VICTORIA

COUNTRY ROADS BOARD

FORTY-NINTH ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1962

PRESENTED TO BOTH HOUSES OF PARLIAMENT PURSUANT TO ACT No. 6229.

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FRONTISPIECE: Narracan Shire. Trafalgar-Thorpdale Road. Reconstructed section south of Trafalgar. COVER: Midland Highway. South Gippsland Shire. Initial seal on reconstructed section north of Welshpool.



COUNTRY ROADS BOARD

Chairman C. G. Roberts.

Deputy Chairman I. J. O'Donnell.

Member R. E. V. Donaldson.

PRINCIPAL OFFICERS.

HEAD OFFICE.

Chief Engineer .. F. West.

DEPUTY CHIEF ENGINEERS.

Works Road Design Bridges Mechanical
H. S. Gibbs. G. J. Dempster. B. R. Abery. G. M. Langham.

Secretary N. L. Allanson.

Deputy Secretary .. C. C. Liddell.

Accountant R. G. Cooper.

Deputy Accountant .. R. J. C. Bulman.

DIVISIONAL OFFICES.

Division. Divisional Engineer.

Bairnsdale .. W. H. Dolamore.

Ballarat .. F. H. O'Brien.

Benalla .. R. C. Handley.

Bendigo L. Upton.

Dandenong H. P. George.

Geelong .. W. F. Neville.

Horsham .. A. J. Pryor.

Metropolitan .. N. G. Roeszler.

Traralgon .. F. Docking.

Warrnambool .. J. W. C. Pascoe.

COUNTRY ROADS BOARD

FORTY-NINTH ANNUAL REPORT, 1961-62

CONTENTS

											PAGI
1.	Major Works in Year 19									٠.	,
2.	Reorganization of Chief I	Engineer's	Branch	١							16
3.	Finance										10
4.	Receipts and Payments										10
5.	Allocations for Works										1.
6.	Sharing the cost of Road	d Works									1.5
7.	Contracts under the Boar	rd's Direc	t Super	vision							1
8.	State Highways										1
9.	By-pass Roads										2
10.	Main Roads										2
11.	Unclassified Roads										2
12.	Tourists' Roads										3
13.	Forest Roads										3
14.	Bridges										3
15.	Bituminous Surfacing										4
16.	Road Furniture										4
17.	Rural Finance and Settle	ement Cor	nmission	Estate	Roads						43
18.	Works for Other Authori										4
19.	Elimination of Railway										4
20.	Flood and Bushfire Dam		-								4
21.		~									4
22.	Roadmaking Materials an				• •	• •					48
23.	Control of Heavy Traffic					• •			• •		48
24.						• •		• •	••	• •	5
25.	Municipalities Forest Roa					• •	• •	• •	• •	• •	5
26.	Aerial Spraying of Roads	_				• •			••	• •	5
27.	Decentralization			. 1680 0	OHUIOI	• •	• •	• •	• •	• •	5
28.	1 0			• •	• •	• •	• •	• •	• •	• •	55
29.			• •	• •	••	••	• •	••	• •	• •	55
	~ ·		• •		• •	• •		• •	• •	• •	
30.	Displays and Exhibitions National Association of A		 Stata I	ood An	 thaniting		• •	• •	• •	• •	54
31.	Australian Road Research			toad Au	thornes	• •		• •		• •	54
32.						• •	• •	• •	• •	• •	54
33.	Conference with Landsca	-			• •		• •			• •	56
34.	Municipal Association Co									• •	56
35.	Commission of Inquiry in			nent in		• •		• •	• •	• •	57
36.	Conference of Municipal	-		• •	• •	• •	• •	• •	• •	••	57
37.	1	 D			• •	• •	• •	• •	• •	• •	58
38.	Retirement of Mr. D. V.			• •	• •	• •	• •	• •	• •	• •	58
3 9.	Staff and Employment			• •	• •		• •	• •	• •	• •	59
40.	Motor Registrations			• •		• •	• •	• •		• •	61
41.	Acknowledgments	• •		• •	• •			• •	••	••	62
App	endix 1. Statement of Re	eceipts an	d Paym	ents for	year end	led 30th	June, 19	62			63
App	endix 2. Loan liability as	s at 30th	June, 1	962							64
App	endix 3. Chief Engineer's	Report									65



COUNTRY ROADS BOARD

FORTY-NINTH ANNUAL REPORT

60 Denmark Street, Kew, E.4, 1st December, 1962.

The Honorable H. R. Petty, M.L.A., Minister of Public Works, State Public Offices, Melbourne, C.2.

SIR,

In accordance with the requirements of section 128 of the Country Roads Act 1958, No. 6229, the Board has the honour to submit to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1962.

1. MAJOR WORKS IN YEAR 1961-62.

In 1961-62 the State experienced a very long construction season. The dry conditions, owing to lack of rain, enabled the staffs of municipal councils and of the Board to proceed with road and bridge works at an unprecedented rate. In addition, because of the general economic situation, there was a plentiful supply of labour for Board's and councils' works.

Substantial progress was made in the provision of wider and safer facilities for modern traffic needs. The following major works are some examples of the progressive development achieved:—

- (a) the construction of the new Hume By-pass Road, 13 miles in length, in two sections, between Chiltern and Wodonga to eliminate seven railway level crossings and by-pass the narrow main street of Chiltern (Plate 1);
- (b) the construction of the Club Terrace loop deviation of the Princes Highway
 East which provides a completely new road for a length of 10·25 miles
 diverting traffic from a 15-mile length of narrow sub-standard road passing
 through the Township of Club Terrace;
- (c) the construction of five bridges and approaches at Sale to provide an all weather road at the crossing of the Thomson River and Flooding Creek on the Princes Highway East;
- (d) the reconstruction of the very tortuous "Devil's Backbone" section of the Omeo Highway situated about 6 miles south of Tambo Crossing;
- (e) the realignment and widening of the Western Highway between Melton and Bacchus Marsh on the long steep hill known as Anthony's Cutting as an extension of the work previously carried out at Djerriwarrh Creek;
- (f) the duplication of the Bellarine Highway (Ormond Road) at East Geelong between Myers Street and Loch Terrace;

- (g) the extension of the sealing on the Henty Highway to provide a completely sealed road between Portland and Mildura;
- (h) the duplication of the Hume Highway over Pretty Sally Hill in the Shire of Kilmore eliminating a steep curved section which has long been a bottleneck on this interstate route.

A feature of the works in the vicinity of the metropolitan area was the general extension of multi-lane works on State highways radiating from Melbourne, where suburban development has overrun sections of the Board's declared system which were country roads until a few years ago. This type of development took place on—

- (a) the Maroondah Highway in the Cities of Box Hill, Ringwood and Nunawading (Plate 2);
- (b) the Princes Highway East between Dandenong and Doveton, including the channelized intersection with the South Gippsland Highway;
- (c) the Hume Highway northerly from Camp Road in the City of Broadmeadows;
- (d) the Nepean Highway between Moorabbin and Mentone;
- (e) the Western Highway between Ashley Street and Duke Street in the City of Sunshine;
- (f) the Calder Highway along the south side of the Melbourne Airport at Essendon.

The Board also carried out work during the year on several major railway level crossing elimination projects. In addition to the Hume By-pass Road the more important of these were—

- (a) the Merton Gap deviation of 2·49 miles of the Maroondah Highway where two railway level crossings were eliminated;
- (b) the Craigieburn Over-pass of four lanes on the Hume Highway together with connecting links and associated structures (Plate 3);
- (c) A grade separation to carry the Hume Highway under the main north-east railway line at Tallarook.

As indicated later in the report, considerable financial assistance to councils was made towards the progressive development of main roads and unclassified roads. Typical works carried out under this heading were:—

Main Roads:—

- (a) A total of over 9 miles of reconstruction, realignment and sealing of Ararat—Halls Gap, Maroona—Glenthompson and Rossbridge—Streatham Roads in the Shire of Ararat.
- (b) Four miles of construction and sealing of the Beulah-Birchip-Wycheproof Road in the Shire of Birchip, thus completing the link Rainbow-Beulah-Birchip.
- (c) Reconstruction and extension of seal, 20 feet wide, for a distance of 4 miles to provide improved road conditions on the Strathfieldsaye Road in the Shire of Strathfieldsaye; this road will serve as a main access from Bendigo to the new Eppalock Reservoir.

Unclassified Roads—

- (a) Construction and sealing of 3.5 miles of the Linton-Naringhil Road in the Shire of Grenville.
- (b) Sealing of 2·3 miles of the Peppers Plains Road in the Shire of Dimboola; this completes the sealing of this road in the Shire of Dimboola.
- (c) Reconstruction of 4 miles for sealed pavement of the Promontory Road, south of Yanakie, in the Shire of South Gippsland and 1·1 miles of realignment for sealed pavement through sand hills.

MAJOR WORKS.

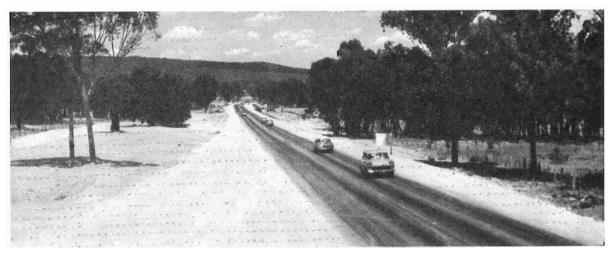


Plate I.—Hume By-pass Road. Traffic using the new section near Chiltern. Chiltern Shire.

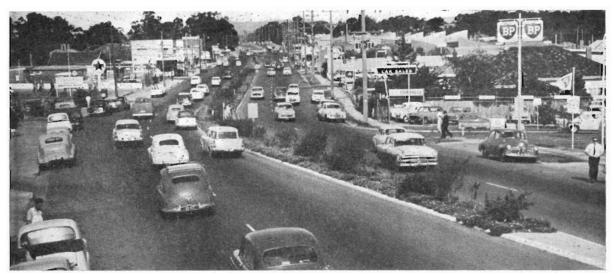


Plate 2.—Maroondah Highway. New dual pavements at Blackburn. Nunawading City.



Plate 3.—Hume By-pass Road. Craigieburn Overpass. The completed Craigieburn section with dual pavements bridging the Sydney-Melbourne railway. Whittlesea and Bulla Shires.

2. REORGANIZATION OF CHIEF ENGINEER'S BRANCH.

The increase in volume of work during recent years and particularly during the last year has placed heavy responsibilities on senior executive engineers especially the Chief Engineer and Deputy Chief Engineer. The Board, after a detailed and searching analysis of the tasks of these engineers, decided to regroup responsibilities so that the Chief Engineer could be further assisted by senior executive engineers by giving them appropriate delegations of authority. The four engineers responsible for highways and road works, road design, bridges, and mechanical plant and equipment, were given appropriate delegations of authority and the designations of Deputy Chief Engineer—Works, Deputy Chief Engineer—Road Design, Deputy Chief Engineer—Bridges, and Deputy Chief Engineer—Mechanical, respectively. These changes did not involve any increase in staff.

3. FINANCE.

Owing to the dry conditions and plentiful supply of labour referred to previously, works proceeded in 1961–62 at a faster rate than had been expected, with a consequent higher rate of expenditure than had been estimated. By the end of December, 1961, the Board's actual expenditure, including reimbursement of expenditure incurred by municipal councils, amounted to £11,274,000 against £7,906,000 for the same six months period in the previous financial year. The high expenditure took place despite the fact that allocations made and estimated funds available were much the same as in the previous year. Representations were made by the Board to the Government for further funds to avoid postponement and curtailment of works during the second half of the financial year. Following the Loan Council meeting in February, 1962, the Board received an additional £400,000 loan funds together with special Commonwealth assistance through the State Treasury of £500,000. This additional money, together with controlled reduction in expenditure, enabled the Board to meet its financial obligations without the retrenchment of its own works on a severe scale which would otherwise have been necessary.

Previous reports have stressed the inadequacy of financial resources available to the Board to achieve a sufficient volume of road and bridge construction, reconstruction and maintenance to keep pace with traffic needs.

In the first and second years of the 1960–70 target programme, expenditure has lagged behind needs, leaving a deficiency of £136,000,000 for the remaining eight years of the decade, an average of £17,000,000 per year. Additional revenues for road purposes are therefore essential in Victoria. In the past year, the Commonwealth has collected nearly £70,000,000 in fuel taxation over the whole of the Commonwealth (£20,000,000 from Victoria) and has made a distribution of £50,000,000 from Consolidated Revenue to the various States, Victoria receiving £10,000,000. If an amount equivalent to the whole of the fuel tax collections were distributed by the Commonwealth under the present distribution formula, the additional amount payable to Victoria would be approximately £4,000,000.

It is understood that representations to the Commonwealth have not been successful in this regard, and that consideration has now been given to requesting the Commonwealth to collect an additional tax on fuel to be returned to the State of collection. A fuel tax of 6d. per gallon, if applied in Victoria would return approximately £11,000,000 per year based on present fuel consumption, and would involve the average motorist in additional expenditure of approximately $\frac{1}{3}$ d. per mile above the present average overall cost of about 1s. per mile. In the case of heavy freight vehicles, the additional charge would, on freight charges of £4 per ton, increase such rate to £4 2s. per ton. Contentions that such additional charges would be "crippling" to the transport industry could therefore not be justified. The benefits to be gained by improved road facilities are so great that a wider appreciation of the true facts should dispel criticism based on inadequate data.

4. RECEIPTS AND PAYMENTS.

The total funds available to the Board for expenditure during the year amounted to £24,045,769 as compared with £22,582,441 during 1960-61 financial year, an increase of £1,463,328.

Actual expenditure amounted to £24,040,847 as compared with £22,579,541 for the previous financial year, an increase of £1,141,306. Of the total expenditure of £24,040,847 £14,746,780 was incurred by the Board and £9,294,067 by the municipalities.

The cash balance at 30th June, 1962 was £4,922.

COUNTRY ROADS BOARD FUND.

During the year the net amount received by the Board from motor registration fees and fines, half the drivers' licence fees, drivers' licence testing fees, and municipal repayments was £10,644,052, an increase of £277,674 over the amount of £10,366,378 received from the same source during 1960–61 year. Fees received from applicants undergoing tests of competency for drivers' licence amounted to £76,901. The whole of the fee (£1) is paid into the Country Roads Board Fund.

Proceeds of charges under the Commercial Goods Vehicles Act amounted to £2,262,417 as compared with £2,254,421 received during the previous financial year.

The amount standing to the credit of the Country Roads Board Fund at 30th June, 1962 was £4,922.

COMMONWEALTH AID ROADS FUND.

Under the provisions of the Commonwealth Aid Roads Act 1959 which came into operation on 1st July, 1959, an amount of £10,079,282 was paid to the State of Victoria; of this amount £9,877,696 was received by the Board and the balance of £201,586 was allocated for other works connected with transport by road or water. The whole of the money received by the Board was expended.

LOAN MONEYS.

The total amount of loan money made available to the Board during 1961-62 for its normal works was £683,000 and was expended as follows:—

			£
Main Roads	 	 	 135,781
State Highways	 	 	 $514,\!219$
Tourists' Roads	 	 	 33,000
			683,000

Of the amount of £683,000, £400,000 was made available in February, 1962, to provide continuing employment for men who would otherwise have had to be retrenched.

COMMONWEALTH-STATE GRANTS (SPECIAL ASSISTANCE).

Five hundred thousand pounds was made available to the Board from the Commonwealth Government's works grant to provide continuing employment for its employees. This grant, which was fully expended, is not required to be repaid by the Board. It was additional to the £400,000 loan money previously referred to, which was provided for the same purpose.

Full details of the Board's receipts and payments for 1961-62 are shown on the statement certified by the Auditor-General on page 63 of this report.

5. ALLOCATIONS FOR WORKS.

As in the past applications were called in March, 1961, from municipalities and from the Board's own engineers for proposals for road and bridge works to be continued or commenced in the financial year 1961–62. The Board's system of financial control ensures that its finances are kept under constant review and that estimates of funds available for the forthcoming financial year are soundly based. After examining its estimates of receipts for the year 1961–62 and the commitments outstanding at 1st July, 1961, and after providing for interest and sinking fund charges for general and administration expenses the Board determined in July, 1961, the allocation of funds for construction, reconstruction, maintenance and repair of roads throughout the State by its own engineers and municipal councils.

In accordance with its usual custom, in making this allocation the Board provided for contract and direct labour commitments carried forward from 1960-61 and for works proposed to be completed or commenced prior to the succeeding year's allocation. Provision was also made for revotes of grants made in the previous year but not committed and for which application had been made.

In making its allocations the Board gives very close consideration to councils' applications in consultation with the Board's engineers directly concerned with such work. In making allocations to each municipality the Board has regard to each council's needs as reflected in its applications for the year's work together with the municipality's requirements in respect of the Ten Year Plan. Each council's financial position, capacity for work and local conditions in each municipality are also studied. The Board's allocations are not made by mere mathematical formula but are based on the knowledge gained by the Board Members themselves on scheduled inspections of municipalities' roads and on the advice tendered by the Board's own resident engineers.

Apart from works undertaken for other authorities which total £763,345 as shown on the statement on page 45 the total allocation for roads and bridge works from all funds in the financial year 1961–62 including revotes and amounts already committed in respect of works authorized was £26,684,619 as compared with £26,636,535 in 1960–61. Details are shown in the following table:—

Board's Allocations for Road and Bridge Works. (including revotes and commitments.)

			1960-61.	1961-62.
			£	£
Country Roads Board Fund	 		11,483,625	10,880,449
Commonwealth Aid Roads Moneys	 		12,451,711	12,252,139
Loan Fund	 		446,748	698,219
Commercial Goods Vehicles Act	 	!	2,254,451	2,353,812
Commonwealth-State Special Assistance	 			500,000
Totals	 		26,636,535	26,684,619

In some municipalities where work is comparatively cheap owing to favourable topography or where road making materials are available at low cost, the Board's main roads are becoming well developed. In future, grants to these municipalities for works on main roads may necessarily be reduced so that more money may be provided for the construction and reconstruction of main roads in other municipalities where such work is less advanced in relation to traffic densities.

Experience over the last two years has also shown that both the Board and municipalities are spending a greater proportion of the money allocated for works under their control than previously. While dry weather has undoubtedly had some influence, it is considered that the major factors bringing about this change have been the increased efficiency of works organizations, both Board and municipal, and further decentralization of control through the Board's Divisional Engineers. It will therefore be necessary to reduce the ratio of grants to allowable expenditure when allocating funds for work to be carried out in 1962–63.

Section 7 (2) of the Commonwealth Aid Roads Act 1959 requiring that 40 per cent. of the funds made available to the State of Victoria by this Act shall be spent in rural areas on roads which are not main roads or State highways has resulted in money being available for providing a bituminous surface on unclassified roads carrying little traffic while 3,089 miles of road in the Board's classified system, including 414 miles of State highways, are still unsealed.

In Victoria the State highways form a primary system of roads, main roads a secondary system and the more important of the unclassified roads may be considered to form a tertiary system. The bulk of the Board's allocations for heavier work and sealing on unclassified roads should be spent on a planned system of connecting roads rather than on a large number of isolated works. Some councils are already building such a tertiary system of unclassified roads with the assistance of Board's grants. It is considered that all councils in conjunction with their neighbours and with the advice of the Board's Divisional Engineers as required should plan a tertiary system of unclassified roads used by through traffic to which the greater part of the Board's allocations should be applied.

6. SHARING THE COST OF ROAD WORKS.

As required by statute the entire cost of work in respect of through traffic on State highways, by-pass roads, tourists' roads and forest roads is borne by the Board. The Country Roads Act provides for apportionment to municipalities of part of the cost of works on main roads. Councils are also required to meet a proportion of the expenditure on unclassified roads for which grants have been made from Commonwealth Aid Roads moneys.

The Country Roads Act provides that not more than one-third of the amount expended from the Country Roads Board Fund on the maintenance of main roads during the preceding financial year shall be apportioned to the municipalities. Councils' contributions may be reduced below one-third where the cost of maintenance of a road is deemed to be excessive and where such cost is due to motor traffic not of local origin or to timber traffic. In dealing with the apportionment of the cost of works the Board is required to take into account the revenue, valuation and rating of the municipality concerned.

Details of expenditure incurred on main roads in 1960–61 and apportioned to municipalities in 1961–62 are as follows:—

	£
Expenditure from the Country Roads Board Fund	4,516,147
Expenditure from Commonwealth Aid Roads moneys	1,325,075
	$\overline{5,841,222}$
Amount apportioned to councils (based on expenditure from Country Roads Board Fund only)	748,935
Percentage of amount apportioned to the total expenditure from the Country Roads Board Fund	16.58%
Percentage of apportionment to total expenditure (including Commonwealth Aid Roads grants)	12.82%

Had the Board decided to finance the whole of the expenditure on main road maintenance from the Country Roads Board Fund and had the apportionment been made strictly on a one-third basis, municipalities would have been required to contribute one-third of £5,841,222, i.e., £1,947,074. Reduced contributions and grants from Commonwealth Aid Roads moneys reduced their contributions by £1,198,139 to a total of only £748,935.

The percentage of contributions by councils to the total expenditure for main road maintenance for 1960–61 was 12·82 per cent. as compared with 12·33 per cent. in respect of 1959–60.

It will be appreciated that the Board's flexible policy of adjusting councils' contributions where special relief appears justified and by grants from Commonwealth Aid Roads moneys affords a considerable saving in councils' expenditure. Unfortunately there must be a limitation to such relief to municipalities by reason of the inadequacy of the Board's present finances to meet the road requirements of this State.

These principles are applied by the Board in the making of grants for unclassified roads and the determination of councils' proportions is based on the nature, extent and location of the work, and the financial position of the council concerned.

The average contributions by councils towards expenditure on maintenance of main roads is about one pound in eight. On unclassified roads councils contribute less than one-fifth of the total value of contruction works; grants for maintenance works are shared equally by Board and councils in urban areas while councils in rural areas pay only one-third.

In urban areas, where permanent works expenditure is incurred on a limited scale from Loan funds, expenditure is generally shared equally by councils and Board, repayments extending over a period of 35 years.

7. CONTRACTS UNDER THE BOARD'S DIRECT SUPERVISION.

During the financial year 1961-62 the Board entered into 332 contracts for road and bridge construction, supply of materials and other services.

It is interesting to note that over the past five years the average value of road construction contracts increased from approximately £24,000 to £41,000. This increase is due to the Board's policy of constructing longer sections of road than were undertaken formerly, thus taking advantage of the present day pool of contractors suitably equipped to carry out major works expeditiously, with a minimum of inconvenience to the travelling public. The trend towards larger projects has engendered keen competition among a growing body of earthmoving contractors with consequent reductions in unit prices. Among the contractors now tendering for large works are several operators who have graduated from minor works to important contracts, as a result of encouragement and careful supervision by the Board's Engineers.

During the same period the average value of bridge construction contracts has fallen from approximately £17,000 to £7,750. This reduction in average price is due to the following factors—

- 1. The post-war back-log of major bridge replacements has been partially overcome, and a large proportion of current works consists of widening comparatively small but important bridges on heavily trafficked roads.
- 2. The increasing use of precast components secured by the Board under period contracts and supplied to contractors for assembly.
- 3. The economic advantage of a substantial degree of standardization of design following the increased use of prestressed members.
- 4. The saving of overhead charges by contractors who are relieved of the responsibility in organizing supply and cartage of components and materials.

The Board's practice of obtaining bridge members under period contracts not only effects savings in cost as indicated above but also ensures strict control in quality and prompt availability from built up stocks.

A further interesting feature in the Board's contracts during recent years has been the trend towards lower prices in a number of fields, despite slight increases in general costs. An example of this was the progressive reduction in prices of certain crushed quarry materials which are now lower than those tendered in 1954. The price reductions in this particular field are due to increased competition following the opening up of quarries by new contractors, and the expansion of production in established quarries consequent upon the installation of larger and more efficient processing plant.

CONTRACTS UNDER COUNCILS' SUPERVISION.

During the financial year the Board authorized municipalities to accept 800 tenders valued at £2,494,500 for road and bridge works subsidized by the Board. In addition the Board approved of the utilization of 185 municipal period contracts for supply of materials and services incorporated in direct labour works under council supervision, for which the Board had provided funds.

Examination of tenders recently received for municipal contracts indicates that the average number of tenders for road and bridge works has increased sharply. As in the case of the Board's contracts there is evidence of strong competition and reduction in prices.

8. STATE HIGHWAYS.

The total length of declared State highways at the end of the financial year was 4,498 miles. For the financial year the Board's Divisional Engineers collectively applied for an amount of £12,280,160 to maintain and improve the system, and the Board made allocations totalling £7,461,760, equivalent to 61 per cent. of the applications. The amount allocated for maintenance was £1,603,090, equal to 22 per cent. of the total allocated, leaving an amount of £5,858,670 or 78 per cent. of the total available for reconstruction, improvements or new construction.

During the year sealing was extended for a further 59 miles on the Princes Highway East, Murray Valley, Omeo, Ouyen, Goulburn Valley, North Western, Henty and Midland Highways. The length of State highways remaining unsealed at the close of the year was 414 miles, representing 9·2 per cent. of the total length.

Restoration of bituminous surfaces is a constantly recurring maintenance operation. Normally, this work takes the form of spray coat resealing which renews the surface with no improvement of riding quality. Machine spread premixed asphalt, when used for resurfacing, has the valuable property of smoothing out irregularities and improving the riding quality of the road. This type of work is normally more expensive than conventional sprayed retreatments. On roads carrying more than 1,500 vehicles per day, and where the inherent strength of the pavement is adequate, this process is now frequently employed. Dense graded bituminous concrete produced to comply with a rigid specification was supplied, spread and compacted under a number of contracts, and by a number of suppliers on a total length of 13 miles during the year. The length of such surface treatment was $5 \cdot 6$ per cent. of the sealed mileage of State highways at the commencement of the year which compares with 10 per cent. in each of the two preceding years.

Throughout the State, sections of State highways which had deteriorated beyond the stage where further maintenance was economical or satisfactory, or where the standard of width and/or geometric design was below that required for present traffic, were reconstructed to a standard suitable for the anticipated life of the road.

Funds remaining after providing for maintenance and re-instatement were devoted to general improvements, including duplication and elimination of sections subject to recurrent flooding.

Earlier in this report the major works on State highways during the financial year have been listed and briefly described. In addition to these the following projects were completed—

Princes Highway West.—A channelized intersection with Somerville Road, Footscray.

At Norlane, Geelong, the highway was duplicated between Arunga Avenue and Separation Street, thereby extending the divided highway a further length of 1 mile. This work included a new bridge over Cowies Creek. This new section of highway now provides three lanes in each direction (Plate 4).

Four sections between Waurn Ponds and Mt. Moriac were reconstructed providing improved width and visibility.

A length of 0.6 mile on the eastern approach to Colac and a 2 mile section near Pirron Yallock were reconstructed.

A start was made on the improvement of the Stony Rises section of this highway by the completion of a length of 0.67 mile west of Pirron Yallock (Plate 5).

West of Gnotuk and north of Bolwarra Junction three sections totalling 7 miles were reconstructed, and west of Narrawong and at Heathmere and Heywood widening was carried out over approximately 6 miles.

Princes Highway East.—From west of Clayton Road to east of Wellington Road, over a length of 0.62 mile the highway was converted to six lanes, and this work included a major channelized intersection at North and Wellington Roads, with duplication of these roads extending 400 and 500 feet respectively. Similar work was commenced between Springvale Road and Corrigan Road, Noble Park, and it will be completed next financial year.

East of Beaconsfield at Pink Hill realignment and regrading of 0.64 mile eliminated a very sub-standard section (Plate 6).

PRINCES HIGHWAY.



Plate 4.—Princes Highway West, Section I. Dual highway at Norlane. Corio Shire.



Plate 5.—Princes Highway West, Section 2. Reconstructed section through Stony Rises, west of Pirron Yallock. Heytesbury Shire.

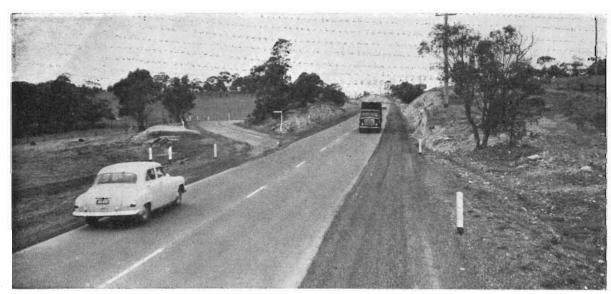


Plate 6.—Princes Highway East, Section I. Realignment at Pink Hill, Beaconsfield. Berwick Shire.

Between Warragul and Darnum $2 \cdot 3$ miles of new 24-ft. pavement was constructed (Plate 7) with improved alignment at Nilma.

At Sale 1 mile of new roadway embankment was constructed, bringing into service four of the new bridges on this section which is being constructed to place the highway above flood level (Plate 8).

Near Fulham a 2 mile section was reconstructed, and through the Township of Stratford a divided highway completed.

Between Cann River and Genoa 3 miles of new construction was completed and sealed (Plate 9), and east of Genoa 1.5 miles of realignment, including sealing, was carried out (Plate 10), which completed the seal between Genoa and the New South Wales border.

Within the Bairnsdale Division and including the Club Terrace Loop deviation (Plates 11 and 12) the sealing was extended on this highway approximately 18 miles during the year.

Western Highway.—Between Gordon and Ballarat sections totalling $6\cdot7$ miles were widened to 24-ft. sealed pavement, a similar width being provided on a length of $2\cdot2$ miles west from Ballarat, and a width of 22 feet in sections totalling $8\cdot5$ miles between Middle Creek and Dobie (Plate 13). A further $3\cdot5$ miles near Dobie were widened and strengthened.

Westerly from Deep Lead 7·2 miles of pavement was reconstructed to provide a 22-ft. seal, thereby completing a pavement of adequate width between Stawell and Horsham.

Calder Highway.—At Woodend, and between North Woodend and Carlsruhe approximately 5 miles of reconstruction, including widening, was carried out, and between Kyneton and Malmsbury three curves were realigned.

North of Culgoa for a length of 3.78 miles, and south of Nandaly for 5.6 miles reconstruction with a 20-ft. sealed pavement was carried out; the latter project involved cutting down sandhills to improve visibility.

Hume Highway.—The pavement was widened to 24 feet on three sections between Green's Pinch north of Kilmore and Tallarook.

A length of $1\cdot 2$ miles between Winton and Benalla was reconstructed with 24-ft. sealed pavement, while the elimination of the flooding problem on the Ovens River flood plain north of Wangaratta was brought a stage nearer completion by the construction of two new bridges, each 70 feet long, and raised approaches thereto.

Omeo Highway.—Further widening and reconstruction work was carried out on the mountainous section between Glen Wills and Lightning Creek, resulting in the improvement of some $2\cdot 5$ miles of road.

At Wiseleigh, near Bruthen, a bridge carrying the railway line over the highway was replaced by the Railways Department at the expense of the Board to provide adequate lateral clearance for road vehicles and a safe alignment.

Between Mitta Mitta and Eskdale $2 \cdot 2$ miles were reconstructed and sealed 18 feet wide.

A narrow bridge over Scrubby Creek was replaced with a large pipe culvert.

At Tallandoon a section previously subject to frequent flooding was raised and sealed, the length being 1.91 miles, while the seal was extended towards the Murray Valley Highway junction, a length of 5.45 miles, after reconstruction.

Murray Valley Highway.—Between Tintaldra and Corryong, the sealed road was extended 4·25 miles to link the two centres by a sealed road and 2·5 miles were widened and reconstructed to carry heavier traffic anticipated in connexion with cartage from Cudgewa Railway Station and the Snowy Mountains Hydro-Electric Authority centre at Khancoban, New South Wales.

PRINCES HIGHWAY EAST.

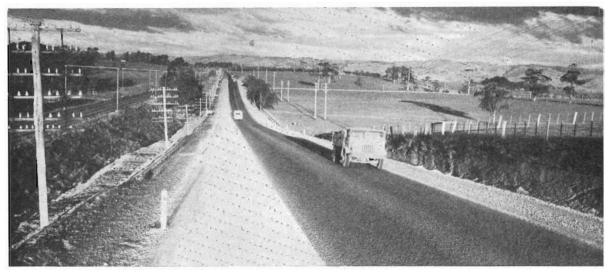


Plate 7.—Princes Highway East, Section 2. After widening and reconstruction east of Nilma. Warragul Shire.



Plate 8.—Princes Highway East, Section 2. New bridges over floodway east of Thompson River at Sale. Sale City.

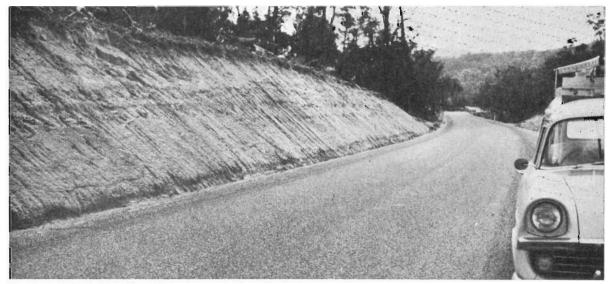


Plate 9.—Princes Highway East, Section 6. West of Genoa after reconstruction. Orbost Shire.

PRINCES HIGHWAY EAST.

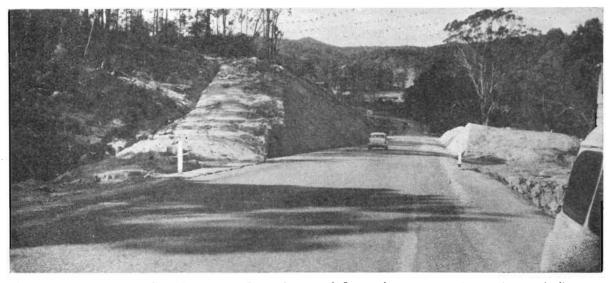


Plate 10.—Princes Highway East, Section 6. One mile east of Genoa after reconstruction on improved alignment.

Orbost Shire.



Plate 11.—Princes Highway East, Section 5. Bemm River Bridge on Club Terrace deviation. Orbost Shire.



Plate 12.—Princes Highway East, Section 5. Sealed section of Club Terrace deviation. Orbost Shire.

Two sections, one at Ebden and the other west of Sandy Creek, totalling 2.6 miles were reconstructed and sealed to an improved standard.

Between Rutherglen and Yarrawonga the sealed pavement was widened over a length of 3.64 miles, and similar work was carried out between Yarrawonga and Cobram over a length of 8.7 miles.

At Echuca a length of $2 \cdot 6$ miles was reconstructed to provide a 24-ft. seal and similar work providing a 22-ft. seal was executed at Nyah, the length in this case being $1 \cdot 2$ miles.

Northern Highway.—The formation was widened to a minimum width of 30 feet for 8.5 miles from the junction with the Hume Highway, and at Heathcote, north of Elmore and between Rochester and Echuca widening and reconstruction work was completed over a total length of approximately 7.5 miles.

Approaches were provided to the new bridge over the Campaspe River near Elmore.

South Gippsland Highway.—Works on this highway included 1.68 miles of reconstruction involving realignment east of Korumburra, 0.8 mile of reconstruction between Black Spur and Meeniyan, and approaches totalling 0.4 mile in length to a new concrete bridge over Stony Creek.

Midland Highway.—At Dry Diggings, north of Daylesford, 2·2 miles of narrow winding road was realigned, regraded and sealed (Plate 14).

At Mooroopna a divided highway was constructed and one way traffic introduced, the length of the project being approximately 0.75 mile.

Widening of the pavement easterly from Shepparton was continued a further distance of $2 \cdot 6$ miles, and a floodway east of Nalinga was eliminated by the provision of box culverts and raising of the pavement.

Between Benalla and Mansfield the sealing was extended a total distance of $5 \cdot 3$ miles in two sections near Lima South and Barjarg.

North of Welshpool a length of 2.5 miles was reconstructed and prepared for extension of sealing next year.

Henty Highway.—North of Dooen at Kewell West 5·1 miles of pavement was strengthened and widened and sealed 20 feet wide.

Between Gama and Turriff, a distance of 5·1 miles, the limestone road was strengthened and sealed for the first time, thereby completing the sealing of the whole of this highway and providing a sealed road connexion between Portland and Mildura a fact mentioned earlier in this report.

Ouyen Highway.—A deviation of this highway was constructed near Linga, thereby removing two railway level crossings from the route of the highway, and this work, together with an extension of reconstruction to the west enabled the sealing to be extended 7 miles during the year.

Nepean Highway.—A start was made on the duplication of the Nepean Highway from Davey Street, Frankston to Rocky Cliff, while improvements were effected at Sorrento on two sections totalling $1\cdot 2$ miles, involving widening and realignment.

Glenelg Highway.—The work of realignment and regrading at Cherrytree Hill near Linton was completed, the length being 2·3 miles, while sections in Smythesdale and Streatham townships were reconstructed and widened. Similar work was carried out at Dunkeld and between Dunkeld and Hamilton near Grange Burn (Plate 15) over a total length of approximately 3·5 miles.

Ovens Highway.—A section of 2.5 miles south-east of Bowman's Gap was reconstructed.

Borung Highway.—The widening and strengthening of this highway was completed in the Bendigo division by the completion of a length of approximately 5 miles at Lake Wooronook.

HIGHWAYS.



Plate 13.—Western Highway, Section 2. Reconstruction between Middle Creek and Dobie. Ararat Shire.

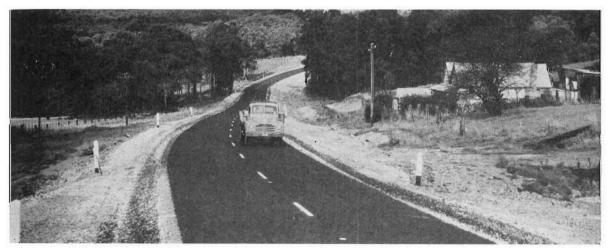


Plate 14.—Midland Highway, Section 2. Reconstructed section north of Daylesford. Glenlyon Shire.

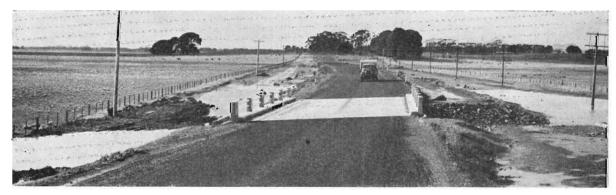


Plate 15.—Glenelg Highway. New bridge over Grange Burn at approximately 176 miles. Dundas Shire.

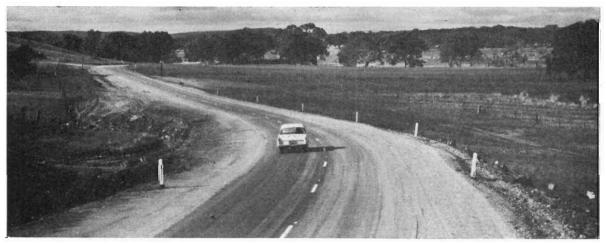


Plate 16.—Realignment of McIvor Highway at Derrinal deviation. McIvor Shire.

North Western Highway.—Through Learmonth a length of 3 miles of reconstruction was completed, and a new bridge 212 feet long built over Mountain Creek north of Avoca.

South of St. Arnaud 3·15 miles were reconstructed and widened, and through the Township of Donald the whole highway was rebuilt to provide a modern cross section between reconstructed channels.

A length of $3\cdot 1$ miles was widened between Buloke and Litchfield with a 20-ft. seal, while west of Birchip $6\cdot 4$ miles were similarly treated.

Between Curyo and Watchupga 6 miles of reconstruction and new sealing 20 feet wide was completed, and further north a length of $4\cdot 1$ miles of similar work between Watchupga and Woomelang. The sealing of this $10\cdot 1$ miles in the year, leaves only approximately 2 miles to complete a sealed connexion by this route between Ballarat and Mildura.

Maroondah Highway.—A deviation of the Maroondah Highway was completed at Narbethong, the total length being 1.75 miles, with a sealed pavement 22 feet wide.

A start was made on a deviation 1.41 miles long at Buxton, including two new bridges over the Steavenson River, while a realignment 0.9 mile in length involving very heavy earthwork was completed near Alexandra to replace the very substandard Josephine Cutting section.

McIvor Highway (Plate 16).—The deviation of this highway around the top water level of Eppalock Reservoir near Derrinal, including a new bridge over the Mt. Ida Creek was completed, the length being approximately 3·3 miles. This project was partly financed by the State Rivers and Water Supply Commission.

Back Creek bridge in the City of Bendigo was replaced, also Sweeney's Creek bridge.

Warburton Highway.—The first 2 miles of this highway, commencing at the Maroondah Highway, has been reconstructed to provide a 24-ft. wide seal, while near Launching Place 0.7 mile was reconstructed and realigned to provide approaches to a new bridge over Hoddles Creek.

Hamilton Highway.—Near Inverleigh pavement widening and strengthening was carried out over a length of 1.5 miles. Similar work executed near Cressy, west of Berrydale, west of Hexham and east of Caramut totalled 7 miles.

9. BY-PASS ROADS.

Progress continued during the year on the planning and construction of by-pass roads.

At 30th June, 1962, by-pass roads open to traffic were the Maltby, Frankston, Hume (Craigieburn, and Chiltern-Barnawartha sections), Princes (Hernes Oak to Morwell) and Whitelaw By-pass Roads. Only the Maltby and Hume (Craigieburn section) By-pass Roads are developed to the final stage with divided carriageways with no access from adjoining properties; the others are two-way two-lane roads with controlled access, sufficient for present traffic and planned for completion to full by-pass road conditions in the future as required.

The Craigieburn and Chiltern-Barnawartha sections of the Hume By-pass Road were completed and opened to traffic prior to the running of the first train on the standard gauge Melbourne to Albury railway line in January, 1962.

The Craigieburn project costing approximately £388,000 and including a large bridge structure over the railway, was carried out by direct labour, the roadwork under the direction of the Divisional Engineer Dandenong and the bridge works under the Deputy Chief Engineer—Bridges. The Chiltern-Barnawartha section, a major undertaking costing approximately £480,000 and including two bridges over streams and other structures of moderate size, was executed partly by contract and partly by direct labour in a period of approximately eight months, under the control of the Divisional Engineer, Benalla.

Title surveys have been completed or are in progress on the several roads forming the Dandenong Ring Road system described and illustrated by plan in the Forty-Eighth Annual Report and some land for right of way has been purchased by agreement with owners.

The Board is continuing the active planning of new road facilities to cope with the increasing traffic demand. The new roads are planned as full freeways and are to be provided in many parts of the State, particularly near the metropolitan area where the traffic volumes are high.

10. MAIN ROADS.

Applications were received from 208 municipal councils and from the Board's Engineers in respect of works under direct supervision of the Board. The following table shows the total allocations made and the actual expenditure for the year. Particulars for the previous year are shown for comparison, together with relevant percentages indicative of the "carry over" inherent in planning and executing works—

		 		 		1960-61.	1961-62.
						£'000s.	£'000s.
A. Applic	ations]	14,708	14,531
B. Alloca	tions	 		 		9,728	9,723
C. Expen	diture	 		 • •		5,923	7,427
						%	%
B. as per	centage of A	 		 		$66 \cdot 1$	66.9
C. as per	centage of B	 		 		$60 \cdot 9$	$76 \cdot 4$

The average ratio of Board expenditure to contribution required from councils is approximately seven to one.

Particulars of major works typical of the many improvements on main roads undertaken during the year are set out hereunder—

Bairnsdale Division.

Bairnsdale Shire.—Bairnsdale-Dargo Road—2 miles of reconstruction and sealing near Glenaladale and 1 mile of reconstruction of narrow existing seal near Hillside. Bairnsdale-Paynesville Road—reconstruction and sealing of 1 mile of narrow sealed pavement near Bairnsdale.

Omeo Shire.—Ramrod Flat Road—reconstruction of 3,700 lineal feet of deviation completed and sealed near the Township of Ensay (Plate 17). Benambra Road—realignment of 1·1 miles at Hinnomunjie.

Tambo Shire.—Gelantipy Road—an additional 2 miles of reconstruction completed and sealed north of Buchan.

Ballarat Division.

Ararat Shire.—Ararat—Halls Gap Road— $3\cdot 6$ miles of reconstruction and sealing. Maroona–Glenthompson Road— $2\cdot 5$ miles of reconstruction and realignment. Rossbridge–Streatham Road— $3\cdot 3$ miles of reconstruction and realignment.

Avoca Shire.—Landsborough Road—2·8 miles of sealing. Ararat—St. Arnaud Road—2·3 miles of reconstruction and realignment. Moonambel Road—reconstruction of a 4-span concrete bridge 72 feet long over Wattle Creek, and approaches.

Ballarat City.—Daylesford-Ballarat Road (Water Street)—the final section of this road which forms a link between the Daylesford-Ballarat Road and the Western Highway at Caledonian Bridge, completed and sealed.

Ballarat Shire.—Clunes-Creswick Road—reconstruction of a 1-span composite rolled steel joist and concrete bridge 45 feet long over Glendonnel Creek, and approaches. Maryborough-Ballarat Road—two lengths of approximately 1 mile each reconstructed and sealed north and south of Miners Rest.

Clunes Borough.—Glengower Road—construction commenced of a 3-span composite rolled steel joist and concrete bridge 100 feet long over Creswick Creek.

Grenville Shire.—Lismore Road—construction of a 3-span concrete bridge 90 feet long, using pre-stressed slabs, over Naringhil Creek, and approaches.

Lexton Shire.—Beaufort-Amphitheatre Road—reconstruction and sealing of a further length of 3 miles near the Shire boundaries.

Ripon Shire.—Eurambeen-Streatham Road—4 miles reconstructed and sealed.

Benalla Division.

Benalla Shire.—Kelfeera Road—2·8 miles reconstructed and sealed.

Bright Shire.—Bright–Tawonga Road—reconstruction and realignment of 1.8 miles (Plate 18).

Chiltern Shire.—Indigo Creek Road—realignment and reconstruction of 3,800 lineal feet.

Mansfield Shire.—Mansfield—Tolmie Road—a new 3-span reinforced concrete and steel beam bridge 211 feet 6 inches by 24 feet constructed over Broken River.

Nathalia Shire.—Echuca-Nathalia Road—2.5 miles reconstructed and sealed.

Yackandandah Shire.—Yackandandah—Wodonga Road—1·6 miles realigned and reconstructed.

Bendigo Division.

Cohuna Shire.—Cohuna–Koondrook Road—3 miles of reconstruction and sealing north of Cohuna.

Kerang Shire.—Donald-Swan Hill Road—4 miles of reconstruction and sealing north of Lalbert. Boort-Kerang Road—a 6-span reinforced concrete bridge 120 feet long by 24 feet constructed over Wandella Creek replacing two old narrow timber bridges constructed in 1878.

Korong Shire.—Bendigo-St. Arnaud Road—a 3-span reinforced concrete bridge 111 feet by 22 feet constructed over Fentons Creek at Logan to replace a lower level narrow timber bridge 80 feet by 16 feet and subject to flooding.

Marong Shire.—Bendigo-Eddington Road—a 3-span reinforced concrete bridge 120 feet by 24 feet constructed over Bullock Creek, replacing an old 7-span timber bridge 105 feet by 24 feet.

Strathfieldsaye Shire.—Strathfieldsaye Road—reconstruction and extension of seal 20 feet wide for a distance of 4 miles to provide improved road conditions on this road which will serve as a main access from Bendigo to the new Eppalock Reservoir (Plate 19).

Swan Hill Shire.—Sea Lake-Robinvale Road—7 miles reconstructed ready for sealing between Chinkapook and Cocamba which will eliminate two railway crossings.

Dandenong Division.

Bass Shire.—Dalyston–Glen Forbes Road—1 mile of sealing. Grantville–Glen Alvie Road—1 mile of sealing.

Berwick Shire.—Nar-Nar-Goon-Longwarry Road—1.73 miles of reconstruction.

MAIN ROADS.



Plate 17.—Omeo Shire. Ramrod Flat Road. Completed construction at Ensay.



Plate 18.—Bright Shire. Bright-Tawonga Road. Reconstructed section approximately five miles east of Bright.



Plate 19.—Strathfieldsaye Shire. Strathfieldsaye Road. Reconstructed and sealed section.

Broadford Shire.—Strath Creek Road—2 miles of sealing Broadford-Wallan Road—1·3 miles of sealing. King Parrot Road—1·2 miles of sealing.

Buln Buln Shire.—Neerim East Road—2·8 miles of sealing. Noojee-Powelltown Road—1 mile of sealing.

Eltham Shire.—Yarra Glen-Yea Road—22 feet wide gravel pavement constructed on existing 28 feet formation over a length of $2\cdot 4$ miles from Dixon's Creek to the Healesville–King Lake Road.

Fern Tree Gully Shire.—Fern Tree Gully Road—approaches $\cdot 5$ mile in length constructed to new bridge over Dandenong Creek. The road and bridge are on a much improved alignment, and the section of road previously subject to flooding has now been raised in level.

Flinders Shire.—Mornington–Flinders Road—0.9 mile reconstructed. Rosebud–Flinders Road and Frankston–Flinders Road—0.8 mile reconstruction at junction of these roads in Flinders township, including replacement of old bridge by 72-inch diameter reinforced concrete pipe culvert.

Frankston Shire.—Cranbourne–Frankston Road— $0\cdot47$ mile of reforming and paving from McMahons Road.

Healesville Shire.—Healesville-Yarra Glen Road—1·15 miles of reconstruction and realignment to V–50 m.p.h. standard, approximately 4 miles west of Healesville (Plate 20).

Korumburra Shire.—Bena-Kongwak Road—2 miles of sealing. Fairbank Road— $1\cdot 1$ miles of sealing.

Lillydale Shire.—Monbulk-Seville Road—1 mile of sealing.

Nunawading City.—Canterbury Road— $0\cdot 22$ mile of reconstruction for dual carriageway west of Forest Hill.

Phillip Island Shire.—Ventnor Road—Sealing of 1·3 miles.

Pyalong Shire.—Tooborac-Lancefield Road—Sealing of 1 mile.

Ringwood City.—Canterbury Road—0.28 mile of reconstruction and sealing on new alignment from Bedford Road to city boundary.

Springvale City.—Wells Road—Construction of 0.6 mile of roadworks including level bank, to form approaches to new high level bridge over Carrum Outfall Drain 2.25 miles west of Springvale Road.

Warragul Shire.—Hazeldene Road—1·13 miles of sealing.

Waverley City.—Doncaster-Mordialloc Road—0·26 mile of reconstruction and widening between High Street Road and Holskamp Street.

Yea Shire.—Yea-Glenburn Road—2·2 miles of sealing.

Geelong Division.

Bannockburn Shire.—Geelong–Ballan Road —Reconstruction and realignment continued for a further $2\cdot 2$ miles to complete the sealing of this road throughout.

Barrabool Shire.—Anglesea Road—Through the settlement of Bellbrae, a deviation has been constructed to provide a wider and stronger pavement, on better grades and better alignment, over a length of 1·58 miles. The majority of the work has been completed and sealed, but a new concrete bridge over Spring Creek is at present under construction; it is expected that this structure, together with its approaches, will be available for use by traffic before December, 1962.

Colac Shire.—Corangamite Lake Road—2·25 miles reconstruction and realignment.

 ${\it Corio~Shire}. \hbox{---} \hbox{Geelong---} \hbox{Bacchus~Marsh~Road---} 2\cdot 5 \hbox{~miles~of~narrow~weak~sealed} \\ \hbox{pavement~widened~for~an~18-ft.~seal~and~strengthened~by~re-sheeting}.$

Melton Shire.—Coimadai—Diggers Rest Road—A new reinforced concrete bridge constructed over the east branch of the Kororoit Creek together with approaches on a vastly improved alignment.

Otway Shire.—Charley's Creek Road—2·8 miles of reconstruction, under the plan to totally reconstruct this road, made necessary because of the closure of the Beech Forest railway. Skenes Creek Road—reconstruction and realignment of 1·1 miles.

Horsham Division.

The length of main roads in the division is now 1,037·2 miles of which 949·4 are sealed.

Arapiles Shire.—Horsham-Noradjuha Road—7 miles of widening.

Birchip Shire.—Berriwillock-Birchip Road—5 miles constructed and sealed. Beulah-Birchip-Wycheproof Road—4 miles constructed and sealed, thus completing the link Rainbow-Beulah-Birchip.

Dimboola Shire.—Rainbow Road 17 miles widened.

Karkarooc Shire.—The seal extended on 19.6 miles of main roads within the Shire.

Kowree Shire.—Wombelano Road—3·65 miles constructed and sealed. Kaniva—Edenhope Road—4 miles constructed and sealed. Thirty-three miles of main road within the Shire were resealed.

Stawell Shire.—Landsborough Road—New reinforced concrete bridge over the Wimmera River completed at Joel Joel. Marnoo Road—New reinforced concrete bridge over the Wimmera River at Campbell's Bridge completed. Navarre Road—reconstruction and sealing completed throughout.

Wimmera Shire.—Kalkee Road—Sealed throughout. Horsham-Noradjuha Road—Construction of new bridge over the Wimmera River at Kennys Ford commenced.

Metropolitan Division.

Altona Shire.—Koroit Creek Road—Reconstruction and sealing between Princes Highway West and Maidstone Street.

Box Hill City.—Canterbury Road—Reconstruction and widening Wavell Street to Station Street. Warrigal Road—Reconstruction and widening Canterbury Road to Chester Street (Jt. Camberwell City).

Brighton City.—South Road—Reconstruction of north carriageway, Canberra Grove to Cummins Road.

Camberwell City.—Doncaster Road—New bridge constructed over Koonung Creek (Joint Doncaster and Templestowe Shire).

Heidelberg City.—Bell Street—Reconstruction, as a divided facility, from Oriel Road to Waterdale Road. Heidelberg-Warrandyte Road—completion of bridge over Yarra River (Banksia Street Bridge). Chandler Highway—Reconstruction from Heidelberg-Eltham Road to Yarra River.

 $\begin{tabular}{ll} \it Keilor\ City. -- Melbourne-Bendigo\ Road\ -- Reconstruction\ from\ Walters\ Avenue\ to\ The\ Avenue. \end{tabular}$

Moorabbin City.—Centre Dandenong Road—widening easterly from Warrigal Road. South Road—Construction of new southern lane from Bluff Road to Nepean Highway.

Oakleigh City.—North Road—Reconstruction from Best Street to Warrigal Road. Wellington Road—Reconstruction of Princes Highway East toward Blackburn Road.

Preston City.—Bell Street—Reconstruction from O'Keefe Street to Patterson Street. Whittlesea Road—Construction of new bridge and approaches at Darebin Creek.

Sandringham City.—Beach Road—Widening and regrading Haydens Road to Cromer Road.

South Melbourne City.—Beach Road—Reconstruction of south carriageway, from Fraser Street to Armstrong Street.

Sunshine City.—Millers Road—Widening and duplication from Princes Highway West to Primula Road.

Travalgon Division.

Alberton Shire.—Yarram-Traralgon Road—1 mile of realignment for sealed pavement, near Willung South (Plate 21).

MAIN ROADS.

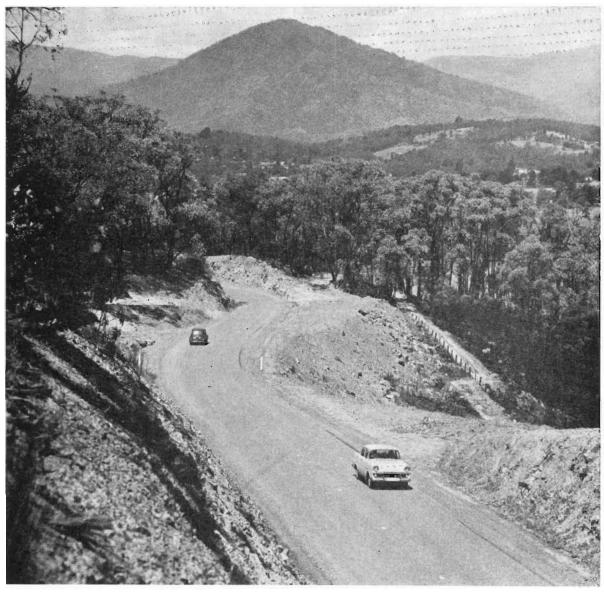


Plate 20.—Healesville Shire. Healesville-Yarra Glen Road. Realignment and reconstruction west of Healesville.

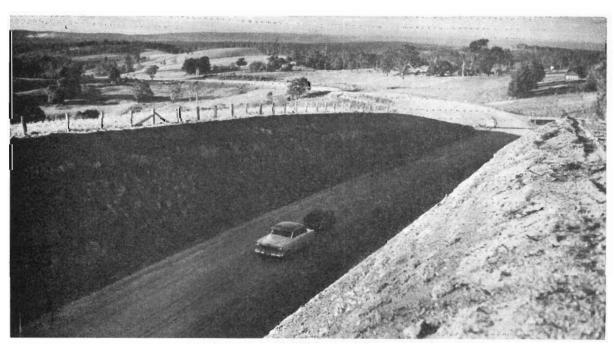


Plate 21.—Alberton Shire. Yarram-Traralgon Road. One mile of realignment at Willung South.

Narracan Shire.—Trafalgar-Thorpdale Road—1·8 miles of realignment and reconstruction for sealed pavement and replacement of two bridges (Frontispiece).

Rosedale Shire.—Maffra—Rosedale Road—3.5 miles of widening for sealed pavement. Traralgon—Maffra Road—Construction of a 2-span pre-stressed slab bridge 42 feet by 24 feet over Toongabbie Creek.

South Gippsland Shire.—Toora–Gunyah Road— $1\cdot 6$ miles of realignment and reconstruction for sealed pavement near Toora.

Traralgon Shire.—Traralgon–Maffra Road—1 mile of reconstruction for sealed pavement and construction of a pre-stressed concrete beam bridge 41 feet by 28 feet over Boyd's Creek.

Woorayl Shire.—Canavan's Road—a composite rolled steel joist and concrete bridge 72 feet by 22 feet constructed over Wilkur Creek. Farmers Road—1·3 miles of reconstruction for sealed pavement, between Meeniyan and Dumbalk. Inverloch—Lower Tarwin Road—1 mile of construction of deviation, east of Inverloch.

Warrnambool Division.

Dundas Shire.—Hamilton-Port Fairy Road—Realignment, construction and sealing of three curves, 0.6 mile, and reconstruction and sealing of 0.75 mile.

Glenelg Shire.—Casterton-Apsley Road—4 miles of reconstruction and sealing.

Hamilton City.—Dartmoor-Hamilton Road—Three-span reinforced concrete bridge 104 feet by 28 feet 6 inches constructed over Grange Burn River.

 $Hampden\ Shire.$ —Camperdown–Ballarat Road— $2\cdot 2$ miles of reconstruction and sealing.

Heytesbury Shire.—Timboon–Nullawarre Road—3.8 miles of reconstruction and sealing and 2.3 miles of reconstruction.

Portland Shire.—Woolsthorpe-Heywood Road—A 2-span reinforced concrete and rolled steel joist bridge 80 feet by 26 feet constructed over Darlots Creek. Reconstruction of 1.5 miles.

11. UNCLASSIFIED ROADS.

In accordance with its usual practice the Board in the year 1961–62 again assisted councils in undertaking works of major improvement and construction and in general maintenance of unclassified roads under municipal jurisdiction.

The following table shows the allocations and expenditure and relates to the financial assistance provided by the Board apart from councils' contributions—

	 ·	1960-61.	1961-62.
Construction		£'000s.	£'000s.
Construction— Applications (totals)	 	 14,535	14,765
Allocations (Country Roads Board portion)	 	6,023	6,231
Expenditure (Country Roads Board portion)	 	 3,634	4,520
Maintenance—			
Applications (totals)	 	 1,500	1,562
Allocations (Country Roads Board portion)	 	 652	697
Expenditure (Country Roads Board portion)	 	 593	673

The average ratio of Board's provision to councils' contribution is approximately 3 to 1.

Particulars of some major works typical of the many improvements on unclassified roads undertaken during the year are set out hereunder—

Bairnsdale Division.

Orbost and Tambo Shires.—Bonang-Gelantipy Road—Curve improvements and replacement of timber culverts proceeded.

Ballarat Division.

Ararat Shire.—Warrak Road—Further progress made in constructing 5 miles near Warrak.

Creswick Shire. —Deep Creek Road—Construction of $1\cdot 5$ miles on a deviation of this road commenced.

Grenville Shire.—Linton-Naringhil Road—3.5 miles of construction and sealing.

Lexton Shire.—Lexton-Ararat Road—Construction of a 4-span bridge 80 feet long over the Avoca River, and approaches.

Newstead Shire.—Kemp's Bridge Road—Three 40-ft. spans of the pre-stressed concrete bridge over Loddon River completed.

Ripon Shire.—Mt. Emu-Streatham Road—3.5 miles of reconstruction and sealing. Mt. Emu Settlement Road—3 miles of reconstruction and sealing.

Tullaroop Shire.—Maryborough-Baringhup West Road—Construction of new reinforced concrete bridge 120 feet long over Deep Creek commenced.

Benalla Division.

Benalla Shire.—Winton-Lurg Road—2.7 miles of re-sheeting and sealing (Plate 22).

Nurmurkah~Shire.—North and South Boundary Road—2 \cdot 5 miles of reconstruction and sealing.

Oxley Shire (Joint Myrtleford Shire).—Merriang Estate Road—Construction of a 6-span bridge with reinforced concrete substructure on reinforced concrete piles, rolled steel joist beams and timber deck.

 $Towong~Shire. — Lockharts~Gap~Road — 0\cdot7~mile~of~reconstruction.~Mitta~Mitta~Road — Construction~of~6-span~bridge,~239~feet~by~12~feet~over~Mitta~Mitta~River.$

Bendigo Division.

Bendigo City.—Williamson Street—Construction of a reinforced concrete single-span bridge over Back Creek, replacing a timber structure.

East Loddon Shire.—Dingee-Serpentine Road—3.6 miles of construction and sealing.

Echuca Borough.—Hovell Street—1 mile of construction and sealing between Anstruther Street and the Murray Valley Highway.

McIvor Shire.—Knowsley-Eppalock Road—Strengthening and sealing of 3 miles of new road constructed for the State Rivers and Water Supply Commission (Plate 23).

Mildura Shire.—Red Cliffs-Morkalla Road—4 miles of construction and sealing between Meringur and Karween railway sidings.

Rochester Shire.—Thompson's Weir Road—Construction of a rolled steel joist and timber bridge 120 feet by 12 feet over Gunbower Creek replacing an old timber bridge which crossed Gunbower Creek via the State Rivers and Water Supply Commission's weir bank.

Swan Hill Shire.—Fish Point Road—2 miles of construction and sealing.

 $Wycheproof~Shire. — Wycheproof-Corack~~Road\\ -0.75~~mile~~of~~construction~~and~~sealing.$

Dandenong Division.

Bass Shire.—Corinella Road— $2\cdot 2$ miles of forming and surfacing eastwards from Township of Corinella.

UNCLASSIFIED ROADS.

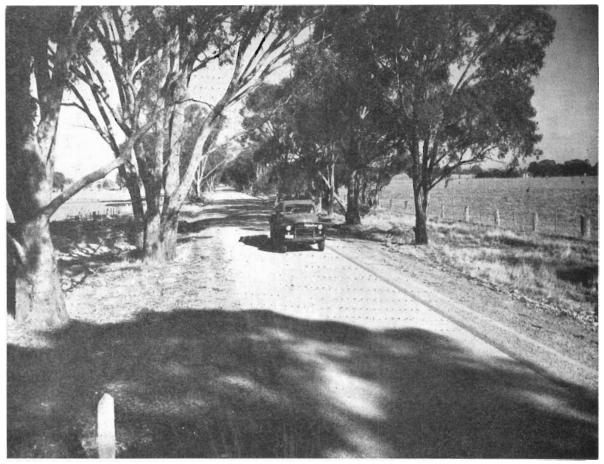


Plate 22.—Benalla Shire. Winton-Lurg Road. Resheet and seal near Winton.

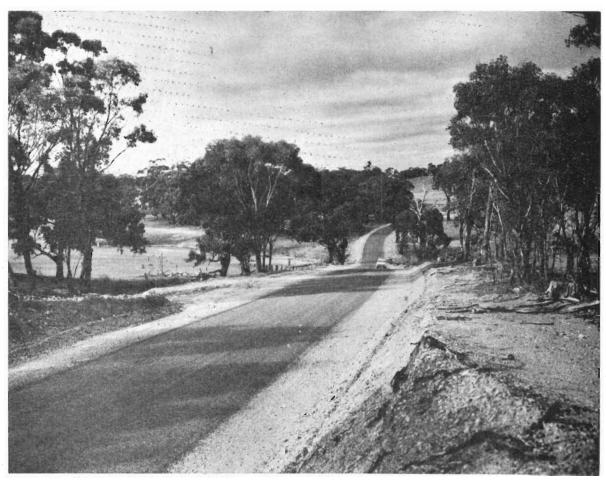


Plate 23.—McIvor Shire. Knowsley-Eppalock Road, to Eppalock Reservoir.

Dandenong City.—0·38 mile of construction and sealing of approaches to Clow Street bridge.

Eltham Shire.—Research—Warrandyte Road—0.74 mile of reconstruction and realignment west of Stony Creek.

Mornington Shire.—Wooralla Drive and Mount Eliza—1·46 miles of formation and pavement construction between Tower Road and Moorooduc Road.

Nunawading City (Joint with Box Hill City).—Middleborough Road—0.42 mile of reconstruction between Springfield Road and Katrina Street.

Ringwood City.—Alexandra Road—0·41 mile of reconstruction and widening between Dublin Street and Bondi Street.

Waverley City.—Blackburn Road—1 mile of reconstruction between Fern Tree Gully Road and Waverley Road.

Geelong Division.

Bulla Shire.—Vineyard Road—Reconstruction completed to provide a sealed connexion from the Calder Highway and Diggers Rest to Sunbury.

Corio Shire.—Station Road, Lara—A new reinforced concrete and steel bridge over Hovell's Creek and 0.75 mile of roadworks completed to provide an alternative all-weather route to Lara.

Kyneton Shire.—Games Lane North—4·4 miles of forming, paving and sealing completed to improve timber extraction facilities in this area.

Melton Shire.—Derrimut Road—2·3 miles of strengthening and sealing, completing the important link between Rockbank and Werribee or between the Western and Princes Highways.

Newtown and Chilwell Shire (Joint Shire of South Barwon).—Princes Bridge—Construction of a new bridge over the Barwon River at Highton commenced.

Otway Shire.—Carlisle-Colac Road—Construction of a 3-span concrete, steel and timber bridge over the Gellibrand River.

South Barwon Shire.—Settlement Road project at Belmont—A further stage of the development of an alternative route for traffic through Belmont was constructed along the continuation of Separation Street, from the Torquay Road to Bailey Street for a length of 0.5 mile.

Horsham Division.

At present 373 miles of unclassified roads have been sealed. The extension to the sealed length was 80 miles for the year.

Dimboola Shire.—Peppers Plains Road—2·3 miles of sealing. This completes the seal on this road in the Shire of Dimboola.

Dunmunkle and Donald Shires.—At the Richardson River an old narrow timber bridge was replaced by a new reinforced concrete bridge.

Kaniva Shire.—Serviceton North Road—2 miles constructed. Yearinga Extension Road—1 mile constructed.

Kowree Shire.—The length of seal on various unclassified roads was extended by 16 miles in this Shire, including 3.5 miles on the Rocklands Road.

Stawell Shire.—Several bridges were completed on unclassified roads.

Warracknabeal Shire.—The length of seal was extended by 11.6 miles on various unclassified roads, including three miles on the Rupanyup Road.

Wimmera Shire.—Riverside Road—A new concrete bridge is being constructed over the Wimmera River replacing an old narrow timber bridge.

Metropolitan Division.

Altona Shire.—Maidstone Street—Reconstruction and widening from Kororcit Creek Road south to Geelong railway line.

Box Hill City.—Station Street—Reconstruction and widening north of Maroondah Highway.

Brunswick City.—Victoria Street West—Reconstruction between Gardiner Street and Pearson Street.

 ${\it Camberwell~City.} {\it --} {\it Balwyn~Road--Widening~from~Whitehorse~Road~to~Belmore~Road.}$

Coburg City.—Gaffney Street—Reconstruction and widening from Sussex Street to Cumberland Road. Murray Road—Bridge widening and construction of approaches over Merri Creek commenced (Plate 24). Newlands Road—Construction of bridge and approaches over Moonee Ponds Creek. Reynard Street—Construction of bridge and approaches over Moonee Ponds Creek.

Footscray City.—Sunshine Road—Reconstruction from Grainger's Road to Geelong Road.

 $Heidelberg\ City.$ —Burke Road—Reconstruction with dual carriageways from Yarra River to the Boulevard.

Moorabbin City.—Centre Road—Widening and reconstruction from Warrigal Road to East Boundary Road.

Oakleigh City.—Huntingdale Road—Reconstruction and widening from Princes Highway to Fern Tree Gully Road.

 ${\it Richmond~City.} \hbox{--Burnley~Street---Reshaping, strengthening and bituminous surface treatment from Swan Street to Bridge Road.}$

St. Kilda City.—Grey Street, Barkly Street, Mitford Street reconstruction.

South Melbourne City.—City Road—Commencement of replacement of road blocks with asphaltic concrete from Sturt Street to Kings Way.

Travalgon Division.

 $\it Mirboo~Shire. — Limonite~Road — 1 \cdot 25~miles~of~realignment~and~reconstruction~for~sealed~pavement.$

 ${\it Morwell~Shire.} - {\rm Mountain~Hut~Road} - 3 \cdot 0 {\rm ~miles~of~reconstruction~for~sealed~pavement.}$

Rosedale Shire.—Cowwarr—Seaton Road—Construction of a 3-span reinforced concrete and pre-stressed beam bridge 120 feet by 20 feet over Thomson River. Glengarry North Road—Construction of a 3-span pre-stressed slab bridge 90 feet by 20 feet over Eaglehawk Creek.

South Gippsland Shire.—Promontory Road—4 miles of reconstruction for sealed pavement, south of Yanakie and 1·1 miles of realignment for sealed pavement through sand hills (Plate 25).

Woorayl Shire.—Buffalo–Fish Creek Road— $1\cdot 6$ miles of reconstruction and realignment for sealed pavement near Buffalo (Plate 26) to complete the reconstruction and sealing of the road between Meeniyan and Fish Creek.

Warrnambool Division.

Portland Shire.—Condah–Coleraine Road—3 miles of re-sheeting and sealing. Lyons–Hotspur Road—Construction of reinforced concrete bridge and approaches. Winnap–Drik Drik Road— $2\cdot25$ miles of reconstruction and sealing. Portland–Nelson Road—Construction of approaches to bridge—Mileage $8\cdot92$ to $9\cdot89$.

UNCLASSIFIED ROADS.

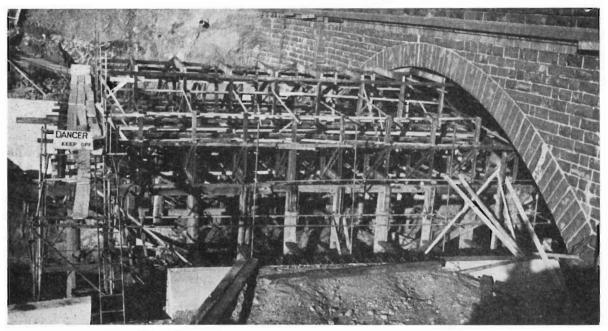


Plate 24.—Coburg City. Murray Road. Bridge over Merri Creek during reconstruction and widening.



Plate 25.—South Gippsland Shire. Promontory Road. 1.1 miles of realignment through sand hills before sealing.

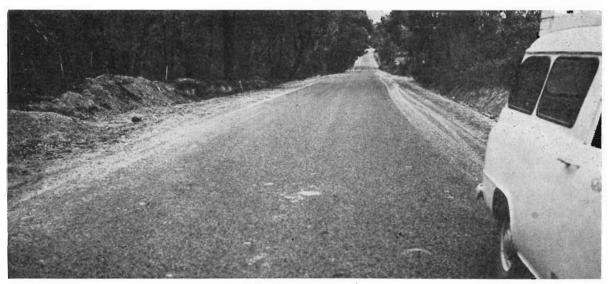


Plate 26.—Woorayl Shire. Buffalo-Fish Creek Road. Reconstructed and sealed section near Buffalo.

12. TOURISTS' ROADS.

The length of tourists' roads declared under the Country Roads Act remained unaltered at 426 miles during the year. Applications for funds by Board's Divisional Engineers totalled £856,660 and the Board allocated an amount of £701,710.

The Board is responsible for the full cost of maintenance and improvements on tourists' roads, and the work is carried out directly by the Board, with the exception of a section of the Ocean Road in the Shire of Otway and the Arthur's Seat Road in the Shire of Flinders.

The Board's system of declared tourists' roads provides access to some of the principal tourist attractions of the State, including the rugged coastal areas stetching from Torquay to Port Campbell, and including the ocean beach resorts of Torquay, Anglesea, Lorne and Apollo Bay, to the popular fishing resorts of Sydenham Inlet, Mallacoota and Gipsy Point in eastern Victoria, to the picturesque hill scenery of the Dandenong Ranges close to Melbourne and the rugged beauty of the Grampians Mountains in the central west, to the Alpine regions of the north-eastern district, and to Mount Donna Buang which is within easy reach of Melbourne.

The growing popularity of winter sports has created a demand for improved facilities, particularly to the popular resorts of Mount Buller, Mount Buffalo (Plate 27) and Mount Hotham, all served by declared tourists' roads, and also to Mount Donna Buang which attracts many sightseers as well as skiers when the snow is suitable. Maintenance of access to these resorts in the winter involves snow removal, and in a normal year expenditure on this account alone amounts to approximately £12,000. The Board does not undertake to keep the whole of the roads at the high altitudes clear of snow at all times, and on the most difficult section—The Alpine Road over Mount Hotham, snow removal during the winter of 1962 included the following sections:—

- (a) From Omeo as far as Slatey Cutting and when possible, to the vicinity of the East Gippsland Ski Club Lodge;
- (b) From Harrietville as far as the flat near Hotham Heights Hotel until the end of June, and after the end of August. In the intervening period the road is cleared when possible up to the Diamentina Hut (Plate 28).

The major improvement works carried out on tourists' roads during the year were as follow:—

Alpine Road.—One mile of road reconstructed near Dinner Plain, south of Mount Hotham and widening of 2 miles between the Country Roads Board hut and Blowhard and between the Gallows and Diamentina Hut and a further 2.5 miles above the Sambas Mine. In addition, a heavy stone-crushing unit was employed during the summer months to stockpile crushed stone for future surfacing work on the south side of the mountain.

Mount Buffalo Road.—A length of 0.6 mile was widened to 24 feet near Stakers Lookout and 3.7 miles between Eurobin Falls and Stakers Lookout.

Mount Buller Road.—Further widening to provide a clear formation width of 20 feet was carried out at various sections extending over 1.9 miles and 0.8 mile reconstructed and sealed near Merrijig.

Acheron Way.—Reconstruction and realignment of 2.5 miles on the Warburton side of Cement Creek, including a sealed pavement 20 feet wide.

Ocean Road.—Widening of a section 0.75 mile in length between Eastern View and Cinema Point, a new concrete bridge at Jamieson River with approaches above flood level and widening of curves at various locations between Lorne and Apollo Bay. The provision of a new bridge over the Barham River at Apollo Bay.

Grampians Road.—New bridges replacing timber bridges were constructed at Barneys Creek, Bovine Creek, the second crossing of Fyans Creek and at the first and second crossings of the Wannon Creek (Plate 29).

TOURISTS' ROADS.



Plate 27.—Bright Shire. Snow blower working at The Cathedral, Mount Buffalo Road.

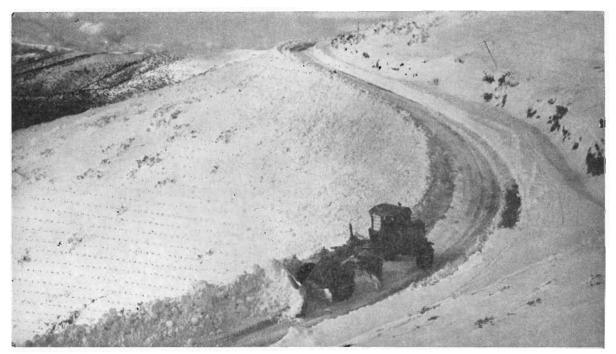


Plate 28.—Bright Shire. Alpine Road. Grader snow plough working at Mount Hotham above Diamentina Hut.



Plate 29.—Stawell Shire. Grampians Road. New bridge over Wannon Creek No. I.

13. FOREST ROADS.

Applications totalling £448,141 were received for the 463 miles of forest roads proclaimed under the Country Roads Act and £378,730 was allocated.

Much of this work is under council supervision, but no contribution is required from councils.

Major works on forest roads undertaken during the year included—

Benalla Shire.—Tatong-Tolmie Road—Construction of a 3-span rolled steel joist and concrete bridge 96 feet 5 inches by 24 feet over Holland's Creek.

Otway Shire.—Forrest-Apollo Bay Road—1.5 miles of reconstruction on virtually new and improved alignment.

Tambo Shire.—Bruthen-Buchan Road—2·3 miles of reconstruction near the Red Knob junction to be sealed at an early date (Plate 30).

Newstead Shire and Glenlyon Shire.—Drummond-Vaughan Road—2·5 miles of construction and sealing.



Plate 30.—Tambo Shire. Bruthen-Buchan Forest Road. Reconstructed section near Red Knob Junction.

14. BRIDGES.

The value of new bridge projects from Board funds commenced during the year have shown a further increase compared with the previous twelve months.

During the year 1961–62, 199 new bridges were started of an estimated total value of £2,119,000 compared with bridge projects valued at £1,724,000 in 1960–61. One hundred twenty-eight of these new bridges (estimated to cost £800,000) were under municipal supervision and 71 (estimated to cost £1,319,000) were under the Board's supervision.

In addition, the Board's Bridge Division collaborated in the design of some of the more complex bridges constructed under municipal supervision.

Major bridges completed under the Board's supervision in various parts of Victoria during 1961–62 included:—

- (a) 184 feet by 28 feet between kerbs reinforced concrete and pre-stressed flat slab bridge over a floodway of the Thomson River at Wurruk on the Princes Highway East near Sale.
- (b) 486 feet by 26 feet between kerbs composite reinforced concrete and rolled steel girder bridge over the Campaspe River on the Northern Highway at Elmore. The Chairman, Mr. D. V. Darwin, performed the opening ceremony on 16th February, 1962 (Plate 31).
- (c) 152 feet by 28 feet between kerbs reinforced concrete and pre-stressed flat slab bridge plus two pre-stressed slab flood opening structures, one of 30 feet and one of 45 feet by 28 feet between kerbs over Dandenong Creek on a section of the Fern Tree Gully Road, frequently subject to flooding. Completion of this work will eliminate all but rare interruptions to traffic at this crossing.
- (d) 176 feet by 28 feet between kerbs over the Moe River at 70·4 miles on the Princes Highway East. The new pre-stressed concrete slab bridge replaced a sub-load standard concrete bridge built in 1916 and widened to 22 feet in 1936.
- (e) Three reinforced concrete and precast pre-stressed concrete beam bridges each 28 feet wide by 106 feet, 121 feet and 141 feet, respectively, together with five 14 feet by 10 feet reinforced concrete subway structures at a total cost of £85,000 on the Hume By-pass Road.
- (f) Three hundred tons of welded steelwork was completed and erected for the high tensile bolted steel truss bridge 450 feet by 22 feet between kerbs plus a 4-ft. footway over the Glenelg River at Nelson (Plates 9 and 10, Chief Engineer's report). It is anticipated that the reinforced concrete deck will be completed early in 1963.

Some of the larger bridges constructed during the year under municipal supervision included—

- (a) Joel Joel bridge 400 feet by 24 feet between kerbs of reinforced concrete, steel girder and rail construction over the Wimmera River on the Joel Joel-Crowlands Road and Campbell's Bridge 270 feet by 24 feet over the Wimmera River on the Stawell-Marnoo Road. The Chairman, Mr. D. V. Darwin performed the opening ceremony of these two Stawell Shire bridges on 10th August, 1961.
- (b) 240 feet by 22 feet between kerbs reinforced concrete and pre-stressed concrete beam bridge over the Goulburn River on the Back Eildon Road, in the Shire of Alexandra. A Board Member, Mr. W. H. Neville, performed the opening ceremony on 21st February, 1962.
- (c) 200 feet by 24 feet between kerbs plus a 6-ft. footway reinforced concrete and rolled steel girder bridge over Hovells Creek, Station Street, Lara in the Shire of Corio (Plate 32).
- (d) A reinforced concrete and pre-stressed beam bridge 180 feet by 28 feet between kerbs over Mordialloc Creek and an adjoining drain on Wells Road in the City of Springvale.
- (e) Dykes Bridge 100 feet by 22 feet between kerbs constructed of reinforced concrete and pre-stressed concerete beams over the Tarwin River on the Grand Ridge Road in the Shire of Mirboo. The new bridge was constructed by Mr. J. C. Hourigan who had approximately 40 years earlier constructed the timber bridge which it replaced. The Chairman, Mr. D. V. Darwin performed the opening ceremony on 21st March, 1962.
- (f) 140 feet by 24 feet between kerbs of reinforced concrete and pre-stressed concrete slab construction, over Mount Hope Creek on the Mitiamo-Echuca Road in the Shire of East Loddon.

METROPOLITAN BRIDGES AND OVERPASSES.

As in previous years the Board has continued with the construction of a considerable number of bridges and overpasses in the metropolitan area. Included amongst those on which construction was started or completed during the year were—

- (a) 210 feet by 52 feet plus a 6-ft. footway in pre-stressed concrete slab deck construction on long steel shell piles over the Coal Canal on Footscray Road in the City of Melbourne. Work is expected to be completed early in 1963.
- (b) A bridge over the Yarra River 276 feet by 28 feet plus two 6-ft. footways of reinforced concrete and welded steel plate girder construction on Fitzsimmons Lane in the Shires of Eltham, and Doncaster and Templestowe. The Chairman, Mr. D. V. Darwin officially opened the bridge on 13th October, 1961 (Plate 33).
- (c) 91 feet 6 inches by 48 feet reinforced concrete and pre-stressed concrete slab bridge over Moonee Ponds Creek on Pascoe Vale Road in the City of Broadmeadows.
- (d) A bridge 122 feet by 28 feet plus a 6-ft. footway constructed in reinforced concrete with pre-stressed concrete beams over Merri Creek on Newlands Road in the City of Coburg.
- (e) Reconstruction and widening under traffic to 126 feet by 50 feet plus two 8-ft. footways of the St. Georges Road bridge over the Merri Creek in the Cities of Fitzroy and Northcote using reinforced concrete and rolled steel girder construction.
- (f) The northern lane main structure 204 feet by 28 feet using rolled steel girders and reinforced concrete construction together with ancillary structures for the Albion rail overpass on the Western Highway.
- (g) Twin overpass structures, each 241 feet by 27 feet constructed in reinforced concrete and pre-stressed concrete beams together with a 14-ft. diameter pipe culvert 230 feet long at Aitken's Creek for the Craigieburn rail overpass on the Hume Highway.

MATERIALS.

During the year contracts were let for the supply of 8,000 tons of pre-stressed concrete bridge components of a value of £160,000 and reinforced concrete pipes and box culverts valued at £210,000. All the pre-stressed concrete units were supplied completely from metropolitan factories whilst, as in the previous year, approximately one-half of the concrete pipe requirements and two-thirds of box culvert requirements were provided by country contractors.

Corrugated steel pipe and guard-rail purchases during the year totalled £27,400. Ample supplies of cement were available and approximately 9,500 tons was used directly on Board projects.

Due to stocks held and the availability of local supplies there were no shortages of steel girders or steel reinforcing rounds. Approximately 800 tons of rolled steel girders and 2,100 tons of reinforcing rounds were used in Board projects.

Bridge Inspections.

The Board's Bridge Inspecting Engineers carried out detailed inspections of approximately 260 bridges totalling over 30,000 lineal feet and in addition introduced a system of inspection of many bridges which had been inspected in detail some years previously.

TENDERING.

Tendering for bridge contracts advertised by the Board and municipalities has become intensely competitive and a considerable proportion of new bridge construction in the State is now being carried out by contract, with the majority of materials and components supplied by the Board.

BRIDGES.

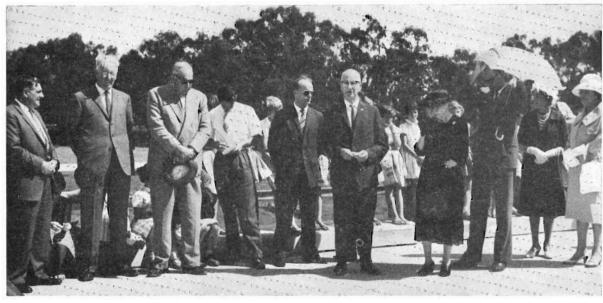


Plate 31.—Huntly and Waranga Shires. Northern Highway. Mr. D. V. Darwin, Chairman of the Country Roads Board, opening the bridge over the Campaspe River at Elmore.

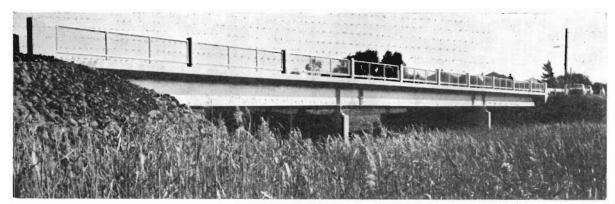


Plate 32.—Corio Shire. Station Street. Hume Bridge over Hovells Creek at Lara.

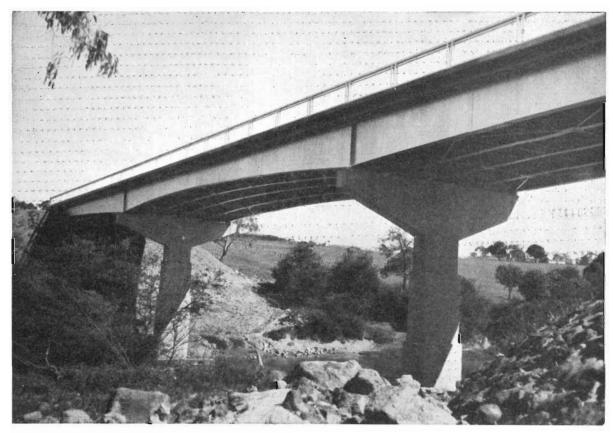


Plate 33.—Doncaster and Templestowe and Eltham Shires. Bridge over Yarra River between Eltham and Templestowe.

15. BITUMINOUS SURFACING.

EXTENT OF WORK.

The total length of bituminous surfacing completed on all classes of roads in 1961–62 amounted to 2,817 miles, representing an increase of 1·2 per cent. on the length of work done in 1960–61 and providing an additional length of 1,154 miles of sealed roads, 193 miles of widening of the existing sealed pavement, 8 miles of duplication of existing carriageways, 371 miles of restoration of the seal coat on reconstructed sections, and 969 miles of maintenance retreatment. It also included 122 miles of sealing work undertaken to assist State and Commonwealth Authorities and for municipalities in cases where no grant has been made by the Board.

The extension of the sealed network added 97 miles to the sealed length on State highways, by-pass roads, tourists' roads and forest roads, 380 miles on main roads and 677 miles on unclassified roads. Retreatment and restoration of the seal coat on reconstructed sections of the declared system amounted to 1,099 miles or 9·6 per cent. of the sealed system, retreatment amounting to 772 miles or 6·7 per cent. 11,480 miles or 79 per cent. of the Board's declared system is now provided with a sealed surface. The Chief Engineer's report shows full details of the various types of treatment carried out on different road categories. A length of 86 miles of bituminous concrete surfacing involving the use of 139,185 tons of hot-mixed bituminous concrete was laid on various widths by contractors on more heavily trafficked roads nearer the metropolitan area, Dandenong and Geelong. This was an increase of 71 per cent. on the quantity of this type of material used in 1960–61.

BITUMINOUS PLANT AND PERSONNEL.

The sprayed bituminous surfacing was carried out by twenty-six mobile spraying units, approximately 660 of the Board's direct labour force being employed on the work. This organization was augmented in certain cases by suitably equipped municipalities and contractors.

SUPPLY OF MATERIAL.

Twenty-seven thousand five hundred and fifteen tons of bitumen in bulk and 95 tons of bitumen in drums used in the sprayed work were supplied by the two Victorian oil refineries. Seventy per cent. of the quantity supplied in bulk was distributed throughout the State by rail tank cars and 30 per cent. by road tankers. A further quantity of approximately 6,900 tons of bitumen was used in hot-mixed bituminous concrete supplied by contractors. Approximately 8,500 tons of tars and cutback bitumen supplied from various gas works and oil refineries were used for priming initial treatment work and for maintenance purposes.

Industrial disturbance at one of the oil refineries during the busy period of the year stopped the supply of bitumen by rail delivery cars for a period of one week. This emphasized the need for maintaining independent efficient road transportation service with bulk bitumen tankers, without which it would have been impossible to maintain the supply of bitumen to many of the Board's mobile spraying units.

Two hundred and seventy-seven thousand four hundred and eighteen cubic yards of covering aggregate were used in the sprayed work, this being supplied, as before, by contractors and two of the Board's own crushing plants. Table 5 in the Chief Engineer's report indicates the trend in costs of aggregate over the past five years.

Plate 34 is a map of Victoria showing by various types of shading the percentages of Board's declared roads which have been sealed in each municipality.

16. ROAD FURNITURE.

To assist in the guidance of heavy volumes of fast moving traffic on State highways and by-pass roads, the Board has taken the following additional action in the provision of road furniture in the form of delineators and road signs—

Delineators.—Strips of reflecting material, 4 inches by 1 inch have been placed near the top of every guide post on the full length of the Hume Highway from Melbourne to the New South Wales border to give a more effective indication of the alignment of the roadway at night. In accordance with the Standards Association of Australia Road Signs Code 1960, the delineators used on the left side of the road are red and those on the right are white.

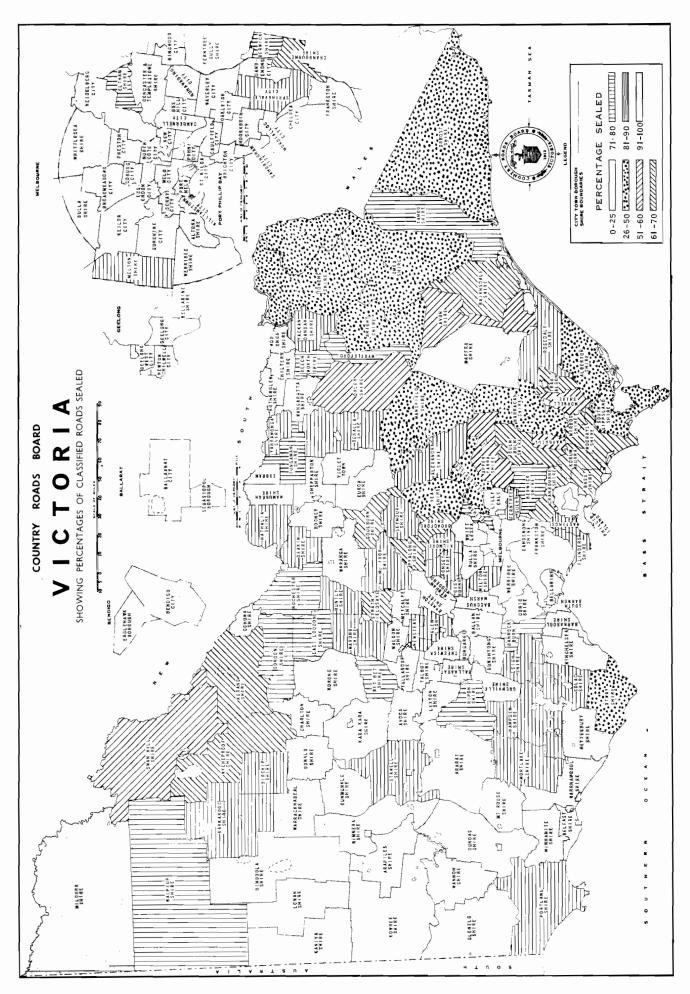


Plate 34.

Road Signs.—With the opening in 1961–62 of the first lengths of by-pass road, it was desired to adopt a distinctive colour system for direction and information signs. The Standards Association of Australia Road Signs Code 1960, provides that coloured backgrounds may be used on signs for the purpose of identifying special routes. It was decided by the Board to use green signs with white lettering and this colour combination was subsequently adopted by the National Association of Australian State Road Authorities for use on limited access routes. These signs are larger than those normally on other roads.

A decision was also made to alter the colour system on advance direction signs throughout the State. These signs, which were previously white with black lettering, required large areas of relatively expensive reflectorized material for the background. All new advance direction signs have black backgrounds with white reflectorized letters. They are at least as effective as the previous design and are considerably cheaper to manufacture.

17. RURAL FINANCE AND SETTLEMENT COMMISSION ESTATE ROADS.

The Board has now completed its seventh construction season in the Heytesbury Settlement Area, in conjunction with the Rural Finance and Settlement Commission (Plate 35). The programme in 1961–62 involved the construction of 19·25 miles of formation by direct labour, and 23·75 miles of pavement by both direct labour and contract. One small bridge and a number of large diameter culverts with endwalls were constructed.

Work was also undertaken for the Rural Finance and Settlement Commission on Warrowie Estate in the Shire of Colac and on the East Goulburn irrigation settlement area, in the Shire of Tungamah.

During the year the total expenditure on road and bridge works to serve Soldier Settlement Estates was £228,172 of which one-half is borne by the Commission, three-eighths by the Board and one-eighth by the councils.

The total expenditure on all road and bridge works associated with Soldier Settlement Estates since the inception of the scheme in 1947 is £2,215,588 of which £1,238,859 was contributed by the Commission, £708,464 by the Board and £268,265 by the councils.



Plate 35.—Heytesbury Shire. Heytesbury Settlement area. New stockyard road.

WORKS FOR OTHER AUTHORITIES.



Plate 36.—Morwell Shire. Princes Highway East, Section 2. Channelization on deviation of highway at Hernes Oak constructed as result of operations of State Electricity Commission work in the area.



Plate 37.—Morwell Shire. Tree plantation on Morwell end of Hernes Oak deviation.



Plate 38.—Narracan Shire. Walhalla Road. Deviation made necessary as result of construction of Moondarra Reservoir by Latrobe Valley Water and Sewerage Board.



Plate 39.—Maffra Shire. Tamboritha Road. One of the bridges built in the reconstruction of this access road for the Forests Commission.

18. WORKS FOR OTHER AUTHORITIES.

The following summary shows works undertaken during the year at the cost of other Authorities— $\,$

Works Executed on Behalf of Commonwealth and State Government Authorities for Year Ended 30th June, 1962.

Departments.	Description of Works.		Ex	oendi	cure.		
Victorian Departments.		£	8.	d.	£	s.	d.
State Rivers and Water	Construction of various bridges over Commission channels;	29,410	5	1			
Supply Commission Rural Finance and Settlement Commission	roadworks in connexion with Eppalock Weir, &c. Roadworks—Commission estates throughout the State	187,103	5	5			
State Electricity Commission	Roadworks—Morwell Shirc—Hernes Oak Deviation (Plates 36 and 37)	5,516	1	6			
Housing Commission Department of Lands and	Roadworks in Morwell Housing Estate	40,296 26,731					
Survey Department of Public Works	Roadworks—Albert Park Lake Reserve roads. Con- struction of various fruit fly inspection points	2,998	9 1	0			
Melbourne and Metropolitan Board of Works	Roadworks—Healesville Shire	2,214					
Latrobe Valley Water and Sewerage Board Forests Commission	Roadworks—Gould deviation on Walhalla Road, Shire of Narraean (Plate 38) Road and Bridgeworks in Shire of Maffra (Plate 39)	36,033					
Forests Commission Victorian Railways	Road and Bridgeworks in Shire of Maffra (Plate 39) Deviation of Hume Highway at Broadford	13,791 8,915			353,011	6	0
Commonwealth Departments.					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
Department of Works	Roadworks—Various access roads to Commonwealth establishments (Plate 40)	74,506	12	1			
					74,506	12	1
Special Projects.							
Kings Bridge	Construction of bridge over Yarra River with southern viaduct approach and overpass in Flinders Street, including land acquisition—Cities of Melbourne and South Melbourne	280,317	2	3			
Napier Street Bridge	Construction of bridge over the Maribyrnong River and rail overpass—Cities of Melbourne and Footseray	1,103	3	7			
Coal Canal Bridge	Construction of temporary and permanent bridge over the Railway Coal Canal at West Melbourne—City of Melbourne	46,261	1	8			
Railway Level Crossings Municipalities Forest Road	Elimination of various railway level crossings Improvement of various roads adjacent to State forests to	*31,870 11,738			r.		
Improvements Lower Yarra Crossing	facilitate the extraction of forest produce General and preliminary foundation investigations	28,278	10	8	335,827	10	11
	Total			_	763,345		

^{*} Includes credit adjustment of £162,789 16s. 6d.

19. ELIMINATION OF RAILWAY LEVEL CROSSINGS.

Expenditure incurred during the year on projects concerned with the elimination of railway level crossings was shared as follows:—

			${\mathfrak L}$
Country Roads Board		 	 598,416
Level Crossings Fund		 	 311,199
Victorian Railways		 	 290,780
Uniform Rail Gauge Trust	Fund	 	 104,230
Total		 	 1,304,625

The concentration of effort was mainly on works associated with the new standard gauge line between Melbourne and Sydney. Expenditure incurred by the Board on such works amounted to £465,584 and included the following projects—

Hampshire Road Over-pass, Sunshine City (Plate 41).

Western Highway, Albion Over-pass.

Hume Highway, Craigieburn Over-pass.

Hume Highway, Tallarook Under-pass.

Goulburn Valley Highway, Seymour Under-pass.

Anderson Street Over-pass, Euroa.

Rowan Street Under-pass, Wangaratta.

Templeton Street Pedestrian Under-pass, Wangaratta.

Hume By-pass Road, Chiltern.

There was little money available for projects elsewhere in the State, but progress was made on works to eliminate level crossings in Pascoe Vale Road, Strathmore, and the Princes Highway West at Brooklyn.

During the year preliminary investigations were made into the needs and priorities for the elimination of railway level crossings on the Western Highway at Wallace, Bungaree, Buangor, Beaufort and Wail. Other preliminary investigations were carried out at Burnley; Camp Road, Broadmeadows; Somerville Road, Yarraville; and at Maindample.

20. FLOOD AND BUSHFIRE DAMAGE.

As a result of the dry conditions no flooding with consequent damage to roads and bridges took place, but the dryness of the countryside provided the worst bushfire conditions since 1939.

In January, extensive bushfires occurred in the Healesville, Launching Place, Eltham, Warrandyte and Mount Dandenong districts, resulting in loss of life, considerable damage to property and the destruction of large areas of bushlands.

As far as roads and bridges were concerned, damage was confined mainly to timber bridges under the jurisdiction of municipal councils.

The Board was asked to assist in the fighting of fires with water tankers and manpower and immediate action was taken to concentrate tankers from the Board's Syndal Depot and from various road projects.

These tankers were despatched to destinations decided upon by the Country Fire Authority (Plate 42). In addition, all Country Roads Board regional divisions were alerted to have their tankers available, manned by two drivers and equipped with spare pumps, to be prepared to move at one hour's notice.

In all, nineteen tankers were despatched to various centres at the request of the Country Fire Authority.

The Board also provided trucks for evacuation purposes in the Fern Tree Gully area and to carry supplies to the Warrandyte district.

The cost of restoration of damage to bridges in the Healesville and Eltham Shires alone is estimated at £31,020.

21. LOWER YARRA CROSSING.

To establish engineering and economic data on which the provision of a toll crossing of the Lower Yarra River can be based, the Board was authorized by the Government to carry out investigations and an allocation of £50,000 was made by the Government for the purpose.

Bulletins have being issued to interested parties furnishing very detailed results of bores, soil tests and traffic studies.

WORK FOR OTHER AUTHORITIES.

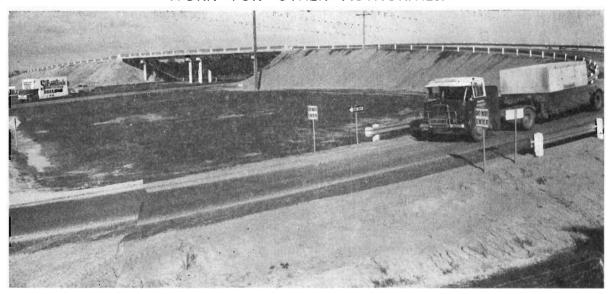


Plate 40.—Corio Shire. Princes Highway West, Section I. Overpass at Point Wilson turn-off to provide safer crossing of the highway by explosives trucks.

ELIMINATION OF LEVEL CROSSINGS.



Plate 41.—Sunshine City. Hampshire Road. Sunshine railway overpass.

BUSHFIRES.



Plate 42.—Healesville Shire. Country Roads Board tanker at scene of bushfire on Myers Creek Road.

The project would extend from Salmon Street, Port Melbourne to the Princes Highway in the vicinity of the Kororoit Creek, a distance of approximately 5·25 miles, with intermediate access only at such places as Williamstown–Footscray Road and Millers Road.

Preliminary estimates for the section from Salmon Street to Williamstown–Footscray Road are £11,300,000 for a bridge with a vertical clearance of 170 feet for shipping, £10,300,000 for a bridge with 149 feet clearance, and £15,100,000 for a tunnel. The additional cost of the section further west common to both alternatives is of the order of £3,500,000. Land resumption costs included in the estimates are £1,300,000 for the tunnel and £1,400,000 for the bridge.

22. ROADMAKING MATERIALS AND RESEARCH.

Depletion of known sources of roadmaking materials has made it necessary to continue investigations into alternative sources and alternative materials. During the past year, geologists of the Board's Materials Research Division have been engaged on investigations of materials along the Bonang Highway, in the area south and east of Ballarat, in the Western Wimmera, and in the area between Seymour and Nagambie. In the Bonang Highway area, suitable deposits of hill gravel were located between Deddick River and the New South Wales border. River gravel was found in the Brodribb River and several deposits of granite and older basalt suitable for crushing were also located. In the area south and east of Ballarat, deposits of suitable material have been largely worked out. However, there are possibilities of producing a satisfactory roadmaking material by mixing sluiced gravels from the large deposits located south of Ballarat with plastic gravels still available.

Development of heavy grid-rollers and the need for pavements of considerable thickness have permitted the use of very coarse rubble in the base courses of pavements. This work originated in Bendigo Division to utilize deposits of soft sandstone and limestone, but has been applied recently on the Alpine Road near Mount Hotham, on Mount Buffalo and Mount Buller Roads and on unclassified roads in the Shire of Korumburra. In these works, sandstone and shale have been successfully compacted, but basalt was found too resistent to treat in this manner. By eliminating the need for crushing, substantial reductions in pavement costs have been obtained.

COUNTRY ROADS BOARD FELLOWSHIP.

The Research Fellowship in Highway Engineering sponsored by the Board in the Civil Engineering Department, University of Melbourne, was continued during the year. The holder of the Fellowship, Mr. J. Morris, B.E., A.M.I.E., Aust., continued experimental studies of idealized pavement systems and in April submitted a thesis entitled "An Experimental Investigation of Vertical Stresses in Two-Layered Systems" for the degree of Master of Engineering Science. Mr. Morris recently joined the Board's staff and is engaged on a study of problems in bituminous surface treatment work.

23. CONTROL OF HEAVY TRAFFIC.

In 1961–62 the number of offences reported was 7,198, an increase of 316 (4.5 per cent.) as compared with the total in 1960–61. 6,209 offences were successfully prosecuted for which a total of £107,270 was awarded in fines and costs which is 11.7 per cent. more than in 1960–61.

Cases of refusing to weigh decreased from 37 to 24. Twenty-two trucks were impounded as compared with 32 in 1960–61.

For many years the Board has assisted vehicle manufacturers and operators in the purchase and design of the most suitable type of vehicles to operate economically and within the provisions of the law.

During 1961–62 this service has been extended by the provision of a machine known as a "Vehicle Load Calculator" (Plate 43). By means of this machine any type of truck can be reproduced in miniature. By application of known tare weights and adding appropriate load weights to the model, the correct placement of bodies, axles and fifth wheels can be ascertained.

The calculator is available for use by any interested person and advice will be given by the Board's Traffic Section to any applicant. The Board welcomes all enquiries as it is firmly of the opinion that by correctly designing vehicles, overloading offences can be greatly reduced with a consequent decline in road damage and in operating costs of heavy vehicle operators.

On the 1st July, 1961, 529 miles of State highways, main roads, tourists' and forests roads were limited to 5-ton gross axle loads under the provisions of the Motor Car Act. No additional closures were imposed during the year but the limitation was removed from 238 miles of the Board's roads during the period. At 30th June, 1962, the following mileages were subject to load limits of 5-ton gross axle loads—

					N	$\it liles.$
State highways						7 2
Main roads						66
Tourists' and Forest	roads					153
Total						
10001	• •	• •	• •	• •	• •	291

In addition five roads which are considered to be subject to excessive damage during the winter were similarly restricted under the provisions of the Country Roads Act for specific periods during the year.

During the year the *Motor Car Act* 1958 No. 6325 was amended appointing the Board as the permit issuing authority in respect of the issue of permits for vehicles and loads in excess of statutory limits for any proposed journey over any State highway, main road, tourists' road, forest road or by-pass road within the meaning of the *Country Roads Act* 1958, or for any proposed journey on highways in the municipal districts of any two or more greater metropolitan municipalities.

The municipalities concerned are listed in the Statute and include the whole area of greater Melbourne together with the Mornington Peninsula.

This has resulted in an increase in the amount of office work and necessitated the introduction of additional office control systems and the use of new types of permit forms.

Thirteen thousand and sixty-six permits were issued during the year in cases which were considered to warrant special concessions. This is an increase of 24 per cent. over the number of permits issued in 1960–61.

In many cases it is necessary to inspect the loads prior to the issue of permits. Twenty-eight separate routes were carefully inspected before being decided upon. The dimensions of many buildings were checked prior to the issue of permits for movement over roads and bridges. In the metropolitan area bridges were carefully checked for overhead clearances.

Of these permits 743 were for gross loads in excess of 40 tons, whilst 91 represented gross loads exceeding 70 tons, this latter figure being an increase of 160 per cent. as compared to the year 1960-61.

These permits cover a wide field but are principally for the movement of loads associated with State development by Governmental departments and Plates 44 to 47 show a cross-section of some of the loads from which the difficulties involved may be gauged.

Despite the excellent work on the part of the two police officers seconded for duty with the Board to collect outstanding unpaid fines, a total of £62,000 is still outstanding, this being 10.4 per cent. of all fines imposed since 1947. In 1961-62 the police officers executed 2,463 warrants amounting to £33,832 in fines.

Over 60 per cent. of unpaid fines are in respect of operators domiciled in New South Wales and arrangements will be made for another trip to Sydney by the police officers so that action can be taken against the offenders concerned.

The co-operation of the Chief Commissioner of Police and the keeness and efficiency of members of the Mobile Traffic Section, Victoria Police who have been seconded for duty with the Board are greatly appreciated.

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CONTROL OF HEAVY TRAFFIC.

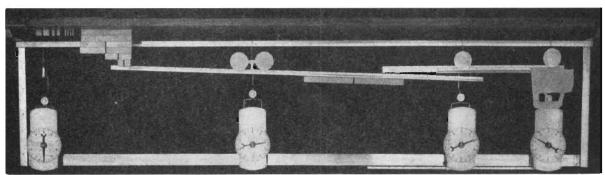


Plate 43.—Country Roads Board Vehicle Load Calculator.

SOME HEAVY LOADS TRANSPORTED DURING THE YEAR.

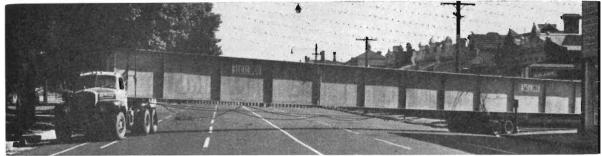


Plate 44.—Bridge girder 115 feet long being transported to the Punt Road Over-pass via Hoddle Main Road.



Plate 45.—Fractionator 135 feet long, 16 feet wide, en route Melbourne to Adelaide. Gross weight 98 tons.

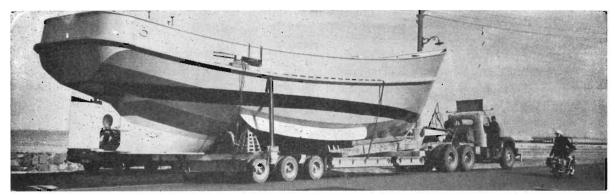


Plate 46.—A motor launch making gross weight of 46 tons en route Melbourne to North Wharf for launching.

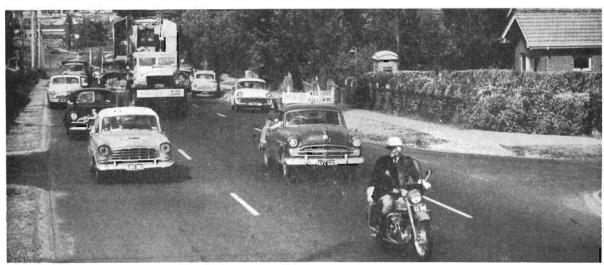


Plate 47.—Gross weight 71 tons. This 15 feet wide and 75 feet long shovel section was transported under police escort from Holmesglen to Bayswater.

24. TOURIST DEVELOPMENT.

During 1961–62 a further £100,000 was provided by the Government for expenditure on road works requested by the Tourist Development Authority and this amount was duly allocated by the Authority and the Country Roads Board.

Where the road works were of some benefit to ratepayers, relevant grants were made subject to a financial contribution from the councils concerned.

The amount of £100,000 made available in 1961–62 has been fully allocated in providing access to various picnic places, seaside resorts, water falls and other places of particular tourist interest including the Bellarine Peninsula (Ocean Grove Foreshore Reserve and Lookout) Steavenson's Falls in the Shire of Healesville, Rocklands Dam west of the Grampians, Point Leo surfing beach on Westernport Bay, Frazer National Park (Eildon) and the Fern Tree Gully National Park lookout area. Allocations to the latter two items were made subject to a financial contribution from the National Parks Authority.

In addition the Board is required under the terms of the *Tourist Act* 1958 to pay into the Tourist Fund each year 2 per cent. of the amount credited to the Country Roads Board Fund from motor registration fees, fines and drivers' licence fees. In 1961–62 the Board paid into the Tourist Fund the amount of £191,554.

25. MUNICIPALITIES FOREST ROADS IMPROVEMENT FUND.

Reference was made in the Board's Forty-sixth Annual Report to the establishment in 1955 by the Government of a fund to be called the Municipalities Forest Roads Improvement Fund with an initial contribution of £50,000. The fund was to be used for the improvement and protection of roads under the control of municipalities adjacent to State forest areas in order to facilitate the extraction of forest produce.

Following representations made by the Forests Commission and the Board in 1958–59, the Government made an additional contribution of £15,000 to the fund. Further representations have resulted in the Government authorizing the expenditure of an additional £50,000. Allocations totalling £25,000 have been made and the allocation of the remainder is in progress.

Of the total amount of £90,000 allocated, expenditure re-imbursed to councils to 30th June, 1962, was £77,094 for which a proportionate contribution was payable in each instance by councils benefiting from the grants provided.

26. AERIAL SPRAYING OF ROADSIDE EUCALYPTS FOR PEST CONTROL.

The initial treatment was carried out in 1958 and this was dealt with in detail in the Forty-sixth Annual Report which indicated the species of eucalypt attacked, the insects mainly responsible for the infestation, the type and concentration of sprays used and conditions desirable for successful aerial spraying.

Spraying was repeated in 1959, 1960 and 1961 on the length of 25 miles of the Princes Highway East, between Stratford and Bairnsdale (Plate 48).

The spray used is not injurious to humans or to live stock but will cause slight eye irritation.

Perfectly calm weather conditions are essential and spraying has invariably been carried out early in the morning when the calmest conditions prevail.

Traffic is stopped on the section being sprayed mainly to prevent low flying aircraft from distracting the attention of drivers of motor vehicles and in the early hours of the morning very little interruption to the normal flow of traffic occurs.

The spray used has very little effect on Christmas beetles which also cause damage to the roadside trees in this area. Attacks by this beetle are severe but of short duration and although trees are sometimes almost entirely defoliated they do not appear to suffer any lasting damage.

It is important that bee-keepers be advised so that hives may be removed from the area. The spray is also known to have killed fish in small ponds presumably by suffocation resulting from the oil film produced.

A high proportion of the larger trees have recovered and natural regeneration of healthy eucalypt saplings has greatly improved. It is hoped that improved ground cover will result in an increase in the bird population which will in turn help to keep infestation of insects to a reasonable level.

27. DECENTRALIZATION.

A new two-storey divisional office of approximately 10,000 square feet and separate laboratory building of approximately 1,200 square feet were completed in Benalla. Architects for the work were Leith and Bartlett Pty. Ltd. and the builder was W. A. Parnell of Wangaratta.

The new office building comprises a reinforced concrete frame and concrete floors with brick spandrels to window sill height between columns and aluminium framed window above. Off-street parking for vehicles is provided.

The staff of Benalla Divisional Office moved into the new premises on 5th April, 1962, and the building was officially opened by the Honorable H. R. Petty, M.L.A., Minister of Public Works, on 9th May, 1962 (Plates 49, 50, 51).

28. WORK STUDY.

During the year numerous requests were received by the Methods Section for methods surveys in various sections of the Board.

The work simplification technique used by the Methods Section is based on employee participation. This method is proving most successful and many suggestions for improvements are being received from supervisors and employees.

Many projects of work simplification have been completed, including investigations into accounting, workshop and depot costing, clerical procedures, organization studies, forms design, office machines, layout and design of workshops, storage and handling, construction studies and plant performance.

A major project during the year consisted of a review of the Board's activities in order that a data processing specification suitable for the Board's organization could be prepared. This specification covering accounting, statistical and engineering computations is nearing completion and will enable consideration to be given to the conversion of existing accounting practices to integrated data processing either by punched cards or computer.

A major part of the work of the engineer seconded to the Methods Section was investigation of job planning, job control and plant performance and the results of these investigations have been included in the present series of divisional training conferences and courses. These training conferences have led to a growing awareness of the aims and benefits of methods study.

29. PHOTOGRAPHY.

During the year the Board's mobile projection unit screened films hired from commercial distributors and films produced by the Board at 30 camps in locations remote from townships. A total of 127 screenings were given to audiences totalling 2,800 persons. On five occasions screenings of Board films were given to various clubs and these films were viewed by 270 people. Films were loaned on twelve occasions and reports indicate that the viewing audience totalled 1,000 persons.

Film supplied by television stations was exposed by a Board's photographer and incorporated in telecast news sessions on eleven occasions.

Increasing use is being made of films for technical and educational purposes.

Throughout the year many still photographs were taken of Board's and Councils' activities on road and bridge works.

Engineers supervising works also took many photographs to illustrate reports and record progress of works. Oblique aerial photographs of extensive works were taken by the Board's photographer using hired aircraft. A number of black and white and coloured 35 mm. transparencies were prepared for lecture purposes.

AERIAL SPRAYING FOR PEST CONTROL.



Plate 48.—Bairnsdale Shire. Princes Highway East, Section 3. Aerial spraying of trees between Stratford and Bairnsdale.

DECENTRALIZATION.



Plate 49.—Benalla Division.
Old Divisional Offices of the Country Roads Board at Benalla.

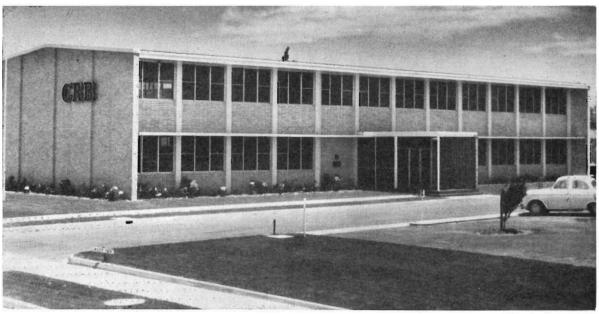


Plate 50.—The new Benalla Divisional Offices opened by the Honorable H. R. Petty, M.L.A., Minister of Public Works on 9th May, 1962.

For research work in connexion with the application of reflective glass beads to traffic lines, a macro camera was designed and constructed. This camera records on 120 roll film $(2\frac{1}{4}" \times 3\frac{1}{4}")$ an area of traffic line measuring $\frac{1}{2}$ inch long by $\frac{3}{4}$ inch wide with such precision as to provide sharp, full detailed enlargements measuring 8 inches by 6 inches.

30. DISPLAYS AND EXHIBITIONS.

A model of a highway project at Craigieburn which involved duplication work and elimination of a railway crossing was constructed and exhibited at the show of the Royal Agricultural Society of Victoria and at the Motor Show. A special leaflet for distribution to interested enquirers was prepared in conjunction with this display.

This model as well as models of the Maltby By-pass Road, Princes By-pass Road (Haunted Hills Section), and of Kings Bridge were loaned to interested bodies for five different exhibitions.

On two occasions classes of students visited the Board's Head Office and viewed displays of models and film screenings. On each occasion a short talk was delivered on the work of the Country Roads Board.

31. NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES.

The Twenty-fourth Regular Annual Meeting of the National Association of Australian State Road Authorities was held at the offices of the Main Roads Department, Brisbane, Queensland, from 30th October to 3rd November, 1961. Representatives of each State Road Authority throughout the Commonwealth and the Director-General of the Commonwealth Department of Works attended, whilst the Secretary of the Commonwealth Department of Shipping and Transport, representing the Australian Transport Advisory Council, was present when road standards and allied subjects and matters relating to the Permanent International Association of Road Congresses were under discussion.

The Department of Main Roads, New South Wales, provided transport for the Chairman and Deputy Chairman, who attended the meeting, so that they were able to inspect the roads between Sydney and Brisbane.

There were 64 items on the agenda including highway bridge design specification, policy for geometric design of urban roads, testing of concrete cylinders, field testing of bitumen sprayers, further national and State route numbering, and additional finance for roads. In regard to this latter item, it was resolved that each State Road Authority should inform its Minister of the discussion which took place on the matter with the object of each Premier asking the Commonwealth Government to impose an extra tax on petrol, which would be returned to the States in which the revenue is collected.

Arrangements were made for the various sub-committees to meet during the year, i.e., Principal Technical Committee, Bridge Design Committee, Bituminous Pavements Committee, Traffic Engineering Committee, Plant and Equipment Committee, Materials Research Committee, Advance Planning Committee and Secretarial and Accounts Committee. It was also decided to hold the next meeting of the Association in Adelaide from the 29th October to 2nd November, 1962.

32. AUSTRALIAN ROAD RESEARCH BOARD.

Two meetings of the Australian Road Research Board were held during the year, the Fourth Meeting at Brisbane on 31st October and 1st November, 1961, and the Fifth Meeting at Kew on 15th and 16th May, 1962 (Plate 52).

At the Fourth Meeting, Mr. C. N. Barton, Commissioner of Main Roads, Queensland, was appointed Chairman and Mr. D. V. Darwin re-appointed Deputy Chairman. Items on the agenda included matters relating to research projects, finance and administration, the establishment of a specialist committee to review the Human Factors area of road safety and its application in road engineering.

At the Fifth Meeting, Mr. C. G. Roberts was appointed Deputy Chairman vice Mr. Darwin on his retirement. Other matters resolved included the appointment of a Specialist Committee on Traffic Flow Theory.

DECENTRALIZATION.



Plate 51.—The Honorable H. R. Petty, M.L.A., Minister of Public Works, declaring the new Benalla Divisional Offices open. Left to right—The Honorable H. R. Petty, M.L.A., Minister of Public Works, Mr. D. V. Darwin, Chairman, Country Roads Board, The Honorable T. Trewin, M.L.A., for Benalla, Mr. C. G. Roberts, Deputy Chairman, Country Roads Board, and Mr. H. S. Gibbs, Divisional Engineer, Benalla Division.

AUSTRALIAN ROAD RESEARCH BOARD.



Plate 52.—Conference of Australian Road Research Board held at Country Roads Board Offices, May 1962, with The Honorable H. R. Petty, M.L.A., Minister of Public Works in attendance. Left to right—Mr. G. D. Maunder, Mr. F. D. Jackman, Mr. R. C. Sharp, Mr. J. D. Leach, Mr. C. N. Barton, Chairman, The Honorable H. R. Petty, M.L.A., Minister of Public Works, Mr. D. F. Glynn, Director, Mr. D. V. Darwin, Deputy Chairman, and Mr. J. A. Shaw.

During the year arrangements for the First Biennial Conference to be held at Canberra from 10th to 14th September, 1962, were finalized. This conference will be the first major example of a forum for the exchange of information regarding development in road research to be held in Australia.

In March, 1962, the first issue of the Australian Road Research Board's Journal, Australian Road Research, was published. The Journal will contain papers or smaller research items and will be supplemented by more formal publications of the proceedings of conferences.

A meeting was held with selected members of the Country Roads Board's staff to exchange views on research matters and a visit was made to the Bairnsdale Division to acquaint the staff and local shire engineers of the Australian Road Research Board's objects and activities.

A series of co-operative studies in conjunction with Universities throughout Australia was initiated during the year. It is hoped that the Universities will assist in the promotion of much of the fundamental co-operative research which will be undertaken. In Victoria arrangements have been made for a research project into repetitive loads on pavements to be carried out within the Civil Engineering Department of Melbourne University. This study is a corollary of a study on stresses in layered systems carried out by the Country Roads Board. A Human Factors project is also under way at Melbourne University concerning the driver operation of motor vehicles.

The Country Roads Board has undertaken several smaller applied research projects on behalf of the Australian Road Research Board.

At the invitation of the Commonwealth Government, arrangements were made for Sir Louis Loder, C.B.E., M.C.E., D.Eng., M.I.C.E., M.I.E. Aust., the former Commonwealth Director-General of Works, to represent Australia at the Road Research Conference to be held in London during June, 1962.

33. CONFERENCE WITH LANDSCAPE PRESERVATION COUNCIL.

On 24th March, 1962, a conference was held at the Board's Head Office between representatives of the Board and the Landscape Preservation Council of the National Trust of Australia to discuss ways and means of collaborating in the preservation of the Victorian landscape.

The purpose of the conference was to establish a basis of mutual understanding and co-operation between the Council and the Board. Professor J. S. Turner, Chairman of the Council, presided.

Mr. D. V. Darwin, Chairman of the Board, stated that roads were essential for communications and transport, and construction works necessarily resulted in temporary spoliation of the countryside. It was the Board's practice, however, to preserve natural vegetation wherever possible and to restore and improve the beauty of the roadside by the planting of trees, co-operation with field naturalist organizations in the protection of native flora, treatment of batters along some sections of roads and the eradication of pests which affected or destroyed timber. Control was also exercised over hoardings and advertisements which spoiled the beauty of the landscape. Several charming old bridges had been preserved and in many cases, the Board had been instrumental in having power or telephone lines erected on private property to avoid the lopping or removal of timber on the roadside. Again, areas surplus to road requirements in many parts of Victoria had been beautified and developed as picnic or rest places. The Board is co-operating with municipal councils and the Tourist Development Authority in the preservation of the landscape and the beautification of roads to the fullest possible extent.

34. MUNICIPAL ASSOCIATION CONFERENCES.

In 1961–62 the following conferences were attended—

1. Municipal Association of Victoria . . At Melbourne on 11th and 12th October, 1961. Attended by Chairman and Members.

2. Gippsland District	 	At Orbost	on	16tł	ı Marcl	n, 1962.
11		Attended	by	Mr.	W. H.	Neville,
		Member of	of th	e Boa	ard.	

3. Northern District ... At Strathfieldsaye on 12th April, 1962.

Attended by the Chairman, Mr. D.

V. Darwin.

4. North-Eastern District At Tatura on 10th May, 1962.

Attended by the Chairman, Mr. D.

V. Darwin.

5. Western District ... At Coleraine on 18th May, 1962.

Attended by the Board's Divisional
Engineer, Warrnambool, Mr. J. W.
C. Pascoe.

6. North-Western District ... At Wycheproof on 25th May, 1962.

Attended by Mr. C. G. Roberts,
Deputy Chairman.

The Board values the opportunity afforded it to attend these conferences and comment upon items on the agenda which are of interest to it, thus strengthening the close co-operation which already exists between the Board and local government.

35. COMMISSION OF INQUIRY INTO LOCAL GOVERNMENT IN VICTORIA.

The Commission, which was appointed by the Government to inquire into and report upon local government in Victoria, sought from the Board, as the State Road Authority, evidence as to the measure of assistance afforded municipalities in the construction and maintenance of roads and also invited the Board's views on any other issues affecting local government administration.

On 25th January, 1962, the Chairman gave evidence to the Commission in answer to certain specific questions asked and generally as to the scope and nature of the Board's activities and the measure of assistance afforded municipalities throughout the State. This evidence was subsequently printed and distributed, with the approval of the Minister of Public Works, to all Members of Parliament, municipalities, and other interested bodies.

36. CONFERENCE OF MUNICIPAL ENGINEERS.

The Eighteenth Conference of Municipal Engineers, convened by the Board, was held at the Board's Head Office, 60 Denmark-street, Kew, on 30th and 31st May, 1962, and approximately 250 attended, including engineers from most of the 208 municipalities throughout the State, senior engineers from the Country Roads Board and representatives of various Commonwealth and State Government departments interested in various items on the agenda.

Before introducing the Honorable H. R. Petty, M.L.A., Minister of Public Works, Mr. D. V. Darwin, Chairman, referred with regret to the passing of Mr. M. K. Johansen (Mildura Shire), Mr. A. G. McKenzie (Queenscliffe Borough), Mr. C. B. Windebank (Frankston Shire), Mr. J. T. Sullivan (Chiltern Shire), and Mr. G. W. C. Venables (Phillip Island Shire), since the last conference.

The Honorable H. R. Petty, M.L.A., welcomed the delegates and officially opened the conference. He outlined the problems facing municipalities and the Board and stressed the need for additional funds for road works, suggesting that a further tax of 6d. per gallon be levied on motor fuel by the Commonwealth Government and returned to the States in the proportion in which it is collected.

Reference was also made to the need to educate the public in the use of roads, particularly by-pass roads on which parking is prohibited. In conclusion, Mr. Petty paid tribute to the excellent work done by Mr. Darwin and extended to him best wishes on his retirement on 30th June, 1962.

Items on the agenda included designs for improved cross-sections of streets and the relation to existing business and local access; methods of assessing the degree of compaction of sub-grade and pavement materials; town and country planning; development of tourism; the design of small depots and workshops suitable for municipalities, and developments in Victorian road and bridge engineering.

During the conference Mr. J. Muntz (Ararat Shire) and Mr. C. E. Tuxen (Brighton City), on behalf of the municipal engineers of Victoria, presented Mr. Darwin with a silver tea and coffee service, and Mr. Neville with a transistor-operated mantel clock in appreciation of their long and valuable service to the Board and to municipal government, on the eve of their retirement as Chairman and Member of the Board respectively.

On Friday, 1st June, 1962, approximately 50 delegates inspected the concrete pipes factory of Humes Limited at Clayton, where details of all aspects of concrete pipe manufacture and associated products, including pre-stressed concrete beams, were explained. The Board appreciates the courtesy and hospitality extended by Humes Limited.

37. BOARD'S INSPECTIONS.

During the year Members of the Board, accompanied by the Divisional Engineer concerned, inspected roads and bridges in 31 municipalities in all parts of the State.

Those visited were the Shires of Kowree, Eltham, Maffra, Violet Town, Euroa, Rodney, Kyneton, Newham and Woodend, Buninyong, Bungaree, Werribee, Charlton, Maldon, Buln Buln, Mirboo, Narracan, Strathfieldsaye, Shepparton, Warragul, Bet Bet and Marong, the Boroughs of Kyabram and Moe, and the Cities of Sandringham, Williamstown, Oakleigh, Bendigo, Shepparton, Kew, Altona and Footscray.

The Board thanks these municipalities for their co-operation in making detailed arrangements and for the hospitality extended to them. Both the Board and the municipalities visited greatly benefited from the opportunity afforded during these inspections to discuss with members of councils the numerous road and bridge problems and works proposed in the coming years.

38. RETIREMENT OF MR. D. V. DARWIN.

Mr. D. V. Darwin, who had been a member of the Board since 11th February, 1945, and Chairman since 1st July, 1949, retired on 30th June, 1962 (Plate 53).

Mr. Darwin began his career with the Board as an assistant engineer in 1920. His progress from then was rapid and sustained. He became Engineer for Bridges in 1925, Assistant Chief Engineer in 1928 and Chief Engineer in 1941.

As Engineer for Bridges he was responsible for the design and construction of the Barwon River Bridge at Geelong. For a thesis on the project he was awarded the degree of Master of Civil Engineering by Melbourne University.

As Chief Engineer during the years of the second World War, Mr. Darwin was responsible for implementing the Board's contribution to the national war effort, which included the task of reconstructing and sealing in two years 787 miles of the Stuart Highway between the railhead at Alice Springs and the railhead at Larrimah, and subsequently continuing the road to Darwin. The Board also at the time was extensively engaged in aerodrome construction and was in fact maintaining two organizations, one in Victoria, the other in the Northern Territory.

Under Mr. Darwin's administration the Board's organization developed to a very great extent. Increased funds enabled the undertaking of many major projects. Multi-lane highways were constructed between Footscray and Norlane, Oakleigh and Dandenong and Fawkner and Broadmeadows. By-pass road legislation was introduced and subsequently the longest section of road in Australia having freeway characteristics, the Maltby By-pass Road, was constructed.

Mr. Darwin was farewelled by the staff in the Board's theatrette and a presentation was made. He leaves with the warmest good wishes of his colleagues and staff.

RETIREMENT OF MR. D. V. DARWIN.

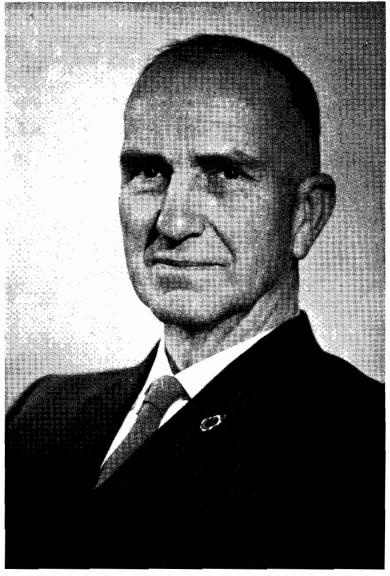


Plate 53.—Mr. D. V. Darwin, M.M., M.C.E., M.I.C.E., M.I.E.Aust., C.E., F.A.P.I.—Chief Engineer 1941–45; Member 1945–49; Chairman 1949–62.

39. STAFF AND EMPLOYMENT.

During the year recruitment of qualified engineers overcame the shortage that has persisted since the last war. For the first time since the war the supply of qualified engineers has been adequate to meet the demand.

Forty-one male officers and 31 female officers resigned during the year. One hundred and thirty-eight new appointments were made (104 males and 34 females). The following officers retired during 1961–62:—

- Mr. R. A. D. Bell, Personnel Officer, on 10th July, 1961, after 35 years service with the Board.
- Mr. W. A. Fowler, Senior Trade Claims Officer, on 13th August, 1961, after 34 years service with the Board.
- Mr. W. T. H. Rainbow, Records Officer, on 6th September, 1961, after nine years service with the Board.
- Mr. A. N. Foster, Tax Records Officer, on 24th November, 1961, after 40 years service with the Board.
- Mr. L. T. Breese, Engineering Surveyor, on 24th January, 1962, after 36 years service with the Board.
- Mr. C. A. Masterton, Engineer for Bridges, on 14th April, 1962, after 26 years service with the Board.
- Mr. W. C. Ness, Clerk, on 14th May, 1962, after 24 years service with the Board.

The Board's Asphalt Engineer, Mr. C. C. Perrin, C.E., A.M.I.E. Aust., was invited to attend an International Conference on the Structural Design of Asphalt Pavements at the University of Michigan in the United States of America. Mr. Perrin left Melbourne, in June, 1962, and will be abroad for a period of five months and will investigate structural problems relating to current developments in the design and construction of bituminous surfacing of all types. Following the period in America, visits will be made to the United Kingdom and Europe for inspections and investigations. Mr. Perrin will also attend the IV. World Conference of the International Road Federation in Madrid in October.

CADETSHIPS.

Four civil engineering cadets completed their studies in 1961, and joined the Board's engineering staff.

The following table shows the number of cadets at Universities in the 1962 academic year—

	 Ye	ear.	 	 Course.	Number of Cadets
First Year	 		 	 Civil Engineering	7
Second Year	 		 	 Civil Engineering	5
Second Year	 		 	 Commerce	1
Second Year	 		 	 Economics	1
Third Year	 		 	 Civil Engineering	5
Third Year	 		 	 Commerce	1
Fourth Year	 		 	 Civil Engineering	10
Fourth Year	 		 	 Surveying	1

During the year the appointment of a Training Officer permitted greater supervision and guidance of cadets.

An induction course for 1st year cadets was held in March. In addition to normal induction lectures the cadets inspected Head Office, Central Depot, Central Laboratory and Geelong Division.

Four pupil surveyors were articled to the Board's licensed surveyors during 1961-62.

The Board provided an additional cadetship in Economics to the Monash University.

TRAINING.

The training of staff and employees was placed on a more formal basis by the formation, during the year, of a Training Steering Committee and by the appointment of a Training Officer (Mr. D. L. Glastonbury, B.A., B.Sc., B.Ed., Dip.Sec.Ed.). These measures have led to a more systematic approach to both the examination of training needs and methods of organizing and supervising training.

The past practice of using suitable external organizations for the education and training of the Board's staff has continued, but at the same time in-service facilities have been increasingly utilized for special training purposes.

The Chief Engineer arranged conferences for Divisional Engineers and Assistant Divisional Engineers to consider proposals for the training of supervising engineers. Arising from these proposals, several courses have been conducted for selected supervising engineers on construction, planning, control and use of plant. These and other similar courses will continue until all supervising engineers have been trained in all aspects of their work.

Among officers who have been sent to special courses of training are, Mr. N. L. Allanson, Deputy Secretary, and Mr. C. C. Liddell, Deputy Accountant, both of whom attended sessions of the senior course of the Australian Administrative Staff College. Mr. W. H. Bell, Assistant Engineer on the staff of the Traffic and Location Engineer, attended, early in 1962, a School of Traffic Engineering at the University of New South Wales. Mr. F. E. Williams, Industrial Officer, and Mr. J. R. Mackenzie, Staff Officer, received training in Human Relations from a private organization of industrial psychologists.

EMPLOYMENT.

The number of employees for the year averaged 3,342. The peak of employment for the year was reached in November, 1961, when 3,567 were working for the Board and the lowest number was 3,034 in June, 1962.

The total number employed in works being carried out for other authorities reached its peak during January, 1962, when 35 men were working on projects for the Housing Commission (17), Latrobe Valley Water and Sewerage Board (17) and State Electricity Commission (1).

During the year 1961-62 no difficulty has been experienced in recruiting employees.

CHARITIES.

Substantial support was given by a large number of the Board's staff. The total sum contributed during the year, including special donations and bush fire appeals, was £494, an increase over the contributions for the previous year.

From this fund a total amount of £461 was contributed to charities throughout the State including various metropolitan hospitals, the Junior Legacy group, the Institute for the Blind and various appeals by or on behalf of the Returned Sailors, Soldiers and Airmen's Imperial League of Australia, and the Lord Mayor's 1962 Bush Fire appeal. Donations on a "bulk" basis were as usual made to several special button day appeals by purchasing buttons or badges for each contributor to the fund. The balance of £217 4s. 6d. on hand at the 30th June, 1962, will be used to meet commitments which will arise later in the calendar year.

40. MOTOR REGISTRATION.

Registrations effected during the year under the Motor Car Act totalled 936,694 an increase of 3.9 per cent. on the registrations effected during the previous year, as compared with an increase in 1960–61 of 5.3 per cent. over the total for 1959–60.

Veh	icles.				ial Year 0-61.		ial Year 1–62.	Increase.	Decrease
Private—									
New Second-hand—	• •	• •		68,543		60,793			
Re-registered				21,281		22,382			
Renewals				599,840		640,482	\ \ \		
					689,664		723,657	33,993	
Commercial and Hire-	_				,		,	,	
New				11,446		9,687			
Second-hand—									
$\operatorname{Re-registered}$				4,894		4,492	l		
$\operatorname{Renewals}$				93,823		96,864			
	,				$110,\!163$		111,043	880	
Primary Producers—Tr	ucks			4.050		0.401			
New	• •	• •		4,079		3,681			
Second-hand—	• •			4,449		4 905			
$egin{array}{c} ext{Re-registered} \ ext{Renewals} \end{array}$	• •		• •	59,549		4,385 61,719			
Ttelle wais	• •		• •		68,077*	01,719	69,785†	1,708	
Licences under Motor	Omnibu	s Act			792		791	-	1
Trailers					13,676		14,294	618	1
Motor Cycles					19,274		17,124		2,150
					901,646		936,694	37,199	2,151

Note.—*Includes 30,827 No Fee Tractors. †Includes 32,268 No Fee Tractors.

41. ACKNOWLEDGMENTS.

The sincere thanks of the Board are tendered to the Minister of Public Works, the Honorable H. R. Petty, M.L.A., for his help and interest in its work.

The Board also desires to place on record its thanks and appreciation for the co-operation and assistance of officers of Government departments, other State instrumentalities and municipal councils, as well as the road authorities in other States.

We have the honour to be,

Sir,

Your obedient servants,

- C. G. ROBERTS, M.C., B.Sc. (Eng.), A.M.I.C.E., M.I.E. Aust., C.E., F.A.P.I., Chairman.
- I. J. O'DONNELL, O.B.E., E.D., B.C.E., A.M.I.E. Aust., Deputy Chairman.
- R. E. V. DONALDSON, J.P., A.A.S.A., A.C.A.A., Member.

N. L. ALLANSON, A.A.S.A. A.C.A.A., Secretary.

APPENDIX 1.

COUNTRY ROADS BOARD.

STATEMENT OF RECEIPTS AND PAYMENTS FOR YEAR ENDED 30TH JUNE, 1962. (Adjusted to nearest pound.)

		oads Board ind.		th Aid Roads 1959.	į ·	Special Works Trust	
	Act 6229.	Act 6222 Road Maintenance Account.	Sec. 7 (1).	Sec. 7 (2).	Loan Funds.	Account Common- wealth Grant.	Total.
Receipts. £	£	£	£	£	£	£	£
Balance at 1st July, 1961 9,530,4 Motor Car Registration Fees 9,530,4 Additional Registration Fees 582,9 Drivers Licence Fees 259,8 Drivers Licence Testing Fees 76,9 Fines 259,6	26 90 01						2,900
10,709,8	31						İ
Less Cost of Collection 843,4	46 9,866,385						9,866,385
Municipalities Repayments— Permanent Works—Main Roads Maintenance—Main Roads 34,3 743,3							
	777,667						777,667
Moneys provided by Commonwealth Aid Roa Act 1959			5,845,983	4,031,713			9,877,696
6222		2,262,417					2,262,417
Receipts from State Loan Funds—Act 6229 Moneys provided under Commonwealth Grant	:: ::				683,000	500,000	683,000 500,000
- '	665						665
General Weeepts		0.000.417	 	4.001.510	420.000		75,039
D	10,722,656	2,262,417	5,845,983	4,031,713	683,000	500,000	24,045,769
PAYMENTS. Main Roads—							
35 1 4	4,225,624 785,323	766,665	1,428,709 84,508		135,781		5,790,114 1,636,496
	1,139,633 24,695	1,495,752	3,162,138		514,219	500,000	5,315,990 1,520,447
By-pass Roads— Construction	680,215		ļ	l			680,215
Maintenance	2,420		::				2,420
Tourists' Roads— Construction and Reconstruction	361,153	ļ	ļ		33,000		394,153
Maintenance	178,602						178,602
Forest Roads— Construction and Reconstruction	148,720						148,720
Maintenance	146,381					::	146,381
Unclassified Roads— Construction and Reconstruction			1,161,500	3,077,618			4 990 110
Maintenance		.:	1,101,000	954,095			4,239,118 954,095
Murray River Bridges and Punts	69,295			· · ·			69,295
Traffic Line Marking Plant Purchases	40,948				• • •	• • •	40,948 174,694
Traffic Lights	9,253			::			9,253
Contribution—Australian Road Research Board			9,128				9,128
Interest and Sinking Fund Payments Payment to Tourist Fund	927,527 191,554		• • •		• •		927,527
Kew Office and Laboratory	19,554						191,554 19,554
General and Administration Expenditure	1,592,143						1,592,143
	10,717,734	2,262,417	5,845,983	4,031,713	683,000	500,000	24,040,847
Balance at 30th June, 1962	4,922						4,922

Note.—Relief to Municipalities granted under Act 6229 Section 32, amounted in 1961-62 to £42,949 14s. 7d.

R. G. COOPER, Accountant.

12th December, 1962.

AUDITOR-GENERAL'S CERTIFICATE.

The accounts of the Country Roads Board for the year ended 30th June, 1962, have been audited. In my opinion the above statement of Receipts and Payments fairly presents in summary form the transactions during that period.

R. W. GILLARD, Auditor-General.20th December, 1962.

APPENDIX 2.

COUNTRY ROADS BOARD.

LOAN LIABILITY AS AT 30TH JUNE, 1962.

		_						Main Roa	ds,	&c.		Developmental	R	loads.	Total	١.	
				£	8.	a	l.	£	8	. d.		£	8.	d.	£	8,	d.
Permanent Works—																	
Main Roads				7,190,429	16		3										
State Highways				6,312,689	1		5										
Tourists' Roads				1 = 1 000			3										
Forest Roads				1,083			1										
						_	_	13,658,495	6	10					13,658,495	6	10
Developmental Roads												6,425,757	0	11	6,425,757		
Discount and Expenses								266,842	18	3 7		268,059			534,902		
Total	amount	Borrowed	l					13,925,338	(5		6,693,817	9	6	20,619,155	9	11
Less Redemption of Loa	ns—																
Redemption Funds								85,219]	. 1		646,386	7	4	731,605	8	5
Main Roads Sinking Fo	ınd							285,688	7	7		·			285,688	7	7
Developmental Roads S		Fund						·				55,083	0	2	55,083	0	2
State Loans Repaymen								1,205,878]	0					1,205,878	1	0
National Debt Sinking								1,666,924		6		2,006,936	5	1	3,673,860	17	7
								3,243,710	2	2 2		2,708,405	2	7	5,952,115	14	9
Loan Liability at 30th	June, 19	62						10,681,627	18	3	_	3,985,411	6	11	14,667,039	15	2

APPENDIX 3.

CHIEF ENGINEER'S REPORT

Country Roads Board, Melbourne.

1st December, 1962.

THE CHAIRMAN,

SIR,

I have the honour to report on matters of technical interest in the work carried out during the financial year 1961-62. The report is divided into four major sections, each containing material from the four Sub-branches created in the reorganization of the Chief Engineer's Branch.

I.—WORKS SUB-BRANCH

Pavement Widening.

Most pavement widening operations require the excavation of a trench at the edge of a pavement, but this trench needs for safety reasons to be back-filled to pavement level at the end of each day's work. An efficient and convenient means of back-filling was developed at the end of 1961 with the purchase of a "Power Pack" hopper-conveyor. This unit consists essentially of a hopper towed by the tip-truck, with a motor-driven conveyor belt traversing the material across the rear of the truck into the trench. There it is contained by a side board running along the outer edge of the trench, and struck off to the required level by an adjustable blade at the rear. Plate 1 shows the conveyor placing the top course in a widening trench 3 feet wide. The capacity of the hopper is 2 cubic yards and the rate of delivery onto the conveyor belt is controlled by an adjustable gate-opening in the bottom of the hopper. The rate of delivery can be further regulated by the throttle control on the engine driving the belt.

The unit occupies a width of 11 ft. 3 in. of roadway while in use but it can be readily towed off the road if desired, or turned parallel to the side of the trench to occupy a width of about 5 feet. For transport between jobs the wheels can be turned through 90° and the unit towed by a detachable tow-bar at the end of the hopper.

Cleaning Warning Signs.

The large number of direction and warning signs now in use, particularly on sections of State Highways with divided carriageway, has made obsolete the old method of cleaning signs by a cloth and water. Reflectorized signs in particular need to be kept clean in order to retain their effectiveness

In order to do the cleaning efficiently and to provide clean water for each sign, a wooden stand carrying two 40-gallon drums was mounted on the rear of a patrol truck. One drum was filled with clean water and the other with a mixture of 1 pint of "Comprox" detergent in 40 gallons of water. Each drum delivers its contents through 20 feet of ½-inch hose fitted with a hand-pressure operated valve and a bus-washing brush. Signs are washed with the detergent and then flushed with clean water in order to protect the reflectorized surface from any effects of the detergent.

On the Princes Highway between Oakleigh and Dandenong it was found possible to wash 180 signs in six hours.

Stabilization of Batters in Alpine Areas.

Under natural weathering and severe frost heave conditions batter erosion and siltation of streams has been a problem in alpine areas. In co-operation with the Soil Conservation Authority, the Mt. Buffalo Parks Committee and the National Parks Authority, a technique of erosion control has been evolved.



Plate 1.—Pavement widening of Hume Highway, Section 1, with a power pack hopper-conveyor. 10903/62.-5

BATTER STABILIZATION IN ALPINE AREAS







Plates 2, 3 and 4.—Bright Shire—Method of stabilization of batters on Mount Buffalo Road.

Plate 2.—Original batter. Plate 3.—After trimming and placing of wattling. Plate 4.—Grass growing through wire netting.

After trimming to a slope of about 1 to 1 a roll of snow gum brush wattling is pegged at the toe of the batters just above the side drains. Another roll of wattling is pegged 6 feet up the batter where necessary. The wattling acts as a silt trap until grass grows on the batter, and prevents the spread of frost heave from the unprotected drain. The batters are then seeded and treated with fertilizer, and grass hay covered with wire netting is pinned over the whole area.

The grass seed is a mixture of perennial rye, white clover, Yorkshire fog, Timothy creeping bent, and brown top, mixed in approximately equal proportions and applied at the rate of 0.6 oz. per square yard. The fertilizer is a mixture of three parts of superphosphate, two parts blood and bone, and one part sulphate of ammonia applied at the rate of 0.8 oz. per square yard. The cost of treatment is approximately 7s. per square yard, and it has achieved the desired results. Plates 2, 3, and 4 indicate various stages in the process.

Costing.

Analysis of Construction Costs, 1961-62.

Distribution of Expenditure.

Financial Year.	!	Plant Cost.	Labour Cost.	Materials Cost.	Stores Cost.
		0/ /0	0,	0,0	0,0
195859		$36 \cdot 1$	$32 \cdot 2$	23 · 3	8.4
1959-60		$38 \cdot 6$	32 · 1	19.6	$9 \cdot 7$
196061		39 · 1	33 · 4	16.6	10.8
1961-62		$37 \cdot 5$	33.0	$20 \cdot 8$	8.6

MATERIALS RESEARCH DIVISION.

Sliding Plate Micro-Viscometer.

The deterioration of bitumen in seal coats and bituminous concrete has been a subject of interest for many years. Study of the problem has been hampered by experimental difficulties, particularly in obtaining representative samples of bitumen from the road surface or mixed material and of measuring the rheological properties of the recovered material. The recent development of the sliding plate micro-viscometer has provided a means of investigating these problems, and a suitable instrument was obtained during the year (Plate 5).

Techniques for recovering small samples of representative material have been successfully developed and studies of the progressive hardening of bitumen during construction operations and during service life are in progress.

This instrument is also being used to study the effects of various kinds and concentrations of fillers on bitumen. Since ground limestone filler is an expensive constituent of bituminous concrete, the development of a cheaper satisfactory alternative may result in a worthwhile reduction in cost of surfacing material.

Bituminous Concrete.

The use of hot-mixed bituminous concrete paving has increased rapidly in recent years and a number of problems associated with this material have become apparent. Design methods for bituminous concrete mixes have followed overseas practices, but it has been found that the rounded nature of some local sands has a detrimental influence on the stability of the material under traffic loads. Several quarries in the metropolitan area produce a considerable amount of material crushed to sand size as a by-product of their normal operations, and the possibility of replacing portion of the natural sand in the mix by this material was investigated during the year.

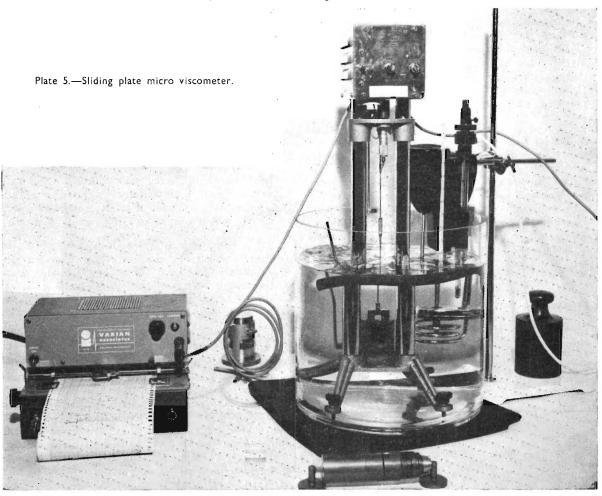
FORMATION COSTS. INCLUDING ALL EXPENSE CHARGES.

	Di1-1	V	,	Ro	ck.	EarthU	nclassified.	To	otal.
	 Financial	1 ear.	 	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Average Cost
				eub. yds.	\mathfrak{L} s. d.	cub. yds.	\mathfrak{L} s. d.	cub. yds.	£ s. d.
1958–59	 		 	29,185	1 2 7	478,563	0 10 4	507,748	0 11 1
1959-60	 		 	5,230	1 3 8	418,299	0 10 4	423,529	0 10 6
1960-61	 		 ••	30,300	1 5 11	983,643	0 12 11	1,013,943	0 13 5
1961-62	 		 	103,121	1 0 4	1,245,419	0 10 5	1,348,540	0 11 3

PAYMENT COSTS, INCLUDING ALL EXPENSE CHARGES.

			Crushed Rock	, Top Course.	Crushed Rock,	Bottom Course,	Grave	l, &c.	Te	otal.
Finar	iclal Year	•	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Unit Cost,	Quantity.	Average Cost.
			cub. yds.	\mathfrak{L} s. d.	cub. yds.	\mathfrak{L} s. d.	cub. yds.	£ s. d.	cub. yds.	£ s. d.
1958-59			85,662	1 18 1	18,300	1 11 5	330,148	1 0 0	434,110	1 4 2
1959-60			52,102	2 1 7	34,806	1 4 4	325,138	0 19 2	412,046	1 2 5
1960-61			59,778	2 6 10	25,128	2 5 5	762,148	1 0 4	847,054	1 2 11
1961-62			72,944	2 4 2	43,450	1 9 8	779,783	0 18 6	896,177	1 1 1

LABORATORY EQUIPMENT.



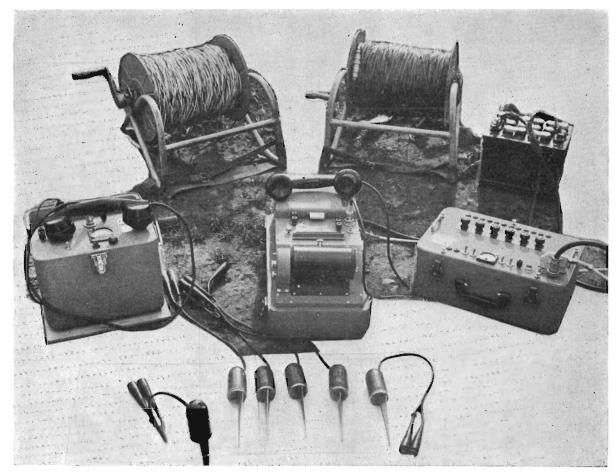


Plate 6.—Six channel recording seismograph.

It was found that the replacement of approximately 40 per cent. of the natural sand by crushed fines resulted in a significant improvement in stability, and furthermore, the tolerance of the mix for small variations in grading was improved considerably.

The use of an excessive amount of crushed fines was found to make the material more difficult to compact and for this reason alone, it is considered desirable to retain a proportion of natural sand in the mix.

Mixing, spreading, and laying techniques have also been of some concern, particularly in regard to segregation and the degree of compaction achieved. Tests of samples obtained systematically from properly laid \(^3_4\)-inch bituminous concrete have shown a high degree of uniformity in grading and bitumen content. However, samples from many sites where ravelling or instability of the surface course has occurred, or which have a poor appearance have indicated that the faults may be due to poor spreading and compaction. Continued investigation of these problems is planned using recently purchased diamond coring apparatus.

Refraction Seismograph.

The portable seismograph continued to be of great value in locating deposits of roadmaking materials. determining rippability of rock in deep cuttings, and in investigating foundation conditions at bridge sites. The success of this work has brought about a demand for more complex investigations beyond the capabilities of simple apparatus. For this reason, during the past year a more advanced six-channel recording scismograph (Plate 6) was obtained from Sweden, and already a variety of complex problems have been successfully studied. At the site of the proposed Lower Yarra Crossing extensive investigations were made over a wide area to confirm the presence of a basalt layer at a depth of the order of 100 feet. The presence of this layer was known from isolated borings and penetrometer probings, but the requirements of river navigation precluded the use of such methods within the river channel. Arrangements were made to close the river channel during two periods totalling six hours during which time four traverses were completed and the presence of the hard strata confirmed. A second application was in investigations of the San Remo Bridge where a wide survey of foundation conditions was completed rapidly and at very little expense. The equipment has been used at many bridge sites where the complex conditions would have required many traverses with simpler instruments.

Deep Sounding Penetrometer.

The deep sounding penetrometer is a device mounted on an enclosed semi-trailer to force a 60° cone of 3 sq. in. into the ground. Strain gauges are fixed within the cone and connected by a three-core cable to a strain gauge bridge on the semi-trailer. The cone is attached to 5-ft. lengths of "A" drill rods, and the cable is threaded through the centre of the rods.

Each 5-ft. length of rod is forced into the ground by a motor-driven rack and pinion mechanism. The reaction load is provided by concrete blocks on the trailer.

Using the strain gauges in the cone it is possible to determine the resistance to penetration experienced by the cone, irrespective of skin friction on the rods. The load on the cone may be expressed either in pounds per square inch or in tons per square foot, after suitable calibration. An estimate of the shear strength of the strata can be calculated from the load on the cone.

The penetrometer has also been used in soft silts to carry out vane testing. This is not possible in stiff clays because the rods are not strong enough.

In addition, an undisturbed sampler taking a 1·7-in. diameter core in a stiff plastic tube liner has been successfully operated to depths down to 90 feet. To sample to this depth a piston with a cone at the end shuts off the sampling barrell. At the desired depth the piston is withdrawn and the sampler forced down a further 4 feet to take a sample.

ASPHALT DIVISION.

Extent of Work.

Table 1 sets out the mileage of all types of bituminous surfacing carried out during the past two years, indicating that the work carried out in 1961-62 amounted to 2,817 miles or an increase of $1\cdot 2$ per cent. on the length of work carried out in 1960-61. This work included extension of sealing by 477 miles on the Board's declared roads and by 677 miles on unclassified roads.

Table 1.—Length of Bituminous Surfacing Work Carried out in 1960-61 and 1961-62.

				Mil	es.		
	Type of Road and Plant Used.		1960-6	31.	1961-62.		
(a)	Work on C.R.B. declared ros	ds:-					
, ,	(i) Board's plant		1,780		1,636		
	(ii) Municipal plant		48		65		
	(iii) Contractor's plant		59		63		
	(111)	-	1	.887		,764	
b)	Work on undeclared roads to w the Board contributes:—	hich					
	(i) Board's plant		723		858		
	(ii) Municipal plant		58		50		
	(iji) Contractor's plant		16		23		
	,			797 -		931	
c)	Work done for other Authoritie Board's plant:—	es by					
	(i) Municipalities		84		114		
	(ii) State Instrumentalit	ies	15		6		
	(iii) Commonwealth worl	xs			2		
	,,			99		122	
			:	2,783	5	2,817	

Table 2 shows the lengths of different types and weight of work on the declared system, while Table 3 sets out, in summarized form, the lengths of different categories of work carried out on all roads to which funds are contributed by the Board.

Types of Work.

While sprayed bituminous surfacing continues to provide the most economical type of seal coat treatment for most of the work in the State, the use of hot mixed bituminous concrete on the more heavily trafficked routes is increasing and 86 miles of this type of work was undertaken during the year. Most comprised the resurfacing of existing sealed pavements with carpets of $\frac{1}{2}$ inch to 1 inch compacted thickness, but in some cases of new pavement construction, where it has been considered that by so doing some saving could be effected in the total pavement depth, thicknesses of up to 4 inches of dense bituminous concrete have been provided as the top layer of the pavement material.

Cost of Work.

The average cost of the sprayed work earried out by the Board's mobile spraying units is set out in Table 5. The average cost for initial treatment work this year has varied between $20\cdot 1$ pence per square yard for light treatments with sand or $\frac{1}{4}$ -in. sized aggregate, up to $37\cdot 7$ pence for more normal treatments where the aggregate sizes have been $\frac{5}{8}$ -in. size and over. Over all there has been a slight downward trend in costs due to good seasonal conditions, a fall of the price of materials, and improved efficiency in bulk handling.

Table 2.-Mileage of Each Type of Work Carried Out on Declared Roads During 1961-62.

											Length	Length in Miles.												
Type of Road and Control of Work,	ntrol of Work.									,	Nature of the Work	the Wo	<u>본</u>											i
				1.00				Initi	Initial Treatments	ints.											Retrea	Retreatments.		
		1.T. 1.T.				L.T.P. and	LT.P.		T.P. and		Seal	I.T.P. and	pua	l.T. Tw		I.T.	i	1.T.	1		Res	Reseals.		
Road	[cartero.]	P.M.S. and S. P.M.S.	P.M.S. and Seal.	and Over.	т	‡-ın.	S.	in.	s. 4-in.	- 1	Only.	two Appherical tion Seal.	pphca- Seal.	Application Seal Only.		Primer-seal	-	P.M.S.		Nomina	Nominal Size of Aggregate.	Аввтер	ate.	
		Duplication.	Widening.	.я .я		22	Б.	≃:	.z. .s.	<i>غ</i>	ᅺ	널	괱	2		Ж	ਤ <u>ਂ</u>	జ	g-in. and Over.	i.		in.	Two Appl.	P.M.S.
State Highway and Direct	Direct	4.51 0.85	:	34.21 17.36 44.38 23.74 35.76 9.92	38 23	74 35 · 76		1 - 34 21	1 · 34 21 · 14 36 · 98		0.40' 28.78	:	:	:	:	· :	: 		5.57 12.04	- 	53-21 107-30	0 44.61		3.47 19.17
Dy-piess roads	$\int \mathrm{Municipal}$	•	96-61 :		68.1	:	:	1 - 43	: - : :	:	:	:	:	:	:	:		:		6.50	: 	:	:	:
	Direct	0.30	:	16.35 0.84		4.88 1.02 2.86	5.86	 	3.77 0.58	3. 23	3 15.45	:	:	:	:	<u> </u>		0.70	65	4 · 25	.5 8·00	0 -1.04	- 4 :	0.24
] Municipal	18.5		0 - 70 124 - 88 54 - 77 41 - 87	87 94	94 · 76 21 · 92 31 · 95		5 - 22 26 - 89		8-80 157 - 76	6 68-43	.: 1	:	4 · 77 -	97-0	÷ :	0.55 0.25		3.61 28.01 123.07	123.0		98.07 238.76		. 24.41
		7.62 0.85	7.62 0.85 0.70 179.05 88.48 88.48 123.38 58.70 44.73	05 88 48 88	48 123	38 58 - 70		7 · 99 51	7.99 51.80 46.36 161.39 112.66	3.161 - 35	9 112 - 66	61 - 10	: _	4.77 0.46		<u>-</u>	1.98 0.23		88 40 · 08	5 187.0	9.88 40.05 187.03 213.37 284.41	7 284 - 4	1	3.47 43.82
Totals	:	8.47	179.7ã	176-96		182-08	52.7	72	98.16	275	274.05	100	13			1.98		10.11			728-33			
								99-166	99															
			Ì										_	1,763.81							772-15	15		
		_																						

Abbreviations.—E. Extension to the bituminous surfaced system.

R. Initial treatment on reconstructed length of previously sealed pavement.

P.M.S. Treatment with plantmix.

Nore,-The table does not include 931 miles of work on underlared roads to which the Board contributed funds.

Table 3.—Summary of the Mileages of Different Categories of Work Carried Out on all Roads to which the Board Contributed Funds During 1961-62.

					State Highways.	By-pass Roads,	Tourists' and Forest Roads.	Main Roads.	Unclassified Roads.	Totals.
Initial Treatments—		,								
Extensions to the scaled sys	toin_				,				ř	
(a) Sprayed work (b) Plant mixed work					59 · 23	13.33	24 · 32	379.82	676.36	1,153.06
Reconstruction of lengths of	nrovious	lv. sonlad		nta	• • • •	• •	• •	$0 \cdot 23$	0.35	0.58
(a) Sprayed work		iv scale u	· · ·		150.06		4.61	161 - 96	38.85	$355 \cdot 48$
(b) Plant mixed work					5.57		:	$4 \cdot 31$	$6 \cdot 02$	15.90
Widening of existing sealed					$54 \cdot 17$:	$125 \! \cdot \! 57$	13 · 12	$192 \cdot 86$
Duplication of existing sealer	l pavem	ents			$5 \cdot 36$			$3 \cdot 11$		8-47
Retreatments—										
(a) Sprayed reseals					227 - 13		13.60	$487 \cdot 60$	179.09	$907 \cdot 42$
(b) Plant mixed work					$12 \cdot 95$	$6 \cdot 22$	0.24	24.41	17.43	$61 \cdot 25$
Totals					514.47	19.55	42.77	1,187.01	931 · 22	2,695.02

Materials.

(a) Aggregate.—Table 4 indicates the cost of aggregate used in sprayed work over the past five years and shows that the weighted average cost of aggregate has maintained a slight downward trend. The quantity of 277,418 cubic yards used this year is less than that used in the year 1960–61.

(b) Bitumen.—Bitumen, 85/100 penetration, was again used exclusively as the basic binder, fluxed and cutback for sprayed work to meet varying conditions. It was produced by two oil refineries in Victoria from Middle East crude oils. By arrangement with the suppliers, acceptance tests are performed by an officer of the Board at the refineries, followed up by regular full-scale laboratory testing. The bitumen throughout the year consistently met the Board's quality specification which conforms to the specification recently adopted by the National Association of Australian State Road Authorities.

Table 4.—Average Price of Aggregate for Bituminous Surfacing at per Cubic Yard in Stacks by the Roadside for the Years 1957-58, 1958-59, 1959-60, 1960-61, 1961-62.

	laterial.			Price per Cubic Yard.										
			195	7-58.	1958	3-59.	1959	9-60.	196	0-61.	196	l62,		
			s.	d.	8.	d.	я.	d.	s.	d.	8.	d.		
Screening	s		49	4	47	9	48	6	47	2	46	7		
Gravel			46	1	46	1	42	2	43	0	44	- 1		
Sand			26	3	32	6	27	4	21	1	19	3		
Scoria			18	9	8	6	27	1	21	3	31	4		
Average p	rice all a	aggre-				ł		:						
gates			47	11	47	0	46	5	45	8	44	П		

Treatment of Special Pavement Materials.

Some pavement materials are difficult to consolidate and prepare for a sprayed bituminous surfacing, but are used because of the shortage of more suitable materials. The nature of the materials makes it impracticable to produce a uniformly consolidated and smooth surface pavement.

Sandstones used in the western and north-western parts of the State are typical and vary in themselves, depending on the source of supply. In general the resulting pavement consists of large hard pieces surrounded by material which cannot be effectively consolidated. It is difficult to treat and produce a uniform primed surface using one grade of primer because of the absorption of the primer into some parts of the pavement. This would mean that the binder for the seal would also be absorbed in a

non-uniform manner causing stripping of the aggregate, either early in the life of the seal or after a period of one year or more.

In these cases it is necessary to adopt the primer-seal process, preferably using the two application method in which it is possible to correct by hand any non-uniformity after the first application of primer has set up. This ensures that the second application of primer, which is a heavier grade than the first, will be sufficiently uniform to hold small-sized aggregate and provide a wearing surface to carry traffic until it is desirable to apply a normal seal to the pavement.

The system of priming from a central depot such as in the Horsham Division (see the 47th Annual Report) can cope with such variable conditions as the pavement may be inspected immediately prior to applying the primer whether the first or second application. Such inspections are made by co-operation between municipal engineers and Board engineers, permitting of last minute variation in the grade of primer used.

Retreatment of "Slick" Surfaces.

In retreatment of "slick" surfaces, advantages have been found in applying preheated fresh aggregate over a very light application of binder. The aggregate can be heated up to 400° F. and the binder used is 85/100 penetration bitumen not fluxed or cut back. The amount applied is a minimum, depending on what binder is already available on the surface. Preheated aggregate must be spread without delay and thoroughly rolled until the binder has set up.

Plant.

In order to carry out plant mixed work in areas remote from fixed plants, the Board purchased a continuous type mobile hot mix asphalt plant during the year. This comprises a 40 ton per hour all electric asphalt plant, provided with a diesel electric generating set, four bin cold feeder, dryer, fines feeder, three bin gradation unit and screens, continuous mixer, and bitumen tank fitted with hot oil heating, the complete plant being designed for rapid movement and re-erection.

II.—BRIDGE SUB-BRANCH.

Pre-stressed Concrete.

Following satisfactory tests of a light-weight aggregate pre-stressed concrete slab, mentioned in the 1960-61 report, a field trial is now proceeding with the construction in the outer metropolitan area of a two-span 30-ft. long bridge—one span of standard 15-ft. pre-stressed concrete slabs normal aggregate and the other span of light-weight aggregate slabs.

Table 5.--Average Cost of Sprayed Bituminous Surpaging Carried Out by Country Roads Board Plant on Roads to which the Board Contributed Funds During 1961-62.

(Cost in Pence per Square Yard.)

							i	İ				Na	Nature of the Work.	ie Work.											
Item.	J	1.T.P. and S. §-in. and Over.	nd F.	1.T.P. and S. ¹ -in.		I.T.P. and S.	منعت ا	L.T.P. and S. ‡-in. and Sand.		I.T.P. and Two Application Seal.	and lication	I.T. Seal Only	l Ouly.	I.T. Two Application Scal Only.	Fwo ation July.	Reseal \$-in. and Over.	ral L. ver.	Reseal 4-in.	<u></u>	Reseat 3-in.	ra-in.	Reseal 1-in. and Sand.	eal n. and.	Two Application Rescal.	o ation sal.
Square Yards Costed	:	2,668,002	25	3,237,040	=	893,259	59	1,650,053	053	29,374	#:	5,245,497	.497	55,417	21	535,672	22	1,861,286	983	2,580,522	27.5	3,119,335	335	51,479	67
:						<i>d</i> .		d.		d.	0,0	d.		d.	o i	. q.	о́° ;	d.	0 0	d.	- ·	d.	90 8	d.	, o
Material	: :		9.80	f: 61	0.70	1.02	8- 4-8	 2. 8	7.00	Z · cZ	61 -3	1.01	7 . 79	23 · 8	2.00	s: -	۶: خو		÷ ;	÷ 21	D. 00	 ?	6. 00	23 · 1	0 4 ·2
Stores	:	£.	3 .4	1.1	ତ: ଫ	1.0	3.2	9.0	3.0	 2	5.9	2.0	6. 6.	<u>.</u> 3i	83 85	0 · 7	51 15	0.5	- n	.:	;; ;;	÷	53 F-	<u>.</u>	3 ·6
Plant Hire	;	6.5	17.3	6.5	18.6	4 · 7	15.2	3.0	14.9	6.5	15.8	3 · 7	15 · 3	ઇં	± ∴	-	# \$	3.7	15. Š.	۱۰ ۱۰	1+ ·3	- ?1		5. 2.	14 · 4
Labour	:	& F-	20.7	Ť.2	21.2	. 5 9.	16.8	&£ &£	16.4	8.2	20.0	4.6	19.1	6.3	17.3		18.4	÷	18.1	တ တု၊	17.0	52 +	16.2	6.4	8 · 21
Totals	:	37.7 10	100.0	34 · 9 10	0.001	31 · 0	100 · 0	20 · 1	100 · 0	41.1	100 .0	24 · 1 100 · 0	·	36 · 5	100 .0	27.7	100.0	8.83	100 · 0	8. 8.	100 · 0	14.8 100.0	100 .0	36.0	100.0

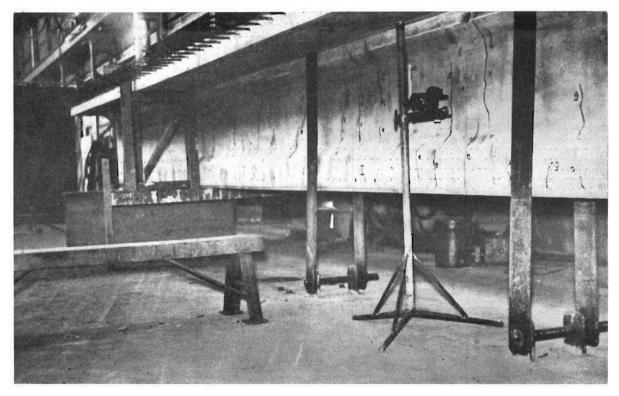


Plate 7.—Load tests on 40 foot high strength reinforced concrete beam.

No appreciable difference can be detected in the behaviour of the light-weight slabs under traffic compared with the normal slabs. The cost of the light-weight slab is approximately the same as the normal slab, but savings of at leat 25 per cent. in weight will reduce transport and handling charges.

High Strength Reinforced Concrete Bridge Units.

Increasing prices for pre-stressed concrete units, and the commercial production by B.H.P. of hard grade deformed reinforcing bars, have led to the development by the Board of a series of precast high strength concrete slabs and beams reinforced with hard grade deformed bars. These 15-ft., 20-ft., 25-ft., and 30-ft. standard slabs, and 30-ft., 35-ft., 40-ft., and 45-ft. standard beams have been designed with a concrete working stress of 1,500 lb. per square inch and a steel reinforcement working stress of 25,000 lb. per square inch. Details of the 30-ft. slab and 40-ft. beam are shown in Diagrams 1 and 2. These units are slightly higher in weight and cost than the comparable pre-stressed concrete unit, but they can be cast in the Board's existing yards remote from Melbourne at some saving compared with the cost of transporting pre-stressed units from factories in the metropolitan area.

Crack and Deflection Tests.

Tests were carried out on one of the first of the new standard 40-ft. beams, to check strains in the upper and lower flange, cracking under load, and deflections, before use in the field. The beam had been precast and the *in situ* deck portion later cast for use as a single precast Tee-beam designed for widening an existing bridge. With the beam held down at two points near mid-span, load was applied in equal increments by hydraulic jacks at each end and measurements taken of the positions and widths of cracks, deflections, at each end and strains in the upper and lower flanges (Plate 7).

The widths of cracks in the web were approximately 0.005 inch at working load, and 0.008 inch at one and a half times working load, while lower flange cracks were 0.003 inch at working load, and 0.005 inch at proof load.

On release of load the cracks gradually closed up leaving cracks approximately 0.002 inch wide in the web, 0.001 inch greater than the initial shrinkage cracks, and some cracks of 0.001 inch in the lower flange. Plate 7 shows the even spacing of the cracking under load. Comparison with standard precast concrete units showed that the shrinkage cracks in the standard precast girders were larger than those in the new higher strength concrete units.

Measurements of strain and deflection were proportional to the applied loadings and agreed closely with the calculated values. Arrangments are now being made to carry out similar tests on one of the new standard 30-ft. U-slabs.

Heavy Transformer Loadings.

The weights of S.E.C. transformers transported to various parts of Victoria have increased considerably during recent years and during the last few months bridges on the Loddon Valley Highway were strengthened by the Board to permit transport by road of two 71-ton transformers to Kerang (Plate 8).

Discussions have also been held with representatives of the S.E.C. to devise means of moving transformers weighing up to 128 tons in the metropolitan area during the next six years. The Board has designed a layout for a large towed trailer which should be satisfactory provided the tare weight as constructed does not exceed that estimated (Diagram 3).

The maximum permissible load is limited by existing bridges so that it becomes necessary with increasing weights to spread the load over a larger deck area. However, 160 tons appears to be the maximum payload that can be carried on existing bridges as the greater tare weight of larger transporters nullifies the increased spread of load.

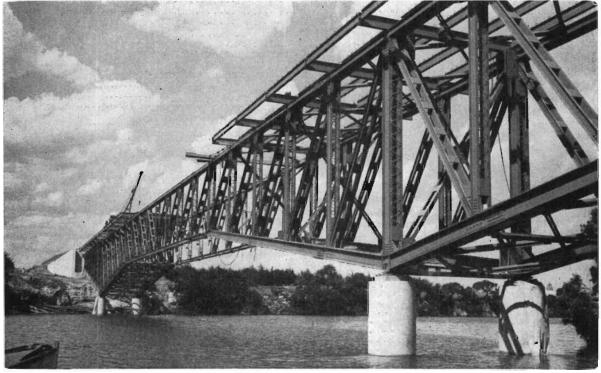
HEAVY LOADS.



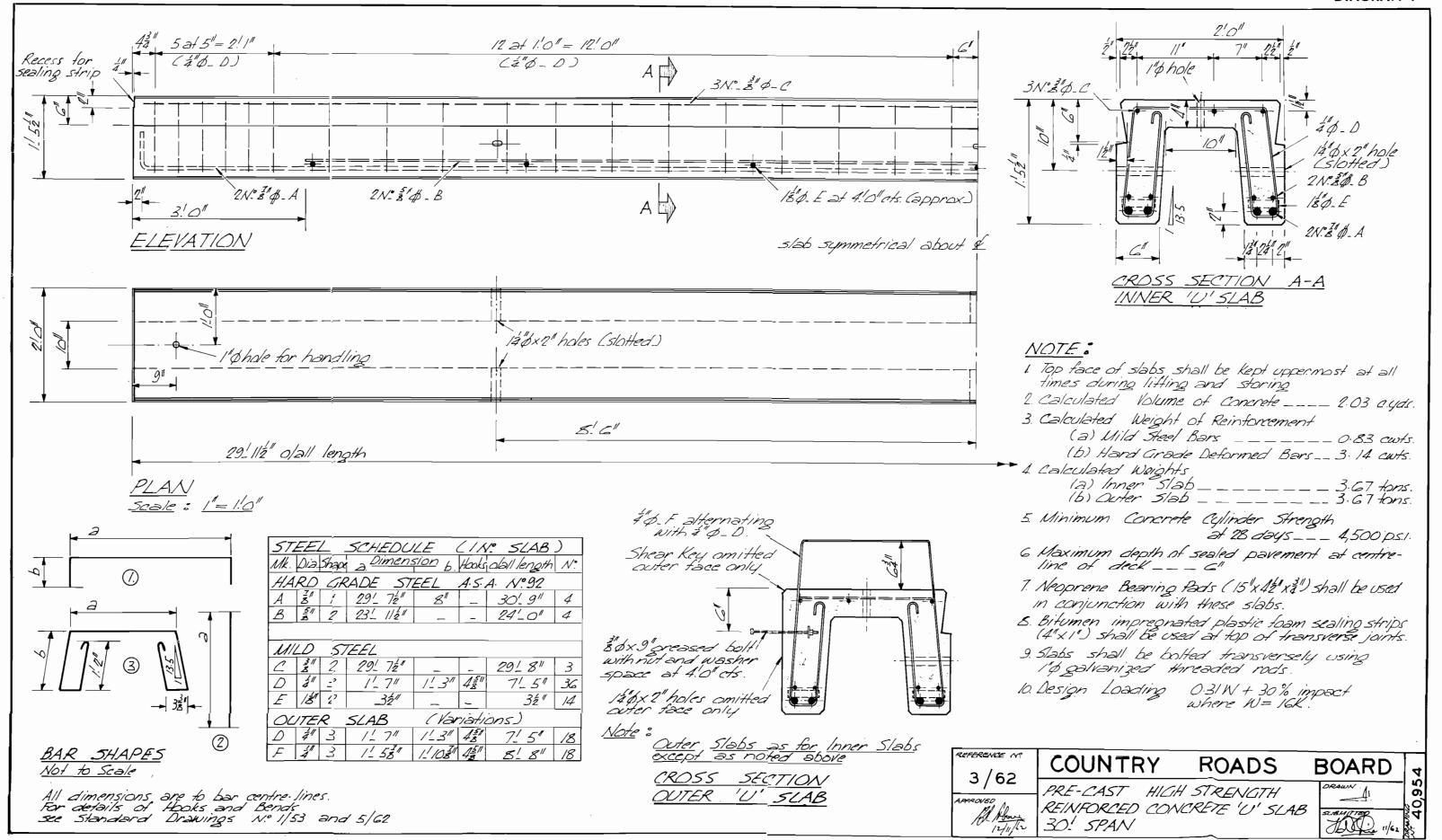
Plate 8.—71 ton State Electricity Commission transformer passing through Gisborne en route to Kerang.

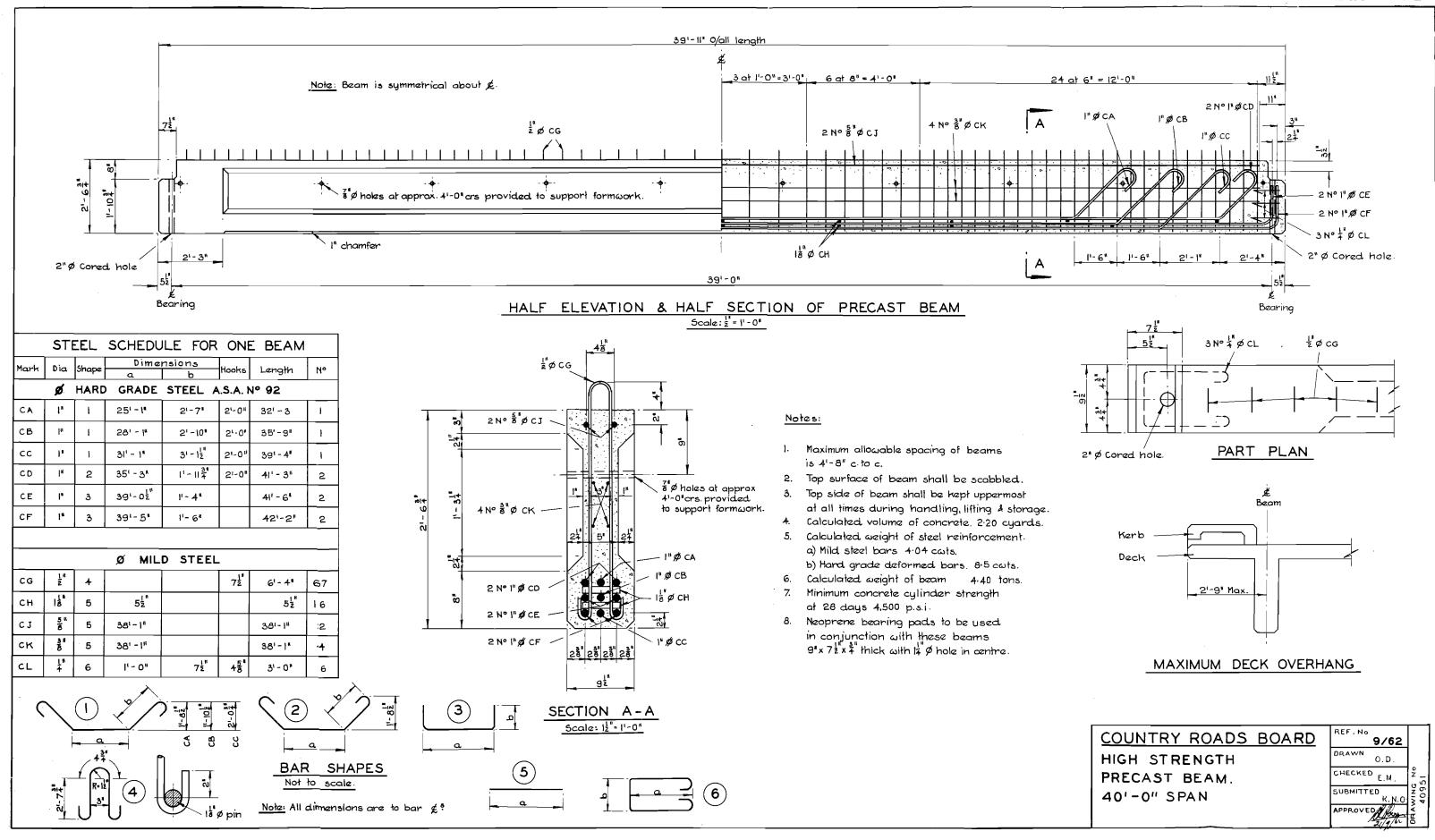
BRIDGING THE GLENELG AT NELSON





Plates 9 and 10.—Portland Shire.—Bolted high tensile steel bridge over the Glenelg River at Nelson, during erection.





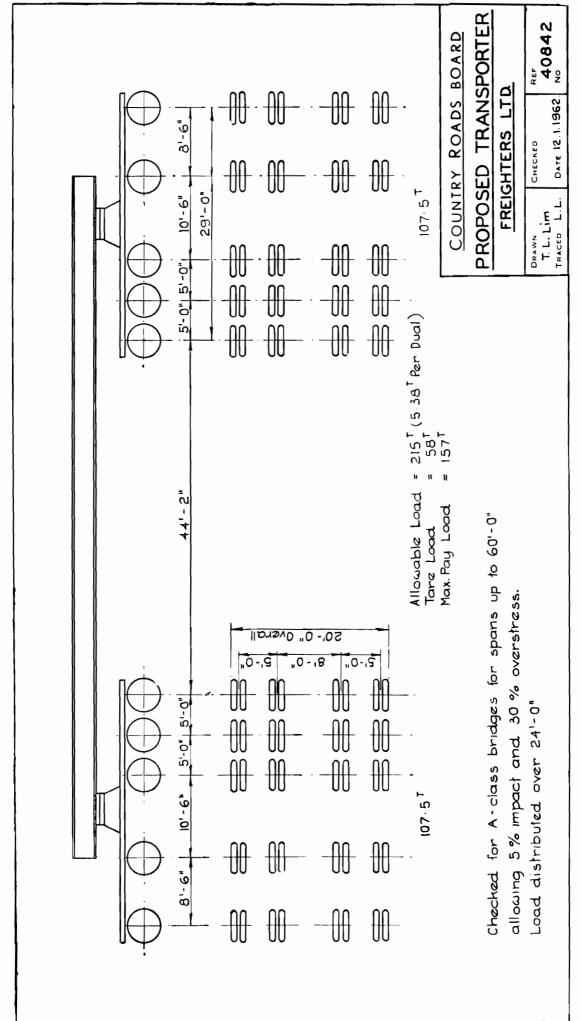


Diagram 3.—Large towed trailer for heavy loadings.

High Tensile Bolted Truss Bridge.

Fabrication and erection of 300 tons of steel work, using high tensile field bolted connexions for a 450-ft. truss bridge over the Glenelg River at Nelson (Plates 9 and 10), provided an opportunity for investigations and tests of various factors connected with high tensile bolted joints.

Friction between Gusset Plates.

During early stages of erection some joints were bolted without removal of a zinc-rich protective paint applied during fabrication. Tests were carried out on the effect of this coat on friction between the plates. The results of the tests showed that for a given bolt force between the plates, the load at initial slip was reduced from 28 to 17 tons due to the coating. Reports on tests in the U.S.A. (Trans A.S.C.E. Vol. 126 Pt. 2, Page 790) gave the following average co-efficients of friction for various conditions of mating steel surfaces:—

1.	Rusted and	wire	brushed	 0.51
2.	Rusted			 0.48
3.	Sand blasted			 0.47
4.	Mill scale			 0.30
5.	Galvanized			 0.26
6.	Red lead			 0.065

Following the tests, plates not satisfactorily cleaned were unbolted, cleaned thoroughly to bare metal, and rebolted.

Tightening Torque and Bolt Tension.

Since construction of the bridge involved the placing and tightening of 23,000 bolts with nuts, and washers, the contractor used a compressed air impact wrench with adjustable torque control.

When final tension is approached, approximately 90 per cent. of the applied torque in tightening a nut is used to overcome the friction of the nut against the thread and against the washer. As only the remaining 10 per cent. of torque is used to develop the bolt tension, slight changes in friction conditions cause a marked change in bolt tension for a given applied torque. Although failure cannot occur, joint slip resulting from low bolt tension may cause loss of camber, and an unsightly appearance in long span trusses.

Various specifications require a minimum tightening torque of 470 ft. lb. for a $\frac{7}{8}$ -in. diameter bolt, to give a required bolt tension of 32,400 lb., but all emphasize that tests must be carried out in given application to determine the torque-tension relationship.

Tests were carried out using an applied torque of 500 ft. lb. on four bolts with threads in various conditions, from new with a light protective oil coating, to badly rusted. The resulting bolt tensions were 34,200 lb., 34,000 lb., 19,200 lb., and 9,600 lb. as the degree of rusting of the threads increased. However, some degree of over-tensioning is permissible and the latest specifications require a tension of 36,000 lb. for a $\frac{7}{8}$ -in. diameter bolt. The method of control adopted was to use a torque setting of 520 ft. lb. on the impact wrench, checked regularly by a calibrated manual wrench, and in addition 10 per cent. of the bolts were checked with the manual wrench after tightening.

Lower Yarra Crossing.

At the request of the Government, an investigation was commenced in December, 1961, in connexion with a proposed crossing by either a high level bridge or a tunnel, of the Yarra River near Spotswood. The area selected was bounded on the north by Stony Creek and on the south by Craig-street.

The sub-surface investigation was divided into three phases:—

- Preliminary exploratory drilling with continuous sampling, supplemented by cone penetrometer tests on the east side of the river.
- 2. Additional boring with careful sampling of critical materials.
- 3. Selective drilling and undisturbed sampling in critical areas (see also page 79).

Phase 2 involving some 8,000 feet of boring was completed on 29th June, 1962. Three percussion and two rotary drilling rigs were employed at the peak of operations.

The Mines Department provided a geologist to classify the soil samples and also supplied the majority of crews and drilling rigs used in the sub-surface investigations. The Division of Soils, C.S.I.R.O., advised on the methods of foundation investigation required and also carried out the testing of soil samples obtained from the bores.

In addition, investigations into the location, layout, and profile of suitable river crossings were commenced. An origin and destination survey of existing traffic within the zone likely to be influenced by the crossing, and a series of travel time studies on the more important routes in the area were undertaken. Traffic assignment studies and estimates of likely future traffic were made in order to assist in the assessment of the economics of the proposals.

Ten fortnightly bulletins were published during the course of the investigations for the information of those likely to be interested in the project. A consolidated Bulletin will contain all the information collected to the end of Phase 2 of the sub-surface investigation. Brochure No. 1 containing preliminary estimates and geometric standards for bridge and tunnel alternatives, was published in June, 1962.

Demolition of Old Reinforced Concrete Bridge.

To make way for the construction of a new bridge over the Moe River on the Princes Highway East near Yarragon, the Board recently demolished the old reinforced concrete bridge built in 1916, together with the widened portions built in 1936. Opportunity was taken to test the concrete and reinforcing in both section of the bridge and the following results were obtained.

Properties of Concrete-

Equivalent 6 in. x 12 in. cylinder strengths:—

1916 Section.	1936 Section.
2,220 lb. per sq. in	3,030 lb. per sq. in.
2,270 lb. per sq. in	5,860 lb. per sq. in. 6,800 lb. per sq. in.
Dry density 143 lb./cub. ft	Dry density 143 lb./cub. ft.
Poorly compacted	Well compacted
Flakey coarse aggregate with surplus mortar	Good mix and coarse aggregate shape

		19	16 Section	1.				19	36 Section.		
	Diameter.	Ultimat	te Tensile	Test.*	Notes.		Diameter.	 Ultima	te Tensile	Test.*	Notes.
-in.		 24.0 7	Γ/sq.in.			1/4-in.		 27.7	T/sq. in.		
-in.		 23 · 2	••			$\frac{1}{4}$ -in.		 28.9	,,		
-in.		 30.9	,,		••	$\frac{1}{2}$ -in.		 21.9	,,		Corroded bar
-in.		 22.4	,,			{-in.		 32.6	,,		
-in.		 41.7	,,		Hard grade bar						
-in.		 27.4		;							

^{*} These stresses are based on the nominal areas of the bars tested.

Use of Electric Computers.

Reference to the use of electric computers to assist in bridge design is included for convenience in the report of Road Design Sub-branch which follows.

III.—ROAD DESIGN SUB-BRANCH.

Use of Electronic Computers in Engineering Work.

The use of computers in engineering work has increased during the year 1961-62. Programmes are now being regularly used in the following types of computation:—

1. Road Design.

Input data for this programme is prepared from level information, alignment plan, and draft longitudinal section. The input data contains terrain detail for each cross-section; chainages and level of intersection points on grade line and lengths of vertical curves and horizontal curve information, type cross-section and compaction factor.

Results contain all finished levels required for road construction, batter peg positions left and right of the centre line, earthwork quantities both cut and fill between successive cross-sections and a running earthworks total.

Processing time on the I.B.M. 1620 computer now in use in Melbourne is approximately half an hour per mile. Electronic computation to date has been used on about 26 miles of road, mainly on the Maroondah, Nepean, and Omeo Highways, and the Tallangatta-Corryong road.

2. Horizontal and Vertical Bridge Geometry.

These two programmes compute the co-ordinates, chainages, and reduced levels on a bridge deck at the intersection of pier lines with the centre line and kerb lines of a bridge. The horizontal alignment may consist of any combination of straights, transitioned or circular curves and the vertical alignment may be a uniform grade or a vertical curve. These programmes were written jointly by C.S.I.R.O. and the Board's engineers.

3. Analysis of Stresses in Rectangular Columns.

The maximum steel and concrete stresses in a rectangular reinforced concrete column subjected to axial loading and two-way bending are calculated. This programme is in regular use and to date approximately 250 column cases have been analysed.

4. Survey Co-ordinates.

This programme, for calculation of co-ordinates for either closed or offshoot traverses, including closure and adjustment of traverses, was obtained from IBM and is

being modified so that it can be used regularly by the Board's Title Survey Section. Survey traverses can now be processed, and results sometimes given to the surveyor before he leaves an area.

In order to check manual results, and also to test a new programme, traverses were processed for the Lower Yarra Crossing investigation. The co-ordinates of approximately 300 pegs, bores, manholes, and test sites were obtained in relation to Melbourne and Metropolitan Board of Works datum. The results were satisfactory.

5. Statistical Analysis of Data.

A programme has been prepared for the calculation of the arithmetic mean, variance, standard deviation and co-efficient of variation of a series of numerical data.

6. Bridge Pier Analysis.

The use of electronic computers will be further developed, and programming has commenced on a bridge pier analysis, which will calculate moments, shears and thrusts at critical sections in a rigid framed pier, with two columns either fully fixed or hinged at their bases. Investigations are also being made into the preparation of a programme for the analysis of a rigid framed bridge abutment.

Line Marking.

A total of 3,915 miles of road was maintained in a striped condition during the year, an increase of 75 miles over the previous year. This total included 2,836 miles of State Highways, 934 miles of other declared roads, and 145 miles of other roads.

The total length of standard stripe (10-ft. lines 3 in. wide with 30-ft. gaps) painted was 6,296 miles, at a total cost of £40,100. The average cost per mile was £6 7s. 6d. The total quantity of lacquer used was 19,900 gallons at an average application rate of 3·17 gallons per mile of standard stripe, i.e., 104 square feet per gallon.

TRAFFIC STUDIES.

Speed.

Measurements were made of vehicle speeds on six locations where the alignment was good and which were remote from any roadside development likely to influence speed. The results of these studies are plotted on a cumulative speed curve (Diagram 4) and compared with similar studies made on U.S. rural highways in 1949 and 1960. In general, the speeds on Victorian roads are similar to those on U.S. roads in 1960. Of the vehicles whose speeds were measured on Victorian roads about 55 per cent. were travelling faster than 50 m.p.h.

COUNTRY ROADS BOARD

SPEED STUDY

	А	0	C	
MEAN SPEED	49	52.6	527	M,RH
85 PERCENTILE SPEED.	56	60	62	MRH
% OVER 30 MPH			 - -	2
% OVER 50 MPH	37.5	58	55	2

		62		
	85 PERCENTILE SPEED. % OVER 30 MPH	MEAN SPEED 49. 85 PERCENTILE SPEED 56. % OVER 30 MPH 37.5. A U.S. 1949 B U.S. 1960	MEAN SPEED 49 52-6 85 PERCENTILE SPEED 56 60 % OVER 30 MPH 37-5 58 A U.S. 1949 B U.S. 1960	MEAN SPEED 49 52:6 52:7 85 PERCENTILE SPEED 56 60 62 % OVER 30 MPH 37:5 58 55 A U.S. 1949 B U.S. 1960

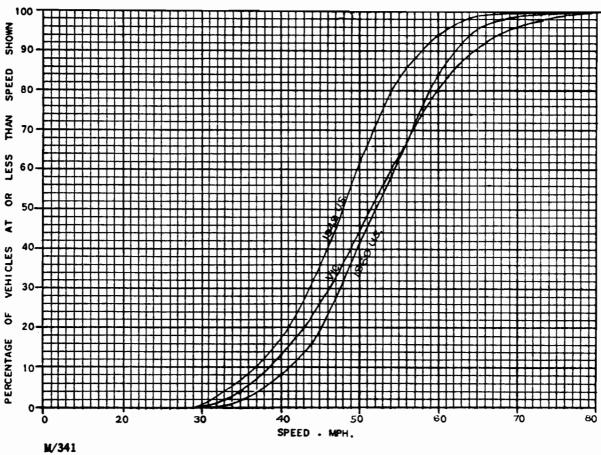


Diagram 4.—Cumulative Speed Curves, U.S.A. and Victoria.

Travel Times to Airport.

As a result of representations made by Sir Hudson Fysh (Governing Director of Qantas Empire Airways) to the Premier on behalf of the International Air Travel Association, a study was made of the travel times of airline buses between city terminals and Essendon Airport. The mean travel time from the city to the airport was found to be 23 minutes and from the airport to the city 23.5 minutes, corresponding to speeds of 20.8 and 20.4 m.p.h. respectively.

The maximum time taken was found to be 40 minutes (12 m.p.h.) and the minimum time 15 minutes (32 m.p.h.).

Traffic Volumes.

Based on a large number of traffic counts taken regularly on rural roads, a traffic index is calculated annually. The base of this index is 100, which represents the traffic volume in 1933–34.

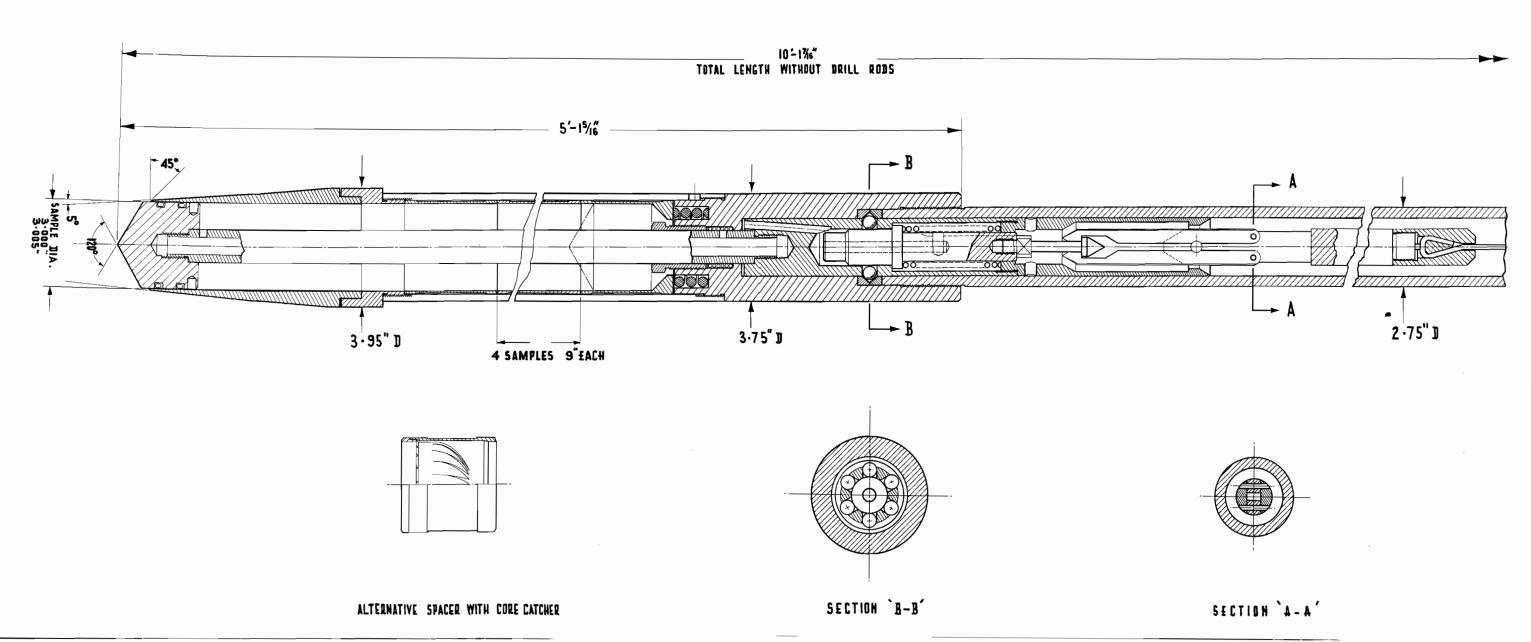
Since 1946 the traffic index has grown as shown:—

$1946 \dots 122$	$1952 \dots 353$	$1958 \dots 530$
$1947 \dots 169$	$1953 \dots 357$	$1959 \dots 583$
$1948 \dots 185$	$1954 \dots 402$	$1960 \dots 634$
$1949 \dots 208$	$1955 \dots 455$	1961 680
$1950 \dots 273$	$1956 \dots 479$	$1962 \dots 701$
1951	$1957 \dots 519$	

During this period the index has shown an average increase of 36 per year, following very closely a straight line growth. Based on the present index the increase is approximately 5 per cent. per annum.

DIAGRAM 5

SOIL SAMPLER



PLANS AND SURVEYS.

Engineering Surveys.

Head Office parties carried out 301 miles of surveys including feature surveys, traverses for preliminary investigations, traverses for air photo control. bridge site surveys, and road centreline surveys.

Plans for Road Construction.

Final plans were completed during 1961-62 for 90 miles of road, involving the preparation of 923 final plans. This work included plans for over 40 miles of State Highways and by-pass roads.

The following are some of the more complex works for which final plans were prepared:—

Nepean Highway

Duplication Warrigal-road to White-street, Mordialloc Duplication Frankston Post Office to the foot of Oliver's Hill

Princes Highway East. Channelized intersection Section 1 with Wellington-road near the Monash University

Pascoe Vale Road .. Strathmore Overpass to eliminate a railway level crossing

In addition many investigations were carried out and plans commenced for the following: -

Omeo Highway, Section Relocation between Swift's Creek and Omeo

Foster By-pass

Koetong

South Gippsland Highway, Section 2

way, Section 2

Tallangatta - Corryong Deviation. Darbyshire to

Princes Highway West, Brooklyn Overpass

Section I
Warrigal Road ... Oakleigh Overbass

Warrigal Road
Princes By-pass

Oakleigh Overpass
Haunted Hills Section
Gunn's Gully to Herne's Oak

Photogrammetry.

Road

Increasing use is being made of aerial photos and contour maps produced from these after ground control survey has been made, for investigation of projects, especially in areas where detailed preliminary ground survey would be difficult and costly.

TITLE SURVEYS.

The total number of title survey plans received during the past year was 550, of which 210 were surveys carried out by the Board's staff. This was less than the previous year, but a greater number of properties were involved.

Title surveys for a total of 41 miles of by-pass roads were completed, including 13 miles of the Hume By-pass road. Of this, all but 9½ miles of the Hume By-pass road, was carried out by the Board's staff parties. This latter work was carried out by a private surveyor, and the average cost per mile, including surveys of inter-changes, was approximately £460. The total cost was £4,307.

Highway Record Surveys and Aerial Strip Photography.

One hundred and ninety-two miles (192) of Highway Record Surveys were completed during the year, mainly on the Hamilton and Wimmera Highways.

Strip map compilations, covering new State Highways, totalled 345 miles.

Other photo-mosaics and miscellaneous strip maps were compiled for various project proposals.

Odometer surveys of Princes Highway East and South Gippsland Highway were done during the year, a distance of 500 miles.

IV.--MECHANICAL SUB-BRANCH.

The following work of technical interest was carried out in this Sub-branch during the 1961-62 financial year:-

- (a) A solid spray painting method which does not use compressed air for atomizing is now employed for painting all road signs and plant. This method reduces overspray and is consequently much cleaner and more economical than the air atomizing system used before.
- (b) The design of a new explosives magazine was completed with the co-operation of the Explosives Department.
- (c) An earth drilling rig for use in soil sampling work at the Lower Yarra Crossing was fitted to a truck chassis, in co-operation with the Soil Mechanics Section of the C.S.I.R.O.
- (d) Arrangements were made for the fabrication of a piston type device for taking 3-in. diameter soil samples. This was designed from a Swedish unit in co-operation with the Soil Mechanics Section of the C.S.I.R.O., also for work at the Lower Yarra Crossing. Detail is shown in Diagram 5.
- (e) Amongst the major new designs in process at present are a pavement line marking machine, a water sprayer for gravity and pressure spraying, a cement spreader for stabilization work, and aggregate belt spreader and carrier for a maximum spreading width of 12 feet, a device for field testing components of hydraulic pressure systems on earth moving plant, 8,000 gallon capacity insulated and heated bitumen storage tanks.
- 2. Methods of cleaning plant and components have been improved by installing an agitated solvent bath using a commercial cleaning product and capable of taking components of up to 10 feet in length. This is especially useful for cleaning B.S.T. sprayer manifolds and pumps. The tank was made from scrap materials left over when the workshop building was completed.

An experimental paint rolling machine has been made and work done to date would indicate that the paint on flat road signs can be rolled into position far quicker than it can be sprayed, with at least equal adhesion.

- 3. The following new items of plant have been acquired during the year:—
 - (a) "Delmag" model D12 diesel pile-driver, with a hammer weight of 5,500 lb., 42-60 blows per minute, and an energy rating of 22,500 ft. lb.
 - (b) "Barber Greene" hot mix asphalt plant with continuous pugmill and a capacity of 300 tons per day, with electric drive using either power or a mobile generator.

PAPERS PRESENTED OR PUBLISHED.

The following papers were presented during the year:—

year:—	
Paper.	Author.
"Road Requirements and Responsibilities." Presented at the Annual Conference of the Municipal Association of Victoria in the South Melbourne Town Hall on 11th October, 1962	D. V. Darwin, M.M., M.C.E., M.I.C.E., M.I.E. (Aust.), C.E., F.A.P.I.
"Broken Windscreens are Highway Hazard." Presented at 17th Conference of Municipal Engineers, Melbourne, 31st May, 1962	Stuart B. Deany, C.E., A.M.I.E. (Aust.)
"Control of Road Access." Presented at the Institute of Engineers, Melbourne, 13th June, 1962	G. J. Dempster, B.C.E., A.M.I.E. (Aust.), M.S.E., M.A.P.I.
"Measurement and Evaluation of Traffic Congestion." Published in a Symposium on the Quality and Theory of traffic flow. Yale University, 1961.	H. P. George, C.E., C.H.T. (Yale), F.A.P.I A.M.I.E. (Aust.)
"Travel Time Relationships." Published in a Symposium on the Quality and Theory of traffic flow. Yale University, 1961	N. S. Guerin, B.C.E., C.H.T. (Yale), C.E., E.W.S., A.M.I.E. (Aust.)
"Standardization of Short and Medium Span Bridges." Presented at the Symposium on Pre-stressed Concrete, University of Sydney, 23rd August, 1961	N. C. Haylock, B.C.E., Dip. T.R.P., A.M.I.C.E., A.M.I.E. (Aust.). A.M.T.P.I., M.A.P.I.

V. T. Lingham, F.R.M.T.C., A.M.I.E.

J. Mathieson, M.C.E.,

T. Underwood, B.C.E., Dip. T.R.P., C.E., C.H.T. (Yale), M.A.P.I., A.M.J.E.

(Aust.) A. Veismanis, B.Sc.

(Aust.),

(Aust.)

M.I.E.

M.A.P.I.

- "The Permeability of Fine Crushed Rock." Published in Australian Road Research No. 2. June, 1962
- "The Problem of Providing for Traffic in a Rapidly Expanding Urban Area." Presented at the Symposium on Urban Survival and Traffic at King's College, University of Durham, Newcastle-on-Tyne, April, 1961
- "Speed, Volume and Density Relationships." Published in a Symposium on the Quality and Theory of traffic flow. Yale University, 1961
- "The Effect of Cement on Strength Properties of Fine Crushed Rock." Published in Australian Road Research No. 2, June, 1962

The following engineering notes were issued during the year:—

No.	Title.	Date.
69	Dozer blade attachments for ripping	12th July, 1961
70	Tip truck three-way tipping body	10th November, 1961
71	Holding road surfaces for sealing	15th January, 1962
72	Washing signs	2nd February, 1962

STAFF.

It is again desired to pay tribute to the work done by both technical and clerical staff. The volume of work continues to increase, and difficulties of administration were aggravated during the year by a large works programme combined with a year of low rainfall. Under conditions that were extreme, a first rate effort was made by all concerned.

Total staff of the Chief Engineer's Branch rose from 558 at the commencement of the year to 591 at its end, expenditure on works rising from £20,796,000 to £22.746,000 during the same period.

J. MATHIESON, M.C.E., M.I.E. (Aust.), C.E., M.A.P.I., Chief Engineer.

1962 - 63

VICTORIA

COUNTRY ROADS BOARD

FORTY-NINTH ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1962

PRESENTED TO BOTH HOUSES OF PARLIAMENT PURSUANT TO ACT No. 6229.

[Approximate Cost of Report.-Preparation, not given. Printing (200 copies), £735.]

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