1924.

NEW ZEALAND.

NEW ZEALAND RAILWAYS.

PROGRAMME OF IMPROVEMENTS AND NEW WORKS.

REPORT BY THE HON. J. G. COATES, MINISTER OF RAILWAYS.

MR. SPEAKER,—

In submitting to honourable members a complete survey of railway improvements I may remind them that in 1914 a scheme was authorized for the purpose of bringing the system up to date and able to meet the transport needs of the community. At that date the railway facilities were admittedly inadequate, but the war with its larger obligations intervened, demands for facilities became more pressing and varied, and it was felt that nothing short of a further comprehensive survey, backed by complete and exact data, would enable a programme to be evolved and carried out which would meet the very extensive requirements of the system.

In drafting a programme of works for the development of our railway system I have endeavoured to lay aside all political considerations based on the rivalry of different geographical areas or the pressure of organizations whose chief function is to advocate expenditure without regard to the financial resources of the Dominion or any proper sense of perspective as to the relative claims of various items of railway-improvement.

In presenting this programme of works I have allowed no influence to operate other than the strict test of the merits of each proposal as ascertained by statistics under such headings as the following:—

(*a.*) Cost of dealing with traffic with existing terminal facilities as compared with the improvements proposed;

(*b.*) Cost of haulage over existing lines as compared with the suggested alterations to the lines by grade-easements or otherwise;

(*c.*) The economies that may be effected by introducing automatic signalling, electric lighting, shop improvements, &c.

A glance at the Chief Engineer's remarks and figures, prepared expressly for my purposes, will indicate the relative importance of each.

In one or two instances other factors than those I have mentioned above have had a bearing on the decision, and in such cases I have made particular reference thereto in the following remarks regarding the specific items.

To meet all the requirements considered desirable by the Department would involve a total expenditure of approximately £13,000,000.

In dealing with the proposals I have had to give due consideration not only to the desirability of the various works from the point of view of the Department of Railways, but also to their relative importance as compared with the many other works that are pressing on the financial resources of the country.

The works proposed in the schedule will cost approximately £8,000,000, and the programme has been laid out so as to apportion the expenditure as far as possible evenly over a period of eight years. This is in addition to the expenditure for rolling-stock, new equipment, housing, and minor improvements covered by the annual appropriations for additions to open lines.

Considerations of finance alone quite preclude all the proposed works being undertaken or even sanctioned immediately, and in dealing with the commitments embodied in the present programme the procedure has necessarily been one of selection based on the principle of utilizing the funds that the Minister of Finance has available for these and other works, to the very best advantage not only of the Railway Department alone, but in the interests of the Dominion as a whole.

I have therefore endeavoured to survey the country's whole developmental programme as affecting not only the Working Railways, but also railway-construction, hydro-electricity, telephone, telegraph, and wireless extension, irrigation, roads, public buildings, &c., and have suggested in some cases small curtailments in connection with these latter activities. For instance, railway-construction, I believe, should be reduced from an approximate annual expenditure of £1,400,000—at which it has stood for the past four years—to £1,200,000, and not exceed that sum for the next seven or eight years. This sum will be sufficient to carry on at a reasonable rate of progress. The £200,000 thus made available is to be devoted to railway-improvement. Similar action has been taken in connection with the other heads of Government expenditure, and I estimate that by reducing slightly the amounts usually spent on other development-works the total borrowing in any one year will not greatly exceed—if, indeed, it will exceed—the present rate of borrowing.

Such a course of action will also have the advantage of making available for the railway-works a portion of the labour now engaged on other works, and will have the effect of avoiding any serious disturbance of the flow of labour in the Dominion.

Commenting on the proposals generally, I desire to say that even during the comparatively short period that I have had control of the Railway Department I have myself observed sufficient to enable me to fully appreciate the difficulties under which the work of the Department has been carried on owing to the inadequacy of the facilities. The management and the staff have been carrying on for some years under circumstances of great difficulty, and I am satisfied that they have done the best that was possible to give the fullest measure of satisfaction to the public. I feel bound to conclude that, apart from other considerations affecting the proposed works, it would be unreasonable to expect the General Manager and his staff to continue to operate the railways under present conditions without a reasonable hope of obtaining the facilities which will enable them to give a full measure of satisfaction. Unsatisfactory working-facilities make for discontent among the staff, and the desirability of ensuring contentment among the staff and a feeling of pride in their concern is an important factor that I have had continually in mind in dealing with the proposals.

I doubt if the public adequately appreciates the significance of the fact that the Department is endeavouring, with facilities little improved over those existing in 1914, to handle a traffic substantially greater than in the year mentioned.

When the 1914 programme of works was formulated, the facilities existing were considered to be totally inadequate, and the difficulties being experienced at the present time may be gauged by the fact that since the 1914 report, 201¾ additional miles have been opened for traffic.

In addition to this, traffic is being carried on 149¾ miles at present under the jurisdiction of the Public Works Department, which will throw an increased burden on the terminal and sub-terminal facilities, and renders increased accommodation still more necessary. Within the period of eight years over which my present proposals are spread, a further 427 miles of line will in all probability be completed and taken over by the Working Railways Department.

The above developments make the question of terminal facilities at Auckland, Wellington, and Christchurch particularly urgent. For instance, the increase in mileage actually connected with the port of Auckland since 1914 has been 137 miles; and by the year 1931 a further length of 220 miles will be added, without taking into consideration the Taranaki connection now in course of construction. Since 1914, the length of additional railway connected with the system centring upon Christchurch is 166 miles, and a further 60 miles will in all probability be added by the year 1931.

After the most mature deliberation on the proposals I do not hesitate to assure the taxpayers of the Dominion that they need have no misgivings as to the expenditure, as I am satisfied that from the point of view of return on the outlay the proposals will amply justify themselves.

WORKS AUTHORIZED UNDER THE RAILWAYS IMPROVEMENT AUTHORIZATION ACT, 1914.

	Estimated Cost of Improvements. £
New stations and station-yards, goods-sheds, and terminal facilities at Auckland, Wellington, Palmerston North, Hastings, Lyttelton, Christchurch, Addington (including a connecting-line between the Addington–Culverden line from a point about 48 chains from Addington Junction running in a south-westerly direction and the main south line at a point about 9 miles 50 chains from Lyttelton, as shown on Plan No. 21769, deposited in the Government Railway Offices at Wellington), and Timaru	1,570,000
Duplications: Penrose–Papakura, Ohinewai–Huntly, Horotiu–Frankton, Newmarket–New Lynn, and Lyttelton Tunnel	485,000
Grade-easements: Penrose–Mercer, Mercer–Frankton, Frankton - Te Kuiti, and Palmerston North – Marton	250,000
New engine-depot and approach-lines at Auckland	140,000
Additions to workshops at Newmarket and Petone	60,000
New line, Auckland to Westfield, as shown on Plan No. 21997, deposited in the Government Railway Offices, Wellington	375,000
Signalling, interlocking, and safety appliances	270,000
Bridge-strengthening	50,000
Total	£3,200,000

The intention was to complete the works in five years, but the intervention of the war rendered that impossible, and for the past ten years the Department has been carrying on its operations, entailing the handling of five million additional passengers and one million additional tons of goods per annum, with facilities that were considered to be inadequate for dealing with the traffic which was handled in 1914.

Of the works included in the above schedule it was found practicable to carry out the following:—

	Spent to 19th July, 1924. £
Auckland yard reclamation, &c.	296,668
New engine-depot, &c...	28,791
Auckland–Westfield—new line	9,671
Grade-easements, Penrose–Mercer	240,534
Grade-easements, Palmerston North – Marton	12,708
Grade-easements, Mercer – Te Kuiti	602
Duplications, Horotiu–Frankton and Newmarket – New Lynn	5,234
Wellington new yard	32,547
Hastings new yard	1,871
Christchurch new yard	5,712
Addington marshalling-yard	11,777
Lyttelton rearrangement	3,206
Workshops additions, Newmarket and Petone	35,962
Plant, steam-shovels	12,014
Hayward's improvements, automatic signalling	2,248
Signals	264,140
	£963,685

Generally, reports in connection with the works were prepared in the first place by the Engineering, Mechanical, Transportation, Tariff, Signals, and other officers of the Department respectively, and subjected to thorough examination by the General Manager before being finally concurred in and submitted to the Government. It will be seen that, quite apart from the improved working-conditions and facilities for the public, many of the works will pay interest ranging from 5 to 17 per cent. on cost.

Signal and Electrical, £710,000.

This item in the schedule is to cover the cost of automatic signalling, general signalling and interlocking, telegraph and telephone facilities, and electrification of railway workshops.

In regard to *automatic signalling:* The experience of the three-position automatic signals on the Wellington – Upper Hutt line, and the three-light automatic signals on the Christchurch – Arthur's Pass line, both in respect of efficiency and economy, has shown that the system is satisfactory, reliable, and economical. Automatic signalling is now being installed between Auckland and Mercer, and it is proposed to extend it to Marton. The cost of the scheme is £400,000, spread over five years. The annual savings are estimated to amount to £32,200, with a saving of staff of twenty-one clerks, four signalmen, and ninety-two tablet-porters. The annual cost, based on 5 per cent. on the capital, and including electric current, is estimated to amount to £25,000, leaving a net annual-recurring saving of £7,200 on the existing expenditure. The installation of automatic signalling increases the capacity of the lines for trains, which can follow each other at close intervals and still be sufficiently protected by signals. The delays that occur to trains through tablet-porters and others sleeping in will also be avoided, in addition to many other staff troubles.

General Signalling and Interlocking.—This includes signalling and interlocking of important stations and junctions, the provision of fixed signals at officered stations not already equipped, interlocking of points at flag stations, and automatic warning signals at level crossings. This will cost £100,000.

Telegraph and Telephone Facilities.—The most important work under this heading is the metallic-circuiting of all telephone-lines, and additions to telephones and telegraph facilities as required. The metallic circuit has been necessitated by the introduction of general electric-power schemes which affect telephone and telegraph circuits in the vicinity. This work is estimated to cost £65,000.

Electrification of Workshops.—This is to provide for Petone, Addington, Hillside, Invercargill, East Town, and Napier Locomotive Workshops. The electrification of these shops will effect a very considerable saving in actual running-costs, and greatly increase the efficiency and output from the machinery. The actual saving in running-costs by the conversion from steam to electric drive of the Newmarket Workshops has been nearly 150 per cent. per annum. This work will cost £70,000.

The expenditure of £710,000 will be spread over a period of five years.

Locomotive Branch, £460,000.

The expenditure includes the following:—

Newmarket Workshops, £20,000: For extension to existing shops and the provision of additional pits and roads.

Petone Workshops, £22,000: Extension of shops, offices, foundry, pits, and alterations for electrification.

East Town Workshops, £21,000: New car-shop, extension of erecting and old car-shops, increased lavatory accommodation, engine-shed for shunting-engine, fire-station, alterations for electrification.

Napier Workshops, £7,000: Extension of car-shop, new store, additional lavatory accommodation, alterations for electrification, extension of pits.

Addington Workshops, £38,300: Extension of shops, foundry, alterations for electrification, new office for Foreman, additional sidings.

Hillside Workshops, £29,000: Extension of shops, new office for Foreman, construction of pits, sidings, extension of foundry, alterations for electrification.

Invercargill Workshops, £9,500: Extension of fitting-shop, new office for Foreman, construction of pits, sidings, and alterations for electrification.

Greymouth Workshops, £5,000: Electrification of shops.

Nelson Workshops, £400: Concrete floor for paint-shop.

Westport, £500: New timber-shed.

Locomotive-depots.—Frankton, £45,000: New engine-shed to hold forty-five AB locomotives, pits and floor, alteration to yard, coal, drainage, &c. The existing Frankton depot is too small to house the locomotives at present stationed at that important depot. The bulk of the engines have therefore at the present time to stand out in the open, and the conditions under which the cleaners are working are not conducive to their health or the satisfactory performance of their duties.

Taihape, £30,000: The extension of shed to hold thirty AB locomotives. The conditions at Taihape are similar to that at Frankton. The shed accommodation is not nearly sufficient to provide for requirements, and the extension of the shed is urgently necessary.

Wanganui, £10,000: The extension of shed and provision of pits, roads, &c. Owing to shortage of shed accommodation a number of engines have to stand outside nightly.

Napier, £8,000: Extension of sheds and provision of pits, floor, roads, &c. The existing accommodation is insufficient for requirements.

Invercargill, £45,000: New engine-shed. The present depot is unsuitable and insufficient for requirements. £26,950 is required to meet expenditure to provide facilities at various smaller locomotive-depots.

Workshop equipment, £108,000; smoke-diffusing plant, machinery, and coaling-cranes, £45,000. This is to provide for the purchase of machinery for Newmarket, Petone, East Town, Napier, Addington, Hillside, Invercargill, Greymouth, Nelson, Picton, and Westport.

The works to be charged to the Locomotive Branch (£460,000) will be carried out by the Maintenance Branch, and are estimated to take five years to complete. The expenditure for equipment (£108,000) will be spread over a similar period. The bulk of the expenditure under this head would in the ordinary course be an annual charge against the Additions to Open Lines vote, which will be relieved to the extent provided in the schedule.

In regard to locomotive-depots, it may be stated that the employment of larger locomotives has rendered the provision of increased locomotive-shed accommodation a matter of necessity. The sheds built to accommodate the older type of locomotives were of limited capacity, and, except where new depots have been built of later years, the accommodation at the locomotive-depots generally is totally inadequate to meet present-day requirements.

In consequence of the insufficiency of the accommodation provided, both in respect to capacity and equipment, at many of the depots, engines have to be left standing out in the open without cover of any kind, and the staff detailed to clean and otherwise attend to the engines are placed at great disadvantage in the performance of their duties.

Modern and up-to-date coaling-cranes are required at all the large depots, and when the immediate and essential requirements have been provided for in the matter of shed accommodation and equipment, consideration will require to be given to the question of providing elevators and chutes for coaling locomotives. The provision of modern appliances of this type will involve a very considerable outlay for which no provision has been made in the schedule attached hereto.

The position in regard to the workshops is similar to that obtaining in connection with locomotive-depots. They are cramped in respect to room. The

congestion, which is almost of daily occurrence, is such as to make it impossible to obtain the same standard of results in respect to economy as would be practicable if proper accommodation and improved facilities were available. Notwithstanding the fact that a number of modern machines have been installed in the more important workshops during the last five years, much of the present equipment, being slower than modern machines, is incapable of turning out the quantity of work that could be dealt with by up-to-date machines. £108,000 is included in the schedule for the purchase of machinery, and it is essential in the interests of efficiency and economy that the expenditure be authorized in order that new machines may be installed when the workshops are being electrified.

It will be necessary in the not-distant future, owing to the limited capacity of the existing workshops and the impossibility of enlarging them to any material extent, to give serious consideration to the question of erecting a central workshop in each Island with up-to-date equipment for building new locomotives, repairing those in service, and for the construction of new cars and wagons, a portion of the present workshops being retained for carrying out repair work only. It is estimated that a saving of at least £8,000 per annum in overhead charges alone would be effected by the establishment of one central workshop in each Island, while the output of rolling-stock would be greatly increased, and the works standardized to a far greater extent than is practicable at the present time; also, a reduction in the cost of output would be assured.

Electric Lighting.

The electric lighting involves the provision of lighting at 261 stations, to cost in round figures £50,000, and 890 houses, to cost in round figures £24,000, viz.:—

	Stations.	Houses.
Auckland district	29	77
Ohakune district	12	114
Wanganui district	34	110
Wellington district	57	231
Greymouth district	5	10
Christchurch district	65	175
Dunedin district	8	41
Invercargill district	51	132

The order in which it is proposed to undertake the works is indicated by the annual allocation of the funds shown on the schedule, and the intention is as far as practicable to carry out the works in the order shown. It may, however, be found in actual practice that the supplies of labour, material, and other essential appliances for carrying out the works may render it necessary to vary the order to some slight extent to enable the best progress to be made and ensure the maximum of economy in carrying out the operations.

The arrangements made will, as far as practicable, provide for a certain number of stations and houses in each district being put in hand each year, so as to reduce to the lowest possible limit any cause for complaint, the most important stations in each district receiving first attention. The new houses erected for the staff in the various localities are wired in anticipation of electricity being available in the near future, but where supplies are available and the houses are completed connections will be made at the time.

Electrification of Railways.

As indicated in my annual Statement, Government is obtaining a comprehensive report in connection with the suggested electrification of the suburban sections at the four main centres from Messrs. Merz and McLellan, Consulting Engineers, of London.

The Government is anxious to have the best opinion available in connection with this very contentious matter, and has no intention of proceeding with any such works until the report referred to has been obtained and definite recommendations received.

Newmarket – New Lynn Duplication.

In submitting proposals with regard to this work the General Manager and Chief Engineer of Railways included details of an alternative route from Auckland new station to Morningside, crossing Beach Road by overbridge and tunnelling under the city by a tunnel 116 chains long.

The work of duplicating between Newmarket and New Lynn was estimated to cost £300,000, as against the duplicated tunnel route costing—Auckland City to Morningside, £449,000; Morningside – New Lynn duplication, £167,000: total, £616,000.

This route will reduce the distance from Auckland to Morningside by approximately one mile and a half, and the travelling-time by about fifteen minutes. The bulk of the suburban traffic to and from that direction will be much better provided for by the alternative route than by the existing train and tram facilities. One underground station would be required in the vicinity of the Town Hall.

In view of the decided advantages to be obtained and the comparative costs of the two works, the Government has decided to adopt the major scheme. So far as electrification is concerned, this section will be included in those to be reported on by Messrs. Merz and McLellan. Apart from the question of electrification, however, it is estimated the saving in working-expenses will almost pay full interest on the cost of construction.

Duplication of Lyttelton Tunnel.

Both the General Manager and Chief Engineer of Railways are of the opinion that there is at present no justification for the duplication of the Lyttelton Tunnel, and indeed that view is to a large extent justified by a close investigation of the business done over a period of years. It has been pointed out that when the 1914 proposals for duplication were made, traffic had increased progressively for some years, and the figures for the years 1913–14, on which the proposals were based, represented practically the peak of the business. From 1915 until date the Christchurch goods business has remained practically stationary. The Lyttelton traffic declined sharply for the five years 1915–20, and, although it has increased since 1920, the goods tonnage is below that handled in 1910. The alteration in the scheme for dealing with goods traffic, and the location of the marshalling-yard in the vicinity of Woolston instead of at Middleton, is the result of a close investigation made of the tonnage recently. These investigations show that the great bulk of the shipping traffic is either from or to Christchurch, and that considerable economy can be effected in operating by abandoning the projected yard at Middleton and substituting one near Woolston.

The proposal to duplicate the tunnel, however, has been the subject of very careful consideration by the Government, and the decision to proceed with the work has been arrived at after every aspect had been closely investigated. The position of the Port of Lyttelton and "the Hole in the Hill" as the gateway of the South Island has been recognized. Through this centre flows the growing inter-Island traffic and a large proportion of the overseas business of the South Island. There is, therefore, justification from a national aspect in the interests of reasonable conditions of travel, for taking a more liberal view of this undertaking than is strictly warranted by a survey of traffic volume. Apart from this, the Government had already approved the work in the schedule of the Railways Improvement Authorization Act, 1914, and considered itself more or less in duty bound to give effect to the previous proposal.

Hawera New Station.

The present location of this station has been the source of strong complaints. Hawera is an important subterminal station, and there is no doubt that the general layout and accommodation are short of requirements. The whole question, however, of improvements at this station must be contingent upon the rearranging of the system of subterminal facilities, which is at present engaging the attention of the departmental engineering and traffic officers. The use of more powerful locomotives, with a much wider sphere of operating, has so increased the length and size of trains as to render it exceedingly difficult, with the present accommodation at subterminals, to handle the larger trains. It has been the policy to arrange subterminals about every forty miles of railway, and that distance was no doubt the maximum, having regard to the coal and water requirements of the smaller locomotives and the shorter trains which they could haul, but with the class of locomotives now in use it is considered that the distance between terminal stations could be doubled, thus enabling the provision of increased accommodation without adding very materially to cost of operating. Some provision has, however, been made for improvements at Hawera, but the amount indicated in the schedule will be subject to revision in accordance with the final decision on the policy of subterminal stations.

Tawa Flat Deviation.

An essential part of the improvement in terminal facilities at Wellington is the construction of a deviation of the railway from a point about three miles beyond Ngahauranga to the vicinity of Tawa Flat, involving a tunnel 2 miles 47 chains long. This work is included in the schedule for immediate attention.

It has been recommended by the Engineer-in-Chief, Public Works Department, in a report published on page 16, and its railway operating advantages are fully described in the attached report of the Chief Engineer of Railways on proposed new works. This shows that the estimated cost is £950,000, and that the expenditure would be immediately reproductive. The saving in working costs if the deviation was in existence to-day would be £40,000 per annum, an economy which would progressively increase with development of traffic. The Tawa Flat deviation would pay interest and show a profit immediately it is constructed.

Rimutaka Deviation.

This work has been inserted by the Government, the route accepted being that recommended by the Engineer-in-Chief of the Public Works Department and included in my Public Works Statement for 1923.

An extract from the report referred to, which fully explains the Government's proposals, appears in an appendix to this paper.

The schedule of proposed new works attached hereto indicates the approximate yearly expenditure for eight years, which would be sufficient to complete the programme within that time. Provision has been made for the carrying-out of small works that may be required urgently during the period, and a miscellaneous item of £60,000 has been included in the programme to meet such cases.

By setting an objective which is within financial resources, and concentrating upon a well-defined programme, it is possible to secure the maximum of benefit from the initial works, and also to show real progress at each yearly survey of results. This principle was applied to new railways construction in 1920, and has undoubtedly resulted in more effective planning and prosecution of the most necessary works. The proposed programme, extending over a period of eight years, is as follows:—

PROPOSED NEW WORKS (EIGHT YEARS' PROGRAMME).

Work.	Total Cost.	First Year.	Second Year.	Third Year.	Fourth Year.	Fifth Year.	Sixth Year.	Seventh Year.	Eighth Year.
	£	£	£	£	£	£	£	£	£
Auckland–Westfield duplication	450,000	100,000	156,000	154,000	40,000	..	..	..	..
Auckland new yard	550,000	130,000	130,000	130,000	160,000	..	..	..	..
Paeroa rearrangement	45,000	20,000	25,000	..	..	..	..	..	..
Palmerston North deviation	390,000	100,000	100,000	95,000	95,000	..	..	..	..
Wellington new yard	1,075,000	80,000	130,000	160,000	210,000	235,000	220,000	40,000	..
Tawa Flat deviation	950,000	75,000	150,000	225,000	250,000	250,000	..	..	..
Pelichet Bay deviation	40,000	20,000	20,000	..	..	..	..	..	..
Elmer Lane depot	40,000	..	20,000	20,000	..	..	..	..	..
Electric lighting	75,000	10,000	5,000	5,000	10,000	15,000	15,000	15,000	..
Woolston marshalling-yard, Christchurch-Lyttelton works, and Lyttelton double-line tunnel	515,000	100,000	75,000	100,000	100,000	75,000	65,000	..	..
Hutt Valley Railway	100,000	30,000	45,000	25,000	..	..	..	..	..
Taihape Station	3,000	3,000	..	..	..	..	..	..	..
Hawera	20,000	..	..	..	..	..	20,000	..	..
Hikurangi	8,500	8,500	..	..	..	..	..	..	..
New Plymouth works	10,000	10,000	..	..	..	..	..	..	..
Marton Station	15,000	..	..	..	5,000	10,000	..	..	..
Huntly rearrangement	40,000	..	..	..	..	15,000	25,000	..	..
Studholme rearrangement	12,000	..	..	..	..	12,000	..	..	..
New Lynn duplication	615,000	..	..	50,000	100,000	175,000	250,000	41,000	..
Helensville rearrangement	10,000	10,000	..	..	..	..	..	..	..
Timaru rearrangement	75,000	..	..	..	..	20,000	..	30,000	25,000
Frankton additions	10,000	..	..	..	5,000	5,000	..	..	..
Penrose–Papakura doubling	80,000	25,000	5,000	..	..	..	25,000	25,000	..
Palmerston–Marton grade-easement	30,000	..	..	..	..	..	..	20,000	10,000
Ngaruawahia–Frankton doubling	40,000	..	..	..	..	..	..	20,000	20,000
Greymouth rearrangement	25,000	..	..	..	..	..	..	15,000	10,000
Wanganui rearrangement	10,000	..	..	..	..	10,000	..	..	..
Frankton–Te Kuiti grade-easement	87,000	..	..	..	..	..	17,000	35,000	35,000
Taupiri rearrangement	10,000	..	..	..	..	..	..	..	10,000
Taumarunui rearrangement	25,000	..	..	..	..	..	10,000	15,000	..
Palmerston North–Whakaronga deviation	50,000	..	..	..	..	..	..	25,000	25,000
Hastings rearrangement	50,000	..	..	..	..	..	..	25,000	25,000
Stratford rearrangement	64,000	..	..	..	..	..	..	20,000	44,000
Morrinsville rearrangement	11,000	1,000	..	..	..	..	..	..	10,000
Otorohanga rearrangement	10,000	..	..	..	..	..	..	..	10,000
Rimutaka deviation	1,000,000	..	..	..	..	125,000	275,000	300,000	300,000
Rakaia rearrangement	10,000	..	..	..	..	..	..	..	10,000
Ohinewai–Huntly duplication	40,000	..	..	..	..	..	..	..	40,000
Mercer–Frankton grading	10,000	..	..	..	..	..	..	..	10,000
Elimination of level crossings	200,000	20,000	..	..	..	20,000	50,000	50,000	60,000
Bridge-strengthening	50,000	15,000	15,000	15,000	5,000	..	..	..	..
Signals and electrical, telephones, telegraphs, and interlocking	710,000	142,000	142,000	130,000	130,000	142,000	24,000	..	..
Locomotive Branch Departments—Workshops and equipment	460,000	100,000	100,000	90,000	85,000	85,000	..	..	..
Miscellaneous	60,000	..	..	..	..	..	..	25,000	35,000
	8,081,500	999,500	1,118,000	1,199,000	1,195,000	1,194,000	996,000	701,000	679,000

REPORT OF CHIEF ENGINEER OF RAILWAYS ON NEW WORKS AND IMPROVEMENTS.

Auckland–Westfield Deviation.

Quite apart from the necessity of this work to cope with the fast-growing increase of traffic, I anticipate the construction of the new line will be an economical proposition. The new line will carry for the same power three times the present traffic. Of the present goods traffic this line will carry, say, 3,000 gross tons per day inwards, and 2,700 gross tons per day outwards; and, allowing a 50-per-cent. increase in six years, will give a total of 8,000 gross tons per day in addition to the passenger services. The saving in goods and passenger services should total, say, £22,500 per annum, which will pay approximately 5 per cent. on cost of deviation, placed at £450,000. Every increase in traffic will, of course, improve the position.

Auckland New Station and Yard.

The importance of this work cannot be over-emphasized. Up to 1914 the curve of annual increase averaged 7½ per cent.; this is equivalent to a 40-per-cent. increase in five years or 100-per-cent. increase in ten years. The present goods traffic is approximately 3,500 tons per day inward and 3,200 tons per day outward (including tare of wagons not included in diagram of analysis of traffic). It will take some years to complete the work, and, allowing only an increase of 50 per cent. in, say, six years' time, the traffic will then be 10,000 gross tons per day. The saving in terminal and shunting charges is difficult to assess, but may easily reach £15,000 under present conditions, and, furthermore, may largely exceed that figure if the traffic keeps increasing in such a manner as to make the present facilities inadequate.

The yard is designed to give all facilities in the lay-out—viz, passenger-station, local goods-yard, marshalling-yard, engine-depot. In a limited time it will no doubt be found necessary to give further accommodation. To enable this to be done the marshalling-yard will then be shifted to Hobson Bay. At a still later date it may be necessary to remove the engine-depot, but by this time I anticipate electrification will be the only economical proposition. The cost of the new yard I estimate at approximately £550,000. As a set-off against this there will be the value of the land between Queen Street and Breakwater Road, probably some £250,000. A design to give a one-level station has been prepared.

Paeroa Rearrangement.

A commencement with this work has already been made. The improvement and stop-banking of the Ohinemuri and Waihou Rivers has necessitated raising the railway-line over the Ohinemuri River and placing the station farther from the river. At the same time it is necessary to enlarge the yard, as it will be a junction station of considerable importance when the through line to Tauranga and eastwards is opened, and of still greater importance when the Pokeno–Paeroa deviation is constructed.

Palmerston North Yard.

Palmerston North station-yard is one of the most important links in the North Island railway system. From its position as the central distributing-point for traffic from the Wellington, Wairarapa, Napier, Main Trunk, New Plymouth, and Foxton lines its importance will grow commensurate with the North Island traffic. The increase in through traffic requiring facilities for marshalling and sorting wagons for the various lines, and based on the increase in the North Island traffic, may be put at 100 per cent. in 12½ years. The present yards are extremely congested, and quite inadequate for the business. On the present site improvements of any consequence cannot be made. With the proposed new yard, adequate facilities for an increasing traffic can be given, and at the same time the cost of working largely reduced. I estimate the cost at £390,000, and as a set-off there will be the value of land released at the present station-site, say £150,000. At the Palmerston North Railway Facilities Commission it was estimated at £200,000. In addition an amount of £50,000 will be required for the deviation of the Napier line from Boundary Road to Whakaronga.

Wellington New Yard and Deviation.

The work consists of—

(*a.*) *Reclamation.*—Sea-wall, £200,000; reclamation, £200,000; culverts, &c., £25,000: total, £425,000. We are already committed to this. The construction of sea-wall is in hand, and we have paid out some £25,000. The preliminary work in connection with reclamation is in hand.

(*b.*) *Station-yard.*—The amount put down for this work was originally £750,000. On going through plans and estimates I think we might reasonably reduce this to £650,000. Part of the work, such as new stores-depot, &c., is not really a charge against the new yard, and for comparative purposes might be placed against "Miscellaneous." There should be a large annual saving in working-costs by the provision of an up-to-date central yard in place of the two scattered yards at present in use. To work the present two stations costs over £80,000 per annum, and on investigation I place the saving in working in the single new yard on a conservative basis at £20,000 per annum. This capitalizes on a 5-per-cent. basis at £400,000.

(*c.*) *Tawa Flat Deviation.*—The Tawa Flat deviation is estimated to cost £950,000. The present gross tonnage hauled per day is—Outward, 4,000; inward, 3,800: total, 7,800 (in 1923). The

increase is at the rate of 5 per cent. per annum. On present costs the saving in working should amount to £40,000 per annum. For the ensuing six years the figures on same basis will be as follows:—

	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Gross daily tonnage ..	8,190	8,600	9,030	9,480	9,955	10,450	10,975
Annual saving	40,000	42,000	44,100	46,300	48,620	51,050	53,600
Interest on cost ..	..	..	..	..	5·12	5·37	5·64

Therefore work should, after paying interest, show a profit immediately on completion.

It will be seen that the construction of the new yard and outlet is economically sound; but, quite apart from this, improved access out of Wellington is an absolute necessity. The present facilities have reached their limit, and the users of the railways are penalized by the impossibility of improving the communication under present conditions.

Pelichet Bay Deviation, Dunedin.

This work includes the deviation and doubling of the line between Dunedin and Ravensbourne. By agreement dated 18th September, 1912, between the Minister of Railways and the Otago Harbour Board, the Department agreed, *inter alia*, to divert the railway to its new alignment on completion of the necessary sea-walls, reclamation, &c. The necessary formation work is now within a month or two of completion, and the deviation must therefore go on in the near future. The cost, inclusive of overhead road-bridge between Hanover and Frederick Streets, is £40,000.

Elmer Lane Locomotive-depot and Greymouth Yard.

The workshops and running-shed accommodation at Greymouth is very cramped and primitive, and to give room for the rearrangement and extension of Greymouth goods-yard it is necesary to remove the depot to another site at Elmer Lane. The cost of the work may be put at £40,000. When the locomotive-depot is shifted it will be possible to rearrange the Greymouth yard and give the needed accommodation. At the present time there is no room left for any extension whatever. The cost of rearrangement of yard will be £25,000.

Electric Lighting.

An amount of £75,000 is included in schedule to make provision for the electric lighting of station-buildings, houses, &c., in all parts of the Dominion. The expenditure will be distributed over all parts of the Dominion to enable the work to be carried out economically, the more important places being done first.

Lyttelton–Christchurch and Marshalling-yard.

Various designs were prepared in connection with the working facilities between Addington and Lyttelton: (1) Rearrangement to deal with all marshalling at Christchurch, and rearrangement of Lyttelton; (2) rearrangement to deal with passenger and local goods at Christchurch, marshalling at Addington, and rearrangement of Lyttelton; (3) rearrangement to deal with passengers at Christchurch, marshalling and local goods at Addington, and rearrangement of Lyttelton. These proposals are all costly, and do not, in my opinion, meet the requirements. An analysis of the traffic shows that if the marshalling-yard were placed between Christchurch and Lyttelton over 80 per cent. of the goods traffic would be dealt with there without any overrunning. The balance would have the extra shunt from Christchurch, but on a separate goods-line. By placing marshalling-yard at Woolston a very large saving in capital cost can be made, and also a very large saving in working-expenses. The estimate of one of original proposals may be put at £720,000. The estimate of proposal for marshalling-yard at Woolston with a rearrangement to suit at Lyttelton, and a rearrangement of Christchurch to give full accommodation for passengers and local goods, is under £250,000. The graphs show that the increase of traffic expected in 1915 has not kept up, and it may be said that with the construction of the new inward shed and siding additions reasonable demands have been met. The large expenditure involved in the rearrangement of Lyttelton and Christchurch stations in the 1914 programme does not appear justified at the present time. If the traffic increases sufficiently to justify it the duplication of the Lyttelton Tunnel can be gone on with at a future date. At present there appears to be no justification in sight for the expenditure.

Taihape Station.

An amount of £3,000 has been included to improve passenger facilities, lengthening platform, &c.

Hikurangi Station.

The layout of this station is inconvenient and dangerous, the station building being on the wrong side of the line. A design for rearrangement has been prepared. Cost will amount to £8,500.

New Plymouth Works.

The New Plymouth Harbour Board proposes to seek authority to raise a loan of £600,000 for the construction of wharves at Moturoa. The new wharves will be equipped with sheds, and business now dealt with at the railway-sheds, New Plymouth, will then be dealt with at Moturoa. The construction period will extend over six years. In the meantime, to cover this period, with its growing traffic, additional accommodation at New Plymouth will be required, principally goods-shed widening and sidings. The amount of £10,000 is to cover this. The accommodation at present is inadequate.

Marton Station.

Marton is a busy junction, and improved facilities are necessary. Approximately 60 per cent. of the goods traffic passing through is between the Main Trunk and south of Marton; 25 per cent. of the goods traffic passing through is between New Plymouth line and Main Trunk. The average traffic to and through Marton Station is as follows: For Marton, 6 per cent.; to and from Wellington – Main Trunk, 59 per cent.; to and from Wellington – New Plymouth, 12 per cent.; to and from New Plymouth – Main Trunk, 23 per cent. On a maximum day about 750 wagons are dealt with. No plans have so far been prepared, but an amount of £15,000 has been included, which should be sufficient to give the accommodation necessary.

Huntly Station.

A plan has been prepared showing the Huntly yard shifted to a site on the south side of the Awaroa Branch; cost, say, £40,000. In 1919 the Chief Traffic Manager reported that there was insufficient room for the then business; it has since been reported as being much overtaxed. Since 1919 there has been a steady increase in traffic of over 25 per cent.

Studholme Junction.

The present yard at Studholme Junction is inconvenient to work. An amount of £12,000 has been included for rearrangement.

Newmarket – New Lynn Duplication.

An amount of £300,000 is included for the duplication of the Newmarket – New Lynn line. The grades over this portion are heavy—1 in 40, with 10-chain curves on the steepest grades. There are at the present time forty-two ordinary trains, exclusive of a maximum of seven special trains, running over this track daily, and the capacity of the line has been about reached. To improve to any extent the grades, particularly over the portion between Newmarket and Morningside, is not feasible, as we are tied in at Mount Eden. The estimate provides for duplicating on a grade of 1 in 45, costs being as follows: Newmarket–Morningside, £130,000; Morningside – New Lynn, £170,000: total, £300,000.

On the locality-plan showing the railway-lines in the vicinity of Auckland I have marked an alternative route, from Auckland new station to Morningside, crossing Beach Road by overbridge, and tunnelling under the city by tunnel 116 chains long. The maximum grade through tunnel would be 1 in 100, with a stretch of 1 in 80 in the open nearing Morningside. Cost of this proposal would be—City–Morningside, £449,000; Morningside – New Lynn, £167,000: total, £616,000.

Comparative distances by present and proposed routes are: (*a*) Present route, Auckland to Morningside, 4 miles 44 chains; (*b*) proposed route, Auckland to Morningside, 3 miles 6 chains. In time, owing to the easy grades, the saving of (*b*) over (*a*) would be about fifteen minutes for all trains.

With a line in this position an underground station double-line platform only in the vicinity of the Town Hall would be required. The bulk of the suburban traffic from this direction would be much better served by the proposed route than by the trains, or trams and trains combined, as at present. If such a line were constructed it would be necessary to electrify it, and presumably if such were done the whole of the lines in the Auckland suburban area would be electrified at the same time. The matter can therefore be considered from a broad standpoint only. Apart from the question of electrification, the saving in working-expenses should almost pay interest on the cost of construction. Thus 50 trains a day saving 1½ miles each = 75 train-miles × 313 = 23,745 train-miles yearly at a little over 10s. would equal £12,000 per annum. Difference in cost is £316,000; at 4 per cent. this would equal £12,640. The question of the electrification of the Auckland suburban area is worth investigation.

From near Morningside on the city route it will in the future be possible to junction with a low-level line to Kumeu if such becomes advisable.

Helensville Rearrangement.

The layout of this station is very bad, and rearrangement is required. An amount of £10,000 has been included to cover this.

Timaru Station.

In 1914 it was proposed to make a big rearrangement of the Timaru Station. From 1905 to 1915 the local goods traffic had increased by 34 per cent. Since 1915 it has dropped again. Of the through business requiring marshalling I have no record, but, basing it on the South Island business generally, the growth is as follows: 1905 to 1915, 30 per cent. increase; 1915 to 1923, 4 per cent. increase. Passenger business is steady. The present facilities at Timaru are not sufficient for satisfactorily and economically dealing with the business. An amount of £75,000 for complete scheme is included in the schedule. Of this, a proportion, say £20,000, should be spent at an early date, the balance later when other more urgent works are completed.

Frankton Junction.

Additional siding accommodation is required at Frankton Junction. An amount of £10,000 has been included to cover this.

Penrose–Papakura Doubling.

The estimated cost of this work is £80,000. It is a necessary one in view of the growth of traffic. The numbers of time-table trains are: Between Penrose and Otahuhu, seventy; between Otahuhu and Papatoetoe, sixty-four; between Papatoetoe and Papakura, forty-eight. In addition to these there are a maximum number of twenty-one special trains per day. It may be found advisable to commence this work earlier than shown on schedule.

Grade-easements, Palmerston North–Marton.

Cost, £30,000. Daily north-bound traffic, 2,170 tons. Equivalent ruling grade, 1 in 44; proposed grade, 1 in 70. Distance between subterminals, twenty-nine miles. Load for 1-in-44 grade, 250 tons; load for 1-in-70 grade, 400 tons.

Annual cost of working on 1-in-44 grade will be

$$\frac{2170}{250} \times \frac{3\frac{1}{2}}{20} \times \frac{313}{1} \times \frac{29}{1} = £13,790,$$

and annual cost of working on 1-in-70 grade will be

$$\frac{2170}{400} \times \frac{3\frac{1}{2}}{20} \times \frac{313}{1} \times \frac{29}{1} = £8,620;$$

therefore saving = £13,790 — £8,620 = £5,170 = 17 per cent. on capital cost.

Ngaruawahia–Frankton Junction Doubling.

The capacity of the single line between Ngaruawahia and Frankton Junction has been reached, and in order to avoid the delays which are now of very frequent occurrence, and enable the movement of traffic to be carried on efficiently and satisfactorily, the duplication of line between the stations named is necessary. The expenditure would be spread over two years.

Wanganui Station.

There has been considerable controversy as to where the future Wanganui Station will eventually be placed. Until this is settled it is impossible to formulate proposals with estimates. Assuming we remain on the present site until the expansion of business necessitates a drastic change, it will be necessary to improve the conditions to tide us over this period. An amount of £10,000 has been included for this purpose.

Hutt Valley Railway.

It is anticipated that duplication of the line between Lower Hutt and Upper Hutt will be necessary within ten years. If the present line is duplicated it will not serve the great bulk of the valley; settlement will therefore be slow. The potentialities of the Hutt Valley for a large population are great, but it will be necessary to build up the traffic. With good access the population of the valley, apart from Petone, may be expected to increase from six thousand to twenty thousand in a limited number of years. The proposal included in the schedule is to construct the line as far as Te Naenae, the northern boundary of the Hutt Borough; the connection to Silverstream and the duplication to be undertaken at a later date.

Grade-easements, Frankton–Te Kuiti.

Cost, Frankton–Te Kuiti, £68,200; Te Awamutu yard, £19,000; total, £87,200. Daily traffic in both directions, 4,000 tons. Equivalent ruling grade, 1 in 50; proposed grade, 1 in 100. Distance between subterminals, forty-one miles. Load for 1-in-50 grade, 270 tons; load for 1-in-70 grade, 400 tons; load for 1-in-100 grade, 550 tons.

The annual cost of working on 1-in-50 grade will be £33,270; annual cost of working on 1-in-70 grade, £22,450; annual cost of working on 1-in-100 grade, £16,330. Taking an average between 1-in-50 and 1-in-70 grades = £26,835; the saving by improving to a 1-in-100 grade will be £27,860—£16,330 = £11,530 = 13 per cent. on capital cost.

Taupiri Station.

This station requires rearrangement. The cost may be put at £10,000. The necessity not being so pressing as some of the others, it can wait until other works are finished.

Taumarunui Rearrangement.

At Taumarunui it is proposed to shift the engine-depot from its present site to a site south of present yard, on land already acquired for the purpose. This will enable extension to be made to the general yard as required to meet the growth of business. Cost is placed at £25,000. Work not to be commenced immediately.

Hastings Station.

In 1914 the rearrangement of Hastings Station was looked upon as urgent; the growth since then has not kept pace with anticipations, and the work is not now urgent. An amount of £50,000 has been included in the schedule, but the work can well wait in the meantime.

Stratford Rearrangement.

The land available on the present site of Stratford Station is too limited to enable the yard to be extended to give the accommodation necessary with the increasing traffic from the branch line. A design for shifting the station to the south side of the Patea River has been prepared; the estimated cost of this is £64,000. When the connection is made with the Okahukura end of the branch there will be a large traffic to be dealt with at Stratford for distribution north and south. The proposal is to take the land now (value, say, £17,000), and carry out the rearrangement later as required. It is necessary to take the land now, as it is being rapidly built upon.

Morrinsville Rearrangement.

Morrinsville is a junction station on a curve, and requires rearrangement. It is proposed to shift the site farther west to enable a more satisfactory layout to be made. Land has been taken for the purpose. Cost of work, apart from land, will be £10,000. Work is not urgent.

Otorohanga Station.

An amount of £10,000 has been included for improvements to this yard. Work is not required at the present time, but it is anticipated that it may be within a few years. The probability is that this will be one of the last of the works to be undertaken.

Rakaia Station.

An amount of £10,000 is included for the rearrangement of this station to bring it up to requirements. There is not likely to be any considerable increase of business in the immediate future. The work is placed well down on the schedule.

Ohinewai–Huntly Duplication.

This work is proposed as part of the general scheme of duplication between Frankton Junction and Auckland, and is necessary to relieve congestion which now exists on the single track.

Mercer–Frankton Grading.

This is included in order to complete regrading of line to give grade of 1-in-100 between Auckland and Frankton.

Elimination of Level Crossings.

With the increasing business of the railways and the rapidly increasing number of motor-vehicles using the railway-crossings, the provision of overbridges is becoming more necessary. An amount of £200,000 has been included in the schedule to allow of an expenditure of, say, £40,000 per annum for this purpose. Diagrams attached show that accidents at level crossings are on the increase, chiefly due to motor-vehicles.

Bridge-strengthening.

An amount of £50,000 is included in the schedule to allow of bridge-strengthening in various localities to enable heavier engines to run. Much of this class of work done is charged to maintenance.

RIMUTAKA DEVIATION.

[*Extract from Report of Engineer-in-Chief of Public Works Department appearing in Public Works Statement for 1923.*]

In view of the very expensive character of what appeared to be the best route, the matter was again investigated, as it appeared that if an expenditure in the order of a million pounds was to be incurred the tunnel route previously thrown out as too expensive might bear re-examination. It was found that a tunnel could be constructed from the permanently usable portion of the main line (at Mungaroa, previously referred to) to Cross Creek, and that the length of this tunnel would not exceed 5¼ miles—it would probably be slightly less than this. Such a tunnel would be on a very easy grade, so that no electrification would be required, as is necessary on account of the very steep grades, with the slightly longer tunnel at Arthur's Pass. Such a tunnel could be constructed for a sum not exceeding £900,000, and might even be done for £800,000. This tunnel would not, of course, eliminate all the heavy grades between Upper Hutt and Featherston, but it would cut out the worst portion of the line both as regards grades and curves. It would not result in the loss of any appreciable traffic, the only station cut off being Kaitoke, the business at which is of no consequence.

The tunnel has a further advantage in that immediately it was constructed the whole of the expensive staff, material, and attendant working-expenses at Cross Creek could be eliminated. The steep grade between Upper Hutt and Mungaroa, being only 2½ miles in length, could be easily coped with, even with a great deal more traffic on the line than at present exists, by means of an assistant engine, while the steep grade from Cross Creek to Featherston could be worked as at present until such time as increasing traffic justified the flattening of the grades, which can be done at very moderate expense. In fact, such portion of the spoil from the tunnel as is not required for lining could be utilized in constructing a considerable portion of the formation of a deviation on favourable grades. The total length of what I may call the tunnel deviation would be 5 miles 48 chains, of which 5 miles 18 chains would be in tunnel. The length of the existing line which would be cut out by this deviation is approximately 14 miles, so that there would be a shortening of nearly 8 miles. The grade would be 1 in 132—in other words, so flat that it would have no influence in limiting the loads which could be carried between Wellington and the Wairarapa, or *vice versa*. There would only be two curves on it, which would be at least twice as favourable as the numerous sharp curves on the present line. The summit-level would be lower than that of any line which has yet been suggested, and would only be 500 ft. above sea-level. Such a line would enable the journey from Wellington to Masterton to be reduced by forty minutes, and the reverse journey from Masterton to Wellington by at least an hour. All the expense involved by the establishment of the Cross Creek Station would be avoided, and that station might be entirely closed. No deprivation of facilities would be suffered by Featherston or by the land to the south, now served either by the stations at Featherston or Pigeon Bush. No alterations would be required to the Woodside Station.

The distance from Wellington to Woodville by the deviation would be 108 miles, as against 114¾ at present, but from Woodville to Wellington via Palmerston North would still be considerably shorter, it being only 105 miles, and will eventually be even shorter; while the running-time, including a stop for a meal at Palmerston, is one hour and a quarter less than the present time via the Rimutaka, and less even than the shortened time which would become possible as a result of the Rimutaka deviation.

The shortening of the line is not an unmixed blessing on a system where all charges are based on the mileage over which the goods are hauled. On the basis of the present traffic over the line the loss under this head will be between £11,000 and £12,000, unless, in order to justify the making of a deviation, the Railway Department is empowered to continue to charge on the original mileage. I doubt whether such a suggestion could be put into practice on a State undertaking like the New Zealand railways.

It must be recollected that even though the loss in revenue may appear to put the railways into a position £12,000 per annum less favourable, New Zealand as a whole, of which the railway is only a part, would gain to the extent of £12,000.

With regard to the saving in working: The average cost of maintaining the line between Mungaroa and Cross Creek may be considered as slightly higher than the average for New Zealand, or £350 per mile per annum. This for 14 miles represents £4,900, while maintenance of the 5½ miles of deviation, being almost entirely in tunnel, should be very considerably below the average cost, in view of the fact that there would be no bridges or other structures, permanent or temporary, and the line would be protected against all the elements, either sun, wind, frost, or rain; there are no fences to keep up, no fire risks on wooden structures, no weeding to be done, and the track itself, having a solid rock bottom, should be more stable than the average track in the open air. As against this there is the disadvantage that men when working in a tunnel cannot be expected to be as efficient as they would be in the daylight. Still, their only work would be fettling the line, and with a solid foundation and rock ballast I think the maintenance cost may be estimated to be not greater than £200 per mile, or a clear saving of £4,000 under this heading.

Between the two ends of the deviation the present line is so tortuous that the wear-and-tear of the rolling-stock—locomotives, cars, and wagons—must be greater than would be the case on a piece of straight and almost level line. I understand, however, that the Railway Department have not figures which would enable this saving to be actually expressed in pounds, shillings, and pence. Taking figures from recognized authorities on railway location for the extra cost of maintenance due to curvature, which on the existing line is excessive, the saving under this heading is not likely to be less than £2,000.

There would be no appreciable saving in the cost of working from the traffic point of view, as regards through traffic, except that a Stationmaster and assistants would not be required at Cross Creek, which station could be closed up altogether, and all the charges in connection with the running of the present incline and amounting to £27,500 would be eliminated.

The position, therefore, with regard to the whole question is that if the tunnel line recommended as most favourable be constructed there will be an increase in interest charges of between £40,000 and £45,000 per annum, while there would be a saving to New Zealand of £45,000, made up as follows:—

	£
(1.) Abolition of all expenses in connection with the incline	27,500
(2.) Saving in maintenance of way	4,000
(3.) Saving due to eliminated curvature	2,000
(4.) Saving through lesser distance to haul	12,000
Total	£45,500

Of these items, (1), (2), and (3) would be a direct saving to the Railway Department, and although the £12,000 would be an apparent loss to them, it would be an actual saving to New Zealand. In addition to such savings as can be assessed in pounds, shillings, and pence, there is also the improvement in travelling conditions to the general public and the live-stock carried on the line, and the saving of time, which cannot be assessed in money unless one knew the value of every person's time who travelled on the railway.

The conclusions to be drawn from the above report seem to me to be that while the deviation of the Rimutaka Railway may not be a crying necessity for financial reasons, yet when funds are available to put the work in hand it can be justified, and its benefit from a social point of view cannot be controverted.

It may be argued that the tunnel proposition does not meet the whole case, because the steep grades leaving Upper Hutt and just beyond Cross Creek have not been eliminated, but I maintain that these are minor matters until the traffic becomes much heavier than it is at present; and when the tunnel is finished, which will take many years, its effects upon the general business situation and the natural growth in trade will have brought about such an increased traffic on the line that the small extra expense required for these deviations will be easily justified by the advantage gained. At any rate, there will be plenty of time to go fully into these problems before the tunnel is actually in operation.

The grades between Upper Hutt and Mungaroa can be brought to the same standard as the rest of the line with an expenditure of £78,680, and the grade between Cross Creek and Pigeon Bush can be eliminated at the cost of relaying and culverts, because the greater part of the formation will be done by distributing the spoil from the tunnel in such a way as to form a bank between the points

indicated on a grade not steeper than 1 in 60 on the straights, and compensated proportionately on curves; and when it becomes necessary to relay the line through the wearing-out of present rails and rotting of sleepers the new work can be done on the new formation without any more cost, and probably without as much as would be necessitated by the ordinary relaying operations.

In conclusion, I consider that the solution of the Rimutaka crossing by railway will be best solved by—

Firstly, driving a tunnel on the lines indicated above, and utilizing the material to form a bank (the basis of a future deviation) between Cross Creek and Pigeon Bush. (Line 1.)

Secondly, as business develops, construct a deviation between Upper Hutt and Mungaroa according to line 2.

Thirdly, when ordinary maintenance requirements necessitate it, relay the line between Cross Creek and Pigeon Bush upon the formation previously referred to as having been made from the tunnel spoil. (Line 3.)

In this connection also the following extract from Mr. E. H. Hiley's 1914 report is interesting:—

Train-working on the Wairarapa line is greatly interfered with by the heavy gradients existing between Upper Hutt and Summit, and the Rimutaka Incline between Cross Creek and Summit. The grade of the latter is 1 in 15, and the length 2 miles 79 chains. Special engines have to be employed exclusively for this portion of the line. The maximum load per engine is 60 tons dead-weight (say, about 20 tons actual traffic); frequently four engines are employed to haul a train of 240 tons, dead-weight, from Cross Creek to Summit. The minimum time for the journey is forty minutes. Every train has to be remarshalled at the Summit and similarly at Cross Creek. This involves a loss of at least fifteen minutes to a train at each station. On an average one hour twenty minutes is required to negotiate the three-mile journey up the incline. This puts a definite limit upon the amount of business from the Wairarapa which can be dealt with. The cost per engine-mile is 3s. 1d. A special track with a third rail for gripping and braking purposes has to be maintained at considerable additional expense compared with the ordinary track. The importance of this route and the productivity of the country which the existing and projected railways will serve justify consideration of the abandonment of the incline and the construction of a deviation with gradients that will enable all trains to be worked with the standard types of engines. A really satisfactory service via the Wairarapa route is impracticable while trains have to be worked over the Rimutaka Incline. A considerable expenditure will be involved in carrying out the deviation, but the work, nevertheless, will have to be considered in the near future.

TAWA FLAT DEVIATION.

Report by Engineer-in-Chief, Public Works Department.

Before the Government makes any definite decision on the question of starting the Rimutaka Deviation, I am of the opinion that this should be considered in conjunction with the question of a deviation to avoid the very steep grades existing on the present line leaving Wellington for the west coast. I refer particularly to the grade between the Esplanade and Khandallah.

Before it is possible to compare any proposed line with an existing line it is necessary to recollect that the existing line is reaching the limit of its capacity, and consequently must be double-tracked within a short time unless some deviation is made; and in fact, if a deviation is made, it will still require to be a double-track line before many years. The present traffic at Thorndon Station amounts to 1,218,000 tons outwards and 1,186,255 tons inwards per annum, and the rate of growth since 1910 indicates that the traffic has been growing at the rate of 5 per cent. per annum, and it is quite reasonable to suppose that this rate of growth will continue. Therefore, by 1928 there will be approximately 1,500,000 tons to be coped with in each direction. On the present line the average gross load of tons is 161 tons, on which basis by 1928 there would be required at least thirty trains a day each way. The position is even worse than this might indicate, because the trains, owing to traffic considerations, cannot be run at regular intervals. As long ago as 1914 the General Manager of Railways stated that the line was reaching the limit of its capacity. Naturally, the position is very much worse to-day.

I do not think it is necessary to lay any stress on the question of danger due to the heavy grades and excessive curvature, because, although a steep and crooked line is not as safe as a level and straight one, there are nevertheless many lines in New Zealand worse than the line under review, and these are not considered dangerous; but for the purposes of this report I consider that sufficient has been shown to indicate that when comparing the financial results from various lines, the costs in connection with a new line should not be compared with the present line but with a double track on the present alignment.

An examination of the grades existing on the line from Wellington north to Marton, and also via the Manawatu Gorge to beyond Woodville, shows that it would not be advisable to adopt a grade much steeper than 1 in 100, and, as this grade would be on a practically straight line, its resistance to haulage would be approximately one-third of the present grade. Therefore, as far as investigations have gone in connection with possible deviations, it has been assumed that a maximum grade of 1 in 100 would be adopted; and in fact, owing to the large amount of tunnelling required, lines have so far been located on the basis of not steeper than 1 in 120 in tunnel. The configuration of the ground is such that a great deal of difference in cost is not made by a moderate variation of the grade in either direction.

The year 1928 mentioned above was adopted because this is probably the earliest date by which the work could be completed if there is not much time lost in starting, and it is also the date when conditions on the existing line will be becoming so difficult as to be almost unworkable. On the basis of the probable traffic in 1928, it is estimated there will be a saving as the result of the grade-easement projected of £33,840 per annum. This figure is based on records of the costs per engine-mile of the locomotives now working the heavy grades out of Wellington.

I should mention that an adequate discussion of the matter assumes that within a reasonable time after the completion of the deviation now under discussion another deviation on an equal standard will be made cutting out the heavy grades over the Paekakariki Hill; and in fact it may be advisable to have both of these deviations completed about the same time. In addition to the saving in haulage as a result of grade-easement, there will be a further saving on account of the shortening which will ensue. There will be further the saving due to the elimination of the curvature, which on the present line, though not extremely sharp, is very extensive. Quite a number of lines of deviations have been considered, and these are narrowed down to Nos. 1 and 4—No. 1 being a line from a point about three miles beyond Ngahauranga to the vicinity of Tawa Flat, and on which there would be a tunnel 2 miles 47 chains long. If it were possible to carry the traffic of both the east and west coast lines over the double track already existing between Wellington and Lower Hutt as far as the point of divergence, then this line would undoubtedly be the cheaper; but the Railway Department are of the opinion that this would not be possible, and that, in addition to the deviation proper, it would be necessary to allow for a quadruplication of the line as far as the point of turn-off. This is estimated to cost £154,000.

The other line which has to be considered is one which leaves the present line some distance beyond Kaiwarra and joins up with the first-described line some two miles and a half south of Tawa Flat Station. This line contains more tunnelling than the previous one, but there are two and possibly three tunnels, and therefore there would be somewhat less trouble with smoke, and for the purposes of construction there would be more points of attack. This would be an advantage in the time necessary to complete, and probably will result in the tunnelling per unit of length being less costly, though no allowance in this direction has been made in the estimates of the summit tunnels. Both of the lines described are estimated at £940,000 to £950,000, and for all practical purposes may be taken as costing the same.

Coming now to the question of the duplication of the present line, this is estimated at £550,000; and, as foregoing considerations show that such duplication is an absolute necessity, it can be taken that the grade-easements due to the deviations referred to will involve an added expenditure of £400,000. The interest on £400,000 at 5 per cent. is £20,000 per annum, and, as the saving on one item alone, as indicated above, is over £30,000, there appears to be no doubt that the deviation should be made, and further that it should be started almost immediately. I should be glad if you would give this matter consideration and direct whether reference to the same should be made in the forthcoming Public Works Statement.

With regard to the line now existing, and on which a certain amount of traffic to serve the suburbs of Ngaio, Khandallah, and Johnsonville will be necessary, it has occurred to me that it might be possible to transfer this line, at a price to be agreed upon, to the Wellington City Council, and that they could utilize the formation for an extension of their electric-tram system as far as Johnsonville. This may be considered as giving away part of the traffic now dealt with by the Railway Department, and would no doubt require to be carefully considered.

There is another point in connection with the deviation which should not be lost sight of, and that is, with a level double line two miles shorter than the present one, all the flat country between Tawa Flat and Plimmerton would be brought within close range of Wellington, and in fact suburban passenger-trains could be run from Plimmerton to Wellington in less time than trams now take from Miramar to the same place.

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