NEW ZEALAND.

# PUBLIC WORKS STATEMENT.

## 1941.

BY THE


## Hon. H. T. ARMSTRONG,

MINISTER OF PUBLIC WORKS.



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1941.

NEW ZEALAND.

# PUBLIC WORKS STATEMENT

(BY THE HON. H. T. ARMSTRONG, MINISTER OF PUBLIC WORKS).

MR. SPEAKER,—

In accordance with the provisions of section 8 of the Public Works Act, 1928, I submit my report on works carried out during the year ended 31st March, 1941, together with a statement of expenditure certified by the Controller and Auditor-General.

As I assumed the office of Minister of Public Works only in February last, this report relates more particularly to public-works activities which were directed by my colleague, the Hon. R. Semple, during the greater part of the year.

In the Statement presented to the House last year reference was made to the Government's decision to curtail public-works construction and to confine activities principally to those undertakings which had reached an advanced stage where completion should be effected and where special considerations demanded.

The effect of this policy is seen in the reduced expenditure under the General Purposes Account of the Public Works Fund, which for the past year amounted to £6,280,127, as against £9,238,447 for the preceding year, a decrease of £3,000,000.

Honourable members will appreciate that the public-works organization has not been engaged entirely upon operations normally associated with the public-works programme. The resources of the Department in respect of staff, men, and material have been utilized by the Government for the prosecution of a large amount of work arising directly from the war and which has been financed from the War Expenses Account. It would be erroneous, therefore, to assume that the scope of purely public-works activities is reflected by the actual operations of the Department. In order to afford a reasonable conception of the position it can be said that approximately one-third of the activities of the Department over the last twelve months has been absorbed by special war work carried out at the request and on behalf of the Army, Navy, and Air Departments, the cost being a charge against the War Expenses Account.

The military works carried out by my Department were numerous and extensive and comprised the design and erection of many hutments, administrative buildings, stores, and hospitals, including major institutions for the reception and treatment of returning sick and wounded, as well as other works of a special nature. The

installation of water-supplies, electrical equipment, drainage systems, food cooking and storage appliances, and fire-fighting and miscellaneous services also represented undertakings of some magnitude, particularly where large concentrations of troops were to be accommodated.

The progress of important national works the completion of which is fully justified and, indeed, necessary, has been affected by a shortage of men and material, a condition arising from the existing world situation.

At the end of the financial year the total number of men employed on all works controlled by the Department was 14,797, a reduction of 4,734 compared with the number at the commencement of the year. Of the 14,797 men, 3,051 were employed by contractors working for the Department, 1,940 were employed by local bodies on public works subsidized through the Department, leaving 9,806 men paid directly by the Department. Included in this latter figure are 2,877 men employed solely on defence works.

The release of officers and men for military service, a large number of whom volunteered, has been such that the remaining personnel has been called upon to work under extreme pressure in order to meet the many urgent demands of the present. I mention for the information of honourable members that at the end of the year 485 members of the staff and 1,912 workmen were serving with the overseas forces. Apart from the ordinary field companies of engineers, which included many Public Works Engineers, eight specialist engineering units have been sent overseas. The majority of the officers and men of these companies were drawn from the Public Works Department; consequently it will be realized that the drain on the professional and technical staff of the Department has been very severe. The Government has also released from public works a considerable number of men who were required in essential industries related to the nation's war work.

To some extent the shortage of materials, previously obtained from abroad, has been met by the use of substitute products manufactured in New Zealand under the Government's plan for developing secondary industries. The main difficulty, however, has been to secure regularity in the supply of structural and reinforcing steel for essential works, with consequent unavoidable delays in time schedules. By redesigning minor proposals wherever possible, the demand for imported steel has been reduced to a minimum.

During the year under review the principal public-works activities consisted of the continuation of projects already in hand at the outbreak of war. One of the most important programmes is that relating to the extension of the hydro-electric-power supply. The demand for electric power has been increasing at such a rate that particularly in the North Island the output from additional generating units now being installed will be almost absorbed as soon as they can be brought into operation. Without the use of standby plants at peak periods the present North Island supply systems could not meet existing demands. The urgency of providing additional supply will therefore be fully appreciated, especially in view of the industrial developments which are taking place. Unfortunately, the shortage of experienced men and the uncertain delivery of machinery and equipment from overseas have delayed the completion of some extension works which have reached an advanced stage. Railway-construction and irrigation schemes have been carried forward, and reasonably good progress has been achieved under the prevailing circumstances.

The erection of certain major public buildings has been continued in order to provide much-needed accommodation, and as structural operations are generally well advanced it is hoped that most of these will reach completion in the early future. Expenditure on main highways and settlement roading, which shows an appreciable reduction on the previous year's figures, has been confined to the works already in progress or those which presented special merit and urgency.

The estimates for the current year have been framed in keeping with the expressed policy of low-level public-works expenditure during the war.

The question of legislation to provide comprehensive measures for river-control throughout the Dominion has received further consideration. Draft proposals were prepared by my Department, which expressed the view that the important matter of soil-conservation should be dealt with in conjunction with river-control. In March last this House appointed a Select Committee to inquire into and report upon such questions relating to the protection of property from damage by floods and erosion and to the control of rivers generally as might be referred to it by the Government, and the Department's draft proposals have been under examination by that Committee.

The Committee has received and considered representations made by local authorities and other interested parties and has submitted important recommendations to the Government. As a result of these recommendations legislation is being drafted for submission to honourable members.

It is realized that after the war a large number of men will be returning from overseas service who will not be able to resume immediately their former occupations or who will require to be specially trained in vocations best suited to their individual circumstances. In the interim other work may have to be provided for some of these men, and with this object in view careful consideration is being given to the selection of national development works where they could be employed pending their rehabilitation in normal civil occupations.

A comprehensive schedule of important post-war projects has been compiled, including provision for flood-control and soil-conservation measures, the improvement of access and transport facilities, and the resumption of construction programmes which have been suspended during the war.

It will be appreciated that in respect of new proposals extensive detailed surveys and investigations would be required in many cases before activities could be launched, and this factor is receiving close attention. The estimates this year include an item for rehabilitation surveys, and although at present the shortage of professional staff does not allow of much being done in this direction it is anticipated that later in the year, when staff becomes available from the urgent national defence works now in hand, some of the required surveys will be commenced.

I desire to place on record the Government's appreciation of the services of Mr. John Wood, who retired from the positions of Engineer-in-Chief and Under-Secretary on the 28th February, 1941, having held these offices for more than four and a half years. Mr. W. L. Newnham has been appointed as his successor.

I wish also to acknowledge the loyal and efficient co-operation given by officers and workmen in carrying out the various works entrusted to the Public Works Department, many of which had to proceed under conditions of urgency associated with the Dominion's war requirements.

With deep regret I mention the fact that of those members of the staff who left New Zealand on military service, fourteen have made the supreme sacrifice and several have been wounded or posted as missing. Three officers serving abroad in the Air Force have been decorated for conspicuous bravery.

## FINANCE.

The payments and receipts and accumulated totals in connection with the Public Works Fund and other associated votes and accounts for the year 1940–41 are shown in the tabulation following.

The gross expenditure amounted to £20,327,529, of which £4,267,869 was expended by other Government Departments; the recoveries in reduction of expenditure amounted to £7,317,521, of which £1,362,390 was recovered by other Departments; the net expenditure totalled £13,010,008, of which £2,905,479 was expended by other Departments.

In addition, the Department collected £2,042,896 for the supply of electric energy, irrigation receipts, and miscellaneous revenue from other sources.

| Class of Work. | Expenditure, 1940–41. Gross. | Recoveries. | Net. | Total Net Expenditure to 31st March, 1941. |
|---|---|---|---|---|
| EXPENDITURE, PUBLIC WORKS FUND. | | | | |
| Railways— | £ | £ | £ | £ |
| New construction | 945,908 | 87,976 | 857,932 | 43,647,338 |
| Improvements and additions to open lines | 1,119,202 | 47,042 | 1,072,160 | 26,259,008 |
| Roads | 650,560 | 51,547 | 599,013 | 28,040,362* |
| Public buildings | 1,478,008 | 35,577 | 1,442,431 | 19,336,832† |
| Lighthouses, harbour-works, and harbour defences | 35,413 | 1,059 | 34,354 | 1,425,345 |
| Tourist and health resorts | 23,634 | 2,059 | 21,575 | 828,103 |
| Telegraph extension | 531,280 | 275,226 | 256,054 | 13,549,466 |
| Departmental | 587,583 | 537,604 | 49,979 | 3,794,004 |
| Irrigation, water-supply, and drainage | 672,309 | 61,271 | 611,038 | 2,577,805 |
| Lands-improvement | 267,031 | 24,073 | 242,958 | 1,651,845 |
| Swamp-land drainage | 13,184 | 9,237 | 3,947 | 109,512 |
| Small farms development | 828,349 | 257,134 | 571,215 | 2,429,824‡*a* |
| Native-land settlement | 1,011,010 | 772,427 | 238,583 | 1,778,203 |
| Dairy industry loans | .. | .. | .. | 46,125 |
| Linen-flax development | 245,997 | 20 | 245,977 | 245,977 |
| Cost and discount, raising loans, &c. | 32,911 | .. | 32,911 | 3,998,827 |
| Closed accounts (for more detail see Table 1) | .. | .. | .. | 8,116,740 |
| Totals, General Purposes Account | 8,442,379 | 2,162,252 | 6,280,127 | 157,835,31 § |
| Electric Supply Account (previously Aid to Water-power Works Account)— | | | | |
| Construction | 1,761,043 | 57,000 | 1,704,043 | 19,211,465‖ |
| Working-expenses | 610,721 | 10,432 | 600,289 | .. |
| Waihou and Ohinemuri Rivers Improvement Account | .. | .. | .. | 709,740*d* |
| Totals, Public Works Fund | 10,814,143 | 2,229,684 | 8,584,459 | 177,756,521 |
| EXPENDITURE, OTHER VOTES AND ACCOUNTS. | | | | |
| Main Highways Account— | | | | |
| Annual appropriation— | £ | £ | £ | £ |
| Construction, reconstruction, and improvements | 1,668,346 | 140,570 | 1,527,776*b* | 16,969,725*c* |
| Maintenance, repairs, and renewals | 1,429,075 | 139,305 | 1,289,770*b* | .. |
| Administration, plant, and miscellaneous expenditure | 238,459 | 65,088 | 173,371*b* | .. |
| Interest, fees, and loan redemptions | 530,365 | .. | 530,365*b* | .. |
| Permanent appropriations (rate subsidies, interest on transfer from Public Works Fund, &c.) | 316,826 | 2,183 | 314,643*b* | .. |
| Consolidated Fund— | | | | |
| Maintenance, public buildings, roads, &c.¶ | 456,290 | 55,136 | 401,154 | .. |
| Plant, material, and miscellaneous services¶ | 4,860,098 | 4,685,555 | 174,543 | .. |
| Closed accounts (for details see Public Works Statement, 1933) | .. | .. | .. | 18,955,387 |
| Labour Department (expenditure by Public Works Department): Amounts not included above | 13,927 | .. | 13,927 | .. |
| Totals, Other votes and accounts | 9,513,386 | 5,087,837 | 4,425,549 | 35,925,112 |
| Grand total of expenditure, Public Works Fund and other votes and accounts for the year ended 31st March, 1940 | 20,327,529 | 7,317,521 | 13,010,008 | .. |
| Capital expenditure to date | .. | .. | .. | 213,681,633 |

* 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, or £122,500 exchange on remittances beyond the Dominion. ‖ Total capital excluding suspense items as per accounts in Table No. 5. ¶ Excludes transfers to Public Works Fund vote, &c. (£30,000.)
*a* Includes previous vote "Settlement of Unemployed Workers." *b* For annual income and expenditure accounts see Appendix E.
*c* As per accounts in Appendix E. *d* Excludes interest and loan charges.

| Class of Work. | Recoveries, 1940–41. |
|---|---|
| RECEIPTS,* PUBLIC WORKS DEPARTMENT. | |
| Ordinary Revenue Account— | £ |
| Irrigation (receipts for year) | 27,267 |
| Miscellaneous receipts for year | 24,397 |
| Electric Supply Account (sales of energy, miscellaneous receipts, &c.): Receipts for year | 1,956,183 |
| Main Highways Account (repayment of advances, &c., and interest): Receipts for year | 35,049 |
| Total receipts | 2,042,896 |

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

*Summary.*

| | Public Works Department. | Other Departments. | Total. |
|---|---|---|---|
| | £ | £ | £ |
| Gross expenditure .. .. .. .. | 16,059,660 | 4,267,869 | 20,327,529 |
| Recoveries and receipts .. .. .. .. | 7,998,027 | 1,362,390 | 9,360,417 |

Of the net expenditure of £13,010,008 previously mentioned, £9,299,234 may be regarded as having been expended from loan-moneys (£6,247,216 General Purposes Account, £1,704,043 Electric Supply Account, and £1,347,975 Main Highways Account) the balance — *i.e.*, £3,710,774 — being expended from loan recoveries, revenue, and taxation.

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, if deducted, would detract from the true portrayal of activities.

| | £ | Per Cent. |
|---|---|---|
| Roads, including construction and maintenance of main highways .. .. .. .. | 4,833,631 = | 21·61 |
| Hydro-electric (construction and working-expenses) | 2,371,764 = | 10·60 |
| Railway-construction, improvements, and additions | 2,065,110 = | 9·23 |
| Public buildings, including schools .. .. | 1,478,008 = | 6·61 |
| Small farms development .. .. .. | 828,349 = | 3·70 |
| Lands improvement .. .. .. .. | 267,031 = | 1·19 |
| Irrigation .. .. .. .. .. | 672,309 = | 3·01 |
| Public buildings, roads, &c. (maintenance) .. | 456,290 = | 2·04 |
| Telegraph extension .. .. .. .. | 531,280 = | 2·37 |
| Native-land settlement .. .. .. .. | 1,011,010 = | 4·52 |
| Plant, material, and services for other Departments | 4,860,098 = | 21·73 |
| Linen-flax development .. .. .. | 245,997 = | 1·10 |
| Miscellaneous .. .. .. .. .. | 706,652 = | 3·16 |
| Revenue receipts .. .. .. .. | 2,042,896 = | 9·13 |
| | £22,370,425 = | 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, 1940 .. .. .. .. .. .. | | | | 1,288,991 |
| Add funds received during the year— | | | | |
| Finance Act, 1939, section 2 (Public Works) | | £ 7,979,565 | | |
| Less— | £ | | | |
| Loans redeemed, 1939–40 | 1,460,000 | | | |
| Exchange on remittances beyond the Dominion | 122,500 | | | |
| | | 1,582,500 | £ 6,397,065 | |
| Miscellaneous .. .. .. .. .. | | | 115,341 | |
| | | | | 6,512,406 |
| | | | | 7,801,397 |
| Deduct expenditure during 1940–41 under annual appropriations .. .. | | | | 6,280,127 |
| Balance available 31st March, 1941 .. .. .. .. | | | | £1,521,270 |

The estimated net expenditure under the General Purposes Account for the current financial year is £5,042,300, 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 £2,957,375 from the Electric Supply Account and £2,742,200 from the Main Highways Account, a total for all these accounts of £10,741,875.

*Summary of Votes under Control of Minister of Public Works and Proposed Ways and Means of Raising the Necessary Funds—Year ending 31st March, 1942.*

| Vote. | Loans. | Consolidated Fund. | Special Revenue. | Total. |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Departmental .. .. .. .. | 200,000 | .. | .. | 200,000 |
| Railway-construction .. .. .. | 607,100 | .. | .. | 607,100 |
| Public Buildings .. .. .. | 900,000 | .. | .. | 900,000 |
| Lighthouses and Harbour-works .. .. | 50,000 | .. | .. | 50,000 |
| Development of Tourist Resorts .. .. | 20,000 | .. | .. | 20,000 |
| Roads .. .. .. .. | 350,000 | .. | .. | 350,000 |
| Land Improvement .. .. .. | 200,000 | .. | .. | 200,000 |
| Irrigation .. .. .. .. | 552,000 | .. | .. | 552,000 |
| Electric Supply .. .. .. | 1,987,000 | .. | 970,375 | 2,957,375 |
| Main Highways .. .. .. | 642,200 | .. | 2,100,000 | 2,742,200 |
| Maintenance of Public Works and Services | .. | 600,000 | .. | 600,000 |
| Totals .. .. .. | 5,508,300 | 600,000 | 3,070,375 | 9,178,675 |

For the current financial year 1941–42 a sum of £600,000 will be provided from the Consolidated Fund for expenditure on maintenance of Public Works and Services, including £100,000 for housing workmen engaged on farm production. The expenditure on main highways (including permanent appropriations estimated at £307,800) is estimated to reach £3,050,000, of which a sum totalling £2,100,000 is expected to be raised by way of special revenue. It is anticipated that the revenue from the supply of electrical energy will reach a sum of £2,288,000, which will be utilized for the payment of arrears of sinking-fund instalments, interest, operating-expenses, and income-tax, &c.

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) | 150,000 | .. | 1,800,000 | 1,950,000 |
| Education Buildings (Minister of Education) .. | 500,000 | .. | .. | 500,000 |
| Telegraph Extension (Postmaster-General) .. | 275,000 | .. | .. | 275,000 |
| Small Farms Development (Minister of Lands) .. | 388,200 | .. | 287,800 | 676,000 |
| Native Land Settlement (Minister of Native Affairs) | 250,000 | 270,000 | 425,000 | 945,000 |
| Linen-flax development (Minister of Industries and Commerce) | 600,000 | .. | 369,000 | 969,000 |
| Total .. .. .. .. .. | 2,163,200 | 270,000 | 2,881,800 | 5,315,000 |

## MAIN HIGHWAYS.

Having regard to the necessity for curtailing expenditure as far as possible on works that, although they may be desirable under normal conditions, are not essential at the present time, it has been the policy during the last year to taper off all improvement or reconstruction works in hand, so that when they reach a stage where they can be left without endangering the safety of the travelling public, they can be closed down altogether. The programme for the elimination of dangerous railway crossings has been suspended for the present except that particular schemes, which were well advanced, are being carried through to completion.

The activities of the Main Highways Board for the past financial year are described in its annual report, which is attached to this Statement. The report indicates that the total receipts from revenue sources amounted to £2,202,638, as compared with £2,758,808 for the preceding period. The reduced income from motor-spirits tax accounts for £475,208 of the decrease of £556,170, and this reduction is, of course, directly attributable to the petrol restrictions that have operated over the period.

The total expenditure from the Main Highways Account for the financial year ended 31st March, 1941, on actual works, as distinct from loan and special charges, amounted to £2,659,002, which is a very substantial reduction on the preceding year's figures. Maintenance expenditure was reduced by £235,088, the renewal of bridges involved £29,727 less than in the previous year, while the curtailment in constructional activities showed a saving of £1,675,205. The total reduction in main highways expenditure therefore was no less than £1,940,020 as compared with the previous year. In addition, interest and loan charges amounted to £587,747 and general rate subsidies paid to local authorities totalled £213,457. The improvements completed included formation and widening lengths totalling 186 miles and the metalling of various sections aggregating in length 128 miles. The length of dustless surfacing added during the year was 243 miles and the length of new bridging totalled 9,405 lin. ft.

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 £97·1, compared with £117·6 for the preceding year.

While a decrease in the average maintenance cost per mile has resulted, due to the reduced traffic, the general standard of maintenance has been maintained.

The Highways Board's proposals for the current year provide for adequate and reasonable maintenance of the existing assets, the renewal of decayed or dangerous bridges, and the completion of contracts already in hand, along with the improvement of sections of highway considered necessary by the Army authorities.

## HYDRO-ELECTRIC DEVELOPMENT.

All generating stations have operated smoothly during the year, and the financial results of operations have again been very satisfactory. After paying net operating-expenses the revenue for the year gave a return of 9·07 per cent. on the average capital in operation, as compared with 8·7 per cent. for last financial year.

The development of secondary industries made necessary by the war has been a factor in increasing the demand in both Islands, and the units generated in Government generating-stations and Government-controlled stations showed an increase over the previous year of 13·90 per cent. in the North Island and 13·41 per cent. in the South Island.

Amending legislation passed last year rendered the Electric Supply Account liable for payment of taxes, and the sum of £336,049 was accordingly paid for income-tax, national security tax, and social security charge.

### Demand versus Generating-capacity.

During the year it has been found necessary to call on all North Island Electric Supply Authorities, which are dependent on the Government hydro-electric generating-stations, to exercise a strict control over the increasing electrical demand in their respective areas. The response so far has enabled the Public Works Department to postpone the implementing of any arbitrary scheme for rationing of supplies, which is the only alternative and one which it is desired to avoid if possible.

Several expedients have been adopted by Supply Authorities in general to tide over the present difficulties, which, however, cannot be disposed of until delivery of additional generating-plant is obtained from overseas; but it is satisfactory to record that up to the present Electric Supply Authorities have not found it necessary to introduce any measures of a drastic nature.

The legislation extending daylight saving throughout the year has proved most beneficial in alleviating the position in the generating-stations.

## Operating Results.

*North Island System.*—The plants at Arapuni, Waikaremoana, Mangahao, and Horahora have been fully operated throughout the year. Assistance from various local plants—principally the King's Wharf Station, Auckland, and the Evans Bay Station, Wellington—was necessary during the autumn and winter months to meet the ever-increasing demand for power.

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

| | £ |
|---|---|
| Capital investment at end of year .. .. | 11,561,705 |
| Revenue .. .. .. .. .. | 1,533,136 |
| Operating-expenses .. .. .. .. | 640,884 |
| Balance .. .. .. .. | £892,252 |

The balance has been used in paying £336,073 for interest, £284,532 for social security charge, national security and income-taxes, and £148,937 to bring the Sinking Fund up to statutory requirements. The balance of £122,710 has been transferred to Reserve Fund. It was not necessary to make any payment to the Depreciation Reserve as this account has reached the statutory limit of 12½ per cent. of capital.

The Reserve Accounts established in connection with this scheme show that £1,112,633 has been credited to Depreciation Reserve, £1,308,951 to Sinking Fund, and £303,948 to the Reserve Fund.

*South Island System.*—The plants at Lake Coleridge, Waitaki, Monowai, and Arnold River have also been operated successfully.

The year's operations resulted as under:—

| | £ |
|---|---|
| Capital investment at end of year .. .. | 7,289,053 |
| Revenue .. .. .. .. .. | 678,813 |
| Operating-expenses .. .. .. .. | 173,289 |
| Balance .. .. .. .. | £505,524 |

The balance has been used in payment of £254,069 for interest, £51,517 for social security charge, national security and income-taxes, £73,711 to the Depreciation Reserve, and £126,227 to the Sinking Fund.

The various Reserve Accounts established in connection with this scheme show that £813,288 has been paid to the Depreciation Reserve, £543,856 to Sinking Fund, and £86,766 to Reserve Fund. There is still a deficiency of £214,654, as against the statutory requirements of Sinking Fund.

*Summarized Position: 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 | 9,519,865 | 1,533,136 | 640,884 | 892,252 | 9·37 |
| South Island system | 5,882,967 | 678,813 | 173,289 | 505,524 | 8·59 |
| Totals .. | 15,402,832 | 2,211,949 | 814,173 | 1,397,776 | 9·07 |

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 £1,925,921 for depreciation, and in addition, has provided £1,852,807 towards the statutory sinking-fund requirement of £2,067,461. In addition, £390,724 has been paid to the Reserve Fund from profits from time to time. In other words, the electric-supply system as a whole has paid all operating and interest charges and provided £4,169,452 in reserves, of which £1,538,178 has already been utilized for the paying-off of loans which formed part of the original capital. There are, however, still to be met arrears of sinking funds amounting to £214,654.

## Construction.

The demand for electric power still continues to increase, and, in addition to the ordinary expansion due to farming development and the construction of houses, industrial development and the supply of military camps has imposed a special load on the supply system.

To meet this demand additional main generating-stations and increased reticulation facilities have to be provided as a matter of urgency.

On the Waikato River two additional 21,600 kW. units are being installed at Arapuni, thus completing the final development at this station to a total of 146,400 kW.

At Karapiro some sixteen miles below Arapuni, a new dam is being built to utilize 100 ft. fall, and three 30,000 kW. generating-units are being installed, thus providing 90,000 kW. additional power from which must be deducted 10,300 kW. at present being generated at Horahora, which will be submerged when this new development is put into operation.

At the outlet to Lake Taupo a diversion canal has been constructed on which six regulating-gates have been installed so that the outflow from Lake Taupo can be regulated to provide water as required for the generating-stations below. The use of these gates will obviate any water being wasted over the spillways at certain seasons, and this water will be stored for use when the peak demand requires it.

At Waikaremoana work is nearing completion on the lower development which utilizes a head of 370 ft., and at this station two 20,000 kW. generating-units are being installed. The main feature of this work is the construction of 7,500 ft. of 16 ft. diameter pressure-tunnel.

At Cobb River good progress is being made on a scheme recently taken over from a private company. This scheme utilizes water under a head of 1,964 ft. and four 3,000 kW. generating-units are being installed, of which one unit is to be used as a spare; therefore the output will be 9,000 kW. This scheme is capable of being doubled at some future date.

In Canterbury construction works are proceeding on Highbank scheme situated on the Rakaia River, although the water-supply is being obtained from the Rangitata River by means of a 42-mile irrigation race. The available fall is 330 ft., and one 25,200 kW. generating-unit is being installed.

At Waitaki two new 15,000 kW. generating-units have been installed, bringing the total capacity of the station to 60,000 kW.

At Lake Tekapo construction has been started on regulating-works which involve the construction of a 20-ft.-diamater concrete-lined pressure-tunnel 6,000 ft. long, and a dam at the outlet of Lake Tekapo. These regulating-works will perform a similar function in controlling the water to Waitaki power-station as the Lake Taupo regulating-works for stations on the Waikato River. In addition to the regulating-works, there is a fall of 100 ft. which will be used subsequently to operate a generating unit of 21,600 kW. capacity at the outlet of the tunnel.

With the exception of Tekapo, tenders for which have not yet been called, the manufacture of the generating-units for these stations is well advanced, and it is hoped that deliveries will be made in due sequence, notwithstanding the prevailing difficulty of shipping during the war period.

## RAILWAY-CONSTRUCTION.

Railway-construction is being confined to those railways which at the outbreak of war had reached an advanced stage towards completion, and it is expected that the Dargaville Branch Railway, the Gisborne–Napier Railway, and the Westport–Inangahua Railway can be substantially completed within the current financial year. The position in regard to the works in progress is as follows:—

*Dargaville Branch Railway.*—The main line is completed and the Public Works Department is operating a useful goods and passenger service.

The formation and platelaying of the station-yards are completed, and a contract for the construction of the station buildings is being arranged.

*Gisborne–Napier Railway.*—The whole of the formation and tunnelling work is now completed, and the bridges are all completed except for two large reinforced-concrete viaducts over the Waiau River which are now in an advanced state of completion.

Platelaying and ballasting have progressed considerably during the year, and at the end of March the gap between railheads was reduced to $6\frac{1}{4}$ miles. All the material for the completion of the line is on hand.

*Turakina–Okoia Railway Deviation (Wellington – New Plymouth Railway).*—The formation and tunnels were completed during the year, and the piers and abutments of the bridges over the Turakina and Wangaehu Rivers are completed in readiness for placing the steel girders. Plans and specifications have been prepared for the station buildings at Wangaehu and Turakina.

*South Island Main Trunk Railway.*—The construction of this railway has proceeded favourably during the year, and the bulk of the formation, tunnelling, and bridge work is completed. The major work remaining to be done is the laying and ballasting of 40 miles of permanent-way, extensive lengths of coastal-protection work, protection of bridge approaches, and the construction of station buildings.

The position in regard to the supply of rails is still obscure on account of the difficulty of obtaining delivery during the war period, but it is hoped that this difficulty may be overcome in the near future.

*Westport–Inangahua Railway.*—The formation and bridging work is now completed, and the work remaining to be done is 5 miles 20 chains of platelaying and the completion of 20 miles of ballasting, of which approximately 13 miles has had one lift.

Some small station buildings are required, and these buildings are in hand.

All the material for the completion of the work is on hand.

## RAILWAYS: IMPROVEMENTS AND ADDITIONS TO OPEN LINES.

The expenditure out of the Public Works Fund for the year ended 31st March, 1941, was £1,087,337, details being as follows:—

| | £ | £ |
|---|---|---|
| Christchurch new station and yard rearrangement | | 33,486 |
| Frankton Junction rearrangement | | 3,153 |
| Wellington new station and yard | | 6,684 |
| Wellington–Paekakariki electrification | | 7,544 |
| Oamaru foreshore protection works | | 20,000 |
| Duplication of lines— | | |
| Levin–Koputaroa | 4,952 | |
| Papakura–Horotiu | 118,889 | |
| Plimmerton–Paekakariki | 7,250 | |
| Tawa Flat – Porirua | 3,240 | |
| | | 134,331 |
| Grade and curve easements— | | |
| Picton | 9,281 | |
| Glen Eden – Henderson | 4,697 | |
| Henderson–Swanson–Waitakere | 8,319 | |
| Miscellaneous | 3,926 | |
| | | 26,223 |
| Deviations— | | |
| Palmerston North | 34,794 | |
| Scroggy Hill | 21,374 | |
| St. Leonard's – Sawyer's Bay | 46,485 | |
| Turakina–Okoia | 34,027 | |
| | | 136,680 |
| General— | | |
| Otira Substation | | 6,698 |
| Purchase of road motor services, plant, and vehicles | | 81,066 |
| Dwellings | | 29,416 |
| Elimination of level crossings | | 15,967 |
| Rail-car depots | | 5,315 |
| Turntables | | 14,849 |
| Workshops buildings and plant | | 29,143 |
| Signalling and communications | | 19,460 |
| Rearrangements of stations and sidings | | 87,282 |
| Miscellaneous works | | 8,661 |
| Additions and improvements to rolling-stock | | 421,379 |
| | | £1,087,337 |

Little progress has been made in connection with the provision of the new station and yard at Christchurch. The position is that the main portion of the work cannot be proceeded with until the new goods-shed has been completed, and this particular work has been held up pending the delivery of steel from overseas.

The placing of stone at the foreshore-protection works at Oamaru has been completed so far as the present scheme is concerned.

*Duplication of Lines.*—Earthworks on the Levin–Koputaroa and Tawa Flat–Porirua duplications were completed during the year. Steady progress has been maintained with the duplication between Papakura and Horotiu. The earthwork has been practically completed to Pokeno on the north end and to Te Kauwhata on the south end. A new station building was completed at Pukerua Bay in connection with the Plimmerton–Paekakariki rearrangement scheme.

*Grade and Curve Easements.*—Steady progress has been maintained with the Henderson–Swanson–Waitakere tunnel grade easements and also on the Glen Eden–Henderson grade easement works. The Para–Tuamarina (Picton) curve easements are nearing completion.

*Deviations.*—Work on the Palmerston North deviation has been suspended.

Approximately 95 per cent. of the earthworks have been completed on the Scroggy Hill deviation and grade-easement works between New Lynn and Glen Eden. Good progress has been made on the easing of the steep grades between Turakina and Bonny Glen. Only 285 ft. of core excavation remains to be moved from the Sawyer's Bay Tunnel, and the concrete lining is being placed from both ends.

*General.*—The erection of the new rectifier substation at Otira to replace the existing steam plant is nearing completion. The local substation to supply the townships of Otira and Arthurs Pass has been completed.

A number of passenger and goods road transport service licenses, together with vehicles, plant, and buildings, were purchased during the year. Some of the more important of these services were the New Plymouth Daily Transport, Ltd., Hodgson's Wanganui–New Plymouth Service, Taafe's Awanui–Otiria Service, McGlashan's Greymouth–Blackball Service, the Napier–Wairoa–Gisborne Transport Service, the Rotorua Motor Transport Co.'s service, and the Rotorua Bus Co.'s service.

In addition to alterations and improvements to dwellings, twenty-two new houses were erected and five dwellings were purchased during the year.

The work of improving the railway-operating facilities was continued and larger turntables to accommodate heavier engines were installed. The car-shop at Otahuhu Workshops was extended and workshops plant renewed and improved.

The rearrangement of stations, sidings, and yards and alterations due to grade and curve easements and deviations have necessitated alterations in signalling and communication facilities.

Further additions and improvements were effected in the equipment for signalling and communications.

The following are the more important works shown under the subheadings of "Rearrangements of stations and sidings" and "Miscellaneous works":—

| | |
|---|---|
| Auckland .. .. | Extensions to goods-shed. |
| Otahuhu and Westfield | Yard alterations. |
| Rotorua .. .. | Yard alterations. |
| Te Awamutu .. | Improved facilities. |
| Te Kuiti .. .. | Yard alterations. |
| Taumarunui .. .. | Alterations and additions to Locomotive Depot. |
| New Plymouth .. | Yard and goods-shed. |
| Feilding .. .. | Additional sidings. |
| Wellington Goods .. | Sealed tracks and roadway. |
| Napier .. .. | Yard and goods-shed. |
| Gisborne .. .. | Station and yard alterations. |
| Picton Section .. | Yard alterations. |
| Belfast .. .. | Yard rearrangement. |

*Additions and Improvements to Rolling-stock.*—During the year 2 class Ed electric and 10 class Ka steam locomotives were placed in service.

Ten new boilers were completed.

One new rail car (imported) was placed in service; 25 new carriages and 20 new brake-vans were built.

During the year, 1,236 wagons of various types were built. In addition to the rolling-stock completed during the year, work was in progress on 31st March, 1941, on the construction of a number of engines, cars, vans, and wagons.

## ROAD-CONSTRUCTION.

New roading-works undertaken during the year consisted principally of relatively small sections of formation and metalling, together with bridging where necessary, in order to provide access to areas where production would be thereby improved. Apart from such works, construction operations were limited to those projects which were well in hand at the commencement of the year, such as the Awanui–Mangonui, Waiouru–Tokaanu, Taumarunui–Tokaanu, Okau–Tongaporutu, Main South Westland, and Makarora–Haast Roads. The construction of the last-mentioned road has now been suspended.

Progress generally has been governed by the availability of men and materials, the number of workmen employed directly by the Department having decreased at the end of the period by more than one-half of the number employed at the beginning of the year.

Altogether 235 miles of road were formed and 400 miles were metalled by the Department and by local authorities in receipt of grants and subsidies from the Government. In addition, 8,395 lineal feet of bridging was completed, and culverts totalling 32,312 ft. in length were installed.

The net expenditure from the "Roads" vote of the Public Works Fund for the year ended 31st March, 1941, was £599,013, the corresponding figure for the preceding year being £1,124,590.

## IRRIGATION AND WATER-SUPPLY.

Steady progress has been maintained on this phase of development work. The completed schemes continue to function well and the area irrigated shows a slight increase on the previous total.

In Otago, thirteen completed schemes are in operation and 52,106 acres were irrigated, out of a total commanded area of 64,000 acres. The annual revenue amounted to £26,730, being £834 in excess of last year's revenue.

In Canterbury, two completed schemes are in operation where 3,350 acres were irrigated, out of a total commanded area of 17,403 acres. The annual revenue amounted to £844, being £157 in excess of last year's revenue. The increase in the use of the Canterbury schemes is below expectation, but this is probably due to reluctance of farmers to prepare their land for irrigation during the war period.

The year's construction activity was confined to the continuation of the large Canterbury schemes which will derive their water-supply from the Rangitata River diversion race.

Work on the Rangitata irrigation and hydro-electric power water-race was continued during the year, and the excavation work is in an advanced state of completion over a length of 40 miles. The total excavation now amounts to 3,220,000 cubic yards, of which 939,000 cubic yards were excavated during the year. The total number of concrete bridges, syphons, and regulating structures now completed on the race is eighty-five, of which fifty-nine were completed during the year. The large intake structure is nearing completion, and the large pressure syphon at Surrey Hills is well in hand. This latter structure is nearly $1\frac{3}{4}$ miles long, and is made up of precast reinforced-concrete pipes 12 ft. in diameter and 12 ft. long, each pipe weighing 28 tons. These pipes are manufactured in a specially-designed pipe-factory near the site of the works.

The construction of the Ashburton-Lyndhurst Scheme, 34,000 acres, and Mayfield-Hinds Scheme, 54,000 acres, has been continued as circumstances permitted; the former scheme is now 94 per cent. completed and the latter scheme 40 per cent. completed. The construction of these schemes is subservient to the completion of the Rangitata diversion race, and labour and materials have been diverted temporarily to this major work.

The operation of a demonstration area on the Ashburton-Lyndhurst Scheme was continued, and last year the average number of sheep carried per acre was 9·96, while 14·1 sheep per acre were carried during the irrigation season.

The Downlands Water-supply Scheme is now in an advanced state of completion, and 700 farms, comprising a total of 109,000 acres, are now being supplied with water for domestic and stock purposes. Pleasant Point Township is also served with a water-supply and fire service. The length of mains and submains laid is 37 miles, or 70 per cent. of the total, and the length of galvanized reticulation piping laid is 572 miles, or 82 per cent. of the total. Five of the six reservoirs are

now completed. It is difficult to forecast when the remaining portion of the scheme will be completed owing to the difficulty of obtaining the remaining piping under present war conditions.

In view of the importance of irrigation and its bearing on closer settlement, it is my endeavour to continue the irrigation-works in progress as actively as the present war conditions will permit.

## PUBLIC BUILDINGS.

The expenditure for last year on the various divisions of buildings was :—

| | £ |
|---|---|
| General Government buildings | 337,769 |
| Courthouses | 13,154 |
| Prison buildings and works | 2,533 |
| Police-stations | 24,343 |
| Post and Telegraph buildings | 352,562 |
| Mental Hospitals buildings | 126,644 |
| Health and Hospital institutions | 44,020 |
| Total | £901,025 |

### New Departmental Buildings.

The erection of a number of major departmental buildings which were commenced during the preceding year has been continued, and, under the prevailing conditions, satisfactory progress has been made.

The new premises for the National Commercial Broadcasting Service at Auckland are nearing completion, and work was continued on the building being constructed for the Internal Marketing Division.

The departmental building in Jean Batten Place, Auckland, was approaching completion at the end of the year under review, and several offices will enter into occupation at an early date.

At Wellington good progress has been made with the Stout Street building, the structural concrete work and stone facing have been completed, but a considerable amount of work remains to be done in the way of exterior and interior finishing, including the installation of services and the subdivision of all floors.

A contract has been let for extensions to the Dominion Laboratory, and construction work was commenced recently.

Owing to the fact that essential material has not been available, it has not been practicable to proceed with the foundations of the new Government Printing Office in Wellington.

Extensions to the departmental buildings at Greymouth were completed and the additional accommodation occupied during the year.

### Agriculture.

Reasonable progress has been made during the year in providing buildings and other more adequate facilities at the Lincoln and Massey Agricultural Colleges.

Apart from some minor completion aspects at the Ruakura Animal Research Station, the main activity, in continuation of last year's work in progress, was at the Wallaceville Animal Research Station. At both of these research stations the staff are now in occupation of buildings of types which suitably house the extensive range of equipment and other facilities which are so essential to investigation and research relative to animal husbandry and crop and pasture management. The need for extensions of accommodation to facilitate the wine-production activities of the Te Kauwhata Horticultural Station has been long felt. A section of this work which was commenced during the year under review is now nearing completion.

## Courthouses.

In last year's Statement a reference was made to a review of all proposals for rebuilding old and out-of-date Courthouses. It has been found that with the difficulties surrounding the supply of materials and skilled labour little material progress has been possible.

It was anticipated that the new Courthouse at Invercargill would have been completed and in use some time ago, but it was found exceedingly difficult to obtain supplies of required materials. The internal fittings are now coming to hand, and it is hoped to be able to arrange for the formal opening within a few months.

The erection of a rebuilt Courthouse at Omakau is well in hand, and a contract has been let for a much-needed new building at Ruatoria. In conjunction with other Departments additions are being erected at Opotiki. Many major proposals were in hand, but these have been deferred in view of the present war situation.

## Health and Hospital Institutions.

During the year an additional fifty-eight beds were made available at Queen Mary Hospital, Hanmer, by the completion of the new male block. The boiler-house was also completed, and work on the new laundry and staff cottage is being proceeded with.

In connection with the activities of the St. Helens Hospitals, work on the tennis-court and roadway at the Invercargill hospital has been commenced, and at Wellington properties adjoining the hospital were purchased as a first step towards increasing the facilities available. Extensions to the nurses' cottage at Wellington were also completed.

On the dental side, repairs and alterations were carried out to the hostels for dental trainees in Wellington.

Plans for the new hospital bathhouse and sanatorium at Rotorua were also proceeded with, and this work is being expedited to meet possible requirements in relation to sick and wounded soldiers returning from overseas.

In order to meet the immediate requirements of sick and wounded soldiers, however, special emergency hospitals at Auckland, Wellington, and Christchurch are being provided, and work on these hospitals is now nearing completion. A clearing hospital at Aotea Quay, Wellington has now been completed. The expenditure on this accommodation was met from War Expenses Account.

## Mental Hospitals.

The renewal and extension of essential services, such as water-supply, drainage, telephones, roading, fire-fighting, laundries, kitchens, &c., have been carried out as circumstances demanded.

Accommodation has been provided for occupational-therapy work at several institutions.

Erection of the Nurses' Home at Kingseat has been continued, and a villa for male patients at Tokanui has been completed.

The erection of three male villas at Ngawhatu has continued, and these buildings should be ready for occupation at an early date.

At Templeton a start has been made on the erection of a villa for male patients at Jenkin's Farm; and at Hokitika a new Nurses' Home and butcher's shop are in course of construction.

## Police-stations.

The police-stations at Rotorua and Port Chalmers were completed, and new stations were erected at St. Heliers Bay, Cheviot, Runanga, and Miramar. New offices have been provided at Levin and Waimate, and lock-ups have been erected at Clyde, Lawrence, and Mokau.

Contracts have been let for a new police-station at Glenavy and for a residence and offices at Temuka, and these works are now in hand.

A site for a police-station was purchased at Glen Eden (Auckland), and residences were acquired for a Sub-Inspector at Northland (Wellington) and for a constable at Lower Hutt.

## Postal and Telegraph.

During the year the following buildings were completed: Chief Post-office buildings at Hamilton and Wanganui; post-office buildings at Brown's Bay, Kaukapakapa, Stockton Mine, Taupo, and Waiouru Military Camp; automatic-telephone-exchange buildings at Avondale, Birkenhead, and Gisborne; line, store, and garage buildings at Nelson and Tauranga; garages at Arrowtown, Culverden, Waiau, and Waiuku; and a radio receiving-station building at Awarua. Additions were made to the post-office buildings at Culverden, Dominion Road, Huntly, Matamata, Ngongotaha, Te Mata, Upper Hutt, Waharoa, and Waikaia, and to the automatic-telephone-exchange buildings at Devonport and Onehunga.

Improved accommodation was provided at Blenheim, Point Chevalier, and Port Chalmers.

Several buildings and sites which were no longer required were disposed of during the year. Sites and additional land for departmental purposes were acquired at ten places.

At the end of the year the following buildings were in course of erection: Christchurch (chief post-office); Dunedin (store and workshops); Invercargill (chief post-office); Katikati (post-office and quarters); Lower Hutt (post-office); Mosgiel (post-office and postmaster's residence); Mount Albert (automatic telephone-exchange); Te Kuiti (post-office).

Also in progress were large additions to the chief-post-office building at Auckland, additions to the Ponsonby automatic telephone-exchange, and major alterations to the Auckland (Newmarket) store and workshops buildings, minor additions to the New Lynn post-office building, and alterations to the Timaru chief-post-office building.

## Prisons.

As was the case for the year ended 31st March, 1940, expenditure has again been kept down to a minimum consistent with efficient management, and until the present war is over it is proposed to follow this policy.

At Auckland Prison a proposal was on foot to install an up-to-date mechanical laundry, but, although the major scheme was held over, a hydro-extractor was installed, and this will be of some assistance in the meantime. The electric-lighting equipment for Rangipo Prison Camp has been received, but owing to pressure of military needs it has not so far been found possible to complete the installation. It is hoped to have this much-needed amenity completed during 1941–42.

At Waikeria Borstal Institution a further cottage has been completed, and to relieve staffing difficulties it is proposed to build a further two, as these are really a necessity. Here, also, an up-to-date pasteurizing plant and additional equipment has been installed in one of the dairies to enable the local schools to participate in the Health Department's milk-in-schools scheme.

## Scientific and Industrial Research.

At Auckland the wiring of humidity-rooms and the provision of temporary electric supply to the fruit-store were completed for the Plant Diseases Division. The surfacing of the main roads on the experimental area was also undertaken during the year.

A refrigerated gas-stove was erected and equipped at Wellington for use in conducting cool-storage and gas-storage experiments on a semi-commercial scale.

The erection of a cottage for the Grasslands Division at Palmerston North was commenced towards the end of the year.

For the Agronomy Division, Lincoln, building extensions were completed, and a new laboratory and glasshouse were provided at the Wheat Research Institute, Christchurch.

Also at Christchurch, alterations and renovations were undertaken to accommodate the local branch of the Dominion Laboratory, and a building was erected for use as a workshop and store for the Magnetic Observatory.

## EDUCATION BUILDINGS.

The gross expenditure on school buildings, additions, teachers' residences, and the purchase of sites amounted to £580,470 during the year ended 31st March, 1941. This sum includes £24,898 provided by the Consolidated Fund to meet the cost of minor works.

The following table shows the capital expenditure on school buildings and sites during the last four years.

| | 1937–38. £ | 1938–39. £ | 1939–40. £ | 1940–41. £ |
|---|---|---|---|---|
| Public schools | 331,558 | 467,255 | 583,918 | 381,547 |
| Education Board offices | .. | 3,850 | 15,816 | 4,100 |
| Secondary schools | 58,924 | 56,819 | 69,545 | 72,305 |
| Technical schools | 97,740 | 82,568 | 60,283 | 20,218 |
| Training colleges | 1,984 | 27,071 | 29,325 | 5,929 |
| Native schools | 34,180 | 39,632 | 77,666 | 70,773 |
| University colleges | 39,086 | 58,710 | 22,456 | 1,384 |
| Child Welfare institutions | 351 | .. | 5,344 | 21,828 |
| Special schools | 312 | 840 | 12,683 | 2,287 |
| School for Deaf, Sumner | 4,841 | 6,295 | .. | .. |
| N.Z. Institute for the Blind | .. | 1,000 | .. | .. |
| Kindergartens | 881 | 1,181 | 1,734 | 99 |
| Refund portion purchase-money sale of Education Board Offices | .. | 1,500 | .. | .. |
| Gross total | 569,857 | 746,721 | 878,770 | 580,470 |
| Less Credits-in-aid | 7,913 | 66,411 | 7,600 | 14,436 |
| | £561,994 | £680,310 | £871,170 | £566,034 |

## TELEGRAPH EXTENSION.

The expenditure on telegraph extension by the Post and Telegraph Department during the year in respect of telephone, telegraph, and radio facilities throughout the Dominion amounted to £256,054, as against £416,778 for the year ended the 31st March, 1940.

The establishment of military camps and other defence activities necessitated the provision of improved and additional toll outlets in various parts of the Dominion to meet the demand for toll service. These increased facilities were arranged principally by the establishment of the following carrier-current telephone systems:—

Hamilton – New Plymouth: One single-channel system.
Hamilton–Ohakune: One single-channel system.
Ohakune – Palmerston North: One single-channel system.
Waiouru Military Camp – Hamilton: One single-channel system.
Waiouru Military Camp – Palmerston North: Two single-channel systems.
Wellington–Seddon: One three-channel system.
Christchurch – Hanmer Springs: One single-channel system.
Westport–Greymouth: One single-channel system.

The installation of the additional Wellington–Seddon three-channel system enabled the Department to increase the number of direct telephone channels between Wellington and Christchurch from seven to eight, while the allotment of direct toll outlets between Wellington and Blenheim was increased from three to four. A twelve-channel carrier telephone system is on order to provide for the establishment of twelve additional telephone channels over the Cook Strait coaxial submarine cable to meet expected inter-Island traffic developments in the near future.

Better facilities were also provided between various centres by the erection of new lines and/or the rearrangement of existing circuits.

A four-channel carrier-frequency telegraph system was brought into operation between Christchurch and Greymouth in June, 1940. All the principal West Coast stations now have direct telegraphic outlets to Christchurch.

The demand for telephone-exchange service has shown little diminution during the year, the net gain in subscribers totalling 6,814, as against 7,546 for the previous year. The grand total of telephone stations (main and extension) in the Dominion on the 31st March, 1941, was 228,346, which is 10,477 in excess of the previous year's figure.

The whole of the equipment for the new automatic-telephone exchange at Gisborne, which was ordered in October, 1938, has been received, and the installation work is nearing completion. It is expected that this exchange will be cut over to automatic working in July, 1941.

Practically the whole of the automatic switching-equipment ordered in 1939 for exchanges in the Auckland metropolitan area has been delivered, and a comprehensive programme for the extension of the automatic switching system in that area is being proceeded with as rapidly as possible. The first stage of this programme comprises the installation at the Auckland Central exchange of one thousand lines of equipment specially designed to deal with heavy traffic loads, such as groups of business telephone connections, which were cut into service in April, 1941, in replacement of temporarily arranged equipment; and the replacement of the existing switching apparatus in the Devonport and Onehunga exchanges by modern 7A2 type rotary equipment which will be brought into commission in June, 1941. Additional equipment comprising two hundred individual lines has also been installed at the Mount Eden exchange; and at all main exchanges in the area the old type friction-driven registers have been replaced by 7A2 registers and link circuits.

Additional switching-equipment was also provided during the year at a number of other automatic exchanges throughout the Dominion, and new magneto telephone-exchanges were opened during the year at Parakao and Hanmer Springs.

## DEVELOPMENT OF TOURIST RESORTS.

The expenditure for the year ended 31st March last was £21,575, as compared with £24,892 for the previous year.

The expenditure during the year under review included extensions to the Rotorua electric system, additional store-room accommodation and the installation of freezing plant at the Chateau Tongariro, formation of roads and tracks in the Rotorua district and in the Tongariro National Park, also the completion of construction work on the reservoir for the water-supply system at Rotorua.

## LANDS-IMPROVEMENT.

Activities under this vote consisted mainly in the continuance of works which were in hand during the preceding year, although a number of miscellaneous improvement works were also undertaken in cases where urgent remedial or protective measures were considered necessary.

Sand-dune reclamation in the North Auckland, Auckland, and Wellington districts was continued, and in the two first-mentioned districts tidal-flat reclamation was undertaken for the purpose of bringing into use what would otherwise remain as waste areas.

Willow-clearing from rivers and streams and drainage of waterways and swamp lands were also features of lands-improvement work carried out during the year.

The water-supply scheme for the Hauraki Plains East district was completed, and a similar undertaking in the Awatere County is approaching completion.

In order to improve flood conditions in the Manawatu River, a contract was arranged for excavating the Whirokino Cut, near Foxton. This new channel is so designed as to conform to any major control scheme which may be adopted in respect of the Manawatu River flooding.

A partial scheme, comprising the clearing of the waterway and the erection of stop-banks, was completed so as to minimize the danger and damage from flooding by the Ashburton and Hinds Rivers, and a recent major flood demonstrated the effectiveness of the works carried out.

A number of river-protection works were completed in the West Coast district of the South Island.

### Rehabilitation of Flax-milling Industry.

In pursuance of the policy of the Government in regard to the rehabilitation of the flax-milling industry, considerable work was carried out in and around Foxton. In Foxton itself the Department supervised the erection of the various buildings required by the New Zealand Woolpack and Textiles, Ltd., to house the extra machinery for the expansion of the woolpack industry as a national undertaking. Suitable arrangements were made for the provision of amenities for the welfare of the employees at the factory, which, it was anticipated, will employ over four hundred workers.

Major developmental work was undertaken by the Department in regard to the Moutoa Estate, which was acquired by the Government for development as a flax plantation. The flax is to be used for supplying fibre to the woolpack-factory. The total area of 4,621 acres is being developed over a four-year programme, and a considerable amount of work is being entailed on account of the infestation of the area with willows, fescue, and other noxious growths. Machinery has been used to advantage especially in heavy clearing work, although the nature of the land does not permit of its fullest use. The activities undertaken have included heavy and light clearing, ring-barking willows, ploughing and disking, planting flax, thickening up flax areas where flax was not growing in payable quantities, cultivation of areas of planted flax, drainage, fencing, roading, and the erection of necessary buildings. Up to one hundred and thirty men have been employed on the area, and very valuable work is being done.

### Land-clearing.

The scheme initiated by my predecessor in office whereby the Department's heavy machinery was hired to farmers for clearing land of stumps, logs, and second growth has been maintained with satisfactory results.

The cost of bringing such land into cultivation by methods formerly employed was so uneconomic that many areas could only have remained indefinitely as semi-waste land. It is now evident that the use of machinery for stumping, logging, clearing, ploughing, &c., has enabled many hundreds of acres of this land to be brought unto early production at a figure which the farmer has been able to finance without difficulty.

During the year 10,000 acres of land were cleared of stumps and growth, 3,000 acres were ploughed and cultivated, and 70 miles of internal farm roads or tracks were formed under the land-clearing scheme.

## TEMPORARY ACCOMMODATION FOR FARM WORKERS AND CHEESE WORKERS.

Last year, when it was desired to increase primary production, arrangements were made to provide farmers with temporary accommodation on their farms for both married and single workers.

The standard of accommodation provided was similar to that used on large public-works construction jobs, and the arrangement was that the temporary accommodation for married men was to be available for the duration of the war, and a season after, at a small weekly rental. In the case of single accommodation this would be purchased outright or rented at a small weekly rental on the same conditions as for married accommodation.

Farmers, particularly in the North Island, very quickly took advantage of this arrangement, and the Department had great difficulty in coping with the orders. Up to 31st March 671 married workers' hutments and 175 single hutments had been erected. Many more have since been completed.

As the requirements in connection with primary produce are now somewhat different from what they were, and as farmers should be able to arrange for any future accommodation under the Rural Housing Scheme, it is not proposed to extend facilities for the provision of temporary accommodation when existing orders are completed.

Temporary accommodation is at present being provided for cheese-factory workers under somewhat similar conditions to those under which farm-workers' accommodation is being provided.

## SMALL FARMS DEVELOPMENT.

During the year the Lands and Survey Department, operating through the Small Farms Board, continued with the development and farming of the many areas acquired for settlement under the Small Farms Act, 1932–33, and, in addition, took over a further 19,100 acres. At the 31st March the area under the Board's control totalled 160,610 acres.

The expenditure for the year on improvements (wages and materials), stock, and chattels totalled £572,562, and the credits-in-aid were £258,553.

The good progress made with the development of the older blocks resulted in a change to routine farming and made possible the release without replacement of a considerable number of workmen. At the beginning of the year the number of men employed was 1,101, but this was gradually reduced to 721 at the 31st March.

A decision has been made by the Government to finance soldier settlement from this vote, and the necessary statutory provisions were embodied in the Small Farms Amendment Act, 1940.

## SWAMP-LAND DRAINAGE.

In the Hauraki Plains Drainage District 3 miles 17 chains of new drains were constructed, while 27 miles 33 chains of drains and stop-banks were improved. In addition, the usual maintenance work on existing drains and stop-banks was carried out.

In the Rangitaiki Drainage District 56½ chains of new drains were constructed, 7 miles 9 chains of existing drains were improved, and 2 miles of stop-banks were reconstructed. Intensive maintenance of existing drains was carried out.

In the Kaitaia, Waihi, and Poukawa Drainage Areas little new work was carried out, but existing works were maintained.

Full details of the work carried out in the various swamp-land drainage areas will be found in the report of the Chief Drainage Engineer contained in the Lands and Survey Department's annual report.

## LIGHTHOUSES AND HARBOUR-WORKS.

*Lighthouses.*—During the year good progress has been made with the erection of radio-beacon stations and the electrification of lights, notwithstanding difficulties by way of delivery of material from the United Kingdom. At Cape Reinga a new station has been established with electric power and the installation of a radio beacon. The station is now almost complete with three new residences and the necessary buildings for engines, &c. Pending the erection of a new tower which is to house the lantern and lens from the Cape Maria station, a temporary light has been exhibited. Cape Maria station has been discontinued and removed to Cape Reinga. Any equipment and material of use on the mainland station was dismantled and transferred. At Tutukaka Heads a new light has been established but is

not yet exhibited. At Cuvier and Moko Hinou Island lighthouses radio beacons and radio telephones have been installed, also the lights electrified. A rearrangement of lights has been carried out at the Hen and Chickens. At Cape Campbell new radio generators were installed and the old set reconditioned to be held as reserve for Baring Head or other beacon stations when required. At Godley Head arrangements are in hand for the reconditioning of the old lens and lantern from Cape Foulwind and erection on a new site. At Centre and Dog Island stations, in conjunction with the Post and Telegraph Department, arrangements are in hand for the installation of radio telephones. At Puysegur Point road access is now almost complete and some progress has been made with the erection of a new power plant to provide electric current for a radio beacon and electrification there. At Jackson's Bay a new tower has been established, but the light is not yet exhibited. At Farewell Spit the erection of a landing-stage has been completed.

*Harbour-works.*—At Waiheke Island the wharf at Beachlands was demolished and a slipway constructed with the materials salvaged therefrom, and the Orapiu Wharf was reconstructed.

At Westhaven the construction of a breastwork and approach road was commenced.

Repairs and extensions are being undertaken at the Havelock Wharf, and preliminary work has been completed prior to arranging a contract for construction.

Jetties have been constructed at Endeavour Inlet, Ship's Cove, and Tennyson Inlet.

Surveys have been made in respect of a number of projected harbour-works as a preliminary to preparing detailed proposals.

## NATIVE-LAND SETTLEMENT.

The gross expenditure from the Public Works Fund for the year under review was £1,010,871 (compared with £1,052,777 for the previous year), the finance for which was provided from the following sources: New loan-moneys, £238,444; grant from the Consolidated Fund, vote "Native," for the promotion of employment of Maoris, £291,669; miscellaneous refunds, £2,663; and farm and other receipts from Native land in course of development and settlement, £478,095.

With the exception of £27,455 expended under the Native Housing Act, 1935, 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, 1941:—

| | |
|---|---|
| Area gazetted for development (acres) | 918,000 |
| Area under development (acres) | 292,000 |
| Individual settlers established | 1,900 |
| Labourers employed | 2,900 |
| Houses erected and repaired to date on schemes and under Native Housing Act from vote "Native Land Settlement" | 1,855 plus 414 huts. |
| Live-stock tallies— | |
| Dairy stock | 59,000 |
| Run cattle | 27,500 |
| Sheep | 251,000 |
| Receipts for year— | |
| | £ |
| Butterfat (Department's proportion only, 40 per cent.) | 169,600 |
| Wool | 79,300 |
| Live-stock | 200,500 |
| Sundries | 28,700 |

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.

Further detailed particulars of public works carried out during the past year are included in the attached reports by the Engineer-in-Chief, the Government Architect, and the Chief Electrical Engineer.

In accordance with section 24 of the Main Highways Act, 1922, the annual report of the Main Highways Board for the year ended 31st March, 1941, together with a statement of accounts duly audited by the Audit Office, is also attached, *vide* Appendix E.

# 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, 1941, AND THE LIABILITIES ON THAT DATE.

| Number of Table containing Details. | Works. | Total Net Expenditure to 31st March, 1940. | Expenditure during Twelve Months ended 31st March, 1941. | Recoveries on Account of Services of Previous Years. | Total Net Expenditure to 31st March, 1941. | Liabilities on 31st March, 1941. | Total Net Expenditure and Liabilities. | Works. |
|---|---|---|---|---|---|---|---|---|
| | | £ | £ | £ | £ | £ | £ | |
| 3 | Railways* .. .. .. .. | 68,093,328 | 1,930,092 | 462 | 70,022,958 | 56,553 | 70,079,511 | Railways.* |
| .. | Roads† .. .. .. .. | 27,521,168 | 599,013 | 491 | 28,119,690 | 38,015 | 28,157,705 | Roads.† |
| 4 | Public buildings‡ .. .. .. | 17,963,513 | 1,442,431 | 1,418 | 19,404,526 | 126,008 | 19,530,534 | Public buildings.‡ |
| .. | Telegraphs .. .. .. .. | 13,294,682 | 256,054 | .. | 13,550,736 | 231,751 | 13,782,487 | Telegraphs. |
| .. | Departmental .. .. .. | 3,753,439 | 49,979 | 46 | 3,803,372 | 6,707 | 3,810,079 | Departmental. |
| .. | Charges and expenses of raising loans .. | 3,965,916 | 32,911 | .. | 3,998,827 | .. | 3,998,827 | Charges and expenses of raising loans. |
| .. | Lighthouses, harbour-works, and harbour defences | 1,394,498 | 34,354 | .. | 1,428,852 | 4,287 | 1,433,139 | Lighthouses, harbour-works, and harbour defences. |
| .. | Irrigation and water-supply§ .. .. | 2,001,542 | 611,038 | 18 | 2,612,562 | 78,073 | 2,690,635 | Irrigation and water-supply.§ |
| .. | Lands improvement‖ .. .. | 1,466,265 | 242,958 | 3,635 | 1,705,588 | 12,855 | 1,718,443 | Lands improvement.‖ |
| .. | Tourist and health resorts .. .. | 809,708 | 21,575 | .. | 831,283 | 258 | 831,541 | Tourist and health resorts. |
| .. | Small-farms development¶ .. .. | 1,865,071 | 571,215 | .. | 2,436,286 | 16,737 | 2,453,023 | Small-farms development.¶ |
| .. | Swamp land drainage .. .. | 106,307 | 3,947 | 108 | 110,146 | 4,471 | 114,617 | Swamp land drainage. |
| .. | Native land settlement .. .. | 1,579,341 | 238,583 | 5,393 | 1,812,531 | 29,934 | 1,842,465 | Native land settlement. |
| .. | Linen flax development .. .. | .. | 245,977 | .. | 245,977 | 22,141 | 268,118 | Linen flax development. |
| | | 143,814,778 | 6,280,127 | 11,571 | 150,083,334 | 627,790 | 150,711,124 | |
| | Closed accounts :— | | | | | | | Closed accounts :— |
| .. | Immigration .. .. .. | 3,312,573 | .. | 88 | 3,312,485 | .. | 3,312,485 | Immigration. |
| .. | Purchase of Native lands .. .. | 2,054,024 | .. | .. | 2,054,024 | .. | 2,054,024 | Purchase of Native lands. |
| .. | Defence .. .. .. .. | 1,389,449 | .. | .. | 1,389,449 | .. | 1,389,449 | 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 .. | 134,826 | .. | .. | 134,826 | .. | 134,826 | 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. |
| | | 8,116,828 | .. | 88 | 8,116,740 | .. | 8,116,740 | |
| .. | Transfer to Main Highways Account, Construction Fund | 1,226,000 | .. | .. | 1,226,000 | .. | 1,226,000 | Transfer to Main Highways Account, Construction Fund. |
| | Totals .. .. .. | 153,157,606 | 6,280,127 | 11,659 | 159,426,074 | 627,790 | 160,053,864 | Totals. |

* Does not include expenditure on Hutt Railway and Road Improvement, Wellington-Manawatu Purchase, and Railway 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, and expenditure under vote "Settlement of Unemployed Workers" is included.

# TABLE No. 2.

## GENERAL SUMMARY.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1919–20 to 1940–41.

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, 1919. | Expenditure. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1919–20. | 1920–21. | 1921–22. | 1922–23. | 1923–24. | 1924–25. | 1925–26. | 1926–27. | 1927–28. | 1928–29. | 1929–30. |
| Immigration .. .. .. .. .. .. | £ 2,330,113 | £ *Cr. 62,561* | £ *Cr. 7,806* | £ 247,528 | £ 90,611 *Cr. 140* | £ 92,600 *Cr. 1,267* | £ 136,353 *Cr. 16* | £ 107,521 *Cr. 443* | £ 184,918 | £ 67,157 | £ 50,266 *Cr. 283* | £ 41,756 |
| Public Works, Departmental .. .. .. .. | 1,431,255 | 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* | 142,252 *Cr. 88,499* | 132,783 *Cr. 51,671* |
| Irrigation and Water-supply .. .. .. .. | 176,700 | 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* | 55,198 *Cr. 8* | 69,657 |
| Railways .. .. .. .. .. .. | 34,594,661 | 748,649 *Cr. 105,196* | 1,365,466 *Cr. 388* | 3,133,200 *Cr. 751* | 2,110,859 *Cr. 3,171* | 1,776,413 *Cr. 1,167* | 1,878,729 *Cr. 37,924* | 1,988,614 *Cr. 16,875* | 1,480,807 *Cr. 95,647* | 1,141,822 *Cr. 1,699* | 1,216,277 *Cr. 2,595* | 1,812,521 *Cr. 1,296* |
| Payment to Midland Railway Bondholders .. .. | 150,000 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Roads :— | | | | | | | | | | | | |
| Miscellaneous Roads and Bridges .. .. .. | 10,224,320 | 376,097 *Cr. 603* | 527,854 *Cr. 81* | 552,895 *Cr. 197* | 643,156 *Cr. 244* | 751,370 *Cr. 188* | 603,968 *Cr. 231* | 564,694 *Cr. 4,810* | 575,898 *Cr. 981* | 669,833 *Cr. 540* | 780,990 *Cr. 330* | 1,005,330 *Cr. 415* |
| Roads to give access to Outlying Districts .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 33,642 | 51,582 | 53,693 |
| Roads on Goldfields.. .. .. .. .. | 1,079,945 | 12,465 | 11,050 | 11,264 | 4,850 | 2,867 | 2,755 | 3,934 | 2,230 | 2,330 *Cr. 467* | 1,005 | 1,885 |
| Development of Thermal Springs and Natural Scenery .. | 16,023 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Lands Improvement Account* .. .. .. | 300,930 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Total, Roads .. .. .. .. | 11,621,218 | 387,959 | 538,823 | 563,962 | 647,762 | 754,049 | 606,492 | 563,818 | 577,147 | 704,798 | 833,247 | 1,060,493 |
| Development of Mining .. .. .. .. | 889,014 | 1,173 *Cr. 7,008* | 2,153 *Cr. 1,606* | 2,130 *Cr. 51* | *Cr. 98* *Cr. 1,785* | 1,363 *Cr. 2,310* | .. | .. | .. | .. *Cr. 1,130* | .. *Cr. 260* | .. *Cr. 260* |
| Purchase of Native Lands .. .. .. .. | 1,569,926 | *Cr. 57* | *Cr. 59* | *Cr. 52* | .. | .. | .. | .. | *Cr. 535* | *Cr. 56* | .. | .. |
| Native Lands Purchase Account .. .. .. | 491,980 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Total, Land Purchases .. .. .. | 2,061,906 | *Cr. 57* | *Cr. 59* | *Cr. 52* | .. | .. | .. | .. | *Cr. 535* | *Cr. 56* | .. | .. |
| Telegraph Extension .. .. .. .. .. | 3,823,597 | 249,379 | 336,468 | 590,981 | 512,657 *Cr. 11,082* | 717,409 | 957,294 | 931,661 | 558,042 | 625,540 | 624,414 | 594,383 |

* 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), 1919–20 to 1940–41—*continued.*

| Description of Services. | Expenditure. | | | | | | | | | | | Total Net Expenditure to 31st March, 1941. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1930–31. | 1931–32. | 1932–33. | 1933–34. | 1934–35. | 1935–36. | 1936–37. | 1937–38. | 1938–39. | 1939–40. | 1940–41. | |
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Immigration | 33,544 | 5,265<br>*Cr. 210* | ..<br>*Cr. 583* | ..<br>*Cr. 532* | ..<br>*Cr. 370* | ..<br>*Cr. 362* | ..<br>*Cr. 146* | ..<br>*Cr. 144* | ..<br>*Cr. 108* | ..<br>*Cr. 88* | ..<br>*Cr. 88* | 3,312,485 |
| Public Works, Departmental | 131,816<br>*Cr. 16,381* | 151,377<br>*Cr. 33,947* | 104,904<br>*Cr. 52,639* | 98,703<br>*Cr. 33,872* | 76,486<br>*Cr. 31,154* | 99,384<br>*Cr. 28,178* | 137,769<br>*Cr. 17,709* | 188,040<br>*Cr. 19,489* | 216,091<br>*Cr. 177* | 147,572<br>*Cr. 2* | 49,979<br>*Cr. 46* | 3,793,958 |
| Irrigation and Water-supply* | 62,614 | 37,749 | 53,290<br>*Cr. 96* | 66,838 | 91,241 | 85,414 | 11,062 | 71,659 | 164,481<br>*Cr. 32* | 416,437<br>*Cr. 21* | 611,038<br>*Cr. 18* | 2,577,785 |
| Railways | 1,987,196<br>*Cr. 792* | 952,388<br>*Cr. 20,568* | 160,853<br>*Cr. 9,056* | 132,111<br>*Cr. 20* | 125,600 | 258,011<br>*Cr. 134,696* | 1,019,094<br>*Cr. 464* | 2,412,990<br>*Cr. 700* | 3,798,083 | 4,165,416<br>*Cr. 500* | 1,930,092<br>*Cr. 462* | 69,755,885 |
| Payment to Midland Railway Bondholders | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 150,000 |
| Roads:— | | | | | | | | | | | | |
| Miscellaneous Roads and Bridges | 1,379,810<br>*Cr. 472* | 1,078,270<br>*Cr. 564* | 396,559<br>*Cr. 1,171* | 359,671<br>*Cr. 445* | 371,573<br>*Cr. 471* | 444,377<br>*Cr. 250* | 913,720<br>*Cr. 172* | 1,126,757<br>*Cr. 253* | 1,290,838<br>*Cr. 68* | 1,124,590<br>*Cr. 370* | 599,013<br>*Cr. 491* | 26,348,236 |
| Roads to give access to Outlying Districts | 91,126 | 3,940 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 233,983 |
| Roads on Goldfields | 4,586 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1,140,699 |
| Development of Thermal Springs and Natural Scenery | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 16,023 |
| Lands Improvement Account | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 300,930 |
| Total, Roads | 1,475,050 | 1,081,646 | 395,388 | 359,226 | 371,102 | 444,127 | 913,548 | 1,126,504 | 1,290,770 | 1,124,220 | 598,522 | 28,039,871 |
| Development of Mining | ..<br>*Cr. 260* | .. | ..<br>*Cr. 50* | .. | .. | ..<br>*Cr. 143* | ..<br>*Cr. 17* | ..<br>*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 |
| Small Farms Development† | .. | .. | 118,723 | 172,109 | 222,309 | 151,345 | 92,016 | 310,665 | 344,684 | 446,758 | 571,215 | 2,429,824 |
| Telegraph Extension | 419,756 | 249,978<br>*Cr. 32* | 99,999 | 144,160 | 135,933 | 195,380 | 232,513 | 312,260 | 575,944 | 416,779 | 256,053 | 13,549,466 |

* Includes £6,727 previously included under Lands Improvement class. † Includes expenditure under vote "Settlement of Unemployed Workers."

## TABLE No. 2—*continued.*

## GENERAL SUMMARY—*continued.*

Showing Net Yearly Expenditure out of Public Works Fund (General Purposes Account), 1919-20 to 1940-41—*continued.*

| Description of Services. | Total Net Expenditure to 31st March, 1919. | Expenditure. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1919-20. | 1920-21. | 1921-22. | 1922-23. | 1923-24. | 1924-25. | 1925-26. | 1926-27. | 1927-28. | 1928-29. | 1929-30. |
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Public Buildings:— | | | | | | | | | | | | |
| General (including Miscellaneous) .. .. .. | 423,428 | 64,207 | 39,504 | 87,057 | 113,553 | 8,160 | 30,791 | 29,369 | 119,864 | 42,553 | 4,272 | 14,106* |
| | | | | | | | *Cr. 35* | *Cr. 345* | *Cr. 429* | *Cr. 1,065* | *Cr. 420* | *Cr. 3,156* |
| Parliamentary .. .. .. .. .. | 484,330 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 35 | 27,142 |
| Judicial — Courthouses .. .. .. .. | 978,889 | 868 | 1,400 | 4,358 | 2,018 | 2,448 | 5,363 | 7,209 | 1,261 | 7,531 | 8,387 | 15,765 |
| | | | | | *Cr. 13* | | *Cr. 19* | | *Cr. 95* | .. | *Cr. 95* | *Cr. 29* |
| Judicial — Prisons .. .. .. .. .. | | 20,981 | 30,038 | 41,740 | 23,113 | 26,484 | 25,279 | 24,197 | 22,812 | 22,358 | 12,573 | 18,814 |
| | | | *Cr. 800* | | | *Cr. 2,568* | *Cr. 86* | | *Cr. 908* | *Cr. 524* | *Cr. 321* | *Cr. 285* |
| Judicial — Police-stations .. .. .. .. | | 24,944 | 36,843 | 22,544 | 6,298 | 12,838 | 18,553 | 16,594 | 7,411 | 5,561 | 6,925 | 8,442 |
| | | | | | | | | *Cr. 102* | *Cr. 13* | *Cr. 970* | *Cr. 605* | *Cr. 319* |
| Post and Telegraph .. .. .. .. .. | 1,302,347 | 66,543 | 93,364 | 112,906 | 77,211 | 108,395 | 65,917 | 89,865 | 86,052 | 77,194 | 62,087 | 104,157 |
| | | | *Cr. 560* | *Cr. 675* | *Cr. 69* | | *Cr. 210* | *Cr. 453* | *Cr. 1,114* | *Cr. 834* | *Cr. 1,980* | *Cr. 197* |
| Customs .. .. .. .. .. .. | 49,441 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Quarantine Stations .. .. .. .. .. | 6,255 | 35,490 | 15,529 | 4,581 | 154 | 171 | 284 | .. | .. | .. | .. | .. |
| Mental Hospitals .. .. .. .. .. | 873,249 | 18,277 | 27,368 | 41,838 | 13,852 | 26,541 | 68,438 | 77,835 | 68,635 | 51,119 | 96,782 | 152,096 |
| | | | | | | | | *Cr. 283* | | *Cr. 3,600* | | |
| Public Health .. .. .. .. .. | 32,754 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Health and Hospital Institutions .. .. .. | 155,291 | 8,484 | 4,099 | 26,131 | 20,981 | 7,420 | 27,951 | 31,177 | 15,840 | 14,361 | 19,637 | 16,651 |
| | | | | | *Cr. 1,399* | | | *Cr. 300* | | *Cr. 310* | | |
| School Buildings .. .. .. .. .. | 2,667,323 | 195,500 | 244,722 | 2,469 | .. | .. | .. | .. | .. | .. | .. | .. |
| | | | | *Cr. 9,255* | *Cr. 368* | *Cr. 1,090* | *Cr. 905* | *Cr. 1,050* | *Cr. 7,953* | | *Cr. 2,428* | |
| Agricultural .. .. .. .. .. | 64,196 | 7,227 | 9,345 | 1,115 | 514 | 282 | 3,242 | 7,932 | 4,164 | 2,863 | 2,808 | 2,963 |
| | | | | | *Cr. 27* | *Cr. 171* | *Cr. 686* | *Cr. 865* | *Cr. 310* | | *Cr. 2,395* | *Cr. 1,721* |
| Workers' Dwellings .. .. .. .. .. | 293,244 | 26,674 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Total, Public Buildings .. .. .. | 7,330,747 | 469,195 | 500,852 | 334,809 | 255,818 | 188,910 | 243,877 | 280,780 | 315,299 | 216,237 | 205,262 | 354,429 |
| Lighthouses, Harbour-works, and Harbour-defences:— | | | | | | | | | | | | |
| Lighthouses .. .. .. .. .. .. | 207,593 | 253 | 758 | 16,359 | 3,260 | 4,473 | 2,850 | 5,690 | 5,758 | 7,979 | 2,637 | 4,460 |
| | | | | | | | | *Cr. 750* | | | | *Cr. 500* |
| Harbour-works .. .. .. .. .. | 394,791 | 3,245 | 4,080 | 2,424 | 6,524 | 6,334 | 423 | 3,717 | 13,263 | 15,891 | 14,425 | 10,736 |
| | | | | | | | | *Cr. 131* | *Cr. 204* | *Cr. 165* | | |
| Harbour-defences .. .. .. .. .. | 546,059 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | | | | | *Cr. 1,235* | *Cr. 16* | | | | | | |
| Total, Lighthouses, &c. .. .. .. | 1,148,443 | 3,498 | 4,838 | 18,774 | 8,549 | 10,791 | 3,273 | 8,526 | 18,817 | 23,705 | 17,062 | 14,696 |
| Rates on Native Lands .. .. .. .. | 68,672 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

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

[*Continued on page 5.*

## TABLE No. 2—*continued.*

## GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1919–20 to 1940–41—*continued.*

| Description of Services. | Expenditure. | | | | | | | | | | | Total Net Expenditure to 31st March, 1941. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1930–31. | 1931–32. | 1932–33. | 1933–34. | 1934–35. | 1935–36. | 1936–37. | 1937–38. | 1938–39 | 1939–40. | 1940–41. | |
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Public Buildings :— | | | | | | | | | | | | |
| General (including Miscellaneous) .. .. .. | 85,204 | 33,189 | 2,107 | 594 | 30,713 | 39,447 | 57,668 | 258,978 | 790,452 | 236,638 | 305,355 | 2,618,912 |
| | *Cr. 55* | *Cr. 4,231* | *Cr. 2,067* | *Cr. 1,075* | *Cr.14,087* | *Cr.125,964* | *Cr. 59* | *Cr. 201* | *Cr. 1,917* | *Cr. 42,896* | *Cr. 295* | |
| Parliamentary .. .. .. .. .. | 15,723 | 37 | .. | .. | .. | .. | 27 | .. | 78 | 3,127 | 7 | 530,506 |
| Judicial { Courthouses .. .. .. .. | 19,572 | 3,513 | 970 | 72 | 533 | 8,701 | 2,655 | 16,403 | 34,873 | 11,436 | 13,154 | |
| | *Cr. 16,403* | *Cr. 529* | *Cr. 222* | *Cr. 255* | *Cr. 93* | *Cr.4,278* | *Cr. 644* | *Cr. 200* | *Cr. 274* | *Cr. 15* | *Cr. 22* | |
| Judicial { Prisons .. .. .. .. .. | 2,504 | 2,621 | 2,026 | 1,018 | 1,605 | 2,123 | 4,621 | 9,476 | 7,656 | 4,348 | 2,533 | 1,790,114 |
| | *Cr. 134* | *Cr. 67* | *Cr. 71* | | | | *Cr. 20* | | *Cr. 2,033* | | *Cr. 25* | |
| Judicial { Police-stations .. .. .. .. | 8,360 | 2,535 | 1,022 | 74 | 2,754 | 6,710 | 7,149 | 11,086 | 77,745 | 60,664 | 24,343 | |
| | *Cr. 54* | *Cr. 91* | *Cr. 80* | *Cr. 79* | *Cr. 240* | *Cr. 35* | *Cr. 172* | *Cr. 546* | *Cr. 197* | *Cr. 581* | *Cr. 550* | |
| Post and Telegraph .. .. .. .. | 138,671 | 104,505 | 2,763 | 21,078 | 100,484 | 232,285 | 158,005 | 248,145 | 280,951 | 362,730 | 352,562 | 4,171,978 |
| | *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* | *Cr. 9,208* | *Cr. 256* | |
| Customs .. .. .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 49,441 |
| Quarantine Stations .. .. .. .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | 62,464 |
| Mental Hospitals .. .. .. .. .. | 134,140 | 45,938 | 28,756 | 73,021 | 98,629 | 67,465 | 142,109 | 125,829 | 128,840 | 175,552 | 126,644 | 2,657,633 |
| | | *Cr. 860* | | | *Cr. 40* | | *Cr. 177* | | | *Cr. 360* | | |
| Public Health .. .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 32,754 |
| Health and Hospital Institutions .. .. .. | 17,338 | 3,316 | 301 | 1,248 | 656 | 2,191 | 12,921 | 15,747 | 88,099 | 67,137 | 44,020 | 598,724 |
| | | *Cr. 1* | *Cr. 113* | *Cr. 150* | | | | | | | | |
| School Buildings .. .. .. .. .. | .. | 259,149 | 52,623 | 52,239 | 51,506 | 122,357 | 268,884 | 546,846 | 660,666 | 844,126 | 541,406 | 6,481,729 |
| | *Cr. 1,110* | *Cr. 40* | | *Cr. 805* | *Cr. 217* | *Cr. 933* | *Cr. 2* | *Cr. 412* | *Cr. 187* | *Cr. 1,062* | *Cr. 270* | |
| Agricultural .. .. .. .. .. | 1,509 | .. | .. | 48 | 88 | 85 | 60,902† | 2,269† | 111,158† | 37,049 | 32,407 | 341,160 |
| | *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 .. .. .. | 403,680 | 443,878 | 81,657 | 145,089 | *Cr.48,241* | 347,394 | 712,316 | 1,196,542 | 2,167,187 | 1,748,685 | 1,441,013 | 19,335,415 |
| Lighthouses, Harbour-works, and Harbour-defences :— | | | | | | | | | | | | |
| Lighthouses .. .. .. .. .. | 4,103 | 5,046 | 688 | 1,276 | 4,021 | 3,320 | 630 | 8,260 | 21,638 | 19,609 | 30,311 | 359,713 |
| Harbour-works .. .. .. .. .. | 6,742 | 6,987 | *Cr. 5,277* | 11,988 | 2,581 | *Cr. 399* | 669 | 3,417 | 12,212 | 2,910 | 4,043 | 520,824 |
| | | | | | | | *Cr. 2* | *Cr. 200* | *Cr. 200* | | | |
| Harbour-defences .. .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 544,808 |
| Total, Lighthouses, &c. .. .. .. | 10,845 | 12,033 | *Cr. 4,589* | 13,264 | 6,602 | 2,921 | 1,297 | 11,477 | 33,650 | 22,519 | 34,354 | 1,425,345 |
| Rates on Native Lands .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 68,672 |

* 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), 1919-20 to 1940-41—*continued.*

| Description of Services. | Total Net Expenditure to 31st March, 1919. | Expenditure. 1919–20. | 1920–21. | 1921–22. | 1922–23. | 1923–24. | 1924–25. | 1925–26. | 1926–27. | 1927–28. | 1928–29. | 1929–30. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | |
| Contingent Defence .. .. .. .. .. | 1,051,578 | 10,187 | 8,701 | 15,586 | 1,702<br>*Cr. 463* | 4,931<br>*Cr. 280* | 27,133<br>*Cr. 580* | 89,670<br>*Cr. 33* | 34,014<br>*Cr. 751* | 39,986<br>*Cr. 465* | 67,652<br>*Cr. 648* | 46,766<br>*Cr. 1,325* |
| Tourist and Health Resorts .. .. .. .. | 261,060 | 6,194 | 19,041 | 17,996<br>*Cr. 110* | 5,435 | 27,264 | 12,343<br>*Cr. 81* | 43,486 | 31,981 | 36,673<br>*Cr. 516* | 39,254<br>*Cr. 440* | 20,547<br>*Cr. 1,213* |
| Lands Improvement* .. .. .. .. | 128,613 | 2,964 | 2,064 | 17,478 | 26,204 | 18,182 | 34,172 | 70,493<br>*Cr. 19* | 56,267<br>*Cr. 135* | 72,898<br>*Cr. 2,574* | 85,861<br>*Cr. 87* | 79,454<br>*Cr. 112* |
| Charges and Expenses of raising Loans .. .. | 1,253,076 | .. | 184 | 174,280 | 62,399 | 311,905 | 241,930 | 297,180 | 155,373 | 100,297 | 438,238<br>*Cr. 3,811* | 518,158 |
| Interest and Sinking Funds .. .. .. .. | 218,500 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Coal-exploration and Mine-development .. .. | 10,835 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Thermal Springs . .. .. .. .. | 14,600 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Plant, Material, and Services .. .. .. .. | 111,613 | 47,682 | 169,910 | 122,801 | *Cr. 4,983* | *Cr. 49,159*<br>*Cr. 16* | *Cr. 30,956*<br>*Cr. 1* | 36,930<br>*Cr. 855* | *Cr. 9,334*<br>*Cr. 1,992* | *Cr. 17,610*<br>*Cr. 8,985* | *Cr. 6,551*<br>*Cr. 1,224* | *Cr. 35,092*<br>*Cr. 360* |
| Motor Transport Service .. .. .. .. | .. | .. | .. | .. | 22,679 | 962 | 5,000 | 4,994 | .. | .. | .. | .. |
| Transfer to Main Highways Account :— Construction Fund .. .. .. .. .. | .. | .. | .. | .. | .. | .. | 226,000 | .. | 400,000 | 200,000 | 200,000 | 200,000 |
| *Total Ways and Means Credits* .. .. | .. | *112,864* | *19,628* | *11,616* | *20,127* | *9,142* | *40,793* | *27,474* | *146,933* | *40,026* | *106,429* | *62,859* |
| Grand Total—Net Expenditure .. .. | 68,676,201 | 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 | 3,870,577 | 4,854,314† |

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

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

[*Continued on page 7.*

TABLE No. 2—*continued.*

## GENERAL SUMMARY—*continued.*

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT), 1919–20 to 1940–41—*continued.*

| Description of Services. | Expenditure. | | | | | | | | | | | Total Net Expenditure to 31st March, 1941. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1930–31. | 1931–32. | 1932–33. | 1933–34. | 1934–35. | 1935–36. | 1936–37. | 1937–38. | 1938–39. | 1939–40. | 1940–41. | |
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Contingent Defence .. .. .. .. .. | 13,812<br>*Cr. 586* | ..<br>*Cr. 4,039* | ..<br>*Cr. 624* | ..<br>*Cr. 76* | .. | ..<br>*Cr. 704* | ..<br>*Cr. 64* | ..<br>*Cr. 40* | ..<br>*Cr. 11,552* | ..<br>*Cr. 40* | .. | 1,389,448<br>.. |
| Tourist and Health Resorts .. .. .. .. | 60,288<br>*Cr. 2,494* | 87,609<br>*Cr. 85* | 14,454<br>*Cr. 877* | 13,510<br>*Cr. 21* | 12,880<br>*Cr. 705* | 13,683<br>*Cr. 20* | 16,789 | 23,159 | 24,552 | 24,892 | 21,575 | 828,103 |
| Lands Improvement* .. .. .. .. .. | 70,534<br>*Cr. 1,041* | 38,899<br>*Cr. 506* | 38,906<br>*Cr. 248* | 71,825<br>*Cr. 329* | 82,092<br>*Cr. 722* | 37,909<br>*Cr. 1,006* | 62,673<br>*Cr. 10,365* | 147,436<br>*Cr. 10,699* | 134,677<br>*Cr. 4,415* | 172,020<br>*Cr. 10,980* | 86,282<br>*Cr. 3,635* | 1,491,029 |
| Swamp Land Drainage .. .. .. .. | .. | .. | 14,807 | 13,959<br>*Cr. 297* | 15,019<br>*Cr. 231* | 12,922<br>*Cr. 263* | 24,965 | 19,402 | 5,324<br>*Cr. 2,598* | 2,700<br>*Cr. 144* | 3,947<br>*Cr. 108* | 109,404 |
| Dairy Industry Loans.. .. .. .. .. | .. | .. | .. | .. | .. | 10,750 | 30,510 | 4,565 | 300 | .. | .. | 46,125 |
| Flaxmilling Industry (Rehabilitation Plan) .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 505 | 156,676 | 157,181 |
| Charges and Expenses of raising Loans .. .. .. | 164,535 | 98,098 | 15,851 | 14 | 600 | .. | .. | .. | .. | 137,609 | 32,911 | 3,998,827 |
| Interest and Sinking Funds .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 218,500 |
| Coal-exploration and Mine-development .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10,835 |
| Thermal Springs .. .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 14,600 |
| Plant, Material, and Services .. .. .. .. | *Cr. 42,824*<br>*Cr. 216* | *Cr. 103,571*<br>*Cr. 1,338* | *Cr. 45,463*<br>*Cr. 161* | 1,421<br>*Cr. 22* | *Cr. 10,513*<br>*Cr. 165* | 22,438<br>*Cr. 418* | †<br>*Cr. 1,642* | ..<br>.. | *Cr. 688*<br>.. | *Cr. 3,830* | .. | 134,826 |
| Native Land Settlement .. .. .. .. | .. | .. | .. | 179,485<br>*Cr. 52* | 125,790<br>*Cr. 9,662* | 71,901<br>*Cr. 9,491* | 112,318<br>*Cr. 3,423* | 254,869<br>*Cr. 25,018* | 493,695<br>*Cr. 3,387* | 357,845<br>*Cr. 5,249* | 238,583<br>*Cr. 5,393* | 1,772,811 |
| Motor Transport Service .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 33,635 |
| Transfer to Main Highways Account :— | | | | | | | | | | | | |
| Construction Fund .. .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1,226,000 |
| Linen Flax Development .. .. .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 245,977 | 245,977 |
| *Total Ways and Means Credits* .. .. | *41,583* | *72,214* | *74,416* | *47,092* | *378,689* | *309,501* | *36,630* | *95,921* | *36,556* | *75,346* | *11,659* | .. |
| Grand Total—Net Expenditure .. .. | 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 | 9,163,103 | 6,268,467 | 159,049,745 |

* 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. † Now provided for under Consolidated Fund.

# TABLE No. 3.

## Expenditure on Railways to 31st March, 1941.

| Lines of Railway. | Mileage opened for Traffic. | Total Expenditure by General Government to 31st March, 1940. | Recoveries on Account of Expenditure of Previous Years. | Expenditure out of Public Works Fund during Year 1940-41. New Works. | | Total Expenditure by General Government to 31st March, 1941. | 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. | £ |
| Kaihu Valley | 24 32 | 179,143 14 9 | .. | .. | .. | 179,143 14 9 | .. |
| Opua Wharf to Whangarei and Onerahi | 58 06 | 622,043 3 9 | 15 0 0 | 1 1 0 | .. | 622,029 4 9 | .. |
| Otiria to Ngapuhi | 13 45 | 128,457 1 3 | .. | .. | .. | 128,457 1 3 | .. |
| Whangarei Branch (Kioreroa to Waiotira) | 19 79 | 421,747 17 11 | .. | .. | .. | 421,747 17 11 | .. |
| North Auckland Main Trunk— | | | | | | | |
| Ngapuhi Northwards | 11 00 | 875,548 2 8 | .. | *Cr.* 3,338 11 8 | .. | 872,209 11 0 | .. |
| Helensville Northwards | 83 39 | 3,603,555 16 9 | .. | .. | 5,583 17 11 | 3,009,139 14 8 | .. |
| North Auckland Main Trunk to Dargaville | .. | 539,948 2 10 | .. | 35,826 6 1 | .. | 575,774 8 11 | .. |
| Helensville to Te Awamutu | 148 67 | 6,457,521 9 3 | .. | .. | 178,735 1 9 | 6,636,256 11 0 | .. |
| Waiuku Branch (Paerata to Waiuku) | 12 69 | 209,359 19 4 | .. | .. | 22 18 8 | 209,382 18 0 | .. |
| 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 | 529,316 9 5 | .. | .. | 4,609 15 5 | 533,926 4 10 | .. |
| Cambridge Branch (Ruakura Junction to Cambridge) | 12 02 | 62,619 6 10 | .. | .. | .. | 62,619 6 10 | .. |
| Morrinsville to Rotorua | 69 33 | 459,197 5 2 | .. | .. | 24,174 0 10 | 474,371 6 0 | .. |
| Marton to Te Awamutu | 209 69 | 3,227,954 17 8 | .. | .. | 9,510 18 5 | 3,237,465 16 1 | .. |
| Waipa Gravel Access Branch | .. | 114 0 0 | .. | .. | .. | 114 0 0 | .. |
| Raetihi Branch | 8 50 | 89,452 2 1 | .. | .. | 22 8 9 | 89,474 10 10 | |
| Rotorua to Taupo | .. | 38,669 2 1 | .. | 309 9 10 | .. | 38,978 11 11 | .. |
| Paeroa to Pokeno | .. | 251,574 16 0 | .. | 10,203 3 11 | .. | 261,777 19 11 | .. |
| Paeroa to Tauranga | 50 65 | 1,256,950 14 8 | .. | .. | 2,626 4 0 | 1,259,576 18 8 | .. |
| Tauranga to Taneatua, including Te Maunga to Maunganui Branch | 59 17 | 1,499,072 6 10 | .. | 125 5 8 | 6,995 13 7 | 1,506,193 6 1 | .. |
| Taneatua to Opotiki | .. | 3,835 9 4 | .. | 1,694 2 2 | .. | 5,529 11 6 | .. |
| Gisborne to Motu | 49 32 | 628,126 19 3 | .. | .. | 6,055 5 8 | 634,182 4 11 | .. |
| 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 | .. | 2,077,299 17 11 | .. | 312,203 17 4 | .. | 2,389,503 15 3 | .. |
| Wairoa Northwards | .. | 20,681 12 6 | .. | .. | .. | 20,681 12 6 | .. |
| Napier Northwards | 38 62 | 2,645,120 17 2 | 447 9 2 | 1,870 0 5 | 828 8 5 | 2,647,371 16 10 | .. |
| Waikokopu Branch | .. | 680,067 8 3 | .. | 301 5 4 | .. | 680,368 13 7 | .. |
| Wellington to Napier— | | | | | | | |
| Napier to Woodville and Palmerston North | 114 06 | 1,192,009 18 5 | .. | .. | 29,394 12 0 | 1,221,404 10 5 | .. |
| Wellington to Woodville, including Te Aro Extension | 129 30 | 3,398,176 0 11 | .. | 2,715 7 11 | 7,911 9 0 | 3,408,802 17 10 | .. |
| Featherston to Martinborough | .. | 399 0 0 | .. | .. | .. | 399 0 0 | .. |
| Wellington to Waitara— | | | | | | | |
| Wellington to Longburn | 83 37 | 4,619,413 4 3 | .. | .. | 42,783 7 4 | 4,662,196 11 7 | .. |
| Foxton to Waitara and Moturoa | 196 22 | 2,688,378 13 7 | .. | .. | 83,191 12 6 | 2,771,570 6 1 | .. |
| 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 | 447,911 10 10 | .. | .. | *Cr.* 96 9 7 | 447,815 1 3 | .. |
| Manaia Branch (Kapuni to Manaia) | .. | 9,483 6 9 | .. | .. | .. | 9,483 6 0 | |
| Rangitikei River Quarry Line | .. | 206 0 0 | .. | .. | .. | 206 0 0 | .. |

## TABLE No. 3—*continued.*

### EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1941—*continued.*

| Lines of Railway. | Mileage opened for Traffic. | Total Expenditure by General Government to 31st March, 1940. | Recoveries on Account of Expenditure of Previous Years. | Expenditure out of Public Works Fund during Year 1940-41: New Works. | | Total Expenditure by General Government to 31st March, 1941. | 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 | 3,123,304 16 7 | .. | *Cr.* 3 6 0 | 2,698 1 10 | 3,125,999 12 5 | .. |
| Nelson to Greymouth— | | | | | | | |
| Nelson to Inangahua | 64 47 | 723,188 3 8 | .. | *Cr.* 83 1 4 | .. | 723,105 2 4 | 78,307 0 0 |
| Stillwater to Inangahua | 57 32 | 239,038 8 0 | .. | .. | 3,202 12 9 | 242,241 0 9 | 279,685 0 0 |
| Ngahere to Blackball | 3 40 | 148,026 2 1 | .. | .. | .. | 148,026 2 1 | .. |
| Westport to Ngakawau | 19 56 | 215,649 11 9 | .. | .. | 10,682 12 7 | 226,332 4 4 | .. |
| 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 | 1,119,189 3 7 | .. | 112,446 19 4 | .. | 1,231,636 2 11 | .. |
| Greymouth to Rewanui | 2 44 | 265,101 2 9 | .. | .. | 2,118 0 0 | 267,219 2 9 | .. |
| Point Elizabeth Branch | 8 70 | 74,363 10 11 | .. | .. | .. | 74,363 10 11 | .. |
| Greymouth to Ross and Mikonui | 36 68 | 445,745 12 3 | .. | .. | 2,613 13 7 | 448,359 5 10 | .. |
| Picton to Waipara— | | | | | | | |
| Picton Southwards | 56 06 | 1,646,566 2 0 | .. | 168,046 14 0 | 6,330 9 1 | 1,820,943 5 1 | .. |
| Waipara Northwards | 44 14 | 1,554,180 3 8 | .. | 232,482 10 11 | .. | 1,786,662 14 7 | .. |
| Christchurch to Greymouth— | | | | | | | |
| Rolleston to Bealey | 73 07 | 1,021,246 18 0 | .. | .. | 9,874 5 0 | 1,031,121 3 0 | 61,579 0 0 |
| Whitecliffs Branch | 11 38 | 25,098 13 11 | .. | .. | .. | 25,098 13 11 | .. |
| Greymouth to Bealey | 58 12 | 2,041,933 8 4 | .. | .. | 9,108 19 10 | 2,051,042 8 2 | 263,889 0 0 |
| Hurunui to Waitaki— | | | | | | | |
| Main Line (Waiau to Waitaki) | 219 07 | 2,915,753 5 10 | .. | .. | 40,203 9 3 | 2,955,956 15 1 | 316,135 0 0 |
| Oxford Branch (Rangiora to Oxford West) | 21 76 | 49,697 17 2 | .. | .. | .. | 49,697 17 2 | .. |
| Eyreton Branch (Kaiapoi to Bennett's) | 20 07 | 44,257 0 0 | .. | .. | .. | 44,257 0 0 | .. |
| Lyttelton Branch | 6 26 | 245,344 18 4 | .. | .. | 37,527 15 0 | 282,872 13 4 | 340,500 0 0 |
| Southbridge Branch (Hornby to Southbridge) | 25 31 | 92,501 0 6 | .. | .. | .. | 92,501 0 6 | .. |
| Little River Branch (Lincoln to Little River) | 22 46 | 112,292 4 6 | .. | .. | .. | 112,292 4 6 | .. |
| Rakaia to Methven | 22 20 | 77,786 11 5 | .. | .. | 85 2 7 | 77,871 14 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 | 46,249 2 9 | .. | .. | .. | 46,249 2 9 | .. |
| 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 | 4,562,673 10 7 | .. | .. | 84,553 10 4 | 4,647,227 0 11 | 82,259 0 0 |
| Duntroon Branch (Pukeuri to Kurow) | 37 33 | 86,243 8 6 | .. | .. | .. | 86,243 8 6 | 37,500 0 0 |
| Ngapara Branch (Waiareka Junction to Ngapara) | 14 76 | 25,511 5 6 | .. | .. | *Cr.* 104 6 6 | 25,406 19 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, 1941—*continued.*

| Lines of Railway. | Mileage opened for Traffic. | Total Expenditure by General Government to 31st March, 1940. | Recoveries on Account of Expenditure of Previous Years. | Expenditure out of Public Works Fund during Year 1940-41: New Works. | | Total Expenditure by General Government to 31st March, 1941. | 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 | 75,350 15 4 | .. | .. | .. | 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 | 724,592 5 4 | .. | .. | 208 6 5 | 724,800 11 9 | .. |
| 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 | 50,430 13 11 | .. | .. | *Cr.* 15 0 0 | 50,415 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 | 185,204 5 5 | .. | .. | 1,208 4 4 | 186,412 9 9 | .. |
| Otago Central (Wingatui to Cromwell) | 147 27 | 1,461,937 10 5 | .. | .. | 5,027 6 2 | 1,466,964 16 7 | .. |
| Invercargill to Kingston— | | | | | | | |
| Main Line | 87 04 | 384,400 12 7 | .. | .. | 2,519 1 2 | 386,919 13 9 | 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 | 362,764 1 9 | .. | .. | .. | 362,764 1 9 | 37,097 0 0 |
| Thornbury to Wairio | 22 15 | 105,171 4 6 | .. | .. | .. | 105,171 4 6 | 23,200 0 0 |
| Forest Hill (Winton to Hedgehope) | 12 40 | 23,360 12 3 | .. | .. | .. | 23,360 12 3 | .. |
| Expenses of Railway Commissions and other Expenditure not chargeable to Individual Lines | .. | 10,337 0 0 | .. | .. | .. | 10,337 0 0 | .. |
| Surveys of New Lines— | | | | | | | |
| North Island | .. | 29,229 6 8 | .. | .. | .. | 29,229 6 8 | .. |
| South Island | .. | 5,942 7 7 | .. | 9 4 6 | .. | 5,951 12 1 | .. |
| Rolling-stock | .. | 15,763,297 4 3 | .. | .. | 468,117 17 11 | 16,231,415 2 2 | .. |
| Motor-omnibus Service, Wellington | .. | 60,571 1 11 | .. | .. | .. | 60,571 1 11 | .. |
| General | .. | 17,645 1 1 | .. | *Cr.* 1,155 11 2 | .. | 16,489 9 11 | .. |
| 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 | .. | 6,432 1 6 | .. | .. | .. | 6,432 1 6 | .. |
| Totals | .. | 79,366,891 14 3* | 462 9 2 | 873,654 18 3 | 1,088,309 6 0 | 81,328,393 9 4* | 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, 1941, AND THE LIABILITIES ON THAT DATE.

| — | Total Expenditure to 31st March, 1940. | Expenditure for Year ended 31st March, 1941. | Total Expenditure to 31st March, 1941. | Liabilities on Authorities, Contracts, &c., to 31st March, 1941. | Total Expenditure and Liabilities. |
|---|---|---|---|---|---|
| General— | £ | £ | £ | £ | £ |
| Alexandra Depot, Wellington* .. .. | 8,084 | .. | 8,084 | .. | 8,084 |
| Government House, Wellington (land and new building) | 77,770 | .. | 77,770 | .. | 77,770 |
| Offices for public Departments† .. .. | 1,611,212 | 254,145 | 1,865,357 | 33,296 | 1,898,653 |
| Air Defence .. .. .. .. | 345,040 | .. | 345,040 | .. | 345,040 |
| Miscellaneous .. .. .. .. | 270,468 | 50,937 | 321,405 | 14,181 | 335,586 |
| Parliament Buildings— | | | | | |
| Old buildings .. .. .. .. | 76,553 | .. | 76,553 | .. | 76,553 |
| New buildings .. .. .. .. | 397,103 | 7 | 397,110 | .. | 397,110 |
| Alterations to streets surrounding grounds and purchase of land | 57,566 | 200 | 57,766 | .. | 57,766 |
| Judicial‡ .. .. .. .. | 1,750,680 | 39,433 | 1,790,113 | 3,364 | 1,793,477 |
| Postal and telegraph‖ .. .. .. | 3,819,672 | 352,306 | 4,171,978 | 7,262 | 4,179,240 |
| Customs .. .. .. .. | 49,441 | .. | 49,441 | .. | 49,441 |
| Quarantine-stations .. .. .. | 62,464 | .. | 62,464 | .. | 62,464 |
| Mental hospitals .. .. .. .. | 2,530,989 | 126,644 | 2,657,633 | 21,568 | 2,679,201 |
| Health and hospital institutions§ .. .. | 587,457 | 44,020 | 631,477 | 3,646 | 635,123 |
| School buildings .. .. .. .. | 5,940,593 | 541,136 | 6,481,729 | 35,829 | 6,517,558 |
| Agricultural .. .. .. .. | 304,470¶ | 32,185 | 336,655 | 2,609 | 339,264 |
| Totals .. .. .. .. | 17,889,562 | 1,441,013 | 19,330,575 | 121,755 | 19,452,330 |

* 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 Railways 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, 1941.

### General Balance-sheet

AT 31st March, 1941, COMPARED WITH POSITION AT 31st March, 1940.

| *Liabilities.* | 1940–41. £ s. d. | 1940–41. £ s. d. | 1939–40. £ s. d. | *Assets.* | 1940–41. £ s. d. | 1940–41. £ s. d. | 1939–40. £ s. d. |
|---|---|---|---|---|---|---|---|
| Aid to Water-power Works and Electric Supply Accounts— | | | | North Island scheme— | | | |
| Debentures Stock issued— | | | | Assets as per separate balance-sheet .. | 12,193,876 18 1 | | *11,039,964 16 8* |
| At 2½ per cent. interest .. .. | 1,300,000 0 0 | | *1,300,000 0 0* | Investments, Sinking Fund .. .. | 25,242 0 9 | | *2,175 7 5* |
| At 3 per cent. interest .. .. | 3,149,372 9 6 | | *3,149,372 9 6* | | | 12,219,118 18 10 | |
| At 3¼ per cent. interest .. .. | 500,000 0 0 | | .. | | | | *11,042,140 4 1* |
| At 3½ per cent. interest .. .. | 1,711,755 0 0 | | *1,449,225 0 0* | | | | |
| At 3¾ per cent. interest .. .. | 567,290 0 0 | | *567,490 0 0* | | | | |
| At 4 per cent. interest .. .. | 1,643,470 0 0 | | *1,643,470 0 0* | | | | |
| At 4½ per cent. interest .. .. | 2,623,913 18 0 | | *2,623,913 18 0* | South Island scheme— | | | |
| At 5 per cent. interest .. .. | 3,159,227 13 6 | | *3,159,227 13 6* | Assets as per separate balance-sheet .. | 7,663,010 7 4 | | *7,294,627 0 0* |
| Treasury Bills— | | | | Investments, Sinking Fund .. .. | 14,222 7 1 | | *10,547 0 5* |
| At 1½ per cent. interest .. .. | 310,000 0 0 | | *110,000 0 0* | | | 7,677,232 14 5 | |
| At 1½ per cent. interest .. .. | 430,000 0 0 | | .. | | | | *7,305,174 0 5* |
| At 3 per cent. interest .. .. | 75,000 0 0 | | *75,000 0 0* | | | | |
| Treasury Notes— | | | | | | | |
| At 4½ per cent. interest .. .. | .. | | *93,500 0 0* | Cobb River scheme .. .. .. | .. | 341,979 1 1 | |
| | | 15,470,029 1 0 | | | | | |
| | | | *14,171,199 1 0* | | | | |
| Consolidated Fund— | | | | | | | |
| Interest accrued on loans to 31st March, 1941 | | 316,742 19 1 | *133,218 9 4* | | | | |
| | | | | Surveys and General .. .. .. | .. | 18,962 16 8 | *18,673 4 4* |
| Temporary transfers from other accounts .. | .. | 125,000 0 0 | *175,000 0 0* | | | | |
| Interest reserve, being excess of interest charged to schemes over interest actually paid on capital liability | .. | 86,555 18 10 | *82,606 13 5* | | | | |
| Carried forward .. .. | .. | 15,998,327 18 11 | *14,562,024 3 9* | Carried forward .. .. | .. | 20,257,293 11 0 | *18,365,987 8 10* |

## TABLE No. 5—*continued.*

### ELECTRIC SUPPLY ACCOUNT.—STATEMENT OF ACCOUNTS AT THE 31st MARCH, 1941—*continued.*

GENERAL BALANCE-SHEET—*continued.*

AT 31st MARCH, 1941, AS COMPARED WITH POSITION AT 31ST MARCH, 1940—*continued.*

| *Liabilities.* | 1940-41. | | 1939-40. | *Assets.* | 1940-41. | | 1939-40. |
|---|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | | £ s. d. | £ s. d. | £ s. d. |
| Brought forward .. .. | .. | 15,998,327 18 11 | *14,562,024 3 9* | Brought forward .. .. | .. | 20,257,293 11 0 | *18,365,987 8 10* |
| Sundry Creditors— | | | | Balance in Electric Supply Account at the end of year— | | | |
| North Island scheme .. .. .. | 201,053 8 9 | | *123,739 19 2* | Cash in Public Account .. .. | 39,991 19 4 | | *50,887 1 2* |
| South Island scheme .. .. .. | 72,367 14 5 | | *46,844 4 9* | Imprests outstanding .. .. | 146,240 0 0 | | .. |
| Surveys and general .. .. .. | 2 1 8 | | *2 10 0* | | | 186,231 19 4 | |
| | | 273,423 4 10 | *170,586 13 11* | | | | *50,887 1 2* |
| Depreciation Reserve— | | | | | | | |
| North Island scheme .. .. .. | 1,112,633 2 6 | | *1,081,075 9 4* | | | | |
| South Island scheme .. .. .. | 813,288 3 3 | | *755,025 16 10* | | | | |
| | | 1,925,921 5 9 | *1,836,101 6 2* | | | | |
| Sinking Fund— | | | | | | | |
| Amount utilized for redemption of loans | 1,538,177 18 3 | | *1,079,347 18 3* | | | | |
| Available for further redemptions .. | 314,628 14 3 | | *498,076 19 11* | | | | |
| | | 1,852,806 12 6 | *1,577,424 18 2* | | | | |
| Reserve Fund— | | | | | | | |
| North Island scheme .. .. .. | 303,958 4 1 | | *181,248 2 9* | | | | |
| South Island scheme .. .. .. | 86,765 15 1 | | *87,199 6 0* | | | | |
| | | 390,723 19 2 | *268,447 8 9* | | | | |
| Sundry credit balances— | | | | | | | |
| North Island scheme .. .. .. | 543 14 9 | | *781 7 2* | | | | |
| South Island scheme .. .. .. | 1,778 14 5 | | *1,508 12 1* | | | | |
| | | 2,322 9 2 | *2,289 19 3* | | | | |
| Total .. .. .. .. | .. | £20,443,525 10 4 | *£18,416,874 10 0* | Total .. .. .. | .. | £20,443,525 10 4 | *£18,416,874 10 0* |
| *Contingent Liability.* | | | | | | | |
| Arrears of appropriation to Sinking Fund .. | 214,654 2 3 | | *252,670 11 5* | | | | |

NOTE.—No charge for cost of exchange on interest payments made in London is included.

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 note enfaced thereon.—CYRIL G. COLLINS, Controller and Auditor-General.

## TABLE No. 5—*continued.*

## NORTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY.

### PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1941, COMPARED WITH YEAR ENDED 31ST MARCH, 1940.

*Gross Revenue Account.*

| — | 1940–41. £ s. d. | 1940–41. £ s. d. | *1939–40.* £ s. d. | — | 1940–41. £ s. d. | 1940–41. £ s. d. | 1940–41. £ s. d. | *1939–40.* £ s. d. |
|---|---|---|---|---|---|---|---|---|
| To Generating-expenses (hydro-electric)— | | | | By Sales of electrical energy— | | | | |
| Arapuni | 28,334 15 1 | | *31,372 4 7* | Bulk for resale | | 1,457,699 13 0 | | *1,264,605 13 2* |
| Horahora | 7,120 3 4 | | *6,412 12 4* | Other than for resale— | | | | |
| Mangahao | 13,407 11 8 | | *12,339 16 6* | Traction | 13,695 4 2 | | | *5,108 15 0* |
| Tuai | 14,996 14 8 | | *11,599 2 6* | Industrial | 43,228 5 8 | | | *43,919 7 2* |
| | | 63,859 4 9 | | Retail | 5,054 1 6 | | | *3,015 9 1* |
| | | | *61,723 15 11* | | | 61,977 11 4 | | |
| | | | | | | | 1,519,677 4 4 | |
| Generating-expenses (fuel)— | | | | | | | | *1,316,649 4 5* |
| Penrose | 3,392 19 6 | | *307 1 6* | | | | | |
| Waihi Grand Junction | 7,828 0 10 | | .. | Rents— | | | | |
| Huntly | 1,159 8 7 | | *35 10 9* | Land and buildings | | 11,162 2 10 | | *10,378 4 3* |
| | | 12,380 8 11 | | Lines and plant | | 560 2 4 | | *571 0 4* |
| | | | *342 12 3* | | | | 11,722 5 2 | |
| | | | | | | | | *10,949 4 7* |
| Purchase of power in bulk | .. | 353,548 19 1 | *103,638 13 3* | | | | | |
| Standby charges | .. | 65,688 15 2 | *65,304 8 9* | Miscellaneous revenue | | .. | 1,736 12 0 | *900 13 5* |
| | | 495,477 7 11 | *231,009 10 2* | | | | | |
| Transmission system: Patrol and maintenance | .. | 31,783 16 1 | *31,775 14 3** | | | | | |
| Substations: Operation and maintenance | .. | 42,390 9 4 | *34,422 10 0* | | | | | |
| Communication system: Patrol and maintenance | .. | 2,295 12 11 | .. | | | | | |
| Distribution: Maintenance | .. | 2,160 4 7 | *2,048 16 4* | | | | | |
| System operation, testing, &c. | .. | 13,820 17 9 | *13,827 6 2* | | | | | |
| Management and general expenses | .. | 52,955 14 1 | *54,930 17 3* | | | | | |
| Balance, to Net Revenue and Appropriation Account | .. | 892,251 18 10 | *960,484 8 3* | | | | | |
| | | £1,533,136 1 6 | *£1,328,499 2 5* | | | | £1,533,136 1 6 | *£1,328,499 2 5* |

*Includes Communication system: Patrol and Maintenance.

*Net Revenue and Appropriation Account.*

| — | 1940–41. £ s. d. | 1940–41. £ s. d. | *1939–40.* £ s. d. | — | 1940–41. £ s. d. | *1939–40.* £ s. d. |
|---|---|---|---|---|---|---|
| To Interest (gross) for year ended 31st March, 1941 | 377,059 1 10 | | *364,664 5 7* | By Balance from Gross Revenue Account | 892,251 18 10 | *960,484 8 3* |
| *Less* interest capitalized | 40,986 5 6 | | *19,456 19 3* | | | |
| | | 336,072 16 4 | | | | |
| | | | *345,207 6 4* | | | |
| Depreciation on completed works | .. | .. | *15,476 15 10* | | | |
| Sinking Fund | .. | 148,937 2 6 | *418,552 3 4* | | | |
| Reserve Fund | .. | 122,710 1 4 | *181,248 2 9* | | | |
| Social Security charge, national-security tax, income-tax | .. | 284,531 18 8 | .. | | | |
| | | £892,251 18 10 | *£960,484 8 3* | | £892,251 18 10 | *£960,484 8 3* |

## TABLE No. 5—*continued.*

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

*Depreciation Reserve Account.*

| —— | 1940–41. | *1939–40.* | —— | 1940–41. | *1939–40.* |
|---|---|---|---|---|---|
| | £ s. d. | *£ s. d.* | | £ s. d. | *£ s. d.* |
| To Replacements, Renewals, &c. .. .. .. | 11,685 7 2 | *19,051 6 10* | By Balance from previous year's statement .. .. | 1,081,075 9 4 | *1,042,932 14 2* |
| Balance.. .. .. .. .. .. | 1,112,633 2 6 | *1,081,075 9 4* | Interest at 4 per cent. per annum .. .. .. | 43,243 0 4 | *41,717 6 2* |
| | | | Amount set aside as per Net Revenue and Appropriation Account .. | | *15,476 15 10* |
| | £1,124,318 9 8 | *£1,100,126 16 2* | | £1,124,318 9 8 | *£1,100,126 16 2* |

*Sinking Fund Account.*

| | | | | | |
|---|---|---|---|---|---|
| | £ s. d. | *£ s. d.* | | £ s. d. | *£ s. d.* |
| To Balance .. .. .. .. .. | 1,308,950 16 5 | *1,159,820 3 11* | By Balance at close of previous year .. .. .. | 1,159,820 3 11 | *741,037 17 0* |
| | | | Interest.. .. .. .. .. .. | 193 10 0 | *230 3 7* |
| | | | Amount set aside as per Net Revenue and Appropriation Account | 148,937 2 6 | *418,552 3 4* |
| | £1,308,950 16 5 | *£1,159,820 3 11* | | £1,308,950 16 5 | *£1,159,820 3 11* |

*Reserve Fund Account.*

| | | | | | |
|---|---|---|---|---|---|
| | £ s. d. | *£ s. d.* | | £ s. d. | *£ s. d.* |
| To Balance.. .. .. .. .. .. | 303,958 4 1 | *181,248 2 9* | By Balance at close of previous year .. .. .. | 181,248 2 9 | .. |
| | | | Amount set aside as per Net Revenue and Appropriation Account | 122,710 1 4 | *181,248 2 9* |
| | £303,958 4 1 | *£181,248 2 9* | | £303,958 4 1 | *£181,248 2 9* |

## TABLE No. 5—*continued.*

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

### BALANCE-SHEET AT 31ST MARCH, 1941, COMPARED WITH POSITION AT 31ST MARCH, 1940.

| — | 1940–41. | | 1939–40. | — | 1940–41. | | 1939–40. |
|---|---|---|---|---|---|---|---|
| *Liabilities.* | £ s. d. | £ s. d. | £ s. d. | *Assets.* | £ s. d. | £ s. d. | £ s. d. |
| Depreciation Reserve .. .. .. | .. | 1,112,633 2 6 | *1,081,975 9 4* | Hydro-electric plants— | | | |
| Sinking Fund— | | | | Arapuni .. .. .. | 2,645,343 5 9 | | *2,646,143 19 2* |
| Utilized for redemption of loans .. | 1,134,771 13 2 | | *739,092 13 2* | Horahora .. .. .. .. | 327,381 9 6 | | *328,466 3 8* |
| Available for further redemptions .. | 174,179 3 3 | | *429,727 10 9* | Mangahao .. .. .. .. | 1,365,097 14 5 | | *1,404,321 18 3* |
| | | 1,308,950 16 5 | | Waikaremoana .. .. .. | 713,523 14 1 | | *704,747 8 7* |
| | | | *1,159,820 3 11* | | | 5,051,346 3 9 | |
| | | | | | | | *5,083,679 9 8* |
| Reserve Fund .. .. .. | .. | 303,958 4 1 | *181,248 2 9* | Fuel-plants— | | | |
| | | | | Penrose .. .. .. .. | 65,431 7 8 | | *65,431 7 8* |
| Sundry creditors— | | | | Huntly .. .. .. .. | 11,264 2 5 | | *11,412 1 11* |
| Public Works Department .. .. | 25,797 12 6 | | *32,717 15 11* | | | 76,695 10 1 | |
| Other Government Departments .. | 2,711 3 3 | | *2,382 12 1* | | | | *76,843 9 7* |
| Non-departmental .. .. .. | 172,544 13 0 | | *88,639 11 2* | Transmission-lines system .. .. | .. | 1,747,812 16 6 | *1,845,213 3 4** |
| | | 201,053 8 9 | | Substations .. .. .. .. | .. | 1,386,362 2 5 | *1,209,854 7 10* |
| | | | *123,739 19 2* | Communication system .. .. | .. | 171,634 19 6 | .. |
| Sundry credit balances .. .. .. | .. | 543 14 9 | *781 7 2* | Distribution system .. .. .. | .. | 56,664 6 1 | *62,342 8 8* |
| Head Office Account .. .. .. | .. | 9,291,979 12 4 | *8,495,475 1 9* | Offices, stores, land, buildings, &c. .. | .. | 71,325 7 8 | *73,715 3 8* |
| | | | | Cost of raising loans .. .. .. | .. | 307,478 12 2 | *296,955 12 2* |
| | | | | Interest during construction— | | | |
| | | | | On assets in operation .. .. | 973,707 15 10 | | *963,962 2 3* |
| | | | | On assets not in operation .. .. | 51,120 4 6 | | *19,546 18 5* |
| | | | | | | 1,024,828 0 4 | |
| | | | | | | | *983,509 0 8* |
| | | | | Works under construction .. .. | .. | 1,667,556 14 11 | *797,127 10 7* |
| | | | | | | 11,561,704 13 5 | *10,429,240 6 2* |
| | | | | Plant, motor-vehicles, and tools .. | .. | 66,416 13 0 | *76,725 4 9* |
| | | | | Stocks of materials .. .. .. | .. | 245,916 16 10 | *224,590 9 6* |
| | | | | Sundry debtors— | | | |
| | | | | Public Works Department .. .. | 9,668 19 6 | | *6,709 10 6* |
| | | | | Other Government Departments .. | 14,077 13 1 | | *4,735 17 3* |
| | | | | Non-departmental .. .. .. | 296,092 2 3 | | *297,963 8 6* |
| | | | | | | 319,838 14 10 | |
| | | | | | | | *309,408 16 3* |
| | | | | Sinking Fund investments .. .. | .. | 25,242 0 9 | *2,175 7 5* |
| | | £12,219,118 18 10 | *£11,042,140 4 1* | | | £12,219,118 18 10 | *£11,042,140 4 1* |

* Includes Communication system.

## TABLE No. 5—*continued.*

## SOUTH ISLAND HYDRO-ELECTRIC-POWER SUPPLY.

### PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1941, COMPARED WITH YEAR ENDED 31ST MARCH, 1940.

*Gross Revenue Account.*

| —— | 1940–41. | | *1939–40.* | | —— | 1940–41. | | | *1939–40.* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | |
| To Generating-expenses (hydro-electric)— | | | | | By sales of electrical energy— | | | | | |
| Lake Coleridge .. .. .. .. | 14,538 18 1 | | *12,668 3 5* | | Bulk for resale .. | | 443,534 13 3 | | *402,773 19 9* | |
| Lake Waitaki .. .. .. .. | 8,560 13 1 | | *8,437 8 6* | | Other than for resale— | | | | | |
| Kaimata .. .. .. .. | 1,577 12 9 | | *1,215 14 10* | | Traction .. .. | 21,479 3 9 | | | *21,089 4 11* | |
| Monowai .. .. .. .. | 6,370 10 0 | | *7,709 0 4* | | Industrial .. .. | 99,050 2 10 | | | *79,340 15 4* | |
| | | 31,047 13 11 | | *30,030 7 1* | Retail .. .. | 101,965 4 2 | | | *96,689 10 4* | |
| | | | | | | | 222,494 10 9 | | | |
| Generating-expenses (fuel) Dobson .. .. | .. | 8,421 14 11 | *12,816 15 8* | | | | | 666,029 4 0 | *599,893 10 4* | |
| Purchase of power in bulk .. .. .. | .. | 298 4 3 | *337 16 11* | | | | | | | |
| Standby charges .. .. .. .. | .. | 225 0 0 | .. | | Rents— | | | | | |
| | | | | | Land and buildings .. .. | | 4,532 15 0 | | *3,641 11 4* | |
| | | 39,992 13 1 | *43,184 19 8* | | Lines and plant .. .. | | 386 6 6 | | *785 6 0* | |
| Transmission System: Patrol and maintenance | .. | 24,564 11 7 | *15,927 19 10* | | | | | 4,919 1 6 | | |
| Substations: Operation and maintenance .. | .. | 22,230 8 1 | *20,671 17 5* | | | | | | *4,426 17 4* | |
| Communication System: Patrol and maintenance | .. | 1,373 0 3 | *1,353 2 3* | | | | | | | |
| Distribution: Maintenance .. .. .. | .. | 19,933 18 0 | *19,473 12 10* | | Miscellaneous revenue .. .. | | .. | 7,864 9 11 | *9,291 17 8* | |
| System operation, testing, &c. .. .. | .. | 11,781 18 1 | *7,826 12 1* | | | | | | | |
| Management and general expenses .. .. | .. | 53,411 16 5 | *66,521 8 7* | | | | | | | |
| Balance, to Net Revenue and Appropriation Account | .. | 505,524 9 11 | *438,652 12 8* | | | | | | | |
| | | £678,812 15 5 | *£613,612 5 4* | | | | | £678,812 15 5 | *£613,612 5 4* | |

*Net Revenue and Appropriation Account.*

| —— | 1940–41. | | *1939–40.* | —— | 1940–41. | *1939–40.* |
|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | | £ s. d. | £ s. d. |
| To Interest (gross) for year ended 31st March, 1941 .. | 262,392 19 11 | | *252,569 17 10* | By Balance from Gross Revenue Account .. .. | 505,524 9 11 | *438,652 12 8* |
| *Less* interest capitalized .. .. .. | 8,323 8 11 | | *5,651 0 0* | | | |
| | | 254,069 11 0 | | | | |
| | | | *246,918 17 10* | | | |
| Depreciation on completed works .. .. | .. | 73,711 4 7 | *124,931 6 1* | | | |
| Sinking Fund .. .. .. .. | .. | 126,227 3 11 | *66,802 8 9* | | | |
| Reserve Fund .. .. .. .. | .. | .. | .. | | | |
| Social Security charge, national security tax, income-tax | .. | 51,516 10 5 | .. | | | |
| | | £505,524 9 11 | *£438,652 12 8* | | £505,524 9 11 | *£438,652 12 8* |

## TABLE No. 5—*continued.*

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

### *Depreciation Reserve Account.*

| — | 1940–41. | *1939–40.* | — | 1940–41. | *1939–40.* |
|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | | £ s. d. | £ s. d. |
| To Replacements, Renewals, &c. .. .. .. .. | 45,649 18 10 | *33,216 13 8* | By Balance from previous year's statement .. .. .. | 755,025 16 10 | *637,799 5 1* |
| Balance .. .. .. .. .. .. | 813,288 3 3 | *755,025 16 10* | Interest at 4 per cent. per annum .. .. .. | 30,201 0 8 | *25,511 19 4* |
| | | | Amount set aside as per Net Revenue and Appropriation Account | 73,711 4 7 | *124,931 6 1* |
| | £858,938 2 1 | *£788,242 10 6* | | £858,938 2 1 | *£788,242 10 6* |

### *Sinking Fund Account.*

| | £ s. d. | £ s. d. | | £ s. d. | £ s. d. |
|---|---|---|---|---|---|
| To Balance .. .. .. .. .. .. | 543,855 16 1 | *417,604 14 3* | By Balance at close of previous year .. .. .. | 417,604 14 3 | *350,840 10 0* |
| | | | Interest .. .. .. .. .. .. | 23 17 11 | *Dr.* 38 4 6 |
| | | | Amount set aside as per Net Revenue and Appropriation Account | 126,227 3 11 | *66,802 8 9* |
| | £543,855 16 1 | *£417,604 14 3* | | £543,855 16 1 | *£417,604 14 3* |

### *Reserve Fund Account.*

| | £ s. d. | £ s. d. | | £ s. d. | £ s. d. |
|---|---|---|---|---|---|
| To Capital loss .. .. .. .. .. .. | 433 10 11 | .. | By Balance at close of previous year .. .. .. | 87,199 6 0 | *87,199 6 0* |
| Balance .. .. .. .. .. .. | 86,765 15 1 | *87,199 6 0* | | | |
| | £87,199 6 0 | *£87,199 6 0* | | £87,199 6 0 | *£87,199 6 0* |

## TABLE No. 5—*continued.*

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

### BALANCE-SHEET AT 31ST MARCH, 1941, COMPARED WITH POSITION AT 31ST MARCH, 1940.

| — | 1940-41. | | 1939-40. |
|---|---|---|---|
| *Liabilities.* | £ s. d. | £ s. d. | £ s. d. |
| Depreciation Reserve | .. | 813,288 3 3 | *755,025 16 10* |
| Sinking Fund— | | | |
| Utilized for redemption of loans | 403,406 5 1 | | *340,255 5 1* |
| Available for further redemptions | 140,449 11 0 | | *77,349 9 2* |
| | | 543,855 16 1 | *417,604 14 3* |
| Reserve Fund | .. | 86,765 15 1 | *87,199 6 0* |
| Sundry creditors— | | | |
| Public Works Department | 19,724 14 0 | | *13,887 8 4* |
| Other Government Departments | 4,896 15 10 | | *10,096 0 11* |
| Non-departmental | 47,746 4 7 | | *22,860 15 6* |
| | | 72,367 14 5 | *46,844 4 9* |
| Sundry credit balances | .. | 1,778 14 5 | *1,508 12 1* |
| Head Office Account | .. | 6,159,176 11 2 | *5,996,991 6 6* |
| | | £7,677,232 14 5 | *£7,305,174 0 5* |
| *Contingent Liability.* | | | |
| Arrears of appropriation to Sinking Fund | | £214,654 2 3 | *£252,670 11 5* |

| — | 1940-41. | | 1939-40. |
|---|---|---|---|
| *Assets.* | £ s. d. | £ s. d. | £ s. d. |
| Hydro-electric plants— | | | |
| Lake Coleridge | 865,214 15 7 | | *861,473 14 11* |
| Lake Waitaki | 1,909,802 7 6 | | *1,775,897 3 3* |
| Kaimata | 146,440 5 4 | | *143,307 12 11* |
| Monowai | 202,881 9 4 | | *202,263 2 1* |
| | | 3,124,338 17 9 | *2,982,941 13 2* |
| Fuel-plants— | | | |
| Dobson | .. | 133,219 19 2 | *133,640 5 0* |
| Transmission-lines system | .. | 1,027,863 5 0 | *1,005,166 2 3* |
| Substations | .. | 721,510 11 10 | *652,966 16 4* |
| Communication system | .. | 73,017 2 9 | *69,378 15 2* |
| Distribution system | .. | 872,192 19 1 | *851,305 19 7* |
| Offices, stores, land, buildings, &c. | .. | 21,670 12 8 | *21,518 6 7* |
| Cost of raising loans | .. | 532,491 17 6 | *529,647 5 2* |
| Interest during construction— | | | |
| On assets in operation | 482,274 18 8 | | *476,533 11 11* |
| On assets not in operation | 7,344 2 2 | | *4,762 0 0* |
| | | 489,619 0 10 | *481,295 11 11* |
| Works under construction | .. | 293,128 14 8 | *209,057 6 9* |
| | | 7,289,053 1 3 | *6,936,918 1 11* |
| Plant, motor-vehicles, and tools | .. | 110,852 3 8 | *114,801 16 2* |
| Stocks of materials | .. | 126,092 18 5 | *121,872 6 8* |
| Sundry debtors— | | | |
| Public Works Department | 5,655 10 5 | | *6,796 9 11* |
| Other Government Departments | 3,866 10 3 | | *2,591 7 4* |
| Non-departmental | 127,490 3 4 | | *111,646 18 0* |
| | | 137,012 4 0 | *121,034 15 3* |
| Sinking Fund investments | .. | 14,222 7 1 | *10,547 0 5* |
| | | £7,677,232 14 5 | *£7,305,174 0 5* |

# APPENDICES

TO THE

## PUBLIC WORKS STATEMENT, 1941.

## APPENDIX A.

## AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1940-41.

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

Public Works Department, Wellington, 25th June, 1941.

SIR,—

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.,

H. T. ARMSTRONG,
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 1940-41.

| Summary. | Appropriation. | Gross Expenditure. | Credits in Aid. | Net Expenditure |
|---|---|---|---|---|
| *General Purposes Account*— | £ | £ s. d. | £ s. d. | £ s. d. |
| Public Works, Departmental .. .. | 190,155 | 586,290 12 0 | 537,560 5 3 | 48,730 6 9 |
| Railways .. .. .. .. | 2,482,050 | 2,065,109 2 11 | 135,017 10 10 | 1,930,091 12 1 |
| Public Buildings .. .. .. | 1,772,525 | 1,478,008 16 5 | 35,577 10 1 | 1,442,431 6 4 |
| Lighthouses and Harbour-works .. | 32,320 | 35,412 19 7 | 1,058 16 3 | 34,354 3 4 |
| Development of Tourist Resorts .. | 25,000 | 23,634 8 7 | 2,059 7 1 | 21,575 1 6 |
| Roads, Bridges, and other Public Works .. | 570,000 | 650,559 14 11 | 51,546 9 11 | 599,013 5 0 |
| Telegraph Extension .. .. .. | 325,000 | 531,279 13 7 | 275,226 2 11 | 256,053 10 8 |
| Lands, Miscellaneous .. .. .. | 350,000 | 267,030 17 2 | 24,073 4 5 | 242,957 12 9 |
| Irrigation, Water-supply, and Drainage .. | 617,500 | 672,309 11 8 | 61,271 9 3 | 611,038 2 5 |
| Swamp Land Drainage .. .. | 11,000 | 13,182 4 3 | 9,235 8 1 | 3,946 16 2 |
| *Small Farms Development .. .. | 370,000 | 572,562 9 0 | 257,133 16 0 | 315,428 13 0 |
| Native Land Settlement .. .. | 350,000 | 1,010,870 14 10 | 772,427 1 4 | 238,443 13 6 |
| Linen-flax Development .. .. | 430,000 | 245,997 8 5 | 20 10 8 | 245,976 17 9 |
| Unauthorized— | | | | |
| Services not provided for .. .. | .. | 1,434 0 5 | 45 19 5 | 1,388 1 0 |
| Totals, General Purposes Account .. | 7,525,550 | 8,153,682 13 9 | 2,162,253 11 6 | 5,991,429 2 3 |
| *Electric Supply Account*— | | | | |
| Development of Water-power .. .. | 2,850,000 | 2,371,764 10 2 | 67,432 11 2 | 2,304,331 19 0 |
| Unauthorized— | | | | |
| Services not provided for .. .. | .. | 208 7 3 | .. | 208 7 3 |
| Totals, Public Works Fund .. | 10,375,550 | 10,525,655 11 2 | 2,229,686 2 8 | 8,295,969 8 6 |

* Includes vote "Settlement of Unemployed Workers" previously shown as separate vote.

APPENDIX A—*continued.*

| Name of Vote. | Appropriation. | Gross Expenditure. | Credits in Aid. | Net Expenditure. |
|---|---|---|---|---|
| PUBLIC WORKS FUND. | £ | £ s. d. | £ s. d. | £ s. d. |
| *General Purposes Account*— | | | | |
| Public Works, Departmental .. .. | 190,155 | 586,290 12 0 | 537,560 5 3 | 48,730 6 9 |
| Railways— | | | | |
| Railway-construction .. .. | 900,000 | 945,907 12 7 | 87,975 14 4 | 857,931 18 3 |
| Railways Improvements and Additions to Open Lines | 1,582,050 | 1,119,201 10 4 | 47,041 16 6 | 1,072,159 13 10 |
| Public Buildings .. .. .. | 1,072,525 | .. | .. | .. |
| Subdivision I—Public Buildings, General | .. | 342,902 8 6 | 5,133 10 8 | 337,768 17 10 |
| Subdivision II—Courthouses .. .. | .. | 18,380 8 1 | 5,226 9 7 | 13,153 18 6 |
| Subdivision III—Prison Buildings and Works | .. | 2,580 15 7 | 47 14 1 | 2,533 1 6 |
| Subdivision IV—Police-stations .. | .. | 31,458 10 1 | 7,115 9 4 | 24,343 0 9 |
| Subdivision V—Postal and Telegraph .. | .. | 353,483 10 7 | 921 2 2 | 352,562 8 5 |
| Subdivision VI—Mental Hospitals .. | .. | 127,066 1 9 | 422 7 3 | 126,643 14 6 |
| Subdivision VII—Health and Hospital Institutions | .. | 46,564 14 5 | 2,544 18 3 | 44,019 16 2 |
| Education Buildings .. .. .. | 700,000 | 555,572 7 5 | 14,165 18 9 | 541,406 8 8 |
| Lighthouses and Harbour-works .. | 32,320 | 35,412 19 7 | 1,058 16 3 | 34,354 3 4 |
| Development of Tourist Resorts .. | 25,000 | 23,634 8 7 | 2,059 7 1 | 21,575 1 6 |
| Roads, Bridges, and other Public Works .. | 570,000 | 650,559 14 11 | 51,546 9 11 | 599,013 5 0 |
| Telegraph Extension .. .. .. | 325,000 | 531,279 13 7 | 275,226 2 11 | 256,053 10 8 |
| Lands, Miscellaneous .. .. .. | 350,000 | 267,030 17 2 | 24,073 4 5 | 242,957 12 9 |
| Irrigation, Water-supply, and Drainage .. | 617,500 | 672,309 11 8 | 61,271 9 3 | 611,038 2 5 |
| Swamp Land Drainage .. .. | 11,000 | 13,182 4 3 | 9,235 8 1 | 3,946 16 2 |
| Small Farms Development .. .. | 370,000 | 572,562 9 0 | 257,133 16 0 | 315,428 13 0 |
| Native Land Settlement .. .. | 350,000 | 1,010,870 14 10 | 772,427 1 4 | 238,443 13 6 |
| Linen-flax Development .. .. | 430,000 | 245,997 8 5 | 20 10 8 | 245,976 17 9 |
| Unauthorized— | | | | |
| Services not provided for .. .. | .. | 1,434 0 5 | 45 19 5 | 1,388 1 0 |
| Totals, General Purposes Account .. | 7,525,550 | 8,153,682 13 9 | 2,162,253 11 6 | 5,991,429 2 3 |
| *Electric Supply Account*— | | | | |
| Development of Water-power .. .. | 2,850,000 | 2,371,764 10 2 | 67,432 11 2 | 2,304,331 19 0 |
| Unauthorized— | | | | |
| Services not provided for .. .. | .. | 208 7 3 | .. | 208 7 3 |
| Totals, Public Works Fund .. | 10,375,550 | 10,525,655 11 2 | 2,229,686 2 8 | 8,295,969 8 6 |

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.

W. L. NEWNHAM,
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, 1940, made no provision for subdivisions in vote, "Public Buildings," the allocation of expenditure to the several subdivisions of that vote has not been checked. —CYRIL G. COLLINS, 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 completed and in progress throughout the Dominion during the financial year ended 31st March, 1941.

### RAILWAYS.

#### Dargaville Branch Railway.

The progress of this work has been retarded by war conditions.

*Kirikopuni–Tangowahine Section* (0 m. to 10 m. 17 ch.).—The work on this section was confined to maintenance, and proposals have now been approved for the lifting of the Kirikopuni Loop and the construction of a new station-yard at the commencement of the loop.

*Tangowahine–Dargaville Section* (10 m. 17 ch. to 19 m. 70 ch.).—The works completed during the year were as follows: Earthwork, 35,000 cubic yards; culverts constructed, 250 lineal feet; Tangowahine River Bridge (10 m. 20 ch.) lengthened by one 30 ft. plate-girder span; overbridge at 17 m. 51 ch. completed; overbridge at 13 m. 53 ch. in hand; platelaying, 1 m. 40 ch.; ballasting, 12,300 cubic yards, this completing the platelaying and ballasting of the main line.

*Te Wharau Station Yard* (15 m.).—This station was completed with the exception of ballasting of the sidings and metalling of the access road.

*Dargaville Station Yard.*—Formation work and platelaying were completed and the first lift of ballast laid. An approach road 43 chains long was completed and the base-course metal laid.

The platform 600 ft. long was completed, and arrangements are in hand for letting a contract for the station buildings.

A regular goods service was maintained over this branch during the year and has been of great value to the district.

#### Paeroa–Pokeno Railway.

Construction work on this railway was suspended in May, 1940.

The total work completed up to the date of suspension comprised: formation, 774,000 cubic yards; fencing, 19 m. 56 ch.; and culverting, 4,439 lineal feet.

The plant and stores have been transferred to other works, and most of the accommodation has been made available to farm workers.

A small maintenance-gang has been employed to keep the completed formation in order.

#### Napier Gisborne Railway.

*Kopuawhara Section* (length, 11 m. 60 ch.).—A total length of 455 chains of permanent fencing was erected during the year. Two pairs of cattle-stops were constructed at road crossings.

Excavation totalling 39,850 cubic yards was carried out, and all earthwork was completed to 30 m. 15 ch. Work is in hand clearing out cuttings and widening banks to 33 m. 33 ch. The total excavation carried out on this section to 31st March, 1941, was 836,250 cubic yards.

Trimming preparatory to platelaying was completed to 30 m. 5 ch. A retaining-wall at 28 m. 64 ch., 66 ft. long, was completed. Wire-mesh and boulder groynes have been placed in the Kopuawhara Stream at 30 m. 45 ch., 31 m. 12 ch., and 32 m. 11 ch., a total of 860 cubic yards being constructed. Concrete-pipe culverts of the following sizes and lengths have been constructed: 12 in. diameter, 16 ft.; 24 in. diameter, 32 ft.; 30 in. diameter, 32 ft.

At the Waiau Stream Bridge at 30 m. 15 ch. the construction of eight 40 ft. spans and one 30 ft. span has been completed, leaving only the central arch span of 180 ft. The steel falsework for this span has been placed in position, and timber work was completed to the stage of laying sheathing for the soffit of the arch rib.

On the Waiau Stream Bridge at 32 m. 1 ch. all the foundations for the piers were completed with the exception of abutment K. Abutment A and piers B, C, D, E, F, G, and H were completed to full height, and piers I and J are in course of construction. Falsework for spans AB, BC, and CD was completed, and boxing steel placings were well advanced.

The Waiau Stream Bridge at 33 m. 27 ch. is to be a reinforced-concrete bridge of four 40 ft. spans. Excavation for foundations for piers C and D has been completed and some concrete has been placed. The Waiau Stream Bridge at 33 m. 33 ch. comprises three 40 ft. plate girder through spans on concrete piers founded on 10 in. by 8 in. R.S.J. piles driven to solid sandstone. During the year the concreting of all piers was carried out and girders placed, but not riveted owing to shortage of labour. In March a riveting gang started and completed one and a half spans.

All bridge-construction has been adversely affected by the shortage of skilled labour.

Tunnelling on this section comprises five short tunnels aggregating 1,511 ft., as well as the southern face of the Waiau Tikiwhata Tunnel. Four short tunnels are complete—viz., at 30 m. 09·45 ch. (156 ft. of excavation and lining), 30 m. 52·16 ch. (385 ft. excavation and lining), 31 m. 40·22 ch. (356 ft. excavation and 359 ft. lining), and at 33 m. 06·77 ch. (397 ft. excavation and 411 ft. of lining).

The tunnel at 32 m. 05·77 ch. will have a total length of 200 ft., of which 117 ft. of excavation and 99 ft. of lining have been completed.

In the Waiau–Tikiwhata Tunnel, which will be 9,804 ft. in length, driving of the south face has been somewhat retarded due to wet ground and shortage of man-power. During the year 1,275 ft. have been excavated and 1,401 ft. lined. The total progress to date is south-end excavation, 4,590 ft. and lining 4,253 ft., while on the north end 4,901 ft. have been excavated and lined, making a total of 9,491 ft. and 9,154 ft. respectively.

At 31st March, 1941, the headings of the tunnel-faces were separated by 218 ft.

Platelaying is completed to 29 m. 70 ch., an advance of 4,525 lineal yards. The three lifts of ballast were completed to 28 m. 38 ch. The men employed on both ballasting and platelaying were transferred to urgent work in another district in January, and since then no advance has been made.

In the Waikokopu Station yard at 22 m. 70 ch. a 6,000-gallon water-vat was completed, together with the necessary supply-lines. Also a loading-bank, shelter shed, and latrines were constructed, and the formation of access roads carried out.

At the Opoutama Station yard at 25 m. 70 ch. large stock-yards, a loading-bank, buffer-stops, and the towers for two 12,000-gallon vats were constructed.

The maintenance of all service roads has been carried out. Early in the year four large bins served by a temporary service line at 28 m. 35 ch. were constructed, and all concrete aggregates and road-metal are drawn from this storage.

*Wharerata Section* (length, 9 m. 17·65 ch.).—Progress on this section has been steady, but tunnelling at the north end of the Waiau–Tikiwhata Tunnel was somewhat retarded due to heavy wet ground being encountered.

The earthwork has been completed except for a large slip of about 7,000 cubic yards at 18 m. 62 ch. and minor slips along the section. Culverts and water drives are complete except for extension and improvements to outlets made necessary by washouts along the steep coastal length.

The total length of bridging on this section has been increased from 875 ft. to 1,080 ft. by the substitution of bridges for retaining-walls. The total length completed is 695 ft.

The tunnelling operations on this section have been completed with a total length of 14,091 lineal feet, made up as follows: Waikoura Tunnel, 4,730 ft.; Tunnel at 20 m. 15 ch., 486 ft.; Coast Tunnel, 3,074 ft.; Tunnels at 35 m. 40 ch., 35 m. 46 ch., and 35 m. 58 ch., 980 ft.; Waiau–Tikiwhata (north end), 4,901 ft.

The platelaying has been completed into the Tikiwhata Valley, 22 m. 11 ch. from Gisborne, the length of main line laid during the year being 8 m. 42 ch. Permanent-way has also been laid on the main and goods-shed sidings in the Wharerata Station yard and the 20 ch. coast siding was completed.

First-lift ballasting has been completed from 14 m. to 16 m. 26 ch., and a second lift from 14 m. to 14 m. 32 ch. This work has been retarded by a shortage of experienced lifters. There remains about 31,000 cubic yards of ballast to be placed in position to complete.

The erection of the permanent telephone-line is complete to 17 m. 51 ch.

*Gisborne Section* (length, 14 m. 0·735 ch.).—Progress on this section was mostly confined to platelaying, ballasting, lifting, and bridging. All this work is well in hand, but progress was retarded on account of the late arrival of bridge girders and the shortage of experienced labour for lifting and ballasting.

Platelaying on the main line has been completed, and a large proportion of the Matawhero Station yard has also been done. First and second lifts of ballast have been completed for the main line over the whole section, 11,300 cubic yards of ballast having been placed during the year. Ballasting of the Muriwai Station yard has been completed, and similar work for the Matawhero yard is in hand.

The bridges over the whole section have been completed except for repainting and the substitution of permanent girders for temporary 20 ft. wooden spans. The substitution of the steel girders when they arrive and the completion of the four spans affected represents only two weeks' work.

The fencing of the section has been completed.

At Muriwai Station yard the platform and loading-banks have been completed, and tenders are being called for the erection of station buildings and additional platelayers' cottages there, and for platelayers' cottages at Matawhero.

The telephone-line has been completed.

At the Waipaoa River the construction of ten pervious pile and sheathing groynes has been completed to combat further erosion of the river-bank at the sharp bend up-stream from the railway-bridge. Rock facing and the planting of bamboo on the batters has yet to be done to complete the work.

### Turakina–Okoia Railway Deviation.

The approaches to the Wangaehu and Turakina Bridges and the completion of a short section at the north end of the Turakina Tunnel comprised the only earthwork carried out during the year.

The excavation of the Turakina Tunnel was completed, together with the lining of the length of 499 ft. which remained unfinished at the close of the previous period.

Flooding interrupted the construction of bridging over the Wangaehu and Turakina Rivers, but in both cases the foundations were practically completed in readiness for the placing of the steel girders.

Practically the whole of the trimming has been finished, while further permanent fencing, with private crossing-gates, was completed over a length of 109 ch.

Plans and specifications were prepared for various buildings at the Wangaehu and Turakina Stations.

A large number of buildings which had been used for accommodating married employees were transferred and re-erected for temporary accommodation on farms.

### Palmerston North Railway Deviation.

There have been 102,745 cubic yards excavated during the year, and this spoil has been tipped at the following places: Main goods-yard filling, 30,208 cubic yards; passenger yards, 16,000 cubic yards; Gillespie's Line ramp, 16,338 cubic yards; Longburn ramp, 2,045 cubic yards; and City Council recreation area, 38,154 cubic yards.

The Kawau Stream culvert, which is 781 ft. long and 18 ft. wide, has been completed. During the year 268 ft. were added and 3,200 cubic yards of spoil excavated from the foundations.

At Gillespie's Line Overbridge 16,338 cubic yards were deposited on the ramp, and all pile driving completed.

Two test piles, each 31 ft. 9 in. long by 16 in. square, were driven at the Longburn–Rongotea Overbridge. At Setter's Line Overbridge four test piles were driven.

The following concrete-pipe culverts were placed: 557 ft. of 3 ft. 6 in. diameter, 102 ft. of 12 in., and 142 ft. of 6 in.

On an area of about 12 acres situated on the corner of Boundary Road and Rangitikei Line 38,154 cubic yards of spoil were dumped. This is to be a recreation area under the control of the Palmerston North City Council.

Two complete private crossings with two extra gates were erected at 86 m. 40 ch., 120 ch. of fencing were erected and strained up, and several side drains were cleaned out and 40 ch. of new drain cut at Longburn.

Six chains of access roads have been formed and metalled for various settlers along the line.

On the Whakarongo Section a dam 60 ft. by 30 ft. by 8 ft. has been excavated at 0·50 ch. to supply water to stock.

Six railway-gates have been erected.

Work on this deviation has now been suspended.

### South Island Main Trunk Railway.

As construction had advanced sufficiently from the north and south ends it was decided to centralize the works headquarters, and from the 1st April, 1940, activities were directed from Kaikoura. Consequent upon the enlistment of staff and workmen for military service, the number of men employed on this railway decreased, and at the close of the year under review amounted to only a little more than one-half of the number employed at the beginning of the year.

Non-delivery of rails and of reinforcing steel for bridge-construction also contributed to a reduction in the rate of progress.

*Clarence Section.*—Work on this section is nearing completion, and stock trains are now running southwards to the Clarence Bridge.

The excavation at the Blue Slip has been completed, and although some movement is still taking place the country is standing reasonably well. The road deviation has been completed and the track has been laid past the slip.

Work is in progress on the erection of station buildings, including platelayers' cottages at Kekerangu, Clarence Bridge, and Parikawa, and water-supplies for locomotive and domestic requirements are being installed at the two first-mentioned places.

All platelaying has been completed and the track on this section is being cleared up and the final lift of ballast ploughed out.

*Kaikoura Section.*—The erection of the steelwork of the Clarence River Bridge (1,524 ft.) was completed with the exception of painting. The contractor also completed the bridge over the Hapuku River (1,541 ft.). Severe flooding in March carried away the protection and north abutment of the Clarence Bridge and damaged the approach banks of the Hapuku Bridge. Heavy slipping on the formation also occurred as a result of the severe rainfall necessitating the removal of 17,000 cubic yards of material.

All bridges north of Kaikoura, with the exception of Middle Creek, have been completed.

Proposals are in hand for bridging south of Kaikoura.

Culvert work is substantially complete and sea protection is well advanced.

Although sleepers and track fittings are on hand, rails are not yet available, and for this reason no platelaying or ballasting has been carried out on this section.

The erection of a number of permanent cottages at Kaikoura is in progress, and arrangements are being made to call tenders for the remaining cottages and station buildings at this location.

The permanent telephone-line has been completed to 104 m. 54 ch., and 6 m. 54 ch. were erected during the year.

Fencing over a length of 3 m. 73 ch. was completed, but this work has been delayed through shortage of material.

*Oaro Section.*—Formation work is well advanced throughout the uncompleted length between 61 m. 40 ch. and 73 m. 30 ch., but recent heavy slipping will involve an increase in the quantity of material to be handled.

The Amuri Bluff Tunnel was completed. The remaining tunnel-work comprises the finishing of the tunnel at 64 m. 48 ch., the excavation of which is approaching completion and an additional tunnel of 7 ch. length at 69 m. 65 ch. which is being driven to avoid a deep cutting in unfavourable ground.

The total length of tunnelling completed during the year was 3,139 lineal feet.

The erection of the Okarahia Stream Bridge was continued, the Oaro River Bridge was approximately 50 per cent. completed, and pile-driving for the Kahautara Stream Bridge was commenced.

Culvert work, although well advanced and ahead of formation requirements, has been retarded owing to shortage of labour. Sea protection has been continued.

The erection of the permanent telephone-line and fencing has been continued as far as circumstances allowed.

Platelaying has been carried on as far as practicable, 2 m. 7 ch. having been completed during the year. Also 1 m. 41 ch. of trimming, 2 m. 4 ch. of ballast first lift, 2 m. 38 ch. of second lift, and 1 m. 63 ch. of third lift were completed.

The Claverley Station yard has been ballasted and sidings laid. Station buildings and cottages have also been erected at this station.

*Conway Section.* Construction on this section has been completed and stock trains are being operated as far as Claverley.

During the year permanent cottages were completed at Ferniehurst Station and permanent station buildings and cottages were erected at Hundalee.

### Westport–Inangahua Railway.

*Cascade Section.*—Maintenance-work has been continued throughout the year. The four steel bridges are carrying temporary track sleepers, but permanent sleepering is coming to hand in readiness for changing over when full supplies are available. In addition to transporting men daily, the works train operated by the Department carried 19,184 tons of coal from the Cascade-Westport Coal Co.'s bin at Cascade Creek to Westport, and also a substantial quantity of ballast material for the Railways Department.

*Cascade - Inangahua Junction Section.*—Formation has been almost completed, the major works yet to be done comprising 10,000 cubic yards on one filling, the battering of steep faces, the removal of slips, and trimming and grading.

A reinforced-concrete bridge, 260 ft. in length, has been erected at Slaty Creek. The construction of the R.S.J. bridge at Tracy Creek has been well advanced, and of the three 100 ft. steel-girder spans for the Orikaka River bridge two spans have been placed in position.

A small amount of culverting remains to be installed on this section.

Platelaying was completed by the contractor over a length of 13 m. 12 ch. and the remaining length of 5 m. 21 ch. will be laid by the Department.

First-lift ballast has been placed and packed from Cascade Bridge to 15 m. On the Inangahua end first-lift ballast has been spread from 21 m. 62 ch. (Westport chainage) to the Buller River Bridge at 60 m. 27 ch. (Stillwater chainage).

Fencing has been completed on the Inangahua end to 60 m. 70 ch. on the right and to 60 m. 63 ch. on the left, the rate of progress being governed by the availability of fencing-wire.

A commencement has been made with the erection of the permanent telephone and signal line.

The station buildings at Te Kuha, which have been used for storing materials, are being renovated. Additional water-storage has been provided at Tiroroa.

The rainfall at Tiroroa for the year ended 31st December, 1940, was approximately the same as that recorded for the preceding year, 155·44 in. having fallen over 176 days.

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## IRRIGATION.

### CENTRAL OTAGO.

Weather conditions in Central Otago varied considerably during the past season. The lack of snow on the high country was counterbalanced by good rains in the spring and early summer, but very dry conditions obtained from January onward. Water-supplies ran very low in the Tarras and Hawkdun Schemes towards the latter end of the season, but ample storage in dams enabled the other schemes to receive a good supply.

The only construction work undertaken was the provision of a new intake and measuring-device from the Manuherikia River near Blackstone Hill. This race supplies six irrigators and commands 1,100 acres, and is part of the Omakau Scheme.

Maintenance-work was heavier than usual due to flood damage, and it was necessary to replace 714 ft. of riveted steel pipe with 370 ft. of concrete flume and 344 ft. of 30 in. diameter reinforced-concrete pipe on the Teviot Scheme, and further extensive damage was sustained on the Omakau, Hawkdun, and Arrow River Schemes.

The number of irrigators shows an increase of thirteen and the irrigated area was increased by 811 acres.

The following table gives details of the completed schemes in operation, also the area which should have been irrigated had all rates been forthcoming :—

| Scheme. | Area actually irrigated. | Area that should have been irrigated. | Number of Irrigators actually supplied. |
|---|---|---|---|
| | Acres. | Acres. | |
| Arrow River .. .. .. | 2,605 | 2,980 | 47 |
| Ardgour .. .. .. .. | 1,364 | 1,364 | 11 |
| Bengerburn .. .. .. | 64 | 94 | 13 |
| Earnscleugh .. .. .. | 1,995 | 2,190 | 48 |
| Galloway .. .. .. .. | 2,398 | 2,448 | 22 |
| Hawkdun .. .. .. .. | 8,181 | 8,977 | 66 |
| Idaburn .. .. .. .. | 565 | 565 | 8 |
| Ida Valley .. .. .. .. | 12,064 | 12,084 | 57 |
| Last Chance .. .. .. | 2,760 | 2,760 | 31 |
| Manuherikia .. .. .. | 4,873 | 4,893 | 75 |
| Tarras .. .. .. .. | 2,675 | 2,675 | 18 |
| Teviot River .. .. .. | 3,562 | 3,942 | 44 |
| | 43,106 | 44,972 | 440 |
| Omakau (includes Dunstan and new Blackstone Hill area) | 9,000 | .. | 66 |
| Totals .. .. .. | 52,106 | 44,972 | 506 |

An area of 50 acres on the Bengerburn Scheme was eliminated as non-irrigable.

The total irrigable area commanded on all schemes is approximately 64,000 acres.

The financial results of the year's working were : Revenue, £26,730 ; working-expenses, £24,002 ; profit on working, £2,728.

The revenue shows an increase of £834 over last year's figure, but working-expenses also have increased by £712, leaving an increase in profit on working of £122. This revenue is the highest annual amount yet collected, the previous highest collection having been £25,980 in the 1938–39 season.

On the Omakau Scheme proper, where irrigation agreements are not in force but where water is purchased as required, the total quantity of water sold was 8,774 acre feet, as against 5,844 acre feet for the previous season. This falls short of the peak sales of 10,380 acre feet in the 1937–38 season. The demand for water on this scheme is still less than might be expected.

The recording of stream-flows, lake-levels, and meteorological data was carried out as in previous years.

## CANTERBURY.

### Operation and Maintenance of Irrigation Schemes.

*Redcliff Scheme.*—Irrigation commenced in the middle of October. The demand for water showed an increase of about 10 per cent. during the past season, the return for sales being £373. The working-expenses were £623. The area watered increased from 1,400 acres to approximately 1,550 acres, and the same beneficial results as in previous seasons have been obtained, although a number of farmers are not yet using the amount of water which they should.

*Levels Scheme.*—Irrigation commenced in the middle of October. On this scheme the returns showed a 25-per-cent. increase to £447. The working-expenses were £1,678. The number of farmers who availed themselves of irrigation increased from fifty-one in the previous year to fifty-eight in the season just passed. The area watered was approximately 1,800 acres. During the season farmers generally have been very keen to have at least part of their farms irrigated, which is a marked improvement on previous years. A steady increase in the sowing of good type pastures continues. More paddocks have been and are being border-dyked.

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

| Scheme. | Area actually irrigated. | Area for which Water is available. | Number of Irrigators. |
|---|---|---|---|
| | Acres. | Acres. | |
| Redcliffs .. .. .. .. | 1,550 | 4,603 | 17 |
| Levels .. .. .. .. | 1,800 | 12,800 | 67 |

The financial result of the year's operations is as follows: Revenue, £844 ; working-expenses, £2,301.

### Schemes under Construction.

*Rangitata Diversion Race.*—This forty-two-mile diversion canal, which has a capacity of 1,150 cusecs and which will be capable of diverting almost the entire winter flow of the Rangitata River, has been designed to irrigate nearly a quarter of a million acres of the mid-Canterbury district. When not required for irrigation purposes the entire flow will be utilized by the Highbank Hydro-electric Station for the development of 36,000 horse-power.

The project will involve the excavation of nearly four and a quarter million cubic yards and the erection of a considerable number of reinforced-concrete structures. These include road bridges, drainage culverts, radial gate controls, and syphonic spillways. To enable the water to be passed under the Ashburton and Hinds Rivers and their tributaries, concrete conduits are required. Some of these will be constructed of precast concrete pipes having an internal diameter of 11 ft. On one difficult section of country a reinforced-concrete conduit is required and will extend for nearly $1\frac{3}{4}$ miles. This structure is being constructed of precast pipes which have an internal diameter of 12 ft. To date 400 ft. of this high-pressure syphon has been laid. The intake structure itself is nearing completion, and it is expected that towards the end of May the concrete caissons, which weigh approximately 700 tons each, will be floated out into the Rangitata River.

During the year another fifty-nine structures have been erected, the total number to date being eighty-five.

Excavation work is now spread over 40 miles of race, the total yardage to date being 3,222,000 cubic yards, and the yardage for this year being 939,000. The excavation work on this race is being carried out by thirty-six high-powered Diesel machines.

*Surrey Hills Pipe-factory.*—The establishment of this modern factory for the manufacture of large concrete pipes is now complete, and it will shortly be possible to produce five pipes daily. To date the factory has turned out forty-one pipes, which have an internal diameter of 12 ft., and weigh 28 tons. The modern methods employed in the manufacture, placing, and finally the steam-curing of the concrete enables the pipes to be handled forty-eight hours after pouring.

Eventually these pipes will be used on three large jobs' namely, the Surrey Hills high-pressure syphon, North and South Branch Ashburton River crossings, and on the upper portion of the penstock line for the Highbank Power-station. These structures will in each case be able to accommodate the entire flow of the Rangitata Diversion Race.

*Ashburton-Lyndhurst Scheme.*—This scheme, which is situated between the North Ashburton River and the Rakaia Methven railway-line, has been designed to irrigate 34,000 acres, involving the formation of 132 miles of race containing 534,000 cubic yards of excavation.

Work for the year has been the excavation of 27 miles of race containing 60,000 cubic yards of excavation, bringing the total race formation to date to 124 miles and the race excavation to 502,000 cubic yards. The percentage of this work completed is 94.

Five hundred reinforced-concrete structures have been built during the year, making a grand total of 1,588. This figure represents 88 per cent. of the structures necessary to regulate the flow of water.

On this scheme an area which was prepared for demonstration purposes still possesses the best pasture in the district. One return issued by the Department of Agriculture showed that the area carried an average of 9·96 sheep per acre and averaged as high as 14·1 sheep per acre during the irrigation season.

All excavation work for the year has been carried out by Diesel-powered excavation plant.

*Mayfield-Hinds Scheme.*—This scheme is situated between the Rangitata and Hinds Rivers and is designed to irrigate 54,000 acres.

The race excavation will amount to 1,000,000 cubic yards and will require the formation of 210 miles of race. Approximately two thousand reinforced-concrete structures will be required to regulate the flow of water on this scheme.

Although progress has been considerably retarded as a result of war conditions, excavation by Diesel-powered plant has been pushed ahead. During the year 40 miles of race has been formed, containing 162,600 cubic yards, and 12 miles of fencing and 148 reinforced-concrete structures have been erected.

During the past few months carpenters on these works have been concentrated on erection of portable accommodation, and several units have been supplied in accordance with the Temporary Farm Workers' Accommodation Scheme.

### Canterbury Irrigation Investigations.

Stream Gauging: Continuous records were obtained from eight automatic water-level recorders on major rivers. Discharge records during low flow periods were checked.

Soil Moisture and Rainfall: Observations and records of soil moisture and rainfall were continued at forty-four stations in Canterbury and Marlborough.

Evaporation: Continuous records of evaporation, wind-mileage, humidity, and temperature in the same districts were obtained from six stations.

Rainfall Run-off: Continuous records of rainfall were obtained from six high-level automatic rain-gauges in the North Ashburton River catchment area, and outfall from the catchment was measured continuously at the North Ashburton River automatic recorder.

Soil Survey: Soil acidity and fertility studies in the Ashburton County continued.

### Downs Water-supply Scheme.

This scheme is now well advanced and 700 farms, covering 109,000 acres out of the total of 154,000 acres, are now being amply supplied with water for stock and domestic purposes.

Mains and Sub-mains: Although difficulty in obtaining steel has delayed deliveries of New-Zealand-made pipes, 37 miles, or 70 per cent. of the total, have now been laid.

Galvanized Pipes: Supplies from overseas are becoming increasingly difficult to obtain. A total of 572 miles, or 82 per cent., has now been laid.

Reservoirs: Five of the six reservoirs are now completed.

Pleasant Point Township: Reticulation of Pleasant Point, which includes provision of fire fighting mains, has been completed.

## HYDRO-ELECTRIC DEVELOPMENT: CONSTRUCTION WORKS.

### Arapuni Power Scheme.

The driving of the tunnels for penstock units Nos. 5 and 6, together with access shafts, porous drainage system, and the laying of rail tracks in concrete foundations, were completed. The two penstock gates were assembled and erected.

The 12-ft.-diameter steel tube lining of No. 6 tunnel has been placed for 122 ft., of which 110 ft. has been concreted.

The concrete foundations for No. 6 generator were completed to the first stage level, and formwork for No. 5 generator in well in hand.

At the outdoor substation concrete foundations are in course of construction.

The efforts to lower the level of tail-race water at the sand-bar were successful to the extent that a very definite improvement was observed in the release of water at the bar. Work was suspended owing to suitable plant not being available, and it appears that no reduction in water-level at the power-house will be effected until the bar is further lowered.

Boring operations at the eastern abutment of the Arapuni Dam were continued, ten additional bores of various depths and totalling 3,260 ft. having been drilled during the year. The sealing of certain bores with bituminous material has resulted in decreased discharge in the leakage, and investigations are still proceeding.

### Karapiro Power Scheme.

*Tunnelling.*—Two working-shafts were sunk to depths of 120 ft. and 140 ft. respectively and equipped with electric lifts.

*Dam.*—Excavation was commenced on the right abutment, and generally the rock contours established by boring and geophysical surveys proved reasonably accurate.

*Concreting.*—Foundations were commenced for a batching plant and silo for cement. Experimental work has proceeded to ensure the suitability of various sands, and a large test-scale model is working satisfactorily. A contract has been let for the supply of the bulk of the crushed stone for concrete aggregate. Arrangements have been made for the mixing and delivery of large quantities of concrete by mechanical means.

*Buildings and Quarters.*—Administration and works buildings have been erected, and living-accommodation for the staff and workmen has been provided. Electricity, water-supply, and drainage systems have been installed.

*Roading.*—Access and internal roads have been constructed.

*Permanent Village.*—Thirteen permanent houses are under construction, and a contract has been let for erecting the water-tower.

*General.*—Progress with construction work generally has been affected through the inability to secure competent artisans.

### Taupo Headworks.

The diversion cut in the Waikato River at the outlet from Lake Taupo has been well advanced. Of the excavation, approximately 80 per cent. of the material has been removed. The gate structure has been concreted to the underside of the slab.

Upstream from the gate structure sand and shingle is being removed from the channel, whilst downstream drilling plant is being operated from a barge in the removal of boulders, rock, reefs, &c.

### Waikaremoana Lower Development.

*Whakamarino Canal.*—This work is now completed. It consists of a concrete intake structure containing six wooden hand-operated gates leading into a reinforced concrete canal 187 ft. long and 16 ft. wide, which in turn runs into a double rectangular-shaped concrete inverted siphon. The siphon, with a horizontal leg of 91 ft., carries the water across the bed of the Waikaretaheke River 28 ft. below canal-level and then up into a trapezoidal section 584 ft. long to discharge into Lake Whakamarino. Access across the canal is provided by a small bridge.

*Whakamarino Dam.*—Boring and grouting the foundation of this dam was continued, 2,180 lineal feet of boring was completed, making a total of 4,150 lineal feet. Grouting used 304 tons of cement. The gate tower on the Kahutangaroa Culvert has been extended to its final level, and 21,250 cubic yards of selected clay placed on the dam and consolidated. The spillway structure, which is also complete, will house four automatic tipping gates, and the spilled water will run down a concrete slope to a specially-designed energy-breaker and a water-cushion. Work on the construction of these gates is in hand.

*Whakamarino Lake.*—The clearing of scrub and trees over the lake area of 80 acres is in hand.

*Tunnel Intake and Earth Dam.*—The rolled fill dam containing 3,500 cubic yards of selected material was completed along with the excavation for the tunnel intake structure.

*Tunnel and Inverted Siphon.*—Good progress was made from 5 faces with the construction of the 16-ft.-diameter water-tunnel, the total length of completed excavation being 7,419 ft. In the main tunnel system all excavation is completed except for a gap of 220 ft. where a heavy fall of some 80 ft. has delayed the work. A small section of 60 ft. also remains immediately adjacent to the surge-chamber. The concrete lining of the tunnel has been completed for a length of 5,658 ft.

*Siphon at Surge-chamber.*—Excavation is almost complete, 3,080 cubic yards of spoil having been removed.

*Surge-chamber.*—A total of 25,480 cubic yards of material has been removed, and a tank has been excavated below the chamber proper and the floor of it has been concreted. A pilot shaft has been sunk in the gate control shaft area.

*Penstocks.*—Both penstock tunnels to the surge-chamber are excavated, and the steel pipes have been placed in the western tunnel and concreted in. Between No. 1 and 2 anchor blocks trimming was completed and the bases of fourteen pedestals have been concreted, 176 cubic yards of concrete being placed. The foundation for No. 2 anchor block has been completed.

In the shaft section below No. 2 block the excavation has been completed and trimmed and stone toe walls at the toes of the batters put in.

The pipes in No. 3 anchor block were placed and concreted in.

*Power-house.*—To date the foundation walls and about half the concrete roof has been completed, a total of 3,923 cubic yards of concrete having been placed. The auxiliary units arrived during the year, and the main transformers are also on the job along with cable and miscellaneous gear.

*Tail-race.*—Deepening and widening of the old river-bed to form a tail-race was put in hand and 5,080 cubic yards of material removed.

*Piripaua Village.*—Two permanent cottages and a single man's quarters were completed.

*Employees.*—The total number of employees is 351.

### Cobb River Power Scheme.

Since the Government took over this scheme the Department has carried on construction activities in connection with the headworks for this scheme.

The access road to the dam-site has been formed for a length of 6 m. 40 ch.

The original tunnel section is being enlarged to permit of a later increase in the generating capacity of this station—1,900 lineal feet had been driven to the original size, but this was enlarged during the year, and a further 1,893 lineal feet of driving to the new section was also completed.

Preliminary excavation near the power-house has been commenced, and boring on the dam-site is in progress.

### Lake Tekapo Power Scheme.

Access roads to works and camp sites have been formed and metalled, and living-accommodation for staff and workmen has been erected, including water-supply and drainage systems, at all camps.

Administration buildings have also been erected, and a commencement has been made with the construction of buildings for the curing and storage of concrete tunnel-lining blocks.

At the inlet end of the power tunnel a shaft 25 ft. by 12 ft., clear of timber, has been sunk to a depth of 40 ft. below ground-level, and a tunnel enlargement to erect the shield-in has been commenced from the bottom of the shaft along the line of the tunnel.

At the outlet end of the tunnel an access adit 10 ft. by 10 ft. has been excavated for a length of 230 ft. A cutting has been opened up at the end of the adit and a concrete invert cast for the erection of the tunnel-driving shield.

Over 900,000 superficial feet of timber has been supplied to the works from local plantations.

### Highbank Power Scheme.

The power-house for this scheme is located 7½ miles from Methven on the south branch of the Rakaia River 777 ft. above sea-level, and at the end of the Rangitata Irrigation Race 42 miles from the intake on the Rangitata River.

The scheme will utilize the surplus water not required for irrigation, and a maximum of 1,000 cusecs will be available.

The supply will be conveyed to the power-house through a piped penstock line, the first section comprising 11-ft.-diameter precast concrete pipes and the remainder 9-ft.-diameter steel pipes. The single vertical shaft turbine will operate under a maximum gross head of 348 ft., generating 36,000 horse-power.

During the year under review 7,000 cubic yards have been excavated for the power-house foundations and 40,000 cubic yards have been taken out of the 46 chain tail-race.

A contract has been let for the power-house, and active work was commenced towards the end of the year. The sinking of the 5-ft. diameter concrete cylinders to form bases for the transmission-line river-crossing towers is in hand. Work is also in hand on the construction of the permanent village buildings.

## CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES.

Activities in respect of the construction and improvement of roads and bridges were on a much smaller scale than for the preceding year. Formation was completed over lengths totalling 235 miles, and metalling was undertaken over an aggregate length of 400 miles. A total length of 8,395 ft. of bridging was erected during the year, and over 32,000 lineal feet of culverting was installed.

Apart from the continuation of works already in hand at the beginning of the year, the programme largely comprised the formation, metalling, and bridging of access to farming localities where primary production would be benefited.

A summary of the larger works carried out during the year is as follows:

The metalling of the Awanui–Mangonui Road was completed, and a reinforced-concrete bridge, 350 ft. in length, was erected across the Taipa River. There are still a number of smaller bridges to be erected on this road.

Formation and metalling of 5½ miles of the Waiotapu–Waikite Valley Road were completed, in order to provide access to lands under development by the Crown.

On the Rotorua–Waikaremoana Road a further length of 4 miles was metalled.

Work was continued on the direct road connecting Waiouru and Tokaanu, 10 miles of formation and 12 miles of metalling having been completed. One bridge 80 ft. in length was erected.

Only 4 miles of formation remains to be constructed between the sections of the Taumarunui–Tokaanu Road which have already been completed. During the year 3 miles of heavy bush were cleared, 2 miles 55 chains were formed, and 1 mile 23 chains were metalled.

The formation and base-course metalling of the Okau–Tongaporutu Road have been completed, thus providing a direct connection between the Ohura district and the Te Kuiti–New Plymouth State highway. The work done during the period under review consisted of 4 miles of formation and 6 miles of base-course metalling.

Good progress was made with the survey of the Napier–Taihape Road.

The Lower Hutt–Melling section of the Western Hutt Road has been completed, and the formation of the Petone–Lower Hutt section is well advanced, in readiness for surfacing next season. A considerable amount of work was involved in the moving of railway-tracks and signalling-equipment.

Formation has been completed on the Woodville–Ashhurst Road, which will provide an alternative to the Manawatu Gorge highway connecting the Hawke's Bay and Wellington districts. The erection of the Pohangina River Bridge, over 360 ft. in length, is in hand.

Improvements to the Springlands Junction–Matakitaki Section were continued.

On the Main South Westland Road, 3 miles of formation and 7 miles of metalling were completed on the Weheka–Haast Section. The erection of the Paringa River Bridge, 1,414 ft. in length, is in hand, and when finished will complete this section as far as is proposed at present. This will then afford an all-weather extension for a distance of 43 miles southwards from Weheka. On the Haast–Jackson's Bay Section, 5 miles 52 chains of formation and 9 miles 72 chains of metalling were completed. This portion of the proposed main road will, when constructed, provide all settlers south of the Haast River with access to Jackson's Bay, where shipping facilities are available. During the year the following bridges were completed: Okuru River (496 ft.), Waituna River (40 ft.), and Karangarua River (420 ft. suspension). The following structures are in course of erection: Turnbull River (496 ft.), Arawata South (200 ft.), and Arawata North (270 ft. suspension).

On the Makarora–Haast Road, full-width formation has now been completed for a distance of 17 miles from the commencement at the Makarora end, and half-width formation has been carried forward to the bridge-site at the Gates of the Haast. The reinforced-concrete bridge over the Fish River, consisting of one arch span, of 102 ft., and two approach spans each 14 ft., was completed. Construction work on this road has now been suspended.

The following table shows the extent of the surveys, formation, metalling, culverting, and bridging completed during the year in the respective public-works districts:—

| District. | Engineering Surveys. | Formation. | Metalling. | Culverts. | | Bridges. | |
|---|---|---|---|---|---|---|---|
| | | | | Number. | Length. | Number. | Length. |
| | M. ch. | M. ch. | M. ch. | | Ft. | | Ft. |
| Whangarei .. .. | 10 12 | 25 06 | 63 10 | 313 | 6,595 | 17 | 1,216 |
| Auckland .. .. | 31 21 | 58 37½ | 83 47½ | 240 | 4,417½ | 10 | 420 |
| Tauranga .. .. .. | .. | 12 59½ | 22 10½ | 90 | 2,426 | 3 | 101 |
| Gisborne .. .. .. | 1 60 | 14 66 | 19 59 | 178 | 4,347 | 2 | 330 |
| Taumarunui .. .. | 16 39 | 28 16 | 28 73 | 106 | 3,254 | 5 | 309 |
| Stratford .. .. | 1 38 | 7 56½ | 17 30½ | 3 | 444 | 2 | 135 |
| Napier .. .. .. | 1 20 | 11 29 | 31 9 | 11 | 1,054 | 2 | 241 |
| Wellington .. .. | 3 79 | 5 52 | 4 26 | 37 | 3,089 | 13 | 785 |
| Nelson .. .. .. | 1 16 | 7 29 | 8 12 | 63 | 1,068 | 2 | 50 |
| Greymouth .. .. | 8 33½ | 19 35 | 30 77 | 91 | 1,751 | 11 | 2,396 |
| Christchurch .. .. | .. | 18 24½ | 36 0½ | 58 | 1,229 | 6 | 945 |
| Dunedin .. .. .. | .. | 18 0 | 40 43½ | 63 | 1,477 | 6 | 308 |
| Invercargill .. .. | .. | 7 75½ | 11 43½ | 35 | 1,163 | 3 | 159½ |
| Totals .. .. | 75 78½ | 235 6½ | 400 42 | 1,258 | 32,312½ | 82 | 8,395½ |

## LANDS-IMPROVEMENT.

### Whangarei District.

*Sand-dune Reclamation.*—Kaitaia Area: The work carried out during the period under review consisted of tree-planting, lupin-sowing, marram-grass planting, and general maintenance.

Tree-planting extended over three months, during which 233,000 trees were planted covering approximately 200 acres. Most of the plants were produced at the Department's nursery at Waipapakauri. The results to date have been very satisfactory.

The quantity of lupin-seed sown was 4,472 lb., most of which was sown in the autumn near Waipapakauri with excellent results.

Marram-grass was planted out over a total area exceeding 400 acres, of which the greater plantations were at Te Kao and Greenfields.

Experiments have been made in the sowing of lupin and other seed by aircraft, and these show an appreciable reduction in cost as compared with hand methods.

Te Kopuru Area: Operations were confined to tree and marram-grass planting and lupin-sowing. Approximately 50 acres of trees and 35 acres of marram-grass were planted.

*Hokianga Harbour Tidal Flats Reclamation.*—At Tullock's, the reclamation stop-bank has been stone protected throughout the length of 70 chains which was subject to erosion by sea.

The Rawene area of 200 acres which was cleared of mangroves has been stumped in preparation for further development of the area.

*Willow-clearing.*—A contract has been let for the clearing of willows from 190 chains of the Waionehu Stream.

Scattered willows have been removed over a length of 107 chains of the Waiotu Stream, while the removal of heavy willow growth, the construction of diverts, and ring-barking were also carried out over a length of 40 chains.

*Swamp Drainage.*—Proposals were prepared for enlarging the Ruawai and Naumai stop-banks over a length of 6 miles, and towards the end of the year a contract was let by the Raupo Drainage Board. This work conforms to the comprehensive scheme of drainage improvements on the Ruawai Flats.

Investigations were made and proposals were prepared in respect of a number of drainage problems, and these are under consideration.

### Auckland District.

*Kaipara Harbour Flats Reclamation, Glorit Section.*—During the year 266 acres were disked and harrowed, 72 acres sown in grass, and 256 acres top-dressed. Wire fencing was erected over a length of 2 miles 12 chains. Two bores were sunk, a water-pump was installed, 7,126 ft. of reticulation pipes were laid, and sixteen concrete troughs, with approaches, were completed. The eradication of fescue was continued, an area of 485 acres being treated.

*Kaipara Harbour Flats Reclamation, Kukutango Block and Oyster Point.*—On this block, 148 acres of mangroves were cleared and burned, and on the stop-banks 35 chains were fascined, 55 chains grassed, and 65 chains repaired. Four drain-crossing bridges were erected, 490 chains of lateral drains were cut, and 449 chains of drain were deepened or cleared. Fencing was erected over a length of 729 chains, roading was formed for a length of 65 chains and metalled for 86 chains, while 142 ft. of culverting was laid. The metalling of the access road on the Oyster Point Block was almost completed.

*Sand-dune Reclamation.*—Woodhill-Helensville: Replanting of marram-grass was carried out over an area of 1,014 acres and tree-planting over an area of 320 acres. One hundred and thirty-four miles of new lines were cut and 1,486 miles of lines were cleared. Firebreaks totalling an area of 906 square chains were cleared and 6 miles of fore-dune fencing erected. In the tree nursery, 524,000 trees were lined out.

*North Waikato Heads and Kariotahi.*—Marram-grass was planted over an area of 500 acres, including 265 acres of new country. Four thousand pound of lupin-seed were sown with good results, and a large quantity of seed was gathered for the next season's requirements. Tree-planting covered an area of 358 acres, bringing the total to 1,026 acres. A total of 1,993 miles of tree lines were cleared and 38 chains of sand-arresting fences were erected on the fore-dunes. Over 400,000 yearling trees were lined out in readiness for the ensuing season.

Rabbits have caused a good deal of damage, and, in addition to regular trapping, experimental measures for poisoning were carried out at the request of the Agriculture Department, and the results were most satisfactory.

*South Kaipara Heads.*—Replanting of marram-grass was undertaken over an area of 345 acres, and 1,700 lb. of lupin-seed were sown. The work previously carried out at this location is in excellent condition.

*Hauraki Plains East Water-supply.*—This scheme was completed and the whole area is now being served.

*Mangaorongo Stream Willow-clearing.*—An additional length of 2 miles 37 chains of stream-bed has been cleared of willows by means of tractor and winch. The growth is extraordinarily heavy, but the general effect of the improvements has been to lower the normal water level 7 ft. at the Main Trunk Railway crossing at Kio Kio. The lowering of the water-level exposed large logs where the steam winch had previously worked, and these were also removed.

*Matatoki Drainage Scheme.*—Excavation was carried out over a length of 57 chains of the Matatoki Drain and 99 chains of the Warahoe Drain. Culverting totalling 322 ft. was laid, and twenty-five floodgates were completed. One 30 ft. span bridge was erected on Matatoki Road and one 17 ft. span bridge on Wainui Road.

*Paeroa Drainage Scheme.*—Drains have been excavated and stop-banks erected for a length of 113 chains. Two 25 ft. M.A.H. bridges and one 24 ft. reinforced-concrete box culvert were constructed, while 192 ft. of culverting was placed under stop-banks and 25 chains of drain were fenced.

*Turua Township Stop-banks.*—In order to conform to the new alignment and levels, 46 chains of stop-banking were constructed and four floodgates and culverts were completed.

### Tauranga District.

*Judea Swamp Drainage.*—The widening and deepening of this stream was continued and a total length of 4 miles 54 chains has now been completed.

*Otara River Erosion.*—The erection of protective groynes, comprising sheathed piling, was completed.

### Taumarunui District.

*Mokau River Willow-clearing.*—The work of ring-barking and poisoning willow growth was continued, and generally successful results have been obtained from the activities of previous years.

*Mangapu Drainage Board.*—This Drainage Board has carried out further clearing of the Mangapu Stream, with financial assistance from the Government.

### Wellington District.

*Sand-dune Reclamation (Hokio to Manawatu River).*—Good progress has been made with the stabilizing of sand-dunes by planting marram-grass and lupin. Tree-planting was continued, but owing to the loss of seedling trees through a storm only 94,000 trees were planted during the season.

*Manawatu River (Whirokino Cut).*—Towards the end of the year under review a contract was let for the excavation of the new channel some 53 chains in length. This work is situated about 1½ miles down-stream from the Whirokino Bridge on the State highway. The dimensions of the cut will be 35 ft. deep from mean surface level and a bottom width of 20 ft., the quantity to be taken out being 372,000 cubic yards.

*Flaxmilling Industry (Rehabilitation Plan).*—Work has been in progress with the clearing and planting of the Moutoa Estate, near Foxton. Heavy clearing has been carried out over an area of 314 acres and light clearing over 572 acres. Of the existing flax plantations, 125 acres have been thickened and 509 acres of new planting completed. The formation and metalling of 2 miles 40 chains of road were also undertaken.

### Nelson District.

*Awatere Water-supply.*—This scheme, which is being carried out by contract arranged by the Awatere County Council with assistance from the Government, is nearing completion. The principal work undertaken during the year was the laying of pipes for reticulation. A total length of 91,500 ft. of pipes, ranging in size from ¾ in. to 6 in., was laid, together with the necessary fittings and service connections.

### Christchurch District.

*Ashburton and Hinds Rivers Flood Control.*—A floodway of 1,400 acres has been cleared of willows and scrub to date, of which 1,200 acres were in the main stream and the balance in the north branch. Stop-banks totalling 7 miles have been erected in the Tinwald and Wakanui districts. A recent major flood proved the effectiveness of the partial scheme already completed, many thousands of acres which were formerly subjected to periodical flooding being saved from inundation.

*Lake Ellesmere and Lake Forsyth Drainage.*—Investigations have been made with a view to preparing a comprehensive report upon the possible methods of constructing outlets for these lakes.

### Greymouth District.

*Karamea Flood Control.*—Repairs to the Otumahana wall were completed, and further stone was placed to arrest the erosion at Hall's and Simpson's. Quinlan's filling was completely restored and the bank at Ferris's overflow was turfed.

The year's output from the Oparara Quarry was 3,609 tons of stone, the whole of this quantity being utilized.

*Oparara River Protection.*—As a result of severe flooding which occurred in February, 1940, it became necessary to carry out repairs and further protective work. Quarry rock was used for facing sections of bank where erosion had taken place. An old bridge approach was removed to allow flood-waters to escape freely.

*Arahura River Protection.*—A small amount of work was undertaken to strengthen the protection previously constructed. Two log groynes with boulder filling were erected to divert branches of the main stream away from certain stop-banks.

*Hokitika River Erosion (Moynihan's).*—A stop-bank was constructed, 12 ft. high and 11 chains long, across an overflow channel, together with scrub-mattress and willow-plantation protection.

*Kokatahi River Erosion (O'Reilly's).*—A stop-bank, 17 chains long and up to 13 ft. in height, was constructed across an overflow channel to prevent erosion down-stream. Heavy scrub-mattress protection was carried out on the down-stream end of the stop-bank.

*Little Wanganui River Erosion.*—New stop-banking averaging 10 ft. in height was erected over a length of 22 chains, and 20 chains of old stop-banking were raised and strengthened. Heavy wire crate mattress protection was provided at the head of two old pile groynes and 2 chains of continuous scrub-mattress protection were completed.

## HARBOUR WORKS.

*Houhora Wharf.*—The contract for the erection of a bridge at Pukenui has been let and work is in hand.

*Orapiu Wharf; Beachlands Slipway; Waiheke Island.*—The wharf at Beachlands was demolished and a slipway constructed with the materials therefrom. Reconstruction of Orapiu Wharf was also completed by the same contractors.

*Tairua Wharf.*—The reconditioning of this wharf was completed by the Thames County Council.

*Helensville Creek Beacon, Kaipara Harbour.*—General maintenance was carried out during the year.

*Bruce Bay.*—Surveys have been made and plans are being prepared for a proposed wharf at this location.

*Westhaven Wharf.*—The construction of a breastwork and approach road are in hand on this site.

*Havelock Wharf.*—Repairs and extensions are being undertaken, and all preliminary work is completed prior to letting a contract for construction of this wharf.

*Momorangi Bay.*—The site has been surveyed and plans are in hand for a jetty on this site.

*Elaine (Brown's) Bay.*—Plans have been prepared for a jetty and access track to be constructed here.

*Endeavour Inlet.*—A 34 ft. jetty has been constructed on Endeavour Inlet during the year.

*Fairy Bay Wharf.*—Plans have been completed for this wharf.

*Kumutoto Bay.* Plans are in hand for the provision of a wharf with launch steps at this location.

*Ships Cove.* The construction of a jetty with launch steps has been completed.

*Tennyson Inlet.*—A jetty complete with launch steps, access road, and approach has been constructed here.

### Lighthouses.

*Moko Hinau.*—A fuel-oil store has been erected, the Diesel engines overhauled, and repairs and maintenance carried out to the electrical equipment.

*Cuvier Island.*—Routine maintenance has been carried out on the Diesel engines and electrical equipment.

*Godley Head.*—The site for the new lighthouse has been constructed involving some 300 cubic yards of excavation in rock. All electrical equipment is on order, and the lens and lantern ex Cape Foulwind are being reconditioned ready for installation. Arrangements are in hand for the construction of the power-line to the new site.

*Akaroa.*—A contract has been let for the erection of a Blondin cableway over the inlet at this station to replace obsolete landing-equipment.

*Puysegur Point.*—The power-house in connection with electrification has been completed and the access road approximately 2 miles long constructed. All material and equipment for electrification and installation of radio beacon is being assembled at Invercargill ready for transport and installation.

*Moeraki.*—A small hut has been erected to accommodate an extra man, and power-lines have been run to the station for electrification. The cottages and buildings are now supplied with electricity, and equipment is on order to electrify the light.

*Centre Island.*—Extension of the cottage drainage is in hand.

*Portland Island.*—A generating set ex Stephens Island has been installed to provide power for radio-beacon purposes. Trial surveys have been carried out for the erection of a Diesel winch and tramway to improve access to the station and also surveys of sites for three new cottages for the keepers.

*Baring Head.*—Routine maintenance of plant and equipment has been carried out during the year. A cross-over connection between this station and the adjacent naval station has been provided to allow for an interchange of power in case of emergency.

*Hen Island.*—The erection of a light-tower and the cableway necessary for servicing is in hand and is now nearing completion. The existing light on the Chickens will be extinguished on completion of this work.

*Cape Reinga.*—A considerable amount of work has been carried out during the year. This includes the erection of two keepers' dwellings, light-tower, and power-house. The construction of a combined garage and fuel-store is in hand, also the erection of a flashing beacon on the mainland at Cape Maria.

The installation of plant and equipment in connection with the radio beacon and electrification has been completed, and the work of erecting the tower-lantern and equipment ex Cape Maria is in hand. With the exception of a 30 ft. bridge, which is in hand, the access road from Te Paki is now completed.

*Cape Maria.*—This station was completely dismantled during the year, the keepers being transferred to Cape Reinga. Everything salvagable was taken off the island, and the lighthouse lantern and equipment transferred to Reinga. When this light was extinguished a temporary electric light was exhibited at Reinga. Cape Maria Island no longer exists as a lighthouse station.

*Tutukaka Heads.*—An automatic flashing beacon has been erected on this location by the Whangarei Harbour Board under the direction of this Department.

*Cape Campbell.*—All buildings and the lighthouse tower have been painted and minor repairs carried out. During the year all electrical equipment received routine maintenance. A fuel-oil store has been erected adjacent to the power-house.

*Stephens Island.*—Routine maintenance has been carried out on this station during the year, and the construction of a fuel-oil store is in hand.

*Jackson's Bay.*—The tower for an automatic flashing light and a cableway for servicing have been erected ready for the installation of the beacon.

*Clay Point (Tory Channel).*—A tower for an automatic flashing light has been erected and an approach track constructed on this location.

*Castlepoint.*—Minor adjustments were carried out at this station, occasioned by the mechanism being displaced by an earthquake.

## LAND-CLEARANCE BY MACHINERY.

Good progress has been maintained with the scheme for making available for hire to farmers heavy constructional machinery suitable for bringing into production large areas of land which have remained uncultivated throughout the years owing to the difficulty and high cost by ordinary methods of carrying out stumping, logging, clearing, ploughing, &c.

Eighteen heavy tractors have been employed on this scheme during the year, and the following work was completed :—

| Public Works District. | Stumping and Clearing. | Ploughing and Cultivating. | Internal (Farm) Road and Track Formation. |
|---|---|---|---|
| | Acres. | Acres. | M. ch. |
| Tauranga .. .. .. .. | 630 | .. | 13 36 |
| Taumarunui .. .. .. .. | 1,100 | .. | .. |
| Stratford .. .. .. .. | 4,402 | 2,076 | 5 77 |
| Nelson .. .. .. .. | 874 | 438 | 4 0 |
| Westport .. .. .. .. | 711 | 536 | 0 20 |
| Greymouth .. .. .. .. | 103 | .. | .. |
| Dunedin .. .. .. .. | 431 | .. | 22 1 |
| Invercargill .. .. .. | 1,749 | .. | 24 7 |
| Totals .. .. .. | 10,000 | 3,050 | 69 61 |

In addition, improvements to creek channels, using drag-line excavators, have been a feature of the programme in Southland, 4 miles 27 chains having been dealt with by machinery during the year, along with 5 miles 67 chains of stop-bank formation.

## TEMPORARY ACCOMMODATION FOR FARM WORKERS.

To meet the shortage of accommodation for farm workers, especially married couples, a scheme was initiated early in 1940 whereby standard Public Works hutments were made available to farmers on very reasonable terms. During the year the number of hutments supplied was as follows, the period of tenancy in most cases being the duration of the war and one season thereafter :—

| District. | Married Men's Quarters. | Single Men's Quarters. |
|---|---|---|
| Whangarei .. .. .. | 32 | 6 |
| Auckland .. .. .. .. | 271 | 58 |
| Tauranga .. .. .. .. | 44 | 20 |
| Gisborne .. .. .. .. | 11 | 7 |
| Napier .. .. .. .. | 22 | 15 |
| Taumarunui .. .. .. | 9 | 2 |
| Stratford .. .. .. .. | 164 | 25 |
| Wellington .. .. .. | 58 | 20 |
| Nelson .. .. .. .. | 15 | 11 |
| Christchurch .. .. .. | 15 | 6 |
| Dunedin .. .. .. .. | 30 | 5 |
| Totals .. .. .. | 671 | 175 |

## DEFENCE WORKS.

During the year the Department continued a very large programme of construction works on behalf of the Army, Navy, and Air Departments in connection with the Dominion's defence requirements. This programme included the erection of numerous buildings, together with the installation of services for water-supply, sewerage, electric power, and other facilities. The extent of such work may be described as comprising approximately one-third of the whole of the Department's activities for the year under review.

## IMPROVEMENTS TO PUBLIC-SCHOOL GROUNDS.

Various improvements to school-grounds throughout the Dominion were carried out during the year in accordance with proposals approved by the Education Department.

This class of work was undertaken by the Public Works Department where the Government, through the Education Department, provided substantial financial assistance or met the whole of the cost involved.

## HOUSING CONSTRUCTION.

In connection with the Government housing scheme, this Department again carried out a considerable amount of work on behalf of the Housing Construction Department. This work covered principally subdivisional roading, including kerbing, channelling, and storm-water drainage, and the clearing and levelling of building-sites.

## PUBLIC BUILDINGS 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, respectively.

I have, &c.,

W. L. Newnham, A.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 31st March, 1941.

During the year plans were prepared for 782 buildings of an estimated value of £2,070,021, and contracts totalling £1,174,365 have been let. Contracts to the value of £340,346 for buildings designed prior to 1st April, 1940, have also been let, making the total value of building contracts let during the year £1,514,711.

In addition to the above, buildings have been designed and erected by other branches in Head Office and by District Offices in connection with railway-construction, main highways, hydro-electric works, and other activities of this Department.

During the year a major part of the organization of the Department was engaged in an urgent defence programme, involving extensive expansion to R.N.Z.A.F. aerodromes, large training camps at a number of military centres, and the establishment of naval and military coastal defence works.

Many materials and fittings previously imported have been difficult or impossible to obtain, but New Zealand manufacturers have risen to the occasion and produced satisfactory substitutes for the majority of them at reasonable prices.

Appended is a schedule of work, which includes maintenance work and contracts prepared in various District Offices.

During the year nine members of my staff volunteered and were accepted for military service, bringing the total now serving up to fourteen. In conclusion, I wish to place on record my appreciation of the efficient and loyal manner in which my staff responded to the heavy demands made upon them.

### Vice-Regal.

*Wellington.*—Extensive renovations and repairs were executed at Government House.

### Department of Agriculture.

*Whangarei.*—Office accommodation was arranged at Kaikohe and Dargaville.

*Auckland.*—At Ruakura a grass-drier plant was installed, and at Te Kauwhata a wine-storage building and still were erected.

*Stratford.*—Renovations were made to the dormitory block at Bulls.

*Wellington.*—At Wallaceville several buildings were erected and a new animal health laboratory building was completed and officially opened. A metabolism shed was completed. Alterations were carried out at two other places.

*Canterbury.*—Four buildings were erected at Canterbury Agricultural College, including a wheat research building and further extensions to the glasshouse.

*Dunedin.*—A new office was erected at Ranfurly and renewals were made to roofs of the dwelling and stables at Tapanui and repairs done at three other places.

### Education Department.

*Whangarei.*—Extensions, renovations, and repairs were executed at the local high school.

*Auckland.*—A housemaster's cottage at Owairaka was completed, and general maintenance was carried out at four Child Welfare Homes.

*Tauranga.*—A water-supply was installed at Pukehina School, and repairs and drainage-work done at Maraenui Native School.

*Napier District.*—Extensive ground improvements and renovations were carried out at Greenmeadows.

*Stratford.*—Substantial additions were made to the engineering block and heating services installed at Hawera Technical School, and at Stratford Technical School the erection of three modern classrooms was completed.

*Gisborne.*—Additions and renovations were carried out at three institutions and ground improvements at three Native schools.

At Gisborne High School painting and renovations were carried out and a shed for bicycles erected.

*Nelson.*—Nelson Boys' College and Marlborough College are still under construction.

*Dunedin.*—At the Special School, Otekaike, a new glasshouse was built and a heating system installed.

*Invercargill.*—At Gore High School a new technical block has been completed.

### Health Department.

*Whangarei.*—Thirty hutments for Native T.B. patients were completed.

*Tauranga.*—A start has been made on the foundations for a new sanatorium at Rotorua, and forty privies for Maoris were completed at Whakatane. Repair work was carried out to three district nurses' cottages.

*Gisborne.*—The construction of one T.B. hutment and forty tube privies was carried out.

*Stratford.*—At New Plymouth two huts were erected for T.B. Maoris and tube privies for Maoris at various pahs and farms in the district. A garage was built for the district nurse at Opunake.

*Wellington.*—Renewals and additions were carried out at four places.

*Nelson.*—One hutment for T.B. Maoris was erected at Wairau.

*Christchurch.*—The male pavilion at Queen Mary Hospital, Hanmer, was completed. Painting, renovations, and repairs were made to three buildings.

*Invercargill.*—The new labour block at St. Helens is nearing completion. General renovations were carried out at the main hospital and nurses' home.

### Justice Department.

#### *Courthouses.*

*Tauranga.*—Extensive renovations and repairs were executed at Whakatane and Opotiki, and a septic tank and drainage system was installed at the latter place.

*Gisborne.*—Extensive renovations and alterations have been done at Ruatoria. A new building is being erected.

*Wellington.*—Alterations and additions were made at Wellington.

*Dunedin.*—At Oamaru an electric heating system was installed and at Cromwell a sewerage system laid. The Arrowtown Courthouse was shifted to Omakau.

*Invercargill.*—The new Invercargill building is very nearly completed.

#### *Prisons.*

*Auckland.*—At Waikeria Borstal Institute two staff cottages were erected and a pasteurization and bottling plant was installed.

*Invercargill.*—Extensive renovations and alterations were carried out at the Borstal Institution.

### Mental Hospitals Department.

*Auckland.*—The nurses' home at Kingseat, together with renovations to villas 12 and 13, has been completed. At Avondale a hairdressing-saloon and glasshouse, and at Tokanui, villa No. 4, with new slaughterhouse and equipment, were erected.

General alterations and maintenance were carried out at several other places.

*Wellington.*—At Porirua the contract for demolition of towers and making good is approaching completion. Reroofing of the farm block is in hand.

*Christchurch.*—A new villa No. 5 at Templeton is under construction.

*Nelson.*—At Ngawhatu three new villas were completed and at Nelson repairs were made to the main building.

*Greymouth.*—The construction of the nurses' home also additions to the laundry building are almost complete.

### National and Commercial Broadcasting Services.

*Christchurch.*—At 3YA fresh staff accommodation of six rooms was erected. Painting and renovations were carried out at 3ZB.

*Invercargill.*—A five-roomed residence was erected at Dacre.

### Native Department.

*Whangarei.*—Seventy new houses, one hutment, and ten cowsheds were erected, and eight renovations carried out.

*Auckland.*—Thirty-two Native houses were completed, and alterations and additions made to a number of dwellings.

*Taumarunui.*—At Nihoniho and Taumarunui houses were built, and ten were completed at Te Kuiti.

*Tauranga.*—Twelve cottages were constructed under the Native Housing Scheme, and thirteen cottages, eleven cow-sheds, and one wool-shed under the Native Development Scheme. Eleven alterations and forty-four painting jobs were attended to.

*Napier.*—Nine residences were erected, and repairs and additions made to six others.

*Stratford.*—At Hawera new office accommodation was arranged, and at New Plymouth renovations were carried out at the hostel.

*Gisborne.*—Ninety houses were erected in this district. Maintenance was carried out at the Native Land Department Buildings.

### Police Department.

*Whangarei.*—At Kaitaia a new building was erected.

*Auckland.*—At St. Heliers a new station and residence was erected.

*Tauranga.*—A new cottage was erected at Waikune and a new station at Rotorua.

*Wellington.*—At Miramar a new residence and station was erected and a new station built at Levin.

*Nelson.*—At Motueka a new garage has been built.

*Christchurch.*—Five new residences were erected—namely, Little River, Cheviot, Glenavy, Waimate, and Riccarton.

*Dunedin.*—New buildings were erected at Port Chalmers and Naseby and a new office and lock-up constructed at Lawrence.

*Invercargill.*—Alterations and renovations were carried out at five stations.

### Post and Telegraph Department.

*Auckland.*—The additions to the Chief Post-office were completed and extensive alterations were made to the top floor. New post-offices and residences were erected at Kaukapakapa and Browns Bay. Alterations and additions were carried out at five post-offices and six telephone-exchanges. Extensive alterations and additions were completed at Newmarket.

*Taumarunui.*—A new post-office and residence at Taupo was completed.

*Tauranga.*—A new garage and line store was erected and maintenance of two other post-offices attended to.

*Stratford.*—At Fitzroy a new garage was erected and a new garage and store at Stratford is being built. Renovations and alterations to nine post-offices were attended to.

*Wellington.*—At Palmerston North alterations and additions have been completed. At Lower Hutt a new office is being erected.

Extensive renovations have been carried out at the General Post Office, Wellington, and maintenance carried out to two other buildings.

*Nelson.*—A new store and garage has been completed and renovations made at two other offices.

*Christchurch.*—Extensive alterations and renovations were carried out at Timaru Post-office.

*Dunedin.*—At Mosgiel a new post-office and residence was erected and repairs and renewals were carried out at four offices.

*Invercargill.*—A new post-office at Invercargill is almost completed. A new radio-receiving station is being erected at Awarua, and the old station converted into living quarters for single staff.

### Social Security Department.

*Whangarei.*—Additional office accommodation was provided at Whangarei and Dargaville, and accommodation at Kaitaia.

*Taumarunui.*—Alterations were carried out at Taumarunui and Te Kuiti.

*Tauranga.*—New office accommodation was arranged at Whakatane and Rotorua.

*Stratford.*—Alterations and additions were carried out at New Plymouth and Stratford.

*Wellington.*—Repairs and alterations were carried out at Aotea Quay.

### Tourist Department.

*Chateau Tongariro.*—Refrigeration machinery has been installed and extensive renewals and repairs to the heating system were carried out.

*Waikaremoana Lake House.*—Additions were made to the kitchen and a new drying room erected and the electric installation was reconditioned.

*Invercargill.*—Renovations and alterations were carried out at Te Anau and Milford.

### Miscellaneous.

*Whangarei.*—For the State Advances Department Rural Housing Scheme, thirty-eight married quarters and seven single quarters were completed. Three farmers were supplied with accommodation for seasonal workers. Renovations were carried out to six small farm cottages under the Small Farms Scheme.

*Auckland.*—The new building at Jean Batten Place is nearing completion, the probability being that the first three floors will be occupied some time in June. At Hamilton the Knox Street garage has been completed. A surfaceman's cottage and a garage were erected at Tirau. Renovations and additions were carried out at twelve Government Departments.

*Tauranga.*—New premises were fitted out for the State Fire Office. Six staff cottages and two surfacemen's cottages were erected at Taupo for the Main Highways Board. Forty-two married quarters and twenty-one single men's huts were erected under the Temporary Accommodation for Farm Workers' Scheme.

*Gisborne.*—A new depot at Awapuni Road was erected for the Department. The erection of a mechanical workshop is in hand. For the State Advances Department eleven married and ten single quarters were completed under the Rural Housing Scheme.

*Taumarunui.*—At Taumarunui an oil-store has been installed in the Public Works garage, and alterations to the grounds and departmental residence carried out. For the State Advances Department nine married and two single men's quarters were erected under the Temporary Accommodation for Farm Workers' Scheme.

*Napier.*—Internal Marketing Department: At the Hastings cool-store work on the insulating-chambers is well in hand. The well has been driven to 274 ft. Twenty-six married and fifteen single quarters were erected under the Small Farms Scheme. Thirty-five bicycle-racks were erected and general ground improvements were carried out at the Government Buildings. A five-roomed cottage was erected at Te Haroto and a three-roomed cottage at Caption Bridge for the Main Highways Board.

*Stratford.*—A new Plant Depot was constructed at Smart Road, New Plymouth. Office accommodation was arranged at New Plymouth and Wanganui.

*Wellington.*—The new Government Life Insurance Building is complete and is now fully occupied. The new dental clinic at Willis Street has been completed. The Stout Street building is about two-thirds complete, and work is going ahead steadily. Additions to the workshops have been completed at the Public Works Department, Palmerston North.

At Foxton several new buildings have been erected for New Zealand Woolpack and Textiles under the Flax Rehabilitation Plan. For the State Advances Corporation fifty-eight cottages for married workers and twenty huts for single men have been erected under the accommodation for Farm Workers' Scheme.

*Nelson.*—At Port Nelson a cool-store for the Internal Marketing Department is almost complete. At Cape Campbell renovations and painting to the lighthouse were carried out, and at Kahurangi Point the keeper's dwelling was removed to a new site on account of sea erosion. At Picton alterations and repairs were made to the Harbourmaster's residence. A linen-flax factory was erected at Blenheim. At Nelson a new laboratory and additions to the staff quarters was completed at the Tobacco Research Station.

*Christchurch.*—Linen-flax factories are almost complete at Leeston, Oxford, Methven, Washdyke, and Makikihi.

*Greymouth.*—Additions to the new Government Buildings are completed. Office accommodation for the Geological Survey was arranged.

*Dunedin.*—Ten cottages were erected for farm workers under the Temporary Accommodation for Farm Workers' Scheme. Alterations were carried out at three offices in addition to extensive alterations and renovations at the Customs Building.

*Invercargill.*—New factories were erected for the linen-flax industry—viz.: At Winton a new building for treating fibre and four temporary married quarters and a number of huts for single men have been erected; and at Otautau a similar programme is in being. For the State Advances Corporation thirty small married quarters have been erected under the Temporary Accommodation for Farm Workers' Scheme.

### Maintenance.

General maintenance and renovations were carried out as required in all districts.

I have, &c.,

John T. Mair, F.R.I.B.A., F.I.A.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 1940-41 the total capital outlay was £9,843,028 representing assets in operation, and £1,718,677 representing assets not in operation, giving a total capital outlay of £11,561,705, and Table 11 gives an analysis of this amount.

#### 2. Financial Results.

The total revenue for the year amounted to £1,533,136 and working-expenses £640,884, which resulted in a gross profit of £892,252, equal to a return of 9·37 per cent. on the average capital in operation (£9,519,865).

The interest charge for the year was £336,073, and as the statutory limit had been reached for the Depreciation Reserve, no payment was necessary to that account. The net profit was therefore £556,179, of which £284,532 was paid for income-tax, national security tax, and social security charge, £148,937 was appropriated to sinking fund, and the balance of £122,710 was transferred to the reserve fund.

Comparative figures for the year ending 31st March, 1940, are as follows: Revenue, £1,328,499; working-expenses, £368,015; interest, £345,207; depreciation, £15,477; with a net profit of £599,800.

The accumulated Reserves and Sinking Funds as at 31st March, 1941, amounted to £2,725,542 Table 1 gives full particulars of financial results as well as other relevant statistical information.

#### 3. System Operation and Load Despatching.

Arapuni and Horahora were run continuously in parallel with Waikaremoana and Mangahao stations for normal operation, and assistance was obtained from auxiliary stations as required.

The radio phone channel in connection with load dispatching between Hamilton, Mangahao, and Tuai has been satisfactory, and is being extended to provide an additional band to cover "poor reception" period.

Control of the following stations was taken over in March, 1941: Napier, Taihape, Patea, Te Aroha, Thames, and Tauranga Borough Councils; South Taranaki and Poverty Bay Electric-power Boards; and Kaponga Town Board.

The Mangahao dams were emptied on 5th March, 1941. The station was shut down altogether for five days and limited to half-load until 8th April, 1941, while one pipe-line was painted.

The following are the maximum daily and weekly outputs of units from the main stations :—

*April, 1940, to March, 1941.*

| | Greatest Daily Units. | Greatest Weekly Units. |
|---|---|---|
| System .. | 3,949,000, 2nd July, 1940 | 25,820,000, week ended 7th July, 1940. |
| King's Wharf .. | 747,930, 7th August, 1940 | 3,891,950, week ended 11th August, 1940. |
| Evans Bay .. | 530,450, 6th August, 1940 | 3,317,600, week ended 11th August, 1940. |
| Arapuni .. | 2,561,700, 25th March, 1941 | 16,048,000, week ended 30th March, 1941. |
| Mangahao .. | 440,480, 27th May, 1940 | 2,950,810, week ended 16th February, 1941. |
| Tuai .. .. | 694,400, 19th August, 1940 | 4,527,910, week ended 18th August, 1940. |
| Horahora .. | 285,360, 21st March, 1941 | 1,887,150, week ended 24th November, 1940. |
| Stratford line .. | 873,360, 21st March, 1941 | 4,842,400, week ended 30th March, 1941. |

The following coal was burnt at King's Wharf during the period April, 1940, to March, 1941: April, 111 tons; May, 4,880 tons; June, 4,612 tons; July, 11,842 tons; August, 10,595 tons; September, 3,109 tons; October, 956 tons; November, 666 tons; December, 1,432 tons; January, 4,135 tons; February, 3,120 tons; March, 5,929 tons. Total coal burnt for period, 51,387 tons.

The greatest amount of coal burnt in one week at King's Wharf was 3,881 tons from 5th to 11th August, 1940, inclusive.

Water was lost over the spillway at Arapuni on the following dates: 7th, 8th, and 9th April, 11th November, 15th to 26th November, and 30th December to 3rd January.

## 4. General.

The units generated and purchased totalled 1,245,947,813 for the system. Units actually sold totalled 1,122,692,042 and units used for station auxiliaries, &c., totalled 5,500,429.

The balance of 117,755,342 units represents transmission and distribution losses amounting to 9·451 per cent. of the total output.

The maximum load on the system was 246,700 kW. and the annual load factor 57·65 per cent. The total connected load was 1,587,056 kW., and the demand factor or ratio of maximum load to connected load was 15·54 per cent.

War conditions are accountable for non-arrival and late deliveries of much material ordered. The load on the system is, however, steadily increasing, and every effort is being made to safeguard the supply, with satisfactory results.

The need, however, for load curtailment on the part of supply authorities is still extremely urgent, and it is hoped that recent requests to this end will have a pronounced tendency to ease the strain during the coming winter.

## 5. Construction, Operation, and Maintenance.

### A. HAMILTON DISTRICT.

#### (1) CONSTRUCTION.

#### (*a*) *Power-stations.*

*Arapuni.*—The General Branch completed excavations for Nos. 5 and 6 penstock tunnels and the installation of the penstock gates. The contractor for the supply and installation of the steel linings in the penstock tunnels has so far placed 122 ft. of steel pipe in No. 6 tunnel, 110 ft. of which has been concreted in position. The new transformers (24,000 kVA.) for Nos. 5 and 6 units have been dried out and placed in position.

*Karapiro.*—Substations were installed to provide supply for these works.

#### (*b*) *Substations.*

*Aongatete.*—Metering-equipments were installed in connection with supply to Tauranga Power Board and Tauranga Borough Council respectively.

*Belmont.*—A start was made in February, 1941, on the construction of a 10,000 kVA. 50/11 kV. substation as a fourth supply point for the Waitemata Electric-power Board.

*Bombay.*—New 11 kV. switchgear consisting of a ten-panel, metal-enclosed, unit-type switchboard was put into service in place of the existing switchgear.

*Hamilton.*—A start was made in January, 1941, on extensions to and the rebuilding of the 110 kV. structure for a second 10,000 kVA. transformer bank and additional transmission-lines. A new relay-house was completed in January. A new radio transmitting and receiving set was temporarily installed and put into service in March, 1941, for the use of the System Load Despatcher.

*Henderson.*—The old 50 kV. steel structure was replaced by a new one, portion of the old structure being re-erected at Karapiro. Two new 3,000 kVA. transformer banks were installed, replacing the two 1,000 kVA. three-phase transformers. The erection of a new transformer house was practically completed by the end of the year. A new 11 kV. feeder O.C.B. was installed in September.

*Kaikohe.*—The substation buildings and three cottages were completed in September. A 50 kV. lightning-arrester from Takapuna was installed in December.

*Kaitaia.*—A temporary 750 kVA. 50/11 kV. substation was put into service as a second point of supply for the Bay of Islands Electric-power Board on 1st July, 1940. A 50 kV. lightning-arrester from Takapuna was installed in December. The substation buildings and two cottages are practically completed.

*Lichfield.*—A temporary 1,000 kVA. substation was put into service as an additional supply point for the Thames Valley Electric-power Board.

*Maungatapere.*—Three new cottages and two private garages were completed in November.

*Mount Roskill.*—A start was made on the substation buildings in June.

*Ngongotaha.*—A 1,000 kVA. three-phase transformer was installed in parallel with the existing banks.

*Ongarue.*—Work was commenced in February on the erection of a 110 kV. steel structure to replace the existing wood-pole structure. Two new cottages are being built.

*Penrose.*—The installation of a second synchronous condenser was completed, the 20,000 kVA. machine being put into service at the end of May, 1940. A 10,000 kVA., 110/50 kV. bank of transformers was put into service on supply to the North Auckland area on 25th October, 1940. Work is proceeding on extensions of the control-room and 110 kV. structure.

*Takapuna.*—The original steel structure has been by-passed and dismantled in readiness for transfer to Kaitaia, and a new steel structure is in the course of erection.

#### (*c*) *Transmission and Distribution Lines.*

*Arapuni–Penrose 110 kV. Tower-line No. 2.*—Construction was completed in September with the exception of the wiring of the terminal spans, which is held up pending the completion of the 110 kV. terminal structure at Penrose.

*Penrose–Henderson 110 kV. Tower-line.*—Construction was commenced in May, and was completed in April, 1941. Survey and pegging was completed for the supervisory and control circuits from Penrose to Mount Roskill.

*Arapuni–Bunnythorpe 110 kV. Tower-line* (Arapuni–Mangaturuturu Section). Final pegging of the Arapuni–Ongarue section has been completed. Tower erection was commenced on the Ongarue–Mangaturuturu section in May, and by the end of March 112 towers had been erected, leaving 56 to complete.

*Karapiro–Hamilton 110 kV. Tower-line.*—Final pegging of tower positions was completed.

*Hamilton–Waihou 110 kV. Line.*—Survey work was commenced in February, 1941.

*Henderson–Takapuna 50 kV. Line.*—A survey was made of a deviation to eliminate the harbour crossing near Hobsonville Air Base, following which a decision was made to rebuild the whole line using heavier conductors. Plans and profiles have been completed.

*Takapuna–Belmont 50 kV. Tower-line.*—Plans and schedules have been completed. The towers for this line will be obtained from the existing Penrose–Henderson 50 kV. line, which is to be dismantled.

*Kaikohe–Kaitaia 50 kV. Line.*—Construction was completed, and the line was livened on 30th June, 1940.

*Bombay–Waiuku 50 kV. Line.*—Possible routes were inspected, line costs estimated, and materials ordered.

*Edgecumbe – Te Puke 50 kV. Line.*—Detail survey was commenced in March, 1941.

*Te Puke – Aongatete.*—An exploratory survey was made in February to fix the location of a proposed line.

### (2) Operation and Maintenance.

#### (*a*) power-stations.

*Arapuni.*—Four 50 kV. O.C.B.'s and two 110 kV. O.C.B.'s were overhauled, new bushings, contacts, and explosion pots being fitted. The bushings on Nos. 7 and 8 transformer banks were fitted with new caps designed to relieve the joints of thermal stresses. The low-pressure coils on two of the original 11/110 kV. transformers were burned out.

Air-conditioning plant was installed in the control-room.

Work was carried out by the General Branch over the greater part of the year on dragging operations to lower the level of the tail-race.

*Horahora.*—The station was run to full capacity throughout the year, giving very satisfactory service.

*Penrose Diesel Plant.*—The two units available for service were run five days a week during the winter months, and at such other times as required. Flashovers occurred in the 6·6 kV. O.C.B.'s of these units in January, causing some damage.

*Huntly Steam Plant.*—A start was made in May on the recommissioning of this station to enable supply to be given if and when required. The plant was given a trial run in September, and was then shut down and left available for use in emergency. Preparations were made in March, 1941, for the regular operation of the station, and supply was commenced in April.

#### (*b*) substations.

##### (i) *110 kV.*

*Penrose.*—An external water-cooling system was installed on the 22/50 kV. banks of transformers to reduce the temperature pending the installation of additional transformer capacity. New windings were fitted to the unit which was damaged by lightning on 12th June, 1939. All H.T. bushings in a 110/22 kV. bank were rejointed on account of oil leaks. Temporary by-pass lines are being erected to connect up the new Penrose–Henderson 110 kV. line to the east and west 50 kV. circuits.

*Bombay.*—A large amount of work was carried out on levelling, turfing, and drainlaying about the H.T. enclosure. The automatic T.C.O.L. equipment on the 50/11 kV. banks of transformers was put into service in December.

*Hamilton.*—A flashover occurred in a tank of an 110 kV. O.C.B. due to moisture gaining entry through defective jointing-material. Six defective insulators were replaced on the 50 kV. structure. Water-mains were laid for three hydrant plugs for fire-fighting purposes, and three 1 in. hose reels were installed.

*Ongarue.*—Three 110 kV. fuses were shattered by lightning. The 750 kVA. transformer that was damaged by lightning on 30th July, 1939, has been fitted with a new H.T. winding.

##### (ii) *50 kV.*

*Hangatiki.*—A new relay system was fitted to the 11 kV. feeder switch. All insulators on the 50 kV. line A.B.S. were replaced.

*Henderson.*—A flashover on a 50 kV. isolator was caused by nesting-material carried by a bird. The structure has been made bird-proof with netting, as far as possible.

*Huntly.*—A 7½ ton chain block was fitted to the gantry in place of a 4 ton block. A cable-box breakdown due to moisture occurred.

*Kaikohe.*—The 11 kV. cubicle switch was damaged by a flashover caused by a bird on 15th January, 1941, and two 250 kVA. transformers in the 50/11 kV. bank were burned out at the same time.

*Kaitaia.*—Two H.T. bushings on the 50/11 kV. bank were shattered and others were chipped by a flashover caused by lightning on 6th November, 1940. Burnouts occurred in two of the 250 kVA. transformers on 17th March, 1941, when the 11 kV. cubicle switch failed to clear a feeder fault. Oil-storage tanks were installed and a temporary store was built.

*Karapiro.*—A breakdown of a 50 kV. string of insulators occurred shortly after the substation had been livened on 26th October, 1940. Three defective 50 kV. insulators were replaced.

*Kerepeehi.*—The oil in the 11 kV. cable end-boxes on the main transformers was replaced by compound, as the oil had been finding its way into the booster transformer cubicle. An outage was caused by faulty operation of the booster transformer in June. Ten cracked 50 kV. insulators were replaced.

*Lichfield.*—Trouble was experienced with the 11 kV. cubicle switch in July, due to faulty adjustment. A breakdown of the 11 kV. trifurcating box on the 1,000 kVA. three-phase transformer occurred in December.

*Mamaku.*—A 50 kV. fuse blew in December. The cause is not known.

*Mareretu.*—The 50 kV. line O.C.B. was transferred to Maungatapere in March, 1941.

*Matamata.*—Following faulty operation of the booster transformer in April, 1940, it was found that a large number of screws and bolts had worked loose. An inspection of similar units at other substations showed that screws and bolts had worked loose on these also.

*Maungatapere.*—Flashovers on Nos. 2 and 3 11 kV. O.C.B.'s were caused by lightning on 1st October, 1940. Further trouble was experienced with damaged bushings on O.C.B. 3 and in the bus chamber. New bus chambers for O.C.B.'s 2 and 3 were installed in December.

*Ngongotaha.*—A bank of transformers was forwarded to Claudelands for repairs to defective L.T. leads. However, owing to transformer breakdowns at Kaikohe and Kaitaia it was necessary to forward some of these units for use as replacements. Two defective 50 kV. insulators were replaced. A new storeroom was built.

*Takapuna.*—The two 50 kV. lightning-arresters were removed to enable work to proceed on the new 50 kV. steel structure and were transferred to Kaikohe and Kaitaia in December. New arresters will later be installed at Takapuna.

*Te Awamutu.*—Six defective 50 kV. insulators were replaced.

*Waikino.*—Two 11 kV. C.T. failures occurred in November, two in December, and one in January.

*Waiotahi.*—A 50 kV. post-type insulator broke down on 14th November, 1940. A pump was installed in September, to provide auxiliary water-supply for the cottages.

*Tahekeroa and Waihou.*—Routine operating and maintenance duties were carried out.

*Edgecumbe.*—Two 11 kV. bushings on the booster transformer were damaged by a flashover caused by a cat. A cracked 50 kV. post insulator unit was replaced.

(iii) *11 kV.*

No trouble was experienced at these substations during the year. Regular inspections were made and equipment was found in good order.

(*c*) TRANSMISSION AND DISTRIBUTION LINES.

(i) *110 kV.*

*Arapuni–Penrose.*—Sags were checked by the return-wave method. The 19/·092 conductors of lines 3 and 4 in the span across the head-race at Arapuni were replaced by 19/·101 conductors. The legs on a large number of towers were inspected for signs of rusting below the ground-line; traces of rust were found on a few legs, and these were cleaned and painted, whilst in some cases the legs were also concreted in. Outages of lines 4 and 5 were caused by lightning on 14th December, 1940. Warning notices were distributed to farmers along the route of this line. The telephone-line was deviated at Karapiro to avoid the village-site. Two 25-ft. telephone-poles broke off at the ground-line during the year due to decay.

*Arapuni–Stratford.*—Considerable work was done on the clearing of access tracks and firebreaks. A 400 lb. lead-filled weight was dislodged from its suspension clamp in July due to the lead being forced out of the bucket by water collecting inside the bucket and freezing. To prevent this, drain holes are being drilled in the cast iron buckets of this type of weight on all lines. An outage occurred during a thunderstorm on 1st October, 1940. A large number of defective rata crossarms on the telephone-line were replaced. The linemen's bach at Rangitoto has been shifted to Hangatiki.

*Arapuni–Edgecumbe.*—The line is still being operated at 50 kV. Pole tops were fitted with metal caps. An outage was caused on 17th June, 1940, by a flashover when a fencing-wire was being strained up beneath the line.

(ii) *50 kV.*

*Penrose–Takapuna.*—Six insulators were replaced on account of cracks caused apparently by corrosion due to salt spray where the pin enters the insulator thimble. Warning lights were erected on towers in the vicinity of the Air Base at Hobsonville. Outages of the Henderson–Takapuna section occurred on 4th February (cause unknown), 12th February (caused by a haystacker), and 12th March (caused by a gorse fire).

*Henderson and Maungatapere.*—The telephone hut at structure 645 (Tauraroa) was shifted to structure 678 (Maungakaramea), and a new hut was installed at pole 566.

*Maungatapere–Kaitaia.*—A bach was built at Mangamuka and a telephone installed. A flashover was caused by a tree on 8th July, 1940, during felling operations.

*Bombay–Waikino.*—Lightning caused an outage of the Bombay-Kerepeehi section on 15th December, 1940, and of the Kerepeehi–Waikino section on 14th December, 1940. An outage of the whole line occurred on 9th August, 1940, but nothing was found to account for the tripping.

*Waikino–Aongatete.*—Outages were caused on 9th October, 14th December, and 15th and 20th March by lightning; on 1st and 4th January due to cause unknown; on 24th January by the failure of an insulator; on 19th February by trouble on McLarens Falls system; on 20th February by a scrub fire; and on 7th, 12th, 14th, and 21st March by trouble on the Power Board system.

*Horahora–Matamata–Waihou.*—Both sections tripped out during a thunderstorm on 18th March, 1941.

*Horahora–Hamilton.*—Outages were caused by lightning on 1st October and 14th December. A tap line was run to Karapiro Substation in October. All Coutts connectors on the telephone-line have been removed and the joints remade and soldered.

*Hamilton–Huntly.*—An outage was caused by the failure of an insulator on 13th December.

*Te Awamutu - Hangatiki.*—Two outages occurred, one on 28th April, 1940, when the line was accidentally earthed, and the other on 7th November, 1940, during a thunderstorm.

*Ngongotaha–Edgecumbe.*—A telephone-wire in the sulphur area broke, due to corrosion. Both wires were renewed in spans 158 to 162.

*Edgecumbe–Waiotahi.*—An outage occurred during a thunderstorm on 6th May.

*Arapuni–Ngongotaha and Waihou–Paeroa.*—The usual patrol and maintenance duties were carried out on each line.

(iii) *11 kV.*

*Horahora–Hautapu.*—An 11 kV. lightning-arrester broke down at Hautapu on 21st August, 1940.

*Hamilton–Frankton.*—An outage was caused on 7th April, 1940, by a piece of fencing-wire being thrown over the line, and on 23rd November, 1940, and 31st December, 1940, by insulator failures on the 11 kV. change-over A.B.S. at the New Zealand Railway substation.

*Waikino–Waihi.*—Corroded steelwork on towers was replaced by reconditioned parts taken from the dismantled Waiorongomai–Waikino 50 kV. tower-line.

*Grand Junction Tap.*—The work of dismantling this line was completed in August.

*Arapuni Village.*—Considerable time was spent on alterations to old service lines and dismantling of old poles.

*Ongarue–Manunui.*—A set of lightning-arresters was installed at Taumarunui.

(iv) *General.*

*Line-maintenance.*—Routine work was carried out on the various lines according to schedule, including the live-line testing of insulators on 110 kV. and 50 kV. lines and the testing of poles by boring.

*Insulator Replacements.*—The results of insulator testing or inspection are as follows:—

| —— | 110 kV. Units. | 50 kV. Units. | 50 kV. Pin. | Totals. |
|---|---|---|---|---|
| Number tested .. .. .. .. | 61,434 | 13,769 | 15,687 | 90,890 |
| Number defective by test.. .. .. | 4 | 2 | 212 | 218 |
| Number defective by inspection .. .. | 2 | .. | 66 | 68 |
| Total number defective .. .. | 6 | 2 | 278 | 286 |
| Percentage defective .. .. | 0·017 | 0·023 | 1·772 | 0·315 |

Twenty insulators were replaced under live-line conditions. In addition to the above replacements, four defective insulators on 11 kV. lines also were replaced.

*Pole Replacements.*—Forty-seven defective poles were replaced during the year, the total being made up of eight 52 ft. poles on 110 kV. lines, one 38 ft. and two 42 ft. poles on 50 kV. lines, four 35 ft. poles on 11 kV. lines, and one 52 ft., one 35 ft., and twenty-nine 25 ft. poles on telephone lines. Two 25 ft. poles broke off at the ground-line, and replacements of the balance were mainly on account of decayed heartwood.

(*d*) TESTING.

Routine tests were made on meters, relays, instruments, &c., throughout the district, installation tests on new equipment at the various substations—Hipot tests on all 110 kV. and 50 kV. bushings, resistance tests on stator windings at Arapuni, and tests on new distance relays and on other relays. All telephone connections were checked and the system diagram brought up to date. Incorrect relay operations were investigated, and insulators were tested on the H.T. set.

(*e*) GENERAL.

*Troubles on System.*—The following is an analysis of troubles experienced on the Department's system in the last three years:—

| Ref. | Description. | Year ending 31st March, 1939. | 1940. | 1941. |
|---|---|---|---|---|
| | 6·6 or 11 kV. lines— | | | |
| 1 | Defects | 3 | 1 | 2 |
| 2 | External causes | .. | 2 | 1 |
| | 33, 50, or 66 kV. lines— | | | |
| 3 | Defects | 10 | 7 | 2 |
| 4 | External causes | 3 | 4 | 5 |
| | 110 kV. lines— | | | |
| 5 | Defects | 3 | .. | .. |
| 6 | External causes | .. | 3 | .. |
| 7 | Lightning | 6 | 14 | 20 |
| 8 | Storms: Nature of trouble not discovered | .. | .. | .. |
| 9 | 5, 6·6, 11, or 22 kV. apparatus | 6 | 13 | 15 |
| 10 | 33, 50, or 66 kV. apparatus | 8 | 5 | 6 |
| 11 | 110 kV. apparatus | 2 | 2 | 2 |
| 12 | Generators or synchronous condensers | 1 | 1 | .. |
| 13 | Relays | 1 | 5 | 3 |
| 14 | Control circuits and batteries | .. | 2 | .. |
| 15 | Operation: Mistakes | 8 | 4 | 4 |
| 16 | Operation: Accidents | 2 | 2 | 1 |
| 17 | Other causes | 4 | 1 | 9 |
| 18 | Cause unknown or fault not located | 2 | 4 | 9 |
| | Totals | 59 | 70 | 79 |

Circuit miles of lines in operation at 31st March, 1941: 11 kV., 75·41; 50 kV., 500·73; 110 kV., 491·92.

Number of substations in service at 31st March, 1941: 11 kV., 3; 50 kV., 20; 110 kV., 4.

Numbers of consumers: Bulk, 16; wholesale, 6.

*Chateau Tongariro.*—Worn deflectors on the lower deflector shaft were replaced in December, assisting in improved turbine operation.

## B. PALMERSTON NORTH DISTRICT.

### (1) CONSTRUCTION.

#### (*a*) POWER-STATIONS.

*Mangahao Power-house and Headworks.*—The site has been prepared, access road completed, and water-supply arranged for two cottages and a three-stall garage at Mangahao No. 1 dam. Tenders have been called for the erection of these buildings.

Two 3,000 kVA. regulators for the Horowhenua Power Board supply were unfortunately lost at sea. A repeat order has been placed.

*Waikaremoana Power-house and Headworks.*—A building was erected to house the gate controls and telephone at the surge-chamber, and extra accommodation for the military guard has been provided at Kaitawa. A new 11 kV. O.C.B. for the Onepoto line was installed. Supplies of new steelwork, O.C.B.s, A.B.S.s, &c., for ten new bays of 110 kV. switchgear and one 50 kV. bay are slowly coming to hand.

The 110/50 kV. transformer bank arrived during the year, but was temporarily diverted for use in the Hamilton district. This bank will be returned to Tuai about September, 1941.

The erection of the new power-house at Piripaua and headworks, under the direction of the General Branch, is progressing steadily.

#### (*b*) SUBSTATIONS.

*Bunnythorpe.*—Two five-roomed cottages and a two-stall garage should be completed by the end of April.

The A.B.S. for the Bunnythorpe–Ongarue line has been erected.

During the year seven 2·5 mVA. tap-changing on load transformers were placed in service. They have replaced a 4·5 mVA. bank transferred to Marton and a 4·5 mVA. bank transferred to Hawera. Tenders have already been called for the supply of two 10 mVA. banks to replace the above. Tenders have also been called for a 25-ton electrically-operated crane, and an order has been placed for a 50 kVA. local service transformer; gang-operated 110 kV. isolators have also been ordered.

*Dannevirke.*—Bus-bars have been erected in Bay E and the erection of a single stall garage completed.

*Greytown.*—The structure and switchgear for a temporary substation at Greytown is in course of erection and a metering cubicle has been installed. Transformer for this substation has been transferred from Marton.

*Gisborne.*—Temporary structure for a second transformer bank ex Hamilton has been erected, and transformers have been placed in position.

*Hawera.*—The conversion of a four-roomed cottage to a five-roomed cottage has been completed. The extension to the traverser track and alteration of existing transformer pads is under way. The 4·5 mVA. transformer bank ex Bunnythorpe has been overhauled, and drying out is proceeding.

*Khandallah.*—Operating-boxes for transformer bank O.C.B.s were received and the wiring of O.C.B.s completed. All new switchgear is now in operation. A high-tension switchgear control panel was received and connected up, and transformer O.C.B. relay panel also erected.

*Mangamaire.*—Erection of switchgear in new transformer bay completed.

*Marton.*—Tower pads, transformer pads, and traverser track have been installed during the year. Portion of structure and new switchgear erected, also two 2,000 gallon oil-tanks. The 4·5 mVA. bank of transformers ex Bunnythorpe and new cable were installed, and the previous 1,500 kVA. transformer transferred to Featherston, together with old switchgear.

*Masterton.*—A third new 110 kV. line O.C.B. was installed, and the installation of the others completed and all control cables run.

*Mataroa.*—The erection of two five-roomed cottages, single men's quarters, and a five-stall garage is nearing completion. Erection of substation structure has been delayed through non-arrival of steelwork.

*Melling.*—Second cottage and garage completed. Extensions to switchroom under way. Installation of O.C.B.s completed and new 10 mVA. T.C.O.L. bank of transformers installed. The installation of two new Railway 11 kV. feeders is in progress.

*Napier.*—New line bay of steelwork and switchgear completed. Oil and 11 kV. cable now stored at substation.

*New Plymouth.*—New 7·5 mVA. T.C.O.L. transformer bank received is now in service, replacing 2,250 kVA. bank destined for Te Kiri. Double 0·4 11 kV. cables were installed on the new bank to meet Borough Council's requirements. Two 2,000 gallon oil-tanks installed.

*Ohakune.*—Four cottages, single men's quarters, and three two-stall garages have been completed. This substation is in a similar position to Mataroa with respect to steelwork.

*Paraparaumu.*—Two 2,000 gallon oil-tanks have been received. A third cottage and single-stall garage erected.

*Stratford.*—Traverser track extended, turn-table installed, and 50/33/11 kV. structures erected. 10 mVA. 110/50 kV. T.C.O.L. transformer bank and 5 mVA. 50/33/11 kV. auto transformer bank placed on pads. The 50 kV. O.C.B.s (six in number) have arrived, and advice of shipment for control panels has been received.

*Te Kiri.*—The site for a new 50 kV. substation of 2,250 kVA. capacity has been selected, surveyed, and the land proclaimed.

*Waipawa.*—Single-stall private garage and erection of new switchgear completed.

*Wairoa.*—Site for new substation selected, surveyed, and proclaimed.

*Woodville.*—Two 2,000 gallon oil-tanks installed. A.B.S. and switch fuse for transformer supply erected. Conduits and conductors for services and controls installed in the new switch-room. Earthing-switch for new Napier line erected and substation fence extended.

### (*c*) TRANSMISSION-LINES.

The circuit-miles of transmission-lines and number of substations in operation are as follow:—

| Voltage. | Circuit-miles of Transmission. | Number of Substations. |
|---|---|---|
| 110 kV. .. .. .. .. | 628·16 | 14 |
| 50 kV. .. .. .. .. | 107·00 | 3 |
| 11 kV. .. .. .. .. | 32·19 | 1 |

#### (i) *110 kV. Lines.*

*Woodville–Featherston.*—The fitting of armour rods and new strain clamps on this line has been completed.

*Woodville–Napier Duplication.*—Pole-erection was completed in February. Wiring at present in progress.

*Bunnythorpe–Ongarue.*—All supports except at substation have been erected, and wiring in progress.

*Tuai–Piripaua.*—Erection of this line has been started.

#### (ii) *50 kV. Lines.*

*Stratford – Te Kiri.*—Surveys completed, material ordered, and with the exception of about twenty poles all requirements are now in New Zealand.

#### (iii) *11 kV. Lines.*

*Tuai – Settlers Lines.*—11 kV. Lines—namely, Tuai–Jessop, Jessop Extension; and Piripaua–Tapper—have been completed, transformers erected, and supply effected.

*Palmerston North.*—Extension to garage workshop and blacksmith's shop completed.

## (2) Operation and Maintenance.

### (*a*) power-stations.

*Waikaremoana.*

*Power-house.*—No. 2 machine developed a fault, damaging six coils—repairs effected; three shifts worked during repairs.

No. 3 unit rotary valve was overhauled and repaired under the supervision of the manufacturer's engineer. New oil-rings fitted to main bearing and roller guides for same.

No. 1 machine was subjected to a major overhaul during the year.

All 110 kV. bushings of a particular make were reconditioned and fitted with new-type caps.

Extra fire-hydrants installed in power-station, and fire barriers erected between power cables in cable basement and tunnel.

Faulty 110 kV. bushing on No. 14 O.C.B. replaced and several 110 kV. bushings reconditioned.

New station battery installed.

Village reticulation altered to suit site for new store, and improvements effected to the new social hall.

*Mangahao.*

*Headworks.*—Five heavy slips and several smaller slips on roads to dams occasioned a good deal of damage, extensive repairs, and remetalling.

The wire ropes which operate the gate-roller cages of No. 1 tunnel gate corroded through and were renewed.

Shutdown took place as opportunity offered in order to inspect and effect necessary repairs on Nos. 1 and 2 tunnel gates, surge-chamber, and pipe-lines.

At the surge-chamber the gates were pulled away from the frames, thoroughly cleaned, and three coats of tar paint applied.

The tunnel gates were very good as far as tightness was concerned, but adjustments were required on the tightening strips of the bypass-tunnel gates.

All preparations have been made for cleaning and painting interior of pipes between surge-chamber and No. 1 anchor block, and this work is now in progress.

The total rainfall for the year was as follows: No. 1 dam, 120·10 in.; No. 2 dam, 104·77 in.; No. 3 dam, 78·17 in.; power-house, 39·69 in.

*Power-house.*—A fault to earth on "B" and a flashover on "A" Horowhenua regulators were experienced—repairs effected.

Control board rewiring has been carried on intermittently and fair progress has been made.

### (*b*) substations.

*Gisborne.*—During the course of repairs due to a broken post insulator on O.C.B., an accident occurred resulting in the death of one man and injury to another.

New C.T.s were installed on Te Karaka, Ngatapa, and Waimata feeders.

Preparations are complete for installation of temporary second bank of transformers ex Hamilton.

*Khandallah.*—Synchronous condenser: Broken field connector on rotor required renewal.

An earthing-switch was found to be inoperative, due to galvanized pins seizing on brass hinge-blocks. These pins now replaced with brass ones.

*Mangamaire.*—Birds-nests in snowhoods of A.B.S.s required removal.

One interruption was caused by short-circuit on transformer H.T. windings.

*Masterton.*—One H.T. bushing failed on No. 1 transformer.

A faulty C.T. in the Kourarau panel caused a fire, resulting in considerable damage. Trouble in summation panel was caused by hot joints in plug contacts.

*Marton.*—Capacity increased from 1·5 mVA. to 4·5 mVA. Damaged 11 kV. bushings replaced.

*Melling.*—Capacity increased by installation of 10 mVA. transformer bank.

*Napier.*—Post insulators replaced where required.

Three-core cable to west bank of transformers was isolated and a three-phase aerial run to supply incoming panel.

*New Plymouth.*—Alterations made to traverser-truck wheels to enable use on rails inside workshop.

Repairs effected to cable sealing end-boxes.

*Stratford.*—11 kV. bus slightly damaged by fire. Insulation increased.

*Woodville.*—Reticulation altered to suit new control-room supply—three new poles erected.

*General.*—Duties regularly attended to; in particular, oil tests, oil filtering, and O.C.B. inspections.

### (*c*) transmission-lines and associated telephone-lines.

(i) *110 kV.*

All lines were regularly patrolled. Pole-to-pole inspections were completed and overhaul attended to. Insulators were tested throughout and defective insulators replaced. One pole (No.571) on the Woodville–Masterton line was shattered by a lightning stroke and was renewed. Track maintenance has been heavy in some sections. Several weights have had to be replaced, due to broken hooks. Woodville–Masterton section was reinsulated to modern standard.

Defective telephone-poles have been replaced as follows: Mangahao–Bunnythorpe section, 6; Bunnythorpe–Wanganui section, 1; Bunnythorpe–Woodville section, 2; Woodville–Masterton section, 3; Woodville–Napier section, 13; Napier–Tuai section, 4. Necessary repairs have been effected as required, and huts throughout inspected and reconditioned where required.

(ii) *50 kV. Lines.*

Regularly patrolled—pole-to-pole inspection completed. Insulators tested throughout and defectives replaced. Service good. Deviation made on Tuai-Wairoa line where Tuai–Piripaua 110 kV intersects.

(iii) *General.*

(1) *Khandallah High-tension Testing-set.*—The main use to which this set has been applied has been the retesting of insulators found defective in live-line testing.

A series of tests on insulators of local and British manufacture was also carried out for one supply authority.

Sample insulators were also subjected to the thermo-cycle test to British Standard Specification.

(2) *Communication System.*—The test department has carried out regular tests and inspection of high-tension telephone equipment at power-stations and substations.

Work is at present being carried out on the construction of a new telephone-line between Bunnythorpe and Ongarue. This, when complete, will give direct low-tension communication with Arapuni.

New telephones are being installed in the signalling system.

The standardization of telephone and alarm circuit apparatus at all substations is still proceeding.

(3) *Test Department.*—All requisite maintenance tests were conducted throughout the year on revenue and demand metering equipment, indicating and recording instruments, relays, batteries, and battery-charging equipment at both power-stations and all substations.

A considerable amount of testing and repair work, involving recoverable charges, was carried out for various consumers.

Owing to growth of load, larger current transformers have been installed at several substations and a periodical survey of load conditions made.

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 all high-tension bushings at Bunnythorpe, Dannevirke, Khandallah, Marton, Mangahao, Masterton, New Plymouth, and Woodville. The "Hipot" tester was available for a short period only.

Tests on the second new bank of transformers for Bunnythorpe revealed a faulty joint between the two halves of the high-tension winding—repairs effected. Tests carried out and assistance given in restoring supply at Masterton when trouble experienced (*a*) on transformer, (*b*) on 11 kV. switchgear.

Deterioration in lightning-arresters was investigated and consideration given to the feasibility of effecting repairs locally.

Transformer relay and control panels for Melling are at present under construction, those for Khandallah being completed during the year.

Maintenance repairs on printometers, contactors, meters, relays, fuses, and various instruments, involving subsequent tests and recalibrations, have been conducted systematically, and all equipment maintained in good condition.

(4) *Reliability of Supply.*—Thirty-nine faults, seven of which caused no interruption, were experienced on the Department's system for the year. In the following comparative table for the last four years the reference number and description of fault is used in subsequent details:—

*Analysis of Troubles on Department's System for the Four Years ended 31st March, 1941.*

| Ref. | Description. | Year ended 31st March. | | | |
|---|---|---|---|---|---|
| | | 1938. | 1939. | 1940. | 1941. |
| | 6·6 or 11 kV. line— | | | | |
| 1 | Defects | .. | .. | 1 | 2 |
| 2 | External causes | .. | .. | 5 | 2 |
| | 33, 50, or 66 kV. line— | | | | |
| 3 | Defects | 1 | 3 | .. | .. |
| 4 | External causes | .. | 1 | 1 | .. |
| | 110 kV. line— | | | | |
| 5 | Defects | .. | .. | .. | .. |
| 6 | External causes | 2 | 4 | 4 | 1 |
| 7 | Lightning | 7 | 8 | 10 | 8 |
| 8 | Storms: Nature of trouble not discovered | .. | 4 | 2 | 1 |
| 9 | 6·6, 11, or 22 kV. apparatus | 3 | 1 | 5 | 4 |
| 10 | 33, 50, or 66 kV. apparatus | 1 | 1 | 1 | .. |
| 11 | 110 kV. apparatus | 6 | 2 | 2 | 4 |
| 12 | Generators or synchronous condensers | .. | .. | .. | .. |
| 13 | Relays | 4 | 1 | .. | 3 |
| 14 | Control circuits and batteries | 1 | .. | .. | 1 |
| 15 | Operation mistakes | 4 | 7 | 3 | 5 |
| 16 | Operation accidents | 1 | 1 | .. | 1 |
| 17 | Other causes | 8 | 17 | 14 | 4 |
| 18 | Cause unknown | 2 | 4 | 8 | 3 |
| | Totals | 40 | 54 | 56 | 39 |

The following interruptions occurred to the Department's supply to consumers :—

| Consumer. | Point of Supply. | Number. | Total Duration. |
|---|---|---|---|
| | | | Hrs. Min. |
| *(a) Interruptions due to Faults on Consumers' Systems.* | | | |
| Hutt Valley Electric-power Board | Khandallah | 5 | 0 53 |
| ,, | Melling | 2 | 0 6 |
| New Plymouth Borough Council | Stratford | 7 | 4 15 |
| Poverty Bay Electric-power Board | Gisborne | 3 | 0 9 |
| Taranaki Electric-power Board | Stratford | 8 | 0 58 |
| Wanganui-Rangitikei Electric-power Board | Marton | 1 | 1 58 |
| Wairoa Electric-power Board | Wairoa | 2 | 0 2 |
| Wellington City Council | Khandallah | 5 | 0 25 |
| *(b) Pre-arranged Interruptions at Consumers' Requests.* | | | |
| New Zealand Railways Workshops | Khandallah | 2 | 9 11 |

## SOUTH ISLAND ELECTRIC-POWER SYSTEM.

### Introductory.

The year ended 31st March, 1941, was the twenty-sixth year of operation of the Lake Coleridge undertaking, and the sixth complete year of operation of the Waitaki Scheme. It also represented the third year of operation since taking over the Arnold River Scheme and the fifth year since taking over the Monowai Scheme.

During the year the Lake Coleridge and Waitaki Stations operated in parallel satisfactorily with Waipori and Monowai as required. Lake Coleridge and Waitaki were separated on five occasions, the duration of separation varying from 59 minutes to 10 hours 59 minutes.

Monowai has normally run in parallel with the main system, but there have been several occasions when the system split, generally for the purpose of line overhaul work and reconstruction work at Winton and Invercargill Substations.

At Arnold operation has been normal and the station has functioned at full output except for one occasion when there was insufficient water for more than two-thirds of the plant-capacity.

The Dobson Diesel Station was called upon on occasions when the main lines went out of operation and also for peak-load conditions during the dry spell in the June–September quarter.

### 1. Capital Outlay.

The capital outlay at 31st March was £7,289,053, of which assets to the value of £300,473 were not in operation.

### 2. Financial Results.

The total revenue for the year was £678,813 and working-expenses totalled £173,288, making a gross profit of £505,524, which equals a return of 8·59 per cent. on the average capital outlay in operation.

The interest-charge for the year was £254,070, which together with depreciation £73,711, was met from revenue, leaving an amount of £126,227 available for the sinking fund this year, after paying £51,516 for income-tax, &c. The sinking fund account was £214,654 in arrears at the end of the year.

The accumulated reserves and sinking funds at the 31st March, 1941, amounted to £1,443,910.

Table I gives full particulars of the financial results and also statistical returns of operations for the year.

## 3. General.

The total units generated (including supply from Dobson Diesel Station) and purchased were 419,883,195, representing an increase of 13·58 per cent. on those of last year. Of these units, 328,971,478 were sold by Christchurch District and 29,470,875 by Southland District, while 2,907,865 were otherwise accounted for. The balance of 58,532,977 units represents transmission and distribution losses, and amounted to 13·94 per cent. of the units generated.

The maximum system load increased from 76,160 kW. to 84,920 kW., an increase of 11·50 per cent. The average system load factor was 56·44 per cent.

## 4. Construction, Operation, and Maintenance.

### A. CHRISTCHURCH DISTRICT.

#### (1) Construction.

##### (*a*) *Power-stations.*

*Lake Coleridge.*—Accommodation was erected for a military guard. A 50 kVA. transformer was installed and reticulation rearranged.

*Waitaki.*—The erection and drying-out of No. 3 unit was completed and, after trials, was finally placed on load in December, 1940, and has supplied 36,375,880 units to the system.

The assembly and erection of No. 4 unit, with its attendant gear, is nearing completion.

Headgate-frames, winches, and screens were assembled and erected for Nos. 3, 4, and 5 units.

The drain-valves of Nos. 3, 4, and 5 suction tubes have been redesigned so that retractable operating spindles can be used.

Soundings and levels were taken on the tail-race side of the dam.

##### (*b*) *Substations.*

At Addington the installation of the first 20,000 kVA. 66/11 kV. transformer-bank and the 5,000 kVA. 66/33 kV. bank was completed in May, 1940. The second 20,000 kVA. bank was completed in March, 1941.

At Timaru one double garage, two single garages, and two tool-sheds were erected.

A four-stall garage was erected and sixty insulators on the outdoor structure were replaced at Glenavy.

A four-stall garage and four tool-sheds were erected. One 110 kV. transformer bushing was replaced after failure, the spare transformer was reinstalled and energized after repairs at Oamaru Substation.

At Half-way Bush a clay bank was excavated and area levelled for lawn, and a shelter-belt of pine-trees planted. At Hororata Substation a 1,000 kVA. transformer-bank was installed and put into service in November, 1940.

At Ashburton the 25 kVA. local service transformer was replaced with a 50 kVA.

At Harewood a new 33/11 kV. substation was erected, including building, transformers, and switchgear.

Four cottages and garages were erected at Otira Substation, and good progress was made with the erection of outdoor structure, the O.C.B.s and transformers being assembled and in place.

##### (*c*) *Transmission-lines.*

The construction of a new 110 kV. line to replace the Ashburton–Timaru "A" line and the overhaul of Ashburton Timaru "B" line is progressing satisfactorily, the work being finished between Ashburton and Temuka River.

For construction purposes at Highbank a 6.6 kV. line one mile long was erected to take supply from Ashburton Power Board. Low-tension reticulation and wiring of buildings also carried out.

On the Waitaki Glenavy 110 kV. line tower No. 20 was transferred to a piled foundation on account of erosion of river-bank.

The 90-chain deviation of the Otira–Arahura 66 kV. lines was completed and went into service in April, 1940.

A length of 1 mile 28 chains of 11 kV. line was built for the Kanieri Gold-dredging Co.

The 11 kV. double-circuit line from Otira to the Tunnel Substation was advanced by completion of tunnel-end section.

Two new 11 kV. 0·2 square inch cables were run and connected up between Addington and Milton Street.

Steelworks and Southern 11 kV. feeders were reconstructed.

A new 11 kV. 0·06 square inch cable was run from Addington to Foster Street Substation for supply to Riccarton Borough Council.

At Hanmer the supply was changed over from D.C. to A.C. and is now ready for new transformers and underground reticulation. Wiring in buildings was overhauled.

The reconstruction of Lake Coleridge–Hororata "B" and "C" lines on towers between Sleeman's Road and Hororata, and the reconstruction of the old "C" line as part of the Hororata–Highbank line was completed. The remainder of the Highbank line, with the exception of the Rakaia River crossing was also completed.

The route of the new 110 kV. Ashburton–Timaru line was surveyed and pegged, and the survey of Timaru–Tekapo line was completed.

(*d*) *Telephone System.*

To connect up with the Post and Telegraph system at Methven one mile of telephone-line was run from Highbank.

(*e*) *Test Department.*

In addition to routine testing a considerable amount of testing and repair work, including recoverable charges, was carried out for Defence, Air, and Post and Telegraph Departments, as well as for other consumers.

(2) Operation and Maintenance.

(*a*) *Power-stations.*

*Lake Coleridge Power-station.*—The main part of the work carried out at the Harper consisted of making good the damage done by the flood in February, 1940.

The outer end of the main diversion groyne was reconstructed and a wide apron placed on north side and east end of groyne and a crust of concrete run over aprons to protect netting. This work was completed in September, and early in October a severe flood caused the river to change its course again and strike into the outer end of the new construction.

The gap cut in the Long Groyne was closed and some 230 ft. of 5 ft. wide apron was placed.

In May, 1940, exceptionally heavy rain (nearly 10 in. fell in three days at Lake Homestead) resulted in the Harper Road being submerged to a depth of several feet east of Lake Georgiana. A temporary road was constructed. During this period the lake-level rose to 1,672·95 ft., the highest recorded.

It was not until the middle of July that the Lake fell below overflow, but after then the decline was fast and the minimum level of 1,666·23 ft. was reached by 27th September. Rapid recovery took place and the level at 31st March, 1941, was 1,672·15 ft.

Owing to the failure of a concrete weir endangering the bridge on the Harper Road the Acheron diversion was closed on 1st November, 1940, and has not yet been reopened.

The usual scooping and trucking work at the intake was continued.

Exterior of all pipe-lines were scraped and painted when necessary.

Erosion round relief-valve seating of No. 2 unit was repaired by welding. Balance cylinder of relief valve was replaced. On 18th November, 1940, this unit was shut down for replacement of governor-relief valve, &c. To date the governor has been set in place, relief-valve discharge welded to original discharge pipe, and work advanced as far as possible pending return of main-valve body, which is being welded and machined.

Vents with hinged covers were cut in air-inlet ducts for Nos. 1, 2, and 3 units to allow air to be drawn from basement when required.

Nos. 4 and 5 sluice-gates were provided with new bronze seating-rings.

During August vibration was noticed in No. 5 unit, and the trouble was found due to shingle becoming wedged in gates, causing the fracture of a gate-lever and twisting four gate spindles.

Further efforts were made to overcome vibration on No. 6 unit and foundations were grouted, electrical tests made on field and stator windings, guide-vanes set to give even opening, and runner tried for balance, but all to no purpose.

At 8.50 a.m. on 3rd March, 1941, No. 5 turbine casing burst, causing extensive damage to equipment and a serious interruption to service. Water escaping from casing caused damage to other generating-units, and at 31st March, 1941, only Nos. 1, 3, and 9 were in service. No. 8 was put on the line after a short dry-out run, but broke down after four days. Exciters Nos. 1 and 2 got the full force of the water, and No. 1 is still on dry out. Governor-control and signalling-circuits were cleared of water and some new wiring run.

Control circuits, metering circuits, switchboard instruments, and relays were damaged. Meters and relays are still being cleaned by Test Department. Water also got into 66 kV. O.C.B.s, 6·6 kV. O.C.B.s, potential transformers, &c., but most of this apparatus is again fit for service.

The 110 volt D.C. lighting and power panels were rearranged for double-pole operation.

*Waitaki.*—Apart from routine maintenance, no repairs have been necessary on turbines, generators, transformers, switchgear, and auxiliary turbines and generators. Thirty defective insulators were replaced on the outdoor structure. The suction-tube-drain valves on Nos. 1 and 2 units have been swept away and so that the drainage pump could be used for Nos. 3, 4, and 5 suction tubes covers were fitted over the drain-holes, the services of a diver being requisitioned for this work.

The average monthly river-flow varied from 3,936 cusecs in August to 21,686 in February, 1941.

The maximum lake-level was 756·25 ft. The lake was below the crest of the dam 11th July, 1940, to 5th October, 1940.

The expansion joints in the dam were filled with bitumen, and galleries and water-channels cleaned out.

Owing to deterioration, the station battery was dismantled and scrapped.

*Arnold.*—Tests were carried out on turbines and governors to determine the suitability of the existing cams for the higher head.

The altered surge-tank has proved quite satisfactory in operation.

*Dobson Diesel Station.*—The overhaul was completed during the year.

The oil-coolers were altered and relocated.

Trouble was experienced with the mercury seal on one of the transformers, but this was discovered before any damage was done and the fault remedied.

*(b) Substations.*

General maintenance and operating was carried out at all transmission-line substations.

At Arahura on 17th October, 1940, the line terminals of the synchronous condenser flashed over probably due to moisture drawn in with the cooling air.

During heavy rains in March flooding took place at Ashburton Substation, when the water-pump motors were under water. Temporary water-supply was obtained from the borough.

*(c) Transmission-lines.*

A general overhaul of all transmission and distribution lines was carried out, including tree-cutting, testing and removal of decayed poles, replacing of all defective insulators, and attention to breakdowns and prompt restoring of power.

Live-line activities have been maintained, and included buzz-stick testing of insulators. A total of 106,042 insulators were tested, 845 were found to be defective, and, of these, 24 were changed alive. Forty-nine poles were renewed, several under live-line conditions.

On the Rangitata River towers-extension pieces and altered cross-arms were fitted.

To counter the effects of snow loading, cross-arms were reconstructed and altered on the towers on Arthur's Pass and Mount Misery. Alterations were also made to middle cross-arms on poles section from Arthur's Pass to Waimakariri River.

Treatment of poles for Ashburton–Timaru line was completed.

Piling was carried out in the Bealey, Otira, and Taramakau Rivers.

The telephone system was maintained in good condition.

3. Rainfall and Lake-levels, Year ending 31st March, 1941.

The maximum flow at Waitaki for the year was 31,700 cusecs on 4th February, 1941, while the minimum flow was 3,670 cusecs on 22nd August, 1940.

Lake Coleridge rainfall was 33·33 in.; Harper rainfall was 44·60 in.; Waitaki rainfall was 20·32 in.

Lake Coleridge lake-level was 1,672·15 ft. at 31st March, 1941.

B. INVERCARGILL DISTRICT.

## 1. Supply, Consumers, Unit Sales, &c.

The year under review completes nineteen years' operations of actual retail electricity throughout the Southland District, comprising fourteen and a half years under the control of the former Southland Electric-power Board and four and a half years by the Public Works Department pursuant to the acquisition of the Southland scheme and reticulation by the New Zealand Government.

The licensed area of supply is 7,918 square miles, embracing the City of Invercargill, Boroughs of Gore, Mataura, South Invercargill, Bluff, Winton, Riverton, and Tapanui, Counties of Southland, Wallace, Tuapeka (part of), and Clutha (part of), Town Boards of Wyndham, Edendale, Otautau, Nightcaps, and Lumsden. The population in the area of supply is 74,000 (approximately).

A widespread network of electric-distribution lines makes it possible to supply electrical energy to practically every industry in the district, as well as to by far the greater number of dwellings therein.

The number of consumers and the connected load continues to increase at a satisfactory rate in the rural area controlled by the Department, as well as in the areas of the bulk-supply consumers—*i.e.*, Invercargill and Bluff. The increases shown in the following table explain the magnitude of the expenditure necessary for reinforcing and strengthening the feeder and distribution system:—

| Year ended 31st March. | Rural Consumers. | Connected Load, in kW. | Invercargill Consumers. | Connected Load, in kW. | Bluff Consumers. | Connected Load in kW. |
|---|---|---|---|---|---|---|
| 1933 .. .. | 9,299 | 32,116 | 5,229 | 13,720 | 445 | 1,300 |
| 1935 .. .. | 9,749 | 35,727 | 5,639 | 15,105 | 498 | 1,645 |
| 1937 .. .. | 10,638 | 39,893 | 6,182 | 17,434 | 531 | 1,746 |
| 1939 .. .. | 11,461 | 47,079 | 6,629 | 20,012 | 569 | 2,177 |
| 1941 .. .. | 12,190 | 54,439 | 7,042 | 24,291 | 596 | 2,697 |

The following table shows the amount of electrical energy, in units, supplied for various purposes. The revenue per unit clearly indicates the benefit being derived by the great majority of consumers from the reductions and modifications in the Government's charges for supply:—

| | Year 1941. | | Year 1937. | | Year 1933. | |
|---|---|---|---|---|---|---|
| | Units sold. | Revenue per Unit. | Units sold. | Revenue per Unit. | Units sold. | Revenue per Unit. |
| | | d. | | d. | | d. |
| Domestic .. | 6,775,932 | 2·389 | 5,739,138 | 2·701 | 5,310,906 | 2·71 |
| Commercial .. | 2,975,917 | 2·417 | 1,961,202 | 3·034 | 1,770,304 | 3·1 |
| Industrial .. | 8,408,156 | 0·977 | 8,112,392 | 0·928 | 4,992,157 | 0·964 |
| Local body .. | 11,322,300 | 0·552 | 7,359,280 | 0·777 | 5,646,540 | 0·795 |

"Commercial" includes milking motors, other rural power, shops, street lighting, &c. Units used for departmental purposes are excluded.

In addition to reducing the price of electrical energy to retail consumers in Southland the Department abolished meter rents as from 1st October, 1936, and as from 1st April, 1937, discontinued the former Southland Electric-power Board's practice of levying land rates.

One of the features revealed by the annual returns is the growth of the unit consumption in respect of three of Southland's important industries—*i.e.*, coal-mines, freezing-works, and lime-works. The following figures indicate that electricity continues in vital association with the industrial life of the district.

| For Year ended 31st March. | Coal-mines. | Freezing-works. | Lime-works. |
|---|---|---|---|
| | Units used. | Units used. | Units used. |
| 1933 .. .. .. .. | 208,440 | 2,681,333 | 217,089 |
| 1937 .. .. .. .. | 687,173 | 3,213,052 | 468,160 |
| 1941 .. .. .. .. | 1,027,924 | 4,180,208 | 1,152,219 |

Notwithstanding reductions in the Southland tariff increases have been made in the total annual sales of electric energy (for all purposes in Southland), as shown in the following comparative statement:—

| | £ |
|---|---|
| 1935 .. .. .. .. .. | 131,272 |
| 1938 .. .. .. .. .. | 147,136 |
| 1941 .. .. .. .. .. | 157,727 |

The system designed to encourage consumers to pay electricity accounts in advance (a special allowance being granted to those who adopted this method) was continued. The object of the system is to enable consumers to eliminate the risk of losing discount through late payment of periodic accounts, to relieve consumers of the necessity of making frequent payments of small accounts, to reduce meter readings in certain cases, and to effect a saving for consumers in stationery and postages.

During the year many consumers agreed to an extension of the Department's system of estimating electricity accounts, thus enabling the Department to curtail the use of petrol and otherwise to economize in transportation costs. These savings would not have been possible had the consumers demanded actual readings of the electric meters. The Department expresses its appreciation of this evidence of co-operation.

Evidence of the popularity and convenience of payment of their electricity accounts at any money-order post-office in the district (other than Gore and Invercargill, where the Department's own offices are situated) is found in the fact that during the year 25,147 payments were made by consumers at the various post-offices.

Bad debts written off during the year amounted to only 0·117 per cent. of the year's total sales of electrical energy.

## 2. Operation and Maintenance.

### (*a*) *Power-stations.*

Monowai Power-station came into operation again on 1st April, 1940, after having been shut down for some months, during which time extensive overhaul was carried out. Final inspection and adjustments to the turbine governors were made by the contractor's representative.

All load was dropped from Monowai on 5th December, 1940, in order to restore the level of Lake Monowai, which has since risen to capacity. Accordingly full load has been carried on occasions to prevent further rise and overflow.

New cables have been installed between the power-house and outdoor substation, and all apparatus in the high-tension yard has been appropriately coupled up to a new earth bus.

The Invercargill City Council's steam-plant was brought into commission on several occasions during the year as required.

### (*b*) *Substations.*

At Invercargill Substation work is proceeding with the installation of new 11 kV. switchgear and metering-equipment. A bank of three single-phase 66/11 kV. transformers with a total capacity of 4,500 kVA. is also in the course of installation. This bank will supplement the existing bank, giving a total capacity of 9,000 kVA. for the substation.

At Gore Substation operation has been normal, while routine inspection and testing of apparatus has been carried out when convenient.

On 29th December, 1940, an interruption to supply lasting forty-three minutes occurred due to the breakdown of an intersystem metering-current transformer.

Instruction in live-line testing has been given at Gore, and subsequently all major lines and substations in the various districts have been tested. Faulty insulator units located in this manner have been replaced.

In the Gore Borough a new 11/3·3 kV. outdoor substation consisting of a 300 kVA. bank of transformers has been installed to replace the old installation.

Temporary rearrangement of the Winton Substation apparatus has been completed. This is to facilitate the installation of further steelwork and switchgear at a later date.

(*c*) *Transmission-lines.*

Overhaul of lines is being carried out by a small gang.

Pile-driving by contract has been proceeding at both Oreti and Aparima River crossings. The Oreti River crossing is now complete, while the Aparima Crossing is nearing completion. These installations remove weak links in the 66 kV. transmission-lines between Monowai and Winton.

At Ohai Substation two automatic reclosing oil-circuit breakers were installed in the 11 kV. feeders.

At Bluff Outdoor Substation the existing 300 kVA. transformer-bank was duplicated by the installation of a further 300 kVA. bank of Moloney transformers.

(*d*) *General Distribution.*

New transformer installations numbering ninety-three give an increase of 693 kVA. in feeder-transformer capacity.

A considerable amount of both high- and low-tension line overhaul was carried out in all areas.

Transformer overhaul has been carried out regularly at the Invercargill Workshop, while the field overhaul vehicle has recently been put into commission again.

Tests have been carried out on transformers, relays, instruments, rubber gloves, consumers' meters, and appliances, and also on various other apparatus.

(*e*) *Concrete-pole Factory at Winton.*

This factory has been in regular production during the year, the total number of poles cast to date being 609, of which 273 have been put into service.

(*f*) *Accommodation.*

Accommodation has been provided as follows: One faultman's cottage and garage built at Edendale; two cottages and single men's quarters built at Gore Substation; two cottages and single men's quarters and combined garage and store office built at Winton Substation; two faultsman's cottages are in course of construction at Balfour and Tapanui; and one faultsman's cottage was purchased at Riverton.

Preparations are being made for the erection of a social hall at Monowai.

(*g*) *General.*

In addition to routine work on records activity in the Draughting Office has been chiefly centered about works proceeding at Invercargill and Winton Substations, and also at Ohai and Bluff Outdoor Substations, as mentioned under those headings. Work on reticulation alterations has also been carried out as required, while the overhaul of distribution maps is proceeding.

Other work in conjunction with Winton Pole-factory has also been carried out from time to time as required.

C. NELSON DISTRICT: COBB RIVER SCHEME.

(*a*) *General.*

The negotiations for the acquisition of the generating-station at Cobb River were completed, and possession taken of the plant, &c., on the 22nd May, 1940. The 900 kW. Diesel station at Stoke, which was in running-order, was immediately leased to the Waimea Power Board to help that authority to meet its demand until such time as supply is available from the Cobb Station. The capital outlay at 31st March, 1941, was £362,772.

(*b*) *Power-station.*

The power-station building had been erected by the vendors, and practically all the generating-plant had been delivered to the site. The erection of the machines, &c., is a condition of the suppliers' contract, and will be commenced shortly.

(*c*) *Substations.*

*Upper Takaka.*—Land had been acquired and one cottage erected by the vendors. An additional parcel of land has since been purchased to provide space for the 66 kV. switchgear, and cottages for the maintenance staff.

*Motupipi.*—Land has been selected and Proclamation plans are being prepared.

*Motueka.*—A site has been purchased and drawings prepared for the layout of this substation.

*Stoke.* The 11 kV. switchgear and transformers necessary to take supply from Cobb are at the site, and erection will be commenced shortly.

(*d*) *Transmission-lines.*

1. *Stoke–Cobb.*—The necessary poles, conductors, insulators, &c., had been purchased by the vendors and stored at various locations along the proposed route. Erection was commenced in January, 1941, and 138 pole structures have been completed.

2. *Stoke–Blenheim.*—A preliminary survey has been made for a possible line to give supply to Marlborough.

## REGISTRATION OF ELECTRICAL WIREMEN.

The registration regulations were amended during the year and reprinted. All pressures above 20 volts are now included, with a few exceptions, all parts of radio sets are included, temporary wiring for experimental, demonstration, research, and testing purposes is exempted in certain places when carried out under the supervision of a qualified person, and the syllabus for the examinations has been extended to include subjects in connection with radio transmission and reception and the reduction of electrical interference with radio reception. A further endeavour was made to see that all electrical wiring work in mines is done in conformity with the Act.

Two ordinary examinations for electrical wiremen and electrical servicemen were held and several special examinations. Arrangements were made to hold special examinations for members of the armed forces who may be leaving for overseas between the regular examinations. The Electrical Supply Authorities are co-operating in the holding of the special examinations for members of the armed forces. The first examination for radio servicemen was held in March, 1941. As a result of bringing the whole of the radio-receiving set under the Act thirteen persons were granted limited registration for work only on the secondary side of the power-transformer. As a result of the difficulty in obtaining conduit it was decided to include in the wiremen's practical examination an exercise in the making-up of a flexible-cord extension. The results were very disappointing when compared with those obtained for similar work carried out by the candidates for the electrical servicemen's examination.

Included in the prosecutions for breaches of the Act were seven consumers for doing wiring; ten contractors for failing to notify the Electrical Supply Authority before beginning work; six salesmen for doing wiring; one showman; two apprentices for working without supervision; and five persons for employing unregistered persons to do wiring. One fatal accident resulted from the changing of a three-pin plug-top by an unskilled person.

The installation and servicing of washing-machines, radio sets, and other portable equipment by unregistered persons is still causing concern.

The statistics for the year ended 31st March are set out below (the figures in parentheses are for the previous year).

| | | |
|---|---|---|
| Number of meetings | 18 | (17) |
| Registrations— | | |
| Inspectors | 31 | (38) |
| Wiremen— | | |
| Full registration | 168 | (123) |
| Limited registration— | | |
| Miscellaneous | 35 | (43) |
| Servicemen, Class D | 15 | (28) |
| Servicemen, Class E | 14 | (14) |
| Provisional licenses | 27 | (64) |
| Temporary permits | 1 | (18) |
| Reregistrations after periodical purging | 7 | (13) |
| Examinations— | | |
| Wiremen's— | | |
| Candidates— | | |
| Written part | 449 | (527) |
| Practical part | 360 | (355) |
| Passed (per cent.)— | | |
| Written part | 32 | (34) |
| Practical part | 53 | (52) |
| Highest marks— | | |
| Written part | 87 | (91) |
| Practical part | 91 | (93) |
| Servicemen's— | | |
| Candidates— | | |
| Written part | 103 | (113) |
| Practical part | 70 | (99) |
| Passed (per cent.)— | | |
| Written part | 40 | (34) |
| Practical part | 67 | (61) |
| Highest marks— | | |
| Written part | 100 | (89) |
| Practical part | 93 | (95) |
| Defective work reports | 36 | (51) |
| Endorsements made | 4 | (2) |
| Endorsements removed | 1 | (3) |
| Breach of Act reports | 91 | (59) |
| Prosecutions authorized | 51 | (36) |

## DESIGN OFFICE.

### Electrical Section.

#### (*a*) *General.*

In the year under review a large amount of detail design work was involved in connection with the various hydro-electric systems controlled by the Department.

Following the purchase of the Cobb River Scheme the completion of the design work for power-station, substations, and transmission-lines was undertaken.

Considerable delay has been experienced in receiving drawings of machinery and apparatus from overseas manufacturers, due partly to diversion of their staffs to more urgent work and partly to losses of drawings and technical data in transit. As a result the completion of the design work for the field has in many cases been delayed.

The standardization of types and sizes of insulated cable to be used for power and control circuits was undertaken, and it is intended in future to carry sufficient stocks to provide for all except major works.

Considerable attention has been given to the subject of fire-protection with the object of reducing the hazard in existing stations and minimizing the fire-risk in the design of new stations.

#### (*b*) *Hamilton District.*

*Arapuni Power-station.*—Foundation drawings were prepared for Nos. 5 and 6 generating-units and for the additional 110,000-volt switchgear to control these units and additional outgoing transmission-lines to Bunnythorpe and Edgecumbe respectively. The cable installation for the above units for designed specifications were prepared for the $CO_2$ fire-protection equipment for the new generating-units.

*Karapiro Power-station and Village.*—Drawings and specifications were prepared for construction purposes for a reinforced-concrete water-tower for the village and for the village substation. Preliminary designs were prepared for the power-station building and outdoor station building. Drawings were prepared for tendering purposes for main and auxiliary generating-units, transformers, cranes, switchgear, and control equipment. As the heaviest lift in the assembly of the main generating-units will exceed 150 tons there will be two main cranes operating in parallel through an equalizer beam for the heaviest lifts, but normally operating independently for all lifts up to their separate capacities. In view of the acute shortage of structural steel it is proposed to use reinforced concrete throughout for supporting the outdoor switchgear, and a preliminary design has been prepared for these supporting structures.

*Substations:* Detail designs were prepared for building extensions to Penrose Substation to provide a separate control-room for indoor and outdoor equipment at that station and at Mount Roskill Substation, which will be remote-controlled from Penrose.

A switchroom building was designed for Belmont Substation, and a relay house for Hamilton No. 2 Substation.

A preliminary design was prepared for an administrative building at Hamilton No. 1 Substation, which will house the District Office staff.

Layout and foundation drawings were prepared for additional or replacement outdoor switchgear, steelwork, and transformers at a number of substations.

A preliminary layout was prepared for a new substation at Lichfield.

#### (*c*) *Palmerston North District.*

*Waikaremoana Lower Development (Piripaua).*—Details, layout, and foundation drawings were prepared for main and auxiliary generating units, machine auxiliaries, and control equipment, and arrangement drawings for pipework and cable.

*Substations:* Switch-room extensions were designed for Melling and Stratford Substations.

Drawings were prepared for the new substation at Central Park, which will form a second point of supply for Wellington City. The site chosen is very favourably situated for supplying the major portion of the city load. The initial installed capacity will be 60,000 kVA.

Preliminary layouts were prepared for new substations at Upper Hutt, Pahautanui, and Greytown.

Layout and foundation drawings were prepared for replacement or additional switchgear and transformer-banks at several substations.

Drawings and specifications were prepared for equipment for handling transformers and other heavy plant, including 45-ton crane for Central Park, 25-ton cranes for Bunnythorpe and Masterton, 45-ton traverser-truck for Melling, and traverser trucks for Paraparaumu, Te Kiri, and Waipawa Substations.

#### (*d*) *Christchurch District.*

*Highbank Power-station.*—Drawings and specifications for the power-station building contract were completed. Layout and foundation drawings for station equipment are in hand.

*Tekapo Power-station.*—A preliminary layout drawing was prepared for power-station and equipment. The station equipment will include a 30,000-horse-power turbine, 21,600 kW. main generator, auxiliary generating-unit for station and local service, and bank of 110,000 volts step-up transformers. Provision is also being made for a bank of step-down transformers to supply the neighbouring district. The main turbine will probably be a Kaplan, or variable-pitch-propeller type.

*Waitaki Power-station.*—The design work for Nos. 3 and 4 generating-units was completed.

*Substation:* Drawings and specifications were prepared for reinforced-concrete substation buildings and water-tower for Hororata Substation, which is the main switching centre for the transmission-lines of the South Island system. Arrangements and foundation drawings were prepared for main outdoor equipment and drawings and specifications for overhead crane, traverser truck, and turntables, each of 40 tons capacity. Foundations were designed for 110,000-volt equipment at Ashburton which replaces existing 66,000-volt equipment. A preliminary layout was prepared for a new substation at Kumara.

### (*e*) *Invercargill District.*

*Monowai Power-station.*—A social hall and an extension to the outdoor station building were designed. Drawings and specifications were prepared for new 66,000-volt outdoor steelwork and switchgear for Winton Substation.

### (*f*) *Transmission-lines and General.*

Work in connection with the design and construction of transmission-lines that have been in the course of erection during the year has been dealt with.

The work has consisted of the preparation of drawings, specifications, charts, and data of various kinds, sag templates, design of special foundations, &c.

Other matters dealt with include concrete-pole and insulator tests, transmission-line parallels with telephone-lines, railway and river crossings, line-deviations, investigation of insect pests in imported Australian timber, &c.

Technical work has also been undertaken in connection with overhead travelling-cranes at a number of power-houses and substations. An investigation was also made in connection with proposals for strengthening turbine units at Lake Coleridge.

## Hydraulic Section.

Investigations for future developments were continued as follows: —

*Ohakuri.*—Intensive studies by boring by geophysical methods and geological examination have been continued throughout the year, and tentative plans have been proposed for development at this site near Atiamuri.

*Whakamaru.*—Advance work has been done by geophysical methods and by geological examination, and plans are in hand to test the foundations by boring.

*Waikato Survey.*—A photo survey of the whole of the Waikato River from Taupo to Cambridge was made to supplement the ground work already done.

*Works in hand.*—Lake Taupo Control Works: The contractor commenced operations in June, 1940. The control gates are well advanced and deepening of the river is in hand. By the end of March the channel excavation totalled 277,000 cubic yards. Design work is virtually complete.

Arapuni: The penstocks for the two final machines are being constructed, as well as the intake gates, &c.

Karapiro: Construction was commenced by the General Branch in June, 1940. This work is well in hand, and designs are being prepared as required.

Waikaremoana Lower Development (Piripaua): This work is well advanced and designs are practically complete.

Cobb River: On taking over these works various features were redesigned—the tunnel was enlarged to provide for full development. The penstock was relocated to provide for the second line, while on account of the difficulty of getting steel, discarded pipes from Waipori have been incorporated in the proposals. Boring and testing for a suitable dam-site are in hand.

Highbank: Designs have progressed with concrete penstocks for the upper portion and intake gates and forebay.

Tekapo: Plans for the tunnel excavation and lining have been prepared.

I have, &c.,

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Chief Electrical Engineer.

TABLE 1.—SUMMARY OF FINANCIAL AND OPERATING STATISTICS FOR NORTH ISLAND AND SOUTH ISLAND ELECTRIC-POWER SYSTEMS FOR THE YEAR ENDING 31ST MARCH, 1941.

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.

| | 1940–41 (Seventh Year). |
|---|---|
| **(1) Capital outlay—** | £ |
| Assets in operation— | |
| North Island system | 9,843,028 |
| South Island system | 6,988,580 |
| Total assets in operation | 16,831,608 |
| Assets not in operation— | |
| North Island system | 1,718,677 |
| South Island system | 300,473 |
| Total assets not in operation | 2,019,150 |
| Total capital outlay | 18,850,758 |
| **(2) Revenue for year—** | |
| North Island system | 1,533,136 |
| South Island system | 678,813 |
| Total revenue for year | 2,211,949 |
| **(3) Costs—** | |
| Working-costs— | |
| North Island system | 640,884 |
| South Island system | 173,288 |
| Total working-costs for year | 814,172 |
| **(4) Capital charges—** | |
| Interest— | |
| North Island system | 336,073 |
| South Island system | 254,070 |
| Depreciation— | |
| North Island system | Nil. |
| South Island system | 73,711 |
| Total capital charges for year— | |
| North Island 336,073 | |
| South Island 327,781 | |
| | 663,854 |
| **(5) Total cost for year—** | |
| North Island 976,957 | |
| South Island 501,129 | |
| | 1,478,026 |

| | 1940–41 (Seventh Year). |
|---|---|
| **(6) Net profit for year—** | £ |
| North Island system | 556,179 |
| South Island system | 177,744 |
| Total **profit** for year | 733,923 |
| **(7) Allocation of Profits—** | |
| Sinking Fund— | |
| North Island system | 148,937 |
| South Island system | 126,227 |
| | 275,164 |
| Income-tax, &c.— | |
| North Island system | 284,532 |
| South Island system | 51,517 |
| | 336,049 |
| Reserve Fund— | |
| North Island system | 122,710 |
| South Island system | Nil. |
| | 122,710 |
| **(8) Accumulated Depreciation Reserve—** | |
| North Island system | 1,112,633 |
| South Island system | 813,288 |
| Total Depreciation Reserve | 1,925,921 |
| **(9) Accumulated Sinking Fund—** | |
| North Island system | 1,308,951 |
| South Island system | 543,856 |
| Total Sinking Fund Reserve | 1,852,807 |
| Arrears in Sinking Fund payments not yet appropriated— | |
| North Island system | Nil. |
| South Island system | 214,654 |
| **(10) Reserve Fund—** | |
| North Island system | 303,958 |
| South Island system | 86,766 |
| Total Reserve Fund | 390,724 |

*(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, 1941—*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.

| | 1940-41 (Seventh Year). |
|---|---|
| **Maximum load (kilowatts)**— | |
| North Island system | 246,700 |
| South Island system | 84,920 |
| **Average load (kilowatts)**— | |
| North Island system | 142,231 |
| South Island system | 47,931 |
| **Average load factor**— | Per Cent. |
| North Island system | 57·65 |
| South Island system | 56·44 |
| **Units output**— | |
| North Island system | 1,245,947,813 |
| South Island system | 419,883,195 |
| Combined | 1,665,831,008 |
| **Units distributed**— | |
| Units sold— | |
| North Island system | 1,122,692,042 |
| South Island system | 358,442,353 |
| Combined | 1,481,134,395 |
| Units unsold (station auxiliaries, &c.)— | |
| North Island system | 5,500,429 |
| South Island system | 2,907,865 |
| Combined | 8,408,294 |
| Total units distributed, North Island system | 1,128,192,471 |
| Total units distributed, South Island system | 361,350,218 |
| Combined | 1,489,542,689 |
| **Line losses**— | Units. / Per Cent. |
| Transmission and distribution— | |
| North Island system | 117,755,342 / 9·45 |
| South Island system | 58,532,977 / 13·94 * |
| Combined | 176,288,319 / .. |

| | 1940-41 (Seventh Year) |
|---|---|
| **Revenue**— | |
| Per kilowatt (system maximum)— | £ |
| North Island system | 6·21 |
| South Island system | 7·99 |
| Per unit generated— | d. |
| North Island system | 0·295 |
| South Island system | 0·388 |
| Per unit distributed— | |
| North Island system | 0·326 |
| South Island system | 0·451 |
| Per unit sold— | |
| North Island system | 0·328 |
| South Island system | 0·454 |
| **Working costs**— | |
| Per kilowatt (system maximum)— | £ |
| North Island system | 2·59 |
| South Island system | 2·04 |
| Per unit generated— | d. |
| North Island system | 0·1234 |
| South Island system | 0·099 |
| Per unit distributed— | |
| North Island system | 0·136 |
| South Island system | 0·115 |
| Per unit sold— | |
| North Island system | 0·137 |
| South Island system | 0·116 |
| **Capital charges**— | |
| Per kilowatt (system maximum)— | £ |
| North Island system | 1·36 |
| South Island system | 3·86 |
| Per unit generated— | d. |
| North Island system | 0·0647 |
| South Island system | 0·1873 |
| Per unit distributed— | |
| North Island system | 0·0715 |
| South Island system | 0·2177 |
| Per unit sold— | |
| North Island system | 0·0718 |
| South Island system | 0·2195 |
| **Total costs**— | |
| Per kilowatt (system maximum)— | £ |
| North Island system | 3·96 |
| South Island system | 5·90 |
| Per unit generated— | d. |
| North Island system | 0·1882 |
| South Island system | 0·2864 |
| Per unit distributed— | |
| North Island system | 0·2078 |
| South Island system | 0·3328 |
| Per unit sold— | |
| North Island system | 0·2088 |
| South Island system | 0·3355 |

* Retail transmission and distribution losses Southland Area 24·975 per cent.

## Table II.—Analysis of Capital Outlay as at 31st March, 1941.

| North Island System. | £ | South Island System. | £ | Combined Totals. £ |
|---|---|---|---|---|
| Headworks and power-stations— | | Headworks and power-stations— | | |
| Land, fencing, and roading— | | Land, fencing, and roading— | | |
| Arapuni | 106,059 | Coleridge | 25,841 | |
| Horahora | 3,208 | Waitaki | 48,441 | |
| Mangahao | 74,707 | Southland | 12,226 | |
| Waikaremoana | 18,533 | Arnold River (Kaimata) | 1,456 | |
| Taupo | 30,693 | Highbank | 1,842 | |
| | | | | 323,006 |
| Headworks— | | Headworks— | | |
| Arapuni | 1,221,524 | Coleridge | 550,679 | |
| Horahora | 151,468 | Waitaki | 1,073,524 | |
| Mangahao | 943,849 | Southland | 86,816 | |
| Waikaremoana | 199,148 | Arnold River (Kaimata) | 109,524 | |
| ,, Lower development | 565,660 | Highbank | 18,763 | |
| Karapiro | 117,078 | Tekapo | 89,963 | |
| | | | | 5,127,996 |
| Generating-station, buildings, and village— | | Generating-station, buildings, and village— | | |
| Arapuni | 257,872 | Coleridge | 101,073 | |
| Horahora | 61,037 | Waitaki | 488,974 | |
| Mangahao | 131,095 | Southland | 43,199 | |
| Waikaremoana | 263,802 | Arnold River (Kaimata) | 8,617 | |
| | | Highbank | 13,143 | |
| | | | | 1,368,812 |
| Generating plant and machinery— | | Generating plant and machinery— | | |
| Arapuni | 927,834 | Coleridge | 194,701 | |
| Horahora | 95,491 | Waitaki | 362,060 | |
| Mangahao | 220,978 | Southland | 60,641 | |
| Waikaremoana | 280,500 | Arnold River (Kaimata) | 26,843 | |
| ,, Lower development | 56,003 | Highbank | 13,340 | |
| | | | | 2,238,391 |
| Auxiliary stations (three)—Penrose, Huntly, Grand Junction | 77,695 | Auxiliary station (one)—Dobson (ex Lyttelton) | 133,220 | 210,915 |
| Transmission and distribution— | | Transmission and distribution— | | |
| Primary distribution— | | Primary distribution— | | |
| 11 kV. lines | 62,822 | 11 kV. lines | 540,747 | |
| 33 kV. lines | .. | 33 kV. lines | 58,871 | |
| 50 kV. lines | 422,883 | 50 kV. lines | .. | |
| 66 kV. lines | .. | 66 kV. lines | 610,255 | |
| 110 kV. lines | 1,855,470 | 110 kV. lines | 392,557 | |
| Secondary distribution | .. | Secondary distribution | 327,722 | |
| | | | | 4,271,327 |
| Substations— | | Substations— | | |
| 11 kV. substations | 13,345 | 11 kV. substations | .. | |
| 33 kV. substations | .. | 33 kV. substations | 35,148 | |
| 50 kV. substations | 416,953 | 50 kV. substations | .. | |
| 66 kV. substations | .. | 66 kV. substations | 471,841 | |
| 110 kV. substations | 1,135,896 | 110 kV. substations | 257,747 | |
| | | | | 2,330,930 |
| General— | | General— | | |
| General offices, garages, stores, and other accommodation | 70,326 | General offices, garages, stores, and other accommodation | 29,205 | |
| Telephone services | 178,123 | Telephone services | 77,437 | |
| Explorations and preliminary surveys; engineering, office, and general expenses; charges and expenses of raising loans | 576,825 | Explorations and preliminary surveys; engineering, office, and general expenses; charges and expenses of raising loans | 533,018 | |
| Interest during construction | 1,024,828 | Interest during construction | 489,619 | 2,979,381 |
| Grand totals | 11,561,705 | | 7,289,053 | 18,850,758 |

TABLE III.—OPERATING OR WORKING COSTS FOR YEAR ENDED 31ST MARCH, 1941.

| — | North Island System. | | | | South Island System. | | | |
|---|---|---|---|---|---|---|---|---|
| | Cost. | Cost per Unit. | | | Cost. | Cost per Unit. | | |
| | | Generated. | Distributed. | Sold. | | Generated. | Distributed. | Sold. |
| | £ | d. | d. | d. | £ | d. | d. | d. |
| (*a*) Hydro stations .. .. | 63,859 | 0·0139 | .. | .. | 31,048 | 0·0178 | .. | .. |
| (*b*) Fuel stations .. .. | 12,380 | 2·9598 | .. | .. | 8,422 | 0·7072 | .. | .. |
| (*c*) Auxiliary stations, power purchased, and standby provision | 419,238 | 0·7097 | .. | .. | 523 | 2·5442 | .. | .. |
| Generated and purchased | 495,477 | 0·0954 | 0·1054 | 0·1059 | 39,993 | 0·0229 | 0·0266 | 0·0268 |
| (*d*) Transmission .. .. | 31,784 | 0·0061 | 0·0068 | 0·0068 | 24,565 | 0·0140 | 0·0163 | 0·0164 |
| (*e*) Communication system .. | 2,296 | 0·0004 | 0·0005 | 0·0005 | 1,373 | 0·0008 | 0·0009 | 0·0009 |
| (*f*) Substations .. .. .. | 42,390 | 0·0082 | 0·0090 | 0·0091 | 22,230 | 0·0127 | 0·0148 | 0·0149 |
| (*g*) Distribution .. .. .. | 2,160 | 0·0004 | 0·0005 | 0·0005 | 19,934 | 0·0114 | 0·0132 | 0·0133 |
| (*h*) System operations .. .. | 13,821 | 0·0027 | 0·0029 | 0·0030 | 11,782 | 0·0067 | 0·0078 | 0·0079 |
| (*i*) Management and general expenses | 52,956 | 0·0102 | 0·0109 | 0·0113 | 53,412 | 0·0305 | 0·0355 | 0·0358 |
| | 640,884 | 0·1234 | 0·1363 | 0·1370 | 173,288 | 0·0990 | 0·1151 | 0·1160 |

| | *North Island System.* | | *South Island System.* | |
|---|---|---|---|---|
| Units generated— | | | | |
| Hydro .. .. .. | 1,103,170,650 | | 419,548,030 | |
| Fuel .. .. .. | 1,003,860 | | 285,830 | |
| Purchased .. .. | 141,773,303 | | 49,335 | |
| | | 1,245,947,813 | | 419,883,195 |
| Units distributed .. .. | | 1,128,192,471 | | 361,350,218 |
| Units sold .. .. .. | | 1,122,692,042 | | 358,442,353 |

# APPENDIX E.

## SEVENTEENTH ANNUAL REPORT OF THE MAIN HIGHWAYS BOARD.

The Hon. the MINISTER OF PUBLIC WORKS, WELLINGTON.

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 seventeenth annual report for presentation to Parliament. The report covers the period from 1st April, 1940, to 31st March, 1941, though a number of matters referred to are carried beyond the latter date for convenience and completeness of record.

### GENERAL.

The present length of main highways maintained or subsidized by the Board is 12,381 miles, and particulars of expenditure for the year ended 31st March, 1941, as well as a detailed statement on the position of various works are given later in this report.

Of the total length of main highways, 3,990 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, 1941, amounted to £3,663,723, compared with £5,673,954 for the year immediately preceding. These figures include a number of charges against the account under special legislative authority and which are not directly related to matters covered by the Main Highways Act, 1922. Of the total reduction of £2,010,231, general improvement works account for £1,704,932 and maintenance £235,088.

The funds made available to the Board for the year were considerably less than for the previous twelve months, and they will be still further reduced for the current year. The combined causes are a reduction in revenue consequent on the petrol restrictions and the curtailment of capital funds to provide for the prior demands of war expenditure.

The general policy, as far as construction is concerned, has been to deal only with matters of urgency or military necessity during the war period, and to also provide the necessary maintenance to cope with the restricted traffic offering and to preserve the highways from deterioration.

As a result it has not been possible to complete a number of major construction works which were in hand, but in each case the reconstruction operations have been brought to a stage where the completed portions are made available for traffic, and the works already carried out will not be endangered.

### PERSONNEL.

During the year Mr. John Wood, Permanent Head of the Public Works Department, by reason of his retirement from the Public Service, relinquished his seat on the Board and the office of Chairman on the 11th March, 1941, and on the same date Mr. W. L. Newnham, Engineer-in-Chief and Under-Secretary of the Public Works Department, was appointed Chairman, and Mr. T. M. Ball Assistant Engineer-in-Chief of the Public Works Department, was appointed a member representing the Government and, pursuant to section 7 of the Main Highways Amendment Act, 1936, Deputy Chairman.

Dr. Marshall, Petrologist to the Board, resigned from the Government service, during the year and as a consequence severed his connection with the Board. The Board recorded in its minutes its appreciation of Dr. Marshall's services.

It is with deep regret that the Board records the death during the year of Mr. A. E. Jull, a foundation member of the Board.

### LEGISLATION.

New legislation affecting the Board and passed since last report was contained in section 4 of the Finance Act, 1940, empowering the Minister of Finance to borrow up to an additional amount of £2,500,000 for the purpose of construction of main highways. The total loan authority for highways now amounts to £15,200,000.

### FINANCE.

The actual income of the Main Highways Account from revenue sources for the financial year 1940–41 amounted to £2,202,638. The following table shows how this amount is made up and also the corresponding figures over the previous nine years. In addition to this amount, apart from temporary accommodation which was raised and redeemed within the year, £1,347,975 was borrowed for main highways. The annual loan charges against the Main Highways Account decreased from £671,154 for 1939–40 to £587,747 for the year 1940–41. Although interest on loan-money showed an increase of £32,305, the amount transferred to reserve for redemption of main-highways securities showed a reduction of £115,140.

| —— | 1931–32. | 1932–33. | 1933–34. | 1934–35. | 1935–36. | 1936–37. | 1937–38. | 1938–39. | 1939–40. | 1940–41. |
|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Proceeds of tax on tires and tubes collected through the Customs Department | 84,649 | 63,253 | 62,979 | 91,693 | 93,308 | 138,894 | 158,526 | 149,017 | 102,706 | 62,888 |
| Registration and license fees of motor-vehicles, &c. | 372,224 | 354,216 | 354,444 | 355,990 | 397,606 | 545,763 | 523,853 | 575,170 | 588,386 | 546,760 |
| Motor-spirits tax .. | 1,231,202 | 644,126 | 669,868 | 970,506 | 1,449,125 | 1,697,942 | 1,918,486 | 2,083,278 | 2,057,001 | 1,581,793 |
| Mileage-tax .. | .. | .. | 1,133 | 1,284 | 1,616 | 3,290 | 6,162 | 7,474 | 10,715 | 11,197 |
| **Totals** .. | 1,688,075 | 1,061,595 | 1,088,424 | 1,419,473 | 1,941,655 | 2,385,889 | 2,607,027 | 2,814,939 | 2,758,808 | 2,202,638 |

The income from revenue sources for the year 1940–41 shows a decrease of £556,170 on the preceding year's figure.

The returns from the Customs tax on tires and tubes show a marked decrease on the corresponding figures for the previous year and are actually the lowest amount that has been received under this heading in any one year since the passing of the Main Highways Act, 1922. The record year was in 1924–25, when the amount received totalled £223,609.

Compared with last year, registration and license fees of motor-vehicles, &c., show a decrease of £41,626.

Revenue from motor-spirits tax is the chief source of the Board's income, and the reduction of £475,208 on the previous year's figure reduced the Board's revenue substantially, and is a direct result of the petrol restrictions at present operating, combined to some extent with the higher cost of petrol.

Although the revenue received from the mileage tax levied in respect of motor-vehicles using other than motor-spirits and trackless trolley-omnibuses again shows an increase, the amount would have been greater were it not that under the Substitute Fuels Emergency Regulations 1940, the mileage tax is not payable in respect of motor-vehicles propelled by an engine deriving its motor power solely from producer-gas or coal-gas or such other fuel used for the propulsion of motor-vehicles as may be described by the Minister of Transport as substitute fuel.

The gross importation of motor-spirits since 1927 is set out below and these figures are usually accepted as providing an index of maintenance and construction requirements. However, under present conditions this index is not as reliable as formerly, as the consumption of petrol by aeroplanes has increased considerably since the outbreak of war.

| | Gallons. | | Gallons. |
|---|---|---|---|
| 1927 (January to December) .. | 48,000,000 | 1934 (January to December) .. | 64,600,000 |
| 1928 „ .. | 54,500,000 | 1935 „ .. | 65,300,000 |
| 1929 „ .. | 62,400,000 | 1936 „ .. | 86,800,000 |
| 1930 „ .. | 68,300,000 | 1937 „ .. | 85,700,000 |
| 1931 „ .. | 61,800,000 | 1938 „ .. | 102,300,000 |
| 1932 „ .. | 58,400,000 | 1939 „ .. | 104,100,000 |
| 1933 „ .. | 55,400,000 | 1940 „ .. | 93,600,000 |

Although the reduction in the gross importation of motor-spirits for the calendar year was only 10,500,000 gallons, representing a decrease of 10 per cent. on the importation for the previous year, the reduction for the financial year was much greater, and amounted to approximately 24 per cent.

The following is a summary of expenditure from the Main Highways Account for the year ended 31st March, 1941 :—

| | £ | Expenditure. £ |
|---|---|---|
| Maintenance— | | |
| North Island .. .. .. .. .. .. | 716,217 | |
| South Island .. .. .. .. .. .. | 350,607 | |
| | | 1,066,824 |
| Renewals— | | |
| North Island .. .. .. .. .. .. | 127,934 | |
| South Island .. .. .. .. .. .. | 32,978 | |
| | | 160,912 |
| Construction and Improvements— | | |
| North Island .. .. .. .. .. .. | 807,913 | |
| South Island .. .. .. .. .. .. | 623,353 | |
| | | 1,431,266 |
| Administration and general charges .. .. .. .. .. | | 203,517 |
| Loan charges (including commutation of toll-gate charges and of Hutt Road fees) .. .. .. .. .. .. .. | | 587,747 |
| Subsidy on rates .. .. .. .. .. .. .. | | 213,457 |
| | | £3,663,723 |

An analysis of the expenditure for 1940–41 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 .. .. .. | 716,217 | 82,872 | 799,089 | 89·63 | 10·37 |
| South Island .. .. .. | 350,607 | 52,429 | 403,036 | 86·99 | 13·01 |
| Total .. .. | 1,066,824 | 135,301 | 1,202,125 | 88·74 | 11·26 |

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:—

| — | 1931–32. | 1932–33. | 1933–34. | 1934–35 | 1935–36. | 1936–37. | 1937–38. | 1938–39. | 1939–40. | 1940–41. |
|---|---|---|---|---|---|---|---|---|---|---|
| North Island— | | | | | | | | | | |
| Maintenance expenditure | 62·31 | 62·84 | 63·80 | 65·44 | 64·80 | 66·82 | 66·46 | 69·26 | 68·28 | 67·14 |
| Motor-vehicles .. | 63·77 | 63·78 | 63·94 | 64·31 | 64·84 | 65·30 | 65·70 | 65·89 | 65·93 | 66·02 |
| South Island— | | | | | | | | | | |
| Maintenance expenditure | 37·69 | 37·16 | 36·20 | 34·56 | 35·20 | 33·18 | 33·54 | 30·74 | 31·72 | 32·86 |
| Motor-vehicles .. | 36·23 | 36·22 | 36·06 | 35·69 | 35·16 | 34·70 | 34·30 | 34·11 | 34·07 | 33·98 |

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 1940–41 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 .. .. .. | 127,934 | 16,367 | 144,301 | 88·66 | 11·34 |
| South Island .. .. .. | 32,978 | 2,341 | 35,319 | 93·37 | 6·63 |
| Totals .. .. | 160,912 | 18,708 | 179,620 | 89·58 | 10·42 |

An analysis of the Board's expenditure and the expenditure by local authorities for the year 1940–41 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 .. .. | 807,913 | 71,535 | 879,448 | 91·87 | 8·13 |
| South Island .. .. | 623,353 | 33,669 | 657,022 | 94·88 | 5·12 |
| Totals .. .. | 1,431,266 | 105,204 | 1,536,470 | 93·16 | 6·84 |

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:—

| — | 1931–32. | 1932–33. | 1933–34 | 1934–35. | 1935–36. | 1936–37. | 1937–38. | 1938–39. | 1939–40. | 1940–41. |
|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Maintenance by Board .. | 849,734 | 600,324 | 674,026 | 932,675 | 1,190,179 | 900,731* | 1,074,112* | 1,311,340* | 1,301,912* | 1,066,824* |
| Maintenance by local authorities | 215,568 | 168,466 | 187,735 | 226,554 | 284,423 | 196,023* | 153,443* | 152,730* | 151,368* | 135,301* |
| Construction by Board .. | 361,969 | 159,323 | 198,295 | 325,483 | 428,084 | 1,501,261† | 2,318,600† | 3,058,346† | 3,297,110† | 1,592,178† |
| Construction by local authorities | 94,973 | 43,181 | 55,997 | 57,975 | 78,263 | 103,260† | 108,225† | 134,359† | 172,839† | 123,912† |
| Totals .. .. | 1,522,244 | 971,294 | 1,116,053 | 1,542,687 | 1,980,949 | 2,701,275 | 3,654,380 | 4,656,775 | 4,923,229 | 2,918,215 |
| *Percentages.* | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| Maintenance by Board .. | 79·8 | 78·1 | 78·2 | 80·5 | 80·7 | 82·1 | 87·5 | 89·6 | 89·6 | 88·7 |
| Maintenance by local authorities | 20·2 | 21·9 | 21·8 | 19·5 | 19·3 | 17·9 | 12·5 | 10·4 | 10·4 | 11·3 |
| Construction by Board .. | 79·2 | 77·6 | 77·0 | 84·9 | 84·5 | 93·6† | 95·5† | 95·8† | 95·1† | 92·8† |
| Construction by local authorities | 20·8 | 22·4 | 23·0 | 15·1 | 15·5 | 6·4† | 4·5† | 4·2† | 4·9† | 7·2† |

*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 £1,754,000 less than in the previous year.

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, 1941, 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 .. .. .. | 771,035 | 1,007,476 | 1,778,511 | 62·13 |
| South Island .. .. .. | 377,442 | 706,566 | 1,084,008 | 37·87 |
| Totals .. .. | 1,148,477 | 1,714,042 | 2,862,519 | 100·00 |

## Maintenance.

The total maintenance expenditure by the Board and by local authorities amounted to £1,202,125, compared with £1,453,280 the previous year. It will thus be observed that the decrease under this heading is considerable, amounting to £251,155.

The average cost per mile was £97·1, as compared with £117·6 in 1939–40.

The feature mostly responsible for the reduced cost of maintenance has been reduction in traffic caused mainly by the imposition of petrol restrictions throughout the entire year.

The increasing length of sealed surfacing has no doubt also had an effect in reducing the cost of maintenance, but with new sealing-works having to be almost entirely suspended on account of financial limitations, the progressive reduction in maintenance costs on this account does not promise to continue in the immediate future.

The number of motor-vehicles registered actually showed a decrease as compared with the previous year, the respective figures being 313,087 and 317,526. This is the first time that there has been a reduction in the number of motor-vehicles registered in any one year compared with the preceding year.

Flood damage cost the Board £159,707, and after reviewing the expenditure for a number of years past it might be said that the year was an average one in this respect.

There has been a tendency for increased cost of materials, as well as a wage increase of 5 per cent., and but for these factors maintenance costs would have shown a still further reduction.

After reviewing all the relative influences, the Board is satisfied that the cost of maintenance for the year under review is reasonable.

The highways over the entire system have been maintained in a satisfactory condition. Efforts have been made to keep maintenance-costs down without allowing the standard to drop. As in past years, a number of complaints of faulty maintenance were investigated, but satisfactory explanations were made in all cases, or the position promptly rectified.

The Board proposes investigating maintenance-costs to see whether any further reduction in such costs is possible without reducing the standard of upkeep. It has always been one of the foremost points in the Board's policy to preserve its assets, and maintenance to a good standard is recognized as being essential in this respect.

### Table 1.—Maintenance of Main and State Highways (including Bridges).

| Highway District. | Length Maintained. | Expenditure. | | | Average per Mile per Annum. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Board. | Local Authorities. | Total. | 1940–41. | 1939–40. | 1938–39. | 1937–38. | 1936–37. | 1935–36. | 1934–35. | 1933–34. | 1932–33. | 1931–32. |
| | M. ch. | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| 1. Auckland North.. | 839 78 | 62,004 | 8,180 | 70,184 | 83·6 | 111·2 | 100·7 | 115·1 | 93·2 | 110·1 | 97·9 | 71·6 | 61·2 | 79·2 |
| 2. Auckland South.. | 1,514 31 | 129,391 | 22,106 | 151,497 | 100·0 | 123·7 | 129·2 | 126·2 | 119·3 | 181·4 | 141·1 | 124·6 | 106·9 | 145·3 |
| 3. Tauranga .. | 710 67 | 98,858 | 4,373 | 103,231 | 145·2 | 216·7 | 158·8 | 128·4 | 84·3 | 153·1 | 87·1 | 72·9 | 61·9 | 70·7 |
| 4. Gisborne .. | 396 72 | 70,446 | 5,208 | 75,654 | 190·6 | 214·2 | 266·5 | 215·2 | 182·9 | 178·1 | 164·9 | 106·4 | 96·3 | 117·3 |
| 5. Napier .. | 735 45 | 77,471 | 8,216 | 85,687 | 116·5 | 147·9 | 285·6 | 99·6 | 82·4 | 138·9 | 117·7 | 81·4 | 79·3 | 75·9 |
| 6. King-country .. | 604 30 | 78,872 | 8,413 | 87,285 | 144·4 | 152·8 | 113·0 | 95·3 | 116·5 | 89·2 | 99·7 | 70·8 | 57·1 | 70·0 |
| 7. Taranaki .. | 474 17 | 58,347 | 4,020 | 62,367 | 131·5 | 117·8 | 122·1 | 94·7 | 104·1 | 123·4 | 102·5 | 83·8 | 84·5 | 125·2 |
| 8. Wanganui .. | 533 49 | 63,733 | 5,101 | 68,834 | 129·0 | 147·4 | 157·1 | 152·5 | 115·9 | 122·0 | 87·5 | 80·8 | 66·0 | 101·0 |
| 9. Wellington West | 522 59 | 41,744 | 7,133 | 48,877 | 93·5 | 152·9 | 105·7 | 102·9 | 121·9 | 164·1 | 124·7 | 106·0 | 110·8 | 149·8 |
| 10. Wellington East | 504 41 | 35,351 | 10,122 | 45,473 | 90·1 | 104·1 | 88·9 | 89·4 | 108·0 | 175·3 | 181·3 | 114·9 | 91·4 | 128·6 |
| Totals, North Island | 6,837 9 | 716,217 | 82,872 | 799,089 | 116·9 | 144·5 | 149·5 | 119·7 | 109·0 | 143·2 | 118·3 | 91·3 | 81·0 | 104·5 |
| 11. Nelson .. | 682 38 | 54,518 | 4,822 | 59,340 | 86·9 | 115·0 | 108·5 | 99·2 | 80·3 | 116·8 | 101·1 | 74·1 | 66·6 | 103·6 |
| 12. West Coast .. | 572 78 | 83,530 | 5,798 | 89,328 | 155·9 | 171·6 | 157·4 | 145·5 | 141·8 | 214·5 | 142·6 | 110·8 | 104·1 | 136·7 |
| 13. Canterbury North | 391 70 | 30,487 | 2,705 | 33,192 | 84·7 | 91·6 | 83·8 | 92·8 | 64·3 | 62·8 | 55·7 | 58·3 | 50·0 | 55·4 |
| 14. Canterbury Central | 762 1 | 36,263 | 7,075 | 43,338 | 56·9 | 68·1 | 71·2 | 63·1 | 54·6 | 81·1 | 55·2 | 50·9 | 50·2 | 76·5 |
| 15. Canterbury South | 834 15 | 34,447 | 6,203 | 40,650 | 48·7 | 52·9 | 58·3 | 52·6 | 54·0 | 96·7 | 66·9 | 59·3 | 67·0 | 78·7 |
| 16. Otago Central .. | 842 49 | 38,138 | 8,067 | 46,205 | 54·8 | 65·9 | 66·5 | 53·8 | 49·5 | 70·1 | 75·1 | 50·3 | 46·4 | 52·8 |
| 17. Otago South .. | 529 17 | 27,052 | 8,219 | 35,271 | 66·6 | 66·8 | 96·6 | 76·5 | 62·8 | 97·8 | 84·6 | 73·8 | 72·8 | 99·5 |
| 18. Southland .. | 928 73 | 46,172 | 9,540 | 55,712 | 60·0 | 73·7 | 61·5 | 74·8 | 57·2 | 57·1 | 53·9 | 44·4 | 41·6 | 43·2 |
| Totals, South Island | 5,544 21 | 350,607 | 52,429 | 403,036 | 72·7 | 84·7 | 83·5 | 77·9 | 67·5 | 96·2 | 77·6 | 62·7 | 60·3 | 77·4 |
| Totals, Dominion .. | 12,381 30 | 1,066,824 | 135,301 | 1,202,125 | 97·1 | 117·6 | 119·9 | 101·2 | 90·5 | 122·4 | 100·3 | 78·5 | 70·7 | 92·5 |

### Flood Damage.

Brief reference was made to flood damage under "Maintenance." The cost of flood damage for the year was £159,707, which is approximately £13 per mile of highway, or one-seventh of the Board's total cost of maintenance. Viewing the cost in this way shows what an appreciable amount is expended each year upon restoration of flood damage.

During the year under review the districts which featured most prominently in this field were Taumarunui, £33,027; Taranaki, £24,500; Wanganui, £20,000; Napier, £18,505; and Nelson, £10,815.

On the forthcoming estimates the Board proposes to take a special item to cover the cost of flood-damage restoration throughout the highways system, and any future expenditure under this heading will no longer remain as a charge against districts' allocations. It is felt that this procedure will enable districts to more accurately estimate their maintenance requirements in any given year.

### Construction, Reconstruction, Improvements, and Renewals.

The expenditure on the three items construction, reconstruction, and improvements was £1,431,266, as compared with £3,106,471 in the previous year, indicating a reduction of over 50 per cent. in this phase of the Board's activities.

Details of more important individual works will be found later under the various district reports. A summary of the work completed is as follows:—

| | |
|---|---|
| Improved formation | 186 miles 36 chains. |
| Metalling | 128 miles. |
| Dustless surfacing (mileage added) | 243 miles. |
| Bridges | 9,405 lineal feet. |

The length of dustless surfacing added during the year was 243 miles, which, due to restriction of finance, is very little more than half the length carried out in the previous year. The total length of dustless surfacing is now 3,476 miles, which represents just over 28 per cent. of the total length of highways.

Indications are that new sealing will be drastically restricted until such time as finance permits resumption of operations in this field.

Bridge construction is an item upon which work must of necessity be undertaken as there are a large number of timber bridges on the highways system which have come to the end of their useful life.

As an illustration of this there were two failures of such bridges under load during the year.

The preparation of proposals for bridges was largely held up on account of the design staff being engaged on work which claimed priority, and as a consequence the programme effected was not as extensive as was desirable. The aggregate length of bridges completed was 9,405 lineal feet, as compared with 11,676 lineal feet in the previous year.

The bridge programme of the immediate future is likely to be adversely affected by lack of skilled men for construction and also by difficulty in obtaining the materials, but every effort will be made to maintain an extensive programme as otherwise the Board would find so many bridges requiring renewal at the same time that the position would be impossible. The relative importance of a number of bridges due for replacement has been carefully considered with a view to including the most urgent in the coming year's programme.

Table 2.—Construction Work completed during Year 1940–41.

| Highway District. | Formation and Widening. | Gravelling and Metalling. | Tar and Bituminous Sealing. | Road- and Plant-mix Bituminous Surfacing. | Bituminous Macadam (Penetration). | Footpaths. | Bridges. | Engineering Surveys. |
|---|---|---|---|---|---|---|---|---|
| | M. ch. | M. ch. | M. ch. | M. ch. | M. ch. | M. ch. | Ft. | M. ch. |
| 1. Auckland North | 2 74 | 4 29 | 14 38 | .. | .. | 2 0 | 789 | 14 0 |
| 2. Auckland South | 8 49 | 16 61 | 30 26 | .. | .. | 2 34 | 789 | 22 45 |
| 3. Tauranga | 6 24 | 8 65 | 11 23 | .. | .. | 0 27 | 600 | .. |
| 4. Gisborne | 3 78 | 4 24 | 7 50 | .. | .. | 0 56 | 256 | 1 42 |
| 5. Napier | 9 3 | 9 17 | 14 64 | 0 50 | .. | 1 24 | 1,936 | 10 67 |
| 6. King-country | 7 0 | 7 46 | 15 25 | .. | .. | .. | 256 | 0 11 |
| 7. Taranaki | 27 2 | 5 12 | 21 52 | 0 45 | 3 74 | .. | 135 | .. |
| 8. Wanganui | 12 39 | .. | 13 23 | .. | .. | 0 78 | 278 | 38 5 |
| 9. Wellington West | 10 32 | .. | 13 74 | .. | .. | 5 31 | 308 | 2 2 |
| 10. Wellington East | 5 70 | 0 49 | 1 0 | .. | .. | .. | 389 | 6 47 |
| 11. Nelson | 14 66 | 20 15 | 10 1 | .. | .. | 0 16 | 1,138 | 6 30 |
| 12. West Coast | 10 35 | 15 35 | 27 67 | .. | .. | 1 13 | 563 | 7 72 |
| 13. Canterbury North | 6 42 | 1 21 | 9 12 | .. | .. | 0 22 | 170 | 13 53 |
| 14. Canterbury Central | 1 33 | 0 79 | 15 51 | 3 76 | .. | .. | 402 | 26 79 |
| 15. Canterbury South | 8 61 | .. | 9 23 | 5 16 | .. | 1 23 | 576 | 21 70 |
| 16. Otago Central | 12 78 | 15 52 | 14 20 | .. | .. | 0 8 | 423 | 6 50 |
| 17. Otago South | 13 8 | 15 21 | 17 51 | .. | .. | 2 35 | 105 | 8 65 |
| 18. Southland | 24 62 | 2 34 | 11 20 | 0 28 | .. | 0 8 | 292 | 10 59 |
| | 186 36 | 128 0 | 258 60 | 10 55 | 3 74 | 18 55 | 9,405 | 198 57 |

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 |
| 1939–40.. .. | 401 | 285 | 444 | 60 | .. | .. | .. | 11,676 |
| 1940–41.. .. | 186 | 128 | 259 | 11 | 4 | .. | .. | 9,405 |
| Totals .. | 3,121 | 2,209 | 2,709 | 372 | 315 | 84 | 66 | 144,884 |

TABLE 4.—LENGTHS OF HIGHWAYS METALLED AND SURFACED SINCE INCEPTION OF BOARD'S OPERATIONS (9TH JUNE, 1924).

| At close of Period ending | Total Length of Highways. | Type of Surface. | | | Dustless Surfacing added during Year. | Percentage of Dustless Surfacing to Total Length of 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 |
| ,, 1940 .. | 12,355 | 251 | 8,870 | 3,233 | 433 | 26·2 |
| ,, 1941 .. | 12,381 | 259 | 8,646 | 3,476 | 243 | 28·1 |
| Percentage at 31st March, 1941 | 100 | 2·1 | 69·8 | 28·1 | .. | .. |

A general description of the more important highway activities in each district is given hereunder :—

*Whangarei District.*

A length of 14½ miles of State and main highways was sealed during the year, a marked reduction in comparison with the previous year's record of 32 miles.

Owing to the large number of bridges in this district which are either in or approaching the "dangerous" stage, the bridging programme has not been curtailed to the same extent. Although only twelve bridges were actually completed during the year, in comparison with twenty-one in 1940–41, work on six others is in hand, and plans for several more are ready.

On the Whangarei–Awanui State highway, reconstruction was carried out on the Otonga–Whakapara, Mitchell's–Waiomio, Kawakawa–Moerewa, and Turntable Hill sections. The last mentioned, which is a very desirable deviation from a tortuous and dangerous section of highway, is now being completed under contract.

The erection of two bridges on the Otonga Flat completes a flood-elimination work north of Hikurangi.

The sealing of a further 1 mile 72 chains between Awanui and Kaitaia provides a continuous sealed surface over this 4½-mile length.

On the Dargaville–Maungaturoto State highway the sealing between Dargaville and Tokatoka was extended for a further mile, making a total of 7 miles on this section.

Farther south, between Raupo and Ruawai, and including the Muddy Mouth Deviation, sealing was carried out over approximately 3 miles.

On the Whangarei–Maungaturoto State highway the completion of the 170 ft. Otaika Bridge and 75-chain deviation, on improved alignment, eliminates the only section between Whangarei and Auckland which was previously subject to flooding.

The main work carried out on the Birkenhead–Maungaturoto State highway was the sealing of 3¾ miles between Kaiwaka and the junction of Nos. 3, 4, and 5 State highways. Some further progress was made with the construction of the Topuni Deviation, which has now been suspended.

On the subsidized highways, activities were mainly confined to urgent bridge renewals.

The largest of these completed were the Waima Bridge of three 45 ft. spans on the Waimamaku–Ohaeawai main highway, the 110 ft. Oramahoe and 44 ft. Foster's Bridges on the Pakaraka–Awanui main highway, and the 54 ft. Te Opou Stream Bridge on the Kaikohe–Maungatapere main highway.

The Rotokakahi Bridge on the Broadwood–Runaruna highway was extensively repaired, a new superstructure being erected and a further span added. The three sections of highway in the Kaikohe Town District were sealed, the total length being 3½ miles.

*Auckland District.*

A moderate sealing programme was carried out which added 28¾ miles to the district quota of dustless surfacing. Other works comprised chiefly the completion of reconstruction proposals already in hand and the renewal of urgent bridges.

North of Auckland the principal works were 1½ miles of sealing and a 66 ft. bridge on the Birkenhead–Maungaturoto State highway, 2 miles of reconstruction on the Helensville highway, together with the completion of the Helensville Overbridge, 2 miles of reconstruction on Beach highway, and 2¾ miles of sealing near Swanson.

A new bridge is in hand at Matakana, on the Warkworth–Leigh highway. A contract was let for an overbridge at Croydon Road Station, and subways are under construction by the Railways Department at Titirangi Road and Swanson.

The Auckland – Hamilton – Te Kuiti State highway is now completely surfaced throughout the district, except for a length of 8¼ miles at the southern boundary near Otorohanga, for which a contract has been let. The Otorohanga Overbridge has been completed, and the formation of the approach deviation is in progress. The bridge is 132 ft. long with a 24 ft. roadway and two footways.

On the Paeroa–Pokeno State highway reconstruction and sealing were completed over 4½ miles near Waitakaruru.

The Kirikiri Stream Bridge on the Paeroa–Thames State highway, which was in a dangerous condition, has been replaced by a temporary bridge, and the erection of a permanent structure commenced.

On the Rahu–Waikino section of the Paeroa–Whakatane highway 2¼ miles of reconstruction and sealing were carried out.

The Piako River Bridge on the Hamilton–Paeroa highway, a three-span structure 150 ft. long, was completed, and the approaches are nearing completion.

Widening and footpath work has been carried out in the Paeroa Borough.

On the Hamilton–Rotorua highway a length of 2 miles in the Matamata County was reconditioned, widened, and resealed.

On the county highways the principal works comprised the completion of current reconstruction and sealing proposals and the erection of short bridges and culverts.

Widening and footpath work was carried out on the Titirangi highway in the Waitemata County.

In the Franklin County 4¼ miles was sealed between Glenbrook and Waiuku, and a further 8½ miles of reconstruction is in hand towards Kohekohe, 4 miles being metalled. Reconstruction and metalling were completed over 6¾ miles from Kingseat to Titi. On the Pukekohe – Glen Murray highway the sealing of 4¾ miles was completed and a 75 ft. bridge erected.

Between Tuakau and Port Waikato a length of 2½ miles received the final sealing-coat.

The Piako County section of the Taupiri–Morrinsville highway is now completely surfaced, the remaining $2\frac{3}{4}$ miles having been treated during the year.

The second coat was applied on a 4-mile length of the Hamilton–Tauhei highway.

On the Te Kauwhata highway improvements over a length of $2\frac{3}{4}$ miles, including a 91-chain deviation, have been carried out, and a small bridge is in hand.

A second-coat seal was applied on 4 miles of the Te Awamutu - Cambridge highway, and a further $3\frac{1}{4}$ miles was reconstructed and sealed.

Three miles was similarly treated on the Cambridge–Eureka highway.

Reconstruction prior to surfacing has been carried out over a length of 2 miles on the Orongo–Netherton highway. The improvement of the Waihi Beach highway was completed by the sealing of the second section of $2\frac{3}{4}$ miles.

On the Waihi–Coroglen highway widening and the construction of short bridges have been continued.

The Thames–Coromandel highway was improved by widening, beach-protection, and $\frac{1}{2}$ mile of sealing. A new bridge was erected over the Tararu Stream in the Thames Borough.

On the Waitoa–Wairakei highway the sealing of $2\frac{1}{4}$ miles has completed a dustless surface from Auckland to Putaruru via Hamilton and Tirau. Farther south the reconstruction work on a 22-mile length was extended, and now comprises $18\frac{1}{2}$ miles of formation, $17\frac{1}{2}$ miles of metalling, and $7\frac{1}{4}$ miles of first-coat sealing, of which $5\frac{1}{4}$ miles has received the second coat.

The 90 ft. Ngutuwera Bridge was erected, and a bridge over the Pokaiwhenua Stream is in hand.

On subsidiary highways a number of minor works have been undertaken by the local authorities concerned.

*Tauranga District.*

On the Paeroa–Whakatane State highway 12 chains of reconstruction was completed, 4 miles 16 chains metalled, and 5 miles of sealing carried out. An 80 ft. concrete bridge was erected at Waitao.

Between Rotorua and Whakatane the Tarawera River Bridge, 150 ft., was completed, together with 2 miles of reconstruction; $3\frac{1}{2}$ miles received a sealing-coat.

On the Whakatane–Gisborne highway 12 chains of reconstruction work was completed at Waiotahi.

Sealing has now been completed between Taupo and Wairakei, and a 50 ft. bridge was erected between Rotorua and Wairakei.

The erection of the lake-control gates at Taupo has involved the realignment of the highway on both sides of the gates.

Between National Park and Taupo considerable improvements have been carried out, including the completion of the 120 ft. Tauranga–Taupo Stream Bridge and 60 chains of sealing at Waitahanui. The Waimarino Stream Bridge is in hand.

Reconstruction on the Waitoa–Wairakei highway has been carried out over a length of $1\frac{1}{2}$ miles.

Between Opotiki and Te Araroa 1 mile of reconstruction work, cutting out dangerous corners and flooded areas, has been completed, and two concrete bridges totalling 200 ft. erected at Torere.

On the Matamata–Tauranga highway, Kaimai Hills section, reconstruction has been effected over 1 mile 53 chains, and 1 mile 63 chains was metalled. The construction of the Judea Bridge has been put in hand.

*Gisborne District.*

On the Whakatane–Gisborne via Waioeka State highway the sealing of the roadway and footpaths through Matawai Township was carried out.

The regrading of the northern side of Otoko Hill was completed.

On the Gisborne – Te Araroa State highway the reconstruction and regrading of a low-lying section at $44\frac{1}{2}$ m. was completed. This will obviate flooding and damage by silting at this point.

A new concrete bridge, consisting of two 50 ft. spans with 24 ft. roadway, was constructed over the Mangapukatea Stream near Tokomaru Bay. It replaces an old timber truss bridge on bad alignment. To provide filling for the approaches to the new bridge, 1 mile of regrading and reconstruction on Busby's Hill was carried out, and the alignment greatly improved.

Sealing was completed through three townships on this highway—namely, Tokomaru Bay, Te Puia Springs, and Tikitiki.

The first section of the Mangahauini steel sheet-piling protective works at 60·35 m. was constructed during the year; 562 lineal feet of wall was completed, and back-filling is in hand.

Between 59 m. and 64 m., 77,300 trees were planted out.

On the Gisborne–Napier via Hangaroa State highway 1 mile 49 chains of reconstruction, 2 miles 14 chains of one-coat seal, and 2 miles 24 chains of two-coat seal were completed. A new concrete balanced cantilever bridge 96 ft. in length was built, replacing an old suspension bridge at Avondale.

Steel sheet-piling for protective works is in hand at Hangaroa.

The second-coat sealing of the reconstructed length of the Gisborne–Ormond via Waiohiki highway was completed. The whole of this highway is now dustless.

On the Patutahi–Rere highway $1\frac{3}{4}$ miles of second-coat seal was carried out.

The roadway and footpaths through Ruatoria Township on the Mangakino–Waiomatatini highway were sealed.

On the Opotiki – Te Araroa highway the Nukutahara Stream was bridged with a 60 ft. steel truss reconditioned from the old Uawa River Bridge at Tolaga Bay.

Sixty-three chains of sealing was completed from Tokomaru Bay Township towards the wharf.

The low-level bridge at Wigan, on the Tolaga–Tauwhareparae highway, was completed. It is 86 ft. in length.

The Kowhai Bridge at 7 m. on the same highway, which was damaged in the 1938 flood, was reinstated. New piers and abutments were built and an extra span added.

*Napier District.*

The work carried out has been confined mainly to the completion of short lengths of sealing, preparations for which had already been made, also of lengths of formation, &c., in cases where only a small amount of additional work was necessary to bring them into use. A number of urgent bridge renewals have also been put in hand or completed during the year.

On the Taupo–Napier State highway construction work was carried on from July until October, 1940, on the Runanga Deviation, and a 205 ft. water-drive 9 ft. by 9 ft. 7 in. in cross-section has been completed on Baker's Deviation.

On the Mohaka River – Eskdale section construction work was also carried on for a few months, 4 miles 30 chains of formation being completed.

One-coat sealing has been completed over a total length of 7¼ miles, and a 3-mile length of priming has been put down.

On the Gisborne–Napier via Hangaroa State highway a new concrete bridge 300 ft. long, and 55 ft. above water-level, has been completed over the Mangapoike River at Opoiti. Work on the approaches is in hand. In the same locality a short timber bridge was replaced by a twin 6 ft. pipe culvert 64 ft. long, and similar work was undertaken in the case of two other bridges near Wairoa. A small amount of reconstruction work was carried out north of Wairoa. The replacement of the old Waikare River Bridge by a concrete structure is in hand. Three miles of sealing was carried out.

The construction of a concrete bridge with 24 ft. roadway over the Esk River, comprising eight 60 ft. spans, has been completed. The original bridge was carried away by the disastrous Hawke's Bay flood of 1938. Since then traffic has been carried on a temporary structure. Adjacent to the new Esk River Bridge the construction of a concrete overbridge 96 ft. long was put in hand to eliminate a dangerous railway-crossing, and is now completed.

South of Paki Paki, on a tortuous section of the Napier – Palmerston North State highway, 3 miles of heavy formation has been completed. The formation work was closed down last December, but in order to make as much as possible available for traffic the metalling of 1¼ miles is now in hand.

In the Waipawa Borough 34 chains of reconstruction and sealing and 50 chains of plant-mix resurfacing have been carried out.

The Maharakeke Bridge, 178 ft. long, has been completed, together with 18 chains of approaches.

A dangerous section will be eliminated by the completion of the Piri Piri Deviation, 1 mile 5 chains in length, which is now in hand.

Reconstruction with improved alignment has been completed on the Maharahara–Matahiwi North and Matihiwi South Deviations, 76 chains and 41 chains long respectively.

A concrete bridge 80 ft. long over the Manga-atua Stream has been completed.

Priming was carried out on a 20-chain length of the Dannevirke–Waipawa County Boundary Deviation.

On the Te Uri – Norsewood main highway a length of 1 mile 73 chains has been reconstructed near the Mangahei Road junction.

The approaches to the Orua–Kiritaki Bridge have been reconstructed on the Woodville County section of the Woodville–Tamaki main highway.

On the Waipukurau–Matamau main highway the approaches to the Papatu Overbridge have been completed.

The Ngaruroro River Bridge at Pakowhai, on the Farndon–Paki Paki main highway, consisting of nine 75 ft. spans, together with the approaches, has been completed, and the old timber bridge dismantled.

The Morea concrete bridge 80 ft. long, and its approaches, which are on a 70-chain deviation, have been completed on the Otane–Tuki Tuki main highway.

On the Dannevirke–Waipukurau main highway, 2 miles 24 chains of reconstruction and sealing has been completed in Waipukurau County, and 1 mile 40 chains in Patangata County.

The formation and metalling of the Waitahora to Cross Roads Deviation, 36 chains long, has been completed.

The total lengths of highway in the district prepared or being prepared for sealing are as under: Prepared for sealing but not primed, 1½ miles; prepared for sealing and primed, 3¼ miles.

*Taumarunui District.*

Substantial progress was made with the improvement of the State highways in this district, 7¼ miles being sealed on reconstructed surfacing north of Taumarunui, and 6½ miles on the southern section. The elimination of several narrow lengths with sharp curvature has been undertaken, involving heavy formation in papa of a total length of 1½ miles. This includes the Mangatupoto Deviation, 29 chains in length, with a 72 ft. bridge over the Ohura River and a 12 ft. arched culvert. The work has now been completed, with the exception of the bridge approaches.

Between the Ongarue turnoff and Taumarunui, 4½ miles of formation and metalling were carried out, and a further 1½ miles remains to complete this section for sealing.

On the Manunui–Piriaka section 30 chains of highway was raised above high-flood level, 7 chains of stone protective-work being provided.

Twenty-five chains of formation and metalling were carried out to complete the reconstruction of 7¼ miles between Owhango and Oio, and the sealing-coat has now been applied on the greater part of this length.

Several short lengths have been sealed on the secondary highways, and 1 mile was reconstructed and metalled on the Pio Pio – Tatu highway.

The restoration of damage caused by the severe flood of February, 1940, has been continued, and has necessitated a great deal of work throughout the district.

*Taranaki District.*

North of New Plymouth the principal work on the State highway has been the virtual completion of the reconstruction of the 8-mile section between New Plymouth and Waitara, which has now been surfaced throughout, except for a portion of the final seal-coat.

A 135 ft. bridge has been erected over the Waiongona Stream.

Plant-mix surfacing was laid on 45 chains of the Mimi Valley Deviation, and 2½ miles was reconstructed and sealed on the Pukearuhe highway.

South of New Plymouth the 3½-mile length between the Ngaere Overbridge and Eltham has been reconstructed and sealed, also 1¼ miles between Boylan Road and Te Roti.

The Rugby Road subway was completed, and brought into use by traffic.

On the coastal highway via Opunake, 1¼ miles of sealing was carried out at Oakura and 30 chains at the Otahi Bridge.

On the Stratford–Taumarunui highway the unmetalled length of 4½ miles in the Tangarakau Gorge was reduced to 60 chains, and this has also now been metalled, completing the metalling of the highway. This was the only clay-surfaced section remaining in the district. The work was done in conjunction with the restoration of damage caused by the flood of February, 1940.

The Egmont highway is now completely surfaced, a length of 3½ miles having been improved and sealed by the Taranaki County Council.

A considerable amount of reconstruction, widening, and sealing has been carried out by the counties on the subsidized highways, the total length involved being 13¾ miles, in addition to the sections mentioned above.

*Wanganui District.*

The improvement of several sections of the Hawera–Wanganui State Highway has been continued, although under present conditions it has not been possible, in some cases, to bring the original proposals to completion.

The ¾-mile Manutahi Hill Deviation was extended by 5 chains and sealed, while the ½-mile and ¼-mile reconstructed lengths at the Manawapou Hill and Kakaramea were also surfaced. At the Whenuakura Hill Deviation a further 10 chains was formed, and 32 chains, representing one-half of the whole work, received a sealing-coat. On the Westmere section 2¾ miles of the 3½-mile length under improvement was reconstructed, of which 2 miles was sealed, and 35 chains of the deviation near Virginia Lake also received a sealing-coat.

The major improvements on the National Park – Wanganui State Highway, or Parapara Road, were added to by 12 chains of reconstruction, 4 miles of sealing, and 2 miles of priming-coat. A large mass-concrete culvert was constructed at the Auriki Stream. The extension of the formation work into the Waimarino County section has not been proceeded with under present conditions.

On the Horopito–Bulls highway the 17-mile length between Waiouru and Taihape is being brought up to an improved standard, 7¼ miles of formation being completed. A large concrete culvert was built 4¾ miles north of Taihape, and a temporary bridge erected over the Hautapu River to replace one damaged in an accident. A contract for a permanent structure has been let.

The 3¼-mile length between the Makohine Viaduct and Mangaonoho Flat was sealed, thus completing 58½ miles of bituminous surface from Bulls to a point 2½ miles north of Taihape, except for a short length at the Vinegar Hill Overbridge.

The 50 ft. Porewa Stream Bridge was erected. The bridge is on the deviation leading to the above overbridge, and the formation of this is well in hand.

Two large culverts were installed south of Rata.

The reconstruction and priming of a 5-mile length of the Rapanui Beach highway were completed, and 1½ miles of this was sealed. The sealing of the remainder has been carried out since the beginning of the present year.

The reconstruction of 4¼ miles of the Curls Bridge – Upper Tutaenui highway was completed up to the top-course metalling, and sealing deferred till next season.

On the Greatford–Ashhurst highway the old combined railway-bridge at Kakariki, now replaced by a new structure, was taken over from the Railways Department, and completely decked for highway traffic.

A 4-mile length on the Wanganui–Kauangaroa highway was completed as to the reconstruction and metalling, and the sealing was commenced.

Some short lengths of subsidiary highways have been improved, and several bridges and large culverts constructed.

*Wellington West District.*

The new coastal section of highway between Plimmerton and Paekakariki, 9 miles in length, which was taken over by the Board in April, 1940, still requires its final sealing-coat; but this work has been deferred under present conditions, and in order to obtain the maximum value from the first coat, which was made heavier than the usual "primer." During the year a good deal of minor work was done by way of guard-fencing, sealing the footpath, construction of culvert-walls, and the planting of 8,500 trees for beautifying purposes.

In the Ngahauranga Gorge the construction of large pipe culverts and water-drives was continued, and 2,000 ft. of steel sewer-pipe laid to serve the city abattoirs. The reconstructed section was severely damaged by flood in February, and restoration work has necessitated the installation of an additional 700 ft. of 6-ft.-diameter concrete pipe culverting.

On the State highway south of Levin, 1¼ miles of footpath was constructed, and two sharp corners near Paraparaumu improved by deviations.

On the Napier – Palmerston North State highway, widening to 24 ft. was continued in the Manawatu Gorge, but the work has now been suspended.

The pavement through the Upper Hutt Borough on the Masterton–Wellington highway is being widened to 24 ft. over the 3-mile length, and a cycle-track provided. The Taita Gorge Section was seriously eroded by flood in March of this year, and the highway is being carried back into solid side-cutting. The surfacing of the 6½-mile Haywards–Pahautanui highway, which was taken over during the year, was completed by an additional mile of sealing. This highway constitutes the main connecting-link between the Hutt Valley and the northern arterial route, and is also part of the principal alternative exit northward from Wellington.

The pavement on the Shannon–Makerua section of the Levin – Palmerston North highway was widened and improved over a length of 1¼ miles, and 1¾ miles was sealed on the Kairanga County section. A 178 ft. bridge was erected over the Tokomaru River, also two shorter bridges.

The reconstruction of the Waitarere Beach highway was completed, and a contract let for plant-mix surfacing of the final section of 2¼ miles. On the Palmerston North – Himatangi highway a further mile of original surfacing was reconstructed and sealed. The approaches to the Longburn Overbridge were completed and the bridge brought into service.

Sealing was also carried out on several of the subsidiary highways to a total length of 10 miles, and three short bridges were completed.

### *Wellington East District.*

No works other than maintenance sealing were required on the State highways in this district. The widening of the 3¼-mile Makuri Gorge section of the Pahiatua–Akitio highway was completed, an adjacent 60-chain deviation with two bridges being deferred.

A number of bridges were erected by the counties, the principal of these being the Taueru Bridge of one 95 ft. and two 76 ft. spans on the Masterton-Stronvar highway, Whakataki of one 65 ft. and two 52 ft. spans on the Masterton–Castlepoint highway, Mangapokia of 104 ft. on the Blairlogie-Langdale highway, and several shorter bridges and large concrete culverts.

Work is in hand on a 90 ft bridge over the Kopuaranga Stream in Mauriceville Township. Some short lengths of reconstruction and sealing were also carried out on the subsidized highways.

### *Nelson District.*

The programme of works instituted on the inception of the State highways system has, during the past year, been somewhat curtailed. A total length of 12¼ miles has received a sealing-coat, and a further 6¾ miles has been or is being prepared for sealing.

The reconstruction programme was gradually slackened off during the year, and there are now none of these works in progress in the district.

On the Picton–Christchurch highway ¼ mile of formation and metalling was completed at the Koromiko Deviation, the highway at Massacre Hill near Tuamarina was raised over a length of 7 chains, and on the 2½-mile deviation between Tuamarina and Spring Creek the 960 ft. Wairau Bridge and all bridge approaches have been completed. This deviation, which is now in use by traffic, eliminates two level crossings, and shortens the distance between Picton and Blenheim by nearly a mile.

Between Riverlands and Dashwood a further 3½ miles has received a dust-laying seal-coat, and 1¼ miles was reconstructed between Seddon and Ward. The approaches and gabion protection at Kekerangu River Bridge have been completed, and a 36-chain deviation and 70 ft. bridge at Tirohanga Flat have eliminated three small obsolete bridges and a section of highway subject to flooding.

On the Blenheim–Nelson highway the raising of 23 chains of road at Double Crossing, near Havelock, has obviated traffic being held up by floods. Ward's and Bown's culverts and approaches, between Canvastown and Pelorus, have been completed, and a dust-laying seal-coat applied for 6¾ miles between Rai Valley and Wangamoa Hill; a further 6¼ miles is ready for similar treatment.

The major reconstruction works on the Wangamoa Hill were discontinued early in the year, 1 mile of metalling completing this work to the foot of the hill on the Nelson side; the 50 ft. Wakapuaka River Bridge at Teal Valley is in hand.

On the Richmond–Collingwood highway the protection of the Riwaka River Bridge is in hand, and the work of repairing flood damage on the Takaka Hill has been continued during the year, several thousands of yards of spoil being shifted, and extensive concrete and stone pitched retaining-walls erected. In this locality a large area of land has been purchased for afforestation, with the idea of preventing constantly recurring flood damage. A further ½ mile of formation and 1 mile of metalling on the Takaka–Onekaka reconstruction were completed before the works were suspended.

On the Nelson–Westport highway the improvements at Arnold's, near Korere, have been completed by the reconstruction and metalling of 1¼ miles.

The Hope Saddle – Eight Mile reconstruction closed down in January, by which time 1½ miles of formation and 3¾ miles of metalling had been completed, as well as a large reinforced concrete retaining-wall at Rotorua Point, near Gowan Bridge.

Protective fencing, chiefly on hill sections, has been erected in various parts of the district, the total for the year being 4¼ miles.

On main highways maintained by the Board, ½ mile of preparation for sealing is in hand on the Nelson Aerodrome highway, and on the Murchison–Maruia via Shenandoah highway 1¼ miles of formation and metalling have been completed.

On county highways some progress has been made. Major repairs to Ferntown Bridge and extensive sea-erosion protection works have been carried out in the Collingwood area. One-coat sealing of a 2-mile section between Spring Creek and Raranga has been completed, and a culvert installed at Robert's Ford on the Murchison–Maruia via Matakitaki highway. Repairs to extensive flood damage to groynes at Woodman's Bend on the Dashwood–Upcot highway, and major repairs to Branch River Bridge on the Renwicktown – Hope Junction highway, are in hand.

On the Korere–Tophouse highway, Coleman's Creek culvert has been completed, and the 30 ft. Marathon Bridge is in hand on the Seddon–Marama highway.

*Greymouth District.*

The general improvement of the principal highways has been continued as far as financial limits would allow, the principal works being on the Inangahua–Greymouth–Waiho and Nelson–Westport State highways, and the Westport–Karamea, Westport–Greymouth, and Reefton – Hanmer Junction highways.

Between Inangahua and Greymouth five lengths totalling 10¾ miles were sealed, and this work is now continuous from Ikamatua to Greymouth, except for a short length at Orwell Creek Bridge. North of Reefton 1¼ miles was widened and metalled, and 2¼ miles between Ahaura and Big Grey. New bridges are in progress at Hard Creek and Orwell Creek.

Farther south the improvement work between Hokitika and Ross was continued, 1¾ miles being formed and metalled and 2¾ miles sealed.

Widening was continued from Westport towards Inangahua, and has now reached the 8½ m. peg, except for a 10-chain gap, and nearly half this length has been sealed. Two short bridges were erected, and a water-drive to replace Neam's Creek culvert is in progress.

On the Christchurch–Kumara State highway the 90 ft. bridge over Harley's Creek has been completed, and some sealing carried out in the Arthur's Pass Township.

The improvement works on the Karamea highway north of Westport have been continued; during the year 13 miles was sealed, and there is now a total length of 19¼ miles of bituminous surfacing on this section.

On the Westport–Greymouth coastal highway the 200 ft. Nile River Bridge was completed, together with the approach deviation of 57 chains.

Widening was continued between Charleston and Punakaiki, and the 2½-mile Barrytown Deviation, which includes a 100 ft. bridge over Fagans Creek, is now practically complete.

The reconstruction of the Reefton – Hanmer Junction highway was continued, ½ mile being completed together with 3¼ miles of metalling. Three bridges were also erected.

*Canterbury District.*

Good progress is being made with sealing-works, and a total of 42¼ miles was completed. A feature of the work over the past few years has been the increasing use of plant-mix, 9¼ miles being treated with this type of paving.

The major improvement to the State highway in the northern portion of the district was the sealing of the 5-mile section from the Kahautara River to Kaikoura. Farther south, between Hurunui and Domett, 4¼ miles were also sealed, and preparation work carried out in Cheviot Township, which has since been sealed. A contract has been let for sealing through the Parnassus Township.

The widening between Parnassus and Oaro was stopped through lack of funds, though the approach to the overbridge at Hundalee was completed in the early part of the year.

The construction works in the Cheviot and Waipara Counties were terminated, with the exception of a block-cutting at Stonyhurst, which is being completed. Altogether improvements to alignment were effected on sections totalling 46 chains.

A contract has been let for the erection of a concrete bridge at Benmore, which will result in greatly improved alignment of the highway north of Tormore.

In the Weka Pass, on the inland route between Waipara and Kaikoura, an 80 ft. bridge was completed early in the year, and a second-coat seal was applied over 2 miles between Pigeon Rock and Waikari.

On the Lewis Pass route a 90 ft. bridge spanning the Kakapo Creek has replaced the existing temporary bridge.

Between the Christchurch City boundary and the Waimakariri River Bridge, shoulders were widened to provide cycle-tracks on both sides of the concrete road. The extra width has materially improved traffic conditions.

From Rangiora to Cust the final 2½-mile section of sealing was completed.

On the arterial route to the West Coast the sealing of 8 miles from Kirwee was completed, also a section in the Sheffield Township. The contract has now been extended to Sheffield, and over a 30-chain section in the Springfield Township.

The 132 ft. bridge and approaches over the Craigieburn Stream have been completed, thus eliminating two fords which caused considerable trouble to motor traffic.

Between Cass and Waimakariri, widening and realignment were continued, a further 60 chains being completed.

The 270 ft. Hawkins River Bridge on the Darfield–Arundel highway was nearly completed. This bridge eliminates a very difficult river-crossing.

The reconstructed section of 3 miles between Governor's Bay and Lyttelton has been sealed, and the realignment of the old road between Teddington and Allandale was completed for 1¼ miles.

Nearly 4 miles of plant-mix paving was carried out on the highway to the Harewood Aerodrome, and on the connecting highway from Belfast, on the northern State highway, to Hornby, on the south State highway. This gives a complete sealed route, by-passing Christchurch, between these highways.

Reconstruction work in the Akaroa County was continued between Duvauchelles and Takamatua Bay, a total length of 1½ miles being carried out.

The section through Little River Township has been sealed, and a 24-chain deviation at Kaituna formed and prepared for sealing.

A contract has been let for sealing the 3-mile section of new highway from Burwood to Marshland.

In South Canterbury the 13-mile contract for plant-mix paving between Winchmore and Methven has been completed, 5 miles being laid during the year, in addition to short lengths of two of the highways which run through the Methven Township.

A ½-mile section in the Rakaia Township was also made dustless.

The Ashburton County completed the preparation of a 6-mile length from Cochrane's Road to Chertsey Road on the main highway to Wakanui, but the sealing has been deferred.

In the Geraldine County four small bridges, totalling 142 ft. were completed, in addition to 2 miles 30 chains of one-coat seal on the highway from Geraldine to Fairlie.

On the new highway from Rangitata to Geraldine, which gives Geraldine direct access to the State highway, a 30 ft. bridge was completed at Coopers Creek, and the full length of 5¾ miles received a one-coat seal.

At the Winchester railway-crossing, on the Christchurch–Timaru State highway, where the proposal to erect an overbridge was abandoned for the duration of the war, the unsealed length of 43 chains was treated with a light coat of sealing. On this highway a 280 ft. concrete bridge has been erected across the Hinds River, replacing an old narrow wooden structure.

On the State highway from Timaru to Lindis two new bridges of 30 ft. each were completed by the Mackenzie County Council at Cricklewood and Coal Creek. The approaches have been formed and metalled, and the bridges are in use by traffic.

*Otago District.*

No major works have been necessary on the Timaru–Dunedin State highway during the year, the sealing of bridge approaches, the construction of side-tracks for horse-drawn traffic on the Goodwood Hill, and the installation of a large concrete culvert being the principal items.

Protection work was continued at Kartigi Beach.

The improvement of the Lindis Pass section of the Timaru–Cromwell highway, although not completed, has been sufficiently advanced to provide an easy route over the Pass between Central Otago and Omarama.

On the Milton–Queenstown State highway, reconstruction work is being continued on a reduced scale between Alexandra and Roxburgh and between Frankton and Queenstown, in order to improve alignment, grades, and road widths. On the 21½-mile Alexandra–Roxburgh section, 10¼ miles of formation and a 30 ft. bridge have been completed, while on the 3½-mile Frankton–Queenstown section 1½ miles of formation and metalling have been carried out to date. A further 3½ miles of sealing has been applied, and there is now a continuous dustless surface between Alexandra and Roaring Meg Creek in the Kawarau Gorge. Provision has been made for pedestrians between Cromwell and Cromwell Railway-station by the construction of a footway on the Clutha River Bridge and 20 chains of footpath.

Sixty-five chains of the Palmerston–Clyde highway in Ranfurly Township has been sealed.

Reconstruction and sealing has been completed on a 17¾-mile section between Pukeuri and Kurow, while in Kurow Township the highway is being prepared for sealing, and kerbing is being constructed.

All but 15 chains of the Dunedin–Waitati alternative northern route into Dunedin, via Leith Valley, has been formed; but the works have now been closed down.

A 35-chain deviation has been completed which eliminates two railway-crossings at Kokonga, on the Kyeburn–Middlemarch highway.

Some further progress has been made with the improvement of poorly aligned and narrow sectiosn of the highway between Wanaka and Haast, but except for a deviation near Alberttown, which is in hand, the work was suspended in the early part of the year.

On the Dunedin–Gore State highway reconstruction and sealing have been completed to Clinton, while improvement work is in hand between Clinton and Waipahi, where a length of 3 miles has yet to be completed.

Included in this section is a 2 mile 30 chain deviation at Waipahi, which will eliminate two railway-crossings and locate the highway clear of the flood area near Waipahi Township. The proposals include an overbridge and a short bridge over Webb Creek. Formation was completed last year, and Webb Creek Bridge is nearly completed. Work has commenced on the erection of a 180 ft. overbridge to eliminate a level crossing at Wairuna.

Other work carried out on this highway comprises the construction of 75 chains of concrete footpath between Caudleton and Milton, 1 mile 48 chains of kerbing and channelling in Milton Borough, and the formation of 1½ miles of footpath between Green Island and Fairfield.

Reconstruction of the Milton–Queenstown State highway was continued until August, when the works were closed down. Reformation and metalling have been completed from Clarksville to within a mile of Waitahuna, except for ¾ mile of bridge approaches. The deviation at Round Hill, to eliminate a dangerous level crossing, has been completed and is open to traffic. A 2 mile 30 chain length between Roxburgh and Coal Creek has been sealed.

On the Dunedin–Harrington Point highway the 105 ft. Anderson's Bay Bridge has been completed.

Sealing of the 5½-mile section of the Dunedin – Duke's Road Railway-station highway, between Dunedin and the Taieri Aerodrome, has been completed, and work is in hand on a 2-mile deviation made necessary by the aerodrome being extended to include portion of the highway.

The 1½-mile Kaitangata Borough section of the Balclutha–Wangaloa highway has been sealed.

Preparation for sealing has been completed on the 1¼-mile section of the Roxburgh – Miller's Flat highway between Roxburgh and Roxburgh Railway-station, but sealing is deferred at present.

On the Gladstone highway a length of 2 miles 12 chains has been sealed between Riccarton and Wingatui Corner.

The Baratta Creek Bridge on the Balclutha – Kaka Point highway is being replaced by a 10 ft. by 10 ft. concrete culvert.

*Southland District.*

The bituminous surfacing of the Dunedin–Gore–Invercargill–Bluff State highway in this district has been completed by the sealing of short lengths at the Okiterama Overbridge and McNab flood-improvement sections, and of the 8-mile length between Invercargill and Bluff which was recently improved and widened, the work being completed during the year.

Twenty-eight chains of widening and reconstruction was also carried out in the Bluff Borough.

On the Invercargill–Queenstown highway the reconstruction between Invercargill and Winton has now been suspended, with 6¾ miles completed to the base-course stage, and of this 2¾ miles is ready for sealing.

The Lorne–Riverton State highway has been improved in both the Southland and Wallace Counties, a total length of 7¼ miles having been reconstructed, including the widening or renewal of six short bridges.

The principal work on the Lumsden – Te Anau – Milford Sound highway has been the continuation of the Homer Tunnel and Milford Sound Road. The tunnel is being ring-drilled in preparation for enlargement to full size, more than half the length having now been dealt with. A test length of 30 ft. was enlarged to full section.

The concrete avalanche-protection work at the Homer portal was completed, the total length being 490 ft. Similar work is in progress at the Cleddau or Milford portal, 62 ft. having been installed.

On the Milford Sound Road part-width formation has been carried up to 9 m. 20 ch., and from that point to the tunnel, at 10 m. 65 ch., the formation is 60 per cent. complete in sections, which still require to be linked up and to have bridges provided.

Twelve small concrete bridges have been built, and foundations put in for two larger bridges over the Cleddau.

On the Edendale–Wyndham highway a contract has been let for a 540 ft. bridge over the Mataura River, and pile-driving is in hand.

A ¾-mile length was sealed east of Wyndham. On the Winton–Gore highway 1¾ miles is being widened and improved.

The Oreti Bridge on the Winton–Ohai highway was damaged by flood, and extensive repairs were carried out on five spans.

Two miles of reconstruction and sealing have been carried out on Dunn's Highway, which connects Oreti Beach with Invercargill. A cycle-track was also provided on this length.

A footway has been constructed on the bridge over the Waiau River at Tuatapere.

## Level Crossings Eliminations.

During the year the expenditure on this item was £57,483, bringing the total since the inception of the programme to £857,183.

Seven crossings were eliminated, making a total of 115, and a further 9 are in hand. In three of these cases the overbridges are completed and the approaches are being formed.

The noticeable decrease in level-crossing accidents on the highways system during the last year or two is undoubtedly attributable to the works carried out under this programme, commenced in 1936; but there are still a few special cases which have been unavoidably held over where it is very desirable that elimination should be effected as soon as funds are available.

## State Highways.

It is perhaps appropriate to point out here that the State finds the whole cost on State highways, and also that while the Board's total expenditure on the complete highways system during the year was £3,663,723, the expenditure by local bodies on main highways was only £259,213, or 6·6 per cent. of the total expenditure.

It is recognized that local bodies could not possibly have faced up to the provision of the funds necessary to meet their share of the cost of bringing the arterial routes up to a standard demanded by the ever-increasing number of motor-vehicles, and this was one of the main reasons for the introduction of the State system.

During the period that has elapsed since the inception of the State highways system it has been possible to assess the advantages accruing from the introduction of the scheme. Essential improvement works have been carried out on arterial highways where the traffic density is greatest, and the main roading system has now reached a standard where it is of great value as a measure of defence. One of the improvement works recently put in hand as a home-defence measure was the reconstruction of the Taihape-Waiouru section of the Horopito–Bulls via Taihape State highway. This work is now nearing completion, and when finished will not only provide an up-to-date highway for the benefit of the motoring public, but will also be of great military value should an emergency occur.

The carrying-out of such improvement works would not have been possible with each county working independently and within its own financial resources, as was the case before the introduction of the State system.

The Board has also been able to introduce the patrol system, thus ensuring a more uniform standard of maintenance, as a patrol does not have to confine itself to a particular county section, but can operate over such lengths as will permit of the efficient and economic use of the Board's plant and organization. For this reason it has been possible, where the density of traffic is greatest, to provide a higher standard of road surface than could be expected under local-body control, where the position was governed by the opinions of the local body and the finance, plant, and organization available to it.

Similarly, on the sections of highway carrying a less volume of traffic, reasonably good roading-facilities have been provided. The Board's programme has thus made it possible to concentrate funds for expenditure where required.

While the largest expenditure was on State highways to provide for their heavier traffic densities, the Board also expended substantial sums in the way of subsidies to local bodies on the highways remaining under their control.

The success of the Army manœuvres carried out early in the year is a striking testimony to the standard of the State highways system.

### Contacts with Local Bodies and Automobile Associations.

Although it is regretted that personal contact with local bodies and automobile associations was not possible during the year owing to the postponement of the Board's annual tour of inspection, the usual high standard of co-operation was extended by local authorities and automobile associations.

The measure of assistance granted in this connection is greatly appreciated, as is also the efforts made by all concerned to adjust their programme of work within the limits of the finance available. The Board looks forward to the maintenance during the current year of the same cordial relationship as has existed in the past.

### Footpaths and Cycle-tracks.

In September, 1937, the Board decided to subsidize on a £1 for £1 basis the construction of footpaths on sections of highway in localities where the amount of pedestrian traffic justified this work as a safety measure, and local authorities have to a considerable extent taken advantage of the proposal.

It was made a condition that the footpath should be sealed, so that there would be less tendency to walk on the surfaced roadway.

Up to 31st March, 1940, a total length of 21 miles 63 chains of footpaths had been constructed, and a further 18 miles 55 chains was added last year, the greater part being on State highways.

The above figures include a few cases of footways being added to existing bridges.

The provision of cycle-tracks, by strengthening and sealing the shoulders of paved surfaces, has also been undertaken in several closely-settled areas.

### Signposting, Centre-line Marking, etc.

As in previous years, the Board provided a £3 for £1 subsidy on the cost of signposting carried out on main highways by automobile associations. The amount thus expended from the Main Highways Account for the year ended 31st March, 1941, was £3,408. Since its inception the Board has contributed a total of £30,170 towards this work.

### Advances to Local Authorities.

During the year under review the Board continued its policy of granting loans to local bodies for highways works. The amount involved was nearly three times that for the previous year. The number of loan agreements entered into was ten, covering an amount of £15,651, compared with seven agreements totalling £5,531 for the year 1939–40.

The total amount advanced to 31st March, 1941, was £317,271, the amount outstanding at that date being £73,573.

### Plant.

Local authorities again availed themselves of the facilities provided by the Board to acquire plant under the hire-purchase scheme, although only to about half the extent of the previous year. The total purchases for the year 1940–41 amounted to £23,252, as compared with £56,122 for the previous year.

Since the inception of the scheme, plant to the value of £367,542 has been purchased, of which amount £66,808 was outstanding at 31st March, 1941.

The items thus acquired during the year were: Graders, 9; trucks, 5; angle-dozers, 2; shovel, 1; crusher, 1; air compressor, 1; tractor, 1; and roller, 1.

Owing to the necessity of conserving overseas exchange, the Board continued its policy of declining the purchase of any machine where such exchange was involved, and advocated the acquisition of plant of local manufacture.

In addition to the foregoing, the Board purchased the following plant items for its own use: Diesel engines, 15; portable huts, 11; graders, 3; pump and motors, 3; scrapers, 2; dump wagons, 2; crane, 1; petrol engine, 1; fan and motor, 1; generating-set, 1; steam-hammer, 1; bitumen pre-heater, 1; spraying-machine, 1; mower, 1; pile-driver, 1; snow-plow, 1; winch, 1.

### Testing of Highways Materials.

In the petrological laboratory a considerable number of tests have been performed with the Los Angeles abrasion machine, principally with a view to obtaining all the information possible regarding the supplies of stone suitable for sealing-chips in each highways district. The results of representative tests are shown in Table 7. The machine is designed to combine the effects of abrasion and impact in one operation, and gives the result quickly and conveniently

The testing of bituminous materials was carried out by the Dominion Analyst, as in past years. Though the reduced sealing programme was reflected to some extent in the number of samples submitted, extra work was involved in some cases by the necessity of making and testing trial mixtures to enable all available materials to be utilized.

### Operations of Magnetic Truck.

During the year the Board's magnetic truck, used for clearing highways of iron or steel puncture-producing articles, operated on main highways for a period of about three months only, largely in the South Island. Early in the year it was decided to discontinue the use of the truck for the duration of the war, it being felt that, taking into consideration the urgent necessity of conserving petrol and the expense involved, the continued use of the truck under existing conditions was not warranted. After this decision was made the Air Department made use of the truck for the purpose of clearing nails, &c., from the buildings area and flying-fields adjacent to the following R.N.Z.A.F. Stations: Wigram, Harewood, Woodbourne, Rongotai (Stores Depot), Ohakea, New Plymouth, Whenuapai, and Hobsonville. Trentham, Papakura, and Ngaruawahia Military Camps were also swept.

The length of highways actually cleared was 1,323 miles, the weight of material picked up being 3,881 lb.

The average yield per mile was 2·9 lb., compared with 3·1 lb. for the previous year.

### Examination for Foremen and Overseers of Road-construction.

Owing no doubt to war conditions, only thirty candidates, as compared with seventy-three the previous year, sat for the fifteenth examination for Foreman and Overseers of Road Construction, held on 30th October, 1940.

Fifteen candidates sat for the paper on general road construction and maintenance only, eight for that on tar, bituminous, and concrete road construction only, and seven for both papers.

Of the seven candidates who sat papers Nos. 1 and 2, two were successful in passing both. Five candidates passed paper No. 1 only, while three passed paper No. 2 only. These three had previously been successful in passing paper No. 1, and thus completed the examination.

Certificates of Competency were awarded to all candidates who passed or completed the examination, the recipients being Messrs. A. Amos, C. W. Gray, E. M. Le Grice, G. P. McIntosh, and E. Sherson.

A certificate was also awarded to Mr. J. W. Weaver, who had completed the examination previously. The issue of a certificate earlier had been withheld while Mr. Weaver acquired more experience.

To date 141 certificates have been issued.

### Declarations and Revocations of Main Highways.

Owing to the heavy commitments against reduced highways funds arising from the immediate requirements of the existing highways system, only a very small mileage of new highways was declared during the year. A number of small adjustments were found necessary.

During the year also a general reorganization of highways, involving alterations in nomenclature, &c., was effected. State highways were declared under the names by which they are more generally known, routes of highways more clearly defined, especially in town districts and the smaller boroughs, terminal points shown more exactly, and mileages corrected.

The more important declarations of highways during the year ended 31st March, 1941, were:—

*Main Highways declared.*

| | Miles | ch. |
|---|---|---|
| No. 1 Highways District— | | |
| Blackbridge–Paihia .. .. .. .. .. .. | 8 | 57 |
| No. 2 Highways District— | | |
| McLennan main highway .. .. .. .. .. | 2 | 3 |
| No. 6 Highways District— | | |
| Bruce main highway .. .. .. .. .. .. | 2 | 5 |
| No. 9 Highways District— | | |
| Masterton–Wellington .. .. .. .. .. .. | 3 | 7 |
| Wellington–Paekakariki Centennial .. .. .. .. | 10 | 0 |
| Haywards–Paremata via Pahautanui .. .. .. .. | 6 | 40 |

Consequent on the completion of the new coastal route to Paekakariki, this road was declared a main highway, and subsequently classified as a State highway under the title "Wellington–Paekakariki Centennial State highway." The Paekakariki Hill route, formerly the State highway, was revoked, but later redeclared as an ordinary main highway. The Hutt Road between Ngahauranga and Petone was declared a main highway, and this length, along with the highway between Lower Hutt and Upper Hutt, was classified as part of the Masterton–Wellington State highway.

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 the Board's 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:

W. L. Newnham, Chairman.

## TABLE 5.—MAIN HIGHWAYS ACCOUNT.

STATEMENT SHOWING PARTICULARS OF NET EXPENDITURE ON CONSTRUCTION, RENEWALS, MAINTENANCE, &c., FOR THE YEAR ENDED 31ST MARCH, 1941, AND TOTAL TO DATE.

| | Construction and Improvement of Main Highways. | | Renewals of Main Highways. | | Maintenance, Repairs, &c. of Main Highways. | | Totals. | |
|---|---|---|---|---|---|---|---|---|
| | Total for Year 1940–41. | Total since Inception of Main Highways Act, 1922, to 31/3/41. | Total for Year 1940–41. | Total since 1/4/36 to 31/3/41. | Total for Year 1940–41. | Total since Inception of Main Highways Act, 1922, to 31/3/41. | Total for Year 1940–41. | Total since Inception of Main Highways Act, 1922, to 31/3/41. |
| Highway District— | £ | £ | £ | £ | £ | £ | £ | £ |
| No. 1 .. .. .. .. | 73,417 | *1,379,823* | 17,682 | *112,247* | 62,004 | *965,780* | 153,103 | *2,457,850* |
| No. 2 .. .. .. .. | 186,852 | *2,673,959* | 21,916 | *138,960* | 129,391 | *1,767,845* | 338,159 | *4,580,764* |
| No. 3 .. .. .. .. | 79,232 | *902,595* | 14,781 | *57,438* | 98,858 | *972,044* | 192,871 | *1,932,077* |
| No. 4 .. .. .. .. | 26,715 | *625,650* | 7,515 | *78,351* | 70,446 | *741,982* | 104,676 | *1,445,983* |
| No. 5 .. .. .. .. | 69,956 | *786,975* | 26,633 | *64,335* | 77,471 | *1,109,707* | 174,060 | *1,961,017* |
| No. 6 .. .. .. .. | 71,930 | *775,653* | 3,064 | *20,953* | 78,872 | *733,538* | 153,866 | *1,530,144* |
| No. 7 .. .. .. .. | 61,464 | *901,808* | 6,077 | *27,784* | 58,347 | *691,800* | 125,888 | *1,621,392* |
| No. 8 .. .. .. .. | 123,151 | *863,128* | 6,116 | *25,387* | 63,733 | *713,956* | 193,000 | *1,602,471* |
| No. 9 .. .. .. .. | 101,397 | *1,425,626* | 9,571 | *34,170* | 41,744 | *796,230* | 152,712 | *2,256,026* |
| No. 10 .. .. .. .. | 13,799 | *420,450* | 14,579 | *51,637* | 35,351 | *658,360* | 63,729 | *1,130,447* |
| Totals for North Island .. | 807,913 | *10,755,667* | 127,934 | *611,262* | 716,217 | *9,150,342* | 1,652,064 | *20,517,271* |
| No. 11 .. .. .. .. | 110,198 | *982,151* | 5,943 | *13,575* | 54,518 | *757,785* | 170,659 | *1,753,511* |
| No. 12 .. .. .. .. | 96,001 | *999,356* | 8,429 | *82,748* | 83,530 | *1,208,158* | 187,960 | *2,291,262* |
| No. 13 .. .. .. .. | 52,375 | *319,102* | .. | *192* | 30,487 | *335,535* | 82,862 | *654,829* |
| No. 14 .. .. .. .. | 69,690 | *825,817* | 2,154 | *5,731* | 36,263 | *527,033* | 108,107 | *1,358,581* |
| No. 15 .. .. .. .. | 29,851 | *504,780* | 3,466 | *9,389* | 34,447 | *598,122* | 67,764 | *1,112,291* |
| No. 16 .. .. .. .. | 78,363 | *788,404* | 2,205 | *12,362* | 38,138 | *472,581* | 118,706 | *1,273,347* |
| No. 17 .. .. .. .. | 63,120 | *818,751* | 4,679 | *11,840* | 27,052 | *430,645* | 94,851 | *1,261,236* |
| No. 18 .. .. .. .. | 123,755 | *975,697* | 6,102 | *28,168* | 46,172 | *550,481* | 176,029 | *1,554,346* |
| Totals for South Island .. | 623,353 | *6,214,058* | 32,978 | *165,005* | 350,607 | *4,880,340* | 1,006,938 | *11,259,403* |
| Totals for Dominion .. .. | 1,431,266 | *16,969,725* | 160,912 | *776,267* | 1,066,824 | *14,030,682* | 2,659,002 | *31,776,674* |

## TABLE 5.—MAIN HIGHWAYS ACCOUNT—*continued.*

### INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1941, AND TOTAL TO DATE.

| EXPENDITURE. | | Total for Year 1940–41. | Total since Inception of Main Highways Act, 1922, to 31/3/41. |
|---|---|---|---|
| | | £ | £ |
| Net expenditure on construction, renewals, maintenance, &c. (see separate statement) | | 2,659,002 | *31,776,674* |
| Administration— | | | |
| Administration expenses (including salaries, travelling-expenses, office rents, printing, stationery, postages, and miscellaneous expenses) | £ 189,797 | .. | *1,162,183* |
| Fees and travelling-expenses of members of the Main Highways Board other than Government members | 770 | .. | *20,175* |
| Miscellaneous expenses— | | | |
| Advertising, maps, rent of halls, traffic tallies, transport of samples, depreciation of furniture, &c. | 82 | .. | *6,198* |
| Compassionate grants to widows and relatives of deceased employees | .. | .. | *4,000* |
| Compensation under section 3, Public Works Amendment Act, 1925 | .. | .. | *1,015* |
| Exchange on remittances | 1,615 | .. | *9,705* |
| Grant to Transport Department towards Traffic inspection | 10,000 | .. | *42,906* |
| Petrological laboratory and other experimental work, Expenses of | 1,253 | .. | *14,251* |
| Total administration | | 203,517 | *1,260,433* |
| Loan charges— | | | |
| Charges and expenses of raising loans, management charges of Consolidated Stock on account of Construction Fund, &c. | 164 | .. | *72,830* |
| Interest on amount appropriated out of Public Works Fund and paid into Main Highways Account Construction Fund | 61,300 | .. | *674,300* |
| Interest on loans, recoupment to Consolidated Fund (section 4, Finance Act, 1919) | 314,500 | .. | *1,908,948* |
| Transfer to reserve for redemption of main highway securities | 1,647,080 | .. | *2,790,490** |
| Payment to local authorities in commutation of toll-gate charges (Finance Act, 1925, section 20) | 1,522 | .. | *31,724* |
| 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) | 25,786 | .. | *304,411* |
| Total loan charges | | 2,050,352 | *5,782,703* |
| Subsidies, &c., in respect of other than main highways— | | | |
| Municipal Corporations (Municipal Corporations Act, 1933, section 71) | 35,656 | .. | *309,101* |
| County Councils and other local authorities (Finance Act, 1930, section 37) | 177,980 | .. | *1,837,337* |
| Subsidies to County Councils for rebate to ratepayers (Finance Act (No. 4), 1931, section 45) | .. | .. | *253,893* |
| Subsidy on rates levied on farming land (Finance Act (No. 3), 1934, section 28) | *Cr.* 179 | .. | *364,252* |
| Maintenance and construction of roads giving access to outlying areas (Finance Act (No. 3), 1931) | .. | .. | *45,918* |
| Total subsidies | | 213,457 | *2,810,501* |
| Balance, being excess of income over expenditure, carried to general balance-sheet | | *Cr.* 67,450 | *468,738* |
| | | £5,058,878 | *£42,099,049* |

| INCOME. | | | Total for Year 1940–41. | Total since Inception of Main Highways Act, 1922 to 31/3/41. |
|---|---|---|---|---|
| | | | £ | £ |
| Loans raised under Main Highways Act, 1922— | | | | |
| Stock and Debentures issued— | | | | |
| At 3 per cent. interest | | | 1,746,000 | *5,491,725* |
| At 3½ per cent. interest | | | .. | *677,890* |
| At 3¾ per cent. interest | | | .. | *190,895* |
| At 4 per cent. interest | | | 17,605 | *1,442,937* |
| At 4½ per cent. interest | | | .. | *542,005* |
| Treasury bills and notes— | | | | |
| At various rates of interest | | | 1,046,975 | *2,605,000* |
| Securities redeemed, Loans Redemption Account | | | .. | *2,850,650* |
| Consolidated Fund—Public Debt Repayment Account | | | .. | *55,720* |
| | | | 2,810,580 | *13,856,822* |
| Finance Act, 1932, section 55—Premium on exchange | | | *Dr.* 121,875 | .. |
| Receipts under section 15, Finance Act, 1923, from Public Works Fund, General Purposes Account (at 5 per cent. interest) | | | .. | *1,226,000* |
| Income from— | | | | |
| Motor-registration licenses, fees, and fines (section 24, Motor-vehicles Act, 1924) | £ 579,058 | | | |
| *Less* Commission on collection by Post and Telegraph Department— | £ | | | |
| Motor-registration fees and licenses | 23,874 | | | |
| Fees for registration of change of ownership | 8,424 | | | |
| | | 32,298 | | |
| | | | 546,760 | *6,512,680* |
| Interest from investments | | | 439 | *218,408* |
| Interest from local authorities on plant purchased on their behalf | | | 3,530 | *34,375* |
| Interest on advances to local authorities | | | 2,913 | *40,009* |
| Mileage Tax (Finance Act, 1931–32 (No. 2), section 19) | | | 11,197 | *42,871* |
| Miscellaneous receipts | | | 10,653 | *15,749* |
| Motor-spirits tax (section 9, Motor-spirits Taxation Act, 1927) | | | 1,581,793 | *17,256,780* |
| Tire-duty (sections 13 and 14, Main Highways Act, 1922) | | | 62,888 | *2,533,273* |
| Transfer from Consolidated Fund (section 14, Main Highways Act, 1922) | | | .. | *210,000* |
| Rent of and tolls from ferries | | | .. | *2,082* |
| Temporary transfers from other accounts | | | 150,000 | *150,000* |
| | | | £5,058,878 | *£42,099,049* |

* 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, 1941.

| LIABILITIES. | — | Total. | ASSETS. | — | Total. |
|---|---|---|---|---|---|
| | £ | £ | | £ | £ |
| Excess of income over expenditure for 1940–41 | *Dr.* 67,450 | | Cash in Public Account— | | |
| *Add* Balance at 31/3/40 | 536,188 | | At call | | 15,931 |
| | | 468,738 | Sundry debtors— | | |
| Sundry creditors— | | | Public Works Department | 34,862 | |
| Public Works Department | 45,081 | | Other Government Departments | 4,199 | |
| Other Government Departments | 4,989 | | Non-departmental | 5,584 | |
| Non-departmental | 153,953 | | | | 44,645 |
| | | 204,023 | Advances to local authorities (Main Highways Amendment Act, 1926, section 2) | | 73,573 |
| Interest accrued on loans | | 68,389 | Motor-registration fees in hands of Postal Department | | 7,147 |
| Reserves for redemption of securities | | 249 | Interest due and accrued | | 2,285 |
| Writing-off in Suspense | | 4,414 | Buildings and land | | 78,567 |
| | | | Stocks of materials, tools, &c. | | 197,609 |
| | | | Furniture, fittings, &c.— | | |
| | | | Expenditure to 31/3/41 | 938 | |
| | | | *Less* depreciation to 31/3/41 | 672 | |
| | | | | | 266 |
| | | | Plant and equipment— | | |
| | | | For Main Highways Board— | | |
| | | | Expenditure to 31/3/41 | 636,157 | |
| | | | *Less* depreciation charged to works | 381,838 | |
| | | | | | 254,319 |
| | | | Purchased for local authorities— | | |
| | | | Expenditure to 31/3/41 | 350,739 | |
| | | | *Less* repayments of principal | 283,931 | |
| | | | | | 66,808 |
| | | | Amount transferred to Loans Redemption Account | 2,850,899 | |
| | | | *Less* amount utilized for redemption of securities | 2,850,650 | |
| | | | | | 249 |
| | | | Stocks Deficits Account | | 4,414 |
| | | £745,813 | | | £745,813 |

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.
W. L. NEWNHAM, 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.—CYRIL G. COLLINS, Controller and Auditor-General.

TABLE 6.—LENGTHS OF HIGHWAYS AT 31ST MARCH, 1941.

| 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 .. .. | 97 27 | 742 51 | .. | 839 78 |
| 2. Auckland South .. .. | 690 3 | 821 28 | 3 0 | 1,514 31 |
| 3. Tauranga .. .. | 134 75 | 332 19 | 243 53 | 710 67 |
| 4. Gisborne .. .. | 108 32 | 288 40 | .. | 396 72 |
| 5. Napier .. .. .. | 266 57 | 468 68 | .. | 735 45 |
| 6. King-country .. .. | 61 29 | 538 31 | 4 50 | 604 30 |
| 7. Taranaki .. .. | 362 7 | 111 30 | 0 60 | 474 17 |
| 8. Wanganui .. .. | 190 40 | 342 26 | 0 63 | 533 49 |
| 9. Wellington West .. | 295 30 | 227 29 | .. | 522 59 |
| 10. Wellington East .. .. | 170 16 | 334 25 | .. | 504 41 |
| Totals, North Island .. | 2,376 76 | 4,207 27 | 252 66 | 6,837 9 |
| 11. Nelson .. .. .. | 115 32 | 560 45 | 6 41 | 682 38 |
| 12. West Coast .. .. | 85 53 | 487 25 | .. | 572 78 |
| 13. Canterbury North .. | 73 56 | 318 14 | .. | 391 70 |
| 14. Canterbury Central .. | 247 41 | 514 40 | .. | 762 1 |
| 15. Canterbury South .. | 199 2 | 635 13 | .. | 834 15 |
| 16. Otago Central .. .. | 153 57 | 688 72 | .. | 842 49 |
| 17. Otago South .. .. | 123 0 | 406 17 | .. | 529 17 |
| 18. Southland .. .. | 100 46 | 828 27 | .. | 928 73 |
| Totals, South Island .. | 1,098 47 | 4,439 13 | 6 41 | 5,544 21 |
| Totals, Dominion .. | 3,475 43 | 8,646 40 | 259 27 | 12,381 30 |
| *Summary.* | | | | |
| State highways .. .. | 2,011 68 | 1,828 28 | 150 4 | 3,990 20 |
| Main highways .. .. | 1,463 55 | 6,818 12 | 109 23 | 8,391 10 |
| Total .. .. | 3,475 43 | 8,646 40 | 259 27 | 12,381 30 |

## Table 7.—Tests of Stone completed during the Year ended 31st March, 1941.

*Abrasion Tests by the Los Angeles Machine.*

(Tests carried out between 1st April and 30th June, 1940, were recorded in the last annual report and are therefore omitted).

Gradings of test-samples are: A, 1½ inches to ½ inch; B, ¾ inch to ⅜ inch.

The Board's Standard Specifications require that the abrasion loss shall not exceed the following figures: Base-course metal, 65 per cent.; top-course, 50 per cent.; sealing-chips, 20 per cent.

| Locality. | Grading. | Percentage of Loss. | Geological Classification. |
|---|---|---|---|
| Port Mapua, Nelson | B | 50·80 | Marble. |
| Patutahi Quarry, Cook County | A | 28·38 | Limestone. |
| Patutahi Quarry, Cook County | B | 28·88 | Limestone. |
| Motuhora Quarry, Cook County | B | 26·68 | Greywacke, shaly. |
| Brynderwyn, Whangarei District | B | 13·78 | Greywacke. |
| Taipa, Whangarei District | B | 29·00 | Hornblende andesite. |
| Larmer's Road, Whangarei District | B | 26·18 | Greywacke. |
| Green Hill, Whangarei District | B | 24·20 | Augite diorite. |
| Bald Rock, Whangarei District | B | 25·22 | Trachyte. |
| Te Paki, Whangarei District | A | 24·72 | Greywacke. |
| Te Kao, Whangarei District | A | 29·04 | Greywacke, slaty. |
| Waiapu River, Gisborne | B | 18·46 | Greywacke. |
| White's Bay, Blenheim | B | 11·88 | Quartzite. |
| Fox's Island, Renwicktown | B | 15·36 | Quartzite and Greywacke. |
| Wangamoa River, Nelson | B | 16·18 | Greywacke. |
| Matthew's Quarry, Papamoa | B | 21·52 | Pyroxene andesite. |
| Duncan's Quarry, Papamoa | A | 20·30 | Pyroxene andesite. |
| P.W.D. Quarry, Athenree | A | 38·90 | Hornblende andesite. |
| Tauranga County Quarry, Athenree | B | 19·78 | Pyroxene andesite. |
| Wangamoa River, Nelson | A | 13·56 | Greywacke and andesite. |
| Wangamoa River, Nelson | B | 13·70 | Greywacke and andesite. |
| Motueka Borough Pit, Hursthouse Street | B | 18·88 | Greywacke, andesite, and sandstone. |
| Waipara County Quarry | A | 13·54 | Greywacke. |
| Cobden Beach | A | 15·70 | Greywacke and some sandstone. |
| Cobden Beach | B | 15·72 | Greywacke and some sandstone. |
| Nelson Creek, Grey County | A | 21·64 | Greywacke and sandstone. |
| 17-Valley Stream, Blenheim | A | 26·94 | Greywacke and sandstone. |
| Hunua Gorge, Papakura | A | 10·58 | Greywacke. |
| Hunua Gorge, Papakura | B | 10·02 | Greywacke. |
| Kakariki, Rangitikei River | B | 16·12 | Greywacke. |
| Totara Flat | A | 23·80 | Greywacke, quartz, &c. |
| North Beach, Greymouth | B | 15·56 | Greywacke, quartz, &c. |
| P.W.D. Quarry, Western Springs, Auckland | A | 23·94 | Basalt-scoria. |
| P.W.D. Quarry, Western Springs, Auckland | B | 23·62 | Basalt-scoria. |
| Waitakere Scenic Drive, Auckland | A | 37·26 | Melaphyre. |
| Waitakere Scenic Drive, Auckland | B | 37·00 | Melaphyre. |
| Ferndale Road Quarry, Mount Wellington | B | 22·52 | Basalt, soft. |
| Smeed's Quarry, Tuakau | A | 11·88 | Basalt, nepheline. |
| Smeed's Quarry, Tuakau | B | 10·86 | Basalt, nepheline. |
| Stevenson's Quarry, Runciman | A | 37·02 | Greywacke, fine grain, partly decomposed. |
| Gulland's Quarry, Mangatawhiri, Pokeno | A | 25·90 | Greywacke. |
| Smale's Quarry, Takapuna | A | 24·14 | Basalt, soft. |
| Winstone's Quarry, Mount Wellington | B | 28·14 | Basalt, scoriaceous. |
| Omahu Shingle Co., Napier | B | 16·32 | Chiefly greywacke. |
| Birkenhead Borough Quarry, Takapuna | B | 14·54 | Basalt. |
| Wellington Pipe Co., Hutt River | B | 13·06 | Greywacke. |
| Palmer's Quarry, Dunedin | B | 21·44 | Basalt. |
| Neuchatel Co., Sockburn | B | 14·82 | Greywacke. |
| Eltham Borough Council | B | 40·96 | Andesite. |
| Waiocka Quarry, 7m., Tauranga District | A | 19·22 | Andesite. |
| Nukuhou Quarry, 7m., Tauranga District | A | 34·46 | Andesite and sandstone. |
| Tirohia Quarry, Paeroa | A | 17·50 | Andesite. |
| Pitangi, Wanganui River | B | 22·14 | Largely andesite. |
| Kapuni River, Hawera County | A | 39·64 | Basalt-scoria. |
| Hauraki Plains County Council: Orongo-Netherton main highway | A | 19·84 | Hornblende andesite. |

Other tests were made by sieve analysis, and for tension, lineal shrinkage, and soil constants of surface- and sub-grade materials.

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