1946.

VICTORIA.

COUNTRY ROADS BOARD.

THIRTY-THIRD ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1946.

PRESENTED TO BOTH HOUSES OF PARLIAMENT PURSUANT TO ACT No. 3662

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COUNTRY ROADS BOARD.

THIRTY-THIRD ANNUAL REPORT.

Exhibition Building,
Carlton, N.3.,
3rd December, 1946.

The Honorable P. J. Kennelly, M.L.C.,
Minister of Public Works,
Department of Public Works,
Melbourne, C.2.

SIR,

In accordance with the requirements of Section 96 of the Country Roads Act (No. 3662), the Board has the honour to submit to you, for presentation to Parliament, the report of its proceedings for the year ended 30th June, 1946.

FINANCE.

During the year the receipts from motor registration fees and fines paid into the Country Roads Board Fund amounted to £1,678,550 compared with £1,510,436 during the preceding year, an increase of £168,114. The cost of collection and refunds totalled £120,070 leaving a net revenue of £1,558,480.

Under the terms of the Federal aid roads agreement the sum of £548,934 was received as against £370,789 during the previous year, representing an increase of £178,145.

The total gross amount received from both sources was, therefore, £2,227,484 an increase of £346,259 over the total for the financial year 1944–45.

From the loan authorization of £500,000, for the construction and reconstruction of metropolitan roads, passed by Parliament under Acts 4188, 4414, and 4498, no expenditure was incurred during the year. The balance of £246,742 therefore remains at the same figure as at 30th June, 1945.

COUNTRY ROADS BOARD FUND.

At the beginning of the financial year 1945–46, Australia was still in the throes of war with Japan and although hostilities ceased in August the effects of the war continued to be felt throughout the year. The initial allocation of funds was made on the restricted basis as operated during the war, but in view of the possibility of labour becoming available, and, in order to assist in the absorption of any surplus local labour, the Board made a supplementary grant for main road maintenance and reconditioning works in February, 1946. Whilst it was thought that probably some difficulty might be experienced in having the works executed immediately, it was considered desirable to make the funds available in order that surveys might be executed and plans and specifications prepared in readiness for the works to proceed. At this time the Board was able to provide for some very important works which it had been necessary to hold over during the war years.

The total amount allocated for reconditioning and maintenance works on main roads, State highways, tourists' roads, forest roads, and Murray River bridges during the year 1945–46 was £1,486,191 as compared with £1,095,509 during the year 1944–45. The fact that of the allocation mentioned for the former year only £737,812 was expended is some indication of the difficulty in having works executed.

The credit balance shown in the Country Roads Board Fund at the 30th June, 1946, was £961,105 which will be required for deferred works and to meet commitments amounting to £124,886 in respect of contracts and direct labour works in hand at the end of the financial year.

Section 34 of the Country Roads Act No. 3662 provided for the half cost of permanent works on main roads apportioned to municipalities to be paid at the rate of 6 per cent. per annum over a period of 31½ years to cover interest and sinking fund. The Councils' contributions in respect of the Board's first year's expenditure (1913–14) is subject to reduction in the year 1945–46 by one-half, as shown by the individual redemption schedules. As the payment of Councils' contributions is now covered by relief as a charge against the Country Roads Board Fund that relief is reduced by an amount of £335 17s. 2d. in the year 1945–46, the total amount for the year being £220,704

Act No. 3944 provides that consolidated revenue shall be recouped from the Country Roads Board Fund all interest and sinking fund payments in respect of loan expenditure under the Country Roads Acts. At the date of the financial agreement with the Commonwealth (30th June, 1927) the total loan liability was netted and will not be redeemed until approximately 58 years from that date. The total amount charged to the Fund during the financial year was £519,977, of which £182,785 represents relief to municipalities of the proportion of charges originally borne by them.

Federal Aid Roads Account.

The following amounts were expended during the year from Federal aid funds :—

	£
Linking up constructed sections of developmental and main roads ..	104,882
Isolated settlers' roads	12,534
Provision towards maintenance of roads previously constructed from moneys provided by the State	78,026
Restoration and re-building of bridges	16,581
Removal of drift sand, and flood and bush fire restoration works ..	17,134
Flood damage repair	5,229
Total	£234,386

For the maintenance and repair of public roads adjoining or of approach to properties of the Commonwealth within the State of Victoria, an amount of £1,795 was made available under the terms of the Federal aid roads and works agreement, which, together with the amount of £2,791 brought forward from the previous year, made a total amount available of £4,586. The expenditure was £381 and £4,205 was carried forward to the ensuing financial year.

At the 30th June, 1946, a credit balance of £1,100,899 is shown in the Federal aid roads account, but after making provision for unexpended amounts allotted to municipalities during the year, for assistance towards the maintenance of roads and bridges, commitments on contracts entered into and works in progress by direct labour, the actual credit balance is £944,827

Defence Expenditure.

With the termination of the war, expenditure on defence works was much less than that for previous years. In accordance with the approved procedure, advances were made by the Federal Government through the State Treasury as the works progressed. The total expenditure during the war period and up to 30th June, 1946, was £6,135,537, which includes cost of works in Central Australia and Northern Territory carried out by the Board for the Commonwealth Government for a total amount of £2,454,534. The works undertaken embrace strengthening and sealing of the North-South-road (Stuart Highway), aerodrome construction, and surfacing at Tindall, Fenton and Long, Katherine, Tennant Creek, Daly Waters, Gorrie, Alice Springs, and Ooodnadatta, as well as sundry works at Alice Springs and Larrimah.

STATE HIGHWAYS.

The State-highway system now comprises a length of 2,918 miles over which maintenance works were carried out during the year, generally on a restricted basis owing to war-time conditions. However, it was considered desirable in the latter part of the year to make provision for certain urgent works, amongst which were the following:—

Princes Highway West.—Realignment and construction of approaches to new reinforced concrete bridge over Surry River at Heathmere.

Princes Highway East.—Resheeting 1½ miles east of Brodribb.

Western Highway.—Resheeting and sealing from Wallace to Bungaree, from Bungaree railway crossing to Ballan-Creswick-road, and from Leigh Creek to Brewery Tap Hotel.

Calder Highway.—Resheeting 19¼ miles between Sea Lake and Nandaly, and 9½ miles between Nandaly and Mittyack.

Murray Valley Highway.—Reconstruction of 3½ miles west of Ovens River, and resheeting 4¼ miles east of Cobram.

Midland Highway.—Resheeting and sealing near Scotsburn and Ballarat.

Henty Highway.—Resheeting between Heywood and Condah, and between Cherrypool and Wonwondah North. Construction through the townships of Speed, Tempy, and Turriff.

Loddon Valley Highway.—Resheeting and sealing 3¾ miles northerly from Campbell's forest.

Owing to limited supplies of bitumen being available for the 1945–46 spraying season, the practice established during the war was continued of confining bituminous surfacing to light types of resealing, where, after special inspection, re-treatment was deemed essential in order to preserve the asset and to save heavy costs in future. The length of resealing thus completed during the year was 202·67 miles compared with 210·8 miles during the previous year. In addition, the bituminous surfaces were restored on 8·94 miles where resheeting was carried out, consequent on failures of certain sections under specially heavy traffic as referred to later in this report.

The total expenditure on maintenance and repairs was £261,956, including the cost of improvements required to meet urgent needs; £15,323 was expended on the erection of new bridges and the restoration of dilapidated structures. Of the total, £259,342 was provided from the Country Roads Board Fund and £2,614 from Federal-aid funds.

MAIN ROADS.

An amount of £959,153 was allocated during the year for the maintenance, improvement, and reconditioning of 8,491 miles of declared roads, but, in view of difficulties experienced in having works performed, the amount expended was only £533,321 being approximately 56 per cent. of the total allocation. Provision of £863,518 was made from the Country Roads Board Fund and £95,635 from moneys available under the Federal-Aid Roads and Works Agreement.

As on State highways, so on main roads resealing was strictly confined to essential works. The length of reseals for the 12 months extended over 448 miles, whilst new seals on sections needing urgent attention were restricted to 13·6 miles. The total of the lengths dealt with is practically the same as in the previous year, the increase being only 0·7 miles.

Thirty-eight new bridge projects were initiated and three existing bridges strengthened at a total cost of £63,991, being three times the amount devoted to such works in the previous year.

In accordance with the powers conferred on the Board under the provisions of the Country Roads Act, municipal contributions towards the cost of maintenance were reduced below one-third of the total cost in the case of declared main roads carrying traffic not of local origin or timber traffic. Assistance given in this way amounted to £35,887 for the year.

Under Act No. 4415 relief to the extent of £221,040 was granted to country municipalities on account of interest and sinking fund payments in respect of main roads and developmental roads for the year.

In the latter part of the year when it was anticipated that labour would become available provision was made for some urgent works which had to be held over previously.

As foreshadowed in the Thirty-second Annual Report certain short lengths of main roads have been declared through towns where sections had been omitted when the main roads were originally declared. In all, twenty-nine sections were declared, affecting sixteen municipalities and covering a total length of 24·63 miles. Whilst the individual sections were short the action in having these lengths added to the main-road system will be of benefit both to the road users in ensuring a uniform system of maintenance and to the municipalities in the assistance granted for financing the work.

The Board has received a large number of applications for the declaration of additional main roads, but during the last few years it has not considered that a general extension of the main road system was expedient until some progress had been made in overtaking arrears of maintenance of existing main roads. The applications received have been listed and will be considered by the Board at an opportune time.

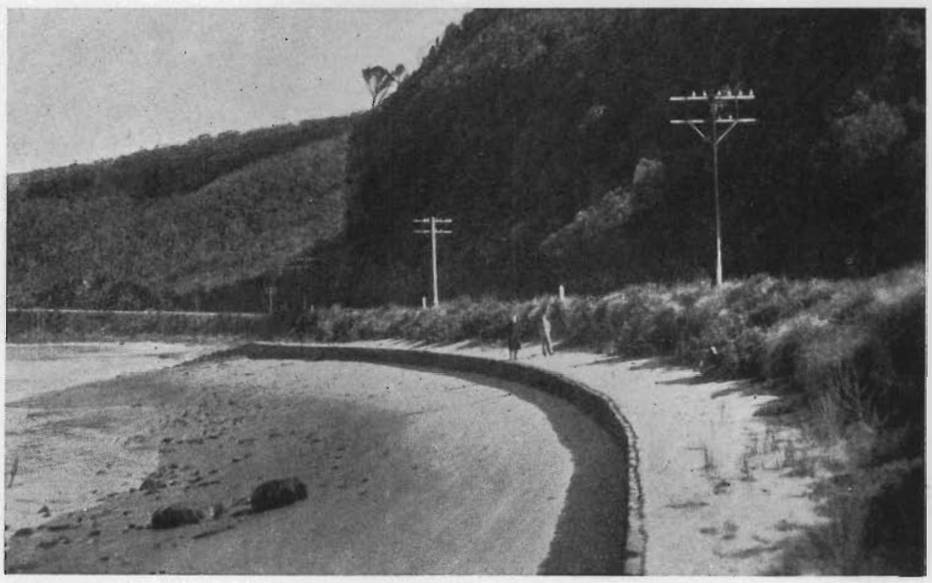
DEVELOPMENTAL ROADS.

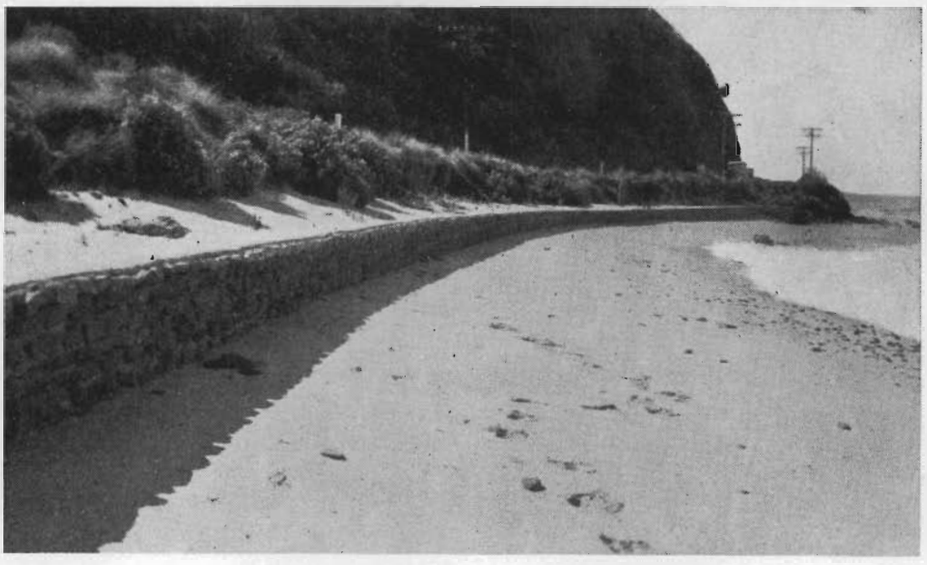
At the commencement of the financial year provision of £226,300 was made from Federal-aid funds to municipal councils for linking up sections of roads on which funds had already been expended and for completion of short lengths of constructed roads of an urgent nature. Funds were also provided for other urgent works mainly consisting of reconstruction and restoration of bridges and approaches together with commitments brought forward from the previous year. £101,616 was expended during the year, supplemented by an amount of £17,971 contributed by the councils from their own funds.

An amount of £44,919 was allocated to councils to assist in the maintenance of roads of a developmental character on which Federal-aid or other funds provided by the State had previously been expended on construction; £34,438 was expended, in addition to which municipal contributions totalled £12,750

TOURISTS' ROADS.

On the Ocean Road considerable maintenance and protective work, due to slips and erosion, had to be carried out during the year. At Cathedral Rock near Lorne erosion had taken place to within a few feet of the pavement, and the roadway was endangered. As a protection 500 feet of sea wall was constructed on bedrock 6 to 9 feet, following the irregularities of the bedrock. This work has resulted in checking the erosion during the past three years and no maintenance has been required. Plates 1 and 2 show sections of the completed work.





PLATES 1 and 2.— Sea wall constructed at Cathedral Rock, Lorne.

Plate 3 shows a section of completed wall before placing of filling. The wall is 60 feet long, with an average depth of 11 feet, involving the use of 175 cubic yards of spalls and 55 cubic yards of cement mortar.

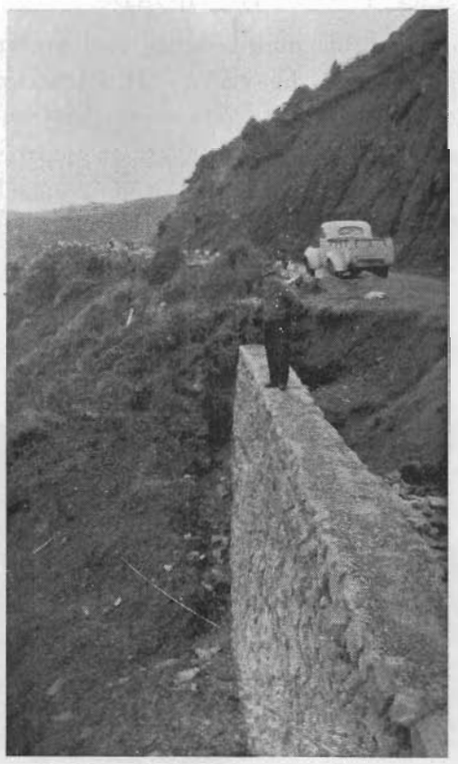


PLATE 3.—Section of completed wall before placing of filling.

Plate 4 shows a sea wall constructed at Eastern View, and a section of the coast along which the wall is to be extended.

PLATE 4.—Sea wall at Eastern View, and site for extension.

The total amount expended on tourists' roads was £51,208 provided from the Country Roads Board Fund.

BRIDGES.

During the year, apart from minor maintenance and repair, 80 bridge projects to a total value of £95,895 were initiated, bringing the total number of structures erected or in course of erection by the Board and municipal councils to 3,042.

Of the 80 new projects 18 to a total value of £40,464 were supervised by the Board and 62 to a value of £55,431 were supervised by municipalities.

Under normal conditions a number of old bridge structures, particularly timber, become due for renewal from year to year, but owing to the difficulty of undertaking work during the war the Board and municipal councils are now faced with a very heavy programme of replacements.

Plate 5 shows a completed structure.

PLATE 5.—New bridge over Erskine River on Ocean Road at Lorne.

For some years consideration has been given to the question of erecting a bridge over the Yarra River in the City of Melbourne in continuation of Swan-street and a number of conferences of interested parties have been held from time to time. In 1938, following a conference convened by the Melbourne City Council, it was decided that this should be the next bridge over the Yarra to be built, but in view of the war situation the work was not undertaken. The question was recently revived at a conference convened by the Minister of Public Works (Hon. P. J. Kennelly, M.L.C.), and as a result of further discussion the Government and the Melbourne City Council have decided that the work should now proceed at the joint cost of the State and the Council. It was also decided that the Board should be the constructing authority. The State's portion of the cost will be borne from loan money under the main road provisions of the Country Roads Act.

The proposed bridge will cross the river at a 45 degrees angle of skew. It will be a reinforced concrete " T " beam type structure of five main spans, the three centre spans being 90 feet and the two end spans 69 feet in length, a total of 408 feet between abutments. It will be supported by reinforced concrete piles of length varying from 35 feet to 77 feet which will be driven to a rock foundation. The roadway will be 40 feet in width together with two footways each 8 feet wide.

Plate 6 shows the site of the bridge. The erection of this bridge should have the effect of considerably easing the traffic position in the congested portions of the city as a result of the diversion of much heavy traffic from Flinders-street.

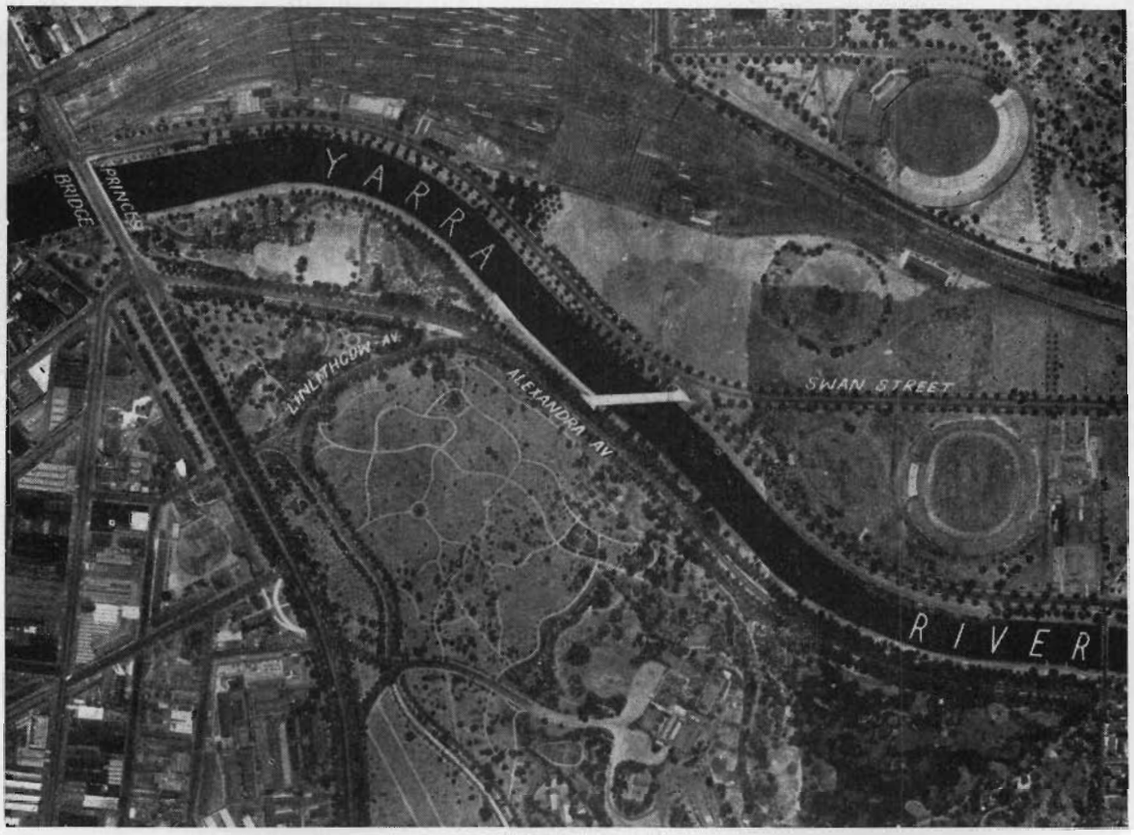


PLATE 6.—Showing site of proposed bridge over Yarra River at Swan Street.

In the last Annual Report reference was made to the Cremorne Bridge Act, which gave effect to the recommendations of the Parliamentary Public Works Committee relating to the construction of a new bridge over the River Yarra between Richmond and South Yarra, and improvement to Alexandra-avenue and Harcourt-parade adjacent thereto, the road work to be carried out by the Board.

The new road alignment under the new bridge in Alexandra-avenue eliminates the old " dog leg " bend, and provides a straight roadway from near Darling-street on the western side through to Chapel-street on the eastern side of the railway line.

Road works were commenced early in May, 1946, with a view to the new traffic-way being opened to the public on completion of the railway bridge spanning the new roadway.

Following a conference which representatives of the Preston and Heidelberg City Councils had with the Minister for Public Works, the Board was requested to investigate the question of erecting a new bridge on an improved alignment over Darebin Creek in Bell-street on the boundary of the two municipalities. The Board has been authorized to proceed with the work from funds at its disposal supplemented by contributions by both councils.

The existing crossing consists of a single-span light plate girder structure on high masonry abutments with a 40-ft. clear span. The decking is of timber with a macadam road surface. The width between kerbs is 18 feet. It is proposed to construct a new reinforced concrete bridge with a clear span of 40 feet between abutments and a total length of 80 feet; the deck system will be cantilevered over each abutment to give the extra length. The width between kerbs will be 43 feet and provision will be made for two 6-ft. footways.

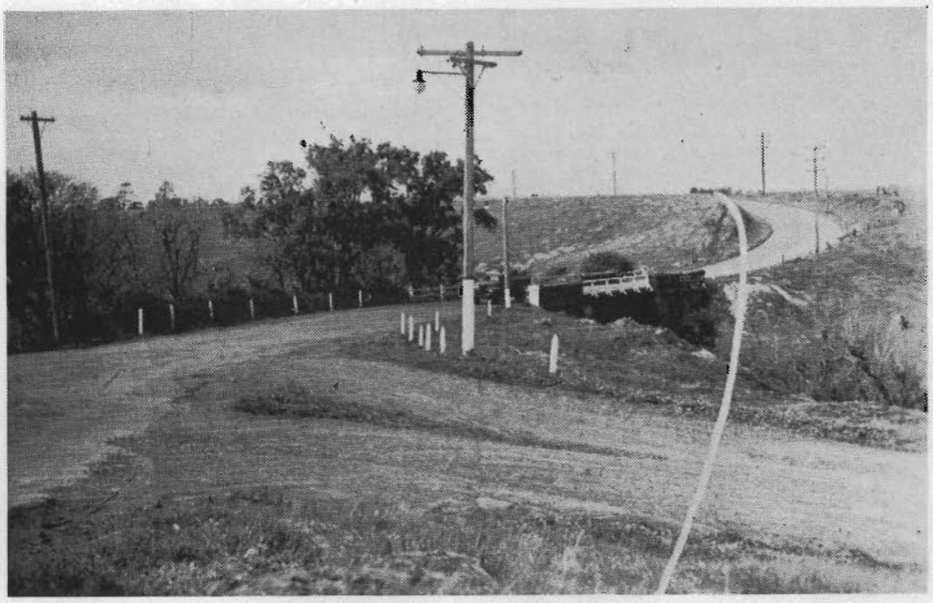


PLATE 7.—Showing bridge over Darebin Creek and proposed alignment of new structure.

Plate 7 shows the existing bridge and approximately the alignment proposed for the new structure.

Consideration has also been given to the question of renewing the bridge over Merri Creek further west in Bell-street on the boundary of the Preston and Coburg Cities, and approval has been given by the Government for this work to be carried out by the Board with funds at its disposal together with contributions by the municipalities concerned.

The existing bridge consists of a single-span structure 84 feet clear between abutments with a roadway width of 18 feet and 4 ft. 4 in. footways on each side.

The abutments and wing walls are of cut masonry and the superstructure consists of two plate girders of wrought iron 7 ft. 3 in. deep and 16 ft. 4 in. centres. On top the deck consists of 10-in. rolled steel joists with longitudinal stringers and steel troughing.

It is proposed to widen the bridge each side by extending the abutments and adding four second-hand lattice wrought iron girders obtained from the Railways Department, cut and welded to give a clear span of 80 ft. 6 in., two on each side of the existing structure. The decking will consist of a reinforced concrete deck placed on rolled steel joists. The total width of roadway will be 43 feet between kerbs together with a 6-ft. footway on each side of the bridge.

The erection of two new bridges in Bell-street will be of considerable value to traffic using this important artery.

FOREST ROADS.

(PROCLAMATIONS).

During the year the following additional roads were proclaimed forest roads under the provisions of the *Country Roads (Forest Roads and Stock Routes) Act* 1943, after inspections had been made by the Board .—

Avon and Bairnsdale Shires	Cobbannah–Lindenow Road.
Bairnsdale Shire	Bullumwaal–Tabberabbera Road.
Bannockburn Shire	Meredith–Steiglitz–Maude Road.
Huntly Shire	Epsom–Fosterville Road.
McIvor Shire	Warrowitue Road.
Omeo Shire	Brookville Road.

The total length of proclaimed forest roads is now 173·50 miles. The total amount expended on the maintenance of such roads during the financial year 1945–46 was £8,021. The cost of maintaining these roads is provided from the Country Roads Board Fund, without any contribution from the Councils.

ROADS FOR TIMBER TRANSPORT.

REEFTON SPUR (WARBURTON–WOODS POINT) ROAD.

In view of the acute housing shortage and the fact that its solution is closely associated with the production of timber, the Board has given special attention to the construction of roads necessary to facilitate extraction of timber from forest areas. One of the principal works is that at Reefton Spur near Warburton. Besides providing for the cartage of timber from forest areas along this route and from State Forests in the Big River area, to the rail head at Warburton, the Reefton Spur Road will form portion of the new road to Woods Point when the existing road is inundated by the McVeigh's dam, which is to be constructed by the Melbourne and Metropolitan Board of Works. The construction of the Reefton Spur Road was commenced in December, 1945.

Despite abnormal weather conditions, when over 22 inches of rain fell in the area during the five months' progress of the works together with falls of snow up to 6 inches deep, a bridge over the River Yarra of a total length of 120 feet was completed and the road formation was finished practically throughout its length of 13 miles. A section of six miles from the Warburton Road was surfaced with crushed rock enabling timber to be transported from the Armstrong Creek area to Warburton, and surfacing with similar material was completed over a length of four miles at then orthern end of the new road by the end of May, 1946.

Work on this road is being carried out at the cost of the Forests Commission and the Melbourne and Metropolitan Board of Works. The road has already been brought into use for cartage of logs from the Walsh's Creek catchment area.

Plates 8 and 9 show work in progress on the road and the completed bridge over the Yarra River.

PLATE 8.—Work in progress on Reefton Spur Road.

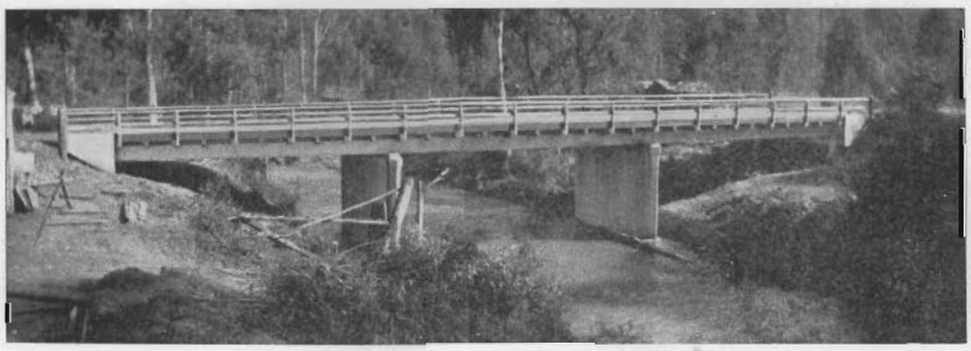


PLATE 9.—New bridge over Yarra River on Reefton Spur Road.

Benwerrin–Mt. Sabine Road.

To facilitate the transport of timber from the forest area, the Board put in hand in February, 1946, the widening of the existing developmental road over a length of 3 miles, with a view to extending the formation a further 3 miles and gravelling the full length of 6 miles, 16 feet wide. Later, it is proposed to extend the formation a further 3 miles to Mt. Cowley. Despite exceptionally wet conditions during March and April, and the necessity to use light tractors—the only ones available—the grubbing and clearing had been completed to a point ¾ mile beyond Todd's corner towards Mt. Cowley. New formation was completed to Todd's corner and one mile of formation sanded, when it was necessary to close down the work early in the winter owing to the very wet conditions encountered.

The Forests Commission is bearing the cost of the work in excess of that required for the construction of a road for ordinary developmental purposes.

Licola Road—Shire of Maffra.

Extensive work has been carried out by the Board on the main road extending north from Heyfield to Licola on which large quantities of timber will be transported from the forest areas beyond Licola. The road was constructed many years ago for carrying light traffic only from the sparsely settled area served, and, to meet the requirements of heavy timber traffic which it will be called upon to carry in the near future, considerable widening, regrading, and surfacing will be necessary, as well as the construction and repair of bridges along the route. In view of the necessity for providing a much higher standard of road than that which would be required for ordinary traffic, the Forests Commission is bearing approximately one third of the cost.

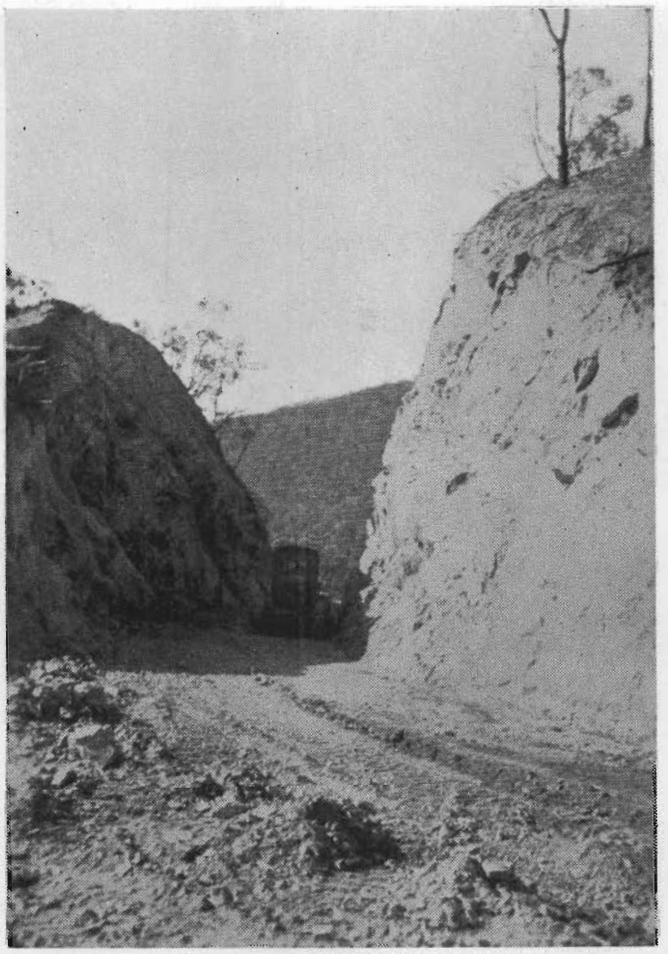


PLATE 10.—Licola Road in course of construction—50′ box cut at 25·5 miles from Heyfield.

In conjunction with the Forests Commission the Board has surveyed a route beyond Licola to serve the area from which timber is to be extracted.

FLOOD DAMAGE.

Stawell Division.

During the year considerable damage was caused in different parts of the State as a result of heavy rains and consequent flooding. Abnormal rains which fell between the 16th and 19th January, 1946, caused flooding in the streams in the Armstrong and Great Western area. The Concongella creek, which is the main waterway of the area, reached a high flood level on the 17th January, 1946, due to a heavy local rainstorm which recorded four inches in one hour. The flood in the Concongella creek was the highest for 40 years. Damage by scour was caused to two bridge structures on the Western Highway, in addition to considerable damage to roads in the Shire as a whole.

In the Stawell, Hall's Gap, and Moyston districts, very heavy rain was recorded on the 18th and 19th February, 1946, resulting in floods in Pleasant Creek, Mount William Creek, and Fyan's Creek; the recording at Hall's Gap for the period was 8 inches. Heavy flooding in Fyan's Creek caused serious scouring of banks and bed, and damage resulted to the foundation of bridges on the Grampians Road. Abnormal rains in the Grampians area during July maintained the streams in the area at high level and caused the Mount William Creek to again flood the Grampians and Pomonal Roads.

Warrnambool Division.

Following record floods in the Western district of the State in March last extensive damage was caused to roads, bridges, culverts, and fencing.

The municipalities mainly affected were the Shires of Belfast, Dundas, Glenelg, Heytesbury, Minhamite, Mount Rouse, Portland, Warrnambool, and Wannon, and the Boroughs of Port Fairy and Portland.

The most serious damage on the Princes Highway was the complete loss of the bridge 120 feet long over the Moyne River at Rosebrook and the destruction of the bluestone arch bridge over the main drain at Port Fairy. The most extensive damage on any one road was sustained by the Warrnambool Shire, which lost three major bridges, namely, Cassidy's, Woolsthorpe, and Caramut bridges between Warrnambool and Caramut, over a distance of approximately 30 miles.

The bridge over the Glenelg River at Dartmoor was completely covered by the flood waters, which reached a height of nine feet above the deck level, which is the highest recorded flood level.

The total estimated cost of restoration work on State highways, main roads, and Councils' roads towards which assistance was rendered is £108,000. Provision of £47,000 for work on State highways and main roads was made from the Country Roads Board Fund, and the balance of £61,000 from Federal-aid funds for works on other roads.

Apart from scours, loss of pavement materials, and minor damage to bridges, culverts, and embankments, 74 bridges were either completely destroyed or seriously damaged.

As soon as it was evident that serious flooding would occur the Board's organization was immediately put into operation. Arrangements were made for the despatch from Melbourne to Warrnambool of six complete spans of army bridges, each capable of spanning a gap of 80 feet and built up in lengths of 16 feet, numerous lengths of rolled steel joists, and a large assortment of bridge building gear, including power winches.

The speedy assembly and despatch of the equipment from Melbourne enabled the repair work to be carried out expeditiously—for instance, a 64-ft. span temporary army type bridge 10 feet wide was erected at Rosebrook on the Prince's Highway in a day, and re-opened communications between Warrnambool and Port Fairy. It was found that the use of the rolled steel joists about 40 to 45 feet span enabled temporary single span bridges to be erected rapidly.

Detours were provided whilst temporary bridges were in the process of erection. Generally communications were speedily restored, although some considerable time will elapse before all bridges can be replaced by permanent structures, owing to the shortage of materials and labour.

In addition to restoring road communication under the direct control of the Board, the Board's employees and staff assisted the various Shires on similar work on roads under municipal control.

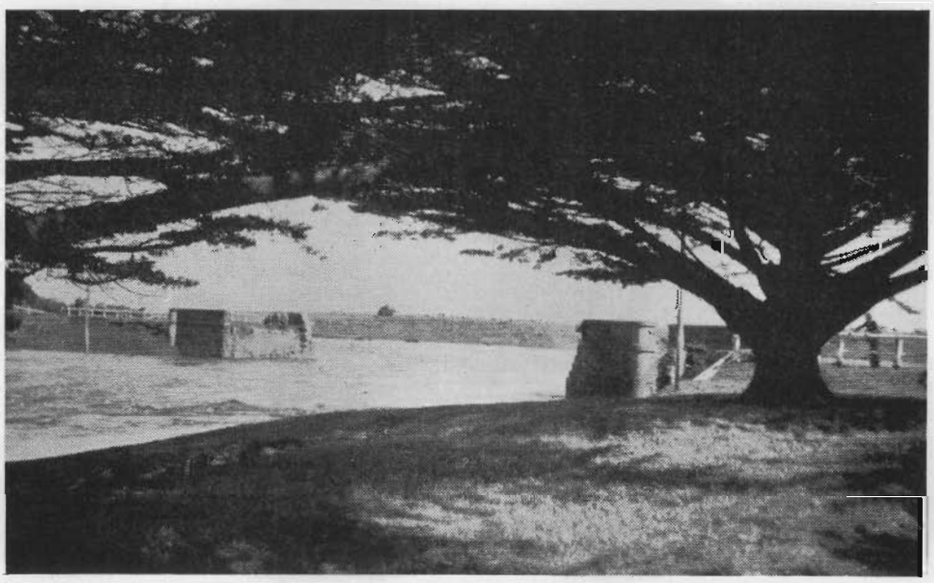


PLATE 11.— Princes Highway West—Site of Moyne River bridge at Rosebrook destroyed by flood.

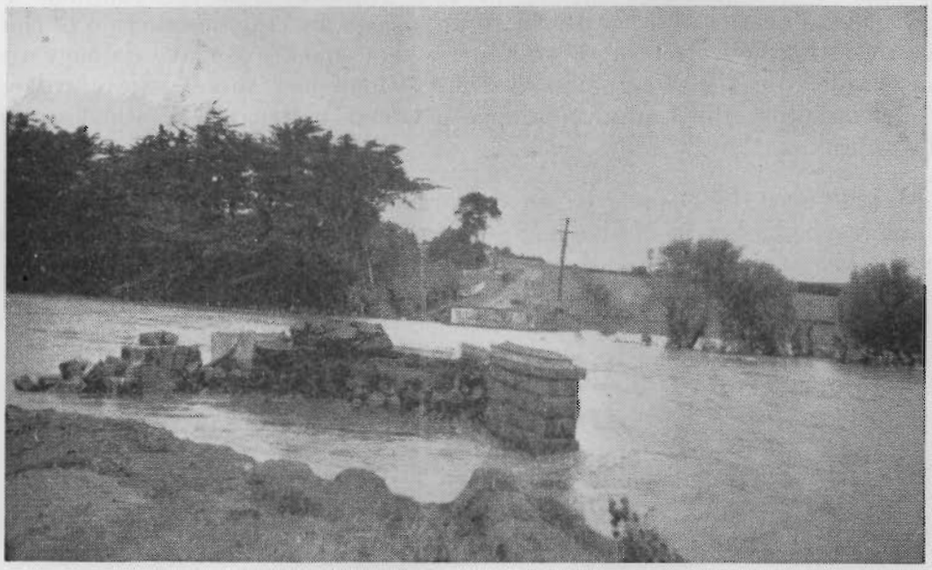


PLATE 12.—Warrnambool—Caramut Road—site of Cassidy's bridge destroyed by flood.

In the past the Board has maintained stocks of rolled steel joists, which have been used from time to time in such emergencies. Just prior to the disastrous floods of March last which occurred in the Western District of Victoria the Board had arranged to purchase eight sets of surplus Army bridging through the Disposals Commission, and when the emergency arose both the Army and the Disposals Commission co-operated to the full and made the equipment available immediately. The value of this was amply demonstrated during these floods. Gaps up to 64 feet could be bridged very quickly, and the equipment had the advantage that only three ton trucks were needed for its transport, and that all sections were in sizes which can be manhandled.

Plate 13 shows one of these bridges in position.

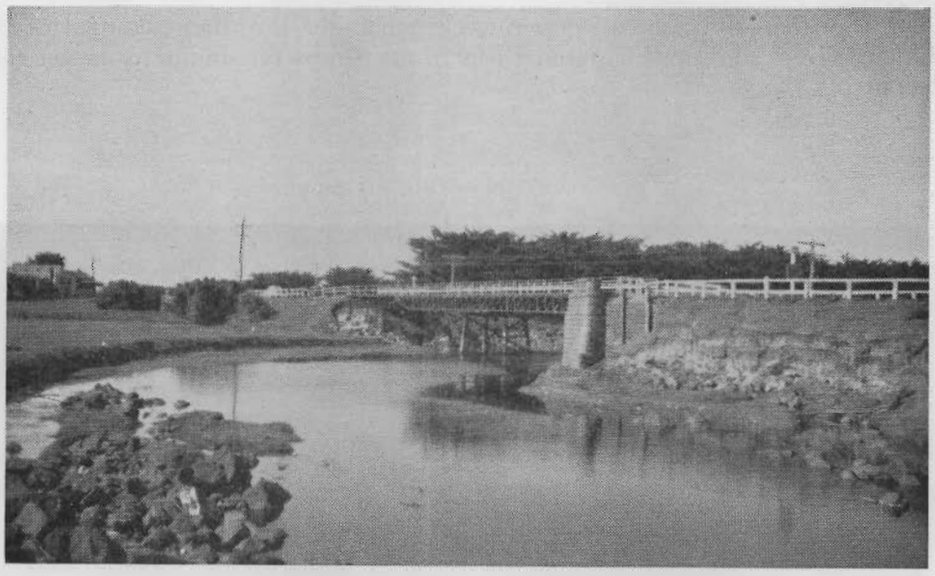


PLATE 13.—Army type bridge erected over Moyne River at Rosebrook.

Additional military bridging has since been purchased for use in cases where a span exceeding 64 feet is necessary, thus enabling gaps up to 140 feet to be rapidly bridged.

It is intended to reserve at the Board's divisional depots stocks of emergency bridging equipment, consisting of Army bridging equipment, rolled steel joists, and sawn timber.

DECENTRALIZATION.

In past reports reference has been made to the Board's proposals for extending the decentralization of its administration. During the year, in pursuance of the Government policy in this direction, as much progress as possible has been made, having regard to the conditions following the war. The acute housing position is, to a large extent, the determining factor in the development of the scheme, as it is not practicable to transfer additional officers to existing divisions or to establish new divisions until accommodation can be obtained for the staff. The only means of effectively meeting the situation is to erect dwellings for the officers, but considerable difficulty has been experienced in obtaining suitable land at reasonable prices as well as having houses erected on land already acquired.

Action has been taken for the establishment in a modified form of workshops for the repair and maintenance of plant at Bendigo ; this has been possible by adapting the existing buildings at the old abattoirs site. At these workshops and associated stores repairs to important plant and equipment are now being carried out. Additional temporary accommodation is also being provided at Benalla by the transfer of old army buildings.

Land for buildings has been purchased, or negotiations are being entered into, for the purchase of building sites at Ballarat, Bendigo, Horsham, Warrnambool, Geelong, Benalla, Bairnsdale, and Morwell.

CONTRACT AND DIRECT LABOUR WORKS.

Under normal conditions it was the Board's general policy to carry out works by contract, with the exception of ordinary maintenance. During the war years, however, difficulty was experienced in obtaining tenders, and in cases where tenders were received prices were excessive and little competition was evidenced. Contractors, however, are now bidding for work at generally satisfactory prices.

The Board has noted in a number of cases that municipal councils which have built up direct labour organizations are loth to invite tenders for works, and give as a reason the lack of contractors. It is recognized, however, that unless the field is open contractors will not be encouraged to compete.

ROADSIDE PLANTING.

For some time the Board has assisted in the carrying out of road beautification schemes, principally in the planting of trees in conjunction with municipalities and other local bodies. During the war years it was necessary to discontinue further planting, owing to labour shortage and the necessity for proceeding with works of a more urgent nature. It is hoped, however, that in the future it will be possible for more attention to be given to aesthetic aspects.

In the past the Board has been handicapped to some extent by the absence from its staff of an expert in silviculture. Approval has now been given for the appointment of a landscape officer who will be required to work in close collaboration with the engineers in tree planting schemes and measures required for the preservation of native timber and the general care and improvement of the roadside.

STAFF.

Since the termination of hostilities the officers who have been absent on service and to whom reference was made in the last annual report have now returned to duty. Some of these servicemen, however, have been granted leave of absence to continue or commence studies at the University under the Commonwealth rehabilitation scheme ; it is recognized that these officers will be much more valuable to the Board on the completion of their academic courses.

The Board views with concern the loss of a number of very valuable officers holding key positions in its service, through their accepting positions at higher salaries in Commonwealth Departments and industrial organizations. Apart from the inconvenience caused the position becomes serious at this period when the Board is faced with the necessity of putting in hand a large number of works which had to be deferred during the war years, many of which are now extremely urgent. The increasing reliance on research and engineering investigation also calls for additional professional staff, and for a high standard of qualification of technical officers.

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In a properly organized Department the positions of officers are graded according to the importance of their duties and the salaries paid are fixed accordingly. Under these conditions grave anomalies are likely to be created should action be taken to increase the salary of an individual officer if inducements are held out to him by another body. The Board feels that the only satisfactory method of dealing with such a situation is to revise the salary scale of all officers, having regard to the ruling conditions in the profession at the time. It appears essential in the national interest when important public works require to be put in hand that the organizations responsible for these works should be able to retain the services of men who have been specially trained over a long period of years. Whilst in some cases replacements of officers have been obtained, it is necessary for some time to lapse before the newly appointed officers become familiar with the special problems they are required to handle.

OFFICE ACCOMMODATION.

A matter which is giving the Board considerable concern is the lack of sufficient accommodation to enable the members of the staff to carry out their duties under satisfactory conditions. The building occupied since 1928 is of a temporary type in which lighting, ventilation, heating and the necessary amenities for the staff are much below modern standards. This is particularly the case with officers engaged on the design and drafting of engineering structures, a type of work which requires special concentration. Some degree of relief has been obtained by the utilization, as a temporary measure, of a hut in the Exhibition arena erected by the R.A.A.F. In addition, laboratory accommodation, in which research work of great importance is carried out, has been provided in what can only be classed as temporary buildings. The Board recognizes that lack of accommodation is common to many organizations at the present time, and hopes that, as soon as the building position eases, it will be possible for more commodious and suitable premises to be made available.

PHOTOGRAPHY.

Since its inception the Board has recorded the progress of its works by means of photographs, and these have proved very interesting and valuable as indicating the development which has occurred over the years. By this means it has been possible to record the progress made with the more important projects, and to illustrate features of design in progressive stages of works, particularly bridge structures. In the earlier years the only photographs available were " stills ", but recently the Board has had moving pictures taken of more important projects and later the " sound track " has been used to provide a commentary on the work.

It has not been possible to produce these pictures in large numbers, but what are already available have proved of inestimable value in illustrating to the general public the work done, and in assisting in the technical education of the Board's engineering staff. The Board has now its own expert officer who has had extensive training in the taking of the pictures, the cutting and editing of the films and their projection. Several films produced have earned high commendation on account of their technical value and excellence of production.

ROAD SIGNS AND DIRECTION BOARDS.

For some years the Board has acted in close co-operation with other State road authorities with a view to the standardization of the type and location of road signs. In 1935 the Standards Association of Australia drew up a " Road Signs Code ", but owing to the increase in traffic volume on the road systems of Australia a revision of this code became necessary. In consultation with State road authorities, railway authorities, road transport departments, police departments, automobile associations, engineering institutes, &c., the Association has now issued a revised code (No. C.E. 1–1946) which is referred to as " Australian standard rules for the design, location, erection, and use of signs for the guidance and regulation of road traffic ".

Illustrations showing colour, detailed dimensions and type of lettering, as well as position of posts and location of signs, are given in the code.

As the road authorities are able to concentrate on their normal functions following their war-time activities, it is expected that they will give special attention to the erection of signs in accordance with the revised code, with consequent benefit to road users.

Acting through the Conference of State Road Authorities the Board has obtained a supply of the code, and copies have been distributed for the guidance of municipal engineers.

TRAFFIC LINE MARKING.

The Board has continued as far as possible the line marking of roads, which has proved of great benefit to road users, particularly for the guidance of traffic at night time and in foggy weather, and appreciative references have been made by the public from time to time as to the value of this service. The dividing of the road surfaces into traffic lanes is carried out primarily with the object of making it clear what portions of the road may be used by traffic, according to the direction of travel.

Unfortunately, the scarcity of suitable paint has restricted the Board's operations in extending the system and re-marking roads which had previously been marked. Whilst white paint has been used by the Board almost exclusively in the past, it may be necessary for yellow paint to be used to some extent temporarily, until sufficient stocks of white paint become available.

The work done by the Board's machine during the last year comprised the painting and repainting of 807·56 miles of State highways and main roads, 45·02 miles on behalf of municipalities, and 4·10 miles for the Melbourne and Metropolitan Board of Works. In addition, re-spotting of 50 miles of pavements was completed by the Board's gang. The total expenditure was £7,850, of which £400 was charged to other authorities. The total quantity of paint used was 7,260 gallons, or an average of 8·47 gallons per mile. The total cost per mile, including labour, materials, and plant hire, was £9 4s. 6d.

SOIL EROSION.

The Board has closely co-operated with the Soil Conservation Board in its efforts to deal with the problem of sand drift in the north-western area of the State by the planting of rye corn on sand hills which extend into road reserves. As a constructing authority the Country Roads Board has arranged to undertake certain scour prevention work on behalf of the Soil Conservation Board, in accordance with the provisions of the Soil Conservation Act.

As indicated in the last Annual Report it was necessary to make provision for the carrying out of extensive works of sand clearing on roads where drifts had occurred, and during the year further works were put in hand, for which funds were made available by the Government, with special earth-moving plant hired by the Board from the Allied Works Council. Works were carried out in the Shires of Birchip, Karkarooc, Mildura, Swan Hill, Walpeup and Wycheproof.

The total expenditure for the year was £24,522 15s. 7d.

ROAD TRANSPORT VEHICLES.

When the Motor Car Act was consolidated in 1928 the number of commercial vehicles was small (15,000) as compared with the present number of approximately 55,000. The types of vehicles were also few, and generally were confined to the two axle and three axle rigid types, and the main provisions relating to load capacities were designed to deal with vehicles of those types, although provision was made to deal with other types by the granting of permits.

In recent years many alterations in design have been introduced, the principal alteration being in the development of the articulated vehicle, known as a semi-trailer, which, originally a three axle unit, now includes developments such as a five axle dual bogey type having eighteen pneumatic tires. Great advances have also been made in engine design, and the braking capacity has been greatly improved by hydraulic or pneumatic operated shoes of larger area on wheels having a greater contact with the road surface. A

further development was the construction of special vehicles for extremely heavy loads, having as many as 36 pneumatic tires, and being tested to carry a net load of ninety tons in safety. As the size of loads, apart from the weight, which can be carried on railways is restricted, very large units must, on occasion, be transported by road, and similarly consideration must also be given to the moving of unusually bulky loads by road.

Permits are, therefore, commonly sought either for single trips or for prolonged operations over specific routes and for vehicles and loads to exceed either the weight, width, or length limits permitted under the Motor Car Acts. In dealing with applications consideration is given to the type and condition of vehicle, the nature of construction of the roads and bridges proposed to be traversed, the availability of other means of transport, &c. A revised schedule of weights has been adopted under which permits may be issued, having regard to the type of vehicle and tire equipment. Generally, the permits are issued on the follwing basis for cartage on the more important roads :—

Maximum axle load (4 low pressure tires)	7½ tons.
,, ,, ,, (4 high pressure tires)	6½ tons.
,, ,, ,, (2 low pressure tires)	4½ tons.
,, ,, ,, (2 high pressure tires)	4 tons.

A special formula is applied to safeguard bridge structures whereby the total loads are reduced on a sliding scale with any reduction in wheelbase. Typical examples of the formula applied to three types of vehicles are shown hereunder :—

	Low Pressure Tires.
1. 3-axle 10-tired semi-trailer (with wheelbase of weight carrying axles 16 ft. or more)	15 tons.
2. 5-axle 18-tired semi-trailer (with wheelbase of weight carrying axles 16 ft. or more)	23 tons.
3. 3-axle rigid 6 wheeler (no limits on wheelbase) ..	15½ tons.

In various parts of the State extensive work of a light nature sufficient to meet the needs of normal traffic in all weathers has been carried out as stage construction only, pending strengthening of the roads when the traffic demanded it. Where necessary it is intended to construct these roads to a higher standard as soon as circumstances permit.

Meanwhile, in view of the excessive damage caused to certain roads during periods of the year it became necessary to exercise power under the Country Roads Act to stop specified classes of traffic. Whilst statutory action is taken to stop unrestricted traffic, permits are issued to cart limited loads, in accordance with the principles referred to above, but with a reduction of allowable weight. The application of this restricted schedule to the same three typical vehicles gives the following results :—

	Tires.	
	High Pressure.	*Low Pressure.*
1. 3-axle 10 pneumatic-tired semi-trailer	11½ tons ..	10½ tons
2. 5-axle 18 pneumatic-tired semi-trailer	20 tons ..	20 tons
3. 3-axle rigid 6-wheeler	13 tons ..	12 tons

BITUMEN—CONTROL AND DISTRIBUTION.

During the early part of the war the procurement and distribution of bitumen were in the hands of the normal trading companies, the price being fixed by the Prices Commissioner under the averaging conditions. In order to conserve for works of high priority the limited quantities coming forward the Commonwealth Government later promulgated the control of bitumen order under the National Security Act. The supply was arranged for and the material allocated to users by the Commonwealth Department of Supply and Shipping, and the Department of Trade and Customs, through the Division of Import Procurement, made the necessary arrangements for procurement and delivery at Australian ports. During December, 1945, the control of bitumen order was revoked, control of distribution ceased, and importation under licence through normal trade channels reverted to. In 1946, after representations to the Commonwealth by the State Road Authorities and others, price fixing under the averaging rule of the Prices Commissioner came into force.

In the latter years of the war the Board obtained its requirements as bitumen became available, but with the return to normal conditions tenders have again been invited simultaneously by all State Road Authorities. The latest tender price is approximately £18 per ton, as compared with the lowest pre-war price of £4 2s. 8d. per ton. The present high price is due mainly to increased cost of material *ex* refinery, high cost of steel containers, sea freight, and insurance. The Board considers that the price is so high that the material should be used only for necessary reseals, and any new seals, except in urgent cases, should be held over until the price is more favorable.

UNATTENDED STOCK ON HIGHWAYS.

With the object of preventing accidents on State highways due to the unauthorized grazing of stock, provision was made in the Country Roads (Impounding of Cattle) Act, which was passed by Parliament in 1935, for the impounding of any cattle found grazing unattended on State highways, and making the owner of the cattle liable to a penalty for a breach of the Act.

Inter alia, the Act provides that any officer of the Board may impound any cattle found grazing on any portion of any State highway without some person in attendance, and the owner of such cattle shall be liable to a penalty of not more than £10.

Whilst considerable improvement is evident as a result of the activities of the Board's officers, it is known that there are still many offenders, and in view of the increasing traffic on the highways it is the Board's intention to take further action to deal with the menace of unattended stock.

During the year the Board's Ranger reported 281 cases of unattended stock; legal proceedings were taken in 49 cases, and warnings were given in 232 cases, mainly because of first offences.

LIBRARY.

The scientific side of road engineering is now of the greatest importance to all authorities responsible for the use of public funds in the various phases of location, design, construction, and maintenance of roads and bridges to a standard adequate for the rapidly growing demands of commercial and passenger road traffic. In the United Kingdom and United States of America, as well as throughout the Dominions of the British Commonwealth, and in certain European States, research into all these phases is constantly proceeding, and the literature of the subjects increases year by year. The Board subscribes to respresentative technical periodicals as well as to the official journals of the principal research organizations of the United Kingdom and United States. The application of overseas research to local conditions requires also constant perusal of reports from other Australian States, New Zealand, South Africa, &c., so as to ensure that the Board's research officers and its engineering personnel are kept abreast of latest developments, enabling full advantage to be taken of resulting economies in materials and manpower. At present over 600 volumes are held in the Board's library, and the number is constantly increasing. All volumes, pamphlets, &c., have now been classified by the universal decimal system, and a convenient method adopted for reference by the Board and the engineering staff.

EMPLOYMENT ORGANIZATION.

As the Board anticipated that numbers of men would be seeking employment following their discharge from the services, arrangements were made for a special organization to be set up to ensure that applicants for employment are dealt with promptly and placed according to their qualifications and suitability.

From January to June, 1946, 756 men were interviewed and engaged, a large proportion of these being ex-servicemen. In the earlier months of the year the number of men who left their employment voluntarily was high, but recently it has been noted that men tend to remain on work for longer periods, due, no doubt, to conditions becoming more stabilized.

RESEARCH WORK.

During the year, as the base for war operations had moved further northwards, and also owing to the conclusion of hostilities, tests done on behalf of the Commonwealth declined, but even so a relatively large amount of time was occupied in tests relating to the important project of paving with cement concrete, runways at the Essendon aerodrome. A statement showing the number of laboratory tests carried out is appended.

—	Total Tests.		Tests Done for Commonwealth Authorities.	
	Samples.	Tests.	Samples.	Tests.
Soils and gravels	730	2,200	130	250
Concrete cylinders and beams	60	60	1,200	1,200
Tensile tests on steel	30	30	..	..
Bitumen	17	79	..	..
Tar	23	69	..	..
Fuel and flux oils	1	2	..	..
Paints and lacquers	52	207	..	..
Lubricants	9	45	..	..
Aggregate-bitumen mixture	3	12	..	..
Miscellaneous	13	13	..	..
Totals	938	2,717	1,330	2,450

The two mobile laboratories have been used extensively. One unit based at Essendon aerodrome has been used to control compaction in base material and to investigate consolidation and moisture contents in subgrade and base materials, both before and after construction of the concrete pavement. The other unit has been used for testing subgrade conditions, making soil surveys, and measuring existing compaction on sections of roads in advance of construction and reconstruction.

Further consideration has been given to the tentative method developed by the Board's engineers for the design of flexible pavements as outlined by the Chief Engineer in preceding reports, and preparations are being made with a view to measuring moisture contents of subgrades in place, and to endeavour to ascertain the range of variation of such moisture contents, and particularly to find if there is a seasonal variation or whether, over a long period of time, the content increases to maximum.

In view of the high cost of traffic line marking, apart from the cost of the paint, it is essential from an economic point of view for the best quality material having the maximum life to be used. Under these circumstances, special attention has been given to the development of a technique for evaluating different types of paints according to their ability to resist the combined effects of weather and traffic abrasion which are encountered in actual use. A " Taber " abrading machine has been installed for the purpose, following upon investigations which proved that whereas on unweathered panels results with this machine do not show good co-relation with field service tests, two weeks outdoor weathering before abrasion improved the co-relation, whilst 168 hours in a twin arc accelerated weathering machine before abrasion gave excellent co-relation.

The weather resisting properties of paints have been determined at the Commonwealth Munitions Supply Laboratories, Maribyrnong, where an Atlas weatherometer is installed, but it is intended to construct an accelerated weathering apparatus in the Board's laboratory.

Application of the tests to samples of paint submitted with tenders for the annual contract for the supply of such materials indicated that on the basis of overall economy acceptance of a good quality material would be justified, even if its price were considerably higher than that of poor material.

INTERSTATE ROAD CONFERENCES.

As indicated in previous Annual Reports the Board has kept in close touch with the road authorities in the other States of the Commonwealth by means of personal contacts between the authorities and their staffs and by the interchange of reports on specific subjects. The annual Conference of State Road Authorities has continued to be a valuable means by which experience in road engineering has been shared and some degree of uniformity of practice has been achieved. The eighth such conference was held at the offices of the Board in December, 1945, when many subjects of common interest were discussed. Conferences of senior technical officers and testing officers were also held with the object of co-ordinating research and familiarizing officers with details of practices adopted in other States and enabling them to submit recommendations to the main conference. When the conferences were inaugarated it was intended that they should be held in the different States in rotation in order that delegates might have an opportunity of viewing specific works in these States during their visit. By 1945 all States with the exception of Western Australia had been visited and arrangements were, therefore, made for the 1946 conference to be held in Perth.

APPORTIONMENT OF COSTS.

In accordance with the provisions of Section 28 (1) of the *Country Roads Act* 1928, the cost of maintenance was apportioned for the year ended 30th June, 1945, the amount apportioned to municipalities in respect of such expenditure being £116,234 9s. 8d.

FEDERAL AID ROADS AND WORKS AGREEMENT.

The first agreement between the Federal and State Governments dealing with the payment to the States of moneys to be devoted to road works was entered into in 1926, and continued for 11 years, expiring on the 30th June, 1937. The current agreement, commencing from the 1st July, 1937, was for a period of 10 years, and therefore expires on the 30th June, 1947.

Both agreements provided for the payments to the States to be on the basis of 3/5ths population and 2/5ths area. The percentages payable to the States on this basis are as follows :—

	%
New South Wales	28·1
Victoria	17·5
Queensland	19·1
South Australia	11·1
Western Australia	19·2
Tasmania	5·0

The current agreement provides for the distribution to the States of the proceeds of 2½d. per gallon on imported motor spirit, and 1½d. per gallon on motor spirit refined in Australia, such amounts to be available for the construction, reconstruction, maintenance, or repair of roads. In addition, it is provided that ½d. per gallon on imported motor spirit and motor spirit refined in Australia shall be available for expenditure on the construction, reconstruction, maintenance, or repair of roads or other works connected with transport as the State may think fit.

In view of the fact that the collections of revenue are highest in the more closely settled States, and the distribution is on the area/population basis, there is a considerable difference between the amounts collected in and the amounts distributed to the States. The following table shows the percentage collected in the various States during the nine years to the 30th June, 1946, as compared with those set out above for distribution during the same period :—

	%
New South Wales	33·83
Victoria	30·58
Queensland	15·28
South Australia	9·94
Western Australia	7·36
Tasmania	2·93
Northern Territory	·08

In common with other State Road Authorities the Board is concerned at the near approach of the termination of the agreement, and a conference of these authorities was held in December last when it was decided to recommend that representations should be made to the Commonwealth Government for the renewal of the agreement, and that an additional amount be made available to offset the increased cost of works. From the Board's point of view it is essential that Federal-aid funds be available to enable the planning of works for some time ahead, and for its regular programme of works to be continued.

This is now the only source from which funds can be provided for new construction works in Victoria, as the existing loan authorization is small, and is earmarked for outer metropolitan main roads. Additional assistance is also given to municipalities in maintaining main roads from the Federal-aid funds, as well as providing financial aid towards the maintenance of roads under municipal jurisdiction which have been constructed in the past with Government funds.

MOTOR REGISTRATION.

During the year 278,829 vehicles, including traction engines and motor cycles, were registered.

The number of motor vehicles of various classes registered for the past two financial years, as set out in the following statement, shows an increase of 17,104 in the figures of the financial year 1945–46.

Vehicles.	Financial Year 1944–45.		Financial Year 1945–46.		Increase.	Decrease.
Private						
New	533		1,205		672	..
Second-hand—Re-registered ..	10,773		12,417		1,644	..
Renewals	127,079		129,734		2,655	..
		138,385		143,356	..	..
Commercial—						
New	1,813		2,038		225	..
Second-hand—Re-registered ..	2,831		6,586		3,755	..
Renewals	32,543		35,376		2,833	..
		37,187		44,000	..	..
Primary Producers—						
New	437		310		..	127
Second-hand—Re-registered ..	2,501		2,924		423	
Renewals	52,014		52,747		733	..
		54,952		55,981	..	..
Hire		2,596		2,933	337	
Licensed under Omnibus Act		689		716	27	..
Trailers		8,053		8,546	493	..
Traction Engines, &c.		65		69	4	..
Motor Cycles		19,798		23,228	3,430	..
Total		261,725		278,829	17,231	127

The highest number of registrations previously effected was in 1939–40 when the total was 272,029. The total for the year 1945–46 represents an increase of 6,800 on that number.

ACCOUNTS.

Statement of accounts for the year ended 30th June, 1946, and the Country Roads Board Fund, and balances as at that date appear in the Appendix.

The following statement shows the expenditure on road construction, maintenance, &c., from moneys at the disposal of the Board in the Treasury, including expenditure under special appropriations :—

—	£ s. d.	Under Board's Supervision. £ s. d.	Under Councils' Supervision. £ s. d.	Total. £ s. d.
1. State Highways—				
Maintenance and reconditioning	.. ..	236,930 12 6	25,025 7 8	261,956 0 2
2. Main Roads—				
Construction and restoration ..	40,947 11 3	85,528 9 5	505,589 16 10	591,118 6 3
Maintenance and reconditioning	550,170 15 0			
3. Developmental Roads—				
Construction and maintenance	136,054 9 8	24,649 3 10	123,938 16 11	148,588 0 9
Roads for isolated settlers ..	12,533 11 1			
4. Tourists' Roads—				
Construction	1,263 4 3	46,551 0 3	7,235 8 9	53,786 9 0
Maintenance	52,523 4 9			
5. Forest Roads Maintenance ..	.. ..	338 19 0	7,682 0 1	8,020 19 1
6. Murray River bridges and punts—				
Maintenance	..	6,958 4 4	664 11 11	7,622 16 3
7. Roads adjoining Commonwealth properties—				
Maintenance	..	300 19 8	80 13 9	381 13 5
8. Commonwealth Defence Works (Northern Territory)	.. ..	6,757 13 4	—	6,757 13 4
9. Commonwealth Defence Works (Allied Works Council)	.. ..	14,072 0 8 (credit)	—	14,072 0 8 (credit)
Totals	..£	393,943 1 8	670,216 15 11	1,064,159 17 7

In addition to the amounts shown in the above statement an expenditure of £383,096 was incurred from the Country Roads Board Fund on works carried out by the Board on behalf of the Commonwealth Government under the National Security Regulations. The cost is recouped by the Commonwealth as the works progress. The amount outstanding on account of these works at the 30th June was £29,970.

OFFICERS AND EMPLOYEES.

Again the Board has to express its appreciation of the efficient manner in which all officers and employees loyally carried out demands made upon them under difficult conditions.

ACKNOWLEDGMENTS.

The thanks of the Board are tendered to the Honorable P. J. Kennelly, M.L.C., Minister of Public Works, for his help and interest in the Board's work.

The thanks of the Board are also due to Government Departments, State Instrumentalities, and the Road Authorities of other States for their assistance, and the co-operation of Victorian Municipal Councils and their officers is also gratefully acknowledged.

We have the honour to be,
Sir,
Your obedient servants,

W. L. DALE, Chairman.
F. CORRIGAN, Member.
D. DARWIN, Member.

R. JANSEN, Secretary.

CHIEF ENGINEER'S REPORT.

Country Roads Board,
Melbourne,
3rd December, 1946.

THE CHAIRMAN,

SIR,

I have the honour to submit the following particulars of matters of engineering interest included in the Board's work during the year 1945–46.

PLANT.

An indication of the increase in the use of mechanical equipment during and since the War is given by Table 1, which shows the numbers of certain typical machines owned by the Board in 1938 and at 30th November, 1946. Bituminous surface treatment plant is not included, as this division was fully mechanized prior to 1938, with the exception of loading equipment.

TABLE 1.

Type of Unit.	Number of Units Owned by the Board.	
	1938.	1946.
Crawler Tractors—		
Over 90 h.p. (Class 1)	Nil	17
65 h.p. to 90 h.p. (Class 2)	2	45
45 h.p. to 65 h.p. (Class 3)	2	24
Power Graders—		
Diesel, tandem drive	1	25
Diesel, single drive	9	10
Kerosene, light, single drive	20	22
Loading Equipment—		
Front End, ⅜ cub. yd.	1	19
,, ,, ½ to ⅞ cub. yd.	Nil	8
Bucket Type, crawler tracks ..	0	2
,, ,, pneumatic tired ..	1	16
Compressors—		
Two-hammer	7	20
One-hammer	6	29

The large increase is due to the increased extent of works to be undertaken, the economy attained by the use of machines, the prevailing lack of manpower, and the availability of plant imported for urgent war work or now being released by the services.

Present staff and facilities for maintenance are quite inadequate. The extension of the Central Workshop recently approved, and the establishment of Branch Workshops at Bendigo and Benalla will materially improve the position; but an efficient lay-out and organization will not be possible until the building position allows of transfer of the Central Workshop and store to a site adequate for present and future needs. Great credit is due to the mechanical engineering staff and workshop and plant employees for the volume of work carried out under difficult conditions.

BRIDGES.

GENERAL.

The rate of bridge replacement before the War did little more than keep pace with the decay of old structures and the growing needs of traffic. The practical cessation of construction during the war years has led to a lag of 600 to 800 structures in this programme of minimum renewal. The position is further aggravated by the increased loads carried on many roads, particularly in connexion with timber cartage. It emphasizes the necessity for that close attention to bridge maintenance which has been stressed in earlier reports, and will be all the more essential until staff, plant, manpower, and funds are available to make up the ground lost. Until this is done, the imposition of load limits on inadequate structures will have to be continued.

BRIDGE LOADINGS.

Multi-wheeled vehicles are now being designed which, by the use of a large number of axles, distribute the gross load over a large area of road pavement. The gross loads which can be carried on such a vehicle without damage to the pavement, however, are frequently in excess of those which can be carried safely by many existing structures or without excessive stresses even by bridges in good condition.

Difficulty in obtaining good timber will lead to the increased use of steel and concrete, with consequent longer life of structures. With increasing traffic, it is probable that the economic axle load limit will be raised before such structures will have reached the end of their useful life. Further, with decentralization of industry, it may be necessary to carry occasional very heavy loads.

In view of these factors, the question of loadings to be adopted for the design of bridges on important roads has been considered at the last two conferences of the Senior Technical Officers of the Australian State Road Authorities. Their final recommendation that the H20–S16–41 loading of the American Association of State Highway Officials should be adopted for State Highways and Main Roads has now been approved by the Conference of State Road Authorities. The Class A loading, hitherto used by the Board in designing bridges on State Highways and Main Roads, and the H20–S16–41 loading are shown in Fig. 1.

EMERGENCY BRIDGES.

Early in 1946, negotiations were proceeding with a view to buying from the Commonwealth Disposals Commission eight 84-ft. span Army Commercial Built-up Girder Bridges for use in emergencies. The advent of the severe flooding in the Western District in March, 1946, made the need for their acquisition urgent, and with the full co-operation of the Department of the Army and the Commission they were made available immediately for carriage by road to their destinations. Five of them were used to provide temporary spans of 64 feet and multiples thereof. All of these are still carrying traffic pending the building of permanent structures.

The bridges provide an easily transported quickly erected deck bridge, with a road width of 10 feet between kerbs. Table 2 gives the gross weights of vehicles which may be carried over various spans when three girders are used. Fig. 2 is a general view of one of these bridges spanning a 64-ft. gap.

TABLE 2.—ARMY COMMERCIAL BUILT-UP GIRDER BRIDGE.

Gross weight in tons of wheeled vehicles which can be carried singly over various spans in emergency. These loads must be reduced approximately 20 per cent. for continued civil use.

Span, using Three Girders.	Maximum Gross Weight of Vehicle.
ft.	tons
32	27
48	17
64	14
80	10
96	7
112	4

When the bridges now carrying traffic in the Western District are available, they will be distributed to various Divisional centres throughout the State.

WESTERN DISTRICT FLOODS.

In March, 1946, an area of 600 square miles in the Western District of Victoria was subjected to very severe floods which caused the complete loss of 26 bridges, and considerably damaged a further 48, in addition to damage to roads. The estimated cost of effecting temporary and permanent repairs in eleven municipalities amounts to £108,000. The very high floods resulted from saturation of the soil by moderate rains followed by extremely severe falls on the 17th and 18th March, reaching 11 inches in 72 hours in certain localities. Immediate steps were taken to provide emergency replacement of affected structures, the types most commonly used for this purpose being R.S.J. and the Army type of bridging equipment shown in Fig. 2.

At the same time a survey party was despatched to the area to collect data on flood levels, &c., from which the discharges which actually occurred at the various bridge and culvert sites could be calculated. Comparison between actual discharges at a number of more important bridges and the theoretical discharge calculated by the "rational formula" used by the Board is given in Table 3. It will be seen from this that the results are consistent with actual discharges. The information obtained will be used for the design of new structures to replace those destroyed, bearing in mind the value of floodways which will provide relief naturally where economic considerations do not justify a structure and approaches above the level of all floods.

TABLE 3.—TABULATION OF FLOOD DATA.

Road.	River and Bridge.	Catchment Area.	Computed maximum velocity in ft./sec. at Site.	Discharge as determined from observations of floods.	Computed discharges from C.R.B. Formula Q = C.I.A.
1. Princes Highway West, Sec. 3	Main Drain, Port Fairy ..	3 sq. mls. .. (1,920 acres)	13·0	1,040 c.ft./sec.	1,080 c.ft./sec.
2. Henty Highway, Sec. 2 ..	Saw Pit Creek	10 sq. mls. .. (6,400 acres)	13·5	1,580 c.ft./sec.	1,790 c.ft./sec.
3. Warrnambool–Caramut Road ..	Muston's Creek at Caramut	71·5 sq. mls. (46,000 acres)	15·8	10,000 c.ft./sec.	8,200 c.ft./sec.
4. Warrnambool–Caramut Road ..	Spring Creek at Woolsthorpe	188 sq. mls. .. (120,000 acres)	15·5	13,300 c.ft./sec. * Bridge upstream	15,000 c.ft./sec.
5. Princes Highway West, Sec. 3	Moyne River at Rosebrook	233 sq. mls. .. (149,000 acres)	11·0	20,500 c.ft./sec. * Bridge upstream	24,800 c.ft./sec.
6. Warrnambool–Caramut Road ..	Merri River at Cassidy's Bridge	326 sq. mls. .. (207,000 acres)	8·5	37,000 c.ft./sec.	38,500 c.ft./sec.

* Bridges upstream affected the observed flood discharges.

In the formula Q = C.I.A.

Q = Discharge in cusecs;

A = Area of catchment in acres;

C = Co-efficient of run-off;

I = Estimated rainfall intensity in inches per hour over a period equal to the time taken for water from the remotest part of the catchment to arrive at the bridge or culvert site.

For the country under consideration in the Western District, a value of C = 0·35 was used.

Although some fine old masonry arches were destroyed, mainly owing to scour of abutments, the majority of the bridges lost were near the end of their useful life. Observation of the damage indicates the importance of the following points in designing replacements and in providing protective work at existing structures:—

1. It is important that waterways should provide for non-scourable velocities at the highest known flood discharges.
2. Protection of approach banks by planting of special grasses.
3. It is considered that full width sealing of 50 feet of the approach bank at each end of a bridge would be very valuable, and if sealing is not possible, full width gravelling.
4. It is important to see that rabbit, or other, holes do not develop in the banks adjacent to bridge abutments. The same can be said to apply to embankments over gullies where pipe culverts are used.

5. After settlement of pipes in a pipe culvert has occurred, it is very advisable that all joints should be grouted and maintained in that condition.

6. The great safety factor afforded by a floodway at one or both ends of a bridge.

7. Particularly in culverts, the line of waterway provided should be carefully sited to provide good hydraulic entrance.

It is desired to express appreciation of the splendid work done in this emergency by the Board's and Councils' officers and employees.

BITUMINOUS SURFACING.

General.

The supply of mineral aggregate being the controlling factor, the wartime procedure of carrying out minimum maintenance by means of retreatments of a light nature was continued. Table 4 shows the predominance of the medium reseal with the binder applied at 0·15 gallon per square yard. Even with the light work adopted, 162 miles of retreatment approved by the Board had to be carried forward to 1946–47 owing to inability to obtain the necessary covering material in time. The supply of mineral aggregate fell short of that required by some 15,000 cubic yards.

The following detailed information is given to complete the record of this type of work up to the first year after the war.

Total Length of Treated Surface.

The total length of "black" surface in the Board's system at 30th June, 1945, and 30th June, 1946, was :—

—	30th June, 1945.	30th June, 1946.
	miles	miles
State Highways	1,890	1,896
Main Roads	3,675	3,680
Tourists' and Forest Roads	93	93
Totals	5,658	5,669

Work Carried Out.

Table 4 shows the total mileage of work carried out by the Board during the year on its own roads. In addition, 124,129 square yards of surfacing was executed for the Commonwealth of Australia, and 8·3 miles of road retreated for municipalities.

Table 4.—Mileage of Work Carried Out under the Board's Control.

Type of Road, &c.		Length in Miles.							
		Nature of the Work.						State Highways.	Other Roads.
		Initial Treatments. Prime and Seal.	Retreatments.						
			Reseals in gallons per square yard.						
Roads.	Control.		0·1.	0·15.	0·2.	0·25.	0·3.		
State Highways ..	C.R.B.	8·9	12·5	146·3	37·4	6·7	..	211·8	..
Other Roads ..	C.R.B.	13·4	5·7	306·9	105·4	11·4	0·9	..	443·7
Other Roads ..	Municipalities ..	0·2	2·9	..	14·8	..	..	..	17·9
Totals ..	.. .. ..	22·5	21·1	453·2	157·6	18·1	0·9	211·8	461·6
,, ..	.. .. ..	22·5			650·9			673·4	

Cost of Work.

In Table 5 is set out the average cost in pence per square yard of the work carried out during 1945–46. Table 6 sets out the average cost of resealing with 0·15 gallon of binder per square yard since 1940. From this table it would appear that the peak cost was reached during season 1943–44, and that the 1945–46 cost for this type of work was 60 per cent. greater than the same work during 1940–41.

Table 5.—Average Cost in Pence per Square Yard of the Work carried out in 1945–46.

Sub-division.	Nature of the Work.				
	Initial Treatments.	Retreatments (Reseals).			
	Prime and Seal. Primer, 0·2; Binder, 0·25.	Nominal Rate of Application of Binder in Gallon per Square Yard.			
		0·10.	0·15.	0·20.	0·25.
Sq. yards costed	216,812	171,251.	4,139,641	1,357,881	155,672
Materials ..	10·50	3·65	5·40	7·19	10·33
Labour ..	2·62	0·71	1·07	1·28	0·92
Stores ..	0·39	0·12	0·18	0·23	0·23
Plant hire ..	2·29	0·63	0·94	1·14	0·98
Totals ..	15·80	5·11	7·59	9·84	12·46

Table 6.—Average Cost of Retreatment by Resealing (Medium Reseals, Binder 0·15 Gallon per Square Yard) for the Years 1940–41 to 1945–46 inclusive.

Year.	Average Cost in Pence per Square Yard.						
	Materials.			Other Charges.			Total Cost.
	Aggregate.	Binder.	Total.	Labour.	Stores.	Plant Hire.	
1940–41 ..	1·51	2·10	3·61	0·62	0·09	0·44	4·76
1941–42 ..	1·77	2·65	4·42	0·90	0·13	0·61	6·06
1942–43 ..	1·89	3·35	5·24	1·19	0·17	0·90	7·50
1943–44 ..	2·01	3·79	5·80	1·22	0·21	0·93	8·16
1944–45 ..	2·13	3·17	5·30	0·94	0·20	0·92	7·36
1945–46 ..	2·28	3·12	5·40	1·07	0·18	0·94	7·59

Bitumen.

The supply of bitumen was not the controlling factor in the amount of work which it was possible to carry out during the year. Table 6 shows that the cost of binder delivered on to the work during the year was approximately 50 per cent. above that for 1940–41. Table 7 shows the average cost of bitumen per ton net over a number of years. The prices are still very high. The principal causes of the very high price at present are, high price of raw material at the refinery, shortage and high price of packages, high sea freight, and insurance and the restriction of the sources of supply to those within the Sterling or Sterling bloc areas.

TABLE 7.—BITUMEN COST PER TON NET.

Year.	Delivery.	Per ton net.
		£ s. d.
1940–41	F.O.W. ..	12 7 0
1941–42	F.O.W. ..	17 9 0
1942–43	F.O.W. ..	22 9 0
1943–44	Average, ex store	21 15 0
1944–45	Average, ex store	16 10 0
1945–46	Average, ex store	14 19 0

MINERAL AGGREGATE.

Table 8 sets out the average cost of mineral aggregate delivered on to the work since 1940–41. During the year the total quantity of aggregate obtained was 59,705 cubic yards, which fell short of the demand by some 15,000 cubic yards. The Board's pre-war average annual demand was in order of 120,000 cubic yards. From Table 8 it will be seen that the average cost throughout the State for the year was 22s. 2d. per cubic yard. Of the total material obtained 3·4 per cent. was sand, at an average cost of 12s. 5d. per cubic yard; 9·6 per cent. was scoria at 9s. 3d. per cubic yard; 9·3 per cent. crushed and screened or screened gravel at 21s. 3d. per cubic yard; the balance 77·7 per cent. screenings at an average cost of 24s. 3d. per cubic yard. As in the case of the binder the aggregate cost per square yard in 1945–46 was approximately 50 per cent. above that for 1940–41.

TABLE 8.—MINERAL AGGREGATE.

Year.	Delivery.	Average Price per Cubic Yard, All Materials, Whole State.
		s. d.
1940–41	Stacked by the roadside	13 9
1941–42		15 2
1942–43		16 7
1943–44		18 7
1944–45		18 7
1945–46		22 2

RETREATMENTS BY RESEALING.

In Table 9 is set out the rates of application of binder and aggregate used during the year for bituminous retreatment by the process of simple resealing.

TABLE 9.—RETREATMENTS BY RESEALING—RATES OF APPLICATION OF BINDER AND AGGREGATE.

Rates are those at which the aggregate was applied.

Work. Retreatment by Resealing. Binder—Gallon per sq. yd.	Aggregate. Nature and Type. Material.	Nature.	Order of Preference.	Grading. Graded. C.R.B. No.	One-Sized. Nom. Size.	One-Sized. Max. Size.	Rate of Application. Square Yards covered by One Cubic Yard on a Surface which is— Weak (Very Open).	Hungry (Coarse).	Smooth (Matte).	Black (Slick).
0·10 (Light) ..	Scoria ..	Screened	3	..	..	¾″	150	140	130	120
	Sand ..	Washed and or screened	3	11	..	..	220	200	180	160
	Gravel or Screenings	Graded	2	9	..	..	170	160	150	140
		One-sized	1	..	¼″ (I)	⅜″	170	160	150	140
0·15 (Medium) ..	Scoria ..	Screened	4	..	..	¾″	95	90	85	80
	Sand ..	Washed and/or screened	4	11	..	..	180	160	140	120
	Gravel or Screenings	Graded	3	9	..	..	160	140	120	110
		Graded	2	3C	..	..	150	140	120	110
		One-sized	1	..	⅜″ (H)	½″	130	120	110	100
0·20 (Heavy) ..	Scoria ..	Screened	4	..	..	¾″	75	70	65	60
	Gravel or Screenings	Graded	3	3A	..	..	90	85	80	75
		Graded	2	2	..	..	70‡	70†	70	65
		One-sized	1	..	½″ (G)	¾″	70‡	70†	70	65
0·25 (Very Heavy)	Scoria .	Screened	4	..	..	¾″	65	60	55	50
	Gravel or Screenings	Graded	3	3A	..	..	80	75	70	65
		Graded	2	2	..	..	70	70†	65	60
		One-sized	1	..	¾″ (E)	1″	*	§	§	§

NOTES.—* Material of this grading not to be used on such surfaces.
† Binder 0·225 gallons per square yard.
‡ Binder 0·25 gallon per square yard.
§ Rates of Application of Binder and Aggregate adjusted as required by Average Least Dimension of Aggregate and condition of the surface.

Experimental Work.

Experimental sections laid on the Main Healesville Road, in the Shire of Lillydale, on the Midland Highway North, between Shepparton and Benalla, and on the Western Highway between Ballarat and Lake Burrumbeet, were described in the Chief Engineer's report for the year ending 30th June, 1939. A further experimental section, to ascertain the behaviour of the most successful of the methods used in the previous tests under the wet conditions experienced in the Western District, was laid on the Prince's Highway West at Garvoc in 1941–42. The results of this work can be summarized as under :—

(*a*) The process of roadmix sealing appears to have been developed as far as possible.

(*b*) Segregation is inevitable with any system of mixing which depends on the use of a low viscosity binder and the flow of material through a road mixing machine of a size which does not need a heavy crawler tractor to pull it.

(*c*) Plantmix sealing should be adopted instead of roadmix sealing, wherever possible.

(*d*) The minimum thickness of roadmix seals laid in one application should be about $\frac{5}{8}$ in. loose—say 1 cubic yard to 60 square yards.

(*e*) For roadmix seals at 1 cubic yard to 60 square yards—

(i) The aggregate should be a graded material all passing $\frac{1}{2}$ in. with a range of sizes 7/16 in. to No. 7. As the percentage of material passing 3/16 in. is critical, the tolerance on sizing should be $\frac{1}{2}$ in., 100 per cent. ; $\frac{3}{8}$ in., 70–90 per cent. ; $\frac{1}{4}$ in., 25–55 per cent. ; 3/16 in., 15–25 per cent ; No. 14, 0–1 per cent.

(ii) The rate of application of a medium curing cutback should be—tack coat, 0·1 gallon per square yard ; binder for mixing 0·15 gallon per square yard ; binder for the surface enrichment seal coat, 0·1 gallon per square yard.

Plant Operation.

Table 10 summarizes the conditions under which the Board's plant has operated since 1941–42. In Table 11 is given a summary of the analyses of the detailed operation of all the Board's bituminous surfacing units for the year.

Table 10.—Number and Length of Jobs, etc.

All Sprayers.	Season.				
	1941–42.	1942–43.	1943–44.	1944–45.	1945–46.
Number of jobs ..	388	161	243	360	380
Longest job .. mls.	12·2	9·75	12·50	14·09	14·35
Shortest job .. mls.	0·02	0·09	0·03	0·05	0·04
Average job .. mls.	1·50	1·67	1·87	1·80	1·74
Total number of spraying dumps	157	75	115	110	102
Miles of work done from each dump (average)	3·7	3·4	4·0	5·9	6·4

Table 11.—Analysis of the Operation of the Board's Bituminous Surfacing Units.

Percentage of the Total Time Spent—	Average for all Units.
Spraying	30·1
Moving	14·2
Weather	20·5
Holidays	8·3
Mechanical delays	3·0
Other delays	23·9
Total	100·0
Details of the other delays—	
Poor organization	4·8
Long leads	5·5
Short sections	8·5
Special conditions	1·4
Road not ready	1·6
No aggregate	1·9
No bituminous materials	0·1
Insufficient labour	0·1
Total	23·9

Basis :—A daily output of ten loads.

Annual Expenditure on Extending and Retreating the Bituminous Surface Treated System.

In Table 12 is set out, since 1933, the annual rate of extending and retreating the bituminous surface treated system, which at 30th June, 1946, comprised a total length of 5,669 miles.

Table 12.—Rate of Extension and Retreatment.

Year.	Surface Treated Mileage at 30th June Each Year.	Initial Treatments.		Retreatments.	
		Extensions (Miles).	I.T. on Previously Treated Lengths (Miles).	Miles	Rate. Percentage of Length Treated to Previous June.
1933–34 ..	2606	..	..	..	..
1934–35 ..	2946	340·0		240	9·2
1935–36 ..	3412	466·0		370	12·5
1936–37 ..	3935	523·0		344	10·1
1937–38 ..	4526	591·0	Not	322	8·2
1938–39 ..	5121	595·0	separated	292	6·5
1939–40 ..	5453	332·0	before	395	7·7
1940–41 ..	5601	148·0	1944–45	726	13·3
1941–42 ..	5631	30·0		564	10·1
1942–43 ..	5643	12·0		257	4·6
1943–44 ..	5655	12·0		443	7·8
1944–45 ..	5658	3·5	15·5	657	11·6
1945–46 ..	5669	11·0	11·5	651	11·5
Average Rate ..	..	..	..	..	9·4

REEFTON SPUR ROAD.

Typical of the forest access roads which the Board was called upon to construct during the year is the Reefton Spur Road. Originally planned as part of the deviation of the Warburton–Wood's Point Road around the new water storage on the Upper Yarra proposed by the Melbourne and Metropolitan Board of Works, its construction became an urgent matter for the cartage of logs from the upper portion of the Big River catchment to

Warburton. It extends from the present Warburton–Wood's Point Road 3 miles east of McMahon's Creek to the Yarra Track, approximately 12 miles east of Marysville. Brief details are :—

Length	13·02 miles
Formation width, excluding side drains	20 feet
Pavement width	16 feet
Ruling grade	1 in 16
Ruling minimum radius of curvature	100 feet
Earthwork involved	171,000 cub. yds.
Rise from Wood's Point Road to the Yarra Track	2,238 feet.

Plant used included seventeen Class 2 tractors at the peak period.

LABORATORY.

Equipment.

In the last annual report reference was made to a 10,000 lb. testing machine which had been acquired for the laboratory. During this last year a second-hand 50 ton capacity machine was obtained so that the Board's requirements are reasonably well catered for up to that load. An additional machine of appreciably larger size will be required to cope with the full range of tests

As opportunity has occurred, various items of standard equipment have been obtained and held in stock for the various laboratories which will be opened at Divisional Headquarters as soon as practicable.

Road-Marking Paints.

When making a choice from a number of different types of road marking paints, it is very desirable to have available a laboratory test procedure which will enable a quantitative estimate to be made of the relative lives of traffic lines painted with the various materials.

Sub-committee IV., on Traffic Paints, American Society for Testing Materials, has found that the durability of road marking paints may be determined with the Taber Abraser, if the abrasion test be preceded by a weathering treatment. It was found that two weeks outdoor weathering before abrasion gave fair correlation, and a seven days' treatment in a twin-arc accelerated weathering machine gave excellent correlation.

This combined weathering and Taber abrasion test is now in use in the Board's laboratory, and Fig. 3 shows a sample of road marking paint undergoing test. The paint film is supported by a 4-in. square, 20-gauge, stainless steel plate, which, after degreasing, is sprayed with the sample to a wet film thickness of 0·01-in., allowed to air dry horizontally for 48 hours, and then subjected to a weathering treatment. The weathered specimen is then weighed to the nearest milligram, and fitted to the turntable of the Taber Abraser. Resilient abrasive wheels (type C.S.–15) are used and arranged to roll on the revolving specimen under a load of 1000 grams. As the line of contact of the wheels is somewhat behind the centre of the turntable, a slight rubbing action is produced as the wheels roll on the revolving specimen. After any number of revolutions or " wear cycles ", the specimen may be removed from the turntable, and the abrasion loss determined by weighing.

The service life of a traffic line may be expected to depend not only on the weathering and abrasion resistance of the paint film, but also on the film thickness, which latter is proportional to the non-volatile content of the paint, multiplied by the number of gallons per mile applied. Therefore, in interpreting the results of Taber abrasion tests, the non-volatile content of the paint is determined and taken into account.

In a series of tests carried out in the Board's laboratory, two types of road marking paints were compared with the Board's pre-war Formula B paint, employing a number of different weathering pretreatments.

The results are summarized in Table 13.

Table 13.

Weathering Treatment before Abrasion.	Life of Line as Percentage of Life of Formula B Line.	
	Sample 1.	Sample 2
3 days at 122° F. ..	22·0	2·5
7 days at 122° F. ..	30·0	13·5
3 days in Atlas twin-arc weatherometer	30·0	29·0
7 days in Atlas twin-arc weatherometer	19·0	All material lost by weathering
20 days on roof	39·0	8·5

The results may be interpreted thus :—

Under the same conditions of traffic, weather, road surface, and rate of application—

1. The life of a line painted with Sample 1, relative to the life of the Formula B line, may be expected to vary between 19 per cent. under severe weather conditions (where there is alternation of exposure to rain and sun), and 39 per cent. for mild and dry weather conditions.

2. The life of a line painted with Sample 2 relative to the life of the Formula B line, may be expected to be 29 per cent. under mild and dry weather conditions, but under severe weather conditions it may be expected to have a very short life.

The cost of the labour and plant required to apply the paint to the road is something like 30 per cent. of the total, so that there is an added reason for using paint of highest quality ; for example, if there is a choice between a poor quality paint at about 15s. per gallon and one which would last four times as long, then it would be economical to pay not merely four times the price for the better paint, but over 5½ times. Already the Taber Abraser has enabled the Board to differentiate between different paints and the one test alone will probably save the cost of the machine several times over.

ESSENDON RUNWAY.

In August, 1945, the Board was asked by the Commonwealth Department of Works and Housing to undertake on its behalf the construction work entailed in the first stage development of Essendon Airport as required by the Department of Civil Aviation. This involved, *inter alia*, the construction of the North–South runway in concrete. The concrete was supplied under contract from a central mixing plant situated 10 miles from the work. Placing and finishing were carried out with plant imported by the Department of Works and Housing.

The design required concrete with high bending strength, with a limit in the cement content of 564 lb. (6 bags) per cubic yard of finished concrete. Considerable investigation was undertaken into the means of obtaining this with the materials and plant available. As completion of the work was urgent, this was concurrent with the earlier stages of construction. Fig. 4 gives particulars of the final mix used, while Fig. 5 indicates the compressive and flexural strengths obtained during the progress of the work.

The results are those obtained by testing beams and cylinders made as the work proceeded. Subsequent investigation indicates that the compressive strength of cores cut from the completed pavement is approximately 25 per cent less than that of test cylinders made of the same mix. This may be partly due to incomplete consolidation by the machines, as the cores have a density approximately 2 per cent. less than the test cylinders. This question is being pursued with a view to improving the strength of the concrete in the pavement by changes in the method of using the placing and finishing machines.

Fig. 6 shows the concrete dumped in front of the placing machine while Fig. 7 shows the mechanical screed in operation behind the placer.

ENGINEERING STAFF.

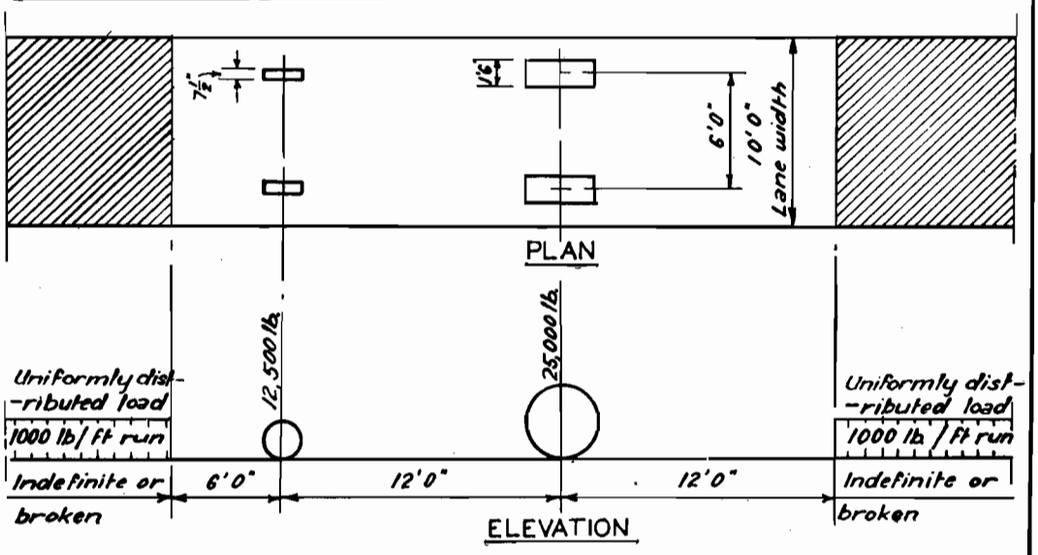
The increased reliance on plant, with its high rate of output and specialized capabilities, and the responsibility for applying the results of research in order to obtain the greatest economy has led to the need for increased and more skilled supervision of all stages of the Board's work, from design to construction and maintenance. In short, the use of machines and the growth of engineering knowledge require that a greater proportion of expenditure, skill, and energy must be put into design and supervision than when work was carried out chiefly by hand methods, and design was based on individual experience and judgment alone. In addition, the volume of work to be carried out is greater than ever before because of the need to overcome the lag which occurred during the War. to provide for the increased weight of traffic and to assist other Authorities associated with vital production.

Unfortunately, owing to the general shortage of experienced Engineers and the low salaries prevailing a number of valued officers of the Engineering Branch have been lost to other Authorities during the period. The greatest credit is due to all members of the staff in maintaining a reasonable standard of work under these difficult conditions.

C. G. ROBERTS,
Chief Engineer.

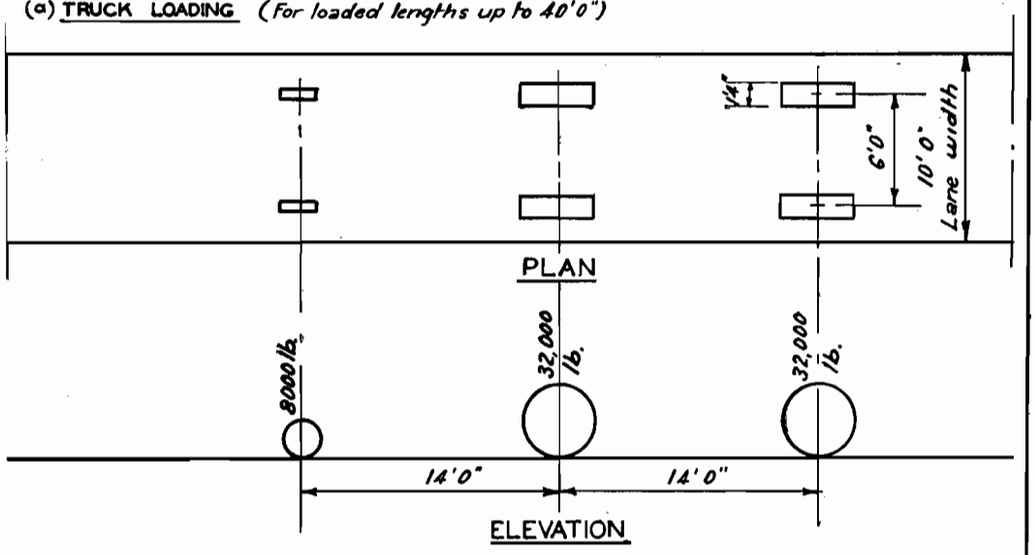
DESIGN LIVE LOADS

C.R.B. CLASS A LOADING



A.A.S.H.O. 1941 H 20 – S16 – 41 LOADING

(a) TRUCK LOADING (For loaded lengths up to 40'0")



(b) LANE LOADING (For loaded lengths above 40'0")

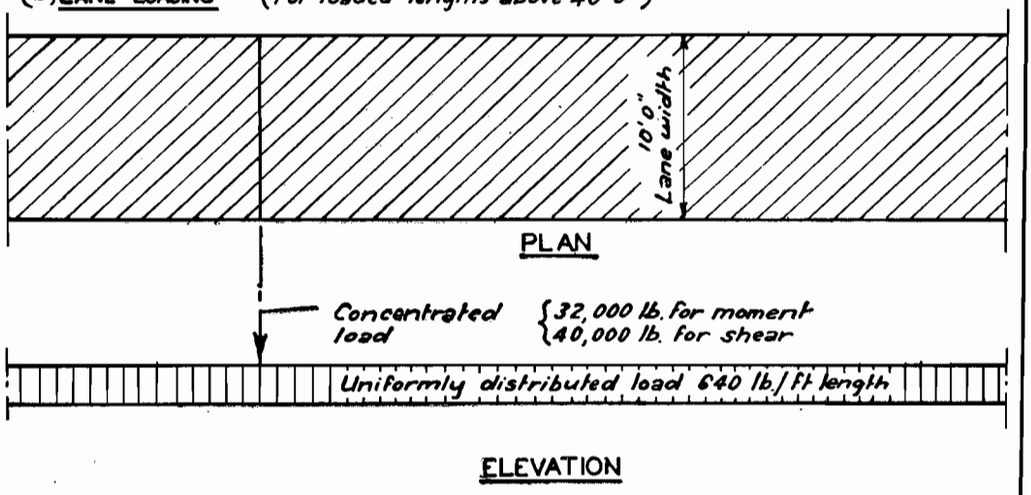


FIG. 1.

FIG. 2.—Temporary bridge over Main Drain at Port Fairy.

FIG. 3.—Taber Abraser.

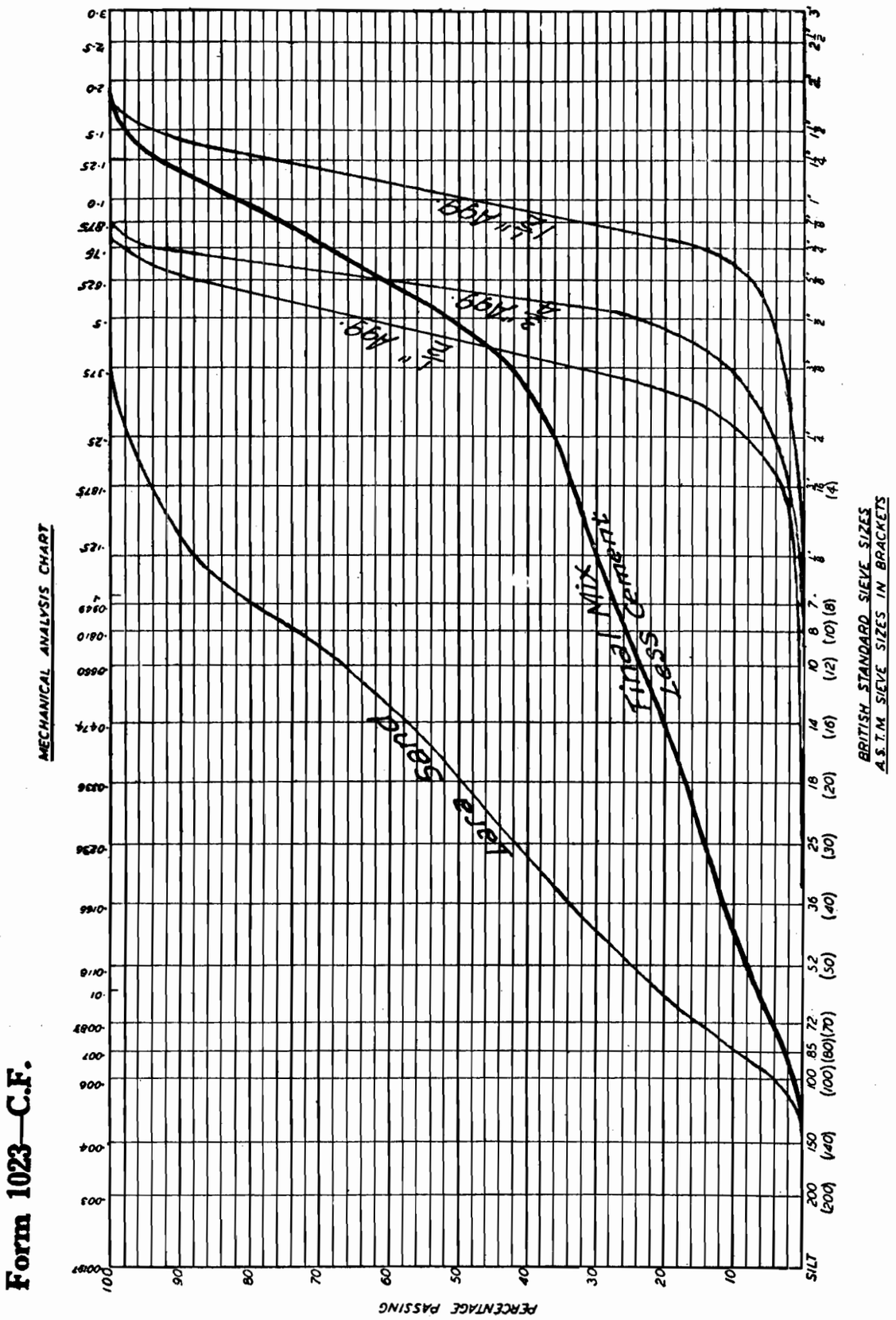


Fig. 4.— Essendon Runway. Concrete Mix.

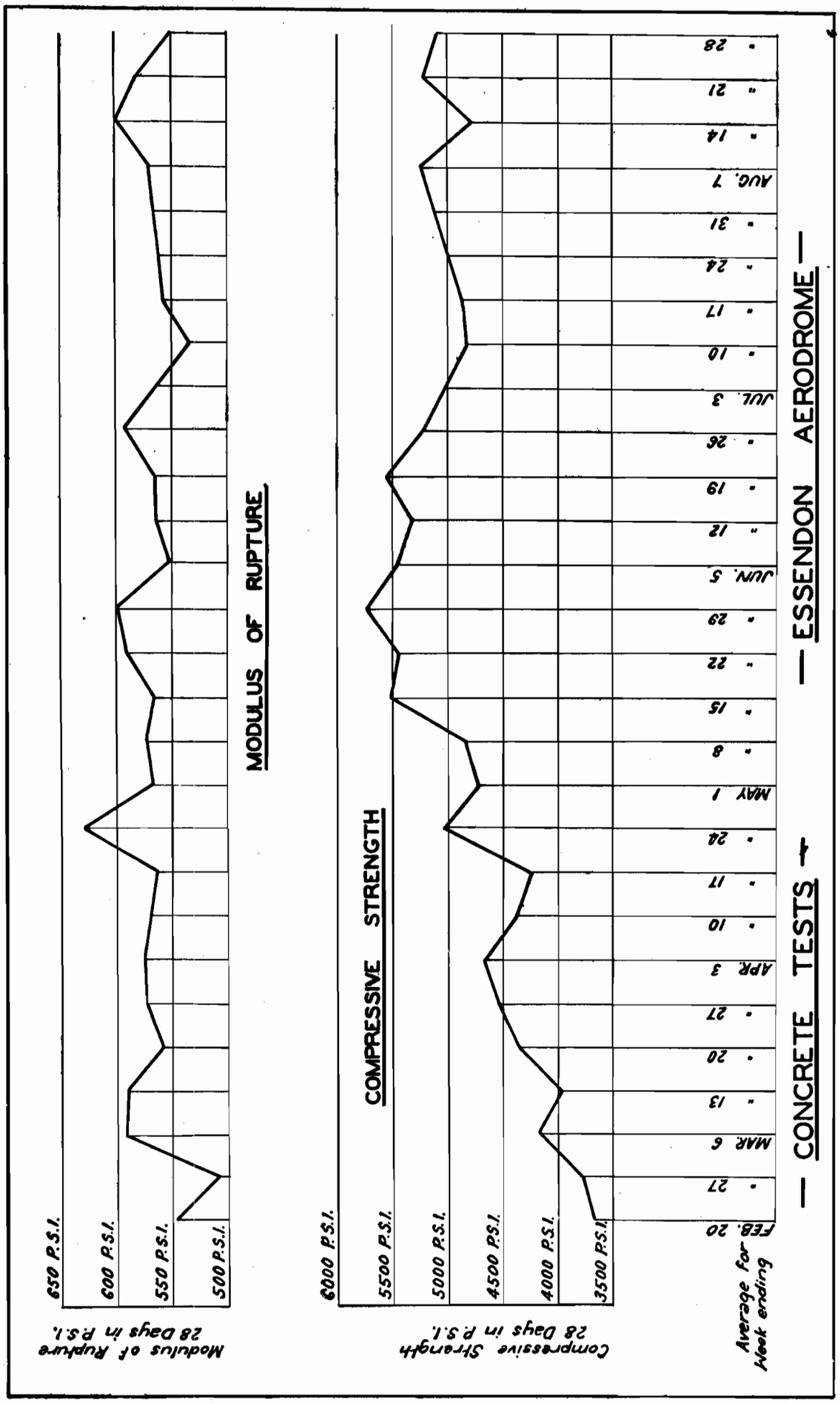


FIG. 5.— Essendon Runway. Concrete Strengths.

FIG. 6.—Placing Machine.

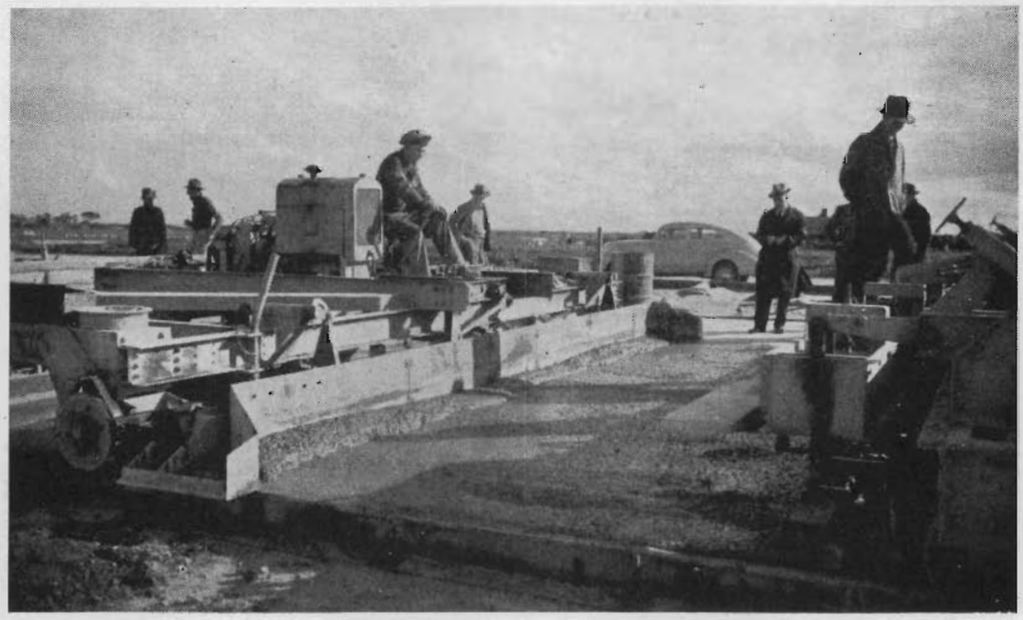


FIG. 7.—Mechanical Screed.

APPENDIX.

COUNTRY ROADS BOARD FUND.

RECEIPTS.

		£ s. d.	£ s. d.	£ s. d.	£ s. d.
1945.					
July 1.	To Balance				1,010,745 5 10
1946.					
June 30.	,, Motor Car Act No. 3741—				
	Registration Fees		1,665,185 9 5		
	Less Refunds		8,681 16 10		
			1,656,503 12 7		
	Fines ..	13,364 17 4			
	Less Refunds ..	35 10 0			
			13,329 7 4		
			1,669,832 19 11		
	Less Cost of Collection ..		111,353 0 6		
				1,558,479 19 5	
	,, Country Roads Acts Nos. 3662, 3741/13, 4332—				
	Fees and Fines		253 9 6		
	Registration of Traction Engines		106 8 2		
				359 17 8	
	,, Acts Nos. 3662, 3741, 4332, 4585—				
	Costs			68 8 4	
	,, Municipalities' Repayments—				
	Permanent Works—				
	Outer Metropolitan Roads	4,603 7 2			
	Relief Acts Nos. 4140, 4415 ..	143,668 4 10			
			148,271 12 0		
	,, Main Roads—Maintenance ..		116,234 9 8		
				264,506 1 8	
	,, Hire of Plant		98,782 1 10		
	,, Stores and Materials		214,569 1 8		
	,, Sundries		172,798 16 0		
				486,149 19 6	
	,, Special Works—Outstanding 30th June, 1945—Recoup			49,085 17 11	
					2,358,650 4 6
					£3,369,395 10 4

PAYMENTS.

		£ s. d.	£ s. d.	£ s. d.
1946.				
June 30.	By Maintenance			829,083 12 4
	,, Murray River Bridges and Punts			7,622 16 3
	,, Interest and Sinking Fund—			
	Municipalities' Repayments			105,412 12 1
	,, Interest and Sinking Fund—Great Ocean Road			1,000 0 0
	Recoup to Revenue Act 3944—			
	Interest—Main Roads		101,205 13 1	
	Developmental Roads		170,227 6 8	
	Sinking Fund Contributions		24,318 13 0	
	Exchange		35,922 12 5	
	Loan Conversion Expenses		4,413 3 9	
	Special Payment National Debt Sinking Fund ..		1,105 2 2	
				337,192 11 1
	,, Relief to Municipalities—Acts Nos. 4140, 4415 ..		.. ..	221,040 8 8
	,, Stores and Materials		214,060 17 5	
	,, Plant Purchase and Repairs		265,309 17 9	
	,, Storeyards 1, 2, and 3		70,661 9 1	
	,, Sundry Debtors'		99,906 9 3	
	,, Traffic Administration—			
	Motor Car Acts		3,643 9 3	
	Country Roads Acts		1,561 9 8	
	,, Bridge Inspections		345 15 0	
	,, Act No. 4332—Impounding of Cattle		1,006 3 4	
	,, Act No. 4609—Tourists' Resorts Fund		7,913 7 0	
	,, Act No. 4585—Traffic Line Marking		7,766 9 9	
	,, Act No. 5015—Cremorne Bridge		4,438 0 0	
	,, Recoup to Revenue—Act No. 3782—Superannuation Charges		1,667 2 3	
	,, General Expenses—			
	Salaries, &c.	150,060 15 3		
	Less Recoup	30,605 2 8		
			119,455 12 7	
				797,736 2 4
	,, Special Works—Outstanding			109,201 15 7
	,, Balance			961,105 12 0
				£3,369,395 10 4

RECONCILIATION.

	£ s. d.
Balance as per Treasury Books	953,486 4 5
Add Transfers Outstanding	26,169 9 5
	979,655 13 10
Deduct Accounts in Transit	18,550 1 10
Balance as per Country Roads Board Account	961,105 12 0

1946.		£ s. d.	£ s. d.	£ s. d.
June 30.	To Maintenance Works—General		499,323 4 0	
,,	Mansfield–Wood's Point Road ..	1,709 13 4		
,,	Wood's Point Road	8,077 15 4		
,,	Walhalla Road	1,401 19 6		
,,	State Highways	259,341 15 11		
,,	Tourists' Roads	51,208 5 2		
,,	Forests Roads	8,020 19 1		
			329,760 8 4	
				829,083 12 4
,,	Murray River Bridges and Punts		.. ..	7,622 16 3
,,	Contribution to Sinking Fund		26,353 3 0	
,,	Interest on Loans		79,059 9 1	
				105,412 12 1
,,	Recoup to Revenue—Act No. 3944—			
	Interest—Main Roads	101,205 13 1		
	Developmental Roads ..	170,227 6 8		
			271,432 19 9	
,,	Sinking Fund Contributions		24,318 13 0	
,,	Exchange		35,922 12 5	
,,	Loan Conversion Expenses		4,413 3 9	
,,	Special Payment to National Debt Sinking Fund ..		1,105 2 2	
				337,192 11 1
,,	Act No. 4395—Great Ocean Road—			
	Interest		507 18 0	
	Sinking Fund		492 2 0	
				1,000 0 0
,,	Tourists' Resorts Fund—Act No. 4609		.. ..	7,913 7 0
,,	Recoup to Revenue—Act No. 3782—Superannuation Charges			.. 1,667 2 3
,,	Relief to Municipalities		.. ..	221,040 8 8
,,	Audit Fee		603 0 4	
,,	Bridge Equipment		4,298 3 5	
,,	Bridge Inspections		345 15 0	
,,	Defence Leave Employees		489 19 11	
,,	Direction Boards and Warning Signs		1,022 2 3	
,,	Divisional Offices		2,115 8 0	
,,	Divisional Storeyards		14,145 8 8	
,,	Gravel Sites and Metal Investigation		57 19 4	
,,	Instruments and Survey Equipment		1,657 7 0	
,,	Insurance of Staff		48 5 1	
,,	Motor Expenses		10,396 11 3	
,,	Offices—Exhibition Building		485 17 3	
,,	Office Expenses		5,738 4 0	
,,	Office Furniture		2,119 14 2	
,,	Patrol Garages		7 8 0	
,,	Patrolmen's Cottages		215 3 0	
,,	Engineers' Residences		597 12 6	
,,	Roadmaster's Residence		6 15 10	
,,	Plans, Purchase		836 8 10	
,,	Plant Purchase		193,114 13 1	
,,	Postage and Telegrams		1,503 10 3	
,,	Printing and Stationery		1,151 17 11	
,,	Promontory Huts and Garages		1 11 10	
,,	Salaries		75,878 11 0	
,,	Pay Roll Tax (Staff)		1,860 4 5	
,,	Storeyard Cartage Expenditure		7,807 5 7	
,,	Telephones		2,126 0 2	

1945.		£ s. d.	£ s. d.	£ s. d.	£ s. d.
July 1.	By Balance				1,414,798 0 8
1946.					
June 30.	,, Motor Car Act No. 3741—				
	Registration Fees		1,665,185 9 5		
	Less Refunds		8,681 16 10		
			1,656,503 12 7		
	Fines ..	13,364 17 4			
	Less Refunds	35 10 0			
			13,329 7 4		
			1,669,832 19 11		
	Less Cost of Collection ..		111,353 0 6		
				1,558,479 19 5	
	Country Roads Act No. 3662—				
	Registration of Traction Engines			106 8 2	
	Fees and Fines			253 9 6	
	Costs—Acts Nos. 3662, 3741, 4332, 4585 ..			68 8 4	
,,	Plant Earnings		98,553 17 11		
,,	*Deduct* Working Costs		72,195 4 8		
				26,358 13 3	
,,	Sundry Earnings			232 10 10	
,,	Old Roads, Sale of			135 7 4	
,,	Rents			1,364 13 11	
,,	Royalty on Gravel and Metal			202 6 6	
,,	Storeyard Equipment Repairs			251 9 0	
,,	Storeyard Cartage Earnings			7,331 5 5	
,,	Timber, &c., Revenue			159 5 6	
,,	Materials, Sale of			38 12 9	
,,	Plans, Sale of			2 8 0	
,,	Storeyards 1, 2, and 3			1,915 8 7	
,,	Great Ocean Road—Interest			279 15 0	
,,	Maintenance Works—				
	Contributions Payable by Municipalities		128,541 18 1		
	Adjustment		41 15 11		
	..			128,500 2 2	
,,	Permanent Work—				
	Contributions Payable by Municipalities—				
	Outer Metropolitan Roads ..		4,603 7 2		
	Adjustment		235 18 0		
			4,367 9 2		
	Other Main Roads ..		143,332 7 8		
				147,699 16 10	
					1,873,380 0 6

,, Testing Materials	3,277 9 9		
,, Travelling Expenses	1,990 2 10		
,, Motor Car Acts Nos. 3741, sections 11–13m and 3901, sections 24–36	3,643 9 3		
,, Country Roads Board Acts	1,561 9 8		
,, Act No. 4332—Impounding of Cattle	1,006 3 4		
,, Act No. 4585—Traffic Line Marking	7,766 9 9		
,, Act No. 5015—Cremorne Bridge	4,438 0 0		
,, Timber, &c., Revenue Account	1 1 0		
,, Camp Sites	17 8 1		
,, Advertising—Government Printer	729 19 3		
,, Legal Work—Crown Solicitor	302 2 6		
,, Insurance—Public Risk	65 2 0		
,, Photography	624 13 11		
,, Tree Nursery	5 0 0		
,, Transportation Survey	54 16 11		
,, Traffic Census	878 15 10		
,, Technical Instruction Classes	71 14 9		
	355,064 16 11		
Less Recoup	30,605 2 8		
		324,459 14 3	
Balance		1,452,785 17 3	
		£3,288,178 1 2	£3,288,178 1 2

BALANCE-SHEET AT 30TH JUNE, 1946.

LIABILITIES.	£	s.	d.
Contractors' Deposits	19,547	19	9
Sundry Liabilities	9,453	17	11
Revenue Account	1,452,785	17	3
	£1,481,787	14	11

ASSETS.	£	s.	d.	£	s.	d.
Country Roads Board Fund				961,105	12	0
Maintenance Expenditure—						
Contributions Payable by Municipalities				128,541	18	1
Permanent Works.						
Contributions Payable by Municipalities—						
Outer Metropolitan Roads	4,603	7	2			
Other Main Roads (Subject to Relief)	143,332	7	8			
				147,935	14	10
Outstanding Accounts	32,082	3	6			
,, Special Works	109,201	15	7			
				141,283	19	1
Materials Stock—						
Storeyard	71,247	0	10			
Branches	12,125	10	4			
				83,372	11	2
Trust Fund				19,547	19	9
				£1,481,787	14	11

SUMMARY SHOWING VALUE AS AT 30TH JUNE, 1946, OF BOARD'S ASSETS CHARGED TO FUND (not included in Balance-sheet).

	£	s.	d.
Divisional Engineers' Residences	5,670	7	6
Divisional Storeyards and Offices	3,135	0	0
New Divisional Premises	11,268	16	1
Divisional Workshop Plant, Tools, and Equipment	4,157	8	5
Patrol Cottages, Huts, and Garages	12,033	7	9
Great Ocean Road Mortgage	1,710	0	0
Storeyard No. 1	7,400	0	0
,, 2	12,370	0	0
Workshop Plant, Tools, and Equipment	8,421	3	0
Furniture and Fittings	13,303	9	8
Testing Laboratory Equipment	3,955	4	4
Carried Forward	83,424	16	9

	£	s.	d.
Brought Forward	83,424	16	9
Bridge Equipment (Girder Bridges)	4,013	8	1
Survey Instruments	2,144	5	9
Loadometers	240	0	0
Concrete Pipe Tester	5	0	0
Motor Registration Branch	6,894	10	9
Motor Testing Branch	515	4	6
Police Motor Cars	9,221	13	0
Police Motor Cycles	980	0	0
Motor Cars	10,621	12	1
	118,060	10	11
Working Plant at Valuation	327,360	14	11
	£445,421	5	10

COUNTRY ROADS BOARD LOAN ACCOUNT—ACT No. 3662.

BALANCE-SHEET AT 30TH JUNE, 1946.

LIABILITIES.	£ s. d.	£ s. d.	£ s. d.
Interest on Permanent Works			18,755 17 10
Loan Securities Issued	4,862,200 12 8		
Add Increase in Expenses Renewal Loans	31,033 4 5		
		4,893,233 17 1	
Less Amount Repaid		80,000 0 0	
		4,813,233 17 1	
Deduct Discount and Expenses		104,366 1 3	
		4,708,867 15 10	
Less Securities Repurchased and Cancelled from National Debt Sinking Fund		478,142 7 5	
		4,230,725 8 5	
Less—			
Redemption Funds	85,219 1 1		
Main Roads Sinking Funds	285,688 7 7		
Repaid to State Loans Repayment Fund	599,897 10 1		
		970,804 18 9	
			3,259,920 9 8
State Loans Repayment Fund			338,258 6 1
Contribution to National Debt Sinking Fund		515,804 13 4	
Less Net Loss on Repurchase of Securities (Including Exchange)		17,844 8 7	
			497,960 4 9
Loan Redemption as Itemized Above			970,804 18 9
			£5,085,699 17 1

ASSETS.	£ s. d.
Permanent Works	5,047,126 1 11
Interest Capitalized on Permanent Works (Act 3662)	18,755 17 10
National Debt Sinking Fund (Cash in Hand)	19,817 17 4
	£5,085,699 17 1

DEVELOPMENTAL ROADS LOAN ACCOUNT—ACT No. 3662.

BALANCE-SHEET AT 30TH JUNE, 1946.

LIABILITIES.

	£ s. d.	£ s. d.	£ s. d.
Loan Securities Issued	6,300,968 3 6		
Add Increase in Expenses Renewal Loans	42,838 4 3		
		6,343,806 7 9	
Deduct Discount and Expenses		157,945 2 11	
		6,185,861 4 10	
Less Securities Repurchased and Cancelled from National Debt Sinking Fund		734,749 17 6	
		5,451,111 7 4	
Less—			
Redemption Funds	646,386 7 4		
Developmental Roads Sinking Fund	55,083 0 2		
		701,469 7 6	
			4,749,641 19 10
State Loans Repayment Fund			239,896 6 1
Contribution to National Debt Sinking Fund		792,624 12 3	
Less Net Loss on Repurchase of Securities (Including Exchange)		27,421 2 0	
			765,203 10 3
Loan Redemption Itemized Above			701,469 7 6
Interest, Act No. 3662, Sec. 86/1		77,372 3 10	
Contributions Postponed		16,656 13 7	
			94,028 17 5
			£6,550,240 1 1

ASSETS.

	£ s. d.
Permanent Works Expenditure	6,425,757 10 11
National Debt Sinking Fund (Cash in Hand)	30,453 12 9
Contributions Payable by Municipalities, Act No. 3662, Sec. 86 (Subject to Relief)	94,028 17 5
	£6,550,240 1 1

DEVELOPMENTAL ROADS INTEREST—ACT NO. 3662—(SECTION 86/1)

RECEIPTS.

1946.	£ s. d.
June 30. To Interest on Account of Municipalities—	
Provided by Relief Act No. 3662—Sec. 86/1	77,372 3 10
	£77,372 3 10

EXPENDITURE.

1946.	£ s. d.
June 30. By Repayments to Treasury (Relief)	77,372 3 10
	£77,372 3 10

AUDITOR-GENERAL'S CERTIFICATE.

The Accounts have been audited and compared with the books, with which they agree. Reconciliations have also been made with the books of the Treasury. Subject to the qualification that the balance-sheets do not include as assets permanent works and improvements resulting from expenditure from revenue moneys and extraneous funds, the several statements, in my opinion, exhibit a correct view of the affairs of the Board at the 30th June, 1946.

E. A. PEVERILL,
Auditor-General,
15th October, 1946.

E. J. HICKS,
Accountant,
15th October, 1946.

By Authority: J. J. GOURLEY, Government Printer, Melbourne.