1950

NEW ZEALAND

MINISTRY OF WORKS STATEMENT

(BY THE HON. W. S. GOOSMAN, MINISTER OF WORKS)

MR. SPEAKER,—

As the Government did not take office until December last this year's reports in the main refer to works commenced during the previous Government's term of office. Such being the case it has been considered desirable that reference to those works, in so far as detailed comment is concerned, be confined to the reports which form the Appendices attached to this Statement. My personal concern is more in connection with policy, and my statement, therefore, will be confined in the main to this.

Since taking control of the Ministry of Works I have endeavoured to inspect not only the major projects which so frequently come before the public through the press, but also to visit as many districts as possible and to see for myself the many works of lesser magnitude which mean so much to the districts in which they are situated. These visits have given me an excellent opportunity of examining the activities of the Ministry of Works in its various fields and inspecting works being undertaken by local bodies. These visits have further enabled me to meet representatives of numerous local authorities, interested organizations, and individuals, and to discuss with them their needs and problems in the localities in which these occur.

It is evident that the Government is faced with a formidable task in endeavouring to overcome arrears of construction and to satisfy the demands being placed upon it from all quarters for works and buildings of every description. Unfortunately, many are prone to believe that these demands can be satisfied at once, but each year's programme must be related to the physical resources available and, further, must take cognizance of the funds available to the Government for capital construction work. These factors prevent decisions being given which would be pleasing and acceptable to all sections of the community. However, I have been careful to point out the limitations, financial and otherwise, which must be placed upon the construction programme if this is to maintain a reasonable balance with other expenditure to which the Government is committed.

By direction of the Right Hon. the Prime Minister and Minister of Finance a complete examination of the whole capital works programme was undertaken by the Ministry of Works, in association with Treasury, very shortly after the present Government took office. The proposals of all State Departments were closely examined together with all other proposals involving, directly or indirectly, the expenditure of State funds. Due allowance was made for commitments made by the outgoing Government and for works already commenced. It has been found necessary to defer many works which are in themselves desirable but which could not, from a national point of view, be considered as immediately essential. The deferment of these does not mean that they will be indefinitely postponed, but that they will come up for annual review with each year's construction programme and will be commenced as soon as conditions permit.

I have found Mr. Speaker, in going round the country, proposals advanced for developmental works of all descriptions put forward by local authorities and interested organizations without much consideration as to how these were to be financed. There has been in the past an undue reliance on the central Government. So far as local authorities are concerned I have endeavoured to point out to them that if local government in the country is to function properly local bodies must be prepared to accept greater responsibility for the works they put forward.

The Government is committed to an exceedingly heavy construction programme and, in considering works which it must carry out itself, as distinct from those of local authorities and private individuals, it is of great importance that the Government should not draw upon the limited construction potential to the detriment of these other interests. Failure to equate works rationally over the whole field of construction to the resources available to carry them out has resulted in many difficulties confronting the country at the present time.

No curtailment of major Government undertakings commenced is contemplated. These will be pushed to completion as vigorously as resources available will permit, and in this connection a special attempt will be made to accelerate the programme of hydro-electric work with a view to bringing, as soon as this is practicable, the supply of electric power more in step with the demand. There are many other works which it is recognized are necessary for the proper development of the country, and these I have already indicated will receive the fullest consideration by the Government in each year's annual review.

Housing requires some special mention. It is the policy of my Government to encourage people to own their own homes and increased facilities to enable them to do this have been made available. Having regard to the fact that our economy depends in the main on our primary production, the Government is anxious that more houses should be built in the rural areas and in the smaller towns and is taking the necessary steps to ensure that an improvement of the housing position in these areas is secured. At the same time the Government is conscious of the fact that there still remains much to be done to overtake the existing acute shortage of housing accommodation in the larger centres. The construction of State houses will be continued, but the Government hopes that, by making available to individuals and to building organizations land near the larger centres, there will be sufficient inducement for private interests to build homes instead of the Government accepting such a heavy responsibility in this particular field.

I should here mention the need for the clearance of slums in our major cities. This is long overdue. It is a matter in which the Government is particularly concerned and on which discussions with local bodies have already commenced. It is intended that the State's responsibility should be limited to financial assistance and that the planning and actual work of demolition, rebuilding, and rehousing of displaced persons should be the responsibility of the local authorities. I am sure that the Government's intentions in this direction will have the whole-hearted support of local bodies and the general public.

In the course of my inspections, and these have been made in some detail, I have met the principal officers of the Ministry of Works and have paid particular attention to the departmental organization in all its aspects. It is evident that since the end of the war the Commissioner of Works and his staff have worked under the greatest difficulties in endeavouring to meet the demands placed upon the Department during a period of serious man-power and material shortages. In spite of this I consider that the Department has coped with its post-war difficulties very successfully. I have been much impressed with the enthusiasm of the officers I have met and with the ability which they show in tackling the many problems connected with the programme of work now under way.

The activities of the Ministry of Works cover a wide and diverse field involving the expenditure of large sums of public money. In the post-war period it has admittedly been very difficult to estimate costs ahead and to control expenditure once works were commenced. These difficulties still exist, but it is hoped that with a programme of work more closely related to the resources available that some stability in this matter can be reached and this alarming upsurge of costs arrested.

Although much of the Department's work is carried out by contract, I feel that there is a need for further extension of this policy. Other major works now being undertaken by the Department's own labour force should be opened up to competition by public tender as soon as circumstances permit, and the Department's labour force limited to that required for works of a maintenance character and to such other works which for various reasons cannot be submitted to public tender. With this change of policy I am sure the whole resources which can be made available to the Government will be used to greater advantage.

FINANCE

The payments and receipts in connection with the Public Works Account and other associated votes and accounts for the year 1949–50 are shown in the tabulation following.

The expenditure administered through the Ministry of Works for the year reached a total of £31,660,165. In addition, a sum of £4,564,603 was expended from the Public Works Account by other Departments—*i.e.*, £2,228,091 Forest Development and £2,336,512 on Education Buildings. The miscellaneous receipts and recoveries by the Ministry of Works amounted to £8,737,978.

Class of Work.	Expenditure 1949–50.
EXPENDITURE, PUBLIC WORKS ACCOUNT	£
Railway construction	365,087
Housing construction	10,709,616
Public buildings	1,096,958
Education buildings	2,336,512
Lighthouses and harbour works	20,238
Roads	464,649
Soil conservation and rivers control	602,193
Irrigation, water-supply, and drainage	283,756
Highways construction	2,342,139
Forest development	2,228,091
	20,449,239
Electric Supply Account: Construction (Ministry of Works)	3,887,046
	24,336,285
EXPENDITURE, OTHER VOTES AND ACCOUNTS	
Consolidated Fund—	
Highways—	
Maintenance, repairs, and renewals	3,275,640
Administration, plant, and miscellaneous expenditure	528,160
Permanent appropriations (rate subsidies, &c.)	336,212
Salaries and expenses, Ministry of Works	1,249,238
Maintenance, public buildings, roads, &c.	983,932
Plant, material, and miscellaneous services	5,478,620
Other accounts (expenditure by Ministry of Works): Amounts not included above	36,681
Total, other votes and accounts	11,888,483
Grand total of expenditure, Public Works Account and other votes and accounts, for the year ended 31st March, 1950	36,224,768

Class of Work.	Receipts.
RECEIPTS,* MINISTRY OF WORKS	£
Departmental receipts, vote, "Maintenance of Public Works and Services"	5,957,862
Highways Maintenance, Miscellaneous receipts	287,685
Miscellaneous receipts for year—	
Ministry of Works	205,376
Housing	14,397
Irrigation receipts for year	37,178
Electric Supply Account: Miscellaneous receipts (Ministry of Works)	246,845
Public Works Account—	
Ministry of Works	1,988,635
Other Departments	774,365
	9,512,343

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

Summary

——	Ministry of Works.	Other Departments.	Total.
	£	£	£
Expenditure	31,660,165*	4,564,603	36,224,768
Recoveries and receipts	8,737,978	774,365	9,512,343

* Includes Housing Construction, £10,709,616.

The ratio which Ministry of Works receipts and expenditure bear to the whole is shown below—

	£	Per Cent.
Roads, including construction and maintenance of main and State highways	6,946,800 =	17·20
Hydro-electric (construction by Ministry of Works)	3,887,046 =	9·62
Railway construction and improvements to open lines	396,154 =	0·98
Housing construction	10,709,616 =	26·51
Public buildings, including purchase of land	1,096,958 =	2·71
Soil conservation and rivers control	602,193 =	1·49
Irrigation, water-supply, and drainage	283,756 =	0·70
Public buildings and roads, &c., maintenance	983,932 =	2·44
Plant, material, and services, other Departments	5,478,620 =	13·56
Miscellaneous	1,275,090 =	3·16
Miscellaneous receipts, &c. (Ministry of Works)	8,737,978 =	21·63
	£40,398,143 =	100·00

Summary of Votes Under the Control of the Ministry of Works for the Year Ending 31st March, 1951

Vote.	Public Works Account.	Consolidated Fund.	Total.
	£	£	£
Railway Construction	579,000	..	579,000
Housing Construction	10,600,000	..	10,600,000
Public Buildings	1,250,000	..	1,250,000
Lighthouses and Harbour-works ..	..	..	..
Roads, &c.	540,000	..	540,000
Soil Conservation and Rivers Control ..	592,500	..	592,500
Irrigation, Water-supply, and Drainage	450,000	..	450,000
Highways Construction	1,750,000	..	1,750,000
Highways Maintenance	..	4,300,000	4,300,000
Maintenance of Public Works and Services	..	8,900,000	8,900,000
	15,761,500	13,200,000	28,961,500

I submit with my report a statement of expenditure for the financial year ended 31st March, 1950 (Appendix A), certified by the Controller and Auditor-General as provided for under section 8 of the Public Works Act, 1928, and the annual reports of the Commissioner of Works (Appendix B), Engineer-in-Chief (Appendix C), Government Architect (Appendix F), and Director of Housing Construction (Appendix G). In addition, there are submitted in compliance with section 24 of the Main Highways Act, 1922, the annual report of the Main Highways Board (Appendix D) and also, in accordance with section 33, subsection (2) of the Soil Conservation and Rivers Control Act, 1941, the annual report of the Soil Conservation and Rivers Control Council (Appendix E) for the same financial year.

W. S. GOOSMAN, Minister of Works.

APPENDICES

TO THE

MINISTRY OF WORKS STATEMENT, 1950

APPENDIX A

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS OUT OF THE PUBLIC WORKS ACCOUNT FOR THE YEAR 1949–50

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

Ministry of Works, Wellington,
13th June, 1950.

SIR,—

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

I have, &c.,
W. S. GOOSMAN,
Minister of Works.

The Controller and Auditor-General, Wellington.

STATEMENT OF EXPENDITURE ON ALL WORKS AND SERVICES CHARGEABLE TO THE PUBLIC WORKS ACCOUNT FOR THE YEAR 1949–50

	Appropriation.	Expenditure.		
	£	£	s.	d.
Railway construction	405,000	365,087	9	6
Housing construction	9,850,740	10,708,619	15	5
Public buildings	1,050,000	1,096,957	18	0
Education buildings	2,250,000	2,336,512	8	1
Lighthouses and Harbour-works	50,000	20,237	11	0
Roads	475,000	464,649	2	4
Soil conservation and rivers control	580,000	602,192	10	11
Irrigation, water-supply, and drainage	312,800	283,755	19	8
Highways construction	2,500,000	2,342,139	4	10
Forest development	2,300,400	2,228,091	8	5
Christmas Island phosphate rights	125,000	..		
Unauthorized expenditure: Services not provided for	..	995	19	1
	19,898,940	20,449,239	7	3

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, Chief Accountant.
E. R. MCKILLOP, Permanent Head.

The Statement of Expenditure charged to the Public Works Account has been examined and found correct.—J. P. RUTHERFORD, Controller and Auditor-General.

APPENDIX B

ANNUAL REPORT OF COMMISSIONER OF WORKS

The COMMISSIONER OF WORKS to the Hon. the MINISTER OF WORKS.

SIR,—

I have the honour to submit my annual report for the year ended 31st March 1950. Post-war difficulties of man-power and materials, referred to in previous annual reports, have continued. The material supply position, though in certain directions still difficult, has, however, improved somewhat and better progress has been possible on the majority of our larger undertakings.

In accordance with Cabinet direction, the demands of all State Departments for works expenditure were submitted to this office for examination and for preparation of the annual works programme. These totalled approximately £47,000,000 and were stated by Departments as representing only their immediately essential works and as being much short of their accumulated requirements. These demands were considered within the limits of finance, man-power, and materials available and, after a full discussion with all the Departments involved, a final programme of work, estimated to cost £36,000,000 was approved. This programme included capital works to the value of £29,500,000 and provision for works of a maintenance character of £6,500,000. As has been the case since the war, the bulk of the finance provided for expenditure on housing, hydro-electric development, highways and roads, land and forest development, education and public buildings, railway construction and improvements, irrigation, water-supply, and rivers control. The value of work completed during the year closely approximated the total sum appropriated, and from the point of view of work done the year under review has been the best since the end of the war.

For the current year it is estimated that the works programme will incur an expenditure in excess of that expended during 1949–50, resulting in the main from :—

(*a*) Commitments entered into prior to 31st March, 1950.

(*b*) Increase in labour and material supplies.

(*c*) Increased costs.

The total labour forces engaged on works coming under the direct control of the Ministry of Works has increased during the year from 17,303 to 18,159. The number employed on housing, and included in these figures, showed a slight decrease—viz., 6,450 to 6,230, whereas the labour force on other buildings, engineering, and other works increased from 10,853 to 11,929.

A comparison between the Department's pre-war and present labour forces is of some interest:—

	31st March, 1939.	31st March, 1950.
Housing	4,156	6,230
Hydro-electric development	1,344	2,247
Highways and roads	11,702	4,779
Public buildings	1,888	939
Railways	2,445	301
Aerodromes	1,503	1,088
Irrigation	656	120
Other works	2,690	2,455
Totals	26,384	18,159*

* Includes 822 employees in the Pacific Islands.

It will be noted that there is a considerable increase on hydro-electric development works. It is very necessary that the labour force on these works should be increased still further, and it is hoped that the present immigration policy will do something to meet this demand.

There has been some improvement in material supply. Steel, which less than a year ago was holding up progress on many projects, is now available in reasonable tonnages. The main source of supply is the United Kingdom and, no doubt, we will continue to get most of our supplies from Britain for some time as supply from Australia is still very restricted and shows little improvement. This is to be regretted as supplies from Australia can be landed in New Zealand at one-half the cost of those obtained elsewhere.

Cement still remains a critical material as the production from the three New Zealand works is quite inadequate to meet the present demand. Sterling funds have had to be used to bring cement in large tonnages from the United Kingdom. During 1949, 27,800 tons were imported, and Cabinet has approved the importation of 101,000 tons during 1950, of which 17,000 tons had been delivered prior to the close of the past financial year. By the end of the present calendar year, and including last year, sterling funds exceeding £1,100,000 will have been so expended. These figures convincingly prove the value of the local cement industry to the Dominion and the loss which the Dominion as a whole is suffering because, for various reasons, the local cement-works are not yet in a position to cope with this demand. Proposals for the extension of the existing works are now well in hand and there is, in addition, a proposal to commence manufacture of cement on the west coast where the requisite materials are located close to the source of coal supply. No assistance in this direction is expected for at least two years and it will probably be longer before local production can supply a demand which is increasing rapidly.

There have been, in parts of New Zealand, serious shortages in the supply of bricks. The position here is being currently examined. Although timber has generally been in much more plentiful supply, there have been, and still are, shortages of certain lines of finishing timber.

The total number of building permits authorized during the year was 49,127. Classification and comparison with the corresponding figures for the previous year are stated hereunder:—

	Year Ended 31st March, 1950.	Year Ended 31st March, 1949.
(*a*) State and other Government housing	4,376	4,652
(*b*) Private housing	10,412	11,878
(*c*) Housing additions	8,313	8,680
(*d*) Works and buildings other than housing	26,026	24,085
	49,127	49,295

Type of Work.	Permits Authorized.		Applications Deferred.	
	Number.	Value.	Number.	Value.
		£		£
Engineering	29	65,975	..	..
Hospitals	87	1,297,620	1	1,450
Schools	297	1,256,285	16	65,177
Other Government	571	2,279,350	10	261,139
Local Bodies	190	701,602	11	282,700
Commercial	3,865	4,305,429	346	1,707,607
Factories	484	1,331,242	86	576,270
State housing	3,899	7,044,439	..	..
Other Government housing	477	760,250	..	..
Rehabilitation Department	216	417,092	..	..
Private housing	10,196	16,418,581	133	200,938
Housing additions	8,313	1,920,302	90	26,510
Community buildings	670	824,688	55	320,979
Farm buildings	3,689	740,828	26	3,850
Maintenance—				
Buildings	1,977	245,112	16	8,105
Other works	21	2,537	..	..
Miscellaneous	14,146	1,158,278	312	37,819
Total	49,127	40,769,610	1,102	3,492,544

The value of permits issued for housing and housing additions was £26,560,664 (65·1 per cent.) and for other buildings and works £14,208,946 (34·9 per cent.). The total value of applications deferred during the year was £3,492,544. The corresponding figures for the previous financial year were £28,202,603 (71·3 per cent.), £11,354,619 (28·7 per cent.), and £5,554,077 respectively.

There still exists a considerable backlog of deferred applications for industrial and commercial buildings much of which is in the highly essential category. The deferment of these has an adverse effect on the expansion of local industry and business interests are embarrassed by not being able adequately to house their expanding staffs. The figures given above, however, indicate that during the year just closed more favourable consideration has been given to the issue of building permits in this category. No doubt in the ensuing year a further easing of restrictions in this field can be made possible.

The following statement shows the number and value of contracts let during the year (State housing excluded) and also includes the corresponding totals for the previous financial year :—

——	Year Ended 31st March, 1950.						Year Ended 31st March, 1949.
	Buildings (Includes Alterations, &c.)		Engineering.		Total.		
	Number.	Value.	Number.	Value.	Number.	Value.	Total Value.
		£		£		£	£
District Tenders Board—							
Auckland	27	33,244	39	80,641	66	113,885	168,599
Hamilton	46	38,619	41	61,780	87	100,399	64,798
Napier	19	15,220	34	64,723	53	79,943	63,400
Wanganui	39	36,988	27	47,695	66	84,683	64,960
Wellington	101	104,297	32	59,892	133	164,189	141,446
Christchurch	65	83,159	47	66,428	112	149,587	145,791
Dunedin	47	37,228	49	93,218	96	130,446	96,405
Totals for district Boards	344	348,755	269	474,377	613	823,132	745,399
Tenders Board, Head Office	37	579,587	96	1,633,954	133	2,213,541	2,150,020
Grand totals	381	928,342	365	2,108,331	746	3,036,673	2,895,419

The reports of the Engineer-in-Chief and of the General Manager of the State Hydro-electric Department cover amply the progress made in the field of hydro-electric construction. Considering the many problems which have had to be overcome, progress during the year can generally be considered as satisfactory although we are still embarrassed on account of technical staff and in getting man-power into the remote parts of the country where these works are, in general, located. There have been inquiries from a number of large overseas contracting firms during the year and representatives of some of these have visited New Zealand. It is felt, however, that the opening of these major works to overseas tender must depend upon the overtaking of the arrears of design with which we are still faced, in order that the requisite plans and specifications may be available. The position in this respect is better than it has been but is still affected by shortage of trained staff.

Dr. J. L. Savage, late of the United States Bureau of Reclamation, visited New Zealand during the year and reported upon all major projects under construction and scheduled for commencement in the near future. Dr. Savage's reports have already been well publicized and it is sufficient to say that, in general, he endorses the methods adopted by our own engineers.

Sir William Halcrow, late President of the Institution of Civil Engineers in Great Britain, and Mr. J. P. Thomas, late Chairman of the London Transport Advisory Committee, visited New Zealand during the year at the invitation of the Government for the purpose of reporting on the proposed railway improvements in the Auckland metropolitan area and the surrounding district. Their full report was received towards the end of the financial year and contains a number of far-reaching recommendations involving considerable expenditure, and is still under review by the Ministry of Works and the Railways Department. To some extent the report must be related to proposals being put forward by the General Manager of the Railways for electrification of the railway system in that area. As soon as the joint review is completed recommendations will be made to the Government.

Arising originally from the proposal to establish a State pulp and paper project at Murupara, the Ministry of Works has continued with the investigation of the railway and harbour facilities required. The investigations covering the selection of a port on the east coast are now nearing completion.

Following the recommendations of the Government geologist that a full exploration of our thermal areas should be made in order to ascertain their potentialities for power supply, work commenced on this at the beginning of the year and is now being prosecuted vigorously. An area in the vicinity of Wairakei has been selected for preliminary investigation and boring is well in hand. So far the results have not been discouraging, but there are several problems to be overcome before it is possible to define, with any assurance, the prospects of obtaining electric power from this source.

Full details of all investigations, together with essential basic information, is now in the hands of Messrs. Freeman, Fox, and Partners, who were selected by the Government to carry out the design of the Auckland Harbour Bridge. There are, however, a number of problems still to be settled, but the preparation of the preliminary drawings is now well in hand and it is hoped to have these early in the current year.

In view of the fact that the principal airports have a local as well as national significance, negotiations have been commenced with the City Councils in Wellington and Christchurch, with a view to their finding a portion of the cost of providing aerodrome facilities in these two places. These negotiations will be continued when the sites for other principal aerodromes are finally determined, and should result in the Government being relieved of a substantial part of the considerable financial expenditure necessary to establish adequate air facilities at the principal centres.

In the main this report deals with questions of an over-all interest to the construction industry, and it should not be concluded without some special reference to the question of rising costs. An analysis made at your direction recently, of the cost of house building, shows that an average house has increased in cost between 1939 and 1950 by 75 per cent.

In other fields of construction the rise in costs is even greater. There are many contributing factors. Award rates of pay have risen by 40 to 50 per cent., and the acute shortage of labour over such a long period has introduced such competition for labour that the resulting actual rates of wages paid range very much above these levels. Improved conditions of employment including minimum wage payments, holiday pay, and travelling-time, together with much overtime at penal rates, payment of board money and bonuses, have all made noticeable contributions to increased costs. There is also a serious shortage of skilled tradesmen in certain categories producing bottle-necks in production, and all works have been slowed up because of the general shortage of labour, skilled and unskilled. Again, material costs increases vary considerably and range between 60 and 300 per cent. higher than pre-war. Material shortages have nullified pre-planning of work and have caused loss of working time and longer contract periods, resulting in added capital charges and higher overhead costs.

It can be seen that here, as in most other parts of the world, the building and construction industry has been heavily over-committed during the post-war years, resulting in much reduced competition when works are put out to tender. There is no clear-cut solution to the problem until the demand is more nearly equated to the building potential available. This will not take place while private people and commercial and industrial organizations have money to invest in housing and building projects, and an unsatisfied demand for these exists, and at the same time the State is endeavouring to overtake arrears of Government buildings and to provide for an expanding population. Some relief would no doubt be obtained by the selection from abroad of people in trades which are not fully manned in New Zealand, and from the increasing availability of materials. Recent information received from Great Britain shows that there, housing costs are now two and a half times pre-war figures, whilst in the United States construction costs generally have been doubled.

Throughout the year all the building and developmental proposals involving the expenditure of State funds have been reviewed by this office, working conjointly with Treasury and with the Department concerned. In this respect I wish to express appreciation of the co-operation this office has had from all State Departments and from Treasury in discharging this difficult responsibility.

The total staff as at 31st March, 1950, was 3,899, made up of 3,327 permanent officers and 572 temporary staff personnel. The corresponding figures at 31st March, 1949, were 3,573 total staff, comprising 3,124 permanent officers and 449 temporary staff. These figures disclose an increase of 326 during the year, due largely to the transfer to staff status of categories of employees previously regarded as casual and not included in previous staff returns.

During the year Mr. F. H. M. Hanson was appointed to the position of Assistant Commissioner of Works and Mr. R. L. MacPhail was appointed Assistant Director of Housing Construction. Mr. R. B. Hammond, Director of Housing Construction took over the duties of Building Controller in place of Mr. MacPhail.

The only senior officer to retire during the year was Mr. G. A. Swanger, District Supervisor, Housing Division, Palmerston North, who was replaced by Mr. T. A. Parsons. Mr. J. V. Jebson, District Supervisor, Christchurch, was appointed to a similar position in Auckland and Mr. H. S. Sherbrooke, District Supervisor, Napier, was appointed to Christchurch. Mr. E. M. Gabites was appointed to the vacant position in the Napier office. Mr. G. D. Dawson was appointed District Architect, Wellington.

During the year several engineers, architects and draughtsmen from the United Kingdom accepted positions with the Department and have already commenced duty. Further similar appointments are in hand, but the numbers offering fall short of the number required to bring the technical staff up to the required strength.

In conclusion, I wish to take the opportunity of expressing to the principal officers and to the whole staff of the Ministry of Works, my appreciation of the great assistance rendered by them throughout the year.

E. R. McKillop,
Commissioner of Works.

APPENDIX C

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

The ENGINEER-IN-CHIEF to the Hon. the MINISTER OF WORKS.

SIR,—

I have the honour to submit the following report on engineering works completed and in progress during the year ended 31st March, 1950:—

RAILWAYS

Auckland Metropolitan Railways.—Sir William Halcrow and Mr. J. P. Thomas, two English experts, the former in engineering and the latter in transportation, were engaged by the Government to report and make recommendations concerning alternative proposals dealing with the problem of passenger transport in the Auckland metropolitan area. They visited New Zealand towards the end of 1949, and completed their investigations and submitted an interim report before leaving the Dominion in November. It was agreed that their final report should be made upon their return to London. Although this had not arrived by the end of the year under review, advice was to hand that it was in course of transit to New Zealand.

During the year, field-work required for the purpose of the report was carried out.

Paeroa–Pokeno Railway.—The fencing of a portion of the reserve (238 chains) has been carried out, and 456 ft. of 12-in.-diameter culvert pipes have been installed. Twenty private crossings have been formed and metalled. The existing formation was maintained throughout the year.

Edgecumbe–Murupara Railway.—The permanent-line survey of 30 miles 26 chains of this railway was completed during the year. This completes the survey to 35m. 26ch with the exception of a 5-mile gap through the heavy plantation, on which work is now in hand.

The work still remaining consists of borings to ascertain the amount, if any, of rock which will be encountered in the formation, and the survey of a number of level crossings and small road deviations where roads cross the line of railway.

Plans of 30 miles of line have been drawn and are being checked and traced.

Putaruru–Reporoa Railway.—Work on the 19-mile section from Putaruru to Kinleith (Wawa Road) has continued. Formation, platelaying, and ballasting (except final lift) have been completed to Lichfield, at 5m. 15ch. Platelaying and final lift ballasting are being undertaken by the Railways Department. The target date for the opening of this section to traffic is June, 1950.

Ahead of Lichfield, formation is complete except for several rhyolite cuttings and the fillings over two large mass-concrete arched culverts. These are now the key to completion to Kinleith.

During construction a wet volcanic pug was met with in several cuttings. This held up progress for a time and, the material being unsuitable for use in banks, had to be run to waste; other suitable material had to be borrowed to complete the banks.

The permanent-line plans for the whole of the Putaruru–Kinleith section have been completed.

East Coast Main Trunk Railway.—A trial-line survey has been made of a deviation (1 mile 15 chains) between Paeroa and Waihi to bypass the Karangahake Tunnel. The route follows the left bank of the Ohinemuri River on a line which was not available originally because of the presence of mining batteries, pipe-lines, and water-races.

Rimutaka Deviation.—During the year the permanent-line plans were completed from Upper Hutt for a length of 10 miles. Field-work on final-line pegging has progressed for a further 2 miles. Precise levelling and triangulation for the long tunnel have been completed by the Lands and Survey Department and permanent bench and line marks have been established at both portals. The permanent-line drawings at the eastern side are in hand, but lack of survey and drafting staff is handicapping progress.

On the western side, excavation of the eastern approach to the Maoribank Tunnel, which will be 25 chains in length, has been proceeded with, and it is hoped to complete this formation before winter. The access road from Te Marua to the west portal of this tunnel has been completed. Construction of the workyard service buildings has proceeded throughout the year. Two heavy compressor units have been installed, one of which is operating. Excavation for aggregate plant at the approach cutting of the main tunnel west has been completed, and metalling is under way. Eighteen married quarters have been completed and occupied and nine are nearing completion. Thirty single huts are in the finishing stages. The cookhouse and ablution block are almost complete. A works office has been completed and has been occupied for some months. Sewerage, water-supply, and electrical reticulation were all completed during the year, including the building of an Imhoff tank.

At the main tunnel, which will be 5m. 37ch. in length, 451 ft. of excavating and timbering have been completed at the western portal and the tunnel lined to a length of 342 ft. Driving has taken place in shingle conglomerate country, but it is expected to reach rock shortly.

In Featherston Camp, on the eastern side, nine houses and six flats were completed during the year, making a total of thirty-six married quarters to date. There are now forty-six single huts completed.

Following further investigation of the eastern approaches to the main tunnel, it was decided to lower the portal by 25 ft., which meant a cutting of 40,000 cubic yards and a water-drive of 300 ft. over the tunnel. The top heading was completed to a length of 210 ft. to a point past the water-drive. Excavation of the water-drive has been completed and lining is in hand. The approach cutting is almost finished. Plans have been drawn up for the workyard layout and the method of handling aggregate and spoil.

Hutt Valley Extension.—The surveying and location of the section from Taita Bridge to Silverstream have been completed, and permanent-line plans are in hand from 13m. to 17m. Line-as-completed plans are also in hand between 10m. and 13m.

On the eastern side (Waterloo–Taita Section) 160 chains of fencing have been completed.

On the eastern side 1 mile of berms has been levelled, and on the western side 2 miles.

Specifications have been prepared and tenders are about to be called for the construction of 44,000 cubic yards of fill between Taita and Pomare Stations. Materials are to be supplied from the Hutt River. Sixteen chains of fill were 65 per cent. complete when work was stopped preparatory to a contract being let.

A works office and store at Haywards have been erected and are now in use.

The formation of the Taita goods-yard was commenced during the year and is 35 per cent. complete.

At 12m. 34·60ch. a 4 ft. by 4 ft. concrete culvert 190 ft. long has been constructed under the railway to carry storm-water from the Taita industrial area.

The Epuni subway has been completed and is in use. A contract has been let for a pedestrian subway at Taita Station.

Two contracts have been let for the Taita Bridge (850 ft.), one for the casting of piles (of which 66 have been cast) and another for driving the piles and constructing the piers. Excavation has now commenced on abutment A and piers B and C.

Concrete platform fronts have been completed at Naenae Station (1,100 ft.) and Wingate (550 ft.). The filling of the Wingate Station has also been done and a temporary station building erected.

Haywards–Plimmerton Railway.—Grade investigations have been carried out between Judgeford and Pahautanui.

Porirua Area.—At Porirua, surveys, plans, and estimates have been completed in respect of the deviation of the Porirua Stream on the section south of the railway-station.

A start has been made on the survey of the proposed railway deviation between Porirua and Plimmerton by way of the western side of the Porirua Harbour.

South Island Main Trunk Railway.—A contract has been let for the construction of an overbridge at Mororimu.

The construction of a 200,000-gallon reservoir at Kaikoura has almost been completed.

Completed-line plans have been finished, and legalization plans are well in hand.

HYDRO-ELECTRIC DEVELOPMENT

Investigations

Investigations into the development of electric power were carried out during the past year with only half the Head Office staff available in the previous year, and in the field a staff of two engineers, one surveyor, and eleven survey or engineering assistants.

The main items of work carried out were as follows:—

Waipapa Power Project.—A few exploratory bores remain to be finished to complete the investigation field-work on this length of the Waikato River. The work done to date indicates that a feasible site exists for a hydro-electric scheme, but lack of staff is holding up examination of the field data and the preparation of an investigation report. Seven sites were prospected by drilling, a topographical survey was carried out at two sites, and geophysical surveys were carried out at four sites.

Whakamaru Power Project.—The topographical survey and plans of the lake which will be formed by a dam at Whakamaru have been completed and survey monuments for the construction work have been erected, thus completing the investigation field-work for this scheme. The investigation report has also been completed, following which a recommendation was made which resulted in the Government approval being given to the project.

Atiamuri Power Project.—Field investigation work has been completed and survey plans prepared of the lake that would be formed by a dam at Atiamuri. The final geological report has been prepared by the New Zealand Geological Survey; soil-testing by the Department of Scientific and Industrial Research has been completed; and the permeability and strength testing of foundation rock is under investigation by the Dominion Physical Laboratory.

Concrete aggregates from deposits in the vicinity of Atiamuri are being tested and the extent of the deposits is being explored by drilling and geophysical surveys.

Plans and the investigation report on the scheme are under preparation.

Maraetai, Ohakuri, Pararīki, and Aratiatia Power Projects.—Geophysical surveys have been made at each of these sites to determine the foundation conditions. At Ohakuri the topographical survey of the dam site and power-house area has also been completed.

Kaituna River Development.—A reconnaissance has been made of the upper portion of the Kaituna River to select possible dam sites and lines of development. An aerial survey of the area on which it is intended to base future investigations is now being carried out by the Aerial Mapping Branch of the Lands and Survey Department.

Geothermal Steam Development at Wairakei.—An intensive programme of prospecting for development of geothermal steam was commenced in January, 1950. Geophysical survey work by the New Zealand Geological Survey is under way in the Wairakei area, a camp for fifty men is under construction at Taupo Township, and survey work has commenced on a line of prospecting-drill holes. Three drilling-rigs have been made available for prospecting drilling, and a further rig is being sent to the site. Preparations are under way to fit the drills with blow-out preventer gear suitable for pressure steam. The installation of water-mains for the drills is in hand in the area selected for the prospecting holes.

Braeburn Power Project.—Investigations were commenced early in 1950, a camp being established at Lake Rotoroa for this purpose. Surveys of the lake outlet, the western shore of the lake near the outlet, and the Mangles River are in hand. A geophysical survey of the outlet has been made, and the area has been flown in preparation for an aerial survey. The construction of access roads to various sections of the project is in progress.

Benmore Power Project.—Work on this project has continued on a reduced priority, some of the men having been transferred to the more urgent investigations for Waitaki Station extensions. A seismic survey has been carried out on the river terraces downstream from the dam site to determine the thickness of the gravels, and a contour survey has been carried out on the spur forming the left bank abutment of the dam. An automatic water-level recorder has been installed on the Ahuriri River. Stripping of the talus on the dam site was carried out during the year, together with some exploratory drilling and tunnelling. Some additions to the camp accommodation have been carried out and a telephone line to the works has been provided.

Waitaki Station Extensions.—The right bank of the Waitaki River has been investigated by exploratory shafts and a drive near the existing power-house. Geologists of the New Zealand Geological Survey have reported on the condition of the foundation rock, and an investigation report has been prepared, resulting in recommendations and the approval of the project by the Government. Some preliminary surveys have been made for the temporary construction village.

Lake Hawea Control Project.—Shafts have been excavated at the lake outlet and a tunnel has been driven into the hillside to examine the geological structure of the foundations for the proposed control works. Drill holes have been put down across Hawea Flat for the determination of water-levels. Samples of soil from deposits adjacent to the control site have been tested for suitability for earth-dam construction. Site investigations for this project are now complete.

Lake Wanaka Control Project.—A full-scale electro-osmosis test has been carried out on the glacial silts at the lake outlet, with very successful results. The test showed that this method of treating the silts can greatly assist the dewatering of excavations during construction of proposed control works.

Roxburgh Power Project.—An exploratory drive has been excavated in the right abutment of the dam to examine the thickness of the talus, and drilling has been carried out to determine the rock profiles of the river bottom at the dam site. An investigation shaft has also been excavated on the left bank of the river. High-speed diamond drills were tested on the schist rock.

Te Anau - Manapouri Development.—An aerial survey of the Manapouri - Deep Cove project has been completed. An aerial survey of the Te Anau - George Sound project is in hand.

Head Office Investigations.—Investigation reports on the Whakamaru power project and the Waitaki Station extensions were completed during the year, and the Atiamuri investigation report brought to virtual completion. The hydrological aspect of several projects under construction, also future developments, has received special attention owing to the importance of this work in hydro-electric development.

Design

General

The Hydro-electric Design Office started the year under review with rapidly increasing commitments which were taken up on the assumption that the additional staff required would arrive in time.

Replies to an initial advertisement for engineers in the United Kingdom were so few that only two out of the total of seventeen required were recruited. A revised advertisement was then put out, with much better response. However, there is considerable doubt as to the number of applicants that will accept offers of positions, as salaries are not sufficiently attractive and accommodation is so difficult to obtain.

In the meantime, a first stage of office extensions was completed and occupied in June, 1949, and the remainder is now about to be commenced.

In July, 1949, the State Hydro-electric Department set out a revised programme of completion dates for power-stations, timed to keep pace with the anticipated growth of load. Commitments have so far been taken up as timed on the programme, but the design teams are increasingly under-strength and it has been necessary to halt design work on one project (Whakamaru). If the staff position does not improve, the progress of works will be affected because there is little margin of time between the production of plans and their execution in the field.

In collaboration with the Department of Scientific and Industrial Research, the Hydraulic-model Laboratory at Gracefield has been brought into being; models for Whakamaru and Roxburgh are in preparation.

Every work now undertaken is subjected to architectural study both as regards the over-all aspect and as regards details of arrangements and finishes and fittings.

During the year, Dr. J. L. Savage, an eminent American consulting engineer, was invited by the Government to visit and report on aspects of hydro-electric work in New Zealand. After a six weeks' intensive tour he left on 16th November, 1949. In his report he expressed his opinion that design work was being satisfactorily handled, but put forward certain suggestions and preferences.

Power and Lake-control Projects

Work has been in hand during the year on the following projects, given in the order of their state of design:—

(1) Kaitawa power project and Waikaremoana Lake control.
(2) Pukaki Lake control.
(3) Tekapo power project.
(4) Maraetai power project.
(5) Cobb Power-station extensions.
(6) Roxburgh power project.
(7) Whakamaru power project.
(8) Waitaki Power-station extensions.
(9) Tekapo Lake control.

Kaitawa Power Project and Waikaremoana Lake Control.—The remaining design work undertaken has included the Waikaremoana Spillway, the Kaitawa jet dispersers, and various details in the intake and gate shafts, together with the general follow up of the leak sealing of Lake Waikaremoana.

Pukaki Lake Control Works.—Design work during the year has included the completion of the spillway gates and lifting-gear and the sluice-gate-lifting gear, with arrangements for the manufacture of these. In addition, the construction of the dam and the spillway has been followed up.

Tekapo Power Project.—Design work has been completed in connection with the intake, surge chamber, penstocks, tunnel lining, and ancillary features, together with arrangements for the fabrication and construction of these items.

The work included the follow-up of construction on the whole project.

Maraetai Power Project.—Design work during the year has been concentrated mainly on the power-house and on final details of the dam and penstocks and the general mechanical equipment.

Contracts have been arranged for the supply and fabrication of the various outstanding parts.

The majority of drawings for this project have now been issued.

Following a suggestion made by Dr. Savage, a trial-load analysis of the dam as designed was carried out in America. Mr. L. S. James, of the Design Office, was present in Denver during the analysis, which produced confirmatory results.

Cobb Power-station Extensions.—The design of the spillway is nearing completion and the majority of drawings are now under issue.

Details of the power-house, penstock and surge tank, and of the mechanical equipment are now in full design.

Roxburgh Power Project.—Design work is proceeding on the diversion channel and on gates and lifting-gear connected with the diversion and the spillway, together with a study of the problems connected with the dam. Sufficient drawings have been produced to maintain progress on the diversion cut at the site.

In the meantime, models are under construction at the Gracefield laboratory for testing the hydraulic features of the provisional design.

Whakamaru Power Project.—The design of this project is in much the same stage as Roxburgh, with which it has many common features.

Owing to the shortage of experienced staff and the necessity for taking up the design of Waitaki, it has been necessary to arrange a halt in the design work on this project at the stage when the design of the diversion is complete.

Waitaki Power-station Extensions.—The design of this work was taken up under high priority early in 1950. Preliminary drawings are in preparation.

Tekapo Lake Control.—Preliminary studies and a provisional design of the dam and sluice structure have been undertaken during the year, parallel with site investigations.

Various.—In addition to the above, design work connected with maintenance has been undertaken for the following operating stations: Karapiro, Tuai, Piripaua, Mangahao, Coleridge, Arnold River, Waitaki, Highbank.

Substations

Design work on two of the major substations, Bunnythorpe and Otahuhu, has been brought to virtual completion during the period. Preliminary work on Haywards has been completed.

Design work on some fourteen smaller substations and associated works has been in hand during the year.

To ease the position in regard to design staff, the District Engineers at Auckland and Christchurch have been asked to help in the design of substations in their districts.

CONSTRUCTION

Roading in Waikato Development Area.—Mangakino–Whakamaru Road (Left Bank), (Length, 5 Miles): Base-course and top-course metalling have been completed and tar primer applied for the full distance.

The Mangakino Stream Bridge, 280 ft. long and consisting of two 85 ft. and one 110 ft. spans (24 ft. roadway), has been completed in reinforced concrete.

Tokoroa–Whakamaru Road (Right Bank): Base-course metalling (5 miles between 12m. and 17m.) has been completed, also the 10-ft.-diameter high-level culvert at the Mangakowiriwiri Stream.

Maraetai–Waipapa Road: A contract has been let for and work is in hand on the formation and culverting of 4½ miles of this road from its junction with the Maraetai Power-house access road.

Maraetai Power-house Access Road: Construction in reinforced concrete of a 220 ft. span arch bridge across the Waikato River is proceeding.

Surveys for 12 miles of road to Waipapa from the Tokoroa–Whakamaru Road, near Tokoroa, are in hand; also for the Maraetai to Waipapa Road, from 4½m. to the Waipapa Dam site.

Mangakino Village.—One hundred and twenty-two houses for staff and workmen's accommodation have been erected during the year, making a total of 717.

A community hall (floor space 9,113 square feet) has been completed.

Three miles of streets have had a dust-proof seal coat of bitumen applied, making a total of 7 miles of streets so treated.

For sewage-disposal, an additional imhoff tank and a set of sludge-drying beds for 500 persons have been installed.

The population of the town and adjacent single men's camp is 3,700.

Maraetai Power Scheme.—The diversion tunnel was completed during the year, including grouting of the soffit of the arch throughout and complete grouting at the gate shaft and spillway junction.

The spillway intake abutment piers have been completed and the arch of the sloping leg from the intake to the diversion tunnel excavated and lined. Removal of the remaining rock in this section is in hand.

The coffer-dams required for dewatering the power-house and dam foundation areas have been completed, also the dewatering. Grouting round this area was done to minimize the leakage of ground water, a precaution that was eminently successful.

Excavation for the arch dam and thrust blocks is nearing completion; consolidation grouting of the foundation rock for the right thrust block has been completed.

Twelve thousand cubic yards of concrete have been placed in the power-house foundations and draft-tube zones. The steel frame for the power-house workshop and three bents of the power-house superstructure frame have been erected in place.

The concrete-aggregate crushing, washing, and screening plant, the aggregate stock-pile and reclaiming conveyor, the cement unloading shed and silo, the concrete weigh-batching plant, and two 7½-ton capacity traversing cableways for handling concrete and other materials to the power-house and dam were designed and have been completed and successfully operated. These units are designed to enable a maximum of 84 cubic yards of concrete to be manufactured and placed per hour. Twenty-five thousand cubic yards of concrete aggregate have been processed and delivered to stock-piles.

Drilling and grouting the cut-off curtain, which is to extend for approximately 1,000 ft. into the country rock from each dam abutment, has been continued. That on the left bank is practically completed, and on the right bank approximately 60 per cent. completed. A total of 79,400 ft. of holes has been drilled and 4,790 tons of cement used for grout.

During the year the design of the dam and foundation rock treatment were inspected and reported on by Dr. Savage, an authority on dam design, and Mr. Simonds, foundation expert of the United States Bureau of Reclamation.

Plantation clearing for the Maraetai Lake area has been continued. Trees have been removed for milling from 356 acres, and burning and burying of slash from 180 acres of the total of 463 acres have been completed.

Whakamaru Power Scheme.—A commencement has been made on the excavation of the diversion cutting. Thirty-five thousand cubic yards of rock have been removed, which is 34 per cent. of the total.

Service buildings and a stationary air-compressor plant have been erected, and service roads have been formed.

The site for the Whakamaru outdoor station has been levelled.

Sources of sand-supply for this project are being investigated.

Lake Taupo Control.—Repair work to the six lake-level control gates has been completed, four of the gates being done during the past year.

Sawmill: This plant has processed pinus logs from the lake clearing and other courses, also logs of native timber.

During the year 3,292,427 super feet of pinus timber and 977,442 super feet of native timbers were produced, the respective totals to date being 7,426,006 and 1,067,931 super feet. All native timber has been used for works in this district, and 1,500,000 super feet of pinus were supplied to other Government works.

Investigation work at other sites is covered elsewhere in this report.

Waikaremoana.—The rainfall for the year, 66·33 in., was little more than three-fourths of a normal year's fall. The lake-level at the start of the year was 2,000·3 ft., in August 2,009·8 ft., and at the end of the year 1,997·5 ft.

The painting of the penstocks has been completed.

The sealing of leaks through the lake-bed is the most important work in hand. Timber is first of all cleared by divers from the leakage holes, unevennesses in the lake-bed are taken out by filling with spalls, and then a blanket of sealing material, graded from crushed rock at the bottom to clay on the top, is placed over the whole leakage area. Finally the sealing blanket is covered with a heavy layer of rock for protection against wave action.

A flood in the lake area in May, 1948, brought large quantities of timber into the leakage area. The removal of all this new timber changed the first phase of the work from a minor to a major part of the job. In general, the state of the work at the end of the year is that timber has been removed from all of the leakage area, the lake-bed has been sufficiently levelled up, and the leakage area has been covered with the first layer of the sealing blanket—crushed metal and gravel. As a result of the work done to date, 45 per cent. of the leakage has been stopped. Although the job has never progressed as fast as hoped, the work now to be done is relatively straightforward and should be completed about July or August next. It is expected that a reduction of leakage approximating 70 per cent. will be achieved. Materials placed in the sealing blanket comprised 17,500 cubic yards, plus 4,800 cubic yards of rubble over an outlying area; 460 cords of wood were removed from the leaks.

Besides minor jobs and general cleaning up, there still remain (1) the building of a spillway at Lake Waikaremoana outlet, (2) the final deepening of the intake channel, and (3) the installation of disperser valves so that enough water can be supplied from Lake Waikaremoana for Tuai and Piripaua Stations when Kaitawa Station is partly or wholly shut down. Plans have been prepared for the second of these jobs.

At Tuai a new school with a floor area of 3,400 square feet has been built by the Department's workmen.

No. 1 penstock at Tuai was repainted inside with coal-tar paint during the summer, and manholes were welded into No. 2 penstock in preparation for its painting. The repainting work took up to 26 men, was a three-shift job for seven days per week, and, with the preparation, spread over almost three full months.

The number of employees has remained fairly steady, owing to the fact that all labour available could be employed on getting materials for leak sealing. Including staff, approximately 100 men are employed, and of these an average of 8 were engaged on bridge-construction and other work on Lake Waikaremoana Highway. An average of 4 have been employed doing jobs at the Lake Waikaremoana Tourist Hostel.

Cobb.—During the year work was concentrated mainly on the completion of the permanent intake tunnel and the erection of a large batching plant and a secondary crushing and screening plant, in readiness for large-scale concreting-work. At the same time excavations for the spillway were taken as far as possible before the diversion of water into the new intake tunnel.

Work was maintained reasonably well up to schedule up to the end of last year, but since the commencement of concreting in January of this year progress has been slower than anticipated, mainly due to an acute shortage of skilled tradesmen.

Details of work carried out during the year on the various sections of the job are as follows :—

(1) Spillway Excavations : Excavations were continued up from the tailrace channel and past the upstream end of the stilling basin (at about the level of the tailrace channel), leaving the deep part of the stilling basin still to be completed.

Commencing also at the upstream end of the river diversion channel, excavations wide enough for two culverts were taken downstream as far as the axis of the dam at footage 1,000. This section is now ready for concreting.

In order to exclude the Cobb River from work going on in the right-hand half of the stilling basin, a concrete coffer-dam 10 ft. high and 250 ft. long was built, and the river was deepened along the river side of the coffer-dam from the tailrace channel up to the concrete check dam, where further work was carried out to prevent erosion.

At the check dam the river is dropped over an artificial fall 16 ft. into the excavated channel, past the coffer-dam.

The total amount of material excavated during the year was 59,500 cubic yards, of which some 20,000 cubic yards were in solid rock and boulders.

(2) Permanent Intake : Driving for the 1,573 ft. permanent intake tunnel was completed in March of last year. Work done during the year just ended consisted of building the permanent intake and log screen and lining the tunnel throughout its entire length.

The first 439 ft. between the intake and the gate shaft were lined with concrete, and the 1,100 ft. section between the gate shaft and the old tunnel were steel lined with concrete backing.

The steel lining was fabricated in Wellington in 20 ft. sections, which were taken into the tunnel by way of the gate shaft, after which they were welded together, sand-blasted, and finally given six coats of coal-tar paint. The whole of the tunnel was grouted in two stages, a total of 61 tons of cement being used. The new intake was put into commission on 18th December.

(3) Aggregate Processing and Batching Plant : The erection of a large secondary and screening plant was completed during the year, and so far some 1,000 cubic yards of coarse aggregates and crushed sand have been processed. A sand washing and classifying plant has also been built and is in operation.

The primary crushing plant at the quarry produced 15,000 cubic yards of stone during the year, which has been stock-piled at the screening plant.

The batching plant previously used at Karapiro was remodelled and re-erected at the Cobb, equipped with a 2-cubic-yard mixer. This plant is almost ready to be put into operation. A 12,000 ft. jig-line, which will transfer the mixed concrete from the batching plant down to the dam-site, 800 ft. below, is complete. It is interesting to note that the screening and batching plants are at an elevation of 3,400 ft. above sea-level.

(4) Permanent Gate Shaft: The sinking of the gate shaft, which is 100 ft. deep by 16 ft. excavated diameter, was completed in March of last year, and concreting was not commenced until September, the interval being necessary while the 20 ft. steel liners were being taken into the intake tunnel through the gate shaft. When concreting had reached 30 ft. above the bottom of the shaft, the bottom section of the permanent screens was installed, together with the gate and gate frame, after which the water was diverted into the tunnel. Concreting was then resumed, and by the end of March was within 4 ft. of the top of the shaft.

(5) Concreting River-diversion Channel: Provision has been made in the general layout of the dam and spillway for the river to be diverted during the construction of the earth dam by means of a concrete intake channel and two 15-ft.-diameter culverts which run through the bottom of the main spillway block. A start was made with the concreting of the right-hand retaining-wall of the intake channel late last year, and to date 770 cubic yards of concrete have been placed. Two 24 ft. steel forms for the culvert barrels were made in Christchurch and were received on the job late in the year. All the reinforcing-steel required for the spillway arrived during the year, amounting to 1,100 tons.

(6) Accommodation: A contract was let late last year for the prefabrication of twenty workmen's cottages. These cottages are being built at Motueka before being assembled at the married workmen's quarters at Upper Takaka.

(7) Roads: General maintenance work was carried out during the year over the 20 miles of access road between Upper Takaka and the Cobb. Approximately 2,000 cubic yards of shingle were spread on the road.

(8) Labour: The number of men employed during the year varied from a peak of 197 last November to 138 in March of this year, which is 70 short of requirements. At no time during the year was the labour force adequate enough to keep the job on schedule.

Lake Tekapo Development.—A steel-sheet pile coffer-dam at the intake is being constructed. The primary grouting behind the lining blocks of the 20-ft.-diameter tunnel is 85 per cent. complete and the secondary grouting 78 per cent. complete. The smooth concrete lining inside the tunnel blocks is 27 per cent. complete. The 600 ft. of steel lining at the outlet end of the tunnel is complete, and the contractor is now placing the steel lining for the penstocks. The contractor for the surge chamber is doing the excavation and compacting the filling for the structure foundations.

The concreting of the main block of the power-house by direct labour is completed, 7,400 cubic yards of concrete having been placed.

The concrete lining of the tailrace has been completed.

Further foundation investigation has been done at the dam-site.

Two hundred and ninety men are employed on the works.

Lake Pukaki Control.—The earth dam has been completed up to the right wall of the spillway, some 350,000 cubic yards of material having been placed. The stone rip-rap wave protection has been substantially completed and further rip-rap material has been stock-piled nearby.

Twenty thousand cubic yards of concrete, about half the total quantity, have been placed by the contractor for the spillway.

A contract has been let for the fabrication of the six steel radial gates on the spillway. Each gate is 46 ft. wide by 21 ft. high.

The upstream coffer-dam has been raised to the height of the permanent dam across the width of the spillway, and protected against wave action.

Two hundred and thirty men are employed on the works.

Roxburgh.—Following the announcement of the selection of the site of the dam at Tamblyns' Orchard in March last, detailed investigation work was concentrated at this point.

Surveys have been made for cableways to span the gorge. Twin cableways of 1,680 ft. span are being obtained.

Exhaustive tests of gravel from Commissioner's Flat have proved it to be of satisfactory quality and adequate in quantity. Designs for a washing and screening plant at Commissioner's Flat and for concrete plant with stock-piles at elevation 600 on the left bank are well forward.

Work on the diversion channel began on 27th June, 1949, with the removal of the orchard trees. Excavation started on 4th July, 1949. Using D8 tractors and 12-cubic-yard carryalls, 235,000 cubic yards of topsoil and gravel had been removed to expose the rock surface by mid-September. Carryalls and "Tournapulls" were tried, but with wet ground conditions and loose gravel these were not suitable for the work.

Despite early troubles with tungsten-carbide drill-bits and alloy drill steel, some 50,500 cubic yards of rock have been removed to bring the diversion channel excavation down to elevation 293 at the intake end and 305 at the spillway block. At the upstream and downstream sides of the diversion channel, 2½-cubic-yard shovels and "Euclid" wagons have stock-piled the material.

The rock at the upper levels is weathered, as was expected, but at the lower levels it is sound and is breaking away from line-bored holes to leave satisfactory side walls. Jackhammer boring has totalled 50,000 ft. and wagon drilling 78,500; 36,700 lb. of explosive and 80,000 ft. of primacord have so far been used in the diversion channel. Tungsten-carbide bits have justified their use and have proved superior to "throwaway" bits in this type of rock.

Some 8,000 cubic yards of stripping have been removed from the right abutment face to expose the rock. Work is in hand to detail the thickness of the broken rock.

Two single men's camps with a social hall and post-office have been constructed on the right bank downstream from the permanent village area, one to house 250 men and the other 150 men. These are fully occupied. No. 3 camp is almost ready for occupation and will house a further 250 men. Twenty-eight cottages have been completed in the construction village and a further sixty-seven are in course of erection. Sewerage for the camps and village has been installed as required, as has water-supply from Elbow Creek. A 100,000-gallon rock reservoir (for incorporation in the permanent village supply) has been built and a 1,000,000-gallon reservoir for the construction village water-supply on the left bank. The old miners' dam taken over from Tamblyn has also been restored to hold 1,000,000 gallons.

Eleven thousand six hundred feet of sewer lines and 17,700 ft. of water-mains have been laid; 5,000 ft. of construction village roads have been formed and 9,200 ft. access roads have been built.

During the year an administrative building, 5,000 square feet (of T.C.I. huts), a main store (100 ft. by 84 ft.), and a mechanical workshop (100 ft. by 64 ft.) with an associated 40 ft. by 30 ft. tool-sharpening shop, garage, &c. have been built.

Construction of Substations

Otahuhu.—The storm-water and oil drainage systems have been carried a stage further, but progress is retarded by shortages of materials. The driving of the fifty-nine piles each 70 ft. in length for transformer pad foundations was completed in April, 1949. Cracked piles in the condenser building foundations have been repaired and a concrete mat for construction purposes has been laid. A contract for the erection of the condenser building was let. The erection of fourteen permanent cottages by the

Housing Construction Division has been completed. At the end of 1949, designs for the outdoor station were finalized, and steps were taken to get the work under way. Preliminary steps have been taken for the calling of tenders for the control block.

Maungatapere.—Engineering surveys for the construction required in enlarging this station have been carried out and tenders have been called for formation work. The Department is working in conjunction with the State Hydro-electric Department in installing a water-supply and sewerage system.

Henderson.—The construction of a stone retaining-wall has been commenced.

Longburn.—During the year the only work proceeded with was the switch and control building and the filter-house.

A contract for this has now been completed, except for the interior painting and some electrical work.

Haywards.—In October, 1948, a contract was let for 135,000 cubic yards of excavation and filling. This was completed in May, 1949. In November, 1949, a second contract for 200,000 cubic yards of excavation and filling was let; this is 50 per cent. complete. The total quantity of excavation and filling necessary to complete the work to the designed level is 435,000 cubic yards. Nos. 1 and 2 contracts, when completed, will bring all excavation to the designed level, leaving the filling about 15 ft. low. A further 100,000 cubic yards of borrowed fill will be required.

The southern housing area (included in the excavation) has been levelled in readiness for a store building.

Eleven test bores from 50 ft. to 100 ft. in depth have been drilled on the main building site.

Stoke.—Survey and subsoil investigations for the proposed condenser block and switchroom have been carried out, two shafts 4 ft. by 4 ft. (15 ft. and 25 ft. deep respectively) being sunk, with satisfactory results.

Smaller Works.—Foundation investigations are in hand in connection with a switch-room at Studholme and a substation at Papanui, Christchurch. Specifications have been prepared for access roading to the proposed substation at Islington, Christchurch.

IRRIGATION

Canterbury.—Increased returns resulting from irrigation on the Ashburton-Lyndhurst scheme have created great interest among farmers. Public meetings have been held both north and south of the Rakaia River with a view to requesting the extension of irrigation in Canterbury.

Although rainfall during the year was slightly above average, the development of the irrigation schemes, particularly Ashburton-Lyndhurst, is proceeding at a progressively faster rate.

Levels Plain scheme—commanding 12,000 acres—has, in its thirteenth season, earned £970 in revenue. The area prepared for irrigation has increased by 137 acres.

Redcliffs scheme—commanding 4,600 acres—has been in operation for fourteen years. The revenue for the year was £381; 90 acres were border-dyked.

Mayfield-Hinds scheme: The main scheme provides for ultimate development of 44,000 acres of irrigable land. A temporary development, drawing water-supplies from the Rangitata Diversion Race, will command 12,000 acres actually under irrigation. It is now 60 per cent. complete. The revenue was £496 during the second year of the operation of the temporary development. Five hundred and eighty acres were prepared for border-dyke irrigation, bringing the total to 918 acres.

Ashburton-Lyndhurst scheme—commanding 34,000 acres under irrigation—has completed its sixth season. During the year 2,273 acres were prepared for border-dyke irrigation, bringing the total to 8,285 acres. Water-sales revenue amounted to £2,433.

Rangitata Diversion Race: The maximum supply of 1,000 cusecs was carried in the race for the whole of the year. Irrigation supplies of up to 315 cusecs were drawn off between 18th September, 1949, and 31st March, 1950. All the remainder of the diversion race flow has been used by the Highbank Power-station. The race has operated very satisfactorily during the year.

Central Otago.—As in the previous year, rainfall and water-supply conditions varied considerably throughout Central Otago.

On the Omakau scheme the sales of water were 13,510 acre feet, as against 12,953 acre feet for the previous season. Here, water is sold on demand and not on an agreement basis as on other schemes.

The rainfall on the Manorburn and Poolburn catchments and over much of Ida Valley has again been much below the normal. In the middle of the Ida Valley irrigation area the figure of 12·80 in. for 1949 was one of the lowest on record.

Details of the schemes in operation are:—

Scheme.	Area Irrigated or Normally Charged for.	Number of Irrigators.
Ardgour	1,322	11
Arrow River	3,241	53
Bengerburn	39	11
Earnscleugh	2,065	49
Galloway	2,651	21
Hawkdun	8,248	69
Idaburn	565	8
Ida Valley	12,358	63
Last Chance	2,818	31
Manuherikia	4,769	92
Tarras	2,698	15
Teviot River	3,900	47
Omakau (estimated)	9,000	65
	53,674	535

The financial position is as follows:—

——	1949–50.	1948–49.
	£	£
Rates collected	..	27,349
Revenue	25,304*	23,962
Working-expenses	40,754	40,662
Loss on working	15,450	16,700

* Estimated.

The revenue figures are some £2,500 below normal on account of the reduction in charges on Ida Valley and Galloway schemes owing to water shortage.

Special Works.—Guniting has continued on the remainder of the upstream face of the Manorburn Dam, and similar work has been carried out on 42 chains of the Upper Bonanza Race. This work has reduced leakage to a considerable extent.

A short portion of the Chatto Creek pipe-line, on the Manuherikia main race, was replaced early in the season with 42-in.-diameter concrete-lined steel and reinforced-concrete pipes.

Substantial repair work following damage by a flood has been carried out on the main 3¼-mile pipe-line out of the Arrow River gorge.

Surveys and Investigations.—Extensive preliminary surveys and investigations have been made into several alternative schemes for the diversion of Hopes Creek for the purpose of augmenting the supply of water to Ida Valley and Galloway.

Field survey work on the Maniototo scheme ended during the year, but the preparation of plans and the collection of data are still proceeding with a view to the production of a final report on this scheme in the near future.

WATER-SUPPLY

Wellington Water-supply Scheme.—Progress on this scheme has turned out much better than anticipated at the beginning of the year, mainly owing to an improvement in the steel plate and pipe supply position.

The first quantity of steel plate released comprised 360 tons of ⅜-in.-diameter plate, estimated to fabricate into 1 mile of 36 in. pipe. A contract was let to Hume Steel, Ltd., for this work, the pipe to be concrete lined. A further 2,000 tons of ⅜-in.-diameter steel plate has been ordered from England and the first two shipments (220 tons) have been landed. Tenders have been called for the manufacture of this steel into 36 in. pipe.

In July, 1949, a contract was let to Stewart and Lloyds, England, for bituminous lined and coated 36 in. pipe. The first order of 18,000 ft. of 5/16 in.-diameter 36 in. pipe commenced to arrive in December. In January further orders were placed with the same firm for 4,500 ft. of 5/16 in.-diameter 36 in. pipe and 3,500 ft. of ⅜ in.-diameter 36 in. pipe, this to be fitted with "Johnston" couplings instead of having welded joints as in the case of the 18,000 ft.

The specials and valves for the above-mentioned pipes have also been ordered, which completes the requirements for No. 1 section, Mangaroa to Silverstream.

During the year steady progress was made on the lining of Nos. 1 and 2 tunnels, No. 1 tunnel (length 2,226 ft.) being completed and No. 2 tunnel (length 9,101 ft.) having 2,650 ft. of lining completed.

The left half of the river has been coffer-dammed and approximately 560 cubic yards of rock have been excavated for the weir base. Reinforcing-steel and specials have been ordered. Concreting plant and scaffolding have been erected.

The flume bridge is 70 per cent. complete and is being used as an access bridge to the south end of No. 1 tunnel. No further work can be done until the weir job is further advanced.

On the No. 3 tunnel (length, 1,422 ft.), driving has been completed but is yet to be lined. This completes all the pipe-line tunnels except for the lining of No. 3 tunnel, Nos. 4, 5, and 6 tunnels having been completed in the previous year.

Pipe-laying at the No. 1 section (2 m. 17·80 ch. to 12 m. 32 ch.) commenced at 2 m. 21 ch. on 1st February, 1950, since when 2,000 ft. of welded-joint Stewart and Lloyd pipes have been welded and laid in the trench. Trenching has been completed from 2 m. 21 ch. to 3 m. 20 ch.

A contract for the Trentham reservoir of 500,000 gallons was let on 21st July, 1949. Work commenced on 8th November, 1949, and is 35 per cent. complete.

For the Trentham reservoir branch, 3,142 ft. of 8 in. pipe and specials have been ordered. To augment the present Upper Hutt supply, 6,000 ft. of 9 in. fibrolite pipe have been ordered to connect (via the new Trentham reservoir) the camp and the Upper Hutt reticulation with the camp well-pumping station. This temporary supply should be brought into use about July, which is the estimated date for the completion of the reservoir.

Water-supply, Thames Borough Council.—The second contract is proceeding satisfactorily. During the year, 3,888 ft. of 12 in.-diameter pipes were laid, bringing the total to date up to 27,671 ft.

COAL-PRODUCTION

Opencast Mines, Waikato.—Excavation at No. 2, Glen Massey (Kemp's Opencast), ceased in June, 1949, after the removal of 22,100 cubic yards during the year, making a total since the opening of the field in 1944–45 of 2,313,149 cubic yards of overburden. Coal removal ceased in August, 1949, when 12,125 tons had been lifted for the year, making a total for the life of the field of 239,093 tons.

Excavation at Hillcrest Field commenced in February, 1948, and 179,900 cubic yards of overburden were shifted prior to 31st March, 1949 (when operations came to an end), making a total to date of 393,700 cubic yards. Coal-mining commenced in April, 1949, and during the year 48,252 tons 13 cwt. were obtained.

As working diminished at Glen Afton, the plant was moved to the Rotowaro area.

Stripping commenced on Barker's Field on 15th March, 1949; 21,800 cubic yards of overburden had been shifted up to the end of that month. Since then a further 209,100 cubic yards of material have been shifted, making a total to date of 230,900 cubic yards. During the year, 33,842 tons of coal were procured.

Excavation at Devlin's Field commenced in February, 1950, and to date 54,900 cubic yards of overburden have been shifted.

Opencast Mine, Waitewhenua.—The stripping removed during the year aggregated 62,158 cubic yards, making a total to date of 719,373 cubic yards. Coal extraction was 39,264 tons, making a total of 190,318 tons to 31st March, 1950.

Access roads in the No. 2 area have been extended. An access road is being built to a new area, No. 5. A total of 3,389 cubic yards of metal was spread on the Pio Pio – Ohura Main Highway to restore the surface after heavy rain and so enable the output of coal to be maintained.

Stockton Ropeway.—Despite the difficulty of recruiting labour in a predominantly mining district, the construction of the Stockton ropeway has made good progress.

Access tracks have been constructed over very rough country and 11 of the 199 towers have been erected, and concrete bases constructed for a further 24.

Opencast Mine, Wangaloa.—Work on stripping the overburden and winning coal has continued throughout the year, with the usual seasonal fluctuations. In spite of very wet winter conditions, coal tallies were maintained at a high level during the winter months, when the demand was high. A total coal output of 41,222 tons 4 cwt. was achieved. Approximately 180,000 cubic yards of overburden were removed during the year.

The stripping has consisted of a very tight conglomerate requiring continuous use of a rooter. In October, 1949, two "Tournapull" units were introduced on to the works and, in spite of minor hold-ups, excellent work has been done on a long uphill lead. Coal is now assured for the coming winter.

Access roads have given little trouble.

The mine buildings and camp are in good condition and have been painted and repaired during the slack coal period in the summer months.

Opencast Mines, Southland.—During the year, machines operating at McLean's Opencast Mine, Ohai, stripped 126,700 cubic yards of overburden and extracted 43,879 tons of coal. In addition, 14,500 tons of coal were stripped and await extraction. Machines on hire to the Mines Department removed 50,000 cubic yards of overburden at Linton Opencast Mine, where a fire threatens to close the underground mine unless the coal is removed. Seven thousand cubic yards of spoil have been shifted for opening up the entrance to the proposed Morley Mine.

At Ohai Miners' Hostel the grounds were cleared up and planted in shrubs and trees, and the roadways were sealed.

LIGHTHOUSES AND HARBOUR-WORKS

Electrification.—New electric automatic installations have been completed at Motuara Island, Gibson Point, Slope Point, Whangaroa Harbour, and The Mount, Tauranga. A gas automatic light has been installed at Whitianga, Mercury Bay, and an electric buoy light at Awanui Harbour. Four small automatic beacons at Lake Taupo have been completed and put into commission. The installation of new electric automatic lights at Cape Kidnappers, Slipper Island, Cape Farewell, Ohau Point, and Bushey Point is in hand. The electrification of automatic beacons at North Cape, Chicken Island, and Channel Island is complete. Preliminary work has begun on new beacons at Chatham Island and at Mangonui Harbour and on the electrification and installation of a radio beacon at Portland Island.

The electrification of Cape Egmont is nearing completion. Baring Head is being modernized and connected to the power-mains supply.

Lighthouses.—The usual maintenance of lighthouse buildings and residences has been carried out.

An additional water-supply has been provided at Mokohinau, where the wharf fender piles and tram-tracks have been repaired.

A new sewer with patent lavatories has been laid at Cuvier Island, and materials are on the site for an additional water-supply.

Improvements practically completed to the landing jetty and adjacent harbour at Portland Island will facilitate the unloading of stores.

A water-supply has been installed at Centre Island.

Harbour-works.—Comprehensive soundings of the Tauranga Harbour have been carried out, partly by lead-line and partly by echo-sounding apparatus hired from the Napier Harbour Board. The area covered by the soundings, approximately $4\frac{1}{2}$ square miles, included the entrance and the channels leading to wharf-sites both at Mount Maunganui and Tauranga.

Several borings have been taken by jetting at the shallowest part of the Tauranga Harbour entrance. The work is still in hand.

A slipway has been constructed at Moeraki for bringing ashore the dinghies used to unload fish from fishing-launches. This slipway is 100 ft. long and is equipped with an electric winch. The work is practically complete.

During the year work continued, as labour and tides permitted, on the stake groyne on the beach at the mouth of the Waikouaiti River.

AERODROMES

Maintenance

The usual maintenance has been undertaken at aviation establishments, both R.N.Z.A.F. and Civil, and has included work on airfields, buildings, engineering services, roads, grounds, aeradio services, and general aerodrome facilities.

Capital Works, R.N.Z.A.F. Stations

Construction items of importance include :—

Lauthala Bay, Fiji.—Five housing units have been completed and two further units are in course of erection.

Whenuapai.—For the interim use of Civil aviation an extra concrete hardstanding is under construction. The provision of permanent runway lighting and night-flying facilities is in hand. The erection of four housing units has been commenced.

Hobsonville.—The erection of four housing units has been commenced.

Stores Depot, Te Rapa.—A contract has been let for the erection of four housing units. A comprehensive sewerage installation is in course of construction. Permanent accommodation for officers, N.C.O.s, and airmen has been completed.

Ohakea.—The erection of eight housing units has been commenced. The provision of temporary runway lighting and night-flying facilities is in hand and equipment for permanent facilities of a similar nature is on order.

Woodbourne.—The provision of facilities for the engine-repair section of the aircraft-repair depot has been completed.

Wigram.—The erection of four housing units has been commenced. A contract has been let for the provision of W.A.A.F. officers' quarters.

Stores Depot, Weedons.—A contract has been let for the erection of four housing units.

Taieri.—The station has been renovated and modified for compulsory military training. A contract is being let for eighteen housing units.

General, R.N.Z.A.F.

A multitude of minor construction works and building alterations has been undertaken.

Airfield Construction, Civil Aerodromes

Paraparaumu.—A steel Butler hangar is being erected for the R.N.Z.A.F. This hangar will also be used for housing aircraft belonging to the National Airways Corporation. The site has been levelled and base course and foundations have been completed. Temporary runway lighting has been installed on two runways, together with other night-flying facilities.

Harewood.—Extensions to the airfield to provide landing-strips to Class E standards have been completed, and work has commenced on the construction of permanent paved runways to this standard. Development will proceed on the extension of the field and on the provision of paved runways to Class C standards. One runway to this standard should be available for use by the end of the year. Temporary runway lighting has been installed on two temporary runways, together with other night-flying facilities.

Hokitika.—The construction of the new aerodrome at Seaview has proceeded to the second stage of development. Two stabilized gravel runways with enveloping strips to Class E standard are complete and available for emergency use. The aerodrome will not be opened for full use until the bituminous surfacing or runways has been completed and essential control services are available.

Flying-boat Base, Mechanic's Bay

A slipway and concrete hardstanding area have been completed to handle the new Solent flying-boats. A new steel landing-pontoon is being fabricated.

Surveys and Investigations

With the tentative selection of Mangere as the site for the combined international and internal Civil airport for Auckland, surveys and investigations have been concentrated on that area with a view to determining the most efficient and economical location and layout.

Preliminary planning and the preparation of estimates of construction costs in connection with the development of Rongotai Airport have been undertaken.

Further preliminary investigations have been undertaken at Evans Bay, Rotorua, and Invercargill.

Aeradio and Air-traffic-control Development

New radio-beacon stations have been erected at Ohura, Pahiatua, Waitaki, and Wanganui, and arrangements are in hand for the erection of a beacon at Rukuhia, Hamilton. A fan marker has been erected at Titirangi, Auckland, and arrangements are in train for the erection of another fan marker at Muriwai.

Considerable work has been undertaken in remodelling existing accommodation and in replacing temporary makeshift buildings with permanent buildings. Additional standby generating equipment has been installed at numerous stations to serve radio installations and control towers.

The new control towers at Westport and Napier have been completed. Passenger-handling accommodation has been erected, or remodelled from existing buildings, on a number of aerodromes to serve National Airways services. A large number of minor improvements have been effected at various aerodromes.

Fiji and Other Pacific Islands

At the regional airports of Nausori (Fiji), Fua-a-motu (Tonga), Faleolo (Samoa), and Aitutaki and Rarotonga (Cook Islands) work has been confined to maintenance, except for minor improvements to existing facilities.

A new aeradio receiving-station has been constructed at Rarotonga, together with three staff residences, with a fourth in hand.

At Nadi, the interim international airport of Fiji, reconstruction of the existing runway and hardstandings to take heavier and more intensive traffic has been undertaken, one runway having been completed with a bituminous-concrete surface; work on the second runway is in hand. Four additional married quarters have been produced from converted military buildings, and various minor alterations and improvements have been effected to existing airport accommodation, services, and facilities. A contract for eighteen new residences has been let.

At the request of the South Pacific Air Transport Council, an engineering survey and investigation was undertaken to determine the possibilities and estimated cost of developing a new major airport for international air service use at the Suva Point site, near Suva. A report has been prepared.

LAND IMPROVEMENTS

Kaipara Harbour Reclamation.—On Glorit Block the major work of widening and raising stop-banks, begun towards the end of 1949, has been completed. Over the 295 chains of stop-banks concerned, 29,500 cubic yards of material were used. It should be possible to release the reclaimed land soon to the Department of Lands and Survey.

Maintenance has been carried out on the Kukutango and Oyster Point Blocks. No stock has been allowed on these blocks during the year, in order that consolidation might be effected without damage.

Swamp Drainage, &c., Northland.—Drains have been enlarged and deepened at Kaitaia Swamp (a work recently taken over from the Department of Lands and Survey), stop-banks have been formed, and outfalls regraded and widened; generally, a good standard of maintenance has been carried out. A survey has also been made of a portion of this swamp.

A survey of Motutangi Swamp has been completed.

Outlets have been cleared at Lake Omapere. A permanent weir has been installed at Punakitere.

Sand-dune Reclamation.—At Kaitaia, 12 miles of the Sweetwater Track have been graded and culverted.

In the South Kaipara Heads area a total of 474 acres has been planted in marram grass, but since the work ceased this year owing to labour shortages considerable deterioration is evident. The thinning and limbing of trees is behind schedule; this is not done now between December and March, a period when the Sirex fly attacks the trees. These attacks are causing serious concern, and steps are being taken to find a remedy.

The prolonged spell of dry weather has made heavy fire-fighting demands on the staff.

A large programme of sand-dune reclamation and afforestation has been carried out in the coastal strip between the Hokio Stream and the mouth of the Manawatu River—known as the Waitarere area. The headquarters for the scheme and the tree-raising nursery are at Waitarere.

Altogether, over 100,000 *Pinus radiata* trees, 20,000 *Pinus laricios*, and 1,650 macrocapas were planted during the year, and 154,000 *Pinus radiata* seedlings have been lined out in preparation for next season.

Some 55 acres of moving sand have been planted in marram grass.

Lupin has been sown by hand and from the Department's aircraft.

A new access road has been formed from the main road to the nursery, and the stream has been bridged.

Fire-watching and a beach patrol were maintained during the summer. The four lookout towers have now been linked with headquarters by telephone.

Land-clearing.—An area of 899 acres has been cleared at Ohakune and 222 acres rooted.

Land-clearing in Southland has slowed down owing to the plant having been diverted to coal-winning. Five hundred and forty-four acres of stumps and second growth have, however, been cleared and brought into production.

HOUSING

Site-developing for the Housing Construction Division was continued during the year, chiefly at Auckland and Wellington, where the usual roading and engineering services, &c., have been provided.

ROADS

Further progress was maintained during the year on the formation and metalling of primary access roads. A total length of 227 miles of new formation was completed, compared with 156 miles in the previous year, whilst the 322 miles of metalling completed represent an increase of 29 per cent. on the 274 miles carried out during 1948–49.

Bridging in permanent materials is still hampered to some extent by the lack of materials, although the easing of the steel situation is reflected in the increased footage completed.

Roading for development schemes undertaken by the Departments of Maori Affairs and Lands and Survey has again featured prominently in the year's working. Owing to the co-operation of most local bodies this work has proceeded very smoothly and a marked improvement is noticeable on the construction of access roads to Maori settlements under development.

The table which follows sets out the extent of roadwork undertaken in the various districts during the year:—

Summary of District Reports

	County Roads.			Rehabilitation.			Maori Lands.		
	Formation.	Metalling.	Bridging.	Formation.	Metalling.	Bridging.	Formation.	Metalling.	Bridging.
	M. ch.	M. ch.	Ft.	M. ch.	M. ch.	Ft.	M. ch.	M. ch.	Ft.
Auckland District—									
Whangarei ..	6 17	19 71	156	1 34	5 60	..	11 58	21 30	115
Auckland ..	10 75	13 6	..	3 64	3 64	..	..	..	..
Hamilton District—									
Hamilton ..	35 72	36 29	124	7 41	13 4	..	2 35	1 35	..
Tauranga ..	3 28	2 57	100	..	..	..	16 79	9 44	..
Rotorua	3 58	5 10	..	4 20	0 74	..	2 60	..	..
Napier District—									
Napier	1 10	6 10	..	5 40	4 1	85	..	..	..
Gisborne	8 28	28 39	100	6 65	10 63	19	1 65	1 0	..
Wanganui District—									
Wanganui ..	6 60	8 20	..	3 0	3 0	..	2 40	2 40	..
Stratford	1 39	3 18	..	1 10	0 20	44	..	..	..
Taumarunui ..	..	6 13	..	..	..	..	..	..	..
Palmerston North ..	2 72	2 3	..	1 0	1 0	18	..	..	..
Wellington District—									
Wellington ..	9 65	15 5	145	2 10	4 16	..	..	..	..
Nelson	7 39	0 39	135	..	..	..	..	..	..
Christchurch District—									
Christchurch ..	17 63	33 77	34	3 47	3 47	..	..	..	..
Greymouth ..	1 14	1 14	..	..	..	..	..	..	..
Westport	4 36	5 76	..	..	..	..	..	..	..
Dunedin District—									
Dunedin	14 43	25 36	..	4 39	13 61	..	..	..	..
Invercargill ..	5 41	5 21	51	3 3	3 3	..	..	..	..
	141 40	218 64	845	47 53	67 13	166	38 17	35 69	115

SUMMARY

——	Formation.	Metalling.	Bridging.
	M ch.	M. ch.	Ft.
County roads	141 40	218 64	845
Rehabilitation	47 53	67 13	166
Maori lands	38 17	35 69	115
	227 30	321 66	1,126

DEFENCE WORKS

The usual maintenance has been carried out at Army and Navy establishments throughout the country. Living and messing accommodation is being overhauled at some of the Army camps in readiness for youths called up under the compulsory training edict.

At Devonport Naval Base the work of installing automatic fire-alarm and sprinkler systems in all store buildings is now complete, and the installation of similar equipment in other major buildings is in hand.

A steel-truss pedestrian overbridge, 291 ft. long, has been erected over the Shoal Bay stores area.

A number of foundations for new machines and for reparation machines from Germany were put down during the year.

A reclaimed area of 25 acres at Ngataringa Bay is in process of being grassed.

A 50,000-gallon reservoir has been erected at Tamaki, also a pumphouse and pumps, thus completing the installation of the new 6 in. fire-fighting service.

MISCELLANEOUS WORKS

Auckland Harbour Bridge.—The precise engineering survey of the bridge-site, the preparation of plans, and the collecting of tidal data, &c., were completed early in the year. The plans have been taken to the United Kingdom by a departmental representative (Mr. Packwood), whose mission is to collaborate with Messrs. Freeman, Fox, and Partners. This firm of consultants has practically finalized a preliminary bridge design.

Field-work during the year consisted of foundation investigations required by the designers. A total of twenty-five bores has been put down.

Civic Square, Auckland.—The comprehensive agreement has been signed by the Auckland City Council and the Government, and the outline development plan submitted by the Technical Advisory Committee has been approved by the participants in the scheme.

The Technical Advisory Committee did not meet during the year.

Teachers' Training College, Ardmore.—What was previously Ardmore Aerodrome is now a teachers' training college. Services such as roads, sewerage, drainage, &c., have been provided for twenty-one houses being built by the Housing Construction Division.

The facilities at Ardmore received wide publicity when used to accommodate the Empire Games teams. Two concrete swimming-pools were constructed, together with four additional basketball-courts. Another athletic field, necessitating 41½ chains of 4 in. tile drains, was also provided.

1YA Transmitter Site, Henderson.—An area of 10 acres has been cleared of gorse by a double rotary hoe.

Gracefield and Seaview Stores.—At the area occupied by the Central Plant Zone and the Department of Scientific and Industrial Research, 8,240 square yards have been sealed. At the Hutt Park Road stores an area of 3,100 square yards has been prepared and primed ready for sealing.

Maintenance of access roads and surrounding areas has also been carried out.

Mental Hospitals.—Side by side with the building programmes, the Department has been busy on engineering services required at new mental hospitals under construction. This work includes the provision of reservoirs, sewage-treatment plants, drainage, roading, water reticulation, &c.

The centres of activities during the year were Lake Alice in the North Island and Cherry Farm in the South.

Schoolgrounds.—Playing-areas, &c., have been constructed at a number of schools and colleges.

PLANT AND MECHANICAL EQUIPMENT

Owing to the continued necessity for conserving overseas funds, as much new construction equipment as possible has been obtained from local sources. Existing plant has been reconditioned and kept in use, even though in some cases this has meant retaining units beyond their economical life.

The equipment at present in use comprises some 9,800 items.

Departmental transport is still below strength, particularly cars and light trucks. Vehicles have accordingly to be hired from outside sources.

Designs for electrical plant to control the concrete-mixing machines at Maraetai and the Cobb have been prepared. Designs have also been prepared for the reception, generation, and distribution of electric power for the hydro-electric project at Roxburgh.

Visual aids in the form of film strips and sound films for the training of apprentices and welders have been made, and a safety campaign involving the use of such aids and lectures is being organized.

Other Departments have been advised regarding proposals to purchase and install plant and equipment, including special electrical installations, both in New Zealand and in the Pacific.

DESIGN OFFICE

During the year the Chief Designing Engineer's office dealt with a large variety of works calling for special attention, from bridges and hangers to a pontoon for raising flying-boat moorings (in the Chatham Islands) and run-off and river-gauging equipment for the Soil Conservation and Rivers Control Council.

Sewage-treatment and water-supply plants have been designed for the new mental hospitals at Lake Alice and Cherry Farm. An 1,100 ft. flume and 1,600 ft. of channel were designed to carry effluent from the Foxton flax-mill; drawings have been prepared for the steel form-work for the concreting of the Rimutaka tunnel; and preliminary designs have been taken out for a new marine-hulls building for the R.N.Z.A.F. at Lauthala Bay, Fiji.

Hydraulic-design tables have been compiled, printed, and issued to engineers and draughtsmen. The printing of structural-design tables and charts is almost complete

The preparation of plans and specification for the construction of the pipe-line for a section of the Wellington water-supply scheme has been completed.

Draughting examinations, both for the Department and for the Public Service Commission, have been conducted by the Design Office. This included the organizing, setting, and marking of papers in all technical subjects.

F. Langbein, M.Inst.C.E.,
Engineer-in-Chief.

APPENDIX D

TWENTY-SIXTH ANNUAL REPORT OF THE MAIN HIGHWAYS BOARD

The Hon. MINISTER OF WORKS.

SIR,—

In accordance with the requirements of section 24 of the Main Highways Act, 1922, the Main Highways Board has the honour to submit its twenty-sixth annual report for presentation to Parliament. The report covers the period 1st April, 1949, to 31st March, 1950.

GENERAL

The present length of main highways maintained or subsidized by the Board is 12,724 miles, and particulars of expenditure for the year ended 31st March, 1950, as well as a detailed statement of the position of various works, are shown later in this report.

Of the total length of main highways, 5,228 miles have been classified as State highways.

The total expenditure under vote "Highways Maintenance," which includes bridge renewals and fixed charges, amounted to £3,876,297. Under the vote "Highways Construction" the total expenditure was £2,246,736, giving a grand total expenditure of £6,123,033, as compared with a total expenditure of £5,608,977 for the year immediately preceding.

The registration of motor-vehicles showed an increase of 26,366 over the previous year's figures, and the latest figures inclued 2,617 more heavy trucks—*i.e.*, over 2 tons laden.

The length of new sealing completed was 329 miles, together with 35 miles of priming coats, making a total of 364 miles. Of this total, 11 miles were carried out on deviations and reconstructed sections of the older sealed highways and 63 miles constituted sealing on previous priming. In consequence, the net increase in dustless surfacing is 301 miles. This makes a Dominion total of 4,487, or 35 per cent. of the highways system. In addition to the above, a length of 333 miles of existing sealed surfaces received a maintenance coat.

The length of new bridging completed was 5,591 lineal feet, compared with 3,107 lineal feet for the previous year.

An analysis of the expenditure for 1949–50 by the Board and by local authorities on maintenance of main and State highways, as distinct from renewals, construction, and other overhead charges, is shown in the tabulation below: —

—	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	£	£	£		
North Island	1,757,979	152,316	1,910,295	92·03	7·97
South Island	750,966	74,123	825,089	91·02	8·98
Totals ..	2,508,945	226,439	2,735,384	91·72	8·28

The following table shows an analysis of expenditure for the year 1949-50 by the Board and by local authorities on bridge 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	338,795	16,329	355,124	95·4	4·6
South Island	97,655	506	98,161	99·48	0·52
Totals ..	436,450	16,835	453,285	96·29	3·71

An analysis of the Board's expenditure and the expenditure by local authorities for the year 1949-50 on improvements and construction shows the following position in respect of main and State highways :—

—	Board's Contribution.	Local Authorities' Contribution.	Total.	Percentage of Board's Contribution to Total.	Percentage of Local Authorities' Contribution to Total.
	£	£	£		
North Island	1,539,344	85,522	1,624,866	94·74	5·26
South Island	707,392	41,626	749,018	94·44	5·56
Totals ..	2,246,736	127,148	2,373,884	94·64	5·36

PROGRESS REPORT

A general description of the more important highway activities carried out in each district is as follows :—

Whangarei District

Work has been directed largely towards extending surface sealing, particularly over lengths of highway requiring minimum preparation, and good progress has been made. A prolonged drought since early December has enabled all forms of construction and sealing work to proceed without hindrance.

Major reconstruction completed totalled 4 miles 24 chains, while less heavy work was carried out over 19 miles 72 chains. Of this length 7 miles 39 chains were sealed, while the sealing of a further 6 miles 46 chains of reconstruction carried out last year was also completed. Thirteen miles of maintenance sealing were completed.

Tenders have been let for the supply of considerable quantities of metal for foundation and base-course work, and the delivery and laying of this is proceeding.

Steady progress has been made with the bridge renewal-programme, and new 24 ft. concrete structures totalling 485 ft. were completed. A further 350 ft. are in hand, while eight small timber bridges were replaced with pipe culverts. Three further bridges were renewed with concrete box culverts.

On the Whangarei–Awanui via Kawakawa State Highway 2 miles 60 chains of major reconstruction were completed on sections near Pakaraka and south of Waiomio, while minor realignment and reconstruction between Whakapara and Towai totalled 6 miles 10 chains. New sealing on this highway aggregated 6 miles 77 chains, the sections concerned being Otonga – Whakapara Bridge, Mitchell's Flat – Waiomio, junction Lake Omapere Highway – Okaihau, and past the Pamapuria Substation,

Maintenance sealing was carried out north of Hikurangi and at Ohaeawai.

The construction of Half-way Creek and Wallace's Bridges is in hand.

Between Whangarei and Dargaville the only work of any importance was resealing at Maungatapere and through the Dargaville Borough, and the widening of the western approach to the Tangiteroria Bridge.

On the Dargaville–Maungaturoto State Highway minor improvements were effected over 5 miles 21 chains, of which 4 miles 46 chains were sealed. The villages of Naumai, Matakohe, and Paparoa have all been provided with a dustless surface highway, while the length between the Maungaturoto Railway-station and Maungaturoto, and 1 mile of the section Maungaturoto–Highways Junction section were also sealed.

South of Kaiwaka, on the Birkenhead–Maungaturoto State Highway, a length of 76 chains was resealed.

A commencement was made on the reconstruction and sealing of the Mangonui–Awanui length of the Pakaraka–Awanui State Highway, and 1½ miles immediately south of Awanui were completed this year. A dust-laying seal was also provided through the Mangonui township. Four small decayed timber bridges were replaced with pipe culverts.

The major work in hand on the Dargaville–Ohaeawai via Waipoua Forest State Highway is the reconstruction and sealing of the Kaikohe–Ohaeawai section. Reconstruction, including the replacement of four small timber bridges with pipe culverts, is complete, and foundation and base-course metalling are proceeding satisfactorily. Resealing at Ohaeawai and a dust-laying seal through Kaihu Village were also carried out on this highway.

On the Whangarei–Onerahi section of the Whangarei–Tamaterau highway reconstruction is completed except for the short lengths affected by the Awaroa, Duck Creek, and Clotworthy's Bridges, which are in the course of construction.

The sealing of the Kaitaia Borough section of the Kataia–Motukaraka via Broadwood highway, which was commenced last year, has been completed.

On the Pamapuria–Oruru highway the Peria Bridge, 130 ft., and Te Puhi Stream Bridge, 85 ft., were completed, together with Simeon's and Old Black Culverts, which replaced bridges bearing the same names. Approach work is also complete.

The Kaikohe Station Highway was resealed over its whole length of 34 chains.

On the Kaikohe–Maungatapere highway the section within the Kaikohe Borough was resealed, while a short length of sealing to allay the dust nuisance past the Maungatapere Dairy Factory was also completed.

The Kaihu River Bridge of two 45 ft. and three 60 ft. spans on the Dargaville–Tikinui highway was completed, as also were the approaches.

Auckland District

Arrears of maintenance are gradually being made up, but the heavy commercial traffic has continued to cause difficulties. Work has consisted principally in metal strengthening, removal of soil shoulders, and widening of formation to improve drainage.

Reconstruction was completed over lengths totalling 3 miles 40 chains, and new sealing aggregated 1 mile 45 chains. In addition, 10 miles 8 chains were tar primed preparatory to road-oil sealing. Resealing, including 1 mile 23 chains of plant mix, was carried out over a total length of 22 miles 12 chains.

Surveys have been continued with the object of providing improved arterial highway access to the Auckland metropolitan area.

Construction has commenced on the southern outlet, Auckland, as the first length of the Auckland–Hamilton Motorway, and work is proceeding over a distance of 1 mile 31 chains. The construction of a 140 ft. four-lane bridge over the railway near Penrose is in hand.

The widening of the Auckland–Hamilton State Highway between Harp-of-Erin and the junction with the motorway at Penrose has continued. Many underground and overhead services have had to be adjusted to the carriageway widening, but the work is now 70 per cent. complete.

On the north-western outlet, Auckland, formation work has been commenced between the Whau Creek and Lincoln Bridge.

The total length of new bridges completed and opened for traffic during the year is 284 ft. The programme of bridge renewals is adversely affected by labour and materials shortages.

On the Birkenhead–Maungaturoto State Highway the widening and shoulder reconstruction for 3 miles 40 chains from Birkenhead Borough boundary to Greenhithe has been completed and resealed over a width of 24 ft. throughout. Similar widening work has been completed on the concrete section of 1 mile 23 chains south of Albany, and plant mix applied to the full 24 ft. width. On the Dairy Flat section widening for the purpose of facilitating drainage and strengthening of foundation has continued, and to date a total of 5 miles 10 chains has been completed and remetalling is in hand.

An alignment improvement was effected by means of a short deviation at Greenhithe Corner.

Grading improvements and resealing were carried out in the Wellsford Village and in the Warkworth Town District 15 chains of highway were widened.

At Silverdale a deviation 1 mile 17 chains in length was constructed and opened to traffic. This deviation, which includes a new reinforced-concrete bridge 260 ft. in length over the Wade River, eliminates several bad bends and a very dangerous one-way bridge.

On the Auckland–Helensville State Highway various lengths of widening work totalling 1 mile 11 chains were completed.

The Trig Hill loop on the Waitakere Scenic Drive has been resealed for a length of 48 chains and the top course has been strengthened and primed on several short lengths totalling 54 chains.

Work on the Auckland–Hamilton State Highway has been confined mainly to surface maintenance, including the refilling of some 5 miles of bitumen joints on the concrete section. On the Bombay Hills section an additional 1 mile 60 chains of widening was carried out, which brings the total of such work completed to date to 5 miles 20 chains.

Reconstruction of the Pokeno–Paeroa via Ngatea State Highway has proceeded. Widening, top-course metalling, and full-width road-oil sealing have been carried out over a distance of 2 miles 30 chains, making a total of 12½ miles of work completed to date out of a total length of 22 miles 20 chains.

In the Waitemata County bad failures due to heavy bus traffic occurred on the Beach Road highway. A length of 2 miles is now being reconstructed. A 25-ft.-span concrete bridge has been built over the Taiotea Stream at Brown's Bay.

On the Albany – Brown's Bay highway sharp corners have been cut back and 1 mile 20 chains of widening carried out.

The reconditioning of the Brigham's Creek – Albany highway to an improved standard has been advanced as far as the tar primer coat. The volume of traffic on this 9 miles 60 chains of highway has appreciably increased since its completion, thereby relieving the congestion on the Auckland harbour vehicular ferries.

On the Waikumete – West Coast highway lengths of 1 mile 14 chains in the Glen Eden Town District and 80 chains in the Waitemata County were resealed.

Resealing has been carried out over a length of 48 chains on the Brigham's Creek – Hobsonville highway.

On the New Lynn – Huia highway the sealing of 60 chains of shoulders to the concrete has been completed.

Several dangerous corners have been cut back on the Kaukapakapa - Port Albert highway, while between Waitoki and Waiwera, on the Helensville–Waiwera highway, the surface has been remetalled.

In the Rodney County some 4,000 cubic yards of additional metal were placed on the Kaukapakapa – Port Albert highway.

On the Warkworth–Tauhoa highway work has started on the erection of a new concrete bridge over the Hoteo River.

In the Franklin County 1 mile 10 chains of reconstruction was carried out and tar primed between Pukekohe and Buckland on the Pukekohe – Glen Murray highway. Culverting and formation have been well advanced on a length of 1 mile 19 chains of reconstruction near Hunua on the Papakura–Hunua highway. Resealing work in the county was carried out over five sections, aggregating 10 miles 39 chains.

In the Manukau County 50 chains of strengthening and resealing were done on the Papakura–Clevedon highway, and on the Howick–Manurewa highway 97 chains of highway reconstruction is in hand, the formation having been completed.

On the Papakura-Howick highway a section of 1 mile in length has been widened and top course laid preparatory to sealing.

Hamilton District

Favourable weather during the sealing season, in contrast to that of the previous year, together with held-over stocks of materials, enabled very good progress to be made in the resealing of both State and main highways. A total of 78 miles 53 chains was resealed. Even more could have been accomplished had sealing chips been obtainable.

Actual reconstruction and widening on State highways was limited to 1 mile 35 chains of completed formation, but on main highways 13 miles 39½ chains were completed.

Metalling to top-course standard on completed formation or in strengthening existing alignments amounted to 16 miles 69 chains, while 35 miles 51 chains of new sealing was carried out.

Two bridges, totalling 324 ft. in length, were built, while the construction of several others is proceeding.

On the Auckland–Hamilton State Highway plant-mix smoothing coat was applied on depressions across the Whangamarino Swamp and on a 40-chain length at the southern end of Huntly Borough. A total of 1 mile 27 chains of road-oil resealing was carried out on other sections. Seventy chains of 6 ft. widening for cycle-track have been completed up to the base-course stage on one side of the carriageway between Ngaruawahia and Horotiu.

On the Hamilton – Te Kuiti State Highway the Waipa River Bridge at Otorohanga, of two 50 ft. and one 70 ft. spans, is well advanced. A further 2 miles 52 chains of new sealing have been completed, and 7 miles 77 chains of maintenance resealing have been carried out.

The Mangaotaki River Bridge, of two 65 ft. and one 85 ft. spans, on the Te Kuiti – New Plymouth State Highway, has been completed, and work on the approaches is well in hand. Abutment and pier bases have been placed for the Awakino River Bridge, of two 39 ft. and one 55 ft. spans, north of Mahoenui on the same highway.

On the Pokeno–Paeroa via Ngatea State Highway widening, strengthening, and sealing of 1 mile 20 chains were carried out on the Waikato County section, and on the Hauraki Plains County section 1 mile 1 chain were resealed.

Maintenance resealing of Thames–Paeroa State Highway consisted of a 2 miles 55 chains length in the Thames County and a 15 chains length in the Paeroa Borough.

Two miles forty-eight chains of resealing were carried out in Ohinemuri County section on the Paeroa–Whakatane State Highway.

The Hamilton–Paeroa State Highway has had plant-mix paving placed on 1 mile 45 chains in Morrinsville Borough and 1 mile 78 chains immediately south of the borough. Road-oil resealing was carried out with lengths of 4 miles 69 chains in Waikato County, 68 chains in Piako County, and 2 miles 18 chains in Ohinemuri County.

On the major improvement works carried out on the Hamilton–Cambridge section of the Hamilton–Rotorua State Highway, the remaining length of 2 miles 72 chains has been primed. The road-oil seal coat was extended a further 5 miles 36 chains. Owing to shortage of sealing-chips it was not possible to complete the full length, and 3 miles 49 chains of primed works remain to be covered by road-oil sealing next year. On the Mamaku section of this State highway, 5 miles 30 chains of resealing was carried out. Again, owing to shortage of chips, a 60 chains length to complete the closure had to be left.

A 3 miles 1 chain length of top-course strengthening and tar dust-laying seal has been completed on the Te Kuiti – National Park State Highway.

On the Thames–Coromandel State Highway, 2 miles 59 chains of dust-laying seal coat were applied in the Thames County section. This gives a continuous dustless surface of 8 miles between Thames and Waiomu. On the Coromandel length an old timber bridge collapsed and was replaced by a single 35 ft. span temporary bridge of rolled-steel joists and timber deck, with a traffic width of 12 ft.

A dust-laying seal coat was placed on 16 chains of the Tapu–Kaimarama State Highway at Coroglen. On the same highway two old timber bridges were replaced by a concrete box culvert, 10 ft. 6 in. by 7 ft., and a pipe culvert. Realignment of 15 chains and 6 chains of stream diversion were also completed.

On the Tauranga–Pairere State Highway a further 1 mile 20 chains of dust-laying seal were applied on a strengthened base.

One mile six chains of formation and base-course metalling have been completed and 22 chains of dust-laying seal have been placed in Te Hoe Township on the Ohinewai–Tahuna highway, while 1 mile 14 chains were resealed in Piako County.

One mile ten chains of maintenance sealing were completed in Piako County on the Te Aroha – Waharoa highway, while on the Kihikihi–Arapuni–Putaruru highway 1 mile was resealed in Waipa County.

On the Ohinemuri County sections of the Hikutaia–Netherton highway a further 36 chains received a dust-laying seal coat, making a total of 1 mile 16 chains on this highway.

On the Te Awamutu – Cambridge highway 50 chains in the Leamington Town District have received a road-oil seal, and in the Waipa County the final 2 miles 67 chains of the 4 miles 73 chains of reconstructed work have received a dust-laying seal. On the same highway the high-level bridge over the Waikato River in the Cambridge Borough has had structural repairs carried out to steelwork and the deck renewed.

On the Ngaruawahia–Waingaro highway continuous reconstruction of 50 chains in the Ngaruawahia Borough and 40 chains in the Raglan County have been completed to formation stage.

In Waikato County on the Cambridge–Eureka highway a length of 1 mile was reconstructed and 3 miles 7 chains were resealed.

On the Otorohanga-Honikiwi highway 53 chains of formation and base-course metalling have been carried out.

One mile of base and top-course metalling, followed by road-oil sealing, has been completed on the Te Kauwhata – Waitakaruru highway.

In Piako County 6 miles 63 chains of maintenance resealing and 20 chains of short lengths of top-course metalling and road-oil sealing were carried out on the Ngatea–Waharoa via Morrinsville highway, and 60 chains of maintenance sealing were completed on the Waitoa–Maukoro highway.

On the Frankton–Pirongia highway the Mangapiko Stream Bridge became unsafe for traffic, and a Bailey bridge, 140 ft. in length, was erected. One mile of resealing has also been carried out on this highway.

On the Ngatea–Turua highway 1 mile 5 chains of resealing were carried out in the Hauraki Plains County.

In Matamata County 1 mile 60 chains of formation work were completed on the reconstruction of the Putaruru–Tapapa highway.

On the Morrinsville–Ngarua highway in Piako County 44 chains were reconstructed and sealed to improve vertical sight distances, and 1 mile 12 chains of maintenance sealing were carried out.

On the Taupiri–Morrinsville highway 72 chains of resealing have been done in Piako County, and in the Waikato County 60 chains of restoration work have been sealed, and 1 mile 10 chains of reconstruction, metalling, and sealing have also been completed.

On the Horotiu – Whatawhata – Te Rore highway new reconstruction is proceeding in Waipa County, and 60 chains of formation have been completed.

In Waikato County the formation on 1 mile 12 chains of reconstruction on the Hamilton–Tauhei highway has been completed, while 3 miles 31 chains were resealed.

On the Huntly–Rotowaro highway reconstruction is proceeding in Raglan County, and 67 chains of formation work have been completed.

In the Leamington Town District 2 miles 8 chains of reconstruction completed last year on the Cambridge–Roto-o-Rangi highway have now had a road-oil seal.

On the Pipiroa–Kopu highway a reconstructed length of 1 mile 10 chains in Hauraki Plains County was sealed.

On the Waipa County length of the Hamilton–Raglan highway a 1-mile length has been resealed. In the Raglan County the extensive realignment work being carried out at the Raglan end is now taking shape. A further 2 miles 17 chains of formation work, bringing the total to 4 miles 17 chains, have been completed, and 3 miles 14 chains have been metalled and received a road-oil sealing coat. The Okete Stream Bridge of 100 ft. and a twin culvert 7 ft. by 7 ft. by 62 ft. 6 in. are all in hand.

On the Matamata–Kaimai highway a length of 5 miles 25 chains of reconstruction is well in hand. A further 2 miles 47 chains of road-oil sealing brings the total to date to 4 miles 48 chains. The Waiomou Stream Bridge of 103 ft. was completed early in the year, and the Omahine Bridge, also of 103 ft., is in hand.

On the Waitoa–Tirau highway 2 miles 35 chains of drag-seal maintenance coat were completed in the Matamata County, and in the Piako County 3 miles 35 chains of road-oil resealing were carried out.

On the Huntly–Rotowaro via Waikokowai highway 2 miles 57 chains were resealed in Raglan County.

In Piako County on the Te Aroha – Springdale highway 1 mile 70 chains were resealed.

Tauranga District

Activities have been centred on improving the principal State highways and on continuing the dust-elimination programme. Most of the remaining unsealed lengths carry much heavy traffic, principally timber, stock, and fertilizer, and an exceptionally dry summer has aggravated the dust nuisance and caused additional maintenance.

A total of 23 miles 20 chains of hot-laid bituminous plant-mix surfacing has been placed, and 21 miles 22 chains of new sealing were carried out. On existing sealed surfaces 4 miles 71 chains have been given a second-coat seal, and 16 miles 79 chains received a maintenance-seal coat. In addition, 9 miles 10 chains have been primed in readiness for hot-laid plant-mix and 2 miles 40 chains of existing sealed surfaces have been prepared for smoothing coat.

The Galatea Quarry is now in production, supplying much-needed concrete aggregate, sealing-chips, and road-metal for the Rotorua area.

Work on the Paeroa–Whakatane State Highway has included extensive repairs on a number of timber bridges, of which the Waipapa, 60 ft. long, was entirely rebuilt. The new concrete bridge, 83 ft. long, over the Judea Stream was completed and the approaches built. Three miles thirty-two chains of new first-coat sealing were completed at Pongakawa, and 72 chains of two-coat sealing placed near Whakatane to close an unsealed gap near the Whakatane Board Mills. A considerable length of the highway between Waihi and Tauranga was surveyed for realignment, including a major deviation to eliminate the Athenree Gorge.

On the Rotorua–Whakatane State Highway heavy reconstruction between 14 miles and 16 miles has been completed, and construction switched to work back over the easier formation from 24 miles 32 chains towards Rotorua. As far as possible a policy of producing a continuous seal is being followed, and a 4-mile length is tar primed in readiness to receive the plant-mix bituminous top course. A gap of 5½ miles between the Tarawera Bridge and the Rotorua County boundary has been prepared for sealing. When this is done only 5 miles will remain unsealed between Whakatane and the Whakatane County boundary. A length of 3 miles 5 chains has been given a maintenance-seal coat.

On the Whakatane–Gisborne highway 1½ miles of widening in the Waimana Gorge were completed, and a length of 4 miles 40 chains from Taneatua through the Gorge was given a first-seal coat. Only half a mile of the Waimana Gorge now remains unsealed, and widening of this is nearly completed. Near Opotiki the 5-mile section between the Waiotahi and Waioeka Bridges has been prepared for sealing, and 3½ miles of first-coat sealing placed. The second-seal coat was placed on the Waioeka Straight of 4 miles, and in the Opato section of the Waioeka Gorge several floods scours have been restored by building concrete walls, affording wider and straighter pieces of roadway.

On the Rotorua–Taupo State Highway reconstruction of the Waiotapu section is almost completed. Bituminous plant mix has been laid over the 4 miles 33 chains of tar-primed surface prepared last year, and a further 5 miles beyond the Waikato River Bridge are primed. The unsealed length of pumice highway remaining between Rotorua and Taupo is 18 miles 14 chains. A maintenance-seal coat has been placed on 4 miles of this highway.

Initial work on the improvement of the Taupo–Napier State Highway from Taupo is in hand. Relocation survey of the first 6 miles has been completed, and 2 miles of the easier formation have been widened and realigned. Four miles in from the 22 m. peg at Rangitaiki Hotel a good-quality blue-metal quarry has been located and proved.

On the National Park – Taupo State Highway 21 miles 68 chains of reconstruction were completed, 10 miles 54 chains have been primed, and 16 miles 36 chains of plant-mix surfacing laid. The two Waiotaka overflow bridges were renewed, and side drains along the Waiotaka Flat are in hand. Test boring for the proposed new Tongariro Bridge is proceeding, and the existing bridge was further strengthened with more Bailey-bridge panels. The 2½-mile-long Taupo Town Board section has been primed in preparation for plant-mix smoothing coat.

Two 10-chain lengths of dust-laying seal at community sections were placed on the Wairakei–Tirau highway.

On the Tauranga–Pairere State Highway 70 chains of first-coat sealing have been placed, and the sealing in the Tauranga Borough section widened from 14 ft. to 26 ft. for a distance of 52 chains. Reconstruction at Wades Hill and at the Omanawa Bridge has been completed, and there is now a length of only 4 miles remaining unsealed. On this there is a deviation 1 mile in length scheduled for construction next year.

On the Opotiki – Te Araroa State Highway improvements were made at Massey's Hill and a retaining-wall erected near Waihau Bay.

On the reconstruction of the County Boundary – Turangi section of the Waiouru–Turangi State Highway top-course and base-course metalling is in hand.

Construction of the Whirinaki River Bridge at Te Whaiti on the Rotorua–Waikaremoana highway is now well advanced.

On the Taumarunui–Turangi State Highway 32 chains of plant mix were laid in the Turangi Township, and 16 chains of small-chip seal were laid in the Tokaanu Township.

One mile sixty chains of sealing were placed on the Mount Maunganui highway, thus completing the unsealed gap. The freedom from dust on this popular highway was greatly appreciated over the Christmas period.

Four miles of re-formation on the Paengaroa–Maketu highway were commenced in Tauranga County.

In the Tauranga Borough the Cameron Road reconstruction on the Tauranga Station highway has been started. When completed this will be a four-lane divided highway with cycle-tracks.

On the Te Teko – Awakeri via Edgecumbe highway the Whakatane County Council has in hand the re-formation of 4 miles between Te Teko and Edgecumbe. Good progress is being made on the new Edgecumbe Bridge over the Rangitaiki River. This 600 ft. bridge is being constructed to replace a very old wooden bridge originally built as a service bridge during the construction of the railway. On the new bridge the abutments and two spans have been finished, and sheet piling is being driven as coffer-dams for the centre piers.

Gisborne District

In this district emphasis must be placed on the needs of the arterial State highways. Both the coastal and the alternative inland route outlets to the south of Gisborne, as well as the northern outlet to the Bay of Plenty, all have considerable lengths that are narrow, tortuous, and, to a lesser extent, steep. The State highway from Gisborne northwards via the East Coast is of equal if not greater importance to the internal economy of the district. It has many old load-restricted bridges, and nothing in the nature of an alternative emergency route exists.

For the southern outlets, priority is being given to the Gisborne–Wairoa via Morere or coastal route, and the aim here is to close the gap in the sealing as quickly as possible. This should be achieved by the end of next season. The chief effort has been to improve the Whakatane–Gisborne via Waioeka State Highway to the north. Only minor reconstruction works have been carried out on the Gisborne – Te Araroa State Highway, but a considerable amount of preparatory work has been done for both resumption of bituminous sealing and for a vigorous programme of bridge-construction.

On all routes in this district considerable strengthening of foundations by building up of metal thickness is an essential prerequisite to new sealing.

During the past year on State highways 10 miles 36 chains have been reconstructed. New sealing amounted to 11 miles 23 chains, while 7 miles were resealed.

Two new reinforced-concrete bridges of 309 ft. total length have been completed, a third bridge of 166 ft. has been 15 per cent. completed, and a contract let for a fourth bridge of 120 ft., while repair work was done on sixty bridges.

A 34-chain deviation on the Opotiki – Te Araroa State Highway in the vicinity of Hicks Bay resulted in the elimination of a double crossing of an unbridged stream. On main highways only 4 miles 22 chains were reconstructed. New sealing amounted to 4 miles 22 chains, while resealing was done on 7 miles.

Reconstruction was commenced on the Whakatane–Gisborne via Waioeka State Highway between 47 m. and 51 m. 40 ch., and 60 chains were completed. Sealing was completed between 16 m. 53 ch. and 19 m. 2 ch. on the work reconstructed last season, and further reconstruction has been completed to 26 m. 43 ch., except for 2 miles at the Te Karaka Bluffs. Sealing was completed to 25 m. 11 ch. A contract has been let for the erection of McGregor's Bridge.

On the Gisborne – Te Araroa State Highway the Pouawa Bridge, 139 ft. in length, was completed. Six miles of maintenance sealing were done between 4 m. and 34 m. and in Te Puia Township. A quarry has been opened up at Mangatuna to supply metal for the proposed extension of sealing beyond Tolaga Bay. The highway through Te Araroa Township was sealed. The Hicks Bay Deviation of 24 chains was completed. This eliminated two open crossings of the Nukutaharau Stream.

Reconstruction and sealing on the Gisborne–Wairoa via Morere State Highway were completed from 16 m. to 19 m. 5 ch. and from 21 m. 5 ch. to 23 m. 5 ch. Maraetaha No. 1 Bridge, 172 linear feet in length, was completed, and work has commenced on Maraetaha No. 2 Bridge.

Maintenance sealing was done over 1½ miles and also 1½ miles of plant-mix surfacing on the Gisborne–Ormond via Waiohika Main Highway.

On the Patutahi–Rere highway 3 miles 8 chains of reconstruction and sealing were completed to 10.60 m. and Spaniards Bridge is under construction.

Two miles of maintenance sealing were done on the Tolaga–Tauwhareparae highway.

On the Motu Front highway, Poututu section, further regrading was completed in repairing the flood damage of 1948.

Two miles of maintenance sealing were carried out on the Manutuke–Wairoa via Mangapoike highway.

On the Tokomaru Bay Wharf highway re-formation and priming were completed between 0·7 m. and 1·9 m. This makes the dustless surface complete on this highway.

Napier District

Good progress has been made in maintenance and improvement works as a result of a favourable year free of major flood damage.

Particular attention has been given to remetalling sections of gravelled highway showing wear from heavy traffic, while some 12 miles 26 chains of main highway have been treated with dust-laying seal coat with small local improvements to alignment.

Sections of the Taupo–Napier and Gisborne–Napier State Highways which are already sealed and carry heavy timber and log traffic are deteriorating, particularly on the side traversed by the loaded vehicle.

The extension of sealed surfaces on State highways was given high priority, particularly between Gisborne and Napier, but, whilst only an additional 3¾ miles between Tuhara and Wairoa were actually sealed this year, formation, metalling, and preparation work over a further 5½ miles between Nuhaka and Wairoa and 5 miles between Raupunga and Kotemaori is well advanced ready for sealing next year.

During the year an aggregate length of 24¼ miles of new dustless surfacing was completed, whilst 29¼ miles of maintenance sealing were carried out, and 11 miles of road-oil and chip sealing completed on priming or tar coat applied last year.

A number of small bridges were replaced in reinforced concrete, and contracts are let or work is in hand on the replacement of eleven structures with culverts or small bridges.

A length of 6½ miles of the Taupo–Napier State Highway realigned in 1940 was metalled and sealed, giving a sealed highway to the west for 31 miles from Napier.

With improvements being carried out on the coast State highway, the Gisborne–Napier via Hangaroa State Highway is not generally used by through traffic. The 4 miles from Frasertown to Wairoa is now all sealed, and this continues 13 miles south of the town to Ohinepaka. Of the 18½-mile gap of shingle road remaining to Napier, plans are prepared for improvements to 3 miles, and work is in hand on 5 miles, which makes an all-sealed road to Wairoa a possibility in the next two or three years.

The Tangoio–Whirinaki Deviation, which eliminates a tortuous 2 miles of shingle road near Napier, is well in hand.

The Tangoio Lagoon Bridge had two spans damaged by fire, and Bailey bridging was used to carry traffic until repairs were effected.

One mile seventy chains of deteriorating sealing at Westshore were reconstructed and primed.

On the Napier – Palmerston North State Highway the replacing of wooden culverts, removing high shoulders or widening same, repairing localized failures, and improving drainage are important improvements. In addition, maintenance sealing has been carried out over 14½ miles. Investigations are almost complete for preparation of proposals to replace the existing timber bridge at Clive, while a new 45 ft. bridge has been completed at Woodville.

The Rotorua–Waikaremoana State Highway has now been restored to reasonable order following the flood in May, 1948. The Hopuruahine Stream Bridge is completed to a stage where it is available for traffic, but the Waiotukapuna Stream Bridge is still under construction.

On the Gisborne–Wairoa via Morere State Highway a further 3¾ miles have been sealed adjacent to the Wairoa Borough.

The Fernhill–Takapau highway is now sealed to Maraekakaho at the northern end, and 2½ miles sealed towards Onga Onga from the Takapau end.

On the Waipawa–Pourere highway 3 miles 30 chains of light re-formation and metalling have been completed, and 1 mile 20 chains primed.

The dustless surfacing of the Woodville–Tamaki highway has been extended 1 mile 50 chains in the Woodville County and 1 mile in the Dannevirke County.

A further 2 miles of the Hastings–Waimarama highway were metalled and sealed, leaving only 7½ miles of metalled road to Waimarama. Good progress has been made on the reconstruction of the Tuki Tuki River Bridge at Van Asch's. Half the deck of the 1,080 ft. structure, and all but one pier base, is completed.

On the Farndon–Pakowhai highway metalling and sealing with tar of 1 mile 55 chains were completed, leaving only 1 mile of this highway with a gravelled surface and providing an alternate route south from Napier, by-passing Hastings.

With the completion of 2 miles 64 chains of sealing, the Waipawa–Tikokino highway now has a dustless surface throughout, while the replacement of an old narrow timber bridge with a concrete box culvert in the Waipawa Borough is well advanced.

The Ngararoro River Bridge at Fernhill, on the Napier–Hastings via Fernhill highway, totalling 1,320 ft. in length, was opened for traffic early in July.

Brabazen's Bridge, a narrow timber structure on the Norsewood – Te Uri highway, was replaced with a concrete box culvert.

Taumarunui District

The year's work has been chiefly concerned with general maintenance, although some reconstruction and improvement works have been undertaken. In areas affected by timber and road traffic, maintenance has been heavy, with constant repair work to bridges.

On the National Park – Taupo State Highway 1,900 cubic yards of metal aggregate were used for maintenance work. The Wanganui and Whakapapanui Bridges were further strengthened, and a temporary bridge and by-pass were constructed at 10 miles from National Park, where a large wooden culvert collapsed.

On the Te Kuiti – National Park State Highway reconstruction has been proceeding over 5 miles 60 chains between Ongarue Turnoff and Okahukura. Re-forming was completed and metalling is well advanced.

The Waimarino River Bridge at Erua, on the National Park – Wanganui State Highway, collapsed under a heavy load, and a Bailey bridge was erected.

On the Taumarunui–Turangi State Highway the Upper and Lower Kuratau Bridges, 66 ft. and 120 ft. long respectively, were completed. Test boring for foundation information was carried out at the proposed new bridge-site at the Manunui River. Strengthening of the temporary Bailey bridge at Manunui was made necessary by heavy timber cartage.

A large creeping slip 2 miles west of Ohura on the Ahititi–Taumarunui State Highway caused considerable trouble and blocked the highway on several occasions. At Ohura a maintenance depot is being built. Nearly 3,000 cubic yards of spoil have been cleared on the section between Ohura County boundary and Taumarunui, chiefly from slips on the Te Maire and Herlihy's Bluffs.

On the Chateau State Highway widening improvements were made to the section above the Chateau Tongariro, and extensive metalling was undertaken.

On the Taumarunui–Ongarue highway a length of 1 mile 48 chains was sealed following widening and improvement work. Corner improvements were carried out over a length of 8 miles, and a further mile was widened towards Ongarue.

Improvements have been made to the Raurimu – Wade's Landing highway by minor widening works. The Tarata Stream Bridge approaches were completed and the old bridge salvaged.

Heavy coal traffic has made constant maintenance necessary on the Pio Pio – Ohura highway, and 3,400 cubic yards of metal aggregate have been applied.

Taranaki District

The major part of the year's work has consisted of maintenance and minor improvements of surfaces. The new State highways declared at the beginning of the year required immediate widening and strengthening of the running surface. As a result of a favourable summer the length of resealing carried out was the greatest for many years.

With the arrival of a plant-mix machine the manufacture locally of material for smoothing the old sealed roads of this district was commenced. During the year 2,014 tons were made and, except for a few tons used throughout the district on maintenance patching, the output was used to improve the old portions of the highway between Inglewood and Stratford.

Old surfaces have been resealed on the present widths over a length of 24 miles 2 chains on both State and main highways, while old surfaces have been widened in preparation for a smoothing surface over a length of 5 miles 24 chains, and a length of this type, of 7 miles 48 chains, has been treated with a smoothing coat of plant mix. In all a maintenance seal has been applied for full width over a length of 31 miles 50 chains.

The total length of new sealing amounted to 7 miles 18 chains, increasing the district's total of dustless surface by this amount.

On the Te Kuiti – New Plymouth State Highway the reconstruction of the approaches and lengths adjacent to the Mahakatino Bridge is well advanced. Further reconstruction has been carried out between Uruti and Mangamaio, and 1 mile 25 chains of the work have been sealed. A large slip on this length required a fortnight for complete clearance. Work has proceeded on the new bridge at Mohakatino, and the structure is now nearly half completed.

A maintenance-seal coat has been applied over three lengths, giving a total distance of 5 miles 15 chains. On two lengths as well, a total of 66 chains of the old surface has been widened.

Further improvements to the New Plymouth – Hawera State Highway have been carried out. The work of widening the old sealed surface has continued, and a smoothing coat has been applied over a length of 4 miles 48 chains between Inglewood and Durham Road, and from Norfolk Road to Tariki. This has also been done over the length of 2 miles through the Stratford Borough. The Tariki Deviation of 72 chains has been reconstructed and resealed completely during the summer months, while a maintenance seal has been placed over three lengths, totalling 5 miles 45 chains.

Between Hawera and Patea a maintenance-seal coat has been laid over a length of 2 miles 20 chains on the Hawera–Wanganui State Highway.

On the New Plymouth – Hawera via Opunake State Highway a maintenance seal has been completed through the Oakura Township for a distance of 1 mile 20 chains.

A total of 8 miles 70 chains of resealing was completed on several main highways. New sealing was completed for 1 mile 43 chains on the Hawera–Mokoia highway, for 2 miles 20 chains on the Devon Road – North Egmont highway, and for 1 mile 50 chains on the Manaia – Dawson Falls highway. The minor improvements over $3\frac{3}{4}$ miles of this last highway have been completed, and as a result the traffic control, required to ensure that only traffic in one direction used the route at one time, has been removed.

A number of old bridges have been repaired, Bailey bridging material being used to temporarily support the structures while work proceeded.

Wanganui District

The improvement of north and south highway communications through the centre of the Island continues to receive particular attention. Fifty-two miles of sealing, chiefly second-coat work, were completed during the year.

On the Hawera–Wanganui State Highway construction of the Whenuakura Deviation is now well advanced, and the road is under traffic. Two and a half miles of widening work have been completed north of Waverley.

Formation work on Farley's Deviation, on the National Park – Wanganui State Highway, is nearly completed, while a bridge has been built over the Upokongaro Stream. Work has commenced on the renewal of the Mangawhero River Bridge.

On the Horopito–Bulls via Taihape State Highway the Winiata Deviation has been commenced, and 52 chains of formation were completed. Between Cliff Road and Norwood Corner an additional 1 mile 50 chains has been reconstructed, making a total of 4 miles 10 chains.

Reconstruction has been carried out over 2 miles of the Raetihi–Ruatiti highway and over $3\frac{1}{2}$ miles of the Bonny Glen – Norwood Corner highway.

On the Blueskin highway metalling has been carried out over the whole length of 3 miles 60 chains, and three corners have been improved.

On the Wanganui–Kauangaroa highway 3 miles of reconstruction have been completed from Denlair Road Junction to Kauangaroa, with the exception of Reid's Hill.

Palmerston North District

On major highways, which are completely sealed, work has consisted chiefly of continuing carriageway widening, and lengths totalling 4 miles 50 chains were completed. Lengths of existing surfacing totalling 11 miles 76 chains were resealed, while new dustless surfacing added during the year amounted to 10 miles 73 chains, bringing the total to more than half the highway mileage in the district. Reconstruction was completed on three lengths totalling 5 miles 52 chains, and is in hand on four lengths totalling 7 miles 58 chains.

On the Wanganui–Levin State Highway widening and sealing were carried out for 3 miles southwards from Himatangi, to complete the new sealed width of 24 ft. between Himatangi and Foxton. Also, on this highway, 2 miles 20 chains were resealed over several individual lengths.

In the Manawatu Gorge section of the Napier – Palmerston North State Highway the temporary bridge over the washout near the Ballance Bridge was replaced by a two-way permanent structure. Also in the Manawatu Gorge section individual lengths totalling 1 mile 15 chains were resealed. At Currie's Hill reconstruction of a 43 chains length is in hand, earthworks being now about three-quarters complete.

On the Sanson – Palmerston North State Highway the 3 miles 25 chains length recently widened between the Oroua River and Newbury was resealed over the full width of roadway. A further 1-mile length from Newbury towards Palmerston North was improved by widening, as also a length of 50 chains between the Mangaone Stream and Palmerston North City boundary.

On the Levin – Palmerston North via Shannon State Highway individual lengths totalling 40 chains were dug out, remetalled, and resealed.

On the Longburn – Tangimoana highway 2 miles 65 chains are under reconstruction, 1 mile 64 chains of new construction were sealed, and two lengths totalling 65 chains were resealed.

On the Bunnythorpe–Kairanga highway a length of 1 mile 1 chain was reconstructed and resealed, and another length of 1 mile 10 chains was resealed.

On the Pohangina Valley – Apiti highway the length of 1 mile 30 chains at Apiti recently reconstructed was sealed.

A length of 10 chains was resealed on East Street highway in Feilding.

On the Awahuri–Mangaweka via Kimbolton highway three lengths totalling 70 chains which had been largely rebuilt were resealed. Reconstruction was completed on the 2 miles 67 chains length between Kimbolton and Spur Road. Also, 34 chains of new sealing were done at Rangiwahia.

On the Greatford–Ashhurst highway 1 mile 15 chains of new reconstruction were sealed, and another length of 3 miles is under reconstruction. Twenty chains of this highway were resealed in Feilding.

On the Ashhurst–Pohangina highway tar priming was completed over four sections totalling 3 miles 12 chains, 1 mile 7 chains of which were completed with road-oil sealing.

On the Kimbolton–Apiti highway a 2 miles 78 chains length of new construction was sealed, and another 1 mile 30 chains length is under reconstruction.

Wellington District

In this district the proportion of dustless surface to the total district mileage is 83 per cent., and bituminous surfacing is therefore mostly maintenance sealing. Twenty-one miles fifty chains of this work were done during the year, while 1 mile 3 chains of new sealing were completed. The main construction work is the Wellington–Foxton Motorway, which is in progress over a length of 4 miles 60 chains from Johnsonville northwards to Porirua.

Maintenance sealing was completed for 12 miles 40 chains on the Levin–Paekakariki State Highway. The Ohau River Bridge, previously limited to 10 tons loading, was strengthened with Bailey-bridge trusses to loading of 15 tons. Complete reconstruction of the traffic bottleneck in the built-up area of Otaki Borough is in hand.

On the Masterton–Wellington State Highway maintenance sealing on the Mungaroa and Rimutaka Hills was completed for 2 miles 19 chains.

On the new motorway between Johnsonville and Porirua earthwork is well in hand to complete formation of a length of 4 miles 60 chains. To date, 1,135,000 cubic yards have been excavated. Metalling is proceeding over the four traffic lanes between Johnsonville and Takapu Road, a length of 3 miles 4 chains.

On the Levin – Palmerston North via Shannon State Highway maintenance sealing was completed for a length of 2 miles 7 chains.

Maintenance sealing was completed for 2 miles 4 chains over the Upper Hutt – Waikanae highway.

On the Pahautanui–Plimmerton highway new sealing was completed for a length of 50 chains on the Plimmerton Hill.

The first sealing on the recently declared Lower Hutt – Wainuiomata highway was carried out in Wainuiomata Township over a length of 33 chains.

Wairarapa District

Dustless surfaces comprise only 35 per cent. of the total district mileage, and most counties are pursuing a vigorous sealing programme.

The most important work in the district is the completion of the Ruamahanga River Bridge, 217 ft. long, on the main arterial road north of Masterton. The approaches, comprising a deviation 1 mile 37 chains long, will soon be completed, when a through route will be available for heavy traffic from Wellington to Hawke's Bay via the Wairarapa. This has not been possible for several years owing to the load restrictions on the present timber bridge over the Ruamahanga River.

Widening and preparation work carried out during the year amounted to 8 miles 58 chains, while 7 miles 78 chains of new sealing and 16 miles 19 chains of resealing were completed. Three bridges totalling 296 ft. in length were built.

On the Woodville–Masterton State Highway the Ruamahanga River Bridge at Mount Bruce, consisting of a 112 ft. reinforced-concrete arch and seven 15 ft. spans, was completed. The bridge approaches, comprising a road deviation 1 mile 37 chains long, are well advanced.

On the Masterton–Wellington State Highway realignment over a length of 16 chains was completed and tar primed at Platform Farm Corner, the scene of fatal accidents, just north of Greytown. In Carterton Borough new concrete kerbing and channelling were completed for a length of 68 chains, and the existing sealing was widened to the kerbs over a length of 75 chains. Maintenance sealing on the Rimutaka Hill and in Greytown Borough was completed for 2 miles 48 chains.

A bridge of 40 ft. span at 1·5 miles on the Mauriceville–Hastwell highway was completed.

The Eketahuna–Nireaha highway was improved by the reconstruction and metalling of a length of 1 mile 3 chains, while in the Eketahuna Borough new footpath sealing was completed for 38 chains.

In the Eketahuna County, on the Pah Valley highway, stream improvements were completed for 1 mile 22 chains to alleviate flooding of the highway.

Reconstruction and metalling were completed for a length of 2 miles 16 chains on the Chester highway.

On the Masterton–Weber highway a bridge at 23·75 miles was renewed by a 35 ft. concrete span, while at Thomas's Slip Deviation, 1 mile 14 chains long, in Akitio County, base-course metalling was completed.

Reconstruction is in hand from 0 m. to 1 m. in the Pahiatua County on the Pahiatua–Akitio highway, and formation is 40 per cent. completed.

Extensive improvements are proceeding on the Masterton–Castlepoint highway. In the Masterton County, on reconstruction between 7 m. 26 ch. and 10 m. 26 ch., formation is 80 per cent. completed, while between 10 m. 76 ch. and 13 m. 45 ch. reconstruction has been completed except for top-course metalling. In Castlepoint County a contract has been commenced for reconstruction between 22 m. 40 ch. and 23 m. 67 ch.

On the Masterton–Stronvar highway new sealing was completed for 2 miles 39 chains on a reconstructed section completed the previous year. Between 8 m. 28 ch. and 10 m. 4 ch. reconstruction is in hand and formation is 40 per cent. completed.

On a section of the Carterton–Gladstone highway reconstructed the previous year, new sealing was completed for 4 miles 26 chains. A commencement was made with the driving of test piles for the new Ruamahanga River Bridge, which will be 625 ft. long.

On the Martinborough – Lake Ferry highway in the Featherston County maintenance sealing was completed for 3 miles 71 chains.

On the Eketahuna–Alfredton highway in the Eketahuna County new sealing on a previously reconstructed section was completed for 1 mile 13 chains.

In the Wairarapa South County on the Martinborough–Masterton highway the Taueru River Bridge, comprising three 55 ft. and two 40 ft. reinforced-concrete spans, is in hand, and pile-driving is practically completed.

Reconstruction is in progress on the Carterton–Longbush highway between 2 m. 25 ch. and 6 m. 46 ch. On the Park Road section, maintenance sealing was completed for 2 miles 22 chains.

On the Martinborough–Awhea highway on Harris' Hill, reconstruction and base-course metalling were completed for 1 mile 60 chains.

Maintenance sealing was completed for 4 miles 40 chains over the Kahautara highway.

On the Dreyer's Rock highway construction of a new concrete bridge 35 ft. long at 4·5 m. has been commenced.

Nelson District

Extension of sealing has been continued on the arterial highways of the district. Six miles forty-two chains of major reconstruction and 4 miles 70 chains of minor improvements, together with 12 miles 47 chains of sealing, were completed. On main highways some 8 miles of sealing were carried out. Bridge construction is being pushed ahead, 775 ft. being completed, while a total of 640 ft. is in hand.

On the Picton–Christchurch State Highway heavy reconstruction has been continued on the Para–Tuamarina section, a further 73 chains being completed. Excavation on this work to date totals over 400,000 cubic yards. In addition to improving the alignment, this reconstruction is raising the roadway to avoid the frequent serious flooding which has occurred in the past. Major improvements are also in hand between Blind River and Ward. The Blind River Bridge, 60 ft. long, is nearing completion, while Tetley Brook Bridge has just been commenced.

Extensive improvements have been carried out over 2½ miles between Pelorus Bridge and Wakapuaka River Bridge on the Blenheim–Nelson State Highway. Preparation and sealing are proceeding over 7 miles between Pelorus Bridge and Brown Bridge, 3 miles of sealing being completed.

On the Richmond–Collingwood State Highway the main improvement work has been the extension of sealing from Takaka towards Upper Takaka, the length completed being 6 miles 77 chains. Considerable flood damage was suffered on this highway, a large slip on the Takaka Hill causing particular trouble. The Appleby Bridge, 728 ft. long, and the Rameka Creek Bridge, 47 ft. long, were completed, while construction is proceeding on Payne's Ford Bridge of 420 ft.

On the Nelson–Westport State Highway limited improvements were made to 3 miles over Spooner's Range in preparation for dust-laying treatment, while major work was carried out over 62 chains. A 40-chain section at Clay Bank and 1 mile 20 chains between Longford and Murchison were reconstructed, while a contract was let for 6 miles 30 chains of reconstruction between Motupiko and Korere. Sealing has been confined to a maintenance coat on 1 mile 57 chains between Richmond and Brightwater, and 2 miles of new sealing on Spooner's Range. The construction of Two-mile Creek Bridge is proceeding.

Steady progress has been made on improvements to the Murchison – Lewis Pass via Shenandoah State Highway. Major work is in hand on the Pea Soup Creek section, while widening has been carried out between Shenandoah River Bridge and Frog Flat, together with the replacement of small wooden bridges with reinforced-concrete pipe culverts.

On the Takaka–Tarakohe highway metalling preparatory to sealing is being carried out between Motupipi and Pohara.

On the Appleby-Motueka via Tasman highway 4 miles 16 chains of sealing have been completed.

A 15-chain deviation has been constructed on the Dashwood–Upcot highway to remove the highway from river erosion near White Bluff Creek.

Sealing has been completed over 2 miles 20 chains of the Renwicktown – Hope Junction highway between Marchburn Bridge and Erina, while on the Seddon–Marama highway 3 miles have been prepared for sealing in Awatere County. Preparation and sealing were completed over 1 mile 44 chains on the Spring Creek – Wairau Bridge highway.

On the Picton-Havelock via the Grove highway extensive subsidences on the Picton Borough section have been repaired.

West Coast District

The heavy rainfall experienced throughout the district, combined with heavy coal and timber traffic on some of the highways, has frequently caused difficult maintenance problems. Flood damage has also created difficulties, in that plant and labour has had to be diverted from other works.

Reconstruction between Inangahua Junction and Berlins on the Nelson–Westport State Highway is taking shape, 1½ miles being completed. A very large quantity of slip material was removed during the year. On Christmas Day exceptionally heavy rain caused three major washouts between 14½ m. and 16½ m., the worst being at Neame's Creek where, owing to a slip blocking a water-drive, 40 ft. of road were washed out to a depth of 50 ft.

On the Inangahua Junction – Greymouth State Highway good progress has been made on general improvements and sealing. New sealing has been completed for 3 miles 10 chains between Waitahu and Cronadun. Preparation for sealing has proceeded between Cronadun and Inangahua, the work being complete from Cronadun to Larry's Creek, while a further length from Larry's Creek to Rotokohu is in hand. On the Reefton–Greymouth section 4 miles 72 chains were sealed, 1 mile 27 chains were resealed, and major repairs were carried out on the Big Grey River Bridge. There are now only two short breaks in the sealing between Reefton and Greymouth, at the proposed Hukarere Deviation and at Reefton Saddle.

An improvement has been made at Granite Creek on the Hokitika–Ross section of the Greymouth–Waiho State Highway by the construction of a 16-chain deviation. Extensive repairs were carried out to the Tatara River Bridge, while at the Poerua River Bridge nearly 1,000 cubic yards of rock were placed in strengthening existing groynes. Two miles seventeen chains of the highway were resealed.

The maintenance of the Arthur's Pass – Kumara Junction Section of the Christchurch – Kumara Junction State Highway is in itself a major job, particularly over the Otira Gorge length. This highway is subject to heavy flood damage, and the year under review has been no exception. The construction of the 130-ft.-long reinforced-concrete bridge at the Little Wainihinihi River crossing was completed, and the formation of the approaches and road realignment is in hand.

On the Waiho–Paringa State Highway the main work has comprised repairs to extensive flood damage and in carrying out protective works at numerous points. The reconstruction of some 10 chains of the 35 chains road deviation at Canavan's Knob near Waiho, which was completed in the previous year, became necessary following a break through of the Waiho River.

Further progress has been made with the Reefton – Garvey's Creek improvements on the Reefton–Waipara State Highway, but plant has been frequently required to perform urgent works elsewhere. Aggregate lengths of 64 chains of formation have been completed.

A 38 chains deviation through the Charleston Township on the Westport–Greymouth (Coast Road) State Highway was formed and sealed. Further progress has been made with the Runanga–Rapahoe improvements and the approaches and road realignment to the Seven-mile Creek Bridge have been completed, whilst further work is in hand on improving the section from Runanga Borough northwards.

Improvements on the Westport–Karamea highway have been in hand, and the section from 12 m. 6 ch. to 16 m. 35 ch. was completed and is ready for priming. Work is in hand on two reinforced-concrete bridges at Tidal Creek, and on a bridge at Glasseye Creek, while major repairs are being carried out to three 120 ft. trusses of the Mokihinui River Bridge.

The construction of the 1,015 ft. reinforced-concrete bridge over the Kokatahi River on the Kanieri–Koiterangi highway has been recommenced, and test piles have been driven.

Improvements have been carried out at Denniston on the Waimangaroa – Burnett's Face highway, and also at Waimangaroa, where some 31 chains of road have been improved preparatory to sealing.

North Canterbury District

Efforts have been made to extend the sealed length of highway north and south from Kaikoura on the Picton–Christchurch State Highway, and towards Hanmer Junction on the Reefton–Waipara State Highway.

The total length of new sealing completed was 17 miles 22 chains, 12 miles 38 chains of this length being reconstructed during this year, while 142 ft. of new bridging was built.

On Picton–Christchurch State Highway the Irongate Bridge, 93 ft. long, has been completed, and the highway reconstructed and sealed from this bridge to Hapuku, a distance of 4 miles 67 chains. A contract has been let for the construction in reinforced concrete of the Mororimu Stream Bridge and Mororimu Overbridge on this highway in conjunction with the Kahautara Bridge on the Red Post – Kaikoura highway.

Realignment and widening in steep rock country over a length of 37 chains is in hand at Ohau Bluff, while on the Hapuku–Kaikoura section a length of 1 mile of new sealing has been completed.

Between Kakautara and Kie Kie a contract is in hand for top-course construction and sealing over a length of 4 miles, and a sea wall 11 chains in length is being constructed to provide widening at the only remaining danger point on this highway.

Considerable improvement has been effected in widening, superelevation, &c., in preparation for sealing between Kie Kie and Oaro, and a bridge approach deviation of 17 chains at Oaro is now completed.

A contract has recently been let for the construction of a deviation of 43 chains in length at Weka Creek near Waipara.

On Reefton–Waipara State Highway all piles are driven and abutments almost completed for the Boyle River Bridge, while at the Gorge and Calf Creek Bridges the abutments are almost completed in readiness for the steel girders on order from England.

Six miles twenty-six chains of this highway have been reconstructed and sealed between Red Post and Montrose, and a further contract recently commenced for reconstruction and sealing from Montrose to Twenty-mile Creek, a distance of 5 miles.

Piles are being cast for the new bridge at Kahautara on the Red Post – Kaikoura highway. This will provide an all-weather crossing of this difficult river, after many years of inconvenience.

This year sees the completion of 4 miles 64 chains of new sealing between Red Post and Rotheram, and the commencement of a further section of reconstruction and sealing from Allen's, near Rotheram, to Waiau, also on this highway.

Christchurch District

The length of new sealing completed is 9 miles 43·5 chains, a total of 9 miles 63·5 chains being reconstructed during the year. Twenty-one miles sixty-two chains of maintenance sealing were also carried out.

Following on the gazetting of the centre-line Proclamation during the year for Christchurch–Lyttelton Motorway, the engineering survey has now been completed to the tunnel portal in Heathcote Valley, providing for original construction as a two-lane highway with cycle-tracks. Pegging of the road reserve is in hand by Lands and Survey Department, and is to include provision for ultimate widening to four-lane highway.

The earthwork construction of the northern access to Christchurch on the Picton–Christchurch State Highway is now well advanced.

On Christchurch–Kumara State Highway extensive pier repairs and underpinning has been carried out under difficult water conditions at the Waimakariri Bridge at Bealey. For the bridging of Broad Stream, arrangements have been made with the Railways Department to obtain steel trusses as they become available from the West Coast railway bridge strengthening programme. Six miles fifty-five chains of resealing have been completed from Paparua to West Melton.

A contract has been let on Christchurch–Timaru State Highway for the construction of a cycle-track and kerbing from Upper Riccarton to Sockburn. There has been no further action on Blenheim Road Deviation, being the proposed southern outlet for Christchurch, but investigations were commenced for the proposed motorway from Riccarton to Templeton.

A total of 6 miles 24 chains of resealing has been completed between Hoon Hay and Tai Tapu on Christchurch–Akaroa State Highway. Every endeavour is being made to increase the sealed length of this highway, and in addition to letting a contract for the reconstruction and sealing of 6 miles 56 chains from Kaituna to Birdling's Flat, proposals are completed for a further length to Little River, and surveys almost completed between Barry's Bay and Akaroa. Deviations at Duvauchelle 33 chains, and Robinson's Bay 10 chains, and a three-cell box culvert at Duvauchelle, are almost completed. Extensive repairs were carried out on the Black Bridge at Little River.

Reconstruction and sealing of 47 chains have been completed through Governor's Bay Township on the Lyttelton–Motukarara highway.

Seven miles sixteen chains of resealing have been completed on the Paparua County section, and a box culvert completed at Doyleston on the Sockburn – Southbridge – Rakaia Huts highway.

The reconstruction and sealing of 4 miles 65 chains of Darfield–Arundel highway have been completed from Darfield to Homebush School, and contracts have been let for the reconstruction and sealing of Leithfield Beach highway and 1 mile 54 chains of Lincoln – Tai Tapu highway.

On the Kaiapoi Beach highway 1 mile 20 chains have been reconstructed and 1 mile of new sealing has been completed. Giles Road – White's Road section of Waimakariri Bridge – Bennett's highway has been reconstructed and sealed for a distance of 3 miles 4 chains, and a length of 1 mile 37 chains of resealing completed on Ilam highway.

South Canterbury District

A total of 16 miles 1 chain of reconstruction and new sealing has been completed, this figure including 2 miles 72 chains of primed surface in readiness for bituminous surfacing next season. Twenty-four miles seventy-seven chains of resurfacing have been completed, comprising 16 miles 77 chains maintenance sealing and 8 miles plant-mix surfacing.

Local bodies in this district are demonstrating their ability to perform reconstruction and sealing works, and are acquiring plant for this purpose.

On Christchurch–Timaru State Highway maintenance sealing has been carried out between Ashburton Saleyards and the railway crossing, and from the Ashburton Traffic Bridge to Tinwald, a total of 45 chains. Tinwald–Hinds section has been resurfaced with plant mix for 8 miles.

Maintenance sealing of 3 miles 30 chains from Pareora to Otaio has been completed on the Timaru–Dunedin State Highway, and the construction of two bridges at Waihao of a total length of 1,033 ft. is now well in hand.

The sealing of Timaru–Cromwell State Highway has been further increased by 4 miles 20 chains of reconstruction and sealing, with a further length of 2 miles 72 chains primed in readiness for sealing next season on the Cave–Albury section. Proposals are in hand for further extension of this sealing to Fairlie, but extensive reconstruction is now necessary through the Mackenzie County, partly as a result of the heavy traffic to Tekapo and Pukaki hydro schemes. Further improvements were effected on this highway by 79 chains of metalling and sealing, and 58 chains of maintenance sealing at Tekapo Village.

Special precautions were taken in transporting heavy generator sections weighing up to 37 tons from Fairlie to Tekapo Hydro, Bailey bridging being used for the passage of all water-ways.

On Geraldine–Fairlie highway the Pusey Culvert and Deviation of 15 chains were completed, and tenders called for the construction of the Skipton Bridge, using steel girders on order from England.

Work is in progress on the reconstruction and sealing of 6 miles 40 chains from Ikawai to Hakataramea on Deep Creek – Waihao Downs – Dip Creek highway.

Six miles reconstruction and sealing have been completed from the State highway to Surveyor's Road on Tinwald–Longbeach highway. The contractor for the construction of the Black Bridge on Surveyor's highway is engaged on driving piles.

On Temuka – Pleasant Point highway a short length of 69 chains is being reconstructed in preparation for sealing between Manse Bridge and Edgar Corner.

A start has been made on the reconstruction of a 3-mile section of the Ashburton–Staveley highway, while 2 miles of maintenance sealing were completed from Trevor's Road to Crocrane's Road on the Ashburton–Wakanui highway.

One mile forty chains of reconstruction and seal were completed on the Timaru – Holme Station Bridge highway. Six miles fifty-six chains, being the balance of a larger contract, have been completed on the Hinds–Winchester via Arundel highway, while the Rangitata–Geraldine highway has been maintenance sealed for a distance of 3 miles from the junction with Christchurch–Timaru State Highway.

North Otago District

In the Dunedin districts efforts have been chiefly directed towards linking up sealed surfaces on the Dunedin–Gore State Highway, and to reconstructing and sealing various sections of the Milton–Queenstown State Highway. Between Dunedin and Gore only 4 miles 56 chains now remain unsealed.

Reconstruction work was carried out over lengths totalling 15 miles 50 chains, while 44 miles 22 chains were sealed and 26 miles 25 chains were resealed.

On the Timaru–Dunedin State Highway limited progress was made on the major deviation at Maheno to replace two very old bridges with one new structure, and to improve the alignment, grading, and railway crossing just north of the township. Continuing the policy of widening the existing 18 ft. seal to 22 ft. between Waianakarua and Hampden, a length of 2½ miles of widening has been primed and sealed during the year between the Waianakarua River and Hampden. Work at Kakaho Hill, which includes alignment and grading improvement over 34 chains of steep winding roadway, has suffered several setbacks owing to plant difficulties, but some 5,000 cubic yards of excavation have been removed. A contract has been let to reconstruct the surfacing over a 3¾-mile length from the Big Kuri Stream southwards to Hillgrove, which is the oldest and roughest section of the sealing between the Waitaki River and Dunedin. Some minor widening is being carried out in conjunction with the resurfacing to give 20 ft. of sealed width. Two major cuttings on the new highway route via the Leith Valley and formation work between Waitati and the Saddle have been completed.

On the Timaru–Cromwell State Highway 2 miles 4 chains of preparation and priming were completed in the vicinity of Gravelly Gully.

On the Milton–Queenstown State Highway a deviation to avoid a tortuous section between Shingle and Gorge Creeks has been continued, 1 mile 1 chain being formed, and 20 chains of base-course gravelling have been completed. Preparation and sealing were carried out near Shingle Creek and at Gibbston, a total length of 3 miles 60 chains having been completed. Flood damage restoration work on this highway has been completed with the exception of some gravelling.

On the Queenstown–Invercargill State Highway flood damage (principally collapsed stone walls and slips) has been restored.

On the Palmerston–Clyde State Highway a very rough length of 3 miles 12 chains between Palmerston and Glenpark has been remetalled and sealed with a dust-laying seal coat, and a section of 40 chains of dust-laying seal coat has been completed in Lauder. Preparation for sealing in the following townships is in hand: Ranfurly, 40 chains; Wedderburn, 50 chains; Becks, 50 chains; and Omakau, 1 mile 2 chains.

Restoration of severe flood damage on the Queenstown–Wanaka highway is well advanced, the highway being usable in fine weather.

On the Pukeuri–Kurow–Omarama Main Highway a length of 5 miles 30 chains has been resealed. A contract has been let for the erection of a new 100 ft. reinforced-concrete bridge of three spans at the Awamoko Stream where a single-way timber bridge was washed out in 1946. A contract for the supply of 15,000 cubic yards of metal to build up the Waitaki Hydro – Omarama section is nearly completed.

A length of 5 miles 50 chains between Weston towards Ngapara on the Waiareka–Ngapara–Duntroon highway has been reshaped, metalled, and sealed. It is proposed to continue this sealing to Ngapara.

Flood damage on Skippers highway has been partly restored and the highway is usable. Improvement gravelling has been completed over a 3-mile section leading to the Coronet Peak Skiing-grounds, and this should give better travelling conditions in Winter.

On the Wanaka–Haast highway flood damage consisted of slips, washouts, and severe surface scouring. A huge slip near Camp Creek, which moves periodically, blocked the highway from May until December. A new roadway was cut over this and has, so far, remained open for traffic.

South Otago District

On the Dunedin–Gore State Highway efforts have been made to close the unsealed gap between 71 m. and 82 m. Various improvement works and metalling have been carried out over the length, and with sealing completed to date the gap has now been reduced to 4½ miles. On the Waipahi Deviation earthwork is proceeding. A contract was let for the resealing of the Balclutha–Clinton section, and a length of 12 miles 60 chains has been completed to date.

On the Clarkesville–Coal Creek section of the Milton–Queenstown State Highway improvement work in preparation for sealing has been continued. The sealed surface is now continuous from Clarkesville turnoff to beyond Waitahuna, and from Island Block to Coal Creek. Between Clarkesville and Glenore 3 miles of sealing were completed, and 1 mile 60 chains of dust-laying seal coat were completed through Waitahuna Township. Reconstruction has been carried out from Waitahuna to Evan's Flat over 7¼ miles. This leaves a gap of 2 miles 15 chains from Forsyth to Lawrence yet to be reconstructed. On the Evan's Flat – Beaumont section reconstruction is now being carried out, and 2 miles 40 chains of formation and subgrade metalling have been completed.

On the Island Block – Roxburgh – Coal Creek section 1 mile 48 chains of formation, 3 miles 28 chains of metalling, and 4 miles 77 chains of sealing were completed.

On the Balclutha–Wangaloa highway 1 mile 42 chains of resealing were completed in the Kaitangata Borough section.

A contract has been let for improvement of the Roxburgh – Miller's Flat highway from Roxburgh Railway-station to the Roxburgh Bridge to provide a good haulage road for the Roxburgh hydro scheme.

Fifty-eight chains of dust-laying seal between Balclutha and Finegand on the Balclutha – Kaka Point highway have been completed during the year, making a total for this section of 2 miles 30 chains.

On the Mosgiel–Middlemarch–Dunback highway 1 mile of reconstruction and gravelling has been carried out.

Six miles forty-six chains of dust-laying seal coat were completed on the Portobello–Harrington Point section of the Dunedin – Harrington Point highway.

On the Green Island – Taieri Mouth highway 5 miles 60 chains of resealing were completed.

On the Allanton–Outram highway priming and sealing were completed over a length of 4 miles 40 chains.

Southland District

In this agricultural district heavy man-power requirements by freezing-works results virtually in a cessation of highway works in the first half of the year. Only minimum maintenance is possible over this period. As the roads are sealed the position will be materially relieved, and therefore priority is being given to the extension of sealing, particularly over the more heavily trafficked routes.

Bridge construction and renewals were restricted by man-power shortages. To maintain access it has been necessary to rebuild some decayed bridges in timber, while other timber structures have been widened to provide safer conditions. Including these timber reconstructions, a total length of 829 lineal feet was built.

On the State highways reconstruction of 18 miles 15 chains was completed, while 17 miles 25 chains were sealed, and 2 miles 15 chains resealed. On main highways 6 miles 53 chains of reconstruction and 4 miles 16 chains of sealing were completed.

On the Dunedin–Gore State Highway the Pukerau Bridge, 45 ft. long, was completed in concrete to replace a narrow decayed structure.

A length of 2 miles 15 chains of the Gore–Invercargill State Highway was resealed, and borings were completed for the renewal of the decayed Waihopai Stream Bridge at Kennington.

On the Queenstown-Invercargill State Highway, the heavily trafficked northern arterial route, the abutments have been poured for Scotts Creek Bridge at a ford that blocks traffic during floods, while a dangerous hair-pin bend and some other bad corners have been eliminated by the construction of a deviation 36 chains long at Lowther. Reconstruction is nearing completion on the section from Lumsden to Josephville, and from that point to Benmore the highway now has a dustless surface with the completion of 3 miles of reconstruction and the sealing of 4 miles 37 chains. In the Centre Bush – Limehills Township 2 miles 42 chains have been sealed, and the Winton – Buxton's

Corner section is completed, except for the Lochiel Deviation, with the reconstruction of 10 miles 43 chains and the sealing of 10 miles 25 chains. In this section a 20-ft.-span bridge has been widened from 12 ft. to 24 ft. in timber, and the Winton Channel Bridge is being similarly widened to take the heavy industrial and general traffic that is now using the highway.

As a start in the improvement of the Gore–Croydon section of the Gore–Lumsden State Highway, dangerous curvature has been eliminated and sight distance improved over 2 miles 60 chains.

In the Riverton Borough and adjacent county section of the Riverton–Tuatapere State Highway 60 chains have been reconstructed and widened from 12 ft. road width to 24 ft. width. The Waimeamea Bridge of 68 ft. length collapsed, and was replaced by a Bailey bridge until the original structure was rebuilt.

On the Lumsden – Te Anau – Milford Sound Highway timber bridges totalling 530 lineal feet and two Baileys each 80 ft. long were erected in place of decayed log bridges. Extensive deferred maintenance in the way of scrub-cutting and reshaping the road has been carried out on the 11-mile section from Homer to Milford to make good the climatic damage during and since the war.

The reconstruction and sealing of the Riverton–Rocks highway was completed for its length of 1 mile 15 chains, while 1 mile 23 chains of reconstruction and sealing in Ohai Township on the Winton–Ohai–Orawai highway were also completed. The local bodies completed the reconstruction and sealing of 1 mile 28 chains of main highways in five townships.

HIGHWAY ENGINEERING AND DESIGN

Details have been given to show just how striking has been the growth of the road transport industry, particularly in the direction of introducing the heaviest classes of vehicles up to the limits which are permitted on highways. With increase in weight-carrying capacity there is naturally increase in size, and vehicles are being built longer and wider, up to the maximum dimensions permitted by law.

Simultaneously, with the increase of vehicle capacity, there has been continued improvement in the travelling performance of all types from motor-cars to the heaviest combinations. Our roads and highways must therefore not only provide for a growing traffic volume, but also for an increasing number of heavier and larger vehicles all moving generally with increased speeds.

The basic problem facing a roading authority is to economically provide the facilities over which efficient automotive transportation can be conducted. The ideal to be aimed at is to provide a road design which will automatically carry traffic safely and fluently at a rate which, because it is in harmony with vehicle performance, will not be unduly restrictive.

Where facilities lag behind the development and performance of traffic units, restraint is imposed on operation, to the detriment of road safety. Under these conditions accidents readily occur when the human element fails.

Exigencies of the time will, of course, require some modification of the ideal in roading policy. Within its resources the Board must meet immediate demands, and at the same time provide for modern trends and guide the sound development of our highway system. In the present effort to extend dustless surfacing, particularly in the closing of unsealed gaps on the more densely trafficked arterial highways, therefore, the Board cannot always undertake the extent of reconstruction which may ultimately be desirable. The policy adopted is that where there appears to be little possibility of improving a section of highway to its lastingly acceptable standard within the next few years, a low-cost dust-laying seal coat is being applied with only such minor improvements to the existing condition of the road as will ensure soundness of the work. Such improvements are usually limited to the correction of drainage deficiencies, the strengthening of the metal courses, reshaping of the road, particularly to provide superelevation on curves, and limited corner improvements to provide two-way width.

The impracticability of early improvement is generally dictated by economic conditions, but a secondary limiting factor is the shortage of material and labour resources under existing conditions.

Where even improvements, which are limited to the existing carriageway and which are necessary to ensure the soundness of a seal coat, cannot be carried out at a reasonable cost, or wherever there is a special case for the adoption of more permanent standards now, then full reconstruction is undertaken. This is then carried out on sound permanent lines to standards which take due regard of traffic, both present and potential, to the end that such major reconstruction shall be lasting and shall be in accordance with the best modern highway engineering practice.

With regard to sealing proposals from counties, loan-money is often involved, and generally, whether such or not is the case, counties desire to make one permanent job when they seal. This, of course, has usually involved reconstruction.

While a great deal of consideration has been given to the planning of motorways, of necessity looking well to the future, actual work has been confined to those sections immediately adjacent to the major cities where the high traffic volumes and deficiencies of the existing facilities have created justifiable demand. Such work must be of a permanent nature, and construction must therefore be carried out to reasonably high standards.

To aid the Board in formulating policy and as a guide to the priority demands of particular highways, it is proposed to conduct a Dominion-wide traffic census during the coming statistical year. The last census was carried out in 1938, and although there has not been normal development during the intervening years, it is now considered that an up-to-date count should not be delayed any longer. In this census more attention will be paid to the tallying of heavy vehicles of various classes.

Particular mention may be made of surfacing work which the Board has been developing in the Rotorua–Taupo area. Following on experimental work which was conducted with local materials, the Board has now constructed a considerable mileage of hot-laid bituminous-mix surfacing.

Sealing in the pumice country in the centre of the North Island presents some distinct problems. No suitable source of sealing-chips has yet been discovered, and even if chips were available our standard surface-seal methods could not be applied without considerable modification.

Although it may be well compacted, pumice falls far short of a properly stabilized metal aggregate or a macadam pavement in unconfined stability and surface hardness. However, it is free draining, non-plastic, and little effected by varying normal moisture conditions, so that it has good foundation properties. Thus, providing it is properly prepared and is contained and protected by a suitable surface coating, it is satisfactory for building up the pavement strength. Good-quality pumice should be used, and it should be placed in layers and thoroughly compacted under moist conditions to the required depth.

Pumice must have some additional strength of surface coating over what would be required on a normal metal surface. In the first place, our standard seal of one coating of chips would be unsatisfactory, because the pumice has insufficient strength to resist the large chip being punched into it. This would quickly cause disruption and break-up of the seal coat. Secondly, there is little bond between the bituminous carpet and the pumice surface, so that there is a lack of horizontal shear strength along the plane of junction of the pumice and surface pavement. There is not the strong keying action provided by the texture of a crushed stone surface. Any bituminous surfacing laid direct on pumice must therefore be of a nature which will not be pushed into the pumice. Also, it must be constructed thickly enough to withstand the shearing force of traffic, and to sufficiently reinforce and protect the pumice base.

Two-coat chip sealing, using tar and a large chip followed by road oil and a smaller chip, was formerly used to carry out some surfacing work in the area. Metal chips had to be imported long distances, however, and the work was costly. Under light pre-war loadings this treatment lasted well, but where loadings have become more severe much of it has failed and heavy reseal coats have been necessary.

The Board recognized that before any extensive programme of dustless surfacing could be undertaken in the Rotorua–Taupo area an economic answer had to be found in the use of local materials. Pumice mix was tried, but too much costly imported bitumen was required. The material adopted was a partially waterworn grit or fine gravel. The particles were reasonably hard, they had retained an appreciable degree of angularity, and generally they did not exceed $\frac{1}{2}$ in. to $\frac{3}{4}$ in. circular screen size. There was, however, a deficiency of fines below the 50-mesh screen, and as this fraction was not readily obtainable from other deposits, it was decided to use an open graded mix instead of one with the more desirable dense grading.

Generally 180/200 penetration bitumen has been used. With this comparatively soft binder and with the non-plastic pumice base it was considered that some initial porosity of the surfacing would not be detrimental. Also, before the binder had lost its ductility, the aggregate would be broken down under the action of traffic to provide a fairly dense carpet. Some sections have been given a light emulsion surface seal. In areas outside the cartage range of the grit deposits work is turning now to the use of the best available local material, and for one job a comparatively low-grade rhyiolte is being crushed for the mix aggregate.

All the bituminous mix has been laid hot by paving-machine and a first-class surface has been provided. This mix has good initial stability, and even though in some instances in the early stages the surface has been somewhat marked by stock, it has generally ironed out again satisfactorily under traffic action. In the interests of economy these carpet coats have been laid as thin as possible, the thickness to date being $1\frac{1}{2}$ in. The bituminous binder content is comparable to that of a two-coat seal, and the cost below that of general base, top course, and sealing work on normal subgrades.

It must be emphasized that this mix surfacing is a method devised only to solve local problems, such as discussed above. Where metal-supplies are available, the Board's standard metalling and chip sealing procedure is to be preferred.

HIGHWAY BRIDGING

Bridging generally, with the increased loadings and heavy goods traffic following on the war period, had reached a position giving cause for grave concern. District reports show some 700 bridges as requiring renewal, and of these 286 of the most urgent, estimated to cost £3,500,000, have been listed for renewal. Of the remaining 414 requiring renewal, some will require renewal at a not very distant date, so that it can be said that there is at least £5,000,000 worth of bridging which should be renewed within a comparatively few years.

Among the chief difficulties in dealing with the position have been the scarcity of contractors and skilled bridging labour willing to undertake this country work, and the difficulties in the supply position, particularly cement and steel. This latter difficulty has considerably improved, and has helped towards nearly twice as much bridge-renewal work being effected this year as against last year.

The bridge-renewal expenditure this year amounted to £436,450, whereas the previous year £287,384 was all that it was possible to expend on this necessary work. As this position eases, the annual expenditure on bridges should be gradually stepped up to and kept at £1,000,000 per annum for a few years.

To get over immediate difficulties and ease the position the Board acquired from Army and United Kingdom War Disposals Commission nineteen sets of Bailey bridging totalling some 1,370 tons of special steel parts, most sets comprising 130 ft. of double double Class 40 loading. Bailey bridging is, however, only really suitable for temporary use, and is in effect a pin-jointed suspension bridge. It has found ready use in that it can be erected quickly in emergency, and has also been utilized to hold up some of our wooden truss bridges which would not otherwise carry the loads. About two-thirds of this equipment is at present in use, and with further immediate and necessary demands it can be said that it is being as fully utilized as is soundly possible and still keep

sufficient bridging available for emergencies, which are not uncommon under present bridging and traffic conditions. It has been used for forty bridges, and is at present in use on thirty of these, and may expect to remain in some cases up to five years.

Apart from construction in New Zealand of bridges in permanent materials, tenders were called in Britain for three manufactured steel bridges, and these should arrive shortly. Also, Callender-Hamilton bridging is being obtained for the Pelorus and Canvastown Bridges on the Blenheim–Nelson highway. Some twenty-one second-hand, 66 ft., wrought-iron truss spans are being acquired ex New Zealand Railways strengthening programme for three highway bridges.

By various temporary means and the steps outlined, together with an improvement in material supplies, if the construction and skilled man-power situation can be improved for bridge-work, the position can gradually be remedied.

LOADING ON HIGHWAYS

During recent years the Board has drawn attention to the great increase in both the numbers and the individual loads of heavy motor-vehicles, and has stressed the effect which this development is making on our highway system and thus on our national economy.

Reference to registration figures shows a striking position. Whereas in 1939 only 3 per cent. of the total number of heavy motor-vehicles were registered in the 7½ to 8 tons class, by 1949 this figure has risen to 31 per cent. In the multi-axled vehicle classes, from 8 to 10 tons, the increase over the same years has been from 6 per cent. to 22 per cent.; while in the heaviest class, consisting of vehicles over 10 tons in gross weight, the figures have risen from 3½ per cent. to 8 per cent.

The significance of these figures lies in the fact that the 7½ to 8 ton vehicle is the heaviest two-axled vehicle of conventional design which up till now it has been possible to operate over a highway. Operators are naturally going to the legal loading limit to provide economic and competitive transportation. Unfortunately they have been all too frequently in practice going beyond the limit. The same position obtains for the multi-axled vehicles with their increasing numbers working to the class limits, and beyond, for the various highways.

As stated in last year's report, the Board had endeavoured to make a realistic approach to the problem of loadings and, after investigation, had made detailed recommendations to the Transport Department. As a result, new loading regulations are now to be introduced at an early date, and in preparation for this a review is being made of the classification or load-carrying capacity of all highways. In the result, with the rationalizing of anomalies which have existed and with a general up-grading of highways, there will be advantage to operators. On the other hand, our highway assets must be protected and preserved within our ability to pay for their reasonable maintenance and there must be strict exercise of control and enforcement of these more modern and liberalized regulations. Strict control and enforcement has been promised the Board by the Transport Department. Unless this control is effective and unless penalties are sufficiently severe to act as a deterrent against overloading, extensive failure and excessive and costly maintenance will continue on our highways.

CENTRE-LINE MARKING OF HIGHWAYS

The usual centre marking of highways consists generally of a 4-in.-wide line, 18 in. long, with 4 ft. 6 in. gap to the next mark. This, however, is not fully standard, and other lengths of line and gap exist. This marking costs by machine marking from £7 to £12 per mile, and has to be done, for satisfactory marking, two and sometimes three times per year.

In view of the cost of centre-line marking, and despite the generally temporary nature of the types of surfacing used in this country, the use of more permanent markings may be economic. To this end centre-line marking has been carried out, chiefly in Southland, utilizing white quartzite pebbles. These have been generally 4 in. wide and 12 in.

long, spaced at 8 ft. intervals. While not fully adequate as a centre-line marking for heavy traffic, they provide a satisfactory permanent mark. The work is carried out during the chip-sealing process. Details of this procedure have been circularized to the various highway districts, and more of this type of work can be expected using limestone or other white chips where such meet the case.

In addition to this, information has been obtained as to various elastic centre-line marking materials, and just north of Auckland a fairly satisfactory centre-line marking has been made by the Board with a mixture consisting of 60 per cent. of white sand mixed with various resins and other necessary materials as recommended by the Road Research Laboratory in England. The little laid so far was fairly costly, but indications were that with development it could be laid at a cost comparable with that required annually for centre-line marking. It is proposed to extend this work. We are also about to try various proprietary plastic centre-line materials.

Marking consisting of glass beads fixed on white paint, which is very effective under night driving conditions, is being used in special circumstances.

It will be a little while before any real opinion can be given on these various types of markings and their economy under paving conditions in this country.

VISITS OF INSPECTION AND CONTACT WITH LOCAL BODIES AND AUTOMOBILE ASSOCIATIONS

The Board was able to continue its practice to maintain contact with local bodies and automobile associations interested in the control of main highways. Such inspections enable the Board as a whole to investigate local problems and conditions, and works in hand and proposed, and to discuss aspects of administration and finance with those authorities most particularly interested.

The Board visited South Canterbury, Dunedin, and Southland in November, 1949; and in March, 1950, Wairarapa, Napier, Gisborne, Rotorua, and Tauranga areas. Local authorities generally have continued to satisfactorily administer highways affairs under their control.

The demand for increasing dustless surfacing is rapidly increasing, and to such an extent that the Board is finding difficulty in providing its share of the cost of the sealing programmes some of the local authorities desire to be put in hand.

The Board is grateful for the continued good will and co-operation that has on all occasions been extended to it by local authorities and motor organizations.

EXAMINATION FOR FOREMEN AND OVERSEERS OF ROAD CONSTRUCTION

The twenty-third examination for Foremen and Overseers of Road Construction was held on 16th November, 1949, when fourteen candidates presented themselves for examination.

Fourteen sat paper No. 1 on general road construction and maintenance, and seven sat paper No. 2 on tar, bituminous, and concrete road construction. Of the twelve candidates that were successful in paper No. 1, seven also were successful in paper No. 2 and thus completed the examination, leaving the remaining five candidates with a partial pass.

SIGNPOSTING

The cost of signposting carried out on main highways by automobile associations during the year ended 31st March, 1950, was subsidized at the rate of £3 for £1, the cost to the Board being £6,069. In cases where the Board or local authorities erected signs required by regulation or for traffic safety, the cost was included as part of ordinary maintenance, and centre-line marking was also regarded as maintenance.

ADVANCES TO LOCAL AUTHORITIES

During the year ended 31st March, 1950, the Board entered into thirteen agreements with local bodies in regard to advancing to them their share of the cost of works carried out on main highways. The principal of these advances amounted to £24,849 1s. 7d. The total of principal advanced to local authorities since the inception of the Board is £417,289 4s. 5d., of which the sum of £67,140 8s. 8d. was outstanding at the 31st March, 1950.

PLANT

The facilities provided by the Board to enable local authorities to acquire plant under the hire-purchase system were again taken advantage of to a considerable extent. The purchases in 1949–50 amounted to £110,165 7s. The total value of plant purchased under this system since its inauguration is £639,431 11s. 11d., of which sum £147,456 8s. 1d. remained outstanding at 31st March,1950.

OPERATIONS OF MAGNETIC TRUCK AND TRAILERS

During the year the magnetic truck and one trailer-type magnet operated in the North Island, and the other trailer-type magnet operated solely in the South Island. Unfortunately the recording of the material picked up has not been dissected sufficiently to show the actual amount collected on highways. It is hoped that this information will be available in the future.

DECLARATIONS, REVOCATIONS, AND ADJUSTMENTS OF MAIN HIGHWAYS

The following are the lengths of main highways declared and revoked during the year ended 31st March, 1950, including formal adjustments :—

Main Highways Declared

	M. ch.
No. 2B Highways District—	
Auckland–Hamilton	57 19
Hamilton – Te Kuiti	36 73
Hamilton–Rotorua	48 76
No. 3 Highways District—	
Tauranga–Pairere	1 0
Whakatane–Kutarere via Ohope Spa	18 43
	1 70
No. 5 Highways District—	
Porangahau Post-office	0 36
No. 9B Highways District—	
Karori – Ohariu Bay	5 56
No. 11 Highways District—	
Spring Creek – Wairau Bridge	7 70
No. 12 Highways District—	
Ngahere–Roa	5 04
No. 13 Highways District—	
Hanmer Junction – Jack's Pass	1 40
No. 14 Highways District—	
Waitangi Wharf – Owenga	12 60
No. 16 Highways District—	
Dunedin–Waitati via Leith Valley	3 08
	200 75

Main Highways Revoked

	M. ch.
No. 2B Highways District—	
Auckland–Hamilton	58 01
Hamilton – Te Kuiti	37 33
Hamilton–Rotorua	49 45
Hamilton–Tauhei via Gordontown	37 35
No. 3 Highways District—	
Tauranga–Pairere	1 0
Wainui	15 60
No. 9B Highways District—	
Karori–Makara	4 20
Masterton–Wellington	4 0
No. 11 Highways District—	
Kaituna–Tuamarina	9 70
No. 12 Highways District—	
Ngahere–Blackball	3 31
	183 57

The Board acknowledges the continued assistance given by the Works Department in the matters relating to highways administration, and records its appreciation of the valuable services rendered by officers of the Department in carrying out the Board's programme. It also greatly appreciates the loyal and efficient work of its engineering and clerical staff in carrying out its policy.

Signed on behalf of the Main Highways Board :

F. Langbein, M.I.C.E., Chairman.

MAIN HIGHWAYS STATEMENT OF ACCOUNTS

STATEMENT SHOWING PARTICULARS OF NET EXPENDITURE ON CONSTRUCTION, RENEWALS, MAINTENANCE, ETC., FOR THE YEAR ENDED 31ST MARCH, 1950, AND TOTAL TO DATE

	Construction and Improvement of Main Highways.		Renewals of Main Highways.		Maintenance, Repairs, &c., of Main Highways.		Totals.	
	Total for Year 1949-50.	Total since Inception of Main Highways Act, 1922, to 31/3/50.	Total for Year 1949-50.	Total since 1/4/36 to 31/3/50.	Total for Year 1949-50.	Total since Inception of Main Highways Act, 1922, to 31/3/50.	Total for Year 1949-50.	Total since Inception of Main Highways Act, 1922, to 31/3/50.
Highways District—	£	£	£	£	£	£	£	£
No. 1	186,745	*1,955,645*	45,554	*508,846*	191,040	*2,081,899*	423,339	*4,546,390*
No. 2A	189,758	*3,843,997*	28,415	*336,084*	217,906	*4,349,487*	436,079	*8,529,568*
No. 2B	149,171		29,311		268,164		446,646	
No. 3	298,899	*1,781,820*	61,064	*154,763*	241,466	*2,342,636*	601,429	*4,279,219*
No. 4	134,796	*880,608*	4,161	*87,386*	146,284	*1,511,576*	285,241	*2,479,570*
No. 5	156,844	*1,293,980*	83,596	*328,992*	175,468	*2,090,661*	415,908	*3,713,633*
No. 6	24,319	*906,018*	9,829	*48,005*	54,238	*1,289,021*	88,386	*2,243,044*
No. 7	31,632	*1,062,013*	26,620	*106,113*	84,331	*1,442,230*	142,583	*2,610,436*
No. 8	93,409	*1,387,472*	19,783	*227,340*	118,726	*1,592,973*	231,918	*3,207,785*
No. 9A	41,426	*2,148,165*	330	*131,101*	63,104	*1,780,476*	104,860	*4,033,178*
No. 9B	198,644		2,743		127,349		328,736	
No. 10	33,701	*513,437*	27,389	*149,322*	69,903	*1,109,820*	130,993	*1,789,143*
Totals for North Island	1,539,344	*15,773,235*	338,795	*2,067,952*	1,757,979	*19,590,779*	3,636,118	*37,431,966*
No. 11	170,666	*1,553,766*	32,637	*119,642*	104,053	*1,492,299*	307,356	*3,165,707*
No. 12	78,836	*1,305,465*	14,188	*202,173*	147,935	*2,220,647*	240,959	*3,728,285*
No. 13	85,156	*546,979*	11,576	*82,811*	56,538	*722,720*	153,270	*1,352,510*
No. 14	31,884	*964,238*	1,068	*32,339*	84,164	*1,062,349*	117,116	*2,058,926*
No. 15	51,983	*642,226*	29,617	*65,222*	84,376	*1,127,251*	165,976	*1,834,699*
No. 16	61,765	*1,093,294*	Cr.1,816	*28,995*	92,142	*1,058,409*	152,091	*2,180,698*
No. 17	132,711	*1,201,155*	2,484	*21,641*	78,919	*925,351*	214,114	*2,148,147*
No. 18	94,391	*1,239,122*	7,901	*69,215*	102,839	*1,164,503*	205,131	*2,472,840*
Totals for South Island	707,392	*8,546,245*	97,655	*622,038*	750,966	*9,773,529*	1,556,013	*18,941,812*
Totals for Dominion	2,246,736	*24,319,480*	436,450	*2,689,990*	2,508,945	*29,364,308*	5,192,131	*56,373,778*

MAIN HIGHWAYS STATEMENT OF ACCOUNTS—*continued*

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1950, AND TOTAL TO DATE

EXPENDITURE.		Total for Year 1949–50.	Total since Inception of Main Highways Act, 1922, to 31/3/50.
		£	£
Net expenditure on construction, renewals, maintenance, &c. (see separate statement)		5,192,131	*56,373,778*
Administration—			
Administration expenses (including salaries, travelling-expenses, office rents, printing, stationery, postages, and miscellaneous expenses) ..	£ 406,681	..	*2,694,641*
Fees and travelling-expenses of members of the Main Highways Board other than Government members ..	1,407	..	*28,840*
Miscellaneous expenses—			
Advertising, maps, rent of halls, traffic tallies, transport of samples, depreciation of furniture, &c. ..	777	..	*9,896*
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 ..	..	..	*9,887*
Grant to Transport Department towards Traffic inspection ..	..	..	*42,906*
Petrological laboratory and other experimental work, expenses of..	1,647	..	*26,532*
Total, administration ..	———	410,512	*2,817,717*
Loan charges—			
Charges and expenses of raising loans, management charges of Consolidated Stock on account of Construction Fund, &c.		..	*88,080*

INCOME.			Total for Year 1949–50.	Total since Inception of Main Highways Act, 1922, to 31/3/50
			£	£
Public Works Account: Capital			2,306,597	*18,969,597*
Securities redeemed, Loans Redemption Account			..	*1,313,613*
Consolidated Fund—Public Debt Repayment Account			..	*55,720*
			2,306,597	*20,338,930*
		£		
Revenue from the Consolidated Fund		3,844,046		
Less Commission on collection by Post and Telegraph Department—				
Motor-registration fees and licences ..	£ 34,386			
Fees for registration and change of ownership ..	9,283			
		43,669		
			3,800,377	*49,089,132*
Interest from investments			..	*218,444*
Interest from local authorities on plant purchased on their behalf			6,934	*56,762*
Interest on advances to local authorities ..			2,280	*53,175*
Miscellaneous receipts			6,845	*52,581*
Rent of and tolls from ferries			..	*2,082*

Interest on amount appropriated out of Public Works Fund and paid into Main Highways Account Construction Fund	..	..	*796,900*
Interest on loans, recoupment to Consolidated Fund (section 4, Finance Act, 1919)	.	..	*2,803,201**
Transfer to reserve for redemption of main highway securities	..	..	*1,252,130*
Payment to local authorities in commutation of toll-gate charges (Finance Act, 1925, section 20) ..	1,191	..	*44,881*
Payment to Wellington City Council in commutation of fees chargeable in respect of motor-vehicles using Hutt Road (Hutt Road Act, 1939, section 6)	19,968	..	*480,538*
Total, loan charges ..	———	21,159	*5,465,730*
Subsidies, &c., in respect of other than main highways—			
Municipal Corporations (Municipal Corporations Act, 1933, section 71)	42,944	..	*614,887*
County Councils and other local authorities (Finance Act, 1930, section 37)	195,653	..	*3,511,070*
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)	..	..	*363,887*
Maintenance and construction of roads giving access to outlying areas (Finance Act (No. 3), 1931) ..	..	..	*45,918*
Total, subsidies ..	———	238,597	*4,789,655*
Accumulated Revenue Account ..	..	..	*332,886*
Balance, being liability to Public Works Account and Consolidated Fund		260,634	*31,340*
		£6,123,033	*£69,811,106*

£6,123,033	*£69,811,106*

* No interest charged after 30th June, 1944.

MAIN HIGHWAYS STATEMENT OF ACCOUNTS—*continued*

GENERAL BALANCE-SHEET AS AT 31ST MARCH, 1950

LIABILITIES.	—	Total.	ASSETS.	—	Total.
	£	£		£	£
Accumulated Revenue Account—					
Balance at 1/4/47	..	*332,886*	Sundry debtors	..	*37,040*
Sundry creditors	..	*426,563*	Advances to local authorities (Main Highways Amendment Act, 1926, section 2)	..	*67,140*
Liability to Public Works Account and Consolidated Fund—			Interest due and accrued	..	*2,931*
Balance at 1/4/49	*Dr.*229,294		Buildings and land	..	*154,306*
Plus increase to 31/3/50	260,634		Stocks of materials, tools, &c.	..	*381,916*
		31,340	Plant and equipment—		
			Purchased for local authorities—		
			Expenditure to 31/3/50	640,543	
			Less repayments of principal	493,087	
					147,456
		£790,789			*£790,789*

NOTE.—The Main Highways Account was abolished by Finance Act (No. 2), 1947, and has been replaced by votes in the Consolidated Fund and the Public Works Account.

J. W. SCOTT, A.R.A.N.Z., Chief Accountant, Ministry of Works.
F. LANGBEIN, M.I.C.E., Chairman, Main Highways Board.

I hereby certify that the Income and Expenditure Account and Balance-sheet have been duly examined and compared with the relative books and documents submitted for audit and correctly state the position as disclosed thereby, subject to the departmental notes enfaced thereon.—J. P. RUTHERFORD, Controller and Auditor-General.

APPENDIX E

EIGHTH ANNUAL REPORT OF THE SOIL CONSERVATION AND RIVERS CONTROL COUNCIL

The Hon. the MINISTER OF WORKS.

SIR,—

In accordance with the requirements of section 33 of the Soil Conservation and Rivers Control Act, 1941, the Soil Conservation and Rivers Control Council has the honour to submit its eighth annual report for presentation to Parliament.

The report covers the period 1st April, 1949, to 31st March, 1950.

INTRODUCTION

The Council has not been able to implement its planned programme for the constitution of additional catchment districts and soil conservation districts during the year, due to lack of a policy decision in regard to this matter from the previous Government. The unsatisfactory position created may have been due to some extent to the representations made by certain organizations; and was also, no doubt, partly due to the destructive criticism of Catchment Boards by the Sheep Industry Commission. The Council took very strong exception to much of the comment made in the sheep industry report, and has ample evidence to refute many of the statements made and opinions expressed. The debate in the House also indicated clearly that the opinions expressed by the Sheep Industry Commission in regard to soil erosion did not receive general support.

The Council does not take up the attitude that the Act in its present form is perfect, and has always been willing to consider amendments to make for better administration and better understanding with local authorities and Government Departments, but it sees no need at present to interfere seriously with the main provisions of the Act, and particularly is emphatic that the constitution of catchment districts, subject to full inquiry by the Local Government Commission, is one of the best features of the Act, and one which incidentally has received commendation from overseas authorities on soil conservation and river control work.

Departmental differences of opinion in regard to the administration of soil conservation work by the Council have delayed the appointment of adequate specialist soil conservation staff, with the result that progress has been retarded. A departmental committee has now been set up by the Government to review the administration of the Act, particularly as it affects soil conservation work, and it is hoped, as a result of the review by this Committee and further consideration by the Council and authorities concerned, that a more generally acceptable form of administration will be evolved.

Despite difficulties experienced during the year, steady progress has been made with most aspects of the Council's work. There has been a substantial increase in the activities of Catchment Boards, particularly in regard to river control and drainage works, but progress on soil conservation work is still being somewhat retarded due to difficulties mentioned above. Other local authorities are taking increasing advantage of subsidies available on river and drainage works. For details of works completed see Table No. 2.

Advisory Committees are continuing to assist the Council. The Committee for aerial distribution of fertilizer and seeds has been particularly active. Several successful trials and demonstrations have been carried out, and public reaction has been so favourable that a number of private companies have been established to carry out aerial top-dressing with light planes. Further large-scale trials are planned by the Committee, and a report and recommendation from the Council are at present under consideration by the Government.

The establishment of two hydrological survey parties, one in the North and the other in the South Island, will ensure much better progress in this aspect of the Council's work. Progress with the establishment of approved river-gauging stations has been disappointing, due to lack of survey staff, labour, and materials.

Several conservation surveys have been carried out during the year, and from the experience gained, properly constituted survey parties are now being established where possible to carry out major surveys of critical areas. There is a shortage of trained staff for this work.

Satisfactory progress has been made with demonstration and experimental work on the Council's soil conservation reserves, and in co-operation with Catchment Boards and Departments on other areas. These are essentially long-term projects, but already valuable information has been obtained.

The Council has approved the establishment of conservation works units, two in each Island, to demonstrate to farmers conservation practices such as contour furrowing, terracing, &c. It is hoped that this demonstration work will encourage farmers to adopt generally such practices in normal farm operations with technical advice from Council or Catchment Board staff. Except in one or two districts, farmers are not generally taking full advantage of the Council's tree-planting and gully-control subsidy schemes. Council has recently approved a new fencing subsidy scheme for conservation purposes, to assist farmers with control of stock on badly eroded areas.

On river control, the year has been notable more for the large number of moderate to small works completed rather than major works. No major works have been completed, but work on the Motueka, Tuki Tuki (Upper), Tauherenikau, Otaki (Upper), Tokomaru, and Waitoa Rivers is in hand. A tremendous amount of investigational work has been carried out in regard to major river control projects. Engineering proposals have been approved for the Waipaoa, Tuki Tuki (Upper and Lower), Rangitikei, Upper Manawatu, Mangatainoka, Hutt River (Lower), and Mangaone and Waikiwi Streams, but as yet no finality has been reached in regard to subsidy. Other major proposals being investigated are the Ruamahunga River and Lake Wairarapa flood control scheme, Manawatu River (Lower), Orari-Temuka-Waihi scheme, Lower Clutha, and Piako, Kaituna, Waimea (Southland), Oreti, Makarewa, Waihopai, and Waikaia Rivers and Otepuni Creek.

Drainage works have again been much to the fore, particularly in Southland, North and South Canterbury, Manawatu, Hauraki, Waikato, and Bay of Plenty districts. Major works completed or in hand include Waimatuku, Bogburn, and Terrace Creeks (Southland), Ashburton-Hinds drainage scheme, Sefton-Ashley-Saltwater Creek scheme, Ohuia drainage (Hawke's Bay), Manawatu main drain, and Taupiri Drainage Board improvements. Investigations are in hand for extensive drainage works in the Kaitaia, Hauraki, Waikato, Rangitaiki, Kaituna, Eltham, Manawatu, Lake Ellesmere, and Southland districts.

As from 1st April, Works Department took over from the Land Drainage Branch of Lands Department responsibility for the engineering design, construction, and maintenance of drainage districts previously administered by Lands Department. The districts were Kaitaia, Hauraki, Waihi, Rangitaiki, and Poukawa. At the same time the Council assumed responsibility on its vote for the provision of the necessary additional funds to cover this further work.

Subsidies have been continued on much the same scale as previous years, but with the limitation of available funds the tendency is towards greater local contributions. For the first time applications from Catchment Boards and other local authorities have had to be substantially reduced, due to restriction in the allocation of funds. Catchment Boards are still handicapped by lack of ready finance for minor works, general works, and maintenance, and it has again been necessary to meet the position to some extent by special grants from the Council. The total expenditure from Soil Conservation and Rivers Control vote during the year was £602,192, as against £464,942 for 1948–49. Local contributions amounted to approximately £200,000. For details of expenditure see Table No. 1.

THE COUNCIL

The Soil Conservation and Rivers Control Council consists of the following members :—

W. L. Newnham, representing the Commissioner of Works (Chairman).
F. Langbein, Engineer-in-Chief, Ministry of Works.
D. M. Greig, Director-General of Lands.
A. R. Entrican, Director of Forestry.
E. J. Fawcett, Director-General of Agriculture.
A. J. Davey, representing agricultural and pastoral interests.
W. A. Lee, representing counties of North Island.
C. V. Kirke, representing Counties of South Island.
J. A. C. Allum, representing the Municipal Association of New Zealand.
J. R. Hair, representing River, Drainage, and Catchment Boards.

The volume of business increased substantially over that of the previous year, with the result that, in addition to the eleven regular monthly meetings two special meetings were necessary. These latter meetings were held, one to consider the report of the Sheep Industry Commission, and the second to determine an objection under the Act to the prosecution of a particular Catchment Board work. With the increase of Catchment Board activities it was to be expected that the Council would on occasions be required to act in a quasi-judicial capacity in determining appeals and objections, but it is pleasing to report that the majority of objections arising through works have been amicably settled without recourse to the Council.

LEGISLATION

On account of the volume of legislation during the 1949 session of Parliament, no amendment to the Soil Conservation and Rivers Control Act was accepted by the previous Government. Draft legislation was prepared to make provision for the control of artesian or underground water, and to remedy slight defects in sections of the Act which, as a result of Court decisions, were found to be deficient. The draft legislation has again been submitted to the Government with a recommendation for early introduction to Parliament.

ADVISORY COMMITTEES

The undermentioned Committees have, during the past year, been of considerable assistance to the Council in advising on and co-ordinating its activities :—

(*a*) *The Central Standing Committee* has advised on the Council's research and experimental work, and has been represented by the Departments of Lands, Forestry, Agriculture, Works, Scientific and Industrial Research (Botany, Grasslands and Soil Bureau Divisions), Marine Department (Fisheries Research), Internal Affairs (Wild Life), and Meteorological Services.

(*b*) *Technical Committee, Hydrological Data.*—While there was no need for a meeting of this Committee during the year, members have been kept informed of progress to date by correspondence between themselves.

(*c*) *Information and Educational Advisory Committee.*—This Committee is comprised of representatives of the Council, its staff, and the Catchment Boards Association, and has done valuable work in preparing plans for the Information Service to suit the Council's and Catchment Board's needs.

(*d*) *Advisory and Co-ordinating Committee on the Aerial Distribution of Fertilizer and Seeds.*—This Committee has been very active, and the team-work of those concerned—Federated Farmers, fertilizer-manufacturers, and Departments of State (Lands, Forestry, Works, Agriculture, Air, and Scientific and Industrial Research)—has made the considerable progress possible.

HYDROLOGY

Further progress has been made by Meteorological Services of Air Department in intensifying, in accordance with Council's request in May, 1946, the national skeleton network of rainfall stations. At the beginning of the year there were in the national network some 830 manual and 45 automatic rain-gauges, whereas by March, 1950, these numbers had been increased to 870 manual and 61 automatic rain-gauges. Again, most of these increases have been made in sparsely populated areas, the increase being made possible by landholders agreeing to care for the instruments and volunteering to take observations. There are still, however, vast unpopulated areas in the headwaters of nearly every river catchment where the Council desires further rain-gauges to be installed, but until a reasonably cheap and reliable recording rain and snow gauge is available it will not be possible to obtain an adequate and complete first cover for the more important river catchments.

Some progress has been made by the Director of Meteorological Services in the further complete analysis of past rainfall records, as required by engineers who are concerned with the safe hydraulic design of new hydraulic structures, but inadequate staffs and the necessity to concentrate on day-to-day forecasting means that only a very limited amount of data can be provided at present. The tabulation of all excessive past rainfalls at manual rain-gauge stations is completed, while analysis of past automatic rain-gauge records to determine excessive falls in intervals of time from five minutes upwards is almost complete. The heaviest rainfall recorded during the year was at New Plymouth on 8th January, when 0·38 in. fell in five minutes, 0·51 in. in ten minutes, and 1·01 in. in twenty minutes. During the year Meteorological Office Note No. 33, "The Frequency of Heavy Rainfalls in New Zealand," by Dr. C. J. Seelye, has become available for general distribution.

To assist in the establishment of values for mean sea-level in the Bay of Plenty, an automatic tide-gauge installation was completed at Mount Maunganui, and a recorder is under construction at Ohope, Whakatane. The Waimana, Rangitaiki, and Tarawera Rivers automatic recording-stations are in hand. In the Gisborne district the improvement of the reaches for automatic gauging-stations on the Waikohu, Wharekopae, and Waipaoa Rivers have been completed. A water-level recorder was installed at Foxton to establish tidal effects. Proposals are complete for a recording-station at Maoribank on Hutt River, while construction is in hand for automatic stations on Horokiwi Stream at Porirua, Upper Wairau River (Marlborough), Buller River at Lake Rotoiti, and two more recorders on Lake Ellesmere. A recording anemometer has been installed at Lake Ellesmere in order to relate wind velocities to water-levels. The Ahuriri River gauging-station is completed, while that on Lake Hauroko is in hand. Some 29 staff gauges have been placed in the Invercargill district for flood-warning purposes.

During the year two hydraulic survey parties were established, one based on Palmerston North to cover the southern half of the North Island, and the other based on Blenheim to cover the northern half of the South Island. These parties are employed full time and continuously on the inspection, selection, and surveys of river-gauging stations, and on the making of river-discharge measurements, particularly at low and flood stages. They will move from district to district on an approved itinerary by means of their own transport. By this continuity of work it is felt by the Council that the personnel of the parties will become more proficient, while far more data of a higher standard will become available to those requiring it than if this work was left to be performed intermittently by district staffs. Each party is fully equipped with various types of current meters and miscellaneous gauging aids, so that the most accurate discharge measurements may be made under almost any adverse conditions, including night work during storms.

The North Island party has made intensive reconnaissance surveys of the Waipaoa, Tutaekuri, Ngaruroro, Tuki Tuki, and Rangitikei Rivers and certain sites are under consideration for adoption as gauging-stations, while detailed surveys have been made of several sites, and proposals for gauging-stations are in hand. The South Island party has concentrated on survey of gauging-station sites for hydro-electric purposes in Nelson, Upper Buller, and Marlborough districts, while both parties have made many standard discharge measurements, particularly of important streams during the phenomenally long, dry season. Towards the end of the year both parties were concentrated on Methven, the centre of the South Canterbury irrigation scheme, and made new surveys and discharge measurements at the various gauging-stations operated by the Irrigation Division, Ministry of Works, while the opportunity was taken to perfect and standardize equipment and techniques.

It was also found necessary to establish a similar, but district, mobile hydraulic survey party in the Hamilton works district, and since December this party has been working intensively on the Lower Waikato River and on the Bay of Plenty rivers locating satisfactory gauging-sites, carrying out surveys of those sites, and making discharge measurements.

The Council is confident that the successful and continuous establishment of these survey parties, the data they will collect, and the derived fundamental run-off information which will thereby be obtained will be of the utmost value to the Dominion in the future. All hydraulic works such as highway and railway bridges, hydro-electric development, irrigation, airfield and municipal storm-water drainage, water-supplies, river control, and soil conservation schemes require as close and perfect a knowledge as possible of precipitation and run-off.

No remarkable flood occurred on any of the larger rivers, the greatest floods occurring on the Manawatu and Tuki Tuki Rivers on the 9th August.

In minor catchments the most spectacular flooding occurred at Marton from the Tutaenui Stream, a tributary of the Rangitikei River, on 13th February. During the five previous days over 7 in. of precipitation was recorded in the catchment. On the morning of the 13th February not less than 2 in. fell during a thunderstorm in two hours, with a further 1 in. in the following two hours, resulting in the highest flood and greatest depth of flooding within living memory. It has been calculated that at the peak some 10,000 cusecs were discharged from a catchment of 27 square miles. This same storm caused lesser flooding in the adjoining catchment, the Makirikiri Stream, a tributary of the Turakina River, resulting in a peak discharge of 2,300 cusecs from 13 square miles.

INFORMATION SERVICE

The Council's Information Service—an integral and basic part of its soil conservation work—has been handicapped by shortage of staff, but this has in part been offset by the growing value of demonstration farms as a valuable medium for creating interest in and disseminating information on soil conservation. Work in the following branches has been carried out during the year :—

(*a*) *Mobile Cinema Unit.*—During the year a complete coverage, organized by the respective Catchment Boards, was made in Southland, Westland, Nelson, North Canterbury (secondary schools only), South Canterbury, Marlborough, and Hawke's Bay, while North Auckland was organized by the local soil conservator and the Ministry of Works. Considerable interest was evinced in all districts, and particularly in Southland, where the Board energetically organized and supported the Unit, and record attendances resulted. The value of a completely self-contained unit was confirmed again on this circuit. Eighty-seven public screenings were made to 5,154 people, and 72 screenings were made to 17,104 secondary-school children.

(*b*) *Movie Films (16 mm.).*—Difficulties in getting films made have been accentuated since the Film Unit of the Ministry of Works has been abandoned, but, despite this, films have been made for the Council. "Green Horizons," a film depicting the origin and causes of the problem in New Zealand, and portraying the forestry and farming aspects of conservation, was made to a sufficiently high standard to be placed on the theatre circuit of New Zealand with a feature film of the year. It has also been requested for use in Australia. "Wet Lands made Fertile," in colour, covers a survey of drainage in this country, and special emphasis is given to farm draining, particularly the detail of correct practices in tile and mole drainage. "Catchment Boards at Work" is designed to cover the soil conservation, river control, and drainage activities of four of the Boards each year. "Ruin by Rabbits" is a good colour film on the rabbit problem, and covers the activities of Rabbit Boards in ridding the country of this vermin. An interesting and topical newsreel on aerial top-dressing, prepared by the National Film Unit, is also being used to stimulate interest in this development.

(*c*) *Film Strips.*—Two film strips, "Types of Soil Erosion" and "Soil Conservation in Poverty Bay," were prepared and circulated widely to Education Board libraries, University and Training College lecturers, and to Catchment Boards.

(*d*) *Newsletter.*—The quarterly newsletter prepared by the Council staff has a circulation of five hundred, and has progressively grown in size and quality of information supplied.

(*e*) *Agricultural and Pastoral Show Displays.*—As in the past, considerable use has been made of the opportunity to display models, diagrams, photographs, and regional plans of work to farmers at the principal shows, and Catchment Boards have co-operated freely in this work in their respective districts.

(*f*) *Press.*—The press has helped considerably in making information available to the public (particularly has this been so in rural areas), while farming periodicals have likewise helped. The staff has supplied them with information wherever possible.

(*g*) *Photography.*—Considerable use has been made of the facilities of the National Film Unit in obtaining photographs of conservation problems and work in the various districts in New Zealand, and this help is acknowledged.

(*h*) *Bulletins.*—Two bulletins are in the production stages, and several reprints of scientific articles have been widely distributed as miscellaneous publications.

The following is a complete list of bulletins published by the Council, together with miscellaneous publications reprinted from various sources and issued by the Council :—

BULLETINS

(1) " The Menace of Soil Erosion." (Out of print.)
(2) " Tackling High Country Land at Molesworth." (Out of print.)
(3) " From Forest to Farm Land." (Out of print.)
(4) " First Steps in Soil Conservation."
(5) " Down to the Sea in Slips."
(6) " Willows and Poplars for Conservation and River Works."
(7) " Fire—Public Enemy No. 1." (Out of print.)

MISCELLANEOUS PUBLICATIONS

(1) " Soil Erosion in New Zealand," by K. B. Cumberland. (Out of print.)
(2) " Soil Erosion," by J. E. Bell and D. A. Campbell. (Out of print.)
(3) " Channel Improvements in Alluvial Streams," by A. P. Grant. (Reprint *Proceedings New Zealand Institution of Civil Engineers*, 1948.)
(4) " Soil Conservation Studies Applied to Farming in Hawke's Bay, Parts I–III," by D. A. Campbell. (Reprint *New Zealand Journal of Science and Technology*, 1945 and 1946.)
(5) " Soil Conservation in New Zealand—Policy and Progress," by W. L. Newnham. (Reprint *New Zealand Science Review*, 1948.)
(6) " Extreme Flood Discharges," by E. C. Schnackenberg. (Reprint *Proceedings New Zealand Institution of Civil Engineers*, 1949.)
(7) " Operation of Tower Excavator, Otaki River," by A. R. Acheson. (Reprint *Proceedings New Zealand Institution of Civil Engineers*, 1949.)
(8) " Preliminary Aerial Distribution Trials with Superphosphate and Seed Mixtures," by D. A. Campbell. (Reprint *New Zealand Journal of Science and Technology*, 1948.)
(9) " Aerial Top-dressing in New Zealand," by D. A. Campbell. (Reprint *New Zealand Science Review*, 1949.)

In print :—

(10) " Estimation of Extreme Flood Discharges by Statistical Methods," by A. D. Benham. (Reprint *Proceedings New Zealand Institution of Civil Engineers*, 1950.)
(11) " Soil Conservation in New Zealand," by A. P. Grant. (Reprint *Proceedings New Zealand Institution of Civil Engineers*, 1950.)
(12) " Development in Aerial Top-dressing, 1949," by D. A. Campbell. (Reprint *New Zealand Journal of Science and Technology*, 1950.)

AERIAL TOP-DRESSING

Following on the successful preliminary distribution trials of the previous year, the Council arranged with the R.N.Z.A.F. and a local committee to evaluate the cost and examine the practicability of an aerial top-dressing service in a 1,000-acre trial in the Wairarapa. From the many applicants ten properties were selected to cover variations in soil type, pastures, terrain, and distance from the Masterton Aerodrome, and on each of these 100 acres was top-dressed, the farmer paying for the fertilizer and the Council for the cost of distribution. The R.N.Z.A.F. provided a flight of three Grumman Avenger aircraft each fitted with a 1-ton hopper, and a mobile radio-equipped ground party.

The operation was carried out in fifty-five hours by the Air Force, and the problems of control and flying were overcome. The farmers were well satisfied with the distribution and measurements on the ground showed that the distribution could not be improved on by alternative methods. The cost was found to be 15s. per acre for transport (8–25 miles) and distribution of 2½ cwt. per acre.

Arrangements were made for the Department of Agriculture to further check the distribution on a 48-acre project at Ohakea, where it was found that the most effective distribution was obtained by flying at 400 ft. in parallel runs 76 ft. apart with the hopper four-sevenths open.

A demonstration was arranged on the hills near Wellington in Ohariu Valley. A large attendance, including His Excellency the Governor-General, diplomatic representatives, members of Parliament, and farmers, was satisfied with the simplicity and effectiveness of the aeroplane in top-dressing very steep, difficult hill country.

During the year, representatives of the Bristol Aeroplane Co. visited this country to investigate techniques and requirements with a view to adapting the Bristol Freighter for this work, and it has been reported from England that good progress has been made.

The outcome of these trials has been the rapid development of an aerial top-dressing service by operators of light aircraft, who have distributed over 3,000 tons of fertilizer in the past few months at a cost of from £3 to £7 per ton for distribution. The increasing demand for this service indicates the farmers' satisfaction with this method for the fringes of the hill country.

Subsequently, the R.N.Z.A.F. have built an internal hopper in the Miles Aerovan which will be available for trials in the near future. The Advisory Committee has prepared and the Council has approved and submitted to the Government an interim report on the results to date, with a recommendation that a small flight (three) of suitable aircraft be obtained to undertake a three to six months' top-dressing task from a suitable aerodrome. This logical next step would make possible the evaluation and costing of large-scale aerial top-dressing by freighter aircraft, which is complementary to the work already being done by small aircraft.

The tremendous significance of this development is emphasized by the following facts:—

(*a*) Top-dressing with phosphate is one of the most practical and effective methods of combating soil erosion in New Zealand, as the lands affected are dominantly hill-country grasslands.

(*b*) Several million acres of hill pastures require top-dressing.

(*c*) Top-dressing not only arrests deterioration, which is too prevalent, but it increases production, cover, and stability of the soil.

(*d*) The response to top-dressing is measured by the three-fold increase in meat, seven-fold increase in butter, and the twenty-fold increase in cheese during the past forty years, largely resulting from top-dressing of easy ploughable land.

(*e*) Experience shows that there is a much larger area of hill land the production of which can be raised from one to more than two sheep per acre by top-dressing and oversowing with clover seed if coupled with prudent management.

(*f*) The further development of New Zealand's farming resources is being stifled because the highly responsive soils are being starved of phosphate.

(*g*) The output of superphosphate from works in New Zealand—up to 600,000 tons annually—is sufficient only to top-dress 6,000,000 acres of the 30,000,000-odd acres farmed.

(*h*) The great bulk of our exports—£150,000,000—are the products of our grasslands, but no more than £1,000,000 worth of phosphate is imported to offset the drain of this fundamentally important material.

SOIL CONSERVATION RESERVES: DEMONSTRATION AND EXPERIMENTAL FARMS

In pursuance of its policy of combating soil conservation problems on a practical farming basis, the Council has acquired several badly-eroded farms typical of large eroded areas.

As lack of proper management has been one of the chief causes of the conditions, practical modifications of management are being employed on these farms, along with comprehensive soil conservation measures, to determine the feasibility and cost of controlling erosion and restoring these areas to permanent productive use.

Much of the work is necessarily of an experimental nature, designed to evolve practices that will achieve the desired result. Experiments designed to solve local problems have been undertaken in methods of management, determination of types of plants, including trees, that are most useful, cultivation practices, and structures; and, finally, comparative run-off and soil-loss measuring devices are being installed progressively and results recorded.

The demonstration value of these farms is already being reflected in the number of farmers attending field-days arranged, and in their requests for assistance to adopt similar measures from interested farmers.

In all cases local Advisory Committees advise and assist directly in the management of these farms, and the Council acknowledges this service, which effectively develops district interest in conservation work done.

Ihungia, Poverty Bay

A reserve of 192 acres was put under conservation management to stabilize eroding slopes and reduce the active gullying which was threatening the highway. The vigorous growth of grasses has had such an effect on infiltration and stability that the gullying has become quiescent, while the poplars and willows located on future dam-sites are establishing satisfactorily.

Waerenga-o-Kuri, Poverty Bay

Considerable improvement in the general appearance, the pastures, and in the carrying-capacity of this 998-acre eroded hill-country farm has been effected during the past two years. Top-dressing and oversowing has developed much stronger swards to combat erosion, and as a result of prudent grazing the reserves of feed on the steeper slopes provide greater protection of the soil. The provision of adequate supplementary feed is making possible the renewal of run-out pastures and the control of rushes, and at the same time relieving the grazing pressure at critical periods on the steeper land.

Gully- and slip-control work is being proceeded with in conjunction with subdivision fencing, making better management of the catchments of gullies possible; and the top end of the large gully has been very successfully stabilized with planting of poplars, willows, and "shipmast" locust. Further, management trials in comparative catchments are made possible by this fencing. Pampas-grass tillers and trees useful for space planting are being raised in the nursery.

The comprehensive conservation work done on this demonstration farm has a wide application over some of the most productive but at the same time some of the most erodible pastoral land in the country.

Tangoio, Hawke's Bay

After a recuperative period of two years, during which top-dressing, oversowing, spelling, and cattle-grazing were undertaken, this 450-acre farm has now been taken over as a full working unit. Further work in subdivision fencing, top-dressing, seeding, water-supply, and tree-planting has been undertaken, and 220 bullocks have been

grazed during the past year. The danthonia-dominant run-out pastures have responded remarkably to top-dressing and oversowing with subterranean and white clover, and have been converted into improved mixed pastures. Great protection of the soil and reduced erosion is evident, and at this stage a small proportion of sheep are being introduced. Comparative management trials of catchments have been made possible by fencing, and the merits of spaced tree-planting, rotational cattle-grazing, oversowing, pasture furrows, and stock dams are being evaluated. Over 40,000 additional trees of coniferous and eucalyptus species have been planted to stabilize land adjacent to the highway, and rabbits are being more successfully dealt with.

Esk, Hawke's Bay

On this 7,500-acre reserve, control of fire has resulted in rapid regeneration of protective scrub and fern, which has done much to stabilize the country and reduce run-off. The final programme of conservation, forestry, and farming is at present being given further consideration.

Wither Hills, Marlborough

The recuperative capacity of some of the worst eroded land in this low-rainfall part of Marlborough is most encouraging, and provides a very practical example of what can be achieved by modifying management. The response to this management has made possible the control of severe sheet and gully erosion and the flooding of lowlands at very low cost on this native pastoral land. The comprehensive application of control of grazing, fire, and rabbits, coupled with spelling, adequate fencing, contour cultivation, contour banks, establishment of good top-dressed pastures on the easy slopes, tree-planting of ruined land, supplementary feed, water-supply for stock, and prudent grazing by cattle and later sheep has been the key to restoring fertility and making possible the doubling of production from this farm in five years.

On the experimental side the effects of cattle-grazing only compared with cattle and sheep grazing are being determined in two comparable catchments, while records are being kept of the regeneration of pastures. Comparative studies are being made of the effects of various management factors on run-off and soil loss from plots. The effects of contour banks and strong vegetation have already been marked in increasing infiltration and reducing soil loss.

Whangamoa, Nelson

An area of 800 acres of poor burnt-over beech country has been set aside to study regeneration of native trees on abandoned country. Access tracks have been cut for fire and pest control. Experiments in natural regeneration are under way on portion of the area, and its progress is being examined on marked quadrats, while several methods of expediting this regeneration by sowing of manuka, sowing of native tree seeds, including beech, and opening up the canopy at later stages are being tried.

Adair, South Canterbury

Since this derelict and eroded farm was taken over two years ago, considerable improvement has been effected by weed-eradication and tree-planting, fencing, repairs to buildings, and thorough cultivation. The 80 acres is subdivided into appropriate paddocks, and comparable pairs of paddocks are treated similarly in the cropping programme, but one is normally cultivated and one is contour cultivated, broad-base terraced, and strip cropped, the object being to build up information on relative crop yields, as this is the critical information required to assess the merits of contour versus normal cultivation. Already positive results are being obtained in terms of run-off and soil loss. On two occasions after heavy rain the normally cultivated slopes have

suffered from sheet wash and rill erosion, while the contoured slopes have absorbed the rain and have lost no soil. Similarly, the strip cropping has given evidence of the variable capacity of crops to assist in the absorption of rain and consequently the preventing of soil loss.

The farm is now a productive unit and is claiming the interest of farmers, who already are requesting assistance in the establishment of trials on their own farms.

Tara Hills, North Otago

This run is typical of the severely eroded high-country areas in the South Island, on which the sunny lower slopes—so important for wintering sheep—have been depleted of vegetation and have suffered severely from erosion. In common with many such runs, it presented a rather hopeless appearance, due to overburning in the past, severe infestation of rabbits, or the bare eroding lower slopes and flats. Positive action has been taken to control fire and rabbits, but the latter is proving to be difficult. To make possible reduction in grazing pressure on the hills, the flock was heavily culled from 2,000 ewes to 800, and 100 acres of flat land was prepared and irrigated.

Subdivision fencing has been increased to make possible controlled grazing and spelling. Supplementary feed from irrigated lucerne and clover has reduced the grazing in the winter country. Where the rabbits have been excluded, surface sowing and spelling have given promising results.

The effects of management on the rate of regeneration of these natural grasslands is being studied on the experimental area, while the development of various grasses, trees, and shrubs are being investigated in trial plots. An extensive system of multi-row shelter-belts has been planned, and with the completion of fencing and rabbit-netting, planting has now begun.

MID-DOME, SOUTHLAND

This area of approximately 800 acres of high country fronting on to the Lumsden–Queenstown Highway has improved in appearance considerably during the past favourable season. A cottage has been erected for the caretaker, and the first phase of new management has begun by isolating the block by wing fencing to spell it, and by a thorough attack on the rabbits. Already a botanical survey has been made of the area, and surface sowing of grasses and clovers has been done on an experimental scale. Direct sowings of lodgepole pine (*Pinus murrayana*) seed were made at the heads of two gullies, of tree lucerne in one gully, and of brush wattle on shingle fans. Rabbits, however, did considerable damage, particularly to the tree lucerne. A small nursery to raise grasses and shrubs likely to be useful has also been established. Here there is an opportunity to demonstrate what effect catchment and management has on arresting the movement of shingle from the hillside into the streams and thence into rivers.

CO-OPERATIVE AND EXPERIMENTAL WORK WITH DEPARTMENTS AND CATCHMENT BOARDS

Considerable experimental and demonstration work has been undertaken as a team effort by departmental officers and Catchment Board staff in the various catchment districts, and is referred to in detail later in the reports of district activities.

CONSERVATION SURVEYS

Sufficient experience has been gained from small surveys carried out to emphasize the need for similar surveys in many of the problem catchments in the country. A survey party of two specialists has commenced work in the Pohangina Catchment, as the Council and the Manawatu Catchment Board are very concerned with the erosion and flooding aspects of this catchment. Methods and standards are being developed

for reconnaissance and detailed conservation surveys, which will be applicable to any catchment, and the party will be made available, when experience is gained, to survey catchments in various districts in the North Island.

CONSERVATION FORESTRY

In last year's report emphasis was laid on the extensive areas in the headwaters of catchments which require attention if the fertile lands of the valleys and plains are to be kept in permanent production; and it is welcome to record a growing realization both by private individuals and by public bodies of the need for this protection and the value of conservation measures in the remoter and steeper back country. In this connection, also, new legislation, embodied in the Forests Act, 1949, has been passed during the year to consolidate and amend the law relating to the management of forests. It is significant of the importance attached to forestry protection that specific reference is now made in this Act to the responsibilities which the Forest Service accepts in controlling and managing State-forest lands for the purpose of water conservation, soil stabilization, and for ensuring a balanced use of the land. Progress in affording protection to such areas is inevitably slow, since it involves the regeneration of native tree species, the control of fire and pests, and in some cases an active policy of reafforestation. A satisfactory beginning has now, however, been made with the acquisition of some of the land most in need of attention; and with general recognition of the principle that equilibrium in the headwaters largely determines downstream conditions, more rapid progress can be anticipated in the future.

The problem of safeguarding many of these catchments at present protected by manuka cover has been brought into prominence as a result of the controversy regarding the so-called "manuka blight." This infection, originating from an insect probably introduced from Australia, has spread rapidly during the past few years, killing all manuka bushes over a wide area in South Canterbury. The value of the blight in ridding pastures of a troublesome weed was quickly recognized by farmers, some of whom have attempted to clean their land by deliberately infecting healthy manuka with branches from diseased plants. Foresters and conservationists, on the other hand, were alarmed lest the blight should spread to the remoter unfarmed hill country where manuka is serving a most useful purpose in checking soil erosion and run-off and as a nurse crop in the regeneration of native forest. In order to provide an authoritative lead in settling the matter, the Council during the year convened a series of meetings of representatives from all interested government departments; and a unanimous statement is now about to be published in the *New Zealand Journal of Agriculture* and in the press setting out the conflicting arguments, and concluding with a warning that the deliberate dispersal of the blight has no great value to farmers and may seriously endanger the vegetative cover in catchments where soil and water conservation are of paramount importance.

Under the Forest and Rural Fires Act, 1947, further encouraging steps have been taken in resolving the problems of Catchment Boards and County Councils; where their responsibilities are at variance, a better understanding now exists regarding the co-ordination of plans and regarding the responsibilities of the fire authority in each area. It is also hoped that when Fire Regulations, at present being drafted, are brought into force the organization of rural fire control on a Dominion-wide scale will prove completely effective.

In matters directly concerned with the establishment of trees, considerable progress can be recorded. During the period under review increasing advantage has been taken of the pound-for-pound subsidies for tree-planting schemes designed to arrest erosion. In all, some fifty-four subsidies have been granted, and a wide variety of species has been employed for shelter-belts against wind erosion and for block and spaced planting on slip and earthflows. In addition, existing nurseries for the propagation of willows, poplars, "shipmast" locust, and other exotic trees were well maintained, and in some

areas new nurseries have been established. Details of tree-planting subsidy schemes, of other Catchment Board activities in the use of trees for soil conservation, and of the work undertaken in the Council's own reserves and in works districts are given in the relevant sections of this report.

A matter of current interest has been the "shipmast" locust (*Robinia pseudoacacia* var. *rectissima*). Root cuttings of this tree were introduced from the United States of America in 1945, and until recently sufficient time has not elapsed for any conclusions to be drawn regarding the success of this importation. The Poverty Bay Catchment Board has now, however, pointed out that specimens grown in its nurseries and planted out on a number of sites do not appear to be developing the erect character attributed to this variety of the black locust. This matter is under investigation; and the United States of America Department of Agriculture, through whom the original cuttings were obtained, has been asked to supply full details of the source of the plants sent to New Zealand and of the behaviour of "shipmast" locust in different sites in the United States of America.

The position regarding research, briefly mentioned in last year's report, remains substantially the same. Forestry problems, in particular those relating to biology, ecology, and hydrology, have not yet received the attention they merit; and until the answers are known to many fundamental questions concerning the establishment and management of protection forests, the control of pests, and the influences of different vegetative covers on soil stability and on the circulation of water, the application of forest measures in conservation work must continue to be in the nature of an experiment, the exact results of which are as yet unpredictable. This is a state of affairs which must be remedied as soon as possible.

PEST CONTROL

During the year the problems of pest damage have featured prominently in the Council's work. Although not represented on the Rabbit Destruction Council, the Soil Conservation and Rivers Control Council maintains close liaison with that body; and a welcome step forward has now been taken, with the agreement of the Department of Agriculture, that representatives of Catchment Boards should be invited to attend Rabbit Board meetings when matters of joint interest are being discussed. Unfortunately there are still indications that the farming of rabbits is condoned in some districts, and it is the Council's firm intention to press for strict application of a killer policy through the Dominion. The position with regard to opposums is serious and leaves no grounds for complacency. Under the auspices of the Wild-life Branch of the Department of Internal Affairs, representatives of interested Departments met during the year to consider the best means of destroying opossums, and a scheme of control is now being drawn up by that Department. Proposals for intensifying the campaign against this pest, and for supplementing measures to keep deer in check, have also been placed before the Council by Catchment Boards most affected; and these suggestions are now under the consideration of the Department of Internal Affairs. As a further step in co-ordination, a suggestion has been made that a Pest Control Council to deal with deer, pig, opossums, goats, &c., should be established on lines similar to the Rabbit Destruction Council. It is evident, in fact, that general concern is now felt regarding the damage caused by pests; but the need for continuous and uninterrupted control measures must be stressed if pest populations are to be kept down to manageable numbers.

SOIL CONSERVATION DISTRICTS

The Waitaki Soil Conservation District Committee has met regularly during the year, and is to be complimented on the steady progress made in the first regional Committee of its kind.

It has acted in an advisory capacity in running the Council's demonstration and experimental high-country station—Tara Hills, near Omarama—and has organized fire control and demonstration plots, and is having conservation surveys made of portions of its district.

A conservation survey has been completed of the proposed Marlborough Sounds Conservation District since the original meeting with the settlers, with the object of formulating proposals to bring into being conservation use of the forest and farm lands in this deteriorated area.

CATCHMENT DISTRICTS

The Council regrets that owing to circumstances beyond its control no new catchment districts were constituted during the year under review.

In the previous year the Local Government Commission held public inquiries on the proposed constitution of Wellington, Bay of Plenty, and Waikato districts. Provisional schemes were issued by the Commission in respect to Wellington and Bay of Plenty districts, and further inquiry was held as a result of objections relating to the Wellington district. The decision on this matter has not yet been promulgated. A further inquiry will also probably be necessary to determine objections in respect to the Bay of Plenty district.

Additional reports are being prepared on the Auckland and North Auckland districts to enable the Local Government Commission to consider these areas in conjunction with the Waikato proposal when the inquiry is resumed.

The Council was given to understand that further action by the Local Government Commission depended upon clarification of Government policy, and made repeated representations to the previous Government for a decision. As the position is most unsatisfactory, the Council has brought the matter to the notice of the present Government, which is at present reviewing the legislation. Lack of confirmation by the previous Government of its policy under the Act has given rise to a feeling of frustration both to the Council and Catchment Boards, which is inimical to progress in soil conservation and rivers control.

CATCHMENT BOARDS

Catchment Boards have carried out their functions in a most satisfactory manner during the year. With the exception of the Otago Board, all Boards have now been functioning long enough to have a full appreciation of the problems of their districts and generally appear to have gained the confidence of the majority of the ratepayers. The Council has been generally impressed with the calibre and enthusiasm of Chairmen and members of Catchment Boards, and feels that the combination of practical farmers and business men with departmental technical officers gives well-balanced Boards. The Council has given careful consideration to the question of administrative costs, and has indicated to Catchment Boards that these costs must be kept as low as possible consistent with efficiency. At the same time, the Council appreciates the desirability and necessity of Boards employing fully qualified and experienced technical and administration staff at adequate salaries, and appreciates that administrative costs for new Boards will necessarily be high for a number of years, due to the tremendous amount of survey, investigation, and planning to be carried out in the early years, and relatively modest expenditure due to the time lag in getting major projects approved and under way. The Council has been favourably impressed with the thoroughness with which a number of major projects have been investigated and planned by Catchment Board staff during the years—a tribute to the efficiency of the staff and the value of specialization. The lack of trained conservators is handicapping Boards in expanding this most important aspect of their work.

As mentioned earlier, Catchment Boards are still handicapped by lack of ready finance for carrying out minor and general works and maintenance, and it is hoped that ways of overcoming this difficulty will be found during the coming year.

The relations between the Catchment Boards Association and the Council have been most cordial during the year, and consultations have cleared up a number of minor difficulties.

WORKS CARRIED OUT BY CATCHMENT BOARDS

A feature of the year's work has been the increase in the mileage of river channels cleared—206 miles last year, as compared with 168 miles the year before. The use of hormone sprays has opened up new possibilities in the eradication of willow and other growth, and progress has been made in methods of applying the hormone. For treating the thick growth in many rivers, large-capacity sprayers are desirable if costs are to be kept within reasonable limits. The most effective implement for large areas of small growth, and willows up to about 4 inches in diameter, is a trailer-type orchard sprayer. Larger trees require frilling, and for this a knapsack sprayer is preferred to the oil-can previously used. Primary clearing of the original growth is ineffective unless it is followed up by adequate maintenance. This can be achieved at reasonable cost with a mobile orchard sprayer if the willows and other growth are treated when young.

The Council's minor works schemes continue to play an important part in the operations of Catchment Boards. Fifty-four small tree-planting jobs were done to prevent earth movements (46 jobs completed in 1948–49), 57 gully-control works (42 previously), 31 minor drainage works (5), and 235 minor river works (175) were carried out.

In addition to the 206 miles of rivers cleared, 20 miles of new drains were dug (17 miles the previous year), 140 miles of existing drains reconstructed (177 miles), 40 miles of river-bank protected ($37\frac{1}{2}$ miles), $6\frac{1}{4}$ miles of river diversions made ($6\frac{3}{4}$ miles), and 47 miles of stop-banks built (30 miles).

Under Catchment Board control there has been an improvement, with the assistance of the Council's subsidy, in the maintenance of drains. One Catchment Board alone has cleaned out 389 miles. The special plant adaptations made by this board, together with minor alterations in the drains themselves and improved access, help in reducing the cost of the work. Another Catchment Board has cleaned 290 miles of drains.

Hauraki Catchment District

Considerable progress has been made with the necessary investigations and surveys on the Piako River and its tributaries, which will form the Board's major scheme in the district. Included in the comprehensive scheme will be the further improvement and extension of the drainage system in the areas under the control of the Lands Department as the Hauraki Plains Drainage District. Thus not only does the full investigation involve many miles of surveys and subsoil investigations, but also much co-operative investigation by the Departments of Lands, Agriculture, and of Scientific and Industrial Research.

The rivers in the district are mostly slow flowing, and little bank erosion occurs. Some, however, are badly infested with willows and 27 miles of willow-clearing have been completed in the Waitoa alone. The extensive stop-banking system in the tidal areas of the district has been maintained, and 2 miles 66 chains of new banks built. On the Waitakaruru River, complete tidal protection has been provided on the western side of the river to the Kairito Canal, where another system of banks is nearing completion.

There are a number of internal drainage authorities which have all been active in availing themselves of the Council's subsidy on drain maintenance, and some 290 miles of drains has been cleaned during the year. In addition, 40 miles 27 chains of existing drains have been enlarged, cleared, and regraded.

A start has been made with the assisted tree-planting work, and three subsidized schemes have been completed. The Board has made use of local nurserymen's facilities to propagate willows and poplars for conservation works.

Poverty Bay Catchment District

Activities in the Poverty Bay district have been very largely the control of gullying and are described elsewhere in this report. One small drainage scheme involving the excavation of 35 chains of main drain was completed, and 21 minor river works have been carried out. In the aggregate, these have consisted of 36 chains of river-bank protection, 1 mile 27 chains of stop-banks, 10 groynes, and 40 chains of willow-clearing.

Off-seasonal work is provided by the Board for employees of the Gisborne freezing-works. During the year, under this scheme, 5 miles 59 chains of drains have been regraded, 24 miles 5 chains of drains given a maintenance clearing, 2 miles 25 chains of willows cleared from river channels, and a further 1 mile 55 chains of willows protecting river-banks cut and layered. Sixty-five chains of the Ngatapa Stream have been enlarged, and a 100 ft. concrete section of the Kaiti Drain repaired.

A scheme, estimated to cost £667,000, is under investigation for the control of flooding in the major river of the district, the Waipaoa. A large flood in this river in May, 1948, caused damage estimated at £338,000 in Gisborne. A topographical survey of the flat lands on the lower reaches is nearing completion, and may be used as a basis for model studies. Experiments have also been carried out into the retarding effect of willows and other vegetation in the upper catchments on the flood hydrograph. The conclusion has been drawn that peak discharges would be only slightly reduced by retards in stream channels.

The pile groyne at the mouth of the Waipaoa was damaged by a flood and eight piles washed out. At Te Wairau bend a system of five permeable groynes was adopted. One groyne, 150 ft. long, was built last year, and during the year under review two more have been constructed, one above the original groyne and 75 ft. long, and one below, 112 ft. 6 in. long. Preparations are in hand to extend the lower groyne. To protect the groynes against scour, gabions of stone have been dumped round them, 200 cubic yards at the upstream groyne, 254 cubic yards at the centre (original) one, and 205 cubic yards at the downstream groyne. These groynes have been very effective, and are bringing about rapid accretion, easing the radius of the bend and halting the severe erosion which had been developing.

The Board has leased portion of the Te Weraroa Catchment (1,200 acres) from the Maori owners in order to carry out practical soil conservation and gully control work in this very severely eroded catchment, which contributes an unduly high proportion of the flood water and debris of the Waipaoa River. In order to prosecute this work vigorously it has been necessary to construct an access road and establish a camp. The boundary fencing is completed, planting of trees on steep unstable slopes has been commenced, debris dams in gullies have been erected, and spelling and pasture-improvement work on stable land undertaken. A good start has been made with the planting of gullied and slumping hillsides with over 20,000 trees, including Douglas fir and three species of pine, pole plantings of willows and poplars, and with the sowing of seed of deciduous species, including oak, chestnut, and sycamore.

At O'Sullivan's, Ruatoria, the Board has undertaken extensive gully and stream control work in this actively eroding catchment, where the shattered shales cause rapid aggradation of the stream-bed, which is in consequence burying rich alluvial land near Ruatoria. Various types of debris dams made from live willows and poplars, scrub, wire, and wire netting have been established successfully, and are having the desired stabilizing effect on gullies and stream-bed. In conjunction with this treatment, prudent management of the catchment is being developed progressively.

At Steven, Ihungia, very severe gullying in soft shattered mud-stone has undermined slopes, with the result that entire hillsides are slipping or flowing into the gullies on this property. The Council has financed the Board to undertake gully control experimental work that is supplied under normal farming conditions. The debris dams, constructed of cheap materials—willows and poplar posts, and wire netting—have resulted in remarkable

building up, and the dams have been raised four and five times in places (12 ft. approximately), with consequent stabilizing of the gully sides. The evidence shows that this work must be coupled with appropriate stock management, top-dressing, and oversowing of the centre gully catchment.

Six tree-planting and thirty-one gully control subsidy schemes were completed during the year.

Hawke's Bay Catchment District

For some years work has been in progress, as part of a more comprehensive scheme, to improve the Manga-o-Nuku, Waipawa, Upper Tuki Tuki, and Makaretu Rivers. This has consisted of willow-clearing in the main channels, willow-planting on the banks, and the construction of anchored tree and facine bank protection. The capital works under the preliminary phase of this scheme were mostly completed during the three previous years, and during the period under review activities have been chiefly confined to special maintenance, strengthening weak places, and the repair of flood damage. Early in the year willow timber from the rivers was stacked and sold for fire-wood. Cleared floodways have been maintained by disking to kill second-growth gorse and lupins, and, where possible, by sowing down with grasses and let for grazing. Four chains of stop-banks have been built on the Upper Tuki Tuki, and below Patangata 10 chains of bank fascining have been completed out of 21 chains to be done.

The Board completed a very detailed economic report and appreciation, on behalf of the Hawke's Bay Rivers Board, of the area which will benefit by the comprehensive works proposed on the Lower Tuki Tuki River, commenced a similar report for the Upper Tuki Tuki River and its tributaries, and completed engineering proposals for both these major schemes and also for the Tutaekuri-Waimate River willow-clearing already commenced.

In the Manga-o-Nuku, 21 chains of stop-bank have been completed and a further 10 chains is up to half height. A cut 12 chains long, and 21 chains of stop-banking, has been completed in the Onga Onga Stream. In the Tauraekaitai Stream, 1 mile of willows has been cleared.

Six tree-planting and eleven gully control subsidy schemes were completed during the year.

Rangitikei Catchment District

A gradual improvement is being effected in the lower reaches of the Rangitikei River, and, though not much new construction has been undertaken, a considerable amount of work has been involved in repairing flood damage and maintaining bank-protection work built previously. Maintaining the cleared channel free of gorse and lupin has been a continuous operation, and some success has been achieved in this direction with a tripod swamp harrow. Experiments have also been carried out with various hormone sprays.

At Omatane a new channel was excavated last year for a stream coming off an eroded catchment, and three concrete drop structures built. This year a three-span concrete bridge was constructed to carry a road over the new channel. Willows and poplars have been planted in the upper catchment. A number of floods have been experienced and the whole job has been most successful.

Two tree-planting and two gully control subsidy schemes were completed during the year. The Catchment Board is establishing a number of tree nurseries where willows, poplars, and other trees useful in conservation work will be propagated.

The Mangaweka Experimental Area is run in co-operation with the Grasslands Division and the Rangitikei Catchment Board. The 80-acre steep catchment has been planted in places to find whether slips can be checked. Ten feet pole planted willows have established well without stock protection. One basin was planted with exotic pines and protected from stock. Several small basins have been left as controls. Surface

sowing with grasses, clovers, and top-dressing has substantially increased carrying-capacity. Although a visible improvement in stability is apparent, it is too early to gauge the effect of trees and improved cover in reducing slipping.

The Waiouru Experimental Area is run in conjunction with the Grasslands Division. Belts of *Pinus laricio* and *Pinus murrayana* have been planted across the 65-acre block to check the further growth of balds, and the take has been very good. The transplanting of various species of tussock across and up and down the "balds" was a failure, but marram grass and *Phorium colensoi* on similar sites are growing well. Grass and clovers have been sown between the lines of trees, portions of the ground being thinly covered with pegged-down manuka.

Manawatu Catchment Board

The Board's staff has been concentrated principally on investigations for a major flood-control scheme on the lower Manawatu, and these investigations are now well advanced. The Mangatainoka River scheme is still under consideration, while investigations are in hand for the upper Manawatu and lower Mangahao.

Many minor and moderate sized works have been carried out on the Manawatu River. At Nott's Bend 20 chains of heavy tree protection were completed early in the year. After successfully experimenting with limestone rip rap last year, four lengths have been protected in this way during the period under review—McRae's Cut (15 chains), Anderson's Bend (10 chains), Stewart's Bend (15 chains), and Larsen's Bend (23 chains). The original length of rip rap at Scotts' Bend has been extended 6 chains, making 26 chains in all. At Larsen's a stop-bank 31 chains long and involving 8,920 cubic yards of earthwork was built, and in the Manawatu-Oroua River Board area 21 chains of stop-bank were set back. In the Makerua Drainage Board's area 50 chains of bank-protection have been repaired and strengthened.

Four miles of low stop-bank have been built on the Oroua River, 2 miles on each side. This involved 20,000 cubic yards of earthwork, and cost £2,336. The improvement of the Tokomaru Stream started during the year, the work consisting of stop-banking, channel improvement, and willow-clearing over a distance of 6 miles, and it is estimated to cost £20,000. One mile of stop-bank has been built, and on the left bank 3 miles of channel have been cleared, while on the right bank 1 mile 25 chains have been completed.

The Catchment Board at the beginning of 1950 took over from the Ministry of Works the maintenance of the channel excavated in the Otaki River below the railway bridge. The Board has produced a scheme for the river above the bridge, and work on this has now begun, 28 chains of anchored-tree protection having so far been completed.

Drainage works have mostly been carried out by internal authorities, who have also made active use of the Council's maintenance subsidy. Early in the year the Makerua Drainage Board completed Seifert's Drain. Work has continued on the Manawatu Drainage Board's main drain in the Taonui Basin which was started last year. The total length is 3 miles 70 chains, and the drain is being enlarged by drag-line. Work on the right bank has been completed, 1 mile 54 chains being done during 1949–50, and 2 miles of the left bank have been finished during the same period. The Buckley Drainage Board has carried out extensive repairs to flood-gates. The Oroua Drainage Board has excavated 13 chains of new drain, and has enlarged Campbell's Drain, also 13 chains long. At Alfredton the Catchment Board has dug 36 chains of new drain and reconstructed 44 chains of the Mangatakato Drain. In addition, five minor drainage works have been carried out in various parts of the District.

Four tree-planting and six gully control subsidy schemes were completed during the year.

The Catchment Board now has five nurseries where useful trees for conservation work are being multiplied.

At Te Awa the Catchment Board and the Grasslands Division of the Department of Scientific and Industrial Research, by arrangement with the local farmers, have done considerable gully control and pasture-improvement work in portions of two catchments which drain into the Oroua River. Valuable experience has been gained in the use of debris-dam structures (both live willows and poplars and concrete) to control gullying of a very vigorous type on the sandy subsoil of this area. While there have been failures, there is also very positive information available regarding gully control in this area, and a bulletin has been prepared on the work.

The upper catchments have been fenced into comparable paddocks, and accurate records are being maintained of the response to fertilizers and oversowing, rotational and set grazing, and space planting of trees for hillside stability.

The greatly increased carrying-capacity resulting from these measures makes possible the retirement of the steepest unstable hillsides to trees without a net reduction in carrying-capacity.

At Pohangina, cascade-type gully control dam structures, in spite of some damage, have held.

At Dannevirke, pole plantings of pussy willow have proved unattractive to opossums and most stock. Previously golden and crack willow plantings were extensively damaged.

As part of the gully control experiments at Kimbolton, minor alterations are planned for spreading water. Good grass growth developed in the pasture furrows, but thistles have been troublesome. The main dykes will be resown in the autumn.

Four tree reserves have been planted with species of poplars, and all are showing remarkable progress. Up to 4 ft. 6 in. growth was recorded in the first growing season.

Wairarapa Catchment Board

During the previous year very satisfactory water-levels were maintained in Lake Onoke by means of periodical openings with a bulldozer at a new site on the shingle spit. Openings were made on five occasions at a total cost of £400. For the year under review the situation has not been quite so satisfactory. Due to adverse weather conditions early in the year, lake levels rose to 4·5 ft. above normal while for a fortnight attempts were made to achieve an opening. One was made, but was closed by heavy seas. The second one, with the head of water then backed up, was successful, and another opening was not needed for over six months. The last opening was made in March. The four openings cost £1,215, £950 of which was incurred on the first two when conditions were unsuitable.

Last year a stop-bank on the Lower Ruamahanga River at Allsop's Bay was set back, and this year 75 chains of drain have been dug behind it to cut off upland water which would otherwise have ponded. A diversion cut involving 13,000 cubic yards of earthwork was made at Mrs. Budd's, Taumata, and has developed satisfactorily. Fifteen chains of light willow bank-protection were carried out and willow plantations established to control the cut. In the Te Ore Ore area a 10-chain cut was made, 20 chains of willows cleared from the channel, and 32 chains of heavy and 10 chains of light bank-protection carried out.

In addition to nineteen minor river works completed, 20 chains of the Wairongomai River have been cleared of willows and 10 chains of bank protected with anchored trees. In the Waiohine River a pilot cut previously made in the Ahikouka River Board's area has developed satisfactorily, 25 chains of heavy tree bank-protection completed. At Masterton in the Waipoua River 20 chains of bank have been protected by anchored trees and 6 chains of stop-bank built.

A scheme estimated to cost £53,500 has been approved for the Tauherenikau River, which flows on top of a rapidly aggrading shingle fan before entering Lake Wairarapa. The work proposed consists of a 2-mile diversion, and stop-banking, bank-protection, and associated drainage and roading over a 9-mile length of river. A contract has been

let for the first plan of the work, and includes the diversion pilot cut, 4 miles 4 chains of stop-banks and seepage drains, and 1 mile of roading. This involves 55,000 cubic yards of excavation and 141,000 cubic yards of filling. So far, 1 mile 4 chains of stop-banks and seepage drains have been completed. In addition, new outlets have been made for two lakeside lagoons and 2 miles of fencing have been erected.

Three tree-planting and six gully control subsidy schemes were completed during the year. The Board now has four established tree nurseries.

At the Whakapuni and Blairlogie gully soil conservation experimental areas trestle dams have been established and have proved very successful. The slab dams are also working well, and there is a good strike of poplar cuttings. Shipmast locust has been established in places, but some have been damaged by stock, and other varieties have also been injured. Trees have done well where stock has been excluded.

At Mataikona the planting of marram in contour rows to check development of bald areas has been very successful.

Nelson Catchment Board

Heavy floods occurred in May. Most damage was suffered in the Takaka area, but all streams were affected to a greater or lesser degree, and much of the Board's energies for the remainder of the year were directed towards flood-damage repairs. A work in the Aorere River consisting of 5 chains of channel clearing, 6 chains of light fascine bank-protection, and 22 chains of stop-banking was nearing completion, and was severely damaged by the flood. A 3-chain breach in the bank was repaired and 4 chains of bank planted with willows.

In the Takaka River a double cut was badly damaged, and two retards totalling 3 chains in length were built to direct the river into the lower leg of the cut. Lower down at Kotinga 7 chains of stone and gabion works were repaired. At Page's and Rose's, where 13 chains of stop-bank was breached or threatened and 23 chains of rip rap damaged, 8 chains of very heavy anchored and weighted willow protection have been built, 2,000 cubic yards of earth used to repair stop-banks, and 4 acres of willow and scrub cleared.

Willows have been cleared from 5 miles of the Tadmor River. In the Wai-iti a total of 48 chains of willow bank-protection have been carried out, much of it being required to stabilize the river after the flood. In addition, willows have been cleared from various localities over a length of 6 miles. Ten chains of bank-protection have been completed in the Wairoa River, 18 chains of channel have been cleared and enlarged in the Pigeon Valley Stream, and 50 chains of the Little Sydney Stream have been enlarged. In conjunction with a new bridge over the Waimea River at Appleby, 28,475 cubic yards of material have been placed in 1 mile 14 chains of stop-banks. Material for the banks and for the bridge approaches is being obtained from the river-bed as near as possible on the most desirable alignment for the main flow.

A major scheme for the lower Motueka from Alexandra Bluff to the sea was approved last year at an estimated cost of £100,000. Detailed plans have been prepared, but full-scale work on the project has not yet started. Urgent protective works forming part of the scheme, particularly rip rap bank-protection and stop-banks near Woodmans' Corner, were carried out in 1948. This work was damaged in May, and 12 chains of rip rap have been repacked and 9 chains of anchored and weighted willow protection constructed. Lower down the river 12 chains of willow retards have been built to trap silt and build up a low area on the left bank, while on the opposite side 16 chains of bank have been protected with willow fascines weighted with stone-filled sausages. In the upper reaches of the Motueka, lengths of anchored-tree protection totalling 11 chains have been completed.

On the Moutere Hills, work has begun with contour orchard experiments. Negotiations are in progress for the acquisition of some adjoining land as a control block.

North Canterbury Catchment Board

Lake Ellesmere was opened twice during the year, in June and July, at a cost of £996. Last year three openings were made costing £1,157. The lake last closed in August, when the water was only 1·4 ft. above mean sea-level. Since then low levels have been maintained, due to the dry weather, by seepage, and by evaporation, which, during the summer, was of the order of 5 in. to 6 in. a month. At the end of the year the lake level stood at 2·7 ft. Lake Forsyth was opened once, in July, at a cost of £121.

This Board pays great attention to the maintenance of its drains and rivers, and has developed several special items of plant for the purpose. In all, 389 miles of drains were cleaned, some more than once, and willows were cleared or layered and protection works repaired in the Waimakariri, Ashley, Eyre, Cust, and Halswell Rivers.

The Hanmer Road Drain, started previously, has been completed, the work mostly being confined to the finishing of the seventeen drop structures, five road bridges, and ten farm access bridges on the drain. Other drainage works completed were Police Creek, near Little River, and Forsyth's and Osborne's Creeks. The first 7-mile section of the enlarging of Irwell Creek, begun the previous year, was finished, and 4 miles of the second section have been cleared of willows. The improvement of Boggy Creek, 1 mile long, has been completed.

The first phase of the Sefton-Ashley-Saltwater Creek scheme has been completed at a cost of £5,000. This has consisted of clearing willows and channel improvement over a length of 12 miles of Saltwater, Boyne, and Baird's Creeks to improve the drainage of 4,000 acres of flat land.

Work has been in progress on the Selwyn River for two and a half years. During 1947–48 a cut of 40 chains was made to give a more direct outlet into Lake Ellesmere. The next year 3 miles 60 chains of heavy channel enlargement, stop-banking, and willow-clearing were carried out. During the year under review 2 miles 42 chains have been completed, making 6 miles 62 chains since the inception of the work. Willow-clearing is now the major operation, channel excavation being confined to eliminating excessive curvature; stop-banks, too, are becoming smaller. Expenditure to date has been £27,981, of which £16,885 was spent during 1949–50. The total length to be improved is approximately 20 miles, but after some more heavy willow-clearing, will become very much lighter upstream.

A large scheme for the improvement of drainage in the basins of the Eyre and Cust Rivers, known as the Oxford to the sea scheme, has been deferred, the recent succession of dry years making it less attractive to the farmers than when investigations were begun.

Six tree-planting and one gully control subsidy scheme have been completed during the year.

The Board has now set up a committee to investigate conditions in the Harper-Avoca catchments with a view to reducing run-off and shingle movement.

As a result of the successful experiment with contour furrows and broad-base terraces at Waipara, two neighbouring farmers are doing similar work on their farms.

South Canterbury Catchment Board

This Board, having completed major willow-clearing operations in some of its larger rivers, has proceeded to deal with others and also with several of its smaller streams. At the same time the work previously done has been followed up with maintenance spraying to check second growth.

The clearing of willows in the Ashburton River has achieved a considerable improvement in the channel and has reversed the aggrading tendency of the river. So that this shingle can continue to move down on its course to the sea, a 550 ft. fairway has been cleared through the willows of the lower 7 miles where because the river was entrenched and did not flood, clearing was previously omitted. Willow-clearing is also in hand in Pig Hunting, Esk Valley, Totara Valley, and Three-mile Bush Creeks.

A start has been made with a three-year programme to clear the three channels of the Lower Rangitata of willows and broom. These channels aggregate 42 miles, and of this, 18¾ miles have been sprayed and the dead material burnt. For some time investigations have been in progress for a scheme to prevent flooding in the Orari and Opihi Catchments. These two rivers caused a bad flood in the Temuka district in 1945. To provide immediate relief, the "50 per cent. clearance scheme" was undertaken. This consisted of clearing willows from a fairing large enough for ordinary floods over 50 miles of river channels, the topping-up of 7 miles 8 chains of stop-banks near Temuka, and protecting 10 chains of eroding bank. This work was completed early in the year for a total cost of £37,000.

Work on the large Ashburton–Hinds drainage scheme is in its final stages. Only 1 mile 58 chains of new drains have been excavated this year, making a total of 159 miles of drains for the 87,000 acres in the area. Five culverts and bridges have been built, and considerable quantities of shingle which accumulated in some of the drains during construction have been removed.

A start has been made with a scheme to prevent flooding of crop land by the lower reaches of Waimate Creek. This consists of 2 miles of channel for excavation, 4 miles 25 chains of stop-banks, a farm access bridge, and an 8 ft. by 6 ft. culvert, and is estimated to cost £5,941. To date 20 chains of channel and 40 chains of stop-bank have been completed.

Fifteen tree-planting subsidy schemes have been completed during the year.

Pasture furrows constructed at Mangati have not only checked run-off, but pasture growth has been greatly stimulated.

The contour furrowing of a 30-acre paddock in the Taiko Valley has checked the sheet erosion and rilling, and green-feed crops have been successfully drilled on the contour.

Westland Catchment Board

At the beginning of 1949 a flood in the Kokatahi River wrecked O'Reilly's stop-bank, which protected some of the best farm land in the district. To hold this danger point a hooked bank was built 22 chains long and containing 16,000 cubic yards. The head is protected by a strongpoint and apron of 3,500 cubic yards of dumped rock. Another bank in the same river at Jones's has been armoured over a length of 5 chains, with fascines lower down. In the Hokitika River, 8 chains of old timber training-wall in Hokitika Borough have been strengthened and tied back.

At Rotomanu, on the Crooked River, 22 chains of stop-bank have been built, 2 chains of river cleared of a log jam, and a 7-chain diversion cut made. Three chains of heavy rip rap have been dumped to protect the Taramakau Settlement groyne. In the Totara River near Ross 14 chains of bank have been protected with fascines and stone-filled sausages; two retards, each 1½ chains long, have been built and an aggregate of 22 chains of channel diversions made. An additional 16 chains of stop-bank on the Poerua, which protects Harihari, have been strengthened with heavy rip rap. Seven chains of stop-bank have been built on the Waitangi River and faced with fascines.

A total of seventeen minor river works were completed during the year, and one small drainage work. Investigations are in progress for the draining of the Koiterangi Swamp.

Otago Catchment Board

This Board was constituted in 1948, and held its first meeting in November of that year. It now has a small staff, and during the year under review has become progressively more and more active. The heaviest work has, of course, been in the Lower Clutha River Trust's area, where flood-damage repairs are in progress, but a number of small works have been undertaken in other parts, and the Board has been taking stock of the problems in its district.

In the Lower Clutha area 26½ chains of the Balclutha rock revetment have been completed, 11,614 cubic yards of rock being required. At Finche's erosion another 13 chains of rip rap were completed. Realigning and strengthening of the Balclutha flood-bank

have been completed except for a length of 3 chains, where a house is to be moved. Stop-banks have been strengthened and repaired in various places on the Koau and Matau branches, and at Barnego. Eighteen chains of Poerua East levee have been built. Drains have been reconstructed in the Matau (2 miles 50 chains) and Otanomomo (1 mile 40 chains) areas and 71 chains of the Waitepeka Creek have been cleared of willows.

The Taieri River Trust has carried out an extensive overhaul of its main pumping-station and has excavated 75 chains of connecting drain for the Waipori farm settlement. The Dunedin City Council has begun to line a further section of the Water of Leith with concrete.

Works carried out in other parts of the district have been four minor drainage schemes at Arrowtown totalling 3 miles 5 chains, 15 chains of channel improvement in the Kyeburn River, an 8-chain diversion cut in the Fraser River on Earnscleugh Station, and a total of 44 chains of light bank-protection in the Cadrona River, Spotts Creek, and Quartz Creek. In the Hopwood Burn an additional 500 ft. of training bank have been built.

Southland Catchment Board

A very large part of the Board's energies are devoted to the improvement of drainage and reduction of flooding by smaller rivers and streams. Typical of such works is the Waimatuka Stream improvement started recently. The scheme provides for the enlargement and straightening of 23 miles 23 chains of channel, and some stop-banking and willow-clearing. The bottom width of the channel is to be 25 ft. in the lower reaches, reducing to 5 ft. in the headwaters. So far 3 miles 4 chains at the lower end have been completed. Other similar works are Terrace Creek, 8 miles 78 chains in length, of which 5 miles 44 chains were completed this year, the balance having been done previously; Landslip Creek, 8 miles 16 chains of light clearing completed during the year; and Bogburn (2 miles 27 chains), Oteramika Creek (3 miles 61 chains), Parawa Creek (71 chains), Shaw's Creek (76 chains), and No. 1 Drain, Oporo Flat (1 mile 15 chains), on all of which work is still in progress. Moffet's Creek was started during the previous year, when 60 chains were enlarged; 3 miles 51 chains have now been completed, and tenders are to be called for the remainder. Gorge Creek, started early in the year, has been opened up for 6 miles 69 chains, the flood-gate near the Mataura River repaired and enlarged, and some 3 miles of tributary drains cleaned out. In all, these stream-improvement works have involved over 250,000 cubic yards of excavation.

A large number of isolated works have been done in the three main river catchments, the Mataura, the Oreti, and the Aparima. Although it is the fourth biggest catchment in the Dominion, only one work has been done on the Waiau, most of the area being uninhabited. The largest single river work undertaken was a 55-chain diversion cut on the Mataura, involving 45,930 cubic yards of excavation, and shortening the river by 70 chains. Other works have been the completion of the Otautau Stop-bank on the Aparima River, the construction of 1 mile 43 chains of flood overflow channel on the Makarewa River, $6\frac{3}{4}$ miles of bank-protection in various localities, and $14\frac{3}{4}$ miles of stop-banks.

Nine miles of access track is being formed to the proposed Lake Hauroki gauge on the Wairaurahiri River; $1\frac{1}{2}$ miles remain to be done.

Nine tree-planting subsidy schemes were completed during the year.

WORKS DONE OUTSIDE CATCHMENT DISTRICTS

Auckland Works District

The Raupo Drainage Board has widened 1 mile 31 chains of Smith's Canal and installed four flood-gates. At Ruawai 14 chains of foreshore have been protected by placing a carpet of 1,430 cubic yards of spalls. A further 25 chains of the Ruawai Stop-bank have been repaired and pitched with rock where necessary. The Otamatea County

Council has frilled and poisoned 2 miles 57 chains of willows in the Kikowhiti Stream, and the contractor is now removing the dead trees. The Aka Aka Drainage Board has reconstructed and widened 4 miles 27 chains of drains.

A comprehensive survey of the Kaitaia Drainage District was commenced with a view towards planning further stage development and the draining of additional areas of undeveloped swamp lands.

The aerial sowing of tree lupin (*L. arboreus*) on the Ninety-mile Beach in 1942 has proved a complete success, and the blown sand has been effectively covered with a dense growth of this plant.

Hamilton Works District

The Taupiri Drainage District has completed 21 chains of new drains and reconstructed 15 miles 51 chains of existing channels. A further five-year programme of drainage improvement is under consideration. Willow-clearing started in the Mangaorongo Stream before the war, but second growth always sprang up before the whole 11-mile length was cleared. With the use of 2–4 D the control of the pest at reasonable cost is approaching, and 2 miles of the river have been taken over by the Otorohanga County Council, and the Ministry of Works has cleared second growth from 6 miles 46 chains. Another large willow-clearing job is in the Mangati Stream, where 7 miles 46 chains have been cleared.

A comprehensive survey is being made of the Waikato River from the sea to Hamilton. A length from the sea upstream, and covering the Aka Aka and the Otaua Drainage Districts, was photographed from the air in December.

The taking-over of land drainage from the Lands Department in the Hauraki, Waihi, and Rangitaiki Drainage Districts has necessitated some reorganization of responsibilities. In the Hauraki district, work on Maukoro Canal extension was commenced. This work will enable the diversion of the Waikoura Stream into the Maukoro Canal, giving it a more direct route to the sea, relieve the already overtaxed Ngarua Canal, and therefore reduce to some extent flood waters in the lower Piako River.

In the Tauranga district 10 chains of drains have been reconstructed, and the Wharere Canal has been enlarged for a length of 1 mile 67 chains. The Upper Pongakawa has been cleaned out and the channel enlarged for 1 mile 47 chains. A total of 1 mile 4 chains of stop-banks have been constructed on the Tarawera and Rangitaiki Rivers. In the Whakatane River 1 mile 7 chains of light bank-protection, 1 mile 6 chains of heavy work, and 10 chains of rip rap has been completed. Other bank-protection works, mostly light willow types, and totalling 71 chains, have been carried out in the Waimana, Waioeka, Otara, and Waiaua Rivers.

Extensive surveys and investigations are in hand for large drainage projects in the Waihi near Tauranga, on the Rangitaiki, and in the Kaituna Swamp.

At Glen Massey, where experiments have been conducted to stabilize and colonize with vegetation the overburden from opencast coal-mining operations, 10,000 Bishop's pine (*P. muricata*) were planted, but manuka alone appears able to establish itself on these unfavourable sites.

Napier Works District

The Ohuia drainage scheme near Wairoa was started during the previous year, but after a small amount had been done, work ceased until the next dry weather. The scheme, estimated to cost £20,000, involves the excavation of 119,000 cubic yards of material from the Waiatai Stream and the formation of stop-banks. Eighty-four thousand cubic yards have been excavated and 1 mile 65 chains of stop-banks are in various stages of completion.

The major portion of the Meeanee drainage scheme, to drain some 6,000 acres of swampy land at the back of Napier and to provide a drain outfall for a further 3,000 acres of rolling country, is practically complete.

A total of 6,500 cubic yards of shingle have been removed from shingle-traps in the Kumeti Drain near Dannevirke. Repairs have been effected to two of the concrete weirs.

Wanganui Works District

On a badly slipping area on Mount Messenger, willows and poplars have been planted and 5 chains of cut-off drain dug. At the mouth of the Waitara River, 100 ft. of boulder wall has been built to extend old concrete work and prevent erosion of sandhills The job have been most successful. A survey has been made for the extension and improvement of the Eltham Drainage Board's works in the Pukengahu and Ngaere Swamps.

Wellington Works District

For the first nine months of the year the Otaki River, from the railway bridge to the sea, was maintained by the Ministry of Works. It was then handed over to the Manawatu Catchment Board. The chief work in the Hutt River was the 25-chain diversion opposite Barton's Bush, which is now a successful operation. A total of 51 chains of heavy willow bank-protection weighted with stone sausages, and 10 chains of light protection, have been completed.

A number of new nurseries of willows and poplars have been established.

Nearly three hundred shipmast locust trees were distributed by the Ministry of Works nursery at Waitarere to the Wairarapa, Rangitikei, and Manawatu Catchment Boards and to farms.

Generally, good growth has been observed, and they appear to be resistant to stock damage. Another five hundred will be available for distribution next year.

A 600-acre property on the Wither Hills is being treated in a similar way to the Wither Hills Conservation Reserve. When the success of the work is established, it is planned to encourage the same treatment on 10,000 acres of similar country. The trial terracing and contouring of sloping vegetable and fruit-growing land at Onahau (Sounds area) was successful. The pasture furrows constructed at Kekerengu have been effective in checking further erosion. At Molesworth an inspection was made of the oversown plots in Acheron Valley and the Campden areas. The results are very encouraging, and it is hoped to aerially sow seed on some of the region, in co-operation with the Lands Department.

Christchurch Works District

A survey of the Waiau-uha River at Spotswood is in progress, and a willow nursery has been established there. In the Clarence River the permeable groyne above the railway bridge is being repaired. The groyne, originally a temporary measure, was breached in 1945, and later an undesirable channel developed through the gap.

On the West Coast 12 chains of fascine and sausage work and 11 chains of stop-bank were built on the Inangahua River. Twelve chains of similar protection and 13 chains of stop-bank were completed on the Maruia River.

New nurseries for willows and poplars have been established.

Dunedin Works District

The whole of this district is covered by catchment districts and the Waitaki Soil Conservation District.

Waitaki Soil Conservation District

The Waitaki River has been photographed from the sea to the dam, and an aeria mosaic is in course of preparation with a view to designing a scheme for the gradual control of the river from Hakataramea downwards. Forty chains of the Awamoko Stream have been cleared of willows, 60 chains of stop-banks have been built on the Ahuriri River at Glenburn Station, and a 15-chain diversion cut made on the Quail Burn.

Farm surveys of land use and incidence of erosion were carried out on thirty-four properties covering 40,000 acres. With the occupiers' co-operation a large number of fenced plots have been established to ascertain the benefit of surface sowing grasses and clovers. Negotiations are in progress to lease a property in the Hakataramea Valley to be run as a demonstration soil conservation farm.

Depots for fire-fighting equipment were established at Kurow, Omarama, Lake Pukaki, and Lake Tekapo.

The Committee organized parties to fight two tussock fires. On application to the Committee, permits to burn off are issued in special cases during a short period in September only.

STAFF

Lack of staff in the past has been responsible for retarding progress particularly in soil conservation activities, and to overcome this difficulty it has been necessary to arrange special training courses. Two courses of ten months duration have been arranged with the Canterbury Agricultural College, to whom the Council is greatly indebted. Fourteen junior soil conservators have completed their initial training, and are now in the field under supervision of the senior staff.

The Council wishes to record its appreciation of the services rendered by its engineering, soil conservation, and secretarial staff, all of whom have done splendid work under very difficult conditions.

APPRECIATION

The Council again wishes to express its appreciation of assistance and information received from its Advisory Committees, Departments of State, Catchment Boards, local authorities, and overseas agencies in the United Kingdom, Australia, India, Canada, South Africa, and the United States of America.

Signed on behalf of the Soil Conservation and Rivers Control Council:

W. L. NEWNHAM, M.I.C.E., Chairman.

TABLE I

Item.	Voted, 1949-50.	Expenditure, 1949-50.	Miscellaneous Receipts.
	£	£ s. d.	£ s. d.
Flood and erosion control works	408,500	368,360 8 7	14,686 14 10
Hydrologic data: Installation of recording apparatus, collection and publishing	20,000	13,153 13 10	18 15 6
Hydraulic model laboratory (on account) ..	5,000	..	..
Initial expenses of Catchment Boards and loans to local authorities	75,000	111,296 9 7	37,339 0 11
Investigations and surveys	13,500	31,675 6 11	82 1 0
Junior soil conservators: Training ..	2,500	2,363 0 0	190 1 5
Publicity and educational work	10,000	6,219 7 5	801 4 3
Research and experimental work	35,000	34,816 15 1	10,751 7 8
Soil conservation districts, including investigations and initial expenses arising out of constitution	1,750	848 17 1	..
Soil conservation reserves: Acquisition and fencing	5,000	1,472 16 4	..
Soil conservation works	45,000	30,736 11 2	1,535 9 8
Travelling-expenses and fees of Council ..	2,500	1,249 4 11	1 5 6
Contribution from Consolidated Fund ..	..	..	5,000 0 0
	623,750	602,192 10 11	70,406 0 9

Amount appropriated for year ended 31st March, 1950, £580, 000.

Table 2.—Schedule of Works Completed During the Year Ended 31st March, 1950

District.	Minor Works: Numbers of Schemes.				Drains.		River Channel Cleared.	Bank-protection.			River Diversion Cuts.	Stop-bank.
	Tree planting.	Gully Control.	Drains.*	River.*	Newly Excavated.	Reconstructed.		Light Types.	Heavy Types.	Rip Rap.		
					M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch	M. ch.	M. ch.
Hauraki	3	..	12	3	0 65	40 27	29 55	0 10	..	..	..	2 66
Poverty Bay	6	31	1	21	0 35	6 44	2 65	0 36	..	..	..	1 27
Hawke's Bay ..	6	11	1	2	0 15	..	2 75	0 17	1 00	..	0 12	0 46
Rangitikei	2	2	2	8	0 45	0 10	0 27	0 38	0 60	..	0 25	0 03
Manawatu	4	6	5	47	4 74	5 51	3 56	2 46	1 75	0 69	0 36	6 16
Wairarapa	3	6	1	19	2 02	..	2 32	1 62	1 36	..	1 03	2 00
Nelson	..	..	..	20	..	0 50	14 03	1 28	0 47	0 07	0 21	1 36
North Canterbury ..	6	1	4	6	0 06	18 02	60 28	3 00	0 47	..	0 73	6 02
South Canterbury ..	15	..	..	22	1 32	2 12	46 67	4 30	3 56	..	0 08	4 34
Westland	..	..	1	17	0 20	..	0 16	0 37	0 42	0 44	0 51	0 64
Otago	..	..	4	8	4 00	7 32	1 55	1 26	..	0 39	0 26	1 54
Southland	9	..	..	59	4 26	14 62	23 44	3 50	3 09	..	1 24	14 56
Catchment district totals	54	57	31	232	19 00	95 50	188 43	19 60	13 52	1 79	5 39	42 04
Auckland	..	..	..	..	..	5 58	..	..	..	0 14	..	..
Hamilton	..	..	..	..	0 71	38 36	17 10	1 60	1 24	0 10	0 17	3 59
Napier	..	..	..	..	..	..	..	..	..	..	..	..
Wanganui	..	..	..	..	0 05	..	..	..	..	0 01	..	..
Wellington	..	..	..	..	..	..	..	0 10	0 51	..	0 25	..
Christchurch ..	..	..	..	..	..	..	..	..	0 24	..	..	0 24
Dunedin	..	..	..	..	..	..	..	..	..	..	..	..
Waitaki Soil Conservation District	..	..	..	3	..	..	0 40	..	..	..	0 15	0 60
Works district totals	..	..	..	3	0 76	44 14	17 50	1 70	2 19	0 25	0 57	4 63
Grand totals ..	54	57	31	235	19 76	139 64	206 13	21 50	15 71	2 24	6 16	46 67

*Lengths of respective types of work entered under applicable heads in other columns.

APPENDIX F

ANNUAL REPORT ON BUILDINGS BY THE GOVERNMENT ARCHITECT

The Hon. the MINISTER OF WORKS.

SIR,—

I have the honour to submit the following report on the work of the Architectural Division for the year ended 31st March, 1950.

Construction has proceeded on a large number of building projects for the various Government Departments. They have varied greatly in size and type, some being of permanent reinforced-concrete construction, some of timber framing, and others of a temporary nature only. Apart from new structures, there has been a large number of alterations and additions and also a considerable volume of maintenance work. In Wellington and in Masterton a number of buildings have been strengthened consequent upon earthquake damage.

The following is a brief summary of the more important projects:—

ACCOMMODATION BOARD

A large programme of alterations to and remodelling of existing premises was carried out in order to provide additional accommodation for Government Departments. Although individually small, collectively they represent a considerable volume of work.

AGRICULTURE DEPARTMENT

Construction of a new dormitory and ablution block at Flock House has progressed steadily and is now nearing completion. Repairs and renovations have been carried out to the buildings on Somes Island.

AIR DEPARTMENT

The re-roofing of Nos. 1 and 2 Hangars at Whenuapai has been completed and the repairs to the roofs of the blister hangars at Ardmore are now in hand. Alterations to No. 1 Mess at Hobsonville have been carried out, and a big programme of painting at Whenuapai, Hobsonville, and Woodburn is proceeding. Additional accommodation was provided at Waipapakauri, and fire reinstatement at Wigram is nearing completion. A large contract has been let for a new store at Weedons, but work has not yet commenced.

ARMY DEPARTMENT

An extensive programme of repainting and renovation work has been undertaken at Linton, Papakura, and Burnham Military Camps in preparation for the intake of trainees in May. The re-erection of "W" type warehouses at Linton is well in hand, and a commencement has been made with the re-roofing of Kensington Drill Hall, Dunedin. Plans were prepared for major extensions at Linton Camp, but construction has been deferred.

EDUCATION DEPARTMENT

At Invercargill a large extension to the Southland Technical College is under construction, work now being in the hands of finishing trades. Likewise at Lincoln Agricultural College the construction of the dormitory block is well advanced. Work proceeds on the following additional projects: Gore High School; Marlborough College, domestic-science block and assembly hall; Wanganui Girls' College, science block;

Auckland University College, physics block; Nelson Boys' College, fives courts; and also the strengthening of the Wellington East Girls' College. A temporary kitchen building was erected to replace the one lost by fire at the Nelson Boys' College. A major programme of post-primary schools is in the planning stage, designs being prepared for schools at Naenae, Rongotai, Penrose, Papakura, Mount Roskill, and Orakei.

Forest Service

At Conical Hill, Southland, good progress, in spite of difficult site conditions, is being made in the erection of a sawmill and ancillary buildings. Kitchen and dining-rooms are being planned. Halls and other camp amenities are also being planned for Minginui, Golden Downs, and Kaiangaroa.

Health Department

Construction continues on the new St. Helens Maternity Hospital, Christchurch. The finishing trades are well advanced on the main building, with stainless-steel equipment now coming to hand. The shell of the laundry and porters' quarters is complete, while a contract for the nurses' home has just been let. At Rotorua a contract has been let for the necessary alterations to the Services Convalescent Hospital in order to convert it to a hospital for the treatment of physical disorders. Following a complete survey of the main bathhouse at Rotorua, long-delayed maintenance has now been put in hand. This, perhaps the most well-known building in New Zealand, had reached a deplorable state of disrepair, and the work now required to extend its usefulness is extensive. At Mangakino a maternity hospital with an out-patient clinic attached has been constructed to serve the community engaged on the hydro-electric projects along the Waikato. Another is being planned for Roxburgh. A District Nurse's cottage has been completed at Rawene and one is under construction at Broadwood.

For the Mental Hygiene Division a contract has been let for the construction of two villas on the recently developed Cherry Farm site. Work has progressed steadily on the project at Lake Alice—two fifty-patient villas and a number of eleven-patient villas are completed ready for occupation. A new main boiler-house is under construction at Avondale. A therapy block has been completed at Porirua, and plans are in hand for a large administration block.

Internal Affairs Department

Renovations and minor alterations were carried out to Government House, Wellington, and also at Government House, Auckland.

Island Territories Department

Investigations were carried out in the use of coral as a concrete aggregate with satisfactory results and construction commenced in Niue with three houses and a Residency using coral concrete blocks. In Rarotonga the concrete aeradio receiving station was completed. Two houses for staff were completed and the construction of another two is well advanced.

Justice Department

Extensive alterations have been carried out to the Supreme Court, Auckland.

Labour and Employment Department

Miners' hostels are under construction at Blackball and Renown Collieries. The directors' quarters at Blackball, acquired from the Westport Coal Co., have been converted to accommodate thirteen miners together with a matron and staff.

Extensions are being made to the hostel at Hansons Lane, Christchurch.

Maori Affairs Department

Fire damage at the Maori Community Centre, Auckland, necessitated extensive reinstatement. The renovations of the Rangiatea Church at Otaki were completed, and the rededication service was held on 18th March.

Marine Department

Plans are being prepared for a large workshop at Westport. A new lighthouse is under construction at Taiaroa Heads.

Marketing Department

Plans have been prepared for an inspection and assembly shed at Motueka and also for an apple assembly shed at Dunedin.

Ministry of Works

Phase one of the development for plant zone Workshops, Mangere Crossing, has been completed, together with the erection of eighteen staff cottages. Twelve staff cottages are under construction at Porirua.

New stores buildings are being erected at Frankton, and a smaller store for the Housing Division has been completed at Rotorua. At Porirua a new oil and bulk store has been built and an existing store building from Tawa Tapu re-erected. The large store building in Blenheim Road, Christchurch, is nearing completion.

Sketch plans have been prepared for the proposed Auckland Civic Centre in conjunction with officers of the Auckland City Council. Provision is made in this scheme for the long-term development of Department accommodation.

Navy Department

The erection of a fuel-pipe store at H.M. Dockyard, Devonport, is well advanced. The installation of sprinkler protection has been completed in some buildings, but much still remains to be done in others.

New Zealand Broadcasting Service

To provide studios for new broadcasting-stations, existing buildings have been remodelled in Invercargill, Gisborne, Wanganui, Hamilton, Rotorua, Whangarei, and Timaru. In addition, alterations have been carried out at the IYA Studios, Auckland, and at the transmitting-station at Henderson.

Police Department

Contracts have been let for the construction of new police-stations at Greymouth and Takapuna.

Post and Telegraph Department

The new post-office at Fielding was opened during the year, and the construction of others commenced at Hokitika, Otahuhu, and Balclutha. Automatic telephone exchanges were completed at Naenae, Kilbirnie, and Riccarton, while a commencement was made at Ellerslie, Hamilton East, Hataitai, Wellington, and Nelson. Contracts have recently been let for a large reinforced-concrete exchange at Remuera, a carrier-repeater station at Taupo, and line stores at Opotiki and Te Aroha.

In addition to these, there is a large building programme in the planning stage.

Prime Minister's Department

To provide for prompt handling of films connected with the British Empire Games, a number of alterations were quickly effected at the Miramar Studios, and further alterations are proceeding to provide better studio facilities. Extensive remodelling of the A.B.C. Building, Wellington, is in hand.

Railways Department

Plans have been prepared for a bus station at Roxburgh, and others are in course of preparation for a traction-control building at Kaiwarra and a station at Naenae.

Scientific and Industrial Research Department

Extensive alterations to the store at the Physical Laboratory at Gracefield have been completed, and work is proceeding on extension to the Fats Laboratory in Sydney Street. A Magnetic Observatory has been established in the Botanical Gardens, Christchurch, while a commencement has been made with the erection of glasshouses and a store for the Agronomy Division at Lincoln.

State Hydro-electric Department

At Roxburgh, No. 3 Camp is now under construction and plans are well advanced for Community Buildings, Shops, Y.M.C.A., Diesel generator building, and permanent staff housing. Additional office accommodation has been constructed for Head Office staff in Sydney Street, and a new substation is under construction at Invercargill North.

Tourist and Health Resorts

The provision of fire-escapes and alterations to the kitchen at the Franz Josef Hostel are practically completed, while work on the erection of fire-towers and extensions to the store at Chateau Tongariro are well in hand. Proposals for the reinstatement of Milford Hostel following the recent disastrous fire have been prepared. Plans are also in hand for new lounge bars at the Chateau and Waitomo, together with improvements to the lounge at Te Anau.

General

In addition to the foregoing, a considerable volume of building Services' work has been undertaken. This has taken the form of new mechanical and electrical installations in existing buildings, together with the provision of fire-sprinklers, fire-escapes, alarms, and fire-fighting equipment of all types. This aspect of building-work has developed considerably of recent years.

The extent of work handled by the Division during the year is shown in the following summary :—

	£
Expenditure on building operations	1,399,713
Works completed and under construction	2,784,025
Working drawings completed or in hand	3,814,857
Sketch plans prepared for projects	5,239,846
Workshops	403,883

Many difficulties have been encountered in the execution of this work, mainly due to the fact that the building industry has not been in a position to meet the demand for construction expeditiously. The rate of progress has been seriously limited by large shortages of both labour and materials. In many trades, particularly in the more skilled, the number of experienced men available has been inadequate, and conditions have been such that the few available have not been prepared to work outside the main centres. Attention must be focused within the industry on trade training schemes capable of providing a continuous flow of competent man-power.

At the beginning of the period under review the short supply of reinforcing-steel seriously restricted work on all major schemes, but this difficulty has been largely overcome by the importation of English steel (at a much higher cost than that formerly obtained from Australia). Cement supplies and distribution have been far from satisfactory, entailing additional costs and many delays, affecting the sequence of all trades.

Timber-supplies are still difficult, particularly in the South Island. The supply lacks balance; sizes or quality are often not available when required. Large supplies of exotic timber are now coming to hand.

Frequent changes in the cost of basic building materials and the upward trend in award rates brought many difficulties. It was found necessary to provide special clauses to take care of this in larger contracts in order to provide a stable basis for tendering.

Apart from the design, construction, and maintenance of buildings technical assistance has been given to a number of Government authorities, including the Earthquake and War Damage Commission, the Standards Institute, the Licensing Commission, the Local Government Loans Board, and the Community Centre War Memorials Committee. Also, architectural staff have been seconded to the Health Department, the Maori Affairs Department, and the State Hydro-electric Department in order that they may assist in direct association with the technical officers of those Departments.

I wish, in conclusion, to place on record my appreciation of the efficient service and loyalty of all my staff and to acknowledge the co-operation and assistance given by officers of other Divisions and by the master builders.

R. A. Patterson, F.N.Z.I.A., F.I.A.A.,
Government Architect.

APPENDIX G

ANNUAL REPORT OF THE DIRECTOR OF HOUSING CONSTRUCTION

The DIRECTOR OF HOUSING CONSTRUCTION to the Hon. MINISTER OF WORKS.

SIR,—

I have the honour to submit the following report on the Division's activities for the year ended 31st March, 1950.

1. GENERAL

The total of houses completed and handed over by the Housing Construction Division for the year was 4,007, as against 4,193 for the previous year. Had it not been for the setback in production in the Auckland district during the carpenters' dispute early last year, when it is estimated that approximately 250 house units were lost, it is considered the previous year's record total would have been exceeded.

The number of building contractors engaged on State housing has remained fairly constant, and as at 31st March, 407 principal contractors were engaged, with a labour force of 6,011 men. The supply position has improved to some extent, but shortages in some lines such as baths, weatherboard, brick, and cement board for exterior sheathing, and flooring have caused inconvenience to contractors and delays in construction. Difficulty in obtaining sub-contractors for painting and plumbing has also delayed the handing-over of houses for occupation in some centres. Further details of housing activity with full statistical information are set out in the sections which follow.

2. BUILDING CONSTRUCTION

To conserve native timbers, experimental construction in non-traditional materials such as pumice-cement boards is still being carried out. There has also been an increase in the use of treated *Pinus insignis* timber. In rural districts, corrugated aluminium sheeting has been used to some extent to relieve the temporary shortages of other roofing-materials.

The major housing schemes at Tamaki, Auckland, in the Porirua–Titahi Bay area, and at Mussel Bay, Dunedin, are progressing very satisfactorily. State rental houses are being built in 135 different towns. Another aspect of housing which developed considerably during the past year is the erection of pensioners' flats in the larger towns where there has been a need for this type of accommodation. To date, 235 of these units have been completed and 138 are under construction, while a further 75 have been sited and contracts are being arranged.

Standard house plans and methods of construction have been kept under constant review and new designs and details added to those already in use. To meet the needs of other Departments for staff housing in the Pacific islands, special house designs suitable for tropical conditions were drawn, and contracts have already been arranged for houses at Lauthala Bay and Nadi.

Consideration has been given to many proposals for the importation of prefabricated houses, but in every instance it has been found on analysis that the final cost of such buildings erected in New Zealand is much greater than that of a similar-sized State house constructed in the normal manner. The standard and planning of fittings in these

prefabricated houses are not up to the standard of those of a typical State house. Opportunity has been taken of sending standard plans and specifications to several overseas prefabricating companies so that, if they desire, they may reconsider their design and costs. During the year tenders were called overseas for the supply and delivery of 50 prefabricated aluminium houses, and, in order to attract offers, specifications were drafted to allow a wide variation in design and manufacture. Despite this, only three tenders from England were received, and none of these was economically acceptable. It is not generally appreciated that a prefabricated house requires a considerable amount of work on site, which adds considerably to the cost, and although claims are made that the house can be erected in a remarkable short time, this usually applies to the house shell only. Foundations have to be built and services comprising plumbing, electrical, drainage, and water-supply have to be installed and finishing work to be undertaken.

Prefabrication of standard houses in New Zealand has been used extensively for the provision of timber-workers' cottages, but the cost of transport and erection on site makes the over-all cost of these units as high as houses erected on site in the usual way. Nevertheless, prefabrication of houses is worth while for isolated localities, as by reducing the time required by labour on the site it has enabled houses to be built in places where a contractor would have otherwise been unwilling to contract.

During the year, at the invitation of the sponsors of the *Daily Mail* Ideal Home Exhibition, Olympia, London, the timber, joinery, and fittings of a typical state rental house were forwarded to England for the construction of a house exhibit. The project was financed on an equal basis by the Government, the New Zealand Meat-producers Board, the New Zealand Dairy Products Marketing Commission, and the New Zealand Wool Board.

A report received from the High Commissioner's Office advises that the results of the exhibition fully justified participation and that the house was visited by members of the Royal Family. Some 140,000 people walked through the house and inspected it, being the maximum number that could be handled in the period of four weeks the exhibition was open. The exhibit received considerable favourable publicity, and the opinion has been expressed that great results have been obtained at an extremely small cost.

3. SIZE AND TYPES OF HOUSES

The following table sets out (*a*) the various sizes of houses built during the year as compared with the previous year, and (*b*) the total number of each of the various types of houses built as at 31st March, 1950:—

(a)

	Units Completed.					
	1949–50.		1948–49.		Total to Date.	
	Number of Units.	Percentage of Total.	Number of Units.	Percentage of Total.	Number of Units.	Percentage of Total.
Bed-sitting room	..	..	..	..	231	1
One bedroom	75	2	24	1	2,552	7
Two bedrooms	1,416	35	1,462	35	14,406	42
Three bedrooms	2,408	60	2,357	56	15,557	44
Four bedrooms and over ..	108	3	350	8	1,985	6
Total	4,007	100	4,193	100	34,731	100

(b)

Weatherboard	19,911	Single units	25,327
Brick	9,678	Double units	8,120
Concrete	1,521	Three units	123
Fibrolite, asbestos, sheathing, sidings, and miscellaneous	3,621	Flats and multi units	1,161
Total	34,731	Total	34,731

4. AVERAGE LENGTH OF TIME UNDER CONSTRUCTION

The average length of time under construction of the State rental houses handed over during the twelve months ended 31st March, 1950 was forty-nine weeks. The figures for the various districts are as follows:—

District.	Average Time Under Construction, in Weeks.	
	For Year Ended 31st March, 1950.	For Year Ended 31st March, 1949.
Auckland	48	55
Hamilton	48	59
Napier	51	66
Palmerston North	46	50
Wellington	50	62
Christchurch	46	56
Dunedin	56	63
Dominion average	49	59

The above figures do not show the actual working-time spent on the building of State rental houses, but represent the time between first work on a house and the date of completion. It should be noted that 20 per cent. of the houses were built by Rehabilitation trainees, who do not work as quickly as experienced tradesmen.

5. WORK FOR OTHER DEPARTMENTS

(a) Land-settlement.—Housing for ex-servicemen under the land-settlement scheme is the largest and most important phase of the Division's work for other Departments. Work has not progressed as expeditiously as is desired, due to the continued reluctance on the part of contractors to undertake rural work, but the past year has been one of considerable progress and many long-outstanding jobs have been put in hand. In addition to the house units for ex-servicemen being settled on the land listed in the table above, the following is a summary of miscellaneous farm buildings constructed during the year, and of renovations or conversion of old buildings into modern residences:—

——	Auckland.	Hamilton.	Napier.	Palmerston North.	Wellington.	Christchurch.	Dunedin.	Total.
Renovations and conversions	..	1	3	2	13	10	13	42
Milk-sheds	75	146	7	104	7	17	15	371
Implement-sheds	57	129	60	101	34	56	34	471
Piggeries	84	29	..	..	..	9	..	122
Wool-sheds	..	..	2	..	6	3	6	17
Stables and barns	..	..	..	..	1	16	31	48

(*b*) There has been a steady demand by other Government Departments for the construction of houses for their staffs, and requests have ranged from a single unit up to a hundred units for hydro-electric workmen at Roxburgh. Units are still being erected in isolated localities under the timber-workers' housing scheme.

The following is an analysis of the houses built for other Departments :—

Department or Service.	Completed, 1949–50.	Completed, 1948–49.	Completed up to 31st March, 1950.	Under Construction at 31st March, 1950.
Agriculture	..	4	47	3
Air	15	44	59	14
Dairy factories	..	..	17	..
Defence	4	29	132	4
Education	2	..	6	22
Fire Boards	6	..	6	..
Forestry	101	37	177	80
Health	6	3	11	1
Hydro-electric	68	187	314	77
Land-settlement	206	107	610	109
Maori Affairs	1	..	1	..
Marine	1	1	3	1
Marketing	..	..	22	..
Mental hospitals	1	..	6	26
Mines	..	..	66	4
National Airways	3	..	3	..
National Broadcasting	2	8	20	1
Police	1	1	3	1
Post and Telegraph	20	23	96	9
Railways	32	39	97	13
Rehabilitation	..	..	1	..
Rural	..	1	149	..
Scientific and Industrial Research	..	1	4	..
Timber-workers	137	277	458	52
Social Security	..	..	1	..
Works	13	17	155	..
R.N.Z.A.F.	..	..	..	16
Totals	619	779	2,464	433

6. REHABILITATION TRAINEE CONTRACTS

The number of rehabilitation trainees employed on housing contracts is now falling off as fewer men come forward for training, and this is reflected in the reduced number of houses completed during the year. The contribution made by trainees to date as indicated by the table of results below has been a valuable and a creditable one, and although this scheme is now declining, the men who have been trained have been absorbed into the building industry either as tradesmen or as contractors on their own account, to the consequent benefit of building production :—

——	Auckland.	Hamilton.	Napier.	Palmerston North.	Wellington.	Christchurch.	Dunedin.	Total.
				UNITS HANDED OVER				
Up to 31st March, 1948	263	101	153	63	246	242	164	1,232
Year ended 31st March, 1949	202	70	151	103	214	190	114	1,044
Year ended 31st March, 1950	146	118	95	91	140	108	97	795
Total	611	289	399	257	600	540	375	3,071

UNITS UNDER CONSTRUCTION

As at 31st March, 1948	200	112	163	119	211	187	138	1,130
As at 31st March, 1949	183	133	103	110	136	112	136	913
As at 31st March, 1950	148	77	91	112	129	111	95	763

NUMBER OF TRAINEES EMPLOYED

As at 31st March, 1948	526	301	270	258	416	326	334	2,431
As at 31st March, 1949	398	205	272	305	334	302	255	2,071
As at 31st March, 1950	343	133	169	179	265	178	175	1,442

7. LAND ACQUISITION AND DISPOSAL

The amount of land acquired for State housing purposes is less than for the previous year.

Approval has been given to acquire 93 different properties in 51 separate towns, which are estimated to provide sufficient land for 1,818 house units. Eighty-one of these properties, providing about 1,570 sites, have been acquired by purchase negotiation, and 12, providing about 248 sites, have been acquired under the compulsory provisions of the Public Works Act.

Approval has also been obtained to transfer 54 sections in 20 different towns to the Lands and Survey Department for the purpose of sale as sites for churches, kindergartens, Plunket rooms, departmental residences, schools, doctors' residences, and for disposal to returned servicemen.

Schedules of sections held in many towns throughout the country which are to be made available for sale to the public are at present in the course of preparation. Groups comprising 146 sections in the Auckland metropolitan area are now being transferred to the Lands and Survey Department for this purpose.

8. PLANNING

Planning activities during the year have been mainly concentrated on advancing the major schemes throughout the country. These large housing areas have brought about greater activity on the part of various bodies such as kindergarten associations, educational bodies, church organizations, and others supplying the social amenities associated with residential areas, leading to their seeking sites for their various requirements. A central Committee of the National Council of Churches recently set up to handle and co-ordinate the applications for and allocation of church-sites will, it is expected, assist considerably in the handling of the future sites required for this purpose.

Areas producing some 6,000 house sections were investigated or finally planned during the year. Further planning work has been carried out for the Porirua-Titahi Bay area, and final scheme plans of substantial areas of Tamaki have been completed to the stage that approximately 60 per cent. of the whole scheme has been finalized.

Other large schemes in various stages of planning include Mount Roskill (Auckland), Te Rapa (Hamilton), Hastings, Rotorua, and New Plymouth in the North Island, and Bryndwr (Christchurch), Oamaru, Invercargill, and the Dunedin suburbs of Half-way Bush, Pine Hill, and Corstorphine in the South Island.

In addition to these, there are many smaller schemes, and, in all, planning operations have been carried out in 76 cities and boroughs throughout the country.

9. PLANNING FOR OTHER DEPARTMENTS

Government Departments which have availed themselves of the services of this Division in the planning of their housing schemes during the year include the Army, Air, Maori Affairs, New Zealand Forest Service, Post and Telegraph, State Hydro-electric, and Tourist and Health Resorts.

For the State Hydro-electric Department, schemes for the housing of the permanent staff have been planned for 18 units at Haywards, 60 units each at Roxburgh and Maraetai, and, in addition, a temporary village of some 600 cottages for the construction workers has been planned at Roxburgh. For the Army Department several large schemes for main camps have been planned. Similar schemes for the Air Department include Woodburne, 123 units; Taieri, 17 units; Whenuapai, 78 units; and Paraparaumu, 30 units. A small block of 7 units has been planned at the Post and Telegraph radio station at Himatangi.

Other work included the investigation for the Maori Affairs Department as to the suitability of proposed schemes at Matahiwi and Porangahau.

10. LAND-DEVELOPMENT

Although still handicapped throughout the past year by a shortage of field staff and of labour and materials, the normal output of serviced house sites has been maintained.

In the preparation of some 5,000 house-sites some 592,000 cubic yards of earthwork were moved, 101,000 cubic yards of road-metal were placed, and 194,000 square yards of sealing were carried out. In addition, engineering services comprising 49 miles of sewers, 20½ miles of water-mains, and 34 miles of kerbing were laid.

Excellent progress continues to be made on the large Auckland schemes at Tamaki and Mount Roskill, and there the provision of serviced sections is well in advance of building contracts. In other towns, however, it has been more difficult, owing to lack of large engineering contracting firms, to keep ahead of the house-builders.

In some towns, owing to the existing municipal systems being overloaded, it has been difficult to obtain sanitary drainage, and in Christchurch it has been necessary on this account to undertake drainage schemes which will later on be taken over by the city.

11. STATISTICS

The following tables summarize the district activities of this Division up to 31st March, 1950:—

(*a*) Houses handed over for occupation:—

District.	1st April, 1949, to 31st March, 1950.			Total to Date.			House Units Under Construction as at 31st March, 1950.		
	State Rental.	Other Departments.	Total.	State Rental.	Other Departments.	Total.	State Rental.	Other Departments.	Total.
Auckland ..	867	65	932	10,779	256	11,035	1,012	68	1,080
Hamilton ..	418	202	620	2,434	1,073	3,507	442	102	544
Napier ..	223	44	267	1,667	169	1,836	240	33	273
Palmerston North	418	79	497	2,985	289	3,274	480	39	519
Wellington ..	677	45	722	8,004	213	8,217	709	34	743
Christchurch	518	86	604	4,245	290	4,535	595	33	628
Dunedin ..	267	98	365	2,153	174	2,327	353	124	477
Total ..	3,388	619	4,007	32,267	2,464	34,731	3,831	433	4,264

(*b*) The following table shows the figures for house construction district by district since the inception of the Division. Land-purchase figures are also shown, and include sections on which houses for other Government Departments have been built. It should be noted that the figures for other Government Departments are already included in the total house-construction figures :—

Year Ended 31st March,	Houses Handed Over for Occupation in Housing Construction Districts.									Total Unit Sections Purchased.†
	Auckland.	Hamilton.	Napier.	Palmerston North.	Wellington.	Christchurch.	Dunedin.	Total.	Houses for Other Govt. Depts. Included in Previous Col.	
1938	95	12	..	31	197	29	35	399	..	9,296
1939	990	186	181	234	593	295	186	2,665	..	4,653
1940	1,340	219	200	234	713	459	230	3,395	27	6,472
1941	1,587	215	175	349	799	541	300	3,966	61	3,532
1942	1,291	247	129	302	649	389	201	3,208	20	5,037
1943	362	283	67	103	171	206	67	1,259	165	7,623
1944	263	74	22	86	242	116	77	880	24	3,571
1945	685	107	95	227	604	158	93	1,969	52	1,877
1946	873	189	104	282	1,139	281	117	2,985	129	3,777
1947	677	281	166	207	758	329	177	2,595	253	2,913
1948	938	381	145	273	777	476	220	3,210	335	1,759
1949	1,002	693	285	449	853	652	259	4,193	779	4,566
1950	932	620	267	497	722	604	365	4,007	619	2,437
Total ..	11,035	3,507	1,836	3,274	8,217	4,535	2,327	34,731	2,464	57,513

(*c*) *Expenditure.*—The following table shows the expenditure each financial year to date :—

Year Ended 31st March,	State Housing.	Other Departments.	Land Purchase and Division.	Administration and General.	Total.
1937–38 ..	1,062,802	..	298,572	115,026	1,476,400
1938–39 ..	3,275,781	..	592,034	101,885	3,969,700
1939–40 ..	4,228,619	26,671	748,255	160,955	5,164,500
1940–41 ..	4,508,116	101,751	910,240	147,293	5,667,400
1941–42 ..	3,299,330	73,258	537,981	164,031	4,074,600
1942–43 ..	1,067,435	124,072	501,399	132,994	1,825,900
1943–44 ..	1,138,913	184,345	357,326	86,016	1,766,600
1944–45 ..	3,351,179	168,055	721,689	204,677	4,445,600
1945–46 ..	4,150,207	524,939	687,009	263,145	5,625,300
1946–47 ..	4,267,052	660,430	840,171	336,747	6,104,400
1947–48 ..	4,579,797	768,629	828,752	461,822	6,639,000
1948–49 ..	5,886,497	1,367,917	1,175,257	456,651	8,886,322
1949–50 ..	7,171,118	1,643,121	1,359,442	534,939	10,708,620
Total	47,986,846	5,643,188	9,558,127	3,166,181	66,354,342

In conclusion, I wish to place on record my appreciation of the continued loyal and efficient service rendered by my staff.

R. B. HAMMOND, F.N.Z.I.A., M.T.P.I.,
Director of Housing.

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