can be increased, and a greater value for the centrifugal ratio can be allowed at the lower speeds, of about 30 miles per hour, with a graduated decrease in the values of the constants until, at the higher speeds, the rate of change of radial acceleration should not exceed 1 ft. per second^3, and the side-friction or that portion of the centrifugal ratio not balanced by superelevation should not exceed 0·1. Further investigation is being conducted along these lines.

Except for an increasing use of a light type of sealing, which, in general, is applied direct on the macadam or gravel surface, the past year has produced little change in the design and technique of construction of metal crusts or bituminous carpets. Initial bituminous surfacing, for the greater part, has consisted of a prime coat of light tar or asphaltic M.C.$_1$ followed by a road-oil seal, while the smoothing of rough but sound bituminous pavements has been accomplished chiefly by a densely graded road- or plant-mix.

Several miles of drag-seal were laid during the past season, some with ordinary power-graders and some with graders fitted with the drag-seal attachment as developed by the Victorian Country Roads Board. Drag-seal surfacing laid early in the season is in better condition than later season work. It seems obvious that this type of treatment, perhaps more than other types, requires a period of warm weather after laying to allow of kneading and compaction by traffic before the binder hardens too much. A tendency towards ravelling was caused by stone fragments too large for the thickness of the carpet, and by segregation of the different sizes of aggregate during mixing. The best results were achieved with uniform size chips all passing a $\frac{7}{16}$ in. round screen when the compacted depth of the course was from $\frac{1}{2}$ in. to $\frac{5}{8}$ in. With further experience it is expected that improved results will be obtained, and that this class of surfacing will fill a useful place in the field of bituminous treatments.

As an outcome of experimental work and experience over the past three or four years the Board has developed a new light type of sealing to be known as "dust-laying seal-coat," which will provide dustless surfacing on the less heavily loaded highways at a cost well below that for the usual priming followed by road-oil sealing.

In the past road-oil seal-coats could be successfully applied direct to the roller-compacted water-bound macadam type of metal course, but the more recently introduced smooth-riding densely graded stabilized top-course, with its comparatively small area of clean stone surface and large proportion of dusty particles, has required a prime-coat treatment to ensure the proper adherence of the road-oil seals. The new "dust-laying seal-coat" serves the functions of a primer, and at the same time retains a ductile binder to hold the mineral aggregate cover-coat. To some extent these conditions have been achieved with No. 1 tar, and more recently with asphaltic M.C.$_3$, but these materials, especially tar, developed too hard a residue which often led to loss of chips, and sometimes starring and cracking during the cold winter months.

It has been found that the road-oils of either the medium or the heavy grade as defined in the Board's Standard Specifications, when cut back to the initial viscosity and approximate distillation range of M.C.$_3$, will not give rise to a spongy mat lying unattached to the metal surface, but will slowly penetrate into the top-course and leave a ductile residue to hold the chips. Under some conditions a very light application of a thin primer at the rate of $\frac{1}{12}$ gallon to $\frac{1}{10}$ gallon per square yard just an hour or two ahead of the dust-laying seal-coat may be desirable, but such very light priming will be much less costly than the standard prime-coat applied prior to road-oil sealing. The light prime or "dust-killing" treatment will be necessary only when the top-course is deficient in stone fragments.

In determining the quantity of cutback road-oil to ensure the adherence of the chips, allowance must be made for evaporation and for absorption by the underlying metal crust. As it is not practicable to apply these cutback products at a much heavier rate than $\frac{1}{3}$ gallon per square yard it will be realized that, after evaporation and absorption losses, there will remain only sufficient binder to hold a small chip. The average least dimension of the cover-coat aggregate should be between 0·25 in. and 0·40 in. Dust-laying sealing will therefore utilize that product of the crusher which is too small for road-oil sealing.

For average New Zealand summer temperatures, road-oil cutback to the initial viscosity of M.C.$_3$ should be used, for midsummer work in the hotter districts the consistency of the cutback should be that of M.C.$_4$, while an M.C.$_2$ viscosity will be more satisfactory for surfacing in cool weather, or when only a very small chip is obtainable. The various grades of dust-laying seal-coat binders will be known as "Soft Residue M.C.$_2$," "Soft Residue M.C.$_3$," and "Soft Residue M.C.$_4$." In other words, the viscosities and distillations will be those of the respective M.C. products, but the residue from distillation will be much softer with a penetration at 77° F. of not less than 300, and a float test at 122° F. of not less than 150 seconds.

Except for some attention to drainage, gravel or macadam roads which have been reasonably well maintained may require very little preparation prior to the application of a dust-laying seal-coat. There are instances where little beyond the sweeping of the surface is necessary, or where a short period of intensive grading and planing during suitable weather or in conjunction with sprinkling will be all that is required. In other cases, where the road is out of shape, some scarifying with the addition of a few yards of new metal per chain will often bring the road to a satisfactory condition.

"Dust-laying seal-coat" surfacing is not intended to supersede the tar prime-coat followed by the road-oil seal for the more important highways, but, if properly laid, dust-laying seal will provide many years of service without further treatment on highways of lower traffic intensities. Even where conditions warrant the prime-coat and road-oil seal, side-road intersections and turn-outs, private entrances, and haunches of highways through townships can often with advantage be treated simply with this lighter class of surfacing. By this procedure the large 1 in. to $\frac{3}{4}$ in. chips are all retained for the construction of the bituminous carpet on the important highway.

Some form of light or temporary seal is frequently required to serve in the meantime on roads which will be deviated or realigned in four or five years' time. The dust-laying seal will meet these conditions. This position frequently obtains at the approaches to old bridges. Many village roads might be given a dust-laying seal-coat after the minimum of preparation. Even in the case of some of the State highways this lighter treatment will often meet requirements.

During the year orders were placed for the supply of New-Zealand-manufactured oil-fired bitumen-sprayers which can be transported by and readily operated from ordinary lorries. It is intended that these items of plant should be used for maintenance, priming, and small construction works which cannot be satisfactorily undertaken by contract. The rapid heating and definite temperature control, together with the general utility of these sprayers, places them much in advance of such machines previously used by the Board.

Within the limits of practicability the Board's constant aim is to keep design, construction, and maintenance standards in pace with transport requirements, or, to use the words which have been quoted in other places, every endeavour is made to make roads fit the traffic rather than try to fit the traffic to the roads.

Standard Specifications.

As indicated in the previous annual report, standard specifications covering the following classes of work have now been printed and bound in the form of a loose-leaf book entitled "Book of Instructions and Standard Specifications":—

M.H.B. 42: Construction of Formation.
M.H.B. 43: Construction of Base-course.
M.H.B. 44: Top-course Construction.
M.H.B. 45: Tar Priming-coat.
M.H.B. 46: Road-oil Sealing-coat.

In addition, a pamphlet, M.H.B. 42A, "Notes on Formation," has been incorporated in the Book of Instructions, and provides a useful guide to present-day practice.

With the object of having these specifications adopted for works financed either wholly or in part from the Main Highways Account, a complimentary copy of the bound book was forwarded to each local authority in New Zealand with a request that the relative specification be included in any proposals for the undertaking of work on main highways.

Bulletin No. 2, which has until recently been regarded as the Board's text-book on highway construction and maintenance, has been considerably superseded by the foregoing specifications and notes.

The distribution of the specifications has brought many appreciative references from roading authorities throughout New Zealand.

A further specification and descriptive notes for a light type of sealing, to be known as a "Dust-laying seal-coat," are now being printed. As opportunity offers it is intended to prepare and issue further instructions covering highway work, all of which will be distributed for incorporation in the Book of Instructions and Standard Specifications.

Copies of the individual specifications are available to local authorities at a small cost from the Government Printer for inclusion in contract documents.

Operations of Magnetic Truck.

During the year the Board's magnetic truck, which is utilized for clearing main highways of iron or steel puncture-producing articles, operated chiefly in the South Island.

The length of road actually cleared during the twelve months ended 31st March, 1939, was 2,084 miles, compared with 4,427 miles for the previous financial year; the weight of material picked

up by the magnet was 4,742 lb., as against 3,783 lb., for the previous year. The reduced mileage travelled for the period as against that travelled for the previous year is accounted for by the fact that during part of the year the truck was undergoing repairs.

The average yield per mile was 2·28 lb., the corresponding figure for 1937–38 being 0·85 lb.

Examination for Foremen and Overseers of Road-construction.

Sixty-five candidates presented themselves at the thirteenth examination for Foremen and Overseers of Road-construction held on the 1st November, 1938.

Fifty-nine papers on general road construction and maintenance, and twenty-one papers on tar, bituminous, and concrete road-construction were returned.

Seventeen candidates were successful in passing Paper No. 1, while eight candidates passed Paper No. 2.

Two candidates passed the full examination, and a further six, who had previously secured a partial pass, completed the examination. The fifteen candidates who were successful in one paper only were credited with a partial pass.

Certificates of Competency have been awarded to all those candidates who passed or completed the examination, the recipients being Messrs. N. Annabell, F. H. Bedford, H. H. Cherry, F. J. Clark, C. D. Fairweather, W. S. Henderson, H. C. Polson, and R. L. Yarr.

Declarations, Revocations, and Adjustments of Main Highways.

The usual annual review of main highways was made during the year, recommendations being submitted by District Highways Councils for the declaration of 518 miles of roads as additional main highways and for the revocation of 23 miles of existing main highways.

However, in view of the fact that the funds available were fully required for the maintenance and improvement of the existing highways system, the Board was not able to recommend any general increase in the mileage of main highways.

Several alterations were effected, these adjustments being found necessary due to changes in local circumstances.

The following are the lengths of main highways declared and revoked during the year ended 31st March, 1939, including formal adjustments:—

Main Highways declared.

	Miles.	Ch.
No. 1 Highways District—		
Ruawai Wharf	0	16
No. 2 Highways District—		
Te Awamutu – Pirongia – Ngutunui	18	58
Te Awamutu – Cambridge	1	5
Waitakere Scenic Drive	7	29
Cambridge – Roto-o-rangi	2	8
Mangere Aerodrome	2	54
Mangere-Otahuhu	1	74
No. 6 Highways District—		
Mangatupoto–Ohura	22	40
Morero	0	36
No. 9 Highways District—		
Pohangina Valley – Apiti	0	18
No. 11 Highways District—		
Murchison – Lewis Pass	22	63
Nelson Aerodrome	1	0
No. 12 Highways District—		
Inangahua Junction – Waiho	0	46
No. 13 Highways District—		
Reefton – Hanmer Junction	30	26
No. 14 Highways District—		
Harewood Aerodrome	4	25
No. 15 Highways District—		
Geraldine–Fairlie	29	1
Winchester – Hanging Rock	15	0
Pleasant Point – Hanging Rock	5	37
No. 16 Highways District—		
Timaru–Queenstown	7	76
Waipiata Sanatorium	1	26
No. 17 Highways District—		
Dunedin – Harrington Point	0	1
No. 18 Highways District—		
Invercargill–Bluff	1	60
Queenstown–Invercargill	58	57
	235	36

Main Highways revoked.

	Miles.	Ch.
No. 2 Highways District—		
Te Awamutu – Pirongia	9	1
Pirongia – Junction Kawhia Road	9	60
Waikumete – West Coast	0	22
Te Awamutu – Cambridge	14	68
No. 6 Highways District—		
Okahukura–Ohura	22	0
No. 9 Highways District—		
Pohangina Valley – Apiti	0	46
No. 12 Highways District—		
Inangahua Junction – Waiho	0	46
No. 14 Highways District—		
Christchurch – Russley Road Junction via Burnside Road	4	65
No. 15 Highways District—		
Geraldine–Fairlie via Cattle Valley	28	56
Gapes Valley Road	8	0
Gapes Valley – Pleasant Point	10	67
No. 16 Highways District—		
Timaru–Queenstown	6	40
No. 18 Highways District—		
Queenstown–Invercargill	49	37
Gore – Te Anau	1	20
Invercargill–Bluff	1	60
	168	28

The Board acknowledges the continued co-operation of the Public Works Department in matters relating to main highways administration and records its appreciation of the valuable services rendered by officers of the Department in carrying out an extended programme during the period under review.

The accompanying tables contain statistical information relative to finance, lengths of highways, and results of stone testing carried out during the year.

Signed on behalf of the Main Highways Board,

J. Wood, M.Inst.C.E.,
Chairman.

TABLE 5.—MAIN HIGHWAYS ACCOUNT.

STATEMENT SHOWING PARTICULARS OF NET EXPENDITURE ON CONSTRUCTION, RENEWALS, MAINTENANCE, &c., FOR THE YEAR ENDED 31ST MARCH, 1939, AND TOTAL TO DATE.

	Construction and Improvement of Main Highways.		Renewals of Main Highways.		Maintenance, Repairs, &c. of Main Highways.		Totals.	
	Total for Year 1938–39.	Total since Inception of Main Highways Act, 1922, to 31/3/39.	Total for Year 1938–39.	Total since 1/4/36 to 31/3/39.	Total for Year 1938–39.	Total since Inception of Main Highways Act, 1922, to 31/3/39.	Total for Year 1938–39.	Total since Inception of Main Highways Act, 1922, to 31/3/39.
Highway District—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
No. 1	212,564 1 7	*1,105,654 19 3*	35,979 14 0	*56,445 19 11*	72,429 14 11	*821,541 13 8*	320,973 10 6	*1,983,642 12 10*
No. 2	500,860 3 6	*1,994,052 18 0*	41,383 17 9	*93,174 9 10*	160,390 14 7	*1,479,932 15 2*	702,634 15 10	*3,567,160 3 0*
No. 3	226,397 15 9	*588,740 10 7*	7,042 14 8	*15,692 17 2*	110,307 16 11	*722,304 2 9*	343,748 7 4	*1,326,737 10 6*
No. 4	46,015 13 11	*539,055 9 9*	25,800 12 9	*59,417 11 1*	97,167 11 9	*591,691 3 2*	168,983 18 5	*1,190,164 4 0*
No. 5	104,691 19 11	*556,254 7 6*	3,669 1 3	*19,259 6 7*	195,282 1 6	*933,826 7 2*	303,643 2 8	*1,509,340 1 3*
No. 6	119,073 8 6	*563,481 8 3*	9,420 13 0	*15,379 13 5*	61,946 1 0	*569,830 19 7*	190,440 2 6	*1,148,692 1 3*
No. 7	156,588 19 6	*658,834 6 7*	2,819 9 9	*15,069 8 9*	53,114 13 9	*581,714 7 2*	212,523 3 0	*1,255,618 2 6*
No. 8	129,754 14 1	*545,297 9 9*	8,654 11 4	*11,814 9 9*	77,093 1 1	*578,713 1 10*	215,502 6 6	*1,135,825 1 4*
No. 9	216,940 18 11	*1,063,658 3 0*	3,646 13 1	*9,135 14 6*	45,181 17 1	*685,066 9 10*	265,769 9 1	*1,757,860 7 4*
No. 10	37,267 7 7	*366,611 7 4*	7,931 15 6	*21,460 12 4*	35,337 14 3	*580,603 14 4*	80,536 17 4	*968,675 14 0*
Totals for North Island ..	1,750,155 3 3	*7,981,641 0 0*	146,349 3 1	*316,850 3 4*	908,251 6 10	*7,545,224 14 8*	2,804,755 13 2	*15,843,715 18 0*
No. 11	225,866 12 10	*650,225 6 7*	3,114 17 10	*5,664 4 8*	69,376 14 4	*629,331 15 10*	298,358 5 0	*1,285,221 7 1*
No. 12	188,976 6 0	*687,518 4 1*	11,004 11 2	*66,208 4 11*	79,992 4 4	*1,031,256 8 7*	279,973 1 6	*1,784,982 17 7*
No. 13	28,986 6 8	*223,810 17 4*	..	*192 6 4*	27,318 11 8	*274,593 19 3*	56,304 18 4	*498,597 2 11*
No. 14	83,321 7 3	*617,870 0 10*	1,143 2 0	*3,309 10 7*	45,608 2 2	*446,866 3 9*	129,472 11 5	*1,068,045 15 2*
No. 15	111,174 2 8	*388,968 8 11*	2,531 19 0	*2,543 15 8*	40,810 12 0	*527,084 0 9*	154,516 13 8	*918,596 5 4*
No. 16	147,234 3 2	*576,033 6 8*	3,961 0 1	*7,538 14 5*	49,035 11 4	*386,002 0 6*	200,230 14 7	*969,574 1 7*
No. 17	138,377 8 0	*652,586 17 11*	608 7 0	*3,857 6 10*	44,431 6 9	*376,222 6 0*	183,417 1 9	*1,032,666 10 9*
No. 18	204,216 13 0	*653,333 9 0*	11,325 12 0	*18,551 13 3*	47,115 12 2	*445,364 16 3*	262,657 17 2	*1,117,249 18 6*
Totals for South Island ..	1,128,152 19 7	*4,450,346 11 4*	33,689 9 1	*107,865 16 8*	403,088 14 9	*4,116,721 10 11*	1,564,931 3 5	*8,674,933 18 11*
Totals for Dominion ..	2,878,308 2 10	*12,431,987 11 4*	180,038 12 2	*424,716 0 0*	1,311,340 1 7	*11,661,946 5 7*	4,369,686 16 7	*24,518,649 16 11*

TABLE 5.—MAIN HIGHWAYS ACCOUNT—*continued.*

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1939, AND TOTAL TO DATE.

EXPENDITURE.				Total for Year 1938–39.			Total since Inception of Main Highways Act, 1922, to 31/3/39.		
				£	s.	d.	£	s.	d.
Net expenditure on construction, renewals, maintenance, &c. (see separate statement)				4,369,686	16	7	*24,518,649*	*16*	*11*
Administration—									
Administration expenses (including salaries, travelling-expenses, office rents, printing, stationery, postages, and miscellaneous expenses)	£ 159,031	19	6	..			*788,387*	*5*	*2*
Fees and travelling-expenses of members of the main Highways Board other than Government members	1,137	2	3	..			*18,265*	*3*	*5*
Miscellaneous expenses—									
Advertising, maps, rent of halls, traffic tallies, transport of samples, depreciation of furniture, &c.	322	14	5	..			*6,040*	*5*	*2*
Compassionate grants to widows and relatives of deceased employees	..			..			*4,000*	*0*	*0*
Compensation under section 3, Public Works Amendment Act, 1925	..			..			*1,015*	*1*	*6*
Exchange on remittances	1,590	5	10	..			*7,860*	*0*	*10*
Grant to Transport Department towards Traffic inspection	5,000	0	0	..			*22,906*	*0*	*5*
Petrological laboratory and other experimental work, Expenses of	481	10	2	..			*11,164*	*10*	*4*
Total administration				167,563	12	2	*859,638*	*6*	*10*
Loan charges—									
Charges and expenses of raising loans, management charges of Consolidated Stock on account of Construction Fund, &c.	664	3	7	..			*69,635*	*7*	*4*
Interest on amount appropriated out of Public Works Fund and paid into Main Highways Account Construction Fund	61,360	0	0	..			*551,700*	*0*	*0*
Interest on loans, recoupment to Consolidated Fund (section 4, Finance Act, 1919)	200,952	4	3	..			*1,312,252*	*9*	*0*
Transfer to reserve for redemption of main highway securities	150,661	0	0	..			*843,795*	*0*	*6**
Payment to local authorities in commutation of toll-gate charges (Finance Act, 1925, section 20)	1,488	0	11	..			*28,692*	*6*	*8*
Payment to Wellington City Council in commutation of fees chargeable in respect of motor-vehicles using Hutt Road (Finance Act, 1927 (No. 2), section 33)	24,535	12	2	..			*255,121*	*19*	*7*
Total loan charges				439,541	0	11	*3,061,197*	*2*	*7*
Subsidies, &c., in respect of other than main highways—									
Municipal Corporations (Municipal Corporations Act, 1933, section 71)	33,328	12	11	..			*243,809*	*19*	*2*
County Councils and other local authorities (Finance Act, 1930, section 37)	175,764	8	11	..			*1,482,406*	*7*	*9*
Subsidies to County Councils for rebate to ratepayers (Finance Act (No. 4), 1931, section 45)	..			..			*253,892*	*12*	*1*
Subsidy on rates levied on farming land (Finance Act (No. 3), 1934, section 28)	*Cr.* 81	8	0	..			*364,502*	*11*	*9*
Maintenance and construction of roads giving access to outlying areas (Finance Act (No. 3), 1931)	..			..			*45,918*	*8*	*8*
Total subsidies				209,011	13	10	*2,390,529*	*19*	*5*
Balance, being excess of income over expenditure, carried to general balance-sheet				312,131	8	3	*633,321*	*1*	*2*
				5,497,934	11	9	*31,463,336*	*6*	*11*

INCOME.				Total for Year 1938–39.			Total since Inception of Main Highways Act, 1922, to 31/3/39.		
				£	s.	d.	£	s.	d.
Loans raised under Main Highways Act, 1922—									
Stock and Debentures issued—									
At 3 per cent. interest				1,625,600	0	0	*3,644,225*	*0*	*0*
At 3½ per cent. interest				..			*685,305*	*0*	*0*
At 3¾ per cent. interest				..			*190,895*	*0*	*0*
At 4 per cent. interest				..			*1,289,720*	*0*	*0*
At 4½ per cent. interest				..			*542,004*	*10*	*10*
Treasury bills—									
At 1¼ per cent. interest				25,000	0	0	*25,000*	*0*	*0*
At 2 per cent. interest				100,000	0	0	*100,000*	*0*	*0*
At 4 per cent. interest				925,000	0	0	*925,000*	*0*	*0*
Securities redeemed, Loans Redemption Account				..			*902,645*	*0*	*9*
Consolidated Fund—Public Debt Repayment Account				..			*55,720*	*0*	*0*
				2,675,600	0	0	*8,360,514*	*10*	*10*
Receipts under section 15, Finance Act, 1923, from Public Works Fund, General Purposes Account (at 5 per cent. interest)				..			*1,226,000*	*0*	*0*
Income from—									
Motor-registration licenses, fees, and fines (section 24, Motor-vehicles Act, 1924)	£ 610,846	5	7						
Less Commission on collection by Post and Telegraph Department—	£	s.	d.						
Motor-registration fees and licenses	23,351	10	0						
Fees for registration of change of ownership	12,324	6	0						
	35,675	16	0						
				575,170	9	7	*5,377,534*	*5*	*0*
Interest from investments				54	15	10	*216,507*	*0*	*0*
Interest from local authorities on plant purchased on their behalf				2,764	5	1	*27,166*	*6*	*11*
Interest on advances to local authorities				3,603	13	2	*33,672*	*6*	*9*
Mileage Tax (Finance Act, 1931–32 (No. 2), section 19)				7,474	8	0	*20,959*	*4*	*9*
Miscellaneous receipts				972	18	8	*3,236*	*6*	*10*
Motor-spirits tax (section 9, Motor-spirits Taxation Act, 1927)				2,083,277	11	8	*13,617,985*	*14*	*3*
Tire-duty (sections 13 and 14, Main Highways Act, 1922)				149,016	9	9	*2,397,679*	*1*	*1*
Transfer from Consolidated Fund (section 14, Main Highways Act, 1922)				..			*210,000*	*0*	*0*
Rent of and tolls from ferries				..			*2,081*	*10*	*6*
				5,497,934	11	9	*31,463,336*	*6*	*11*

* Excludes £60,408 10s. 7d. interest credited.

NOTE.—No charge for the cost of exchange on interest payments made in London is included in the accounts.

TABLE 5.—MAIN HIGHWAYS ACCOUNT—*continued.*

GENERAL BALANCE-SHEET AS AT 31ST MARCH, 1939.

LIABILITIES.	—	Total.	ASSETS.	—	Total.
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Excess of income over expenditure for 1938-39	312,131 8 3		Cash in Public Account—		
Add Balance at 31/3/38	321,189 12 11		At call	..	164,788 6 0
		633,321 1 2	Sundry debtors—		
Sundry creditors—			Public Works Department	12,351 10 11	
Public Works Department	47,295 13 1		Other Government Departments	2,353 1 11	
Other Government Departments	8,944 4 3		Non-departmental	7,876 5 6	
Non-departmental	342,278 5 4				22,580 18 4
		398,518 2 8	Advances to local authorities (Main Highways Amendment Act, 1926, section 2)	..	106,461 2 1
Interest accrued on loans	..	47,189 1 11	Motor-registration fees in hands of Postal Department	..	464 10 8
Reserves for redemption of securities	..	1,558 10 7	Interest due and accrued	..	2,979 11 4
Writings-off in Suspense	..	2,223 2 10	Buildings and land	..	42,709 0 0
			Stocks of materials, tools, &c	..	242,610 7 3
			Furniture, fittings, &c.—		
			Expenditure to 31/3/39	917 13 10	
			Less depreciation to 31/3/39	550 14 5	
					366 19 5
			Plant and equipment—		
			For Main Highways Board—		
			Expenditure to 31/3/39	542,390 8 5	
			Less depreciation charged to works	113,389 10 9	
					429,009 17 8
			Purchased for local authorities—		
			Expenditure to 31/3/39	288,841 18 7	
			Less repayments of principal	221,784 5 7	
					67,057 13 0
			Amount transferred to Loans Redemption Account	904,203 10 7	
			Less amount utilized for redemption of securities	902,645 0 0	
					1,558 10 7
			Stocks Deficits Account	..	2,223 2 10
		1,082,809 19 2			1,082,809 19 2

NOTES.—(*a*) No liability is included for interest on loans redeemed out of Public Debt Repayment Account. (*b*) The two funds, previously known as "Construction" and "Revenue," were amalgamated as from 1st April, 1936, and are now termed the "Main Highways Account," in accordance with section 3, Finance Act (No. 2), 1935.

J. W. SCOTT, A.R.A.N.Z., Chief Accountant, Public Works Department.
J. WOOD Chairman, Main Highways Board.

I hereby certify that the Income and Expenditure Account 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 departmental notes enfaced thereon.—J. H. FOWLER, Controller and Auditor-General.

TABLE 6.—LENGTHS OF HIGHWAYS AT 31ST MARCH, 1939.

Number and Name of Highway District.	Type of Surface.						Total.	
	Dustless.		Gravel or Macadam.		Pumice or Clay.			
	Miles	Ch.	Miles	Ch.	Miles	Ch.	Miles	Ch.
1. Auckland North ..	49	68	775	37	..		825	25
2. Auckland South ..	604	50	842	50	5	52	1,452	72
3. Tauranga	92	24	363	52	262	37	718	33
4. Gisborne	86	64	307	41	..		394	25
5. Napier	221	6	516	60	..		737	66
6. King-country	37	12	553	18	11	75	602	25
7. Taranaki	342	0	124	10	7	10	473	20
8. Wanganui	151	18	378	24	0	63	530	25
9. Wellington West ..	252	70	251	1	..		503	71
10. Wellington East ..	160	43	343	76	..		504	39
Totals, North Island ..	1,998	35	4,456	49	287	77	6,743	1
11. Nelson	76	52	612	23	7	41	696	36
12. West Coast	57	66	485	28	..		543	14
13. Canterbury North ..	55	50	308	40	..		364	10
14. Canterbury Central ..	195	71	554	50	..		750	41
15. Canterbury South ..	149	71	672	67	..		822	58
16. Otago Central	118	34	725	16	..		843	50
17. Otago South	84	71	439	3	..		523	74
18. Southland	62	21	856	36	..		918	57
Totals, South Island ..	801	36	4,654	23	7	41	5,463	20
Totals, Dominion ..	2,799	71	9,110	72	295	38	12,206	21
Summary.								
State highways	1,679	27	2,121	16	175	21	3,975	64
Main highways	1,120	44	6,989	56	120	17	8,230	37
Total	2,799	71	9,110	72	295	38	12,206	21

TABLE 7.—TESTS OF STONE COMPLETED DURING THE YEAR ENDED 31ST MARCH, 1939.

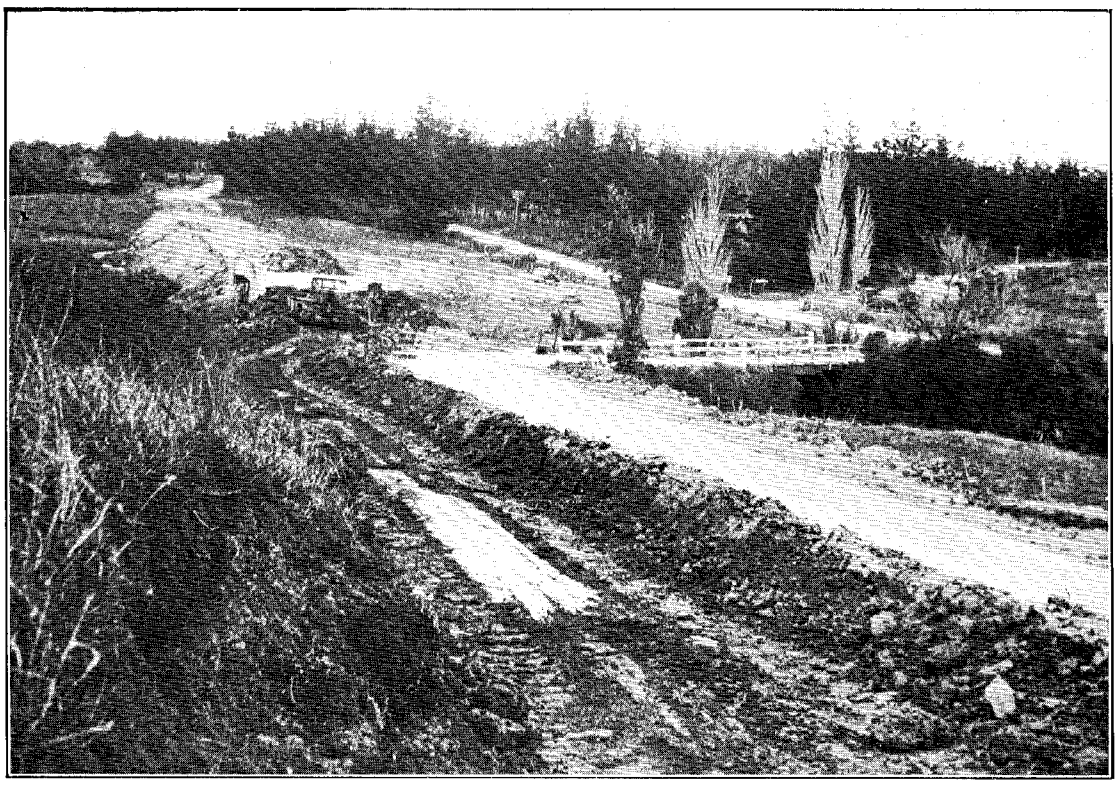
No.	Locality.	Weight in Pounds per Cubic Foot.	Absorption of Water in Pounds per Cubic Foot.	Abrasion.		Hardness.	Toughness.	Geological Classification.
				Percentage of Wear.	French Co-efficient.			
336	Penrose, Auckland	183·37	0·50	2·34	17·10	18·33	15·0	Basalt.
337	Kauaeranga, Thames ..	162·45	0·60	3·84	10·41	18·95	23·5	Hypersthene andesite.
338	Mangaokewa Stream, Te Kuiti	168·90	0·30	..	..	18·58	38·5	Argillite.
339	Raglan County Quarry, Section Part 209, Block V, Alexandra Survey District	166·00	0·70	..	..	15·50	23·0	Argillite.
340	Waiau Stream, Waitara ..	169·25	2·00	3·45	11·60	..	..	Sandy marl.
341	Turiwiri, Dargaville, Section 28, Block XIV, Maungaru Survey District	173·70	0·30	3·66	10·90	18·77	17·0	Diabase.
342	Taipa, Section 1 and Crown Grant 93, Block IV, Mangonui Survey District	159·30	3·00	3·66	10·76	19·31	17·0	Hornblende andesite.
343	Waitara Beach	162·20	3·10	4·46	8·95	..	..	Hornblende andesite.
344	Rosy Bay, Waikaremoana ..	157·31	2·90	3·78	10·60	..	..	Argillite.
345	Page's, 2 miles 67 chains, Fraser-town – Lake House Main Highway	167·30	2·28	4·40	9·00	..	..	,,
346	Cyprian, 2 miles 6 chains, Fraser-town – Lake House Main Highway	161·68	1·50	3·62	11·00	..	..	,,

Approximate Cost of Paper.—Preparation, not given; printing (1,052 copies, including maps and graphs), £126.

By Authority: E. V. PAUL, Government Printer, Wellington.—1939.

Price 4s. 9d.

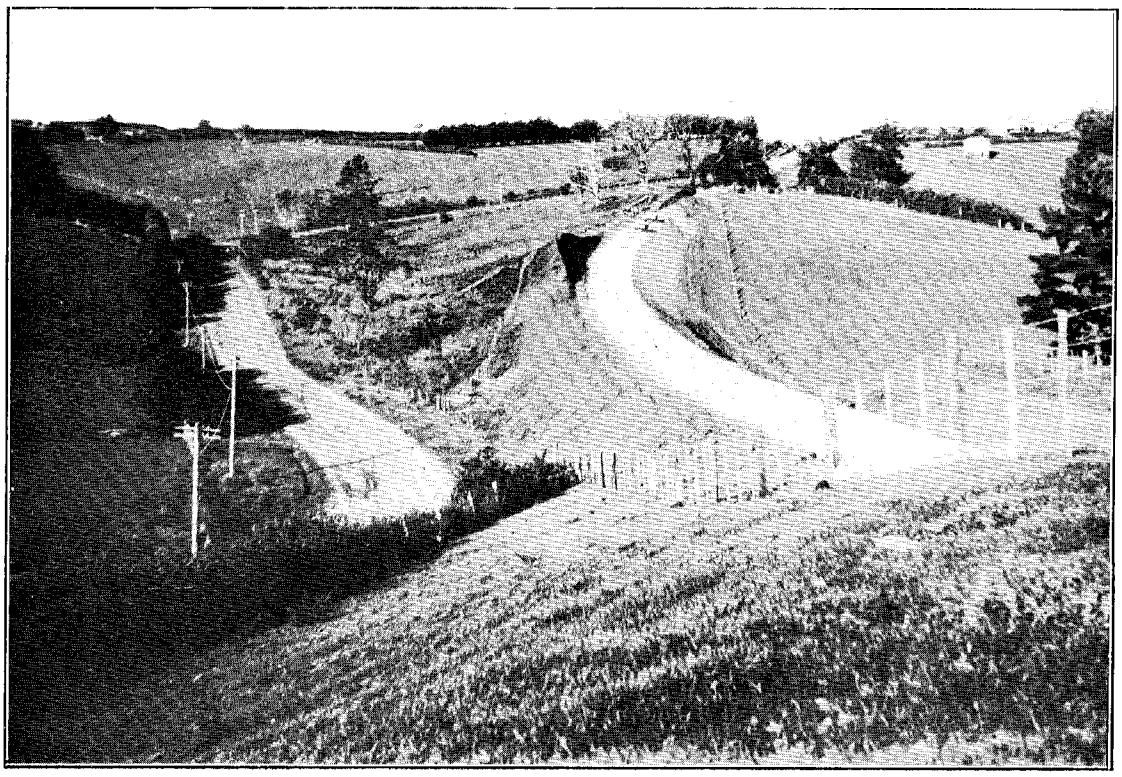
Brynderwyn Deviation. Opening Ceremony at Piroa Bridge on 26th September, 1938.



Dairy Flat Bridge and Deviation, eliminating old One-way Bridge and Two Right-angled Bends.

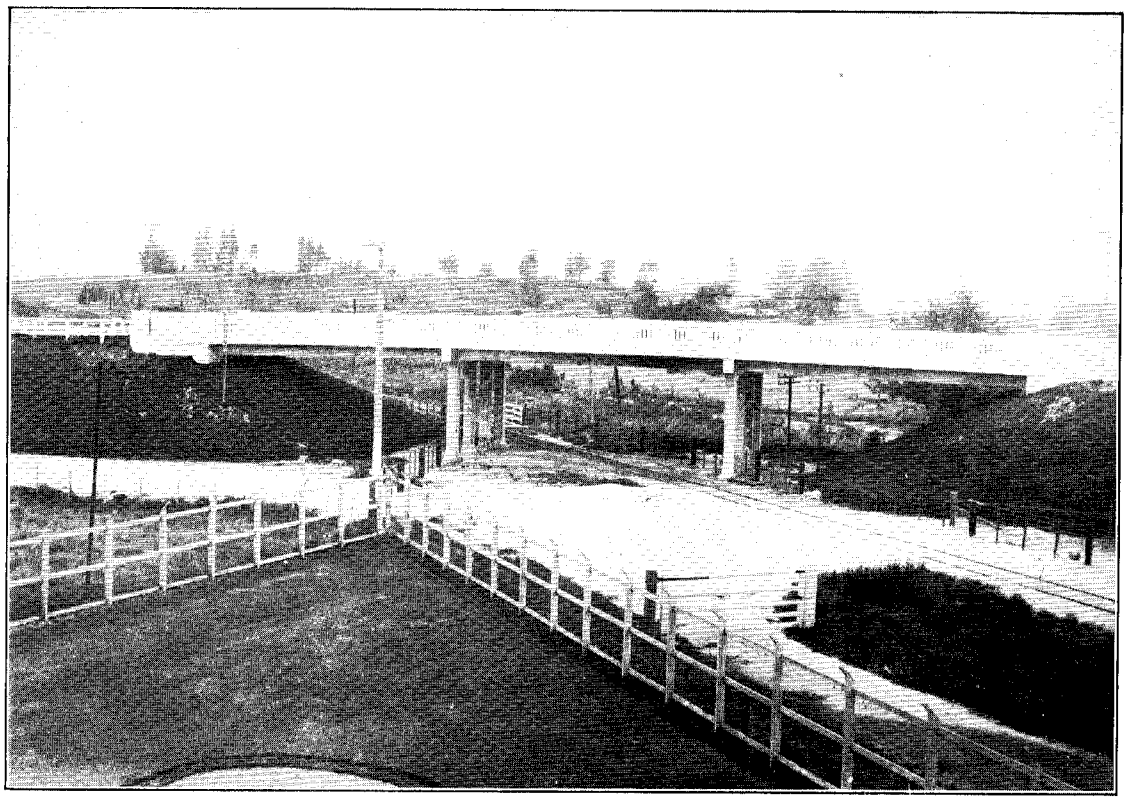
BIRKENHEAD–MAUNGATUROTO STATE HIGHWAY.

1 Main Highways.



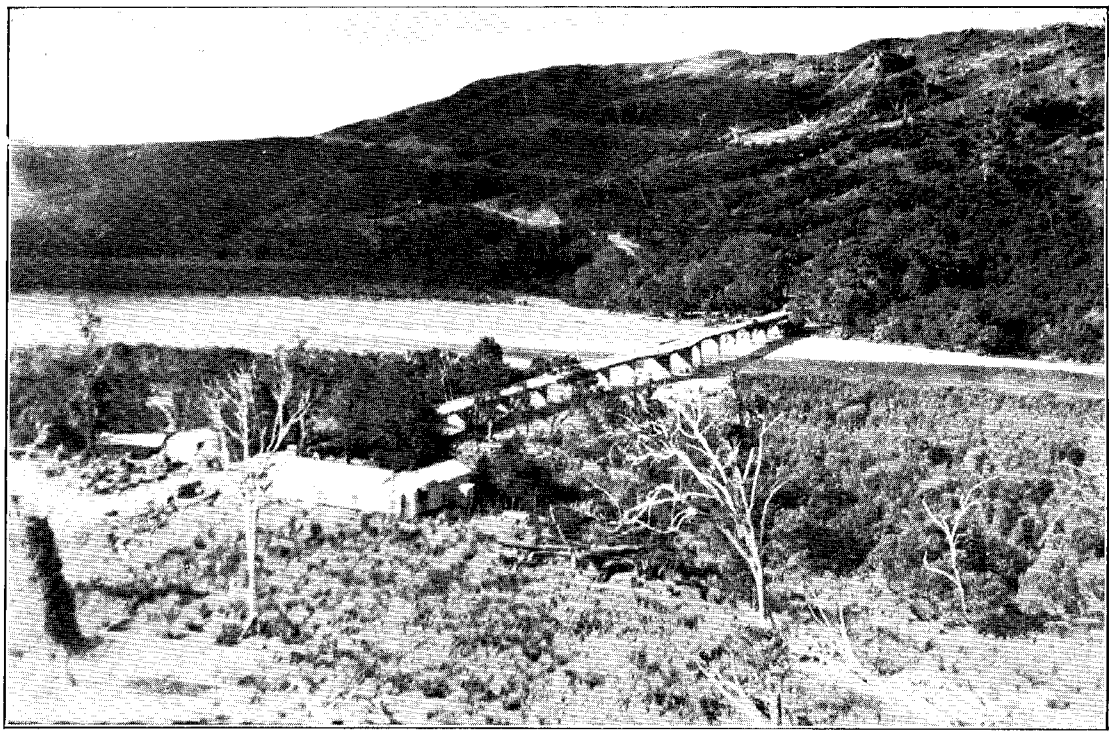
New Alignment near Harrisville Road Junction, with Old Route on Left.

PUKEKOHE–BOMBAY MAIN HIGHWAY.



Koutu Overbridge (Rotorua) Two 40 ft. and One 41 ft. Spans, 24 ft. Roadway.

HAMILTON–ROTORUA STATE HIGHWAY.

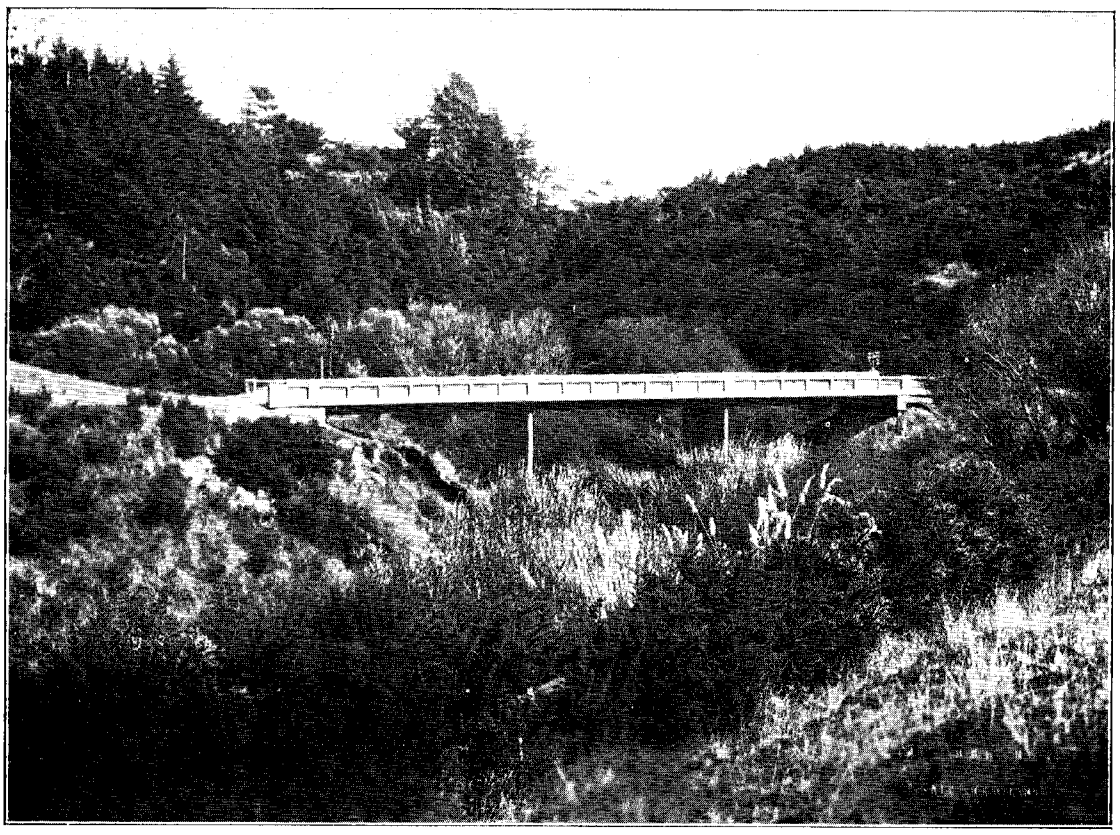


Raukokore River Bridge, Fifteen 44 ft. Spans, 10 ft. 6 in. Roadway, with Passing-place at Centre of Bridge. Handrails not yet placed.

OPOTIKI–TE ARAROA MAIN HIGHWAY.

Kaimai Deviation, Section of Sealed Roadway; Old Route on Left.

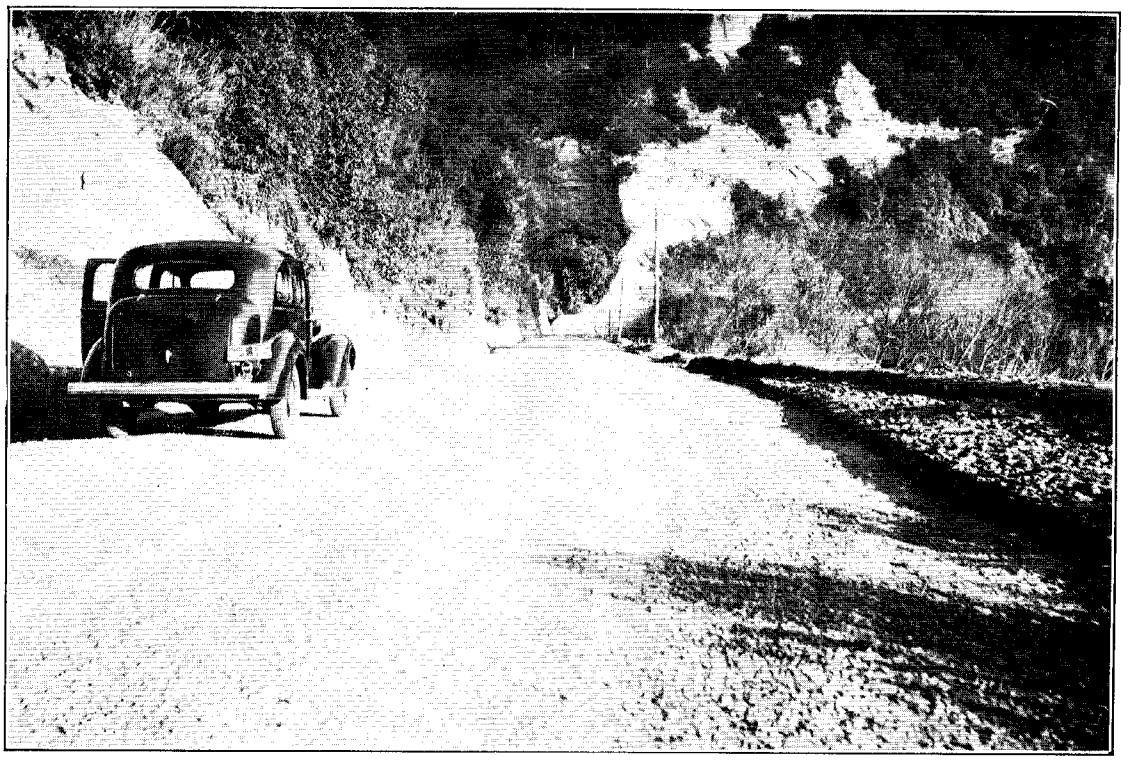
MATAMATA–TAURANGA MAIN HIGHWAY.



Manawapou Stream Bridge. One 50 ft. and Two 49 ft. Spans, 24 ft. Roadway.

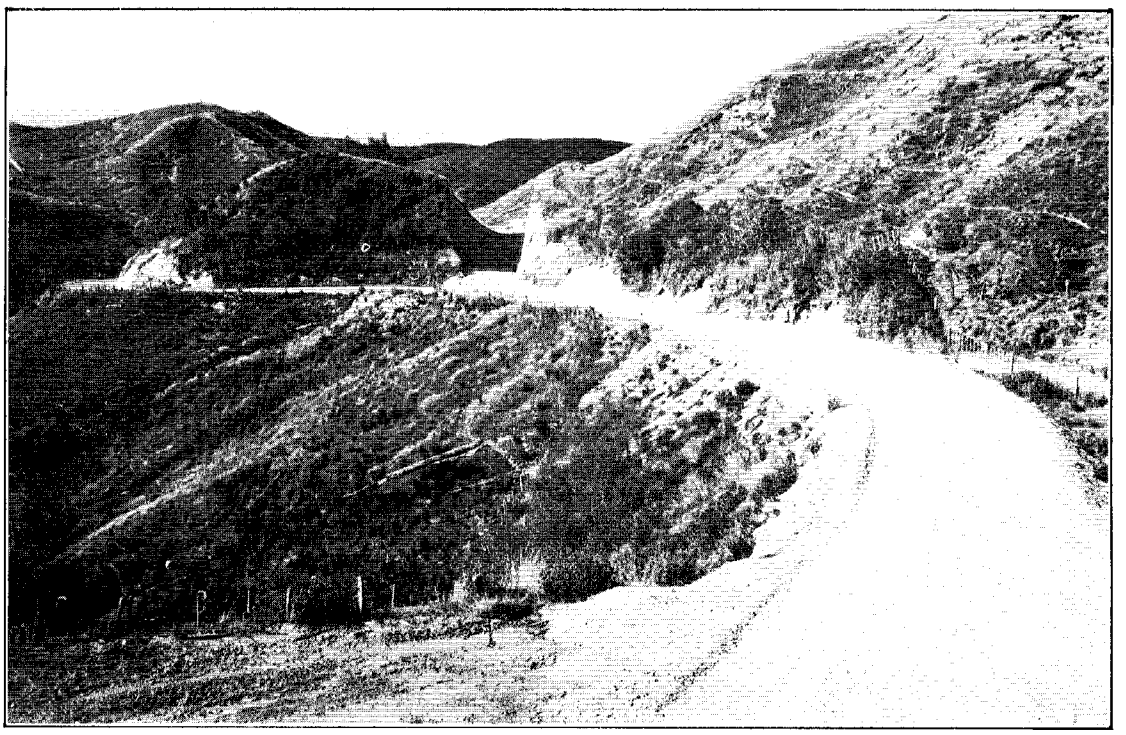
Highway Beautification. Plot of Dahlias planted on Old Roadway by the Waitotara County Council.

HAWERA–WANGANUI STATE HIGHWAY.



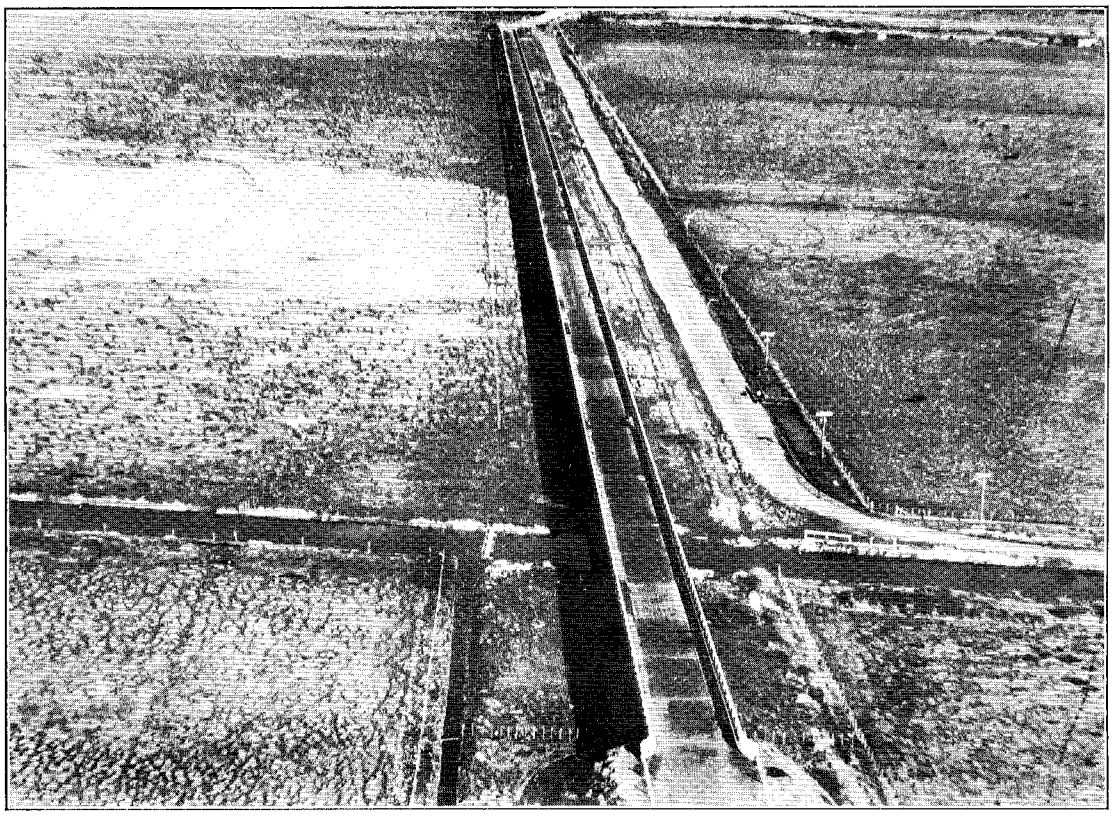
Section of Bitumen-sealing on Reconstructed Length.

NATIONAL PARK–WANGANUI STATE HIGHWAY.

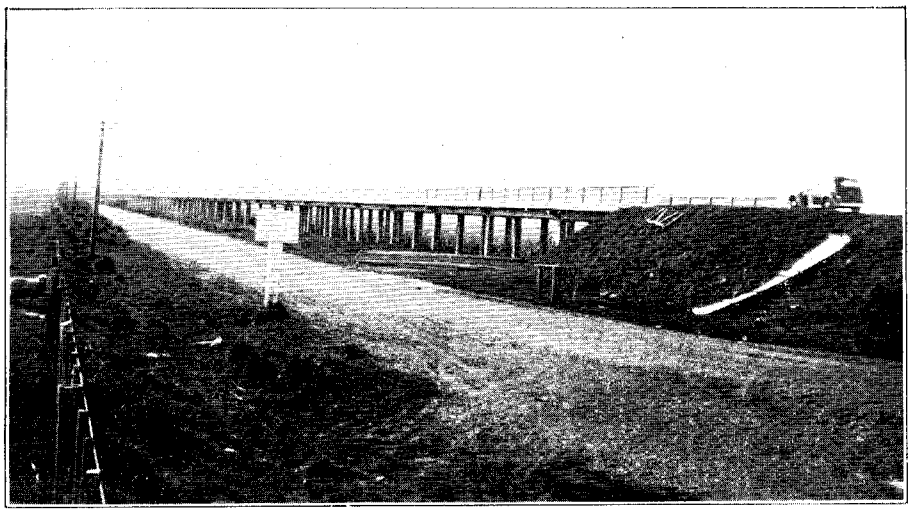


Reconstruction and Re-alignment at Vinegar Hill.

HOROPITO–BULLS, VIA TAIHAPE, STATE HIGHWAY.



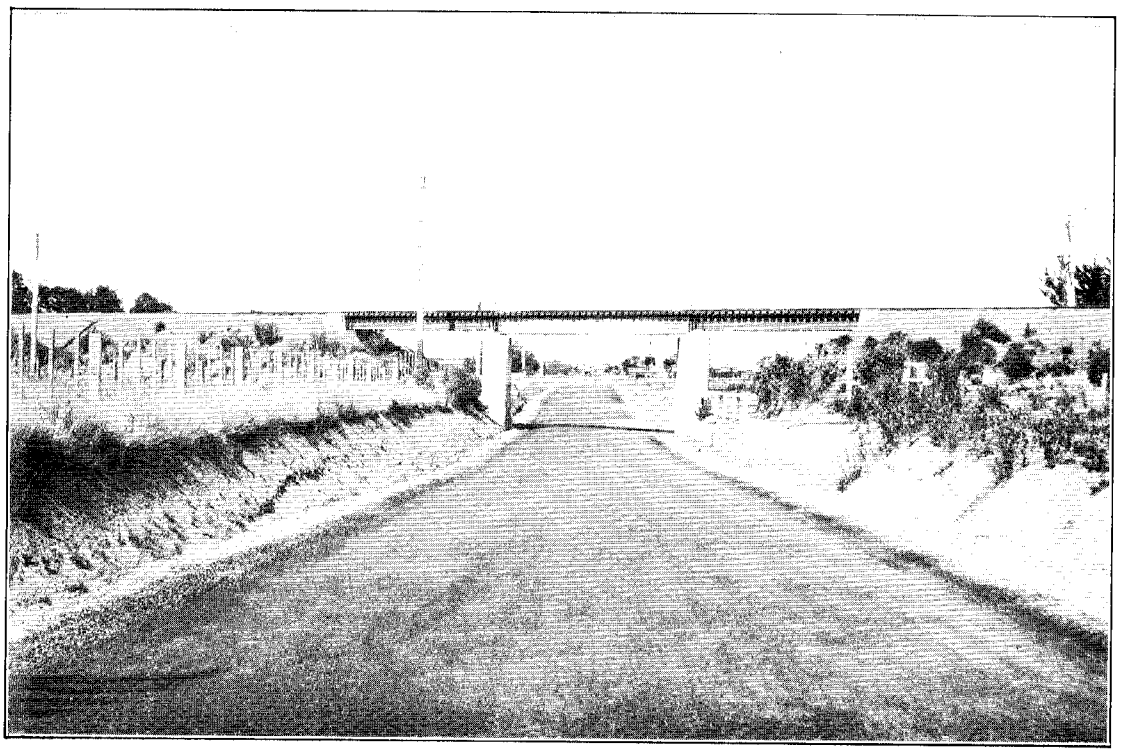
Aerial View from North End.



View from South End.

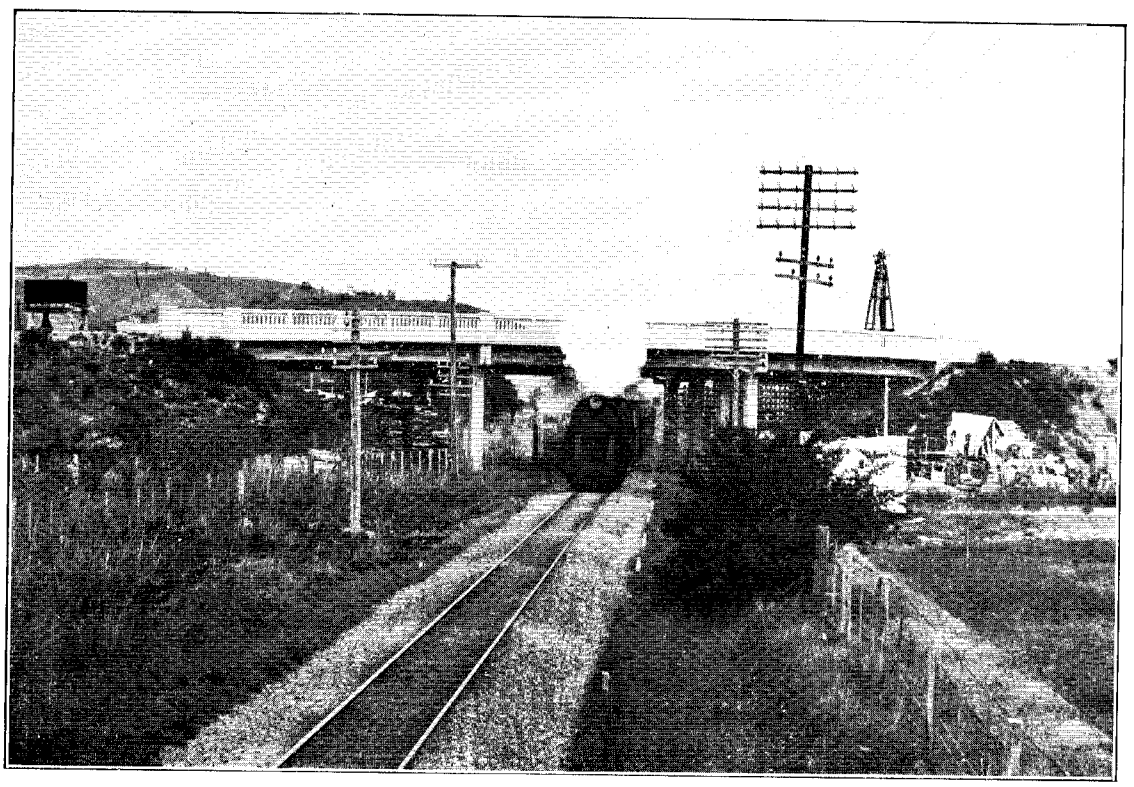
Whirokino Reinforced Concrete Trestle Bridge erected over Manawatu River Flood Overflow. Ninety 40 ft. Spans, 24 ft. Roadway.

WANGANUI–LEVIN STATE HIGHWAY.



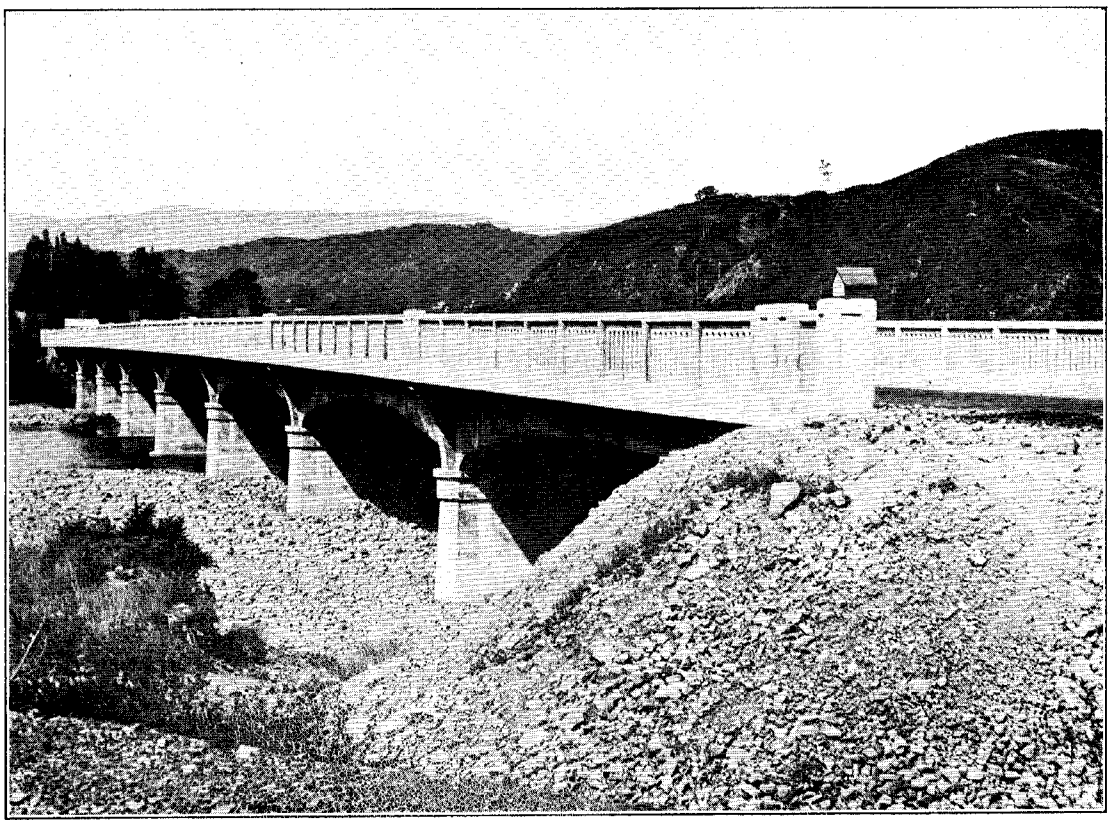
Wellington Road Subway, Marton, looking South.

CURL'S BRIDGE—UPPER TUTAENUI MAIN HIGHWAY.



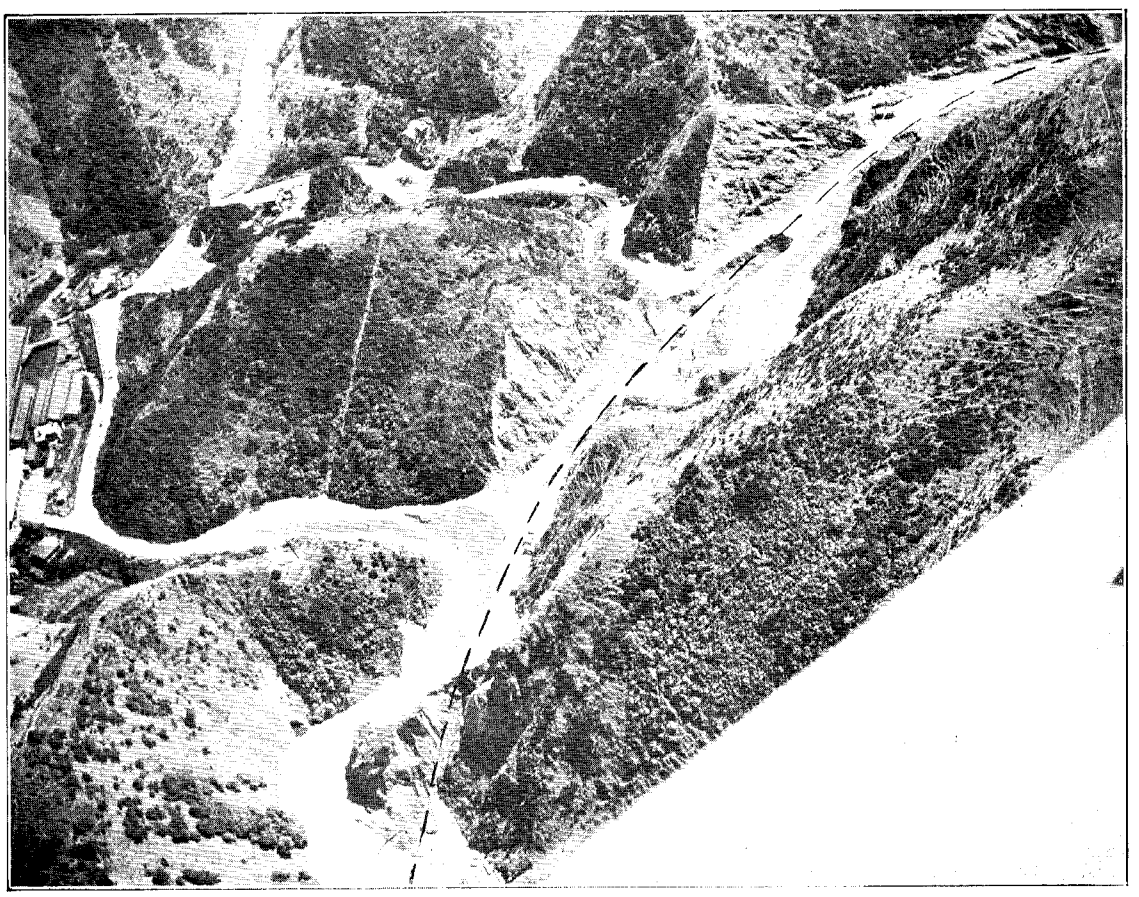
Paraparaumu Overbridge. Two 40 ft. and One 50 ft. Concrete Spans, with 24 ft. Roadway, and One 4 ft. Footway.

LEVIN–PORIRUA STATE HIGHWAY.



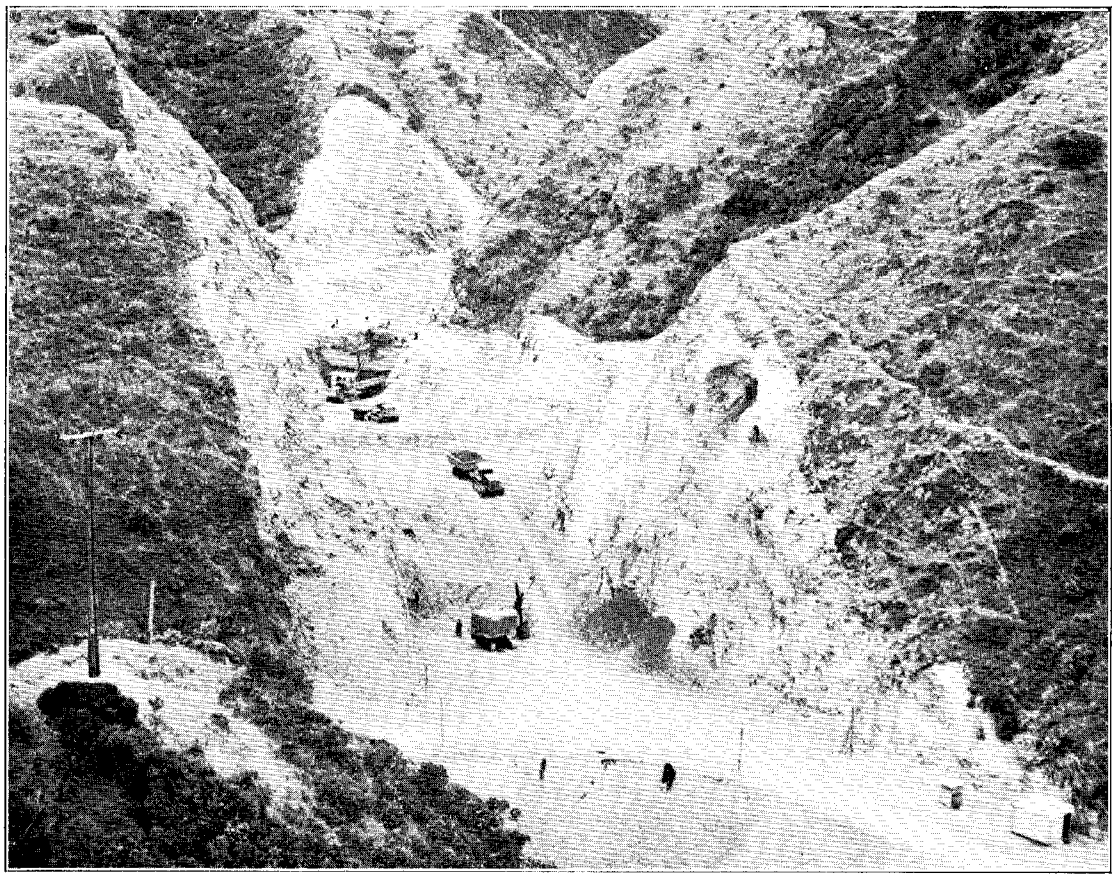
Silverstream Bridge over the Hutt River connecting with Wellington–Napier, via Wairarapa, Main Highway. Eight 62 ft. Spans, 22 ft. Roadway, Two 4 ft. Footways.

WESTERN HUTT MAIN HIGHWAY.



Ngahauranga Gorge Reconstruction. Dotted Line indicates Amended Alignment with Old Route shown on Left.

WELLINGTON–TAWA FLAT MAIN HIGHWAY.



View of the Main Cutting looking towards Johnsonville. Final Alignment of this Section is on a 15-chain-radius Curve. Batters on Left will be 145 ft. and 160 ft.

Excavating and Hauling Equipment in Operation.

NGAUAURANGA GORGE ROAD.

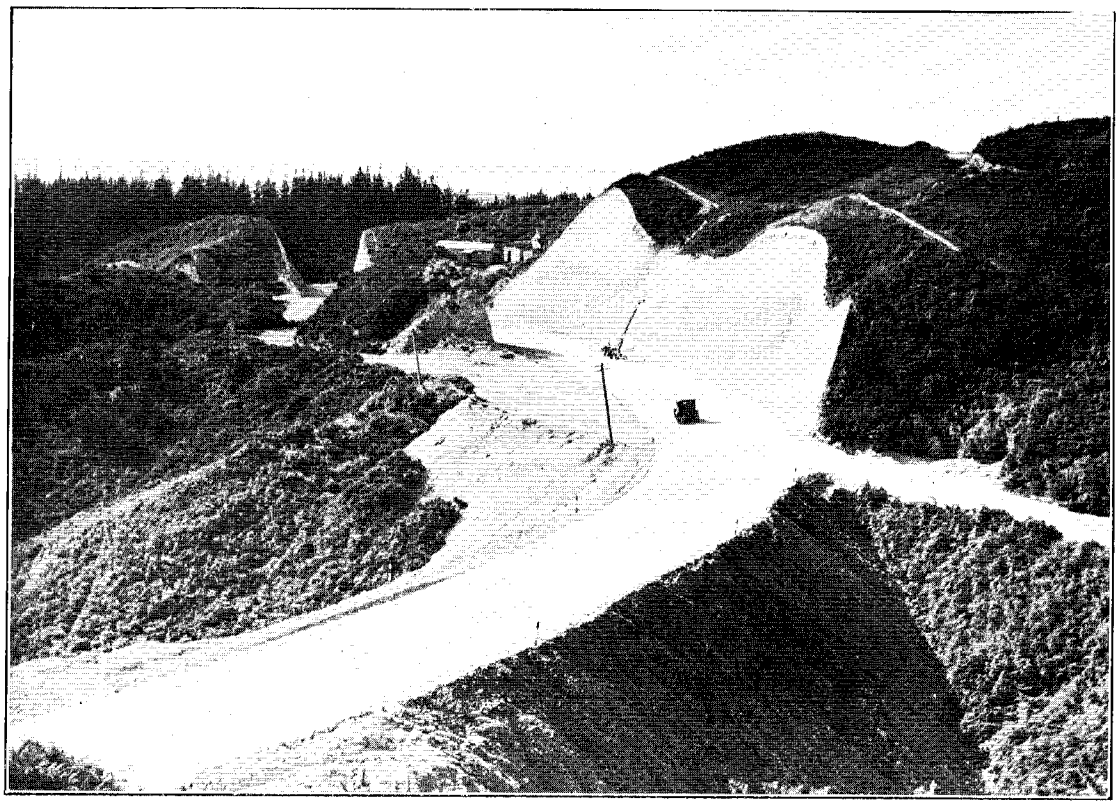
WELLINGTON–TAWA FLAT MAIN HIGHWAY.

Caterpillar Tractor operating Rock Rooter in Trench for Creek-diversion.

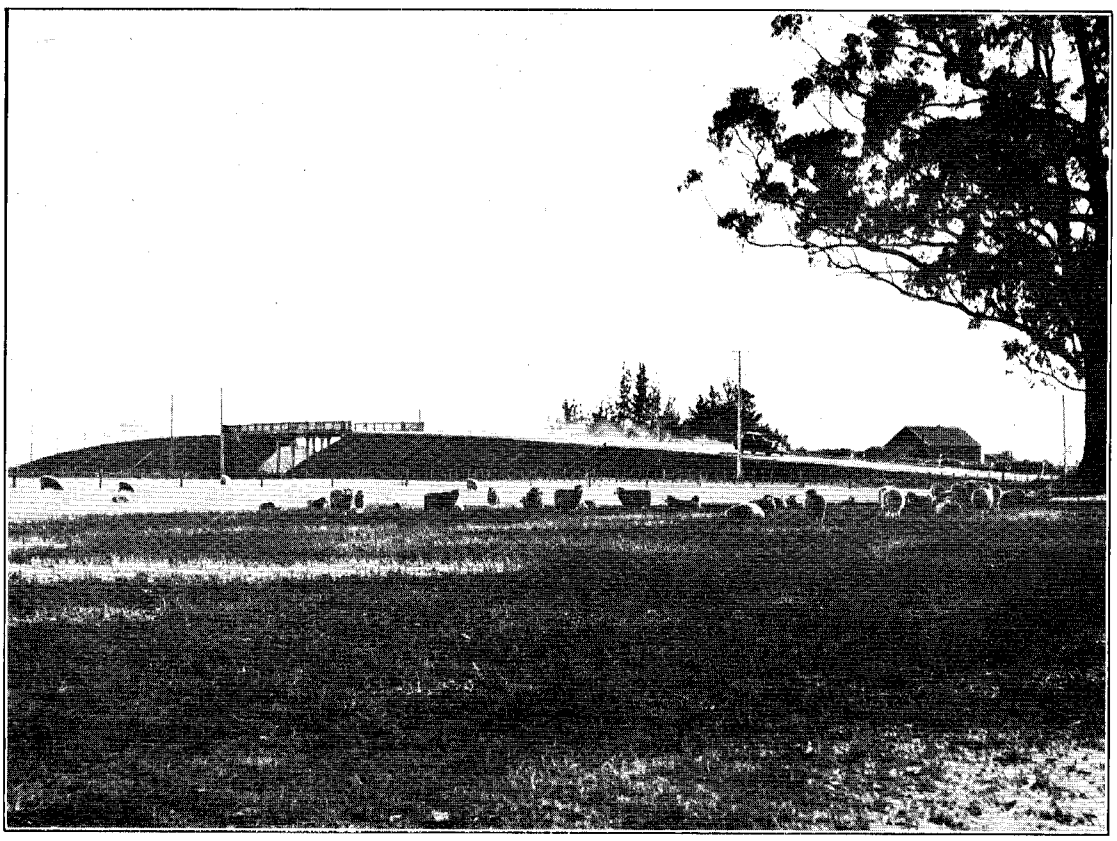
Caterpillar Tractor operating Carryall Scraper on Excavation of Trench for Base of Twin 6-ft.-diameter Concrete Pipes.

NGAHAURANGA GORGE ROAD.

WELLINGTON–TAWA FLAT MAIN HIGHWAY.

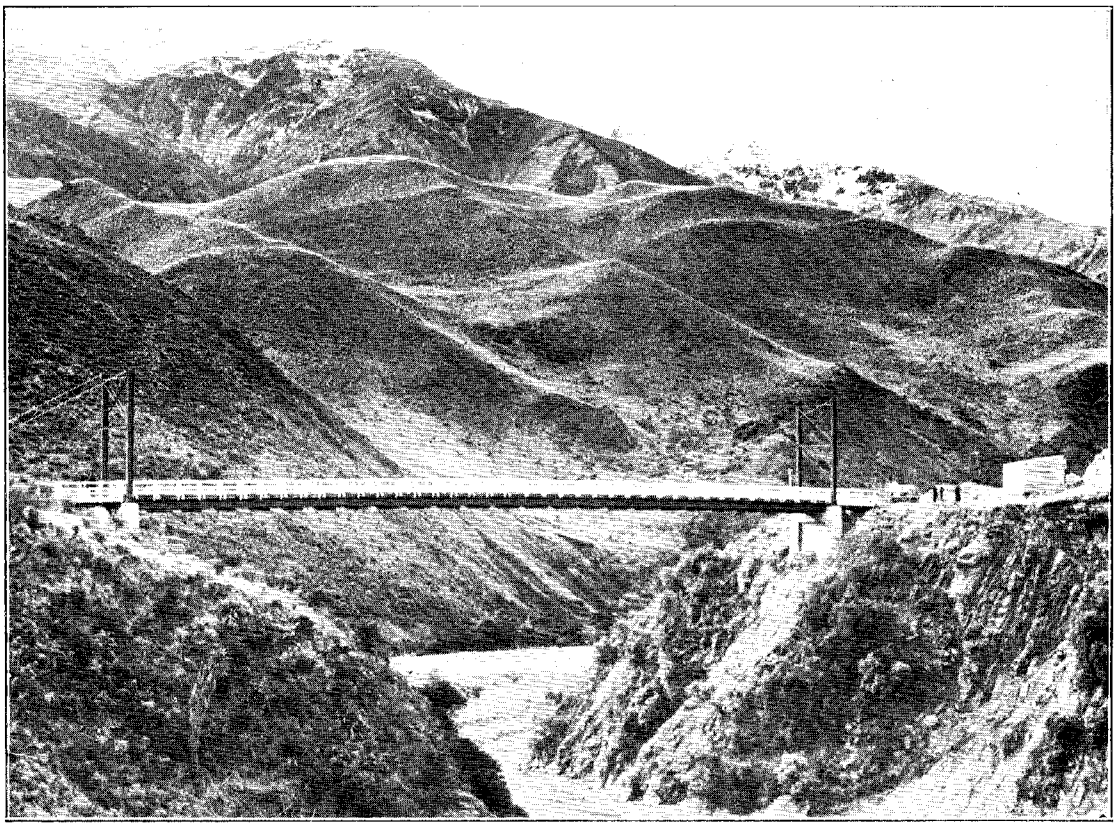


Moutere Hill Improvements, showing Amended Alignment.



Appleby Overbridge and Approaches. Three 30 ft. Reinforced-concrete Girder Spans, 24 ft. Roadway.

RICHMOND–COLLINGWOOD STATE HIGHWAY.

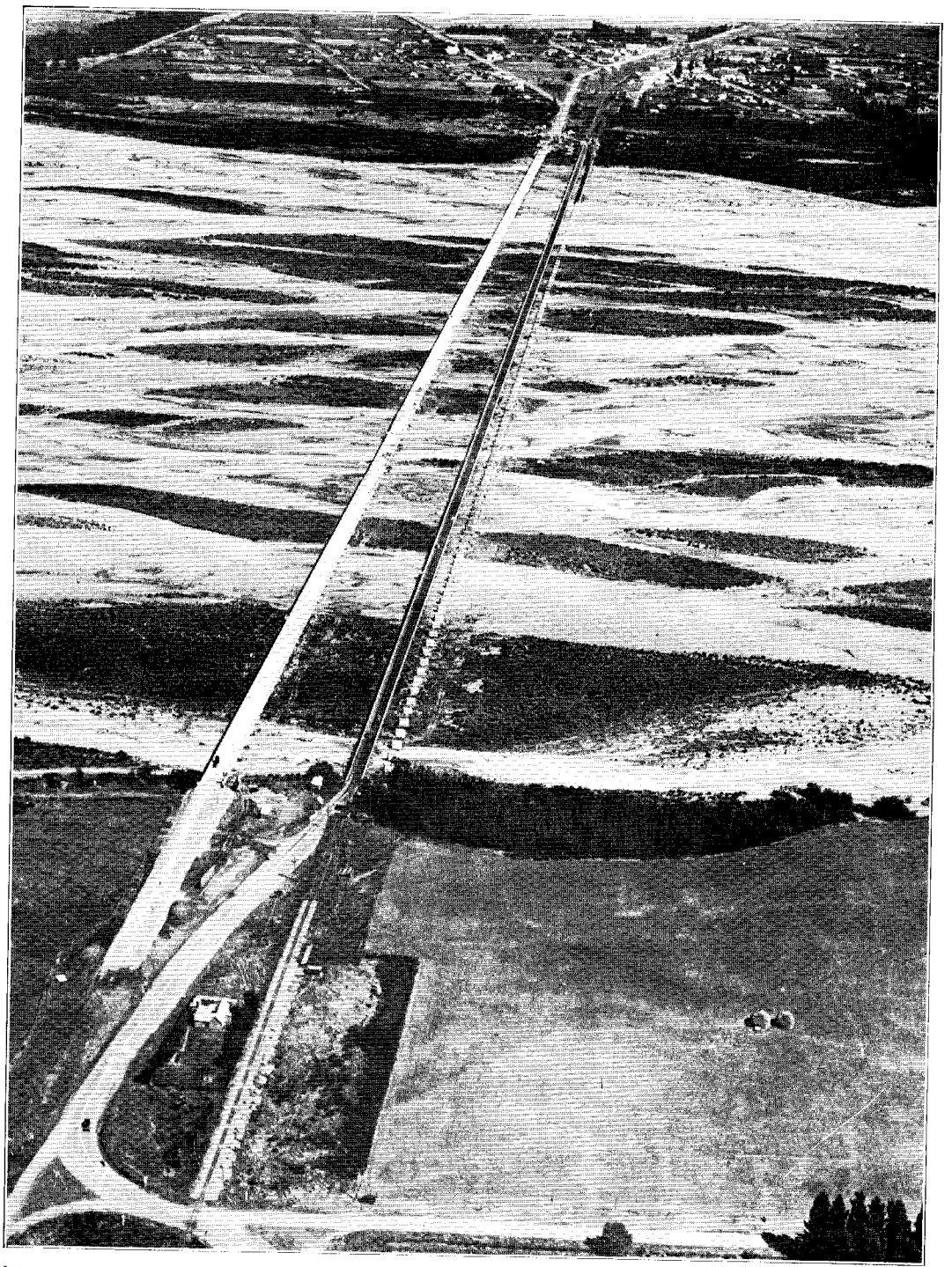


Hodder River Bridge. One 210 ft. Suspension Span and Two 17 ft. Approach Spans, with Concrete Deck, 10 ft. Roadway.

DASHWOOD–UPCOT MAIN HIGHWAY.

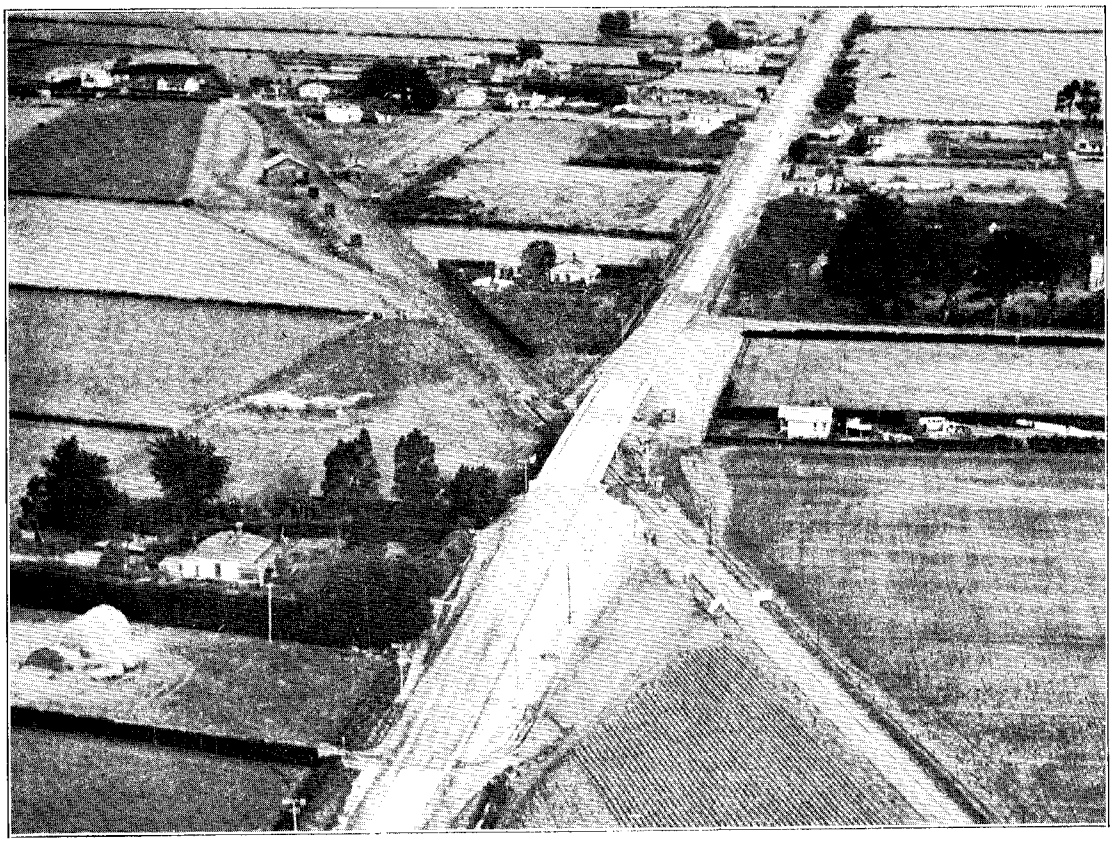
Otiika-iti River Bridge, Buller Gorge. Two 30 ft. and Two 45 ft. Spans, 20 ft. Roadway.

NELSON–WESTPORT STATE HIGHWAY.



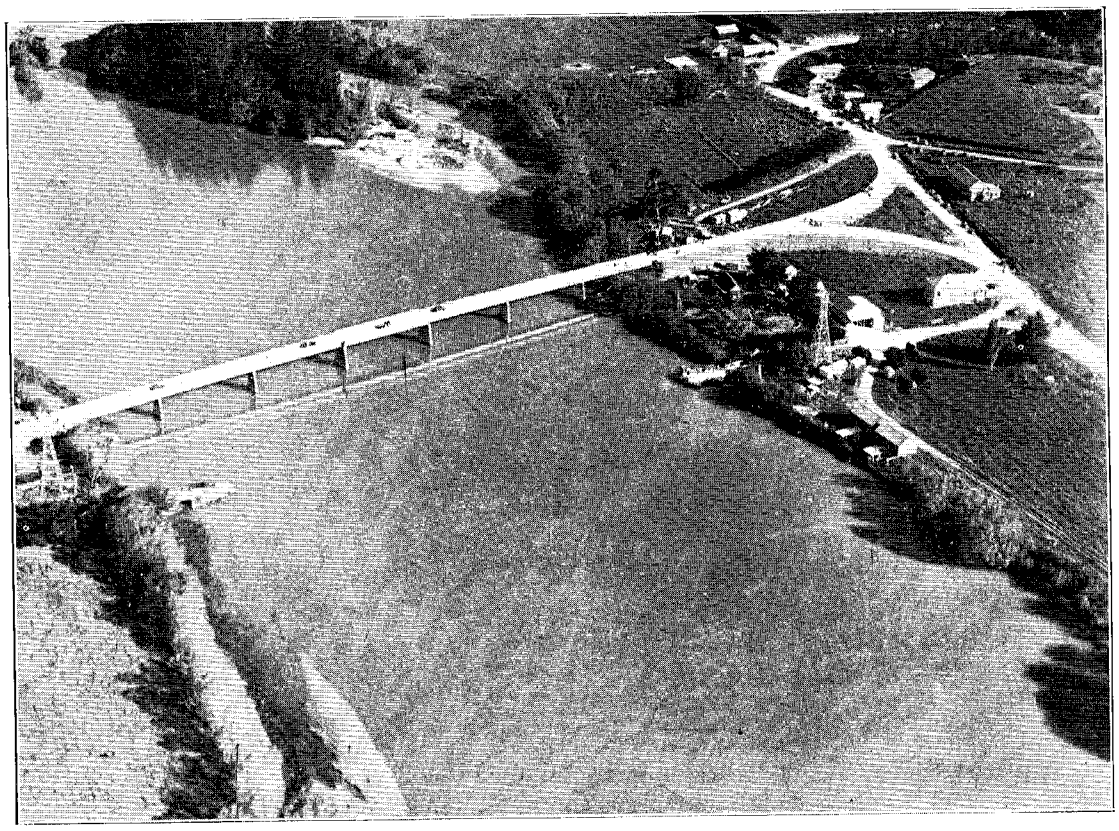
Rakaia River Bridge. New Highway Bridge (Left) of One Hundred and Forty-four 40 ft. Spans with 24 ft. Roadway; combined Road and Railway Bridge (Centre); Piers of New Railway Bridge (Right).

CHRISTCHURCH–TIMARU STATE HIGHWAY.



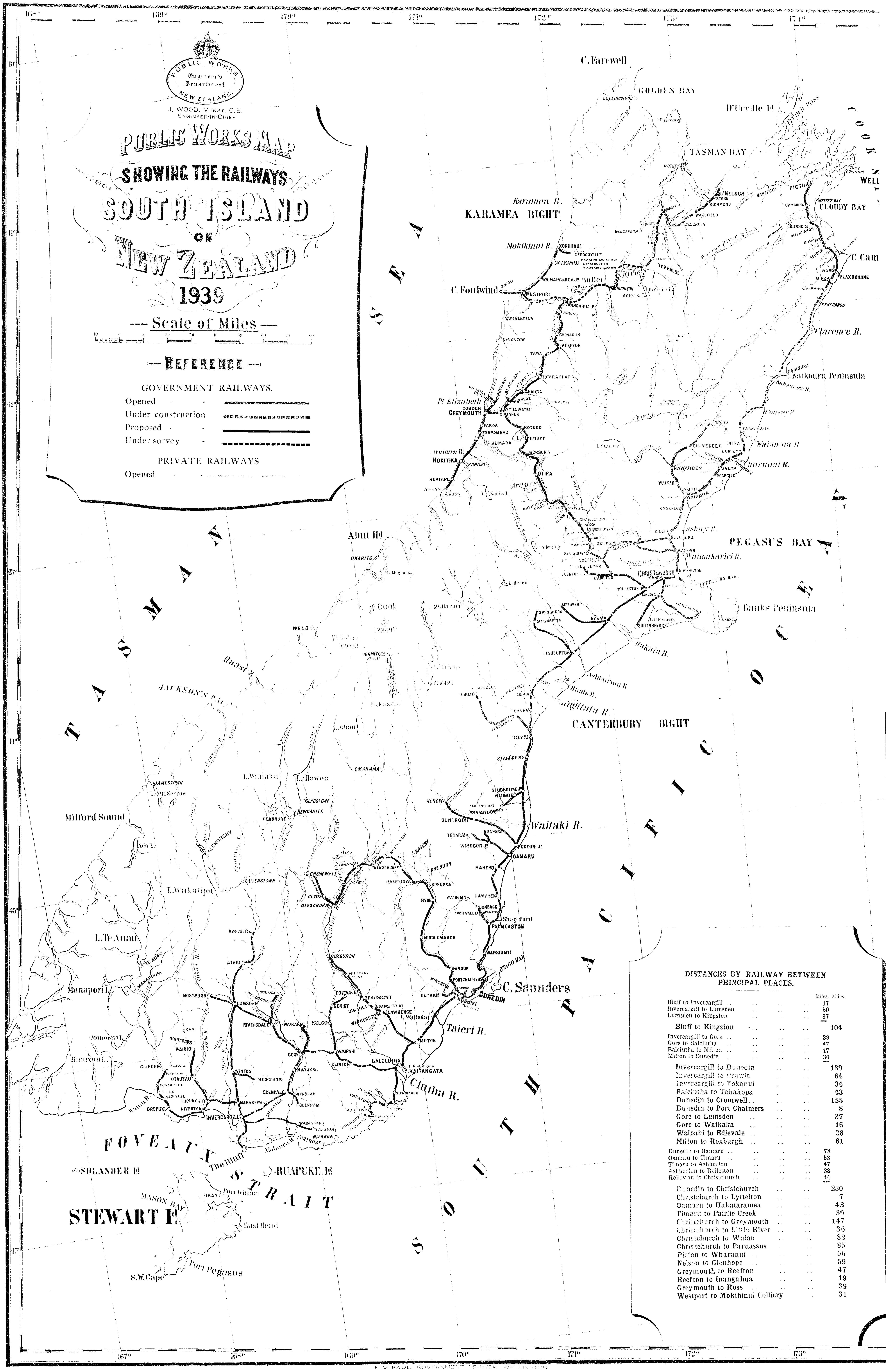
Aerial Photograph of Prebbleton Overbridge, of Four 50 ft. and Two 30 ft. Spans, 24 ft. Roadway, 4 ft. Footway.

SOCKBURN–SOUTHBRIDGE–RAKAIA HUTS MAIN HIGHWAY.



Clutha River Bridge at Clydevale, Seven 100 ft. Spans, 12 ft. Roadway. Access across River was previously accomplished by Punt, the Landing-stages being seen on the Near Side of the Bridge.

WAIWERA–CLYDEVALE MAIN HIGHWAY.



PUBLIC WORKS Engineer's Department NEW ZEALAND.
J. WOOD, M.INST. C.E. ENGINEER-IN-CHIEF
PUBLIC WORKS MAP
SHOWING THE RAILWAYS
SOUTH ISLAND
OF
NEW ZEALAND
1939
Scale of Miles
10 0 10 20 30 40 50 60 70 80
REFERENCE
GOVERNMENT RAILWAYS.
Opened
Under construction
Proposed
Under survey
PRIVATE RAILWAYS
Opened
168° 169° 170° 171° 172° 173° 174°
167° 168° 169° 170° 171° 172° 173°
40° 41° 42° 43° 44° 45° 46° 47° 48°
TASMAN SEA
SOUTH PACIFIC OCEAN
COOK STRAIT
FOVEAUX STRAIT
C. Farewell
GOLDEN BAY
COLLINGWOOD
D'Urville Id
French Pass
TASMAN BAY
MOTUEKA
NELSON
STOKE
RICHMOND
WAKEFIELD
BELGROVE
HAVELOCK
PICTON
WELLINGTON
Tory Channel
WHITE'S BAY
CLOUDY BAY
TUAMARINA
BLENHEIM
RIVERLANDS
RENWICK
Wairau River
Waihopai R.
DUMGREE
SEDDON
C. Campbell
WARD
FLAXBOURNE
MIRZA
Awatere River
WHARANUI
KEKERANGU
Clarence R.
KAIKOURA
Kaikoura Peninsula
Kahautara R.
Conway R.
PARNASSUS
Waiau-ua R.
WAIAU
CULVERDEN
MINA
DOMETT
ETHELTON
TORMOHE
Hurunui R.
HAWARDEN
GRETA
SCARGILL
WAIKARI
OMIHI
WAIPARA
AMBERLEY
Ashley R.
ASHLEY
RANGIORA
KAIAPOI
Waimakariri R.
PEGASUS BAY
OXFORD
SPRINGFIELD
SHEFFIELD
DARFIELD
CHRISTCHURCH
HORNBY
ADDINGTON
LYTTELTON
LYTTELTON HAR.
ROLLESTON Jn
LINCOLN
LITTLE RIVER
L. Ellesmere
SOUTHBRIDGE
Banks Peninsula
METHVEN
SPRINGBURN
MT SOMERS
RAKAIA
Rakaia R.
ASHBURTON
Ashburton R.
Hinds R.
Rangitata R.
FAIRLIE
ORARI
TEMUKA
PLEASANT POINT
TIMARU
CANTERBURY BIGHT
ST ANDREWS
STUDHOLME Jn
WAIMATE
WAIHAO DOWNS
KUROW
DUNTROON
Waitaki R.
NGAPARA
TOKARAHI
WINDSOR Jn
PUKEURI Jn
OAMARU
MAHENO
HAMPDEN
DUNBACK
INCH VALLEY
Shag Point
PALMERSTON
WAIKOUAITI
OTAGO HAR.
PORT CHALMERS
C. Saunders
DUNEDIN
MOSGIEL
Taieri R.
MIDDLEMARCH
HYDE
WAIHEMO
KOKONGA
KYEBURN
NASEBY
RANFURLY
WEDDERBURN
OMAKAU
CROMWELL
CLYDE
ALEXANDRA
ROXBURGH
MILLERS FLAT
BEAUMONT
EDIEVALE
HERIOT
EVANS FLAT
LAWRENCE
L. Waihola
MILTON
KELSO
WAIPAHI
CLINTON
BALCLUTHA
KAITANGATA
Clutha R.
GLENOMARU
OWAKA
CATLINS
PAPATOWAI
GORE
MATAURA
EDENDALE
WYNDHAM
GLENHAM
WAIMAHAKA
TOKANUI
WAIKAWA
FORTROSE
RIVERSDALE
WAIKAKA
LUMSDEN
MOSSBURN
KINGSTON
ATHOL
WINTON
HEDGEHOPE
MAKAREWA Jn
INVERCARGILL
THORNBURY
RIVERTON
OREPUKI
TUATAPERE
OTAUTAU
CLIFDEN
ORAWIA
WAIRIO
NIGHTCAPS
OHAI
Waiau R.
The Bluff
SOLANDER Id
RUAPUKE Id
MASON BAY
ORAN
Port William
STEWART Id
East Head
Port Pegasus
S.W. Cape
Manapori L.
MANAPOURI
TE ANAU
L. Te Anau
Monowai L.
Hauroto L.
Milford Sound
L. Wakatipu
QUEENSTOWN
GLENORCHY
L. Wanaka
L. Hawea
PEMBROKE
NEWCASTLE
GLADSTONE
JAMESTOWN
L. McKerrow
JACKSON'S BAY
Haast R.
WELD
Mt Cook 12349ft
OKARITO
Abut Hd
L. Tekapo
L. Pukaki
L. Ohau
OMARAMA
Mt Harper
L. Heron
L. Coleridge
ROSS
RUATAPU
HOKITIKA
KANIERI
Arahura R.
KUMARA
TARAMAKAU
PAROA
GREYMOUTH
COBDEN
Pt Elizabeth
BRUNNER
STILLWATER
NGAHERE
AHAURA
TOTARA FLAT
Grey R.
KOTUKU
L. Brunner
JACKSON'S
OTIRA
Arthur's Pass
ARTHUR'S PASS
L. Sumner
TAWAI
REEFTON
CRONADUN
INANGAHUA Jn
CHARLESTON
BRIGHTON
WESTPORT
C. Foulwind
Buller River
MURCHISON
Rotoroa L.
Roto-iti L.
TOPHOUSE
GLENHOPE
KAWATIRI-MURCHISON CONSTRUCTION SUSPENDED JAN 1931
NGAKAWAU
SEDDONVILLE
MOKIHINUI
Mokihinui R.
Karamea R.
KARAMEA BIGHT

DISTANCES BY RAILWAY BETWEEN PRINCIPAL PLACES.

	Miles.	Miles.
Bluff to Invercargill	17	
Invercargill to Lumsden	50	
Lumsden to Kingston	37	
Bluff to Kingston		104
Invercargill to Gore	39	
Gore to Balclutha	47	
Balclutha to Milton	17	
Milton to Dunedin	36	
Invercargill to Dunedin		139
Invercargill to Orawia		64
Invercargill to Tokanui		34
Balclutha to Tahakopa		43
Dunedin to Cromwell		155
Dunedin to Port Chalmers		8
Gore to Lumsden		37
Gore to Waikaka		16
Waipahi to Edievale		26
Milton to Roxburgh		61
Dunedin to Oamaru	78	
Oamaru to Timaru	53	
Timaru to Ashburton	47	
Ashburton to Rolleston	38	
Rolleston to Christchurch	14	
Dunedin to Christchurch		230
Christchurch to Lyttelton		7
Oamaru to Hakataramea		43
Timaru to Fairlie Creek		39
Christchurch to Greymouth		147
Christchurch to Little River		36
Christchurch to Waiau		82
Christchurch to Parnassus		85
Picton to Wharanui		56
Nelson to Glenhope		59
Greymouth to Reefton		47
Reefton to Inangahua		19
Greymouth to Ross		39
Westport to Mokihinui Colliery ..		31

E. V. PAUL, GOVERNMENT PRINTER, WELLINGTON.

PUBLIC WORKS
Engineer's Department
NEW ZEALAND.

J. WOOD, M.INST. C.E.
ENGINEER-IN-CHIEF.

PUBLIC WORKS MAP
SHOWING THE RAILWAYS
OF NORTH ISLAND
NEW ZEALAND
1939

— Scale of Miles —

10 0 10 20 30 40 50 60 70 80

— REFERENCE —

GOVERNMENT RAILWAYS.

Opened
Under construction
Proposed
Under survey

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 Taneatua		227
Auckland to Rotorua		171
Auckland to Whangarei		133
Dargaville to Donnelly's Crossing		24
Whangarei to Opua		53
Kawakawa to Okaihau		29
Gisborne to Motuhora		49
Thames to Waihi		33
Stratford to Okahukura		89

E.V. PAUL, GOVERNMENT PRINTER, WELLINGTON.