1964–65

VICTORIA

COUNTRY ROADS BOARD

FIFTY-FIRST ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1964

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

[*Approximate Cost of Report.*—Preparation, not given. Printing (225 copies), £825.]

By Authority:
A. C. BROOKS, GOVERNMENT PRINTER, MELBOURNE.

No. 27.—[68.]—843/65.

FRONTISPIECE :—Nepean Highway—Duplicated carriageways at Olivers Hill, Frankston.

COUNTRY ROADS BOARD

Chairman	I. J. O'Donnell.
Deputy Chairman	R. E. V. Donaldson.
Member	F. West.

PRINCIPAL OFFICERS.

Head Office.

Chief Engineer	H. S. Gibbs.

Deputy Chief Engineers.

Works	*Road Design*	*Bridges*	*Mechanical*
H. P. George.	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. F. O'Brien.
Benalla	R. C. Handley.
Bendigo	L. Upton.
Dandenong	F. W. Docking.
Geelong	W. F. Neville.
Horsham	A. J. Pryor.
Metropolitan	J. R. Galbraith
Traralgon	A. Jacka.
Warrnambool	J. W. C. Pascoe.

COUNTRY ROADS BOARD

MAP SHOWING PORTION OF BOARD'S DECLARED ROAD SYSTEM TO THE NORTH-EAST OF MELBOURNE

SCALE IN MILES

0 1 2 3 4 5

SHIRE OF KILMORE
SHIRE OF BROADFORD
SHIRE OF BULLA
SHIRE OF WHITTLESEA
SHIRE OF YEA
SHIRE OF HEALESVILLE
SHIRE OF DIAMOND VALLEY
SHIRE OF ELTHAM
SHIRE OF BROADMEADOWS
CITY OF PRESTON
CITY OF COBURG
CITY OF HEIDELBERG
CITY OF BRUNSWICK
CITY OF NORTHCOTE
CITY OF KEW
CITY OF CAMBERWELL
CITY OF DONCASTER AND TEMPLESTOWE
CITY OF CROYDON
CITY OF RINGWOOD
CITY OF BOX HILL
CITY OF NUNAWADING
CITY OF WAVERLEY
CITY OF OAKLEIGH
CITY OF SPRINGVALE
CITY OF DANDENONG
SHIRE OF LILYDALE
SHIRE OF SHERBROOKE
SHIRE OF KNOX
SHIRE OF BERWICK

Upper Plenty, Mt. Disappointment, Whittlesea, Wallan, Beveridge Sta, Glenvale, Toorourrong Reservoir, Kinglake West (Tommys Hut), Pheasant Creek, Kinglake Central, Kinglake East, Gordons Bridge, Hustle Bridge, Castella, Toolangi, Kinglake National Park, Kalkallo, Donnybrook, Woodstock, Yan Yean Reservoir, McSweeneys Corner, Streamville, Strathewen, KINGLAKE, Mt. Slide, St. Andrews North (North Queenstown), Arthurs Creek, Hernda, Wollert, Craigieburn, Doreen, Phillips Hill, Mittons Bridge, Steels Creek, Dixons Creek, Healesville West, Mutfield (Clintons Bridge), St. Andrews (Queenstown), Smiths Gully, Cottles Bridge, Yarrambat, Morang, South Morang, Epping, Lalor, Thomastown, Keon Park, Bundoora, Watsonia, Yarra Glen, Christmas Hills, Yarra Glen, HEALESVILLE, Tarrawarra, Yarra Glen, Hurstbridge, Upper Diamond Creek, Panton Hill, Rob Roy, Plenty, Diamond Creek, Wattle Glen, Watsons Creek, Kangaroo Ground, St. Helena, Greensborough, North Eltham, Research, ELTHAM, Montmorency, Lower Plenty, Templestowe, Lower Templestowe, Warrandyte, South Warrandyte, Wonga Park, Coldstream, Gruyere, Yering, Black Spur, LILYDALE, Mt. Evelyn, Wandin North, Wandin Yallock, Wandin, Wandin East, Silvan, Silvan Reservoir, Mt. Dandenong, Montrose, Kilsyth, Croydon North, Croydon, Ringwood East, Ringwood North, Heathmont, Bayswater North, Bayswater, Boronia, The Basin, Olinda, Sassafras, Burtigh, Macclesfield, Mangana, Sherbrooke Forest, Kallista, The Patch, Kalorama, Mt. Dandenong (Tourists Road), Belgrave, Belgrave Heights, Belgrave South, Selby, Menzies Creek, Clematis, Olinda, Lakeside, Monbulk, Emerald, Sassafras, Upper Ferntree Gully, Ferntree Gully, Scoresby, Knox Gardens, Rowville, Lysterfield, Lysterfield Reservoir, Narre Warren North, Harkaway, Berwick, Beaconsfield, Officer, Pakenham, Cranbourne, Dandenong, Springvale, Noble Park, Keysborough, Hallam, Narre Warren, Berwick, Beaconsfield, Officer, Pakenham, Cranbourne

LEGEND

- STATE HIGHWAYS
- BY-PASS ROADS — DECLARED — APPROVED
- MAIN ROADS
- TOURISTS ROADS
- RAILWAYS
- MUNICIPAL BOUNDARIES
- M.M.B.W PLANNING BOUNDARY

31st. OCTOBER 1964

COUNTRY ROADS BOARD

FIFTY-FIRST ANNUAL REPORT, 1963-64

CONTENTS

		PAGE
1	Development of Divided Highways	7
2	Receipts and Payments	10
3	Road Needs Survey	12
4	Commonwealth Aid Roads Act	12
5	Allocations for Road and Bridge Works	13
6	Sharing the cost of Roadworks	14
7	Contracts under Board's Direct Supervision	15
8	Contracts under Councils' Supervision	16
9	State Highways	16
10	By-pass Roads	25
11	Main Roads	27
12	Unclassified Roads	33
13	Tourists' Roads	40
14	Forest Roads	40
15	Bridges	41
16	Bituminous Surfacing	46
17	Rural Finance and Settlement Commission Estate Roads	47
18	Works for other Authorities	48
19	Elimination or Improvement of Railway Level Crossings	50
20	Flood and Bush Fire Damage	50
21	Road Making Materials and Research	50
22	Control of Heavy Traffic	52
23	Tourist Development	53
24	National Parks	53
25	Municipalities Forest Roads Improvement Fund	53
26	Line Marking	54
27	Photography	54
28	Kew Laboratory Building	54
29	Engineering Computer Installation	55
30	Plant and Vehicles	56
31	Displays and Exhibitions	56
32	National Association of Australian State Road Authorities	56
33	Conference of Municipal Engineers	57
34	Municipal Association Conferences	57
35	Board's Inspections	58
36	Legislation Affecting the Board	58
37	Missions Abroad	58
38	Personnel	58
39	Training	62
40	Appointment of a Horticultural Officer	63
41	Acknowledgments	63

Appendix 1	Motor Registration	64
Appendix 2	Statement of Receipts and Payments for Year Ended 30th June, 1964.	65
Appendix 3	Loan Liability as at 30th June, 1964.	66
Appendix 4	Chief Engineer's Report	67

COUNTRY ROADS BOARD

FIFTY-FIRST ANNUAL REPORT

60 Denmark Street,
Kew, E.4.
23rd December, 1964.

The Honorable M. V. Porter, 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, 1964.

1. DEVELOPMENT OF DIVIDED HIGHWAYS.

In the year 1963–64 motor vehicle registrations in Victoria increased to nearly 1,100,000 having risen at an average annual rate of increase of 6 per cent. per annum from approximately 750,000 in 1958–59. Furthermore, it is believed that the growth of motor vehicles on Victorian roads will probably be greater in future.

Adequate road facilities are needed to provide the growing vehicle population of this State with the conditions of operation best suited for modern motor traffic.

Within the limits of its available funds in 1963–64 the Board, in addition to assisting municipalities in maintaining and improving their unclassified roads, has continued its established practice of widening and improving its declared roads system, including the duplication of sections of State highways and main roads where traffic volumes so warrant.

Divided roads within the Board's declared roads system now comprise 28·5 miles of main roads, 78 miles of State highways and 15·5 miles of by-pass roads.

During the year 1963–64 major projects of this nature included—

State Highways—

Princes Highway	..	Completion of section of the duplication between Oakleigh and Dandenong (Plate 1).
Hume Highway	..	Further duplication from Fawkner towards Craigieburn (Plate 2).
Maroondah Highway	..	Duplication through Ringwood City (Plate 3).
Nepean Highway	..	Duplication at Olivers Hill, Frankston.
		Duplication in the vicinity of Moorooduc Road.
		Duplication through Rosebud.

Plate 1.—Princes Highway East—Duplicated carriageways—City of Oakleigh.

Plate 2.—Hume Highway—Duplication Barry's Road to Somerton Road—City of Broadmeadows.

Plate 3.—Maroondah Highway—Duplication in progress between Mitcham and Ringwood.

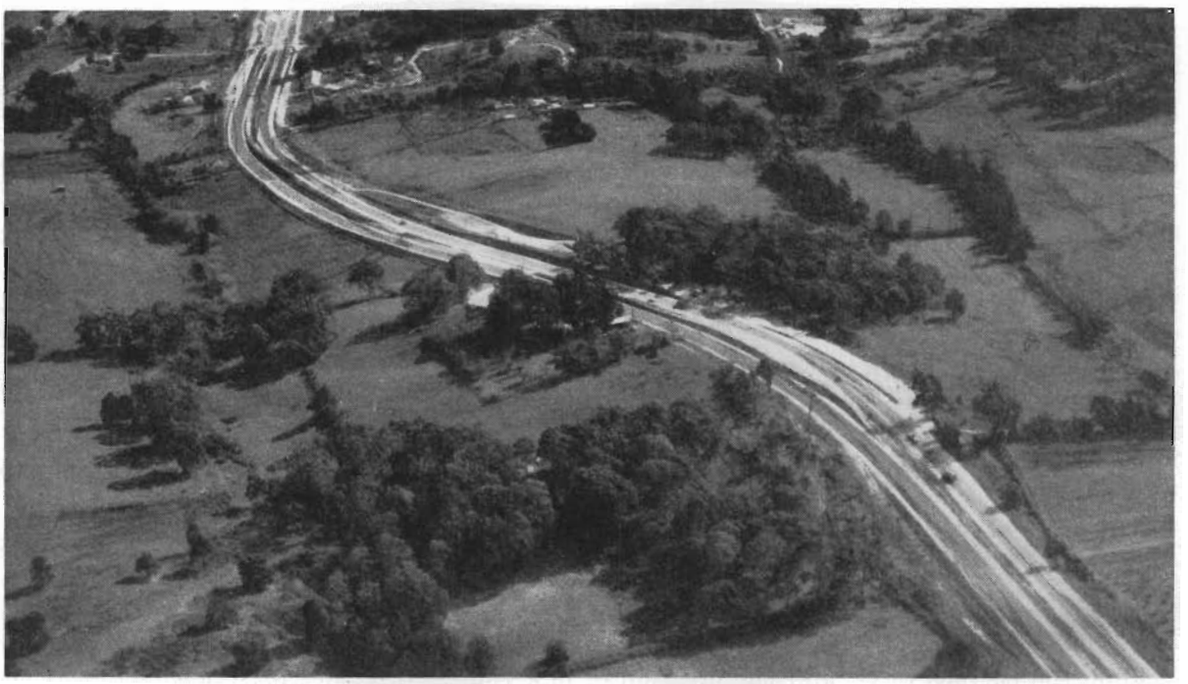


Plate 4.—Western Highway—Duplication at Woodman's Hill—City of Ballaarat.

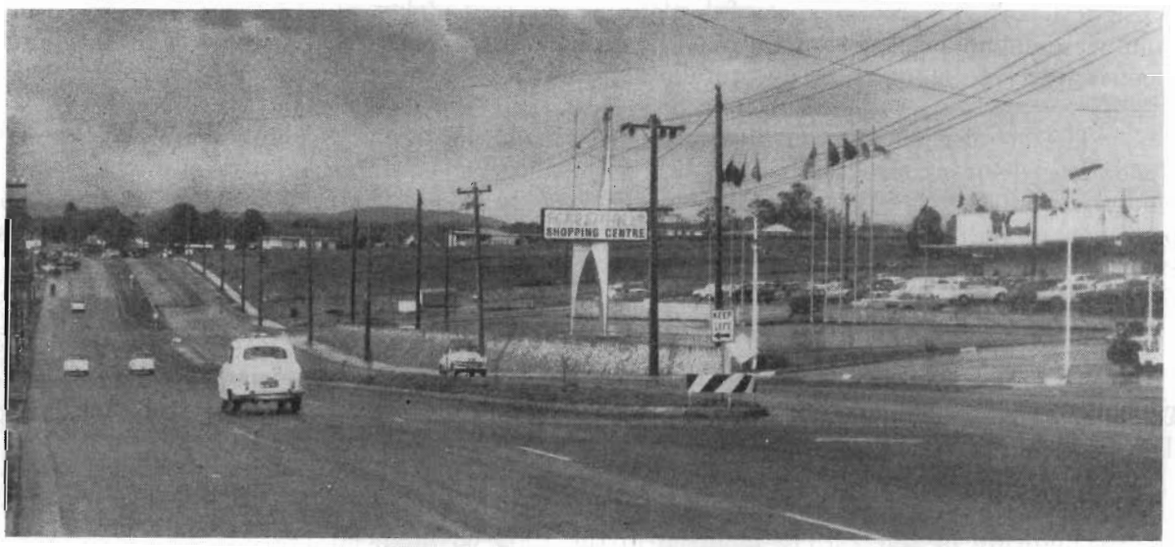


Plate. 5.—Duplication of Canterbury Road, Forest Hill—City of Nunawading.

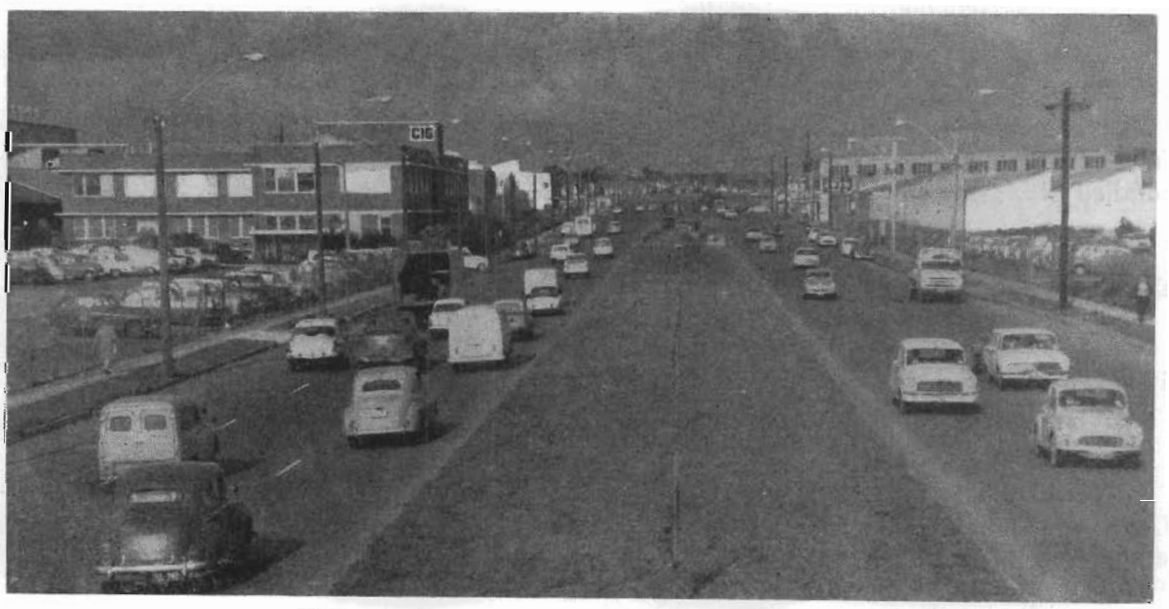


Plate 6.—Duplication of Bell Street—City of Preston.

Western Highway	..	Duplication from Albion westerly to Chatsworth Avenue.
		Duplication at Woodman's Hill east of Ballarat (Plate 4).
Burwood Highway	..	Duplication from Dorset Road to Fern Tree Gully Road.

Main Roads—

Keilor City ..	..	Duplication of Lancefield Road from the Calder Highway to north of Vaughan Street.
Nunawading City	..	Duplication of Canterbury Road, Forest Hill (Plate 5).
Preston City	..	Duplication of Bell Street from O'Keefe Street to Darebin Creek (Plate 6).
Waverley City	..	Duplication of Springvale Road from Fern Tree Gully Road to the Princes Highway.

The widening of existing roads to accommodate more traffic lanes and provide for dividing the carriageways, and the creation of new routes to replace or supplement existing ones involves the acquisition of private lands and the transfer of public lands for road purposes. It is necessary to commence the acquisition of land well in advance of road construction. This requires careful planning so that delay will not occur when traffic volumes demand provision of the new facilities and to ensure that there will be minimum inconvenience to landowners and public bodies.

The acquisition of right-of-way for certain of the freeways planned by the Country Roads Board for construction in the near future has placed an added strain on the Board's annual revenues. The Board considers that the sums needed for purchases of land for provision of right-of-way could well be the subject of additional grants from loan funds.

2. RECEIPTS AND PAYMENTS.

The total funds available to the Board for expenditure during the year amounted to £28,382,654 and included a balance of £1,400,522 brought forward from the previous year. This represented an increase of £3,293,014 over financial year 1962–63.

Actual expenditure totalled £28,379,057 which was an increase of £4,689,939 over the expenditure of £23,689,118 incurred in the 1962–63 financial year.

Of the total expenditure of £28,379,057, £19,101,057 was incurred directly by the Board and £9,278,000 by municipalities.

Country Roads Board Fund.

Net receipts from motor registration fees and fines, half the drivers' licence fees, the full amount of drivers' testing fees, examiners' licence fees and municipalities repayments totalled £12,503,090, which was an increase of £938,252 over the amount received in 1962–63.

The proceeds of charges under the Commercial Goods Vehicles Act amounted to £2,818,969, an increase of £359,412 over the amount received in 1962–63.

The amount standing to the credit of the Country Roads Board Fund at 30th June, 1964 was £3,597.

Commonwealth Aid Roads Fund.

The sum of £11,412,128 was paid to the State of Victoria under the provisions of the *Commonwealth Aid Roads Act* 1959, an increase of £535,136 on the previous year. Of this amount £11,215,367 was received for expenditure by the Board and the balance of £196,761 was allocated by the Public Works Department for works connected with transport by road or water.

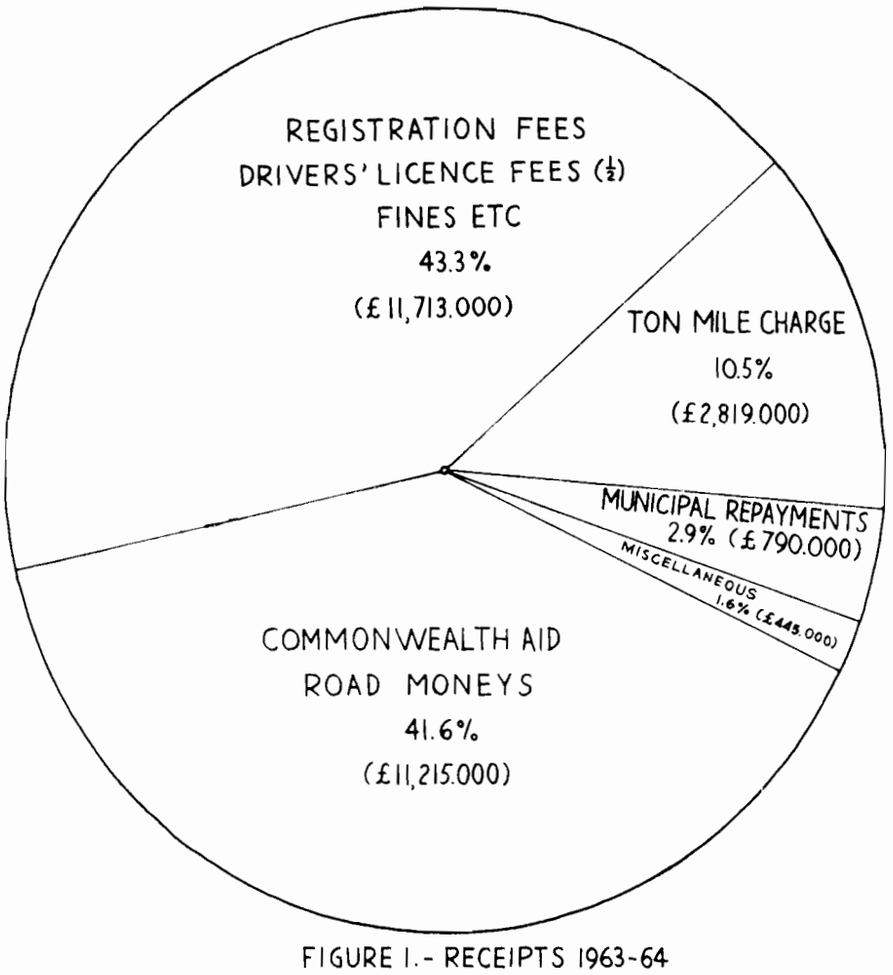


FIGURE 1.- RECEIPTS 1963-64

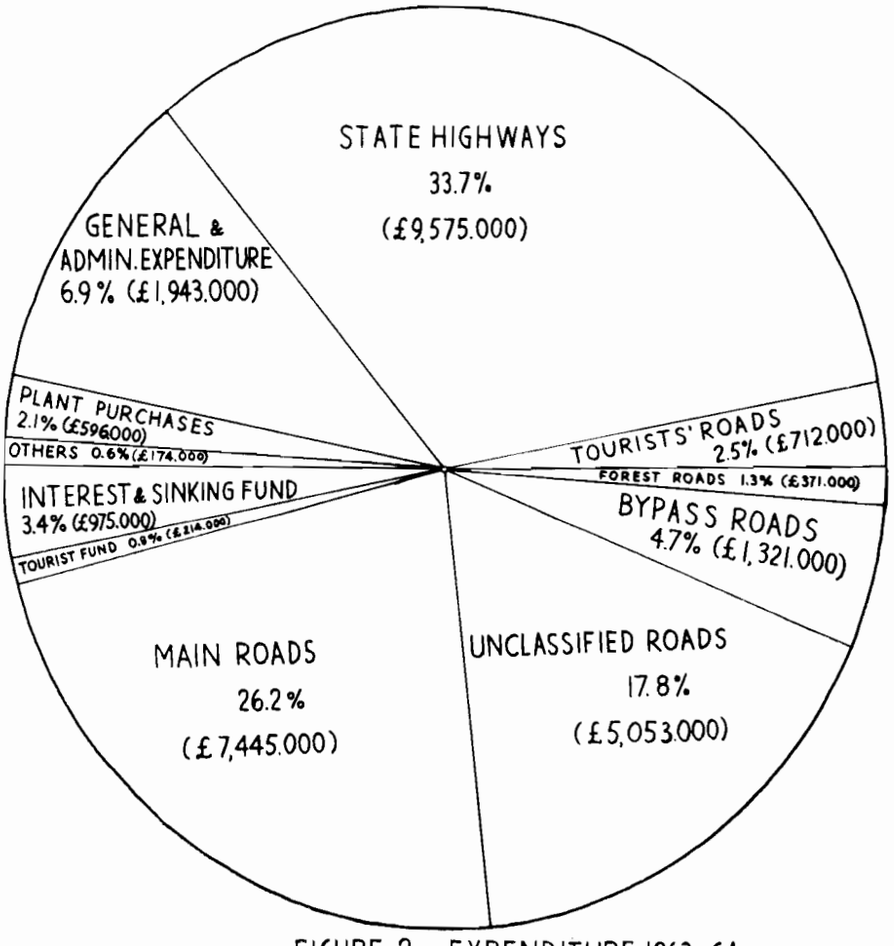


FIGURE 2.- EXPENDITURE 1963-64.

Loan Funds.

Loan money made available to the Board amounted to £333,000 and was expended on main roads and State highways.

General.

The charts in Figures 1 and 2 show, relatively, the sources of the Board's income together with expenditure during the year.

3. ROAD NEEDS SURVEY.

The Board co-operated in the national survey of road needs undertaken by the N.A.A.S.R.A., designed to cover the next two five-year periods. The general procedure for conducting the survey was to determine from traffic counts, the volume of existing traffic, estimate the increase over the periods and assess the standard of road required to meet the requirements of the expected traffic. The cost of necessary works and maintenance to provide for reasonable standards was then estimated.

The estimated costs of the required work for the whole of Victoria including urban areas during the five-year period 1964–69 including municipal works and allowing for rising prices are as follows:—

	£
Freeways (By-pass roads)	180,000,000
State highways	49,000,000
Tourists' and forest roads	7,000,000
Main roads	47,000,000
Unclassified roads	130,000,000
Private streets	34,000,000
	447,000,000

It is estimated that funds available from all sources, State, Commonwealth and Municipal over the same period will amount to £303,000,000 which indicates a deficiency of £144,000,000 an average of approximately £29,000,000 per annum.

Deficiencies are thus accumulating and sources of additional revenue are needed to overtake arrears of work and to expedite the provision of a more adequate network of roads of all categories throughout urban and rural areas.

Unless additional revenues are found, deficiencies of funds and arrears of work will increase and the provision of a more adequate network of roads will be delayed resulting in a retardation of the development of the State.

4. COMMONWEALTH AID ROADS ACT.

The *Commonwealth Aid Roads Act* 1959 provided for the distribution amongst all the States of £58,000,000 during the year 1963–64.

Victoria received £11,412,127 which represented less than 20 per cent. of the total distribution by the Commonwealth. As Victorian vehicle owners contributed more than 30 per cent. of the total fuel taxes collected by the Commonwealth the amount received by Victoria is indeed inequitable.

The *Commonwealth Aid Roads Act* 1959 expired on 30th June, 1964, and was replaced by the *Commonwealth Aid Roads Act* 1964.

Prior to the drafting of the new Act, Victoria presented a case to the Commonwealth for an increased share in the distribution of Commonwealth Aid Road funds.

The distribution of funds under the 1959 Act was 5 per cent. to Tasmania and the remainder to the mainland States on the basis of one-third area, one-third population at the last census and one-third on the number of motor vehicles registered at the previous 31st December.

At the Premier's Conference held in Canberra in February, 1964, the provisions of the proposed new *Commonwealth Aid Roads Act* 1964 were announced. Despite vigorous presentation by the Hon. The Premier of Victoria, of a logical case for an increased share by Victoria, the Commonwealth announced the continuation of the old formula of distribution. The new Act, however, does provide for an increased total distribution to the States. £65,000,000 will be distributed in 1964–65 rising to £85,000,000 in 1968–69. A total of £375,000,000 will therefore be distributed to the States during the next five years as against £250,000,000 during the last five years.

Provision is made under the 1964 Act that money paid by the Commonwealth to a State in a financial year shall be expended or set aside for expenditure within that year. Money set aside but not expended in the year of receipt must be expended within a period of six months within the following financial year. This provision did not apply under the 1959 Act but it did require that money available for rural roads under the terms of that Act was to be expended in full each financial year.

The new Act retains the provision that 40 per cent. of the money allocated to the States shall be spent on rural roads other than State highways, trunk roads and main roads. This provision can result in an unbalanced development of roads in the various States. It will also restrict the Board's ability to extend the present declared road system of State highways and main roads.

The new Act retains the provision which allows for a total of £1,000,000 to be expended each year by the States on the construction of works that are not on roads but are directly connected with transport by road or water.

5. ALLOCATIONS FOR ROAD AND BRIDGE WORKS.

In July, 1963, the Board considered the applications for funds submitted by municipal councils and its own engineers. As usual the applications exceeded the funds available and the amount which the Board was able to allocate.

Allocations made by the Board are divided into commitments, revotes and fresh works.

With respect to works under municipal control a commitment is incurred by the Board in the following circumstances :—

(i) When the Board approves of a council accepting a specified tender for works to be carried out by contract. The amount of the commitment represents the approved contract price plus incidental expenditure, but it is limited by the amount of the grant unless the latter has been appropriately increased by a further grant or by a transfer ;

(ii) When the Board approves of work being carried out by direct labour on approved plans and specifications and for a definite sum. The amount of the commitment is limited by the amount of the grant and represents the approved estimate of cost of the work including incidental expenditure, but excluding supervision ;

(iii) Commitment balances are automatically carried forward from one year to another unless the commitment has been available during two financial years and there has been no expenditure incurred during the second financial year.

A revote may be provided by the Board following a council's application for re-allocation of the uncommitted portion of an allocation as at 30th June.

Fresh works in general include patrol and bridge maintenance and works for which no allocations have previously been made by the Board.

For works to be carried out under the direct control of the Board's own supervisors commitments are not automatically carried forward but are reconsidered together with revotes requested and applications for fresh works, including patrol maintenance.

The following table shows the applications for funds and allocations made by the Board in financial years 1962–63 and in 1963–64.

—	1962–63.		1963–64.	
	Applications.	Allocations.	Applications.	Allocations.
	£'000s.	£'000s.	£'000s.	£'000s
State Highways	10,773	7,843	11,505	10,962
Main Roads	12,906	9,633	14,501	11,154
Tourists' Roads	773	621	872	785
Forest Roads	460	366	501	418
By-pass Roads	748	632	2,143	1,905
Unclassified Roads—				
Construction	13,718	5,765	15,289	6,456
Maintenance	2,077	916	2,143	935
TOTAL	41,455	25,776	46,954	32,615

In determining the allocations the Board gives close consideration to every item applied for by each council and each of its own Divisional Engineers.

The Board's knowledge of local conditions and the assessment of present and future importance of the various works applied for enables it to allocate funds on the basis of road needs for the whole State.

6. SHARING THE COST OF ROADWORKS.

The Board bears the whole of the costs of works carried out for the needs of through traffic on State highways, by-pass roads, tourists' roads and forest roads.

In relation to main roads, the Country Roads Act provides that not more than one-third of the amount expended on main roads from the Country Roads Board Fund may be apportioned to municipalities. Where the expenditure incurred is considered to be excessive and where such cost is due to traffic not of local origin or to timber traffic, the Board may reduce a council's contribution below one-third.

Details of expenditure incurred on main roads in 1962–63 and apportioned in 1963–64 are as follows :—

	£
Expenditure from Country Roads Board Fund	4,381,984
Expenditure from Commonwealth Aid Road Moneys	1,307,794
Expenditure from proceeds of ton-mile tax under the Commercial Goods Vehicles Act	827,494
	6,517,272
Amount apportioned to councils (based on expenditure from Country Roads Board Fund only)	746,969
Percentage of amount apportioned to the total expenditure from the Country Roads Board Fund	17·05
Percentage of amount apportioned to the total main road expenditure (including Commonwealth Aid roads and ton-mile tax grants)	11·47

Contributions by municipal councils would have amounted to £2,172,424, if the whole of the expenditure on main roads had been financed from the Country Roads Board Fund and contributions were based on one-third of the expenditure incurred. As shown above, the actual amount apportioned to councils was only £746,969.

An indication of the extent of relief afforded to councils is given by the following figures :—

	1962-63. %	1963-64. %
Percentage of contributions by councils to the total expenditure on main roads	11·83	11·47

Loan moneys used on main roads were expended in urban areas. This expenditure is shared equally by the Board and councils. Repayments by the councils extend over a period of 35 years.

On unclassified roads councils are required to contribute towards expenditure charged to allocations provided by the Board. In determining the extent of the contribution to be made by each council, the Board takes into consideration the nature, extent and location of the work, together with the council's financial position. On construction works, the councils' contribution was approximately £1,208,000 out of a total of £5,053,390 expended.

Allocations subject to council contribution were also made by the Board to assist councils in the maintenance of unclassified roads. Such allocations were generally on £1 Board to £1 council basis in urban areas and £2 Board to £1 council in rural areas.

7. CONTRACTS UNDER BOARD'S DIRECT SUPERVISION.

The Board's contracts again revealed an upward trend in number and value during the financial year 1963–64.

The most spectacular rise was reflected in contracts for road construction works and supply of road making materials. Whereas in financial year 1962–63 the number of contracts of this type was 253 for a value of £2,390,800, the figures in the financial year 1963–64 were 339 contracts for a value of £3,520,250.

More and larger contracts in the field of highway duplication and improvement works were let during the year and it was evident that more experienced contractors with improved plant and equipment were competing for such projects.

The average value of contracts for road construction works in 1963–64 was £50,130, an increase of £10,370 over the equivalent figure for the financial year 1962–63. Although the Board has advertised larger road construction contracts, tender prices have nevertheless risen. This rise is not unexpected since during the previous period of credit restrictions the Board received a number of low tenders whereas now that conditions are more normal prices have returned to appropriate levels.

The following table provides an analysis of the types of contracts entered into and their respective values :—

Type of Contract.	Number of Contracts.	Value.
		£
Road construction	45	2,255,850
Supply of road making materials	294	1,264,403
Bituminous surfacing materials	41	1,093,420
Bridge Construction	38	491,896
Manufacture of bridge components and supply of fabricated steel	18	141,785
Supply of reinforced concrete box culverts	11	96,000
Supply of road making equipment..	29	523,186
Depot facilities and workshop equipment	4	10,655
Miscellaneous services and materials	34	401,950
	514	6,279,145

8. CONTRACTS UNDER COUNCILS' SUPERVISION.

During the year the Board approved of the acceptance by municipal councils of 688 tenders for a total amount of £3,202,560 for road and bridge works for which the Board provided funds. In comparison with the previous financial year, the total amount of contracts increased by approximately £214,500 mainly due to the approval of a number of large projects in the metropolitan area under the supervision of local councils.

Approval was also given to the utilization of 91 municipal period contracts for the supply of materials incorporated in direct labour works financed from funds allocated by the Board.

9. STATE HIGHWAYS

The total length of State highways at the end of the financial year was 4,465, as against 4,473 miles at the beginning of the year. During the year the Laverton section of the Princes Highway West was converted to the classification of a by-pass road. The length of sealed State highways was extended by 36 miles to a total sealed mileage of 4,143 miles.

An amount of £10,962,000 was allocated for works on State highways, of which £1,322,000 was for maintenance and £9,640,000 for construction and reconstruction. Expenditure amounted to £9,575,353.

Of the amount provided for maintenance £695,000 was expended on 446 miles of bituminous surface treatments required to maintain existing sealed surfaces. Except for 40 miles of pavement which were retreated with hotmix bituminous concrete, this bituminous surfacing consisted of thin flush seal retreatments.

Of the amount of £7,613,000 expended on construction and reconstruction, approximately 3·6 per cent. was expended on land acquisition, 12·3 per cent. was expended on bridge construction and approaches and 84·1 per cent. was expended on road construction and sealing.

Duplication projects were again a feature of the major works on State highways in both urban and country areas. During the year a further 9 miles were converted in the metropolitan planning area to 4 or 6-lane divided standard and opened to traffic. A further 7½ miles were duplicated in country areas.

In some cases duplication was planned to make the maximum use of existing sound pavements, but where existing pavements interfered with the ultimate cross sections or introduced problems regarding levels, drainage, or other services making stage construction uneconomical, completely new construction work was carried out.

Construction and reconstruction work on State highways in urban areas quite often affects such services as gas, water, power and telephones. The relocation of these services as well as being quite costly can materially affect the programming of reconstruction works. The introduction of a formal three-year programming of works assists in the planning of reconstruction works to ensure that removal and/or replacement of services are carried out in time to avoid interfering with the progress of the actual road construction works.

Although there are still many short isolated sections of State highways requiring improvement, the tendency during the year was to deal with longer sections of highways to enable greater economy to be achieved.

The following works are typical of the improvements commenced or carried out on State highways during the year :—

Princes Highway West—

Duplication between Lynch's Bridge over the Maribyrnong River and Nicholson Street in the City of Footscray.

Surface treatment to eliminate pavement cracking on four continuous sections totalling 3·50 miles on the Geelong bound carriageway in the Shire of Corio.

Plate 7.—Princes Highway West—Reconstruction in the City of Colac.

Plate 8.—Princes Highway East—New alignment west of Nowa Nowa.

Plate 9.—Western Highway—Reconstruction at Box's Cutting near Beaufort.

Elimination of earthen shoulders at Belmont by widening the 24-ft. wide seal to 46 feet for a distance of 0·47 mile.

Reconstruction in the City of Colac for a distance of 0·58 mile. (Plate 7).

Widening Deans Creek Bridge at the 93·8 mile post in the Shire of Colac to full formation width and the provision of two multi-cell culverts to eliminate flooding.

Replacement of a narrow timber bridge at the 99-mile post in the Shire of Colac by a multi-cell 6 ft. 6 in. reinforced concrete pipe culvert.

Realignment and reconstruction of 2·07 miles through the Stony Rises at Pirron Yallock.

Reconstruction and realignment of 2·16 miles between Warrnambool and Dennington, including the construction of a road over rail overpass 300 ft. long and a bridge 410 ft. long over the Merri River.

Princes Highway East—

Construction of two 36-ft. carriageways with an 18-ft. central median in the City of Oakleigh from Fern Tree Gully Road to Clayton Road, a distance of 1·80 miles.

Construction of duplicate 36-ft. carriageways with an 18-ft. central median for 1·67 miles from Evelyn Street to Springvale Road in the Cities of Oakleigh and Waverley.

Improvement of the intersection of the highway and Springvale Road in the Cities of Springvale and Waverley.

Construction of 1·76 miles of duplicate 36-ft. carriageways from Corrigan Road to east of Heatherton Road in the cities of Springvale and Dandenong.

Construction of 1·42 miles of duplicate 36-ft. carriageways from east of Heatherton Road to Clow Street in the City of Dandenong.

Resheeting two sections known as the Hallam and Narre Warren Flats in the Shire of Berwick.

Widening pavement for a length of 0·49 mile, 1 mile west of Pakenham township.

Improvement of the alignment for a distance of 0·45 mile at North Garfield.

Resheeting and widening 1·50 miles at North Langwarry.

Widening for a distance of 0·50 mile in Drouin township.

Construction of duplicate pavements for a distance of 0·50 mile in Warragul township east of the road over rail overpass.

Reconstruction of a further 0·50 mile to provide duplicate carriageways in York Street in the City of Sale, including channelized treatment at the intersection with Raglan Street.

Construction of the concrete substructure for a new bridge over the Avon River at Stratford, including approaches on a new alignment.

Reconstruction of 3·96 miles just west of Nowa Nowa, including the construction of approaches to a new bridge to be built over Boggy Creek (Plate 8).

Reconstruction of the remaining section of 4·0 miles between the east end of the Club Terrace deviation and the previous seal at Reed Bed Creek. The work includes the construction of bridges at Tonghi Creek and Reed Bed Creek.

Reconstruction for a distance of approximately 3·0 miles easterly from Cann River to Reedy Creek.

Reconstruction of two sections between Reedy Creek and Scrubby Creek totalling 10·52 miles.

Western Highway—

Widening and reconstruction of the southern carriageway between Ashley Street and Duke Street in the City of Sunshine.

Duplication to four lanes between Albion Overpass and Kororoit Creek in the City of Sunshine.

Construction of a new 3-span bridge on an improved alignment over the Lerderderg River in the Shire of Bacchus Marsh.

Improvement of two curves in the Avenue of Honour, Bacchus Marsh, involving the removal and replacement of seventeen elm trees.

Reconstruction of 1·04 miles west of Gordon.

Duplication of 2·0 miles east of Ballarat.

Construction of a new 4-span reinforced concrete bridge on an improved alignment over the Mount Emu Creek at Trawalla.

Reconstruction and realignment of 2·16 miles west of Trawalla.

Reconstruction of 1 mile at Box's Cutting (Plate 9).

Regrading and widening 2·36 miles west of Ararat.

Reconstruction of 2·0 miles between Drung Drung and Green Lake.

Widening 4·90 miles between Wail and Dimboola.

Widening and resheeting 6·0 miles east of Kaniva.

Widening and resheeting 3·30 miles between Kaniva and Lillimur.

Calder Highway—

Earthworks and bridge works associated with the grade separation at the intersection with Lancefield Road in the City of Keilor.

Reconstruction and realignment of approximately 1·0 mile at Curly Hill in the City of Keilor and the construction of a new bridge over the Maribyrnong River.

Surfacing with bituminous concrete for approximately 3·50 miles, north west of Keilor.

Reconstruction and widening for a length of 1·20 miles in the Black Forest.

Strengthening by resheeting and sealing of 2·50 miles between Woodend and Carlsruhe.

Reconstruction and sealing for a length of 2·0 miles southerly from Malmsbury.

Reconstruction and sealing of 2·0 miles between Malmsbury and Taradale.

Widening and surfacing with hotmix bituminous macadam, including the provision of a climbing lane between Big Hill and Kangaroo Flat.

Widening 3·45 miles west of Marong.

Reconstruction of 3·50 miles between Glenalbyn and Wedderburn including the construction of a new bridge at the Major Mitchell floodway.

Widening the existing seal with curve improvement of 6·31 miles south of Wycheproof.

Widening and resheeting the existing seal on 3·53 miles north of Wycheproof.

Widening and resheeting the existing seal on 3·11 miles between Dumosa and Nullawil (Plate 10).

Construction of 0·90 mile of deviation through Culgoa including a new bridge over Tyrrell Creek.

Widening and resheeting the existing seal on 4·40 miles south of Sea Lake.

Hume Highway—

Duplication of a further 2·04 miles from the drive-in theatre at Campbellfield to Somerton Road.

Resheeting 1·95 miles between Kal Kallo and Beveridge.

Reconstruction for a length of 1·63 miles to improve alignment and provide a climbing lane at Prospect Hill (Plate 11).

Construction of a duplicated carriageway for 1·40 miles north of Tallarook.

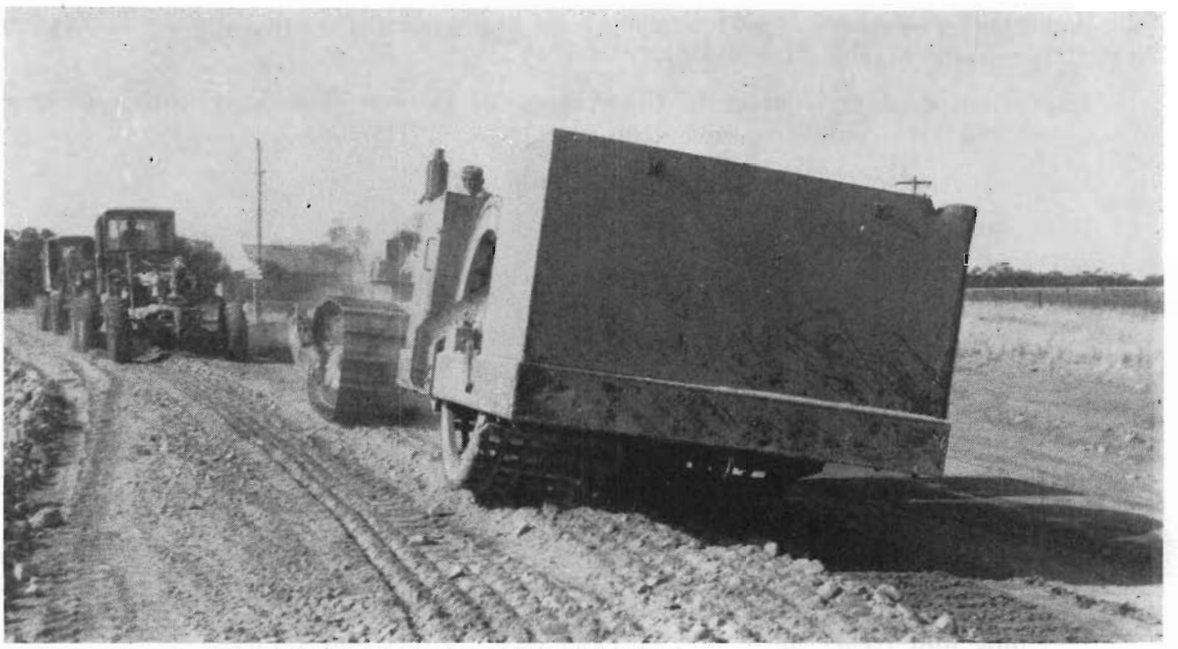


Plate 10.—Calder Highway—Grid Roller working on new alignment at Dumosa.

Plate 11.—Hume Highway—Completed reconstruction at Prospect Hill north of Kilmore.

Plate 12.—Northern Highway—Realignment at Mt. Pleasant Creek.

Construction of a channelized intersection at the junction with the Goulburn Valley Highway north of Seymour.

Elimination of the floodway at Balmattum with sixteen openings of 96-in. by 48-in. box culverts.

Reconstruction of the southern approach to Benalla over a length of 1·0 mile.

Construction of new bridges over the Ovens River and the floodway at Wangaratta.

Resheeting 4·50 miles south of Wodonga.

Northern Highway—

Construction of a deviation near Mount Pleasant Creek and resheeting the existing pavement for a length of 4·71 miles (Plate 12).

Widening and resheeting 2·40 miles north of Toolleen.

Widening and resheeting 3·60 miles near Myola.

Omeo Highway—

Reconstruction and realignment of 4·0 miles to replace the very tortuous section between the Bindi Road turn off and Gibsons in the Shire of Omeo.

Widening and improvement of curves for two sections totalling 4·0 miles in the Shire of Omeo (Plate 13).

Reconstruction of 2·69 miles north of Tallandoon.

Murray Valley Highway—

Replacement of narrow timber bridges at Walwa Creek and Sandy Creek and construction of approaches.

Reconstruction east of Walwa for a distance of 8·33 miles to Pine Mountain Creek.

Widening 4·80 miles east of the Ovens River.

Widening existing seal to provide a sealed width of 22 feet west of McCoy's Bridge.

Construction of a new bridge 240 feet long over the Campaspe River at Echuca.

Widening 5·30 miles of existing 16-ft. seal to provide a sealed width of 22 feet west of Echuca.

Reconstruction of 3·0 miles west of Cohuna.

Reconstruction and sealing of 7·79 miles between Piambie and Boundary Bend, including the construction of six bridges at the inlet and outlet of Heywoods Lake (Plate 14).

South Gippsland Highway—

Realignment and widening of 1·86 miles in the Shire of Cranbourne.

Construction of a deviation for 1·27 miles in the vicinity of Silkestone Hill east of Korumburra (Plate 15).

Construction of a new reinforced concrete bridge over the Franklin River near Toora.

Reconstruction and sealing of 3·25 miles near Hedley.

Midland Highway—

Reconstruction and widening, including raising the pavement over sections where flooding occurs for a length of 2·0 miles, north of Ballarat.

Reconstruction and realignment of 2·58 miles north of Daylesford.

Reconstruction of 2·0 miles north of Barjarg.

Widening 2·40 miles north of Mansfield.

Reconstruction and sealing of 2·80 miles between Welshpool and Port Welshpool.

Cann Valley Highway—

Reconstruction and realignment of 2·50 miles in readiness for sealing.

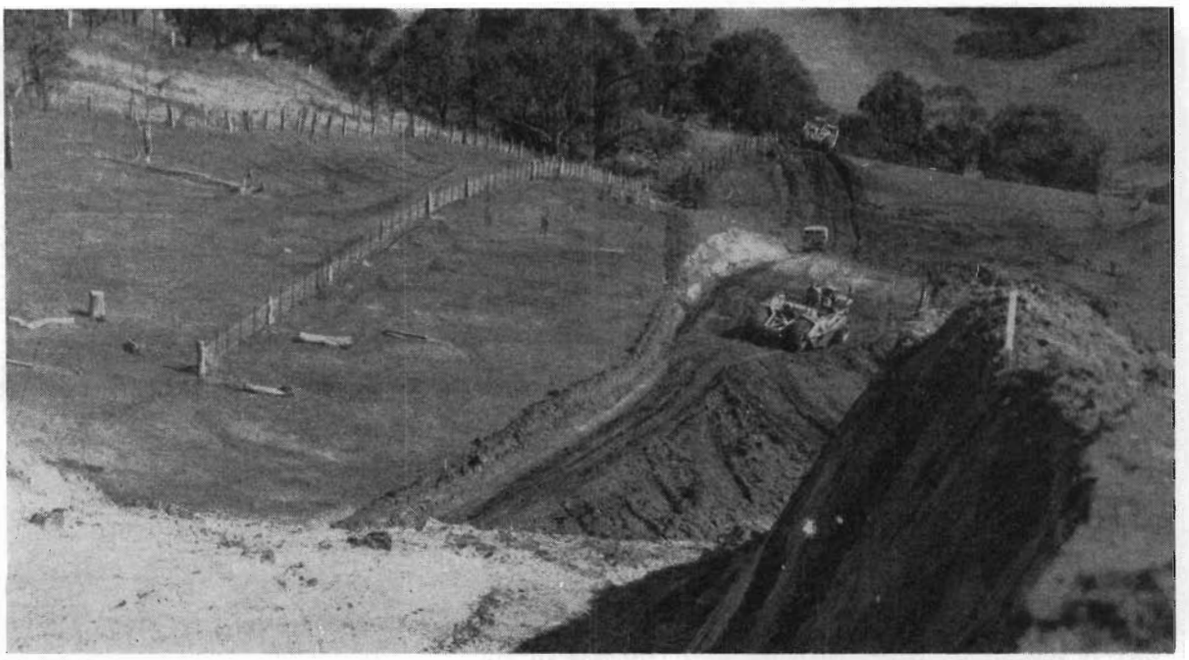


Plate 13.—Omeo Highway—Construction in progress 9 miles south of Omeo.

Plate 14. Murray Valley Highway—New construction between Piambie and Boundary Bend.

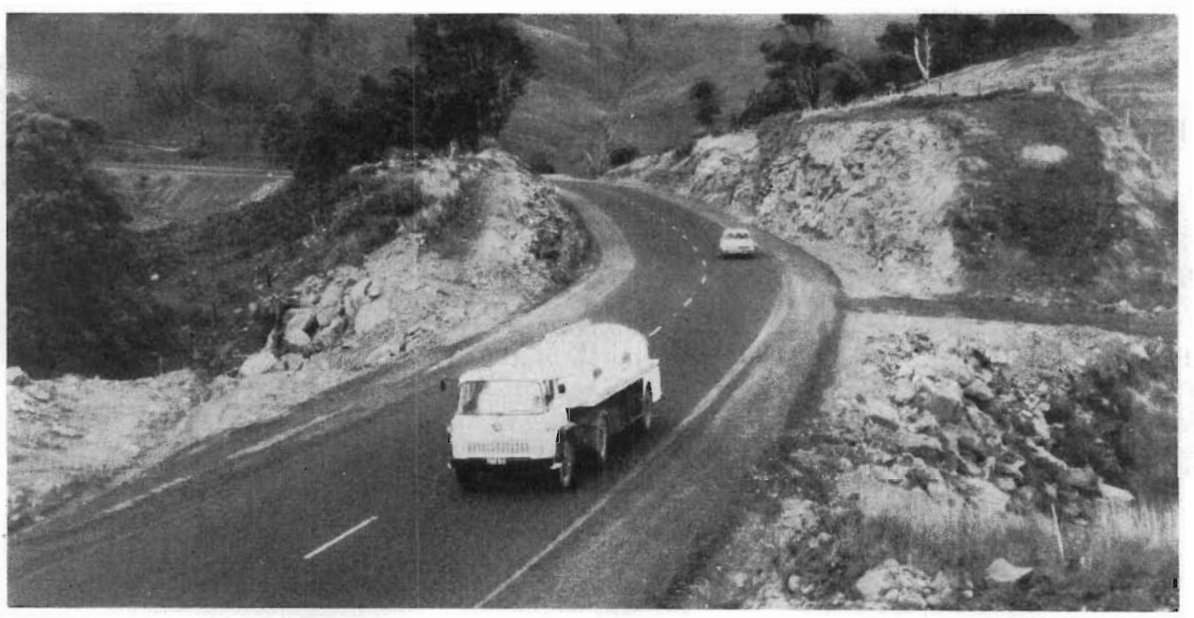


Plate 15.—South Gippsland Highway—Silkestone Hill, Korumburra.

Pyrenees Highway—

Reconstruction and widening of 1·08 miles at Bung Bong.

Reconstruction of 0·62 mile between Avoca and Amphitheatre.

Henty Highway—

Reconstruction of three sections south of Hamilton totalling 6·65 miles.

Reconstruction of 2·40 miles north of Brim.

Loddon Valley Highway—

Widening 6·75 miles near Campbell's Forest.

Goulburn Valley Highway—

Reconstruction of 4·19 miles at Mangalore West.

Reconstruction of 0·99 mile of the southern approach to Numurkah.

Reconstruction of 1·01 miles at Trawool.

Reconstruction of 0·88 mile from Home Creek to Ridds Road.

Ouyen Highway—

Construction and sealing of 4·0 miles near Tutye eliminating two rail level crossings (Plates 16 and 17).

Reconstruction and sealing of 2·65 miles east of Cowangie.

Nepean Highway—

Duplication of 0·32 mile at Oliver's Hill, including the erection of 1,600 feet of sea wall.

Duplication of 0·90 mile, including a channelized intersection at Moorooduc Road.

Duplication of 1·20 miles at Rosebud.

Glenelg Highway—

Construction of the Woady Yaloak Creek deviation, a distance of 1·93 miles, including a new reinforced concrete bridge.

Reconstruction, realignment and widening of 1·90 miles west of Linton.

Widening and resheeting 1·70 miles west of Westmere.

Reconstruction of 3·0 miles at Lake Bolac.

Reconstruction of 3·86 miles east of Glen Thompson.

Widening 6·43 miles west of Moutajup.

Reconstruction of 1·36 miles east of Dunkeld.

Reconstruction and realignment of 1·88 miles at Bochara, including a new bridge over McKinnons Creek.

Reconstruction and realignment of 1·76 miles at Carapook.

Reconstruction and realignment of 2·24 miles east of the South Australian border.

Ovens Highway—

Completion of a new bridge at 6·85 miles and intersection treatment at Tarrawingee (Plate 18).

Reconstruction of 1·30 miles south of Myrtleford.

North-Western Highway—

Construction of two bridges 125 feet and 185 feet long across the Richardson River at Donald.

Reconstruction of 2·60 miles between Donald and Buloke.

Plate 16.—Ouyen Highway—Tutye Deviation before construction.

Plate 17.—Ouyen Highway—Realignment at Tutye completed.

Plate 18.—Ovens Highway—Junction with Beechworth Road.

Maroondah Highway—

Construction of 0·68 mile of six-lane divided highway from Springvale Road to Richard Street in the City of Nunawading.

Construction of 0·68 mile of six-lane divided highway from Richard Street to Lee Parade, Mitcham.

Construction of 0·88 mile of divided highway from Lee Parade Mitcham to Heatherdale Road, Ringwood.

Reconstruction of 0·59 mile of existing two-lane pavement to duplicated three-lane carriageways with a central median between the Clock Tower at Ringwood and east of the Mount Dandenong Road intersection.

Reconstruction of 0·80 mile in the township of Alexandra.

Reconstruction of 3·56 miles in the vicinity of Merton.

Reconstruction of 0·91 mile at Yarra Flats (Plate 19).

Burwood Highway—

Widening 2·15 miles from the Wantirna-Sassafras Road to Fern Tree Gully Road.

Duplication of 0·68 mile from Fern Tree Gully Road to east of Dorset Road.

Hamilton Highway—

Construction of a 3-span bridge 114 feet long over Native Hut Creek, including bridge approaches.

Construction of a new bridge 107 feet long over Warrambine Creek.

Construction of a 5-cell pipe culvert over Mia Mia Creek.

Widening and surface regulation of 2·30 miles near Cressy.

Reconstruction of 1·93 miles at Penshurst.

Wimmera Highway—

Widening 5·0 miles near Bates Lake.

Reconstruction of 3·90 miles between Quantong and Natimuk (Plate 20).

Reconstruction of 2·0 miles through Gre Gre Swamp.

10. BY-PASS ROADS.

The Board has continued to plan new by-pass roads and reserve the land necessary as the need is established and funds become available. During the year, work was done on the following by-pass roads :—

Hume By-pass Road—demolition and reconstruction of the bridge at Black Dog Creek which was destroyed by fire on the 17th November, 1963 (Plate 21).

Tullamarine By-pass Road—Construction of an initial two-lane two-way undivided road, 3·50 miles long, deviating the existing Lancefield Road to by-pass the Tullamarine Jetport runways.

Princes By-pass Road—Construction of 3 miles of undivided two-lane road between Gunn's Gully and Hernes Oak.

The total length of by-pass roads now declared in the State is 37 miles. In addition to the projects described above, a considerable amount of land was acquired during the year on the following routes, with a view to ensuring that further development does not take place on land required for future important routes and to meet cases of hardship where owners wished to sell but were unable to dispose of their properties because of the reservation or freezing of the land for a future route :—

Cranbourne By-pass Road	..	Shire of Cranbourne.
Dingley By-pass Road ..	..	Cities of Moorabbin and Springvale.
Eumemmering By-pass Road	..	Shires of Berwick and Cranbourne.

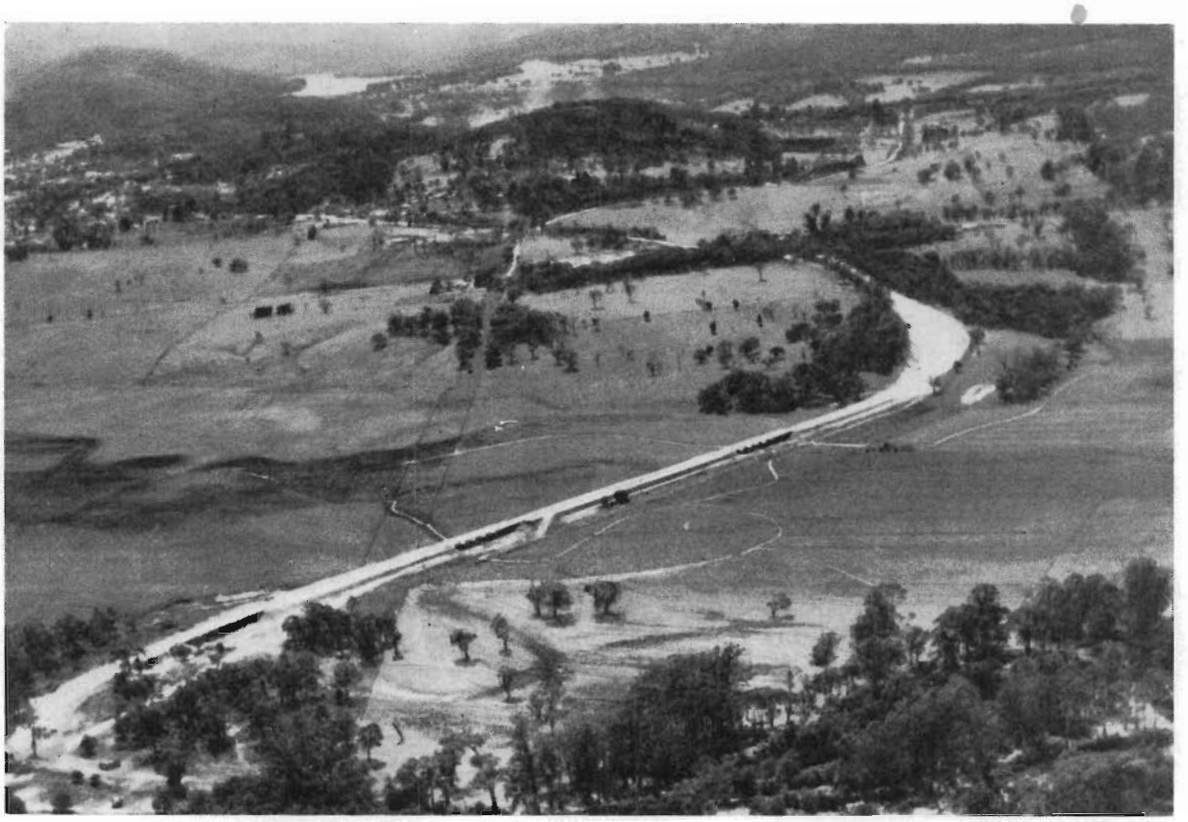


Plate 19.—Maroondah Highway—New construction at Yarra Flats.

Plate 20.—Wimmera Highway—Reconstruction between Quantong and Natimuk.

Plate 21.—Hume By-pass Road—New bridge over Black Dog Creek.

Frankston By-pass Road ..	Shire of Frankston.
Greensborough By-pass Road ..	City of Heidelberg.
Hume By-pass Road	Shires of Bulla, Whittlesea and Chiltern.
Latrobe Valley By-pass Road ..	Shire of Berwick.
Mornington Peninsula By-pass Road	City of Springvale—Shires of Frankston and Flinders.
Mulgrave By-pass Road	Cities of Oakleigh, Waverley and Dandenong—Shires of Berwick and Cranbourne.
Princes By-pass Road	Shires of Altona and Werribee—City of Moe.
Scoresby By-pass Road	Cities of Dandenong and Ringwood—Shire of Knox.
Strathmore By-pass Road ..	City of Broadmeadows.
Tullamarine By-pass Road ..	Shires of Bulla and Whittlesea.

11. MAIN ROADS.

Applications for funds received from municipal councils and the Board's Engineers for works on main roads totalled £14,501,407.

The following table shows applications, allocations and expenditure on *main roads* for financial years 1962–63 and 1963–64.

		1962–1963.	1963–1964.
		£'000s	£'000s
A	Applications	12,906	14,501
B	Allocations	9,633	11,154
C	Expenditure	6,748	7,445
		%	%
B	as percentage of A	74·5	76·9
C	as percentage of B	70·0	51·3

Some of the typical works undertaken during the year on main roads are set out hereunder :—

Bairnsdale Division—

Avon Shire.—Bengworden Road—Reconstruction of 4·0 miles at Meerlieu, including realignment at Hollands Landing turnoff.

Dargo " B " Road—Realignment of 0·50 mile (Plate 22).

Bairnsdale Shire.—Bairnsdale–Paynesville Road—Widening, resheeting and sealing 2·0 miles.

Omeo Shire.—Ramrod Flat Road—Construction of a new reinforced concrete bridge 28 feet between kerbs over Little River at Ensay and reconstruction of 0·90 mile including bridge approaches.

Benambra Road—Reconstruction of 0·70 mile.

Orbost Shire.—Buchan–Orbost Road—Reconstruction and sealing of 3·20 miles.

Ballarat Division—

Ararat Shire.—Ararat–Warrnambool Road—Reconstruction and realignment of 2·82 miles north of Lake Bolac.

Maroona–Glenthompson Road—Reconstruction and realignment of 3·41 miles.

Ballarat Shire.—Maryborough–Ballarat Road—Reconstruction and sealing of 2·10 miles.

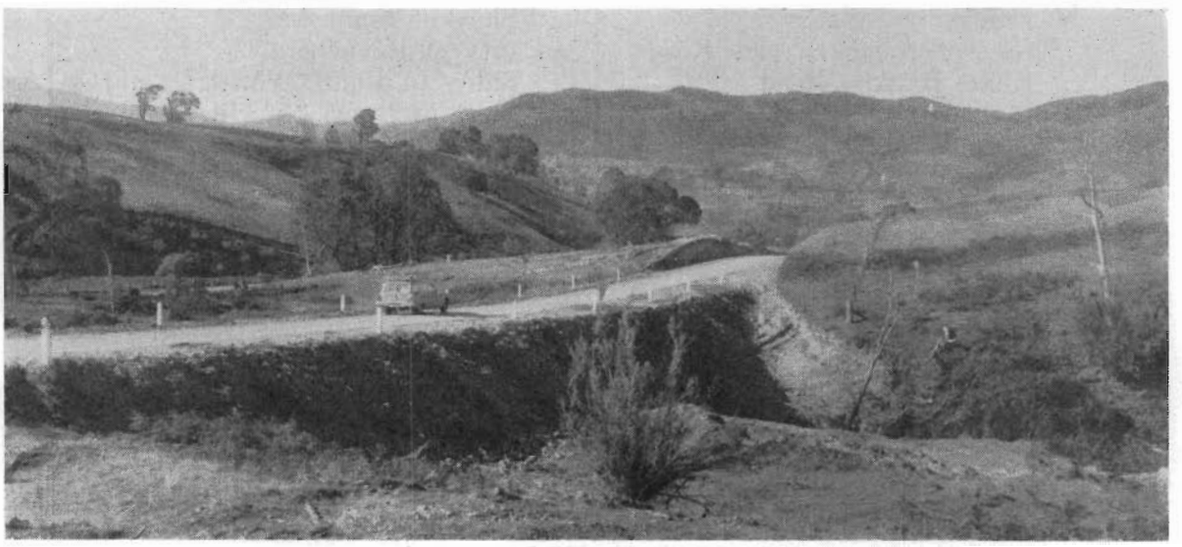


Plate 22.—Dargo Road—New alignment 1 mile south of Dargo—Shire of Avon.

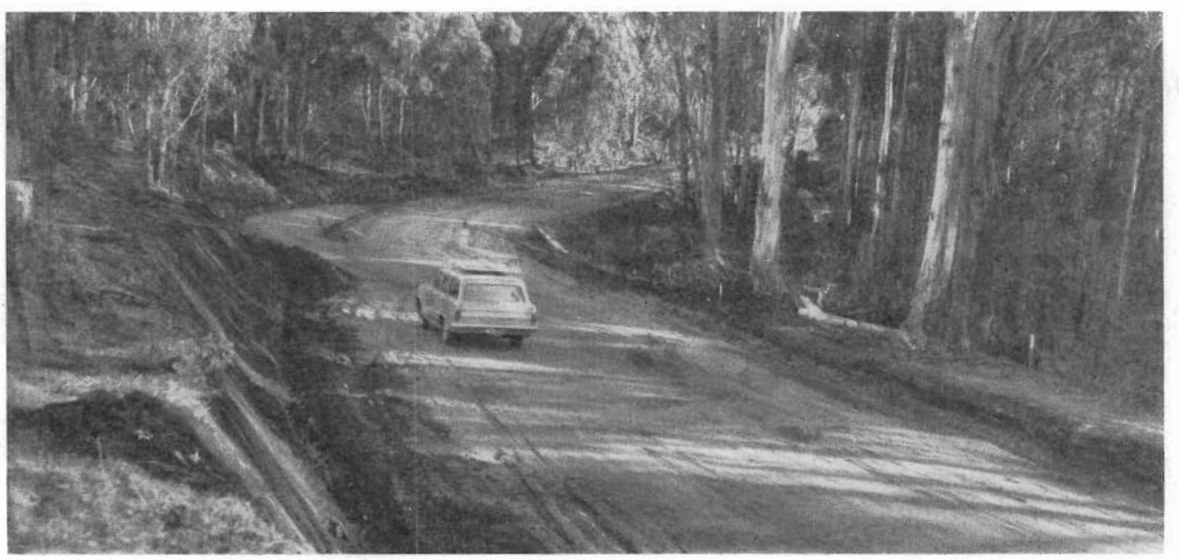


Plate 23.—Daylesford-Trentham Road—Reconstruction and realignment—Shire of Glenlyon.

Plate 24.—Tallangatta-Corryong Road—Reconstruction—Shire of Towong.

Bungaree Shire.—Daylesford–Ballarat Road—Reconstruction of 1·20 miles.

Glenlyon Shire.—Daylesford–Trentham Road—Reconstruction and realignment of final 0·70 mile (Plate 23).

Maryborough City.—Ballarat Road—Realignment and reconstruction of 0·67 mile in Maryborough.

Ripon Shire.—Beaufort–Carngham Road—Reconstruction of the bridges over Mt. Emu Creek and Spring Hill Creek at Lillirie.

Talbot Shire.—Maryborough–Ballarat Road—Reconstruction and sealing of four sections totalling 2·80 miles.

Talbot–Avoca Road—Construction of a 3-span concrete bridge 65 feet long over Back Creek.

Benalla Division—

Bright Shire.—Bright–Tawonga Road—Reconstruction of two sections totalling 3·61 miles.

Oxley Shire.—Moyhu–Glenrowan Road—Reconstruction of 4·0 miles.

Towong Shire.—Tallangatta–Corryong Road—Reconstruction of two sections totalling 5·30 miles (Plate 24).

Yabba Road—Reconstruction of two sections totalling 1·55 miles.

Upper Murray Shire.—Tintaldra Road—Resheeting various sections and reconstruction of 1·0 mile.

Yackandandah Shire.—Running Creek Road—Reconstruction and realignment of 1·90 miles and resheeting of 2·0 miles.

Bendigo Division—

Bet Bet Shire.—St. Arnaud–Dunolly Road—Reconstruction and sealing of 4·30 miles near Bealiba and replacement of Pyke's Bridge with a concrete structure (Plate 25).

Bendigo City.—St. Arnaud Road—Reconstruction, sealing and installation of reinforced concrete structure for floodway elimination on a distance of about 3·0 miles.

Deakin Shire.—Echuca–Kyabram Road—Reconstruction, sealing and culvert widening on 3·90 miles.

East Loddon Shire.—Bendigo–Pyramid Road—Reconstruction and sealing of 2·50 miles south of Tandarra.

Prairie–Borung and Mitiamo–Boort Road—Reconstruction and sealing of 6·0 miles.

Gordon Shire.—Boort–Kerang Road—Reconstruction and sealing of 3·60 miles near Lake Meering.

Boort–Wycheproof Road—Reconstruction and sealing of 6·50 miles in the Marmal area.

Charlton–Durham Ox Road—Reconstruction and sealing of 4·85 miles in two sections.

Wedderburn–Boort Road—Reconstruction and sealing of 2·0 miles north of Mysia.

Kerang Shire.—Boort–Kerang Road—Reconstruction and sealing of 2·30 miles near the southern shire boundary.

Donald–Swan Hill Road—Reconstruction and sealing south of Lalbert.

Dumosa–Quambatook Road—Reconstruction and sealing of several miles at the Donald–Swan Hill Road end.

Koroop Road—Reconstruction and sealing of several miles easterly from the junction with the Kerang–Koondrook Road.

Korong Shire.—St. Arnaud–Dunolly Road—Reconstruction of 2·60 miles and construction of a new reinforced concrete bridge at Foley's Creek.

Serpentine Road—Widening and sealing of 5·90 miles south of the Loddon River.

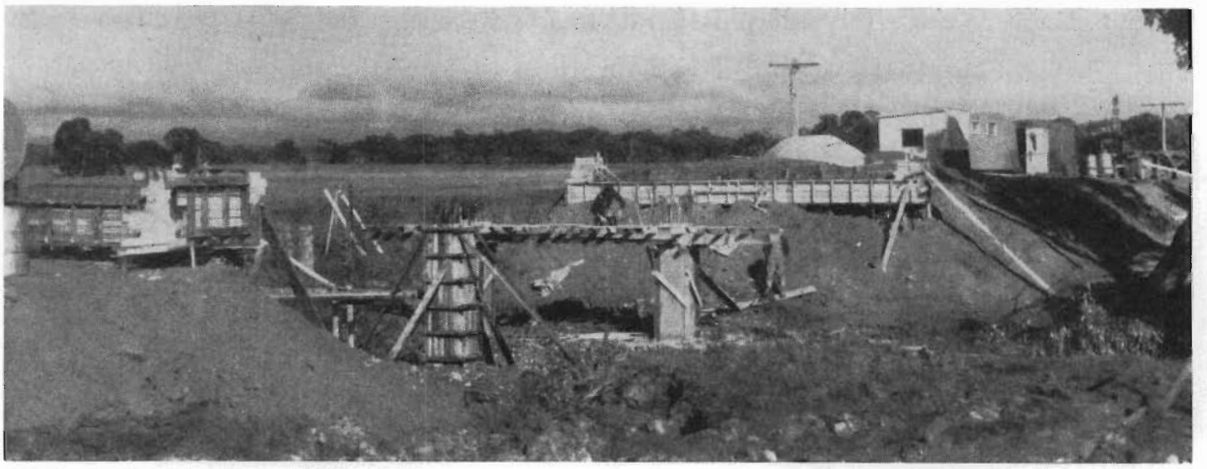


Plate 25.—St. Arnaud-Dunolly Road—Replacement of Pyke's Bridge—Bet Bet Shire.

Plate 26.—Sea Lake-Robinvale Road—Reconstruction—Swan Hill Shire.

Plate 27.—Yarra Glen-Yea Road under construction—Healesville and Yea Shires.

Metcalfe Shire.—Kyneton–Redesdale Road—Replacement of an old timber bridge and realignment of approaches.

Rochester Shire.—Echuca–Mitiamo Road—Reconstruction and sealing of 5·30 miles near Kotta.

Construction of 5·80 miles and sealing of 4·20 miles near Mt. Hope Creek.

Rochester–Bamawm–Prairie Road—Reconstruction of 3·60 miles and sealing of 3·30 miles.

Strathfieldsaye Shire.—Mandurang Road—Reconstruction and sealing of 1·50 miles and sealing of a further 2·0 miles.

Strathfieldsaye Road—Replacement of an old timber bridge at Mosquito Creek with a reinforced concrete structure.

Swan Hill Shire.—Ouyen–Piangil Road—Reconstruction and sealing of 2·90 miles and sealing of a further 2·10 miles.

Sea Lake –Robinvale Road—Reconstruction of 10·0 miles and 7·30 miles of sealing in two sections (Plate 26).

Wycheproof Shire.—Berriwillock–Woomelang Road—Reconstruction, realignment and sealing of 2·50 miles near Culgoa.

Donald–Swan Hill Road—Reconstruction and realignment of 3·0 miles and 4·60 miles of sealing.

Patchewollock–Sea Lake Road—Reconstruction and sealing of 2·50 miles near Nyarrin and near the western shire boundary.

Dandenong Division—

Eltham Shire.—Healesville–Kinglake Road—Reconstruction of 0·75 mile.

Frankston Shire (*Joint Cranbourne*).—Dandenong–Frankston Road—Reconstruction of 1·0 mile as the first stage of duplication at Carrum Downs.

Frankston–Flinders Road—Reconstruction and realignment of 1·25 miles for a 24-ft. sealed carriageway at Frankston.

Healesville Shire.—Yarra Glen–Yea Road—Reconstruction and relignment of 1·87 miles in the vicinity of Highbrow Hill.

Healesville and Yea Shires.—Yarra Glen–Yea Road—Construction of 1·55 miles to link with Castella Road, including a new bridge over the Yea River (Plate 27).

Korumburra Shire.—Poowong–Drouin Road—Reconstruction and realignment of 2·30 miles north of Poowong.

Mansfield Shire.—Mansfield–Woods Point Road—Widening of 1·41 miles.

Nunawading City.—Canterbury Road—Reconstruction of 0·60 mile for duplicated carriageways including intersection treatment at Blackburn Road.

Ringwood City.—Ringwood–Warrandyte Road—Reconstruction of 0·30 mile.

Waverley City.—Springvale Road—Construction of 1·75 miles of carriageway and improvements to the western carriageway between Princes Highway east and Fern Tree Gully Road including intersection treatment at Wellington Road.

Yea Shire.—Whittlesea–Yea Road—Reconstruction and realignment of 2·0 miles between Flowerdale and Hazeldean.

Geelong Division—

Bannockburn Shire.—Meredith–Mount Mercer Road—Reconstruction and realignment of 1·36 miles including replacement of Williamson's Bridge with a 10-ft. diameter Armco pipe culvert.

Barrabool Shire.—Anglesea Road—Widening and strengthening 1·10 miles for coal and cement traffic.

Bellarine Shire.—Geelong–Portarlington Road—Completion of improvements through Drysdale for 0·85 mile.

Bulla Shire.—The Gap Road—Reconstruction of 1·07 mile.

Mickleham Road—Reconstruction and sealing of 1·37 miles in two sections.

Colac City.—Colac–Forrest Road—Construction of a 6-span bridge and approaches over Barongarook Creek.

Colac Shire.—Colac–Beech Forest Road—Widening, strengthening and sealing of 2·70 miles in four sections. Reconstruction of 0·98 mile.

Corio Shire.—Geelong–Bacchus Marsh Road—Reconstruction and sealing of 3·50 miles in two sections.

Geelong–Ballan Road—Widening, strengthening and sealing of 4·90 miles.

Gisborne Shire.—Mount Macedon Road—Curve improvement, widening, strengthening and sealing of 1·90 miles, including bridge replacement.

Kyneton Shire.—Redesdale Road—Reconstruction in preparation for sealing of 2·0 miles.

Leigh Shire.—Colac–Ballarat Road—Provision of new superstructure on existing masonry abutments of an old bridge.

Shelford–Bannockburn Road—Reconstruction of 1·50 miles in preparation for sealing.

Melton Shire.—Coimadai–Diggers Rest Road—Reconstruction and realignment of 2·0 miles in three sections.

Gisborne–Melton Road—Reconstruction involving realignment of 1·70 miles.

Otway Shire.—Charley's Creek Road—Reconstruction of a further 1·20 miles.

Skenes Creek Road—Reconstruction of 1·30 miles.

Romsey Shire.—Gisborn–Kilmore Road—Reconstruction of 2·40 miles.

South Barwon Shire.—Barwon Heads Road—Widening 5·0 miles in three sections.

Torquay Road—Widening 4·40 miles in three sections.

Werribee Shire.—Duncans Road—Widening 1·0 mile.

Winchelsea Shire.—Inverleigh–Winchelsea Road—Reconstruction and realignment of 3·40 miles.

Winchelsea–Deans Marsh Road—Reconstruction of 1·20 miles, including major realignment.

Horsham Division—

Birchip Shire.—Birchip–Sea Lake Road—Construction and sealing of 3·70 miles.

Kaniva Shire.—Kaniva–Edenhope Road—Reconstruction of 3·0 miles to provide a sealed pavement 18 feet wide.

Kowree Shire.—Natimuk–Hamilton Road—Two new bridges 160 feet by 24 feet and 250 feet by 24 feet between kerbs at the Glenelg River Crossing.

Karkarooc Shire.—Hopetoun–Patchewollock Road—Construction and sealing of 8·20 miles.

Patchewollock–Sea Lake Road—Construction and sealing of 2·85 miles.

Kara Kara Shire.—St. Arnaud–Dunolly-road—Replacement of the bridge across Strathfillan Creek. Commencement of new bridge over the Avoca River at Emu.

Stawell Shire.—Landsborough Road—Replacement of the timber bridge by a rail and concrete bridge 134 feet long by 24 feet wide between kerbs.

Stawell–Pomonal Road—Replacement and realignment of two bridges over Mokepilly Creek.

Wimmera Shire.—Horsham–Lubeck Road—Construction and sealing of 3·30 miles.

Metropolitan Division—

Altona Shire.—Millers Road—Reconstruction and duplication from Duosa Road to Blackshaws Road.

Box Hill City.—Doncaster-Mordialloc Road—Widening and reconstruction from Fulton Road to Canterbury Road.

Hawthorn City.—Barkers Road—Reconstruction from Glenferrie Road to Auburn Road.

Keilor City.—Lancefield Road—Duplication from south of Cameron Street to just north of McIntosh Street.

Moorabbin City.—North Road—Reconstruction and duplication from Tyrone Street to Wild Cherry Road.

Oakleigh City.—North Road—Reconstruction of southern carriageway from Best Street to Huntingdale Road and Clayton Road to Princes Highway East.

Doncaster-Mordialloc Road—Reconstruction from Byron Street to Bourke Street.

Preston City.—Bell Street—Duplication from O'Keefe Street to the Darebin Creek.

Traralgon Division—

Alberton Shire.—Yarram-Traralgon Road—Construction of a deviation of 1·95 miles near Carrajung.

Mirboo Shire.—Mirboo South Road—Reconstruction of 1·80 miles south of Grand Ridge Road.

Woorayl Shire.—Nerrena Road—Reconstruction of 2·05 miles west of Dumbalk.

Warrnambool Division—

Dundas Shire.—Hamilton-Port Fairy Road—Reconstruction and sealing of 1·75 miles.

Glenelg Shire.—Casterton-Apsley Road—Realignment, reconstruction and sealing of 2·30 miles.

Portland-Casterton Road—Realignment, reconstruction and sealing of 2·0 miles.

Hampden Shire.—Camperdown-Ballarat Road—Realignment, reconstruction and sealing of 3·50 miles.

Hamilton City.—Mount Napier Road—Construction of a 3-span reinforced concrete bridge 90 feet long by 28 feet between kerbs over Grange Burn Creek.

Mortlake Shire.—Mortlake-Ararat Road—Reconstruction and sealing of 3·60 miles.

Mount Rouse Shire.—Penshurst-Warrnambool Road—Realignment, reconstruction and sealing of 1·50 miles.

Warrnambool Shire.—Peterborough Road—Reconstruction and sealing of 3·40 miles.

12. UNCLASSIFIED ROADS.

During the year the Board continued its practice of assisting councils in undertaking works of major improvement and construction as well as in carrying out the maintenance of unclassified roads under municipal jurisdiction.

843/65.—3

The following table shows the applications, allocations and expenditure for this and the previous year relating to funds provided by the Board apart from councils' contributions :—

	Unclassified Construction and Unclassified Maintenance.	1962-63.	1963-64.
		£'000s	£'000s
A	Applications	15,795	17,432
B	Allocations	6,681	7,388
C	Expenditure	4,834	5,053
		%	%
B	as percentage of A	42·3	42·4
C	as percentage of B	72·4	68·4

Details of some of the major works completed or in hand follow :—

Bairnsdale Division—

Shire of Orbost.—West Cann Road—Construction of a single-span timber and rolled steel joist bridge over Nelson's Creek.

Simpson's Creek Road—Construction of a four-cell reinforced box culvert.

Cape Conran Road—Reconstruction on an improved alignment of 1·50 miles (Plate 28).

Tambo Shire.—Buchan–Ensay Road—Reconstruction of 4·0 miles.

Ballarat Division—

Ararat Shire.—Willaura–Mininera Road—Reconstruction of two sections totalling 3·10 miles.

One Tree Hill Road—Reconstruction of 1·55 miles.

Ballan Shire.—Daylesford Extension Road—Reconstruction of the whole of this road of 0·80 mile.

Grenville Shire.—Geelong–Portland Road—Construction of a pre-stressed concrete bridge 80 feet long over Hoyles Creek.

Ripon Shire.—Stockyard Hill Road—Reconstruction and realignment of 2·0 miles.

Tullaroop Shire.—Timor Road—Construction of a concrete bridge 120 feet long over Bet Bet Creek.

Benalla Division—

Bright Shire.—Dargo High Plains Road—Widening of 7·0 miles.

Shepparton Shire (Joint Violet Town Shire).—Cosgrove–Caniambo Road—Construction of a six-span concrete bridge 241 feet long over Broken River.

Tungamah Shire.—Shepparton–Katamatite Road—Initial construction of 7·50 miles.

Upper Murray Shire.—Benambra–Corryong road—Construction of MacNamara's Bridge and its approaches. Construction and realignment of 2·0 miles (Plate 29).

Bendigo Division—

Bendigo City.—Nolan Street—Replacement of timber bridge.

Carolin-street—Provision of a reinforced concrete cell-type bridge over Back Creek.

Golden Square—Replacement of old bridge over Bendigo Creek.

Bet Bet Shire.—Llanelly–Rheola Road—Replacement of an old timber bridge.

UNCLASSIFIED ROADS.

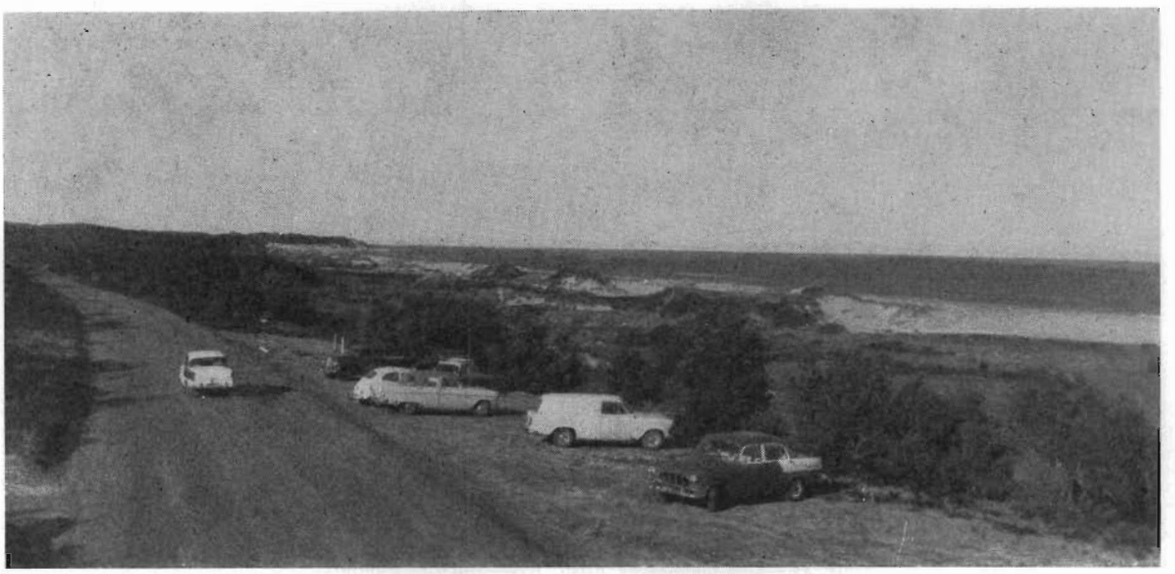


Plate 28.—Marlo-Cape Conran Road—Reconstruction and realignment—Shire of Orbost.

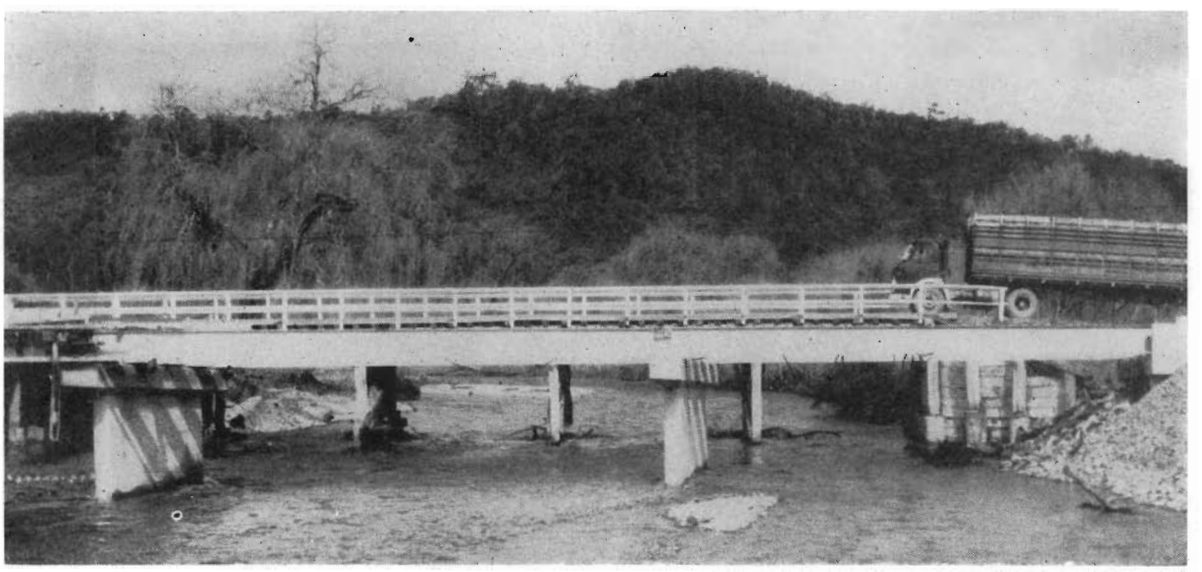


Plate 29.—Benambra-Corryong Road—New bridge over Nariel Creek—Upper Murray Shire.

Plate 30.—Purvis Road, Arthur's Seat—Shire of Flinders.

Plate 31.—Old Melbourne Road, Rye—Shire of Flinders.

Plate 32.—Big Desert Area—Construction of 4·5 miles—Shire of Kaniva.

Plate 33.—Drung-Longerenong Road—Bridge over Wimmera River—Shire of Wimmera.

East Loddon Shire.—Prairie West Road—Reconstruction and sealing of 5·30 miles.

Jarklan West Road—Replacement of the bridge over Serpentine Creek.

Echuca Borough.—Hare Street—Reconstruction and sealing between Heygarth Street and Darling Street.

Kerang Shire.—Lower Loddon Road—Construction of a new reinforced concrete bridge over the Loddon River.

Kyabram Borough (Joint Deakin Shire).—North Boundary Road—Reconstruction and sealing of 2·70 miles.

Maldon Shire.—Fogarty's Gap Road—Reconstruction and sealing of 3·50 miles.

McIvor Shire.—Mia Mia–Derrinal Road—Reconstruction of 1·45 miles and sealing of 1·80 miles.

Mildura City.—Lemon, Chaffey and Walnut Avenues—Reconstruction and sealing.

Mildura Shire.—Red Cliffs–Morkalla Road—Reconstruction and sealing of 5·0 miles.

Rochester Shire.—Ballendella West Road—Reconstruction, realignment and sealing of 1·0 mile.

Rodney Shire.—Girgarre East Road—Reconstruction and sealing of 2·0 miles.

Swan Hill Borough.—Pritchard Street—Construction and sealing.

Swan Hill Shire.—Robinvale Soldier Settlement Road—Reconstruction and sealing of 4·50 miles.

Pira–Chillingollah Road—Reforming, gravelling and sealing 3·50 miles.

Dandenong Division—

Flinders Shire.—Melbourne Road—Reconstruction of 1·25 miles as the first stage of duplicated carriageways near Sorrento (Plate 31).

Hastings Shire.—Woolley's Road and Refinery Access Roads—Construction and reconstruction of 4·0 miles to the British Petroleum Refinery area at Crib Point.

Nunawading City.—Blackburn Road—Reconstruction of 0·25 mile for duplicated carriageways north and south of Canterbury Road.

Geelong Division—

Bannockburn Shire.—Lethbridge Maude Pringles Bridge Road—Construction of a 3-span bridge over Sutherland's Creek.

Barrabool Shire.—Buckley Road—Reconstruction of a further 2·0 miles.

Bellarine Shire.—Murradoc Road—Forming, surfacing and sealing of 1·25 miles.

Bulla Shire.—Station and Horne Streets, Sunbury—Reconstruction and sealing of 0·90 mile.

Colac Shire.—Carlisle Road—Construction on a deviated alignment of 0·60 mile, including major culverts at Murree Creek.

Warrowie Road—Reconstruction and sealing of 0·90 mile.

Corio Shire.—Woodstock Road—Forming and paving of 2·0 miles.

Lower Anakie Road—Channelization of the intersection with the Midland Highway.

Gisborne Shire.—Couangalt Road—Reconstruction and sealing of a further 1·0 mile.

Kyneton Shire.—Pipers Creek and Pipers Creek–Pastoria Roads—Reconstruction and sealing of 2·10 miles of school bus route.

Leigh Shire.—Shelford Meredith Road—Sealing of 2·50 miles.

Melton Shire.—Coburns Road—Reconstruction and sealing of 0·60 mile including the provision of a large multi-cell culvert.

Newham and Woodend Shire.—Woodend–Wallan Road—Reconstruction and sealing of 1·10 miles.

Newtown and Chilwell City.—Princes Bridge—New bridge and approaches over the Barwon River under construction.

Otway Shire.—Carlisle North Road—Reconstruction of a further 1·30 miles.

Romsey Shire.—Sutherlands Road—Reconstruction continued to extend the seal by 1·0 mile.

South Barwon Shire.—Roslyn Road, Belmont—Preparation of 0·70 mile for a bituminous concrete top course.

Werribee Shire.—Ballan Road—Initial construction of 3·30 miles.

Winchelsea Shire.—Barwon Park Road—Reconstruction and sealing of 1·0 mile.

Horsham Division—

Arapiles Shire.—Brimpaen–Lah-Arum Road—Construction and sealing of the last 1·0 mile.

North Wonwondah–East Wonwondah Road—Construction of new concrete bridge 75 feet long over the McKenzie River.

Dimboola Shire.—Rainbow–Nhill Road—Construction of a new concrete bridge over Outlet Creek.

Kaniva Shire.—Big Desert area—Construction of a further 4·50 miles serving the Australian Mutual Provident Society Land Development Scheme (Plate 32).

Stawell Shire.—Marnoo–Raluana Road—Replacement of a narrow timber bridge over Wallaloo Creek.

Wimmera Shire.—Drung–Longerenong Road—Replacement of a narrow weak timber bridge over the Wimmera River (Plate 33).

Metropolitan Division—

Box Hill City.—Highbury Road—Widening and reconstruction from the Doncaster–Mordialloc Road intersection to Station Street.

Camberwell City.—Belmore Road—Widening and reconstruction from Buchanan Avenue to Woods Street.

Fitzroy City.—Victoria Parade—Reconstruction from Brunswick Street to Smith Street including provision of a concrete pavement on the north side.

Oakleigh City.—Centre Road—Widening and reconstruction from Clarinda Road to Springs Street.

Richmond City.—Highett Street—Reconstruction from Church Street to Hoddle Main Road.

Williamstown City.—Mason Street—Reconstruction and duplication from Challis Street to Walker Street.

Traralgon Division—

Morwell Shire.—Brown Coal Mine Road—Reconstruction and sealing of 1·28 miles at North Yallourn.

South Gippsland Shire.—Promontory Road—Reconstruction of 2·30 miles south of Fish Creek.

Warrnambool Division—

Dundas Shire.—Strathkellar Road—Reconstruction and sealing of 1·75 miles.

Portland Shire.—Portland Nelson Road—Reconstruction of two sections totalling 4·47 miles.

Portland Town (joint with Portland Shire).—West Boundary Road—Construction of a 5-span reinforced concrete bridge 100 feet long.

TOURISTS' ROADS.

Plate 34.—Mallacoota Road—Resheeted and sealed section.

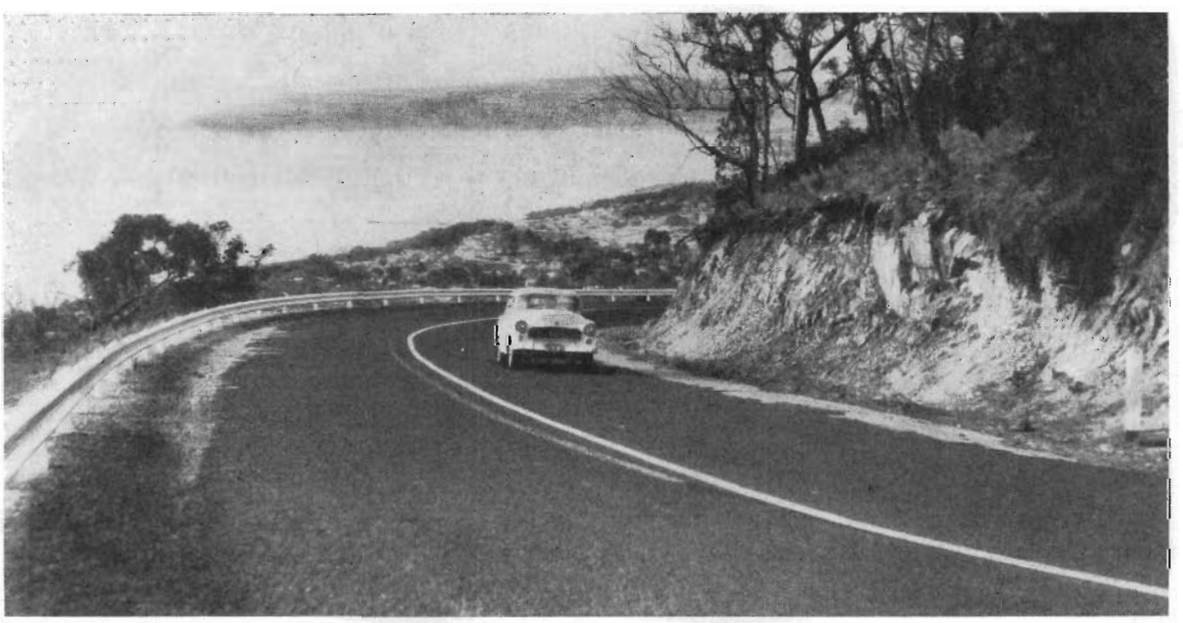


Plate 35.—Arthur's Seat Road—Shire of Flinders.

FOREST ROAD

Plate 36.—Dean's Marsh—Lorne Forest Road—Reconstruction and realignment—Shire of Winchelsea.

13. TOURISTS' ROADS.

The Board bears the full cost of all work, both construction and maintenance, on tourists' roads. An amount of £779,424 was allocated for work on declared tourists' roads during 1963–64. Expenditure amounted to £712,339. The total length of tourists' roads remained unchanged at 449 miles.

Heavy week-end traffic to the snow fields in winter and to the beaches in summer is characteristic of the traffic on these roads. It is interesting to note that during the snow season as many as 1,400 vehicles per day travel the Mt. Buller tourists' road. In the summer, traffic as high as 11,000 vehicles per day has been recorded on the Ocean Road near Anglesea.

The more important works carried out on the roads during the year included :—

Alpine Road.—Reconstruction of 2·50 miles at Slippery Pinch in the Shire of Omeo.

Reconstruction and widening of 3·20 miles in the Shire of Bright.

Grampians Tourists' Road.—Construction of a new bridge 105 feet long and relocation of 2·20 miles south of Halls Gap. Replacement of the existing timber bridge over Dwyers Creek with a concrete bridge 94 feet long.

Mallacoota Road.—Resheeting of 9·20 miles in readiness for sealing (Plate 34).

Mount Buffalo Road.—Widening for a distance of 3·0 miles.

Mount Buller Road.—Reconstruction of 3·45 miles of unsealed pavement.

Mount Donna Buang Road.—Widening for a distance of 1·20 miles.

Ocean Road.—Reconstruction and widening of two sections totalling 0·80 mile between Airey's Inlet and Lorne.

Construction of a new footbridge over the Erskine River at Lorne.

Reconstruction of 1·06 miles between the Wye and Kennett Rivers.

Widening a further 1·83 miles between the Kennett River and Apollo Bay, including the construction of a new reinforced concrete bridge over the Grey River.

Reconstruction and widening of 1·07 miles between Smythes Creek and Apollo Bay.

Reconstruction of the gravel road for 2·40 miles between the Calder and Ford Rivers.

Reconstruction and realignment for a distance of 1·70 miles east of Wattle Hill with a further 2·50 miles of major works near Yuulong.

Wilson's Promontory Road.—Reconstruction and initial sealing of 3·58 miles in Sand Hills area.

14. FOREST ROADS.

The Board bears the whole cost of all work both construction and maintenance on forest roads. Total applications for works on forest roads amounted to £500,787 and a total of £417,949 was allocated. Expenditure amounted to £370,962.

Some major works typical of those carried out during the year are detailed below.

Bannockburn Shire	Meredith Steiglitz-Maude Road—Reconstruction and sealing of 1·0 mile.
Benalla Shire	Tatong-Tolmie Road—Reconstruction of 1·3 miles.
Glenlyon Shire	Drummond–Vaughan Road—Reconstruction and realignment of 1·10 miles east of Vaughan Springs.
Kyneton Shire	Greendale–Trentham Road—Realignment and reconstruction of 1·45 miles in preparation for sealing.
Omeo Shire	Bruthen–Buchan Road—Construction of a new reinforced concrete bridge 28 feet between kerbs.

Otway Shire	Forrest–Apollo Bay Road—Paving of previously reconstructed section of 1·50 miles.
Upper Yarra Shire ..	Warburton–Woods Point Road—Resheeting of existing formation and extension of pavement seal for a distance of 1·75 miles.
Winchelsea Shire	Deans Marsh–Lorne Road—Reconstruction and major realignment of 1·25 miles to provide an 18-ft. sealed pavement (Plate 36).

15. BRIDGES.

There was an increase in the number and value of bridges commenced during the year compared with the previous year. Ninety-one new bridges, estimated to cost £1,914,000, were commenced under the Board's supervision, and 136 new bridges estimated to cost £886,300 under municipal supervision.

Corresponding figures for the financial year 1962–63 were 69 bridges under the Board's supervision estimated at £1,293,000, and 128 estimated at £833,000 under municipal supervision.

The larger bridges completed throughout Victoria under the Board's supervision during 1963–64 included—

(*a*) a welded steel girder and reinforced concrete bridge 411 feet long by 28 feet between kerbs plus a 6-ft. wide footway, over the Merri River on the Princes Highway West at Dennington. A reinforced concrete and pre-stressed concrete beam over-pass structure, 300 feet long by 28 feet between kerbs, was also completed over the railway at Dennington on the new alignment (Plate 37) ;

(*b*) a rolled steel joist and reinforced concrete over-pass structure, 120 feet long by 28 feet between kerbs over the railway at Gunn's Gully, on the Moe–Morwell deviation of the Princes Highway East near Moe ;

(*c*) two reinforced concrete bridges, 122 feet and 182 feet long respectively, by 30 feet between kerbs plus a 5-ft. footway, over the Richardson River on the North Western Highway at Donald (Plate 38) ;

(*d*) construction by contract of the piers and abutments for a welded steel girder and concrete bridge, 812 feet long by 28 feet between kerbs, plus a 6-ft. footway, over the Avon River on the Princes Highway East at Stratford ;

(*e*) a rolled steel joist and reinforced concrete over-pass structure 120 feet long by 28 feet between kerbs over the railway at Langi Ghiran near Buangor on the Western Highway.

Duplicate bridges at five crossings of the Ovens River and its flood channels, totalling approximately 1,400 lineal feet of bridging by 28 feet between kerbs, and providing a four-lane all-weather crossing on the Hume Highway at Wangaratta were also nearing completion.

The construction of a pre-stressed concrete beam and reinforced concrete bridge 550 feet long by 24 feet between kerbs plus a 5-ft. footway over the Murray River at Barmah was also commenced.

Included amongst bridges completed during the year under municipal supervision were :—

(*a*) Victoria Bridge, a pre-stressed concrete slab and reinforced concrete bridge, 180 feet long by 28 feet between kerbs plus a 6-ft. footway, over the Happy Valley Creek on the Buffalo River Road in the Shire of Myrtleford (Plate 39) ;

(*b*) a pre-stressed concrete beam and reinforced concrete bridge, 120 feet long by 28 feet between kerbs plus a 6-ft. wide footway, over Dandenong Creek on McCrae Street in the City of Dandenong (Plate 40) ;

Plate 37.—Princes Highway West—Bridge over Merri River at Dennington.

Plate 38.—North-Western Highway—Bridge over the Richardson River, Donald.

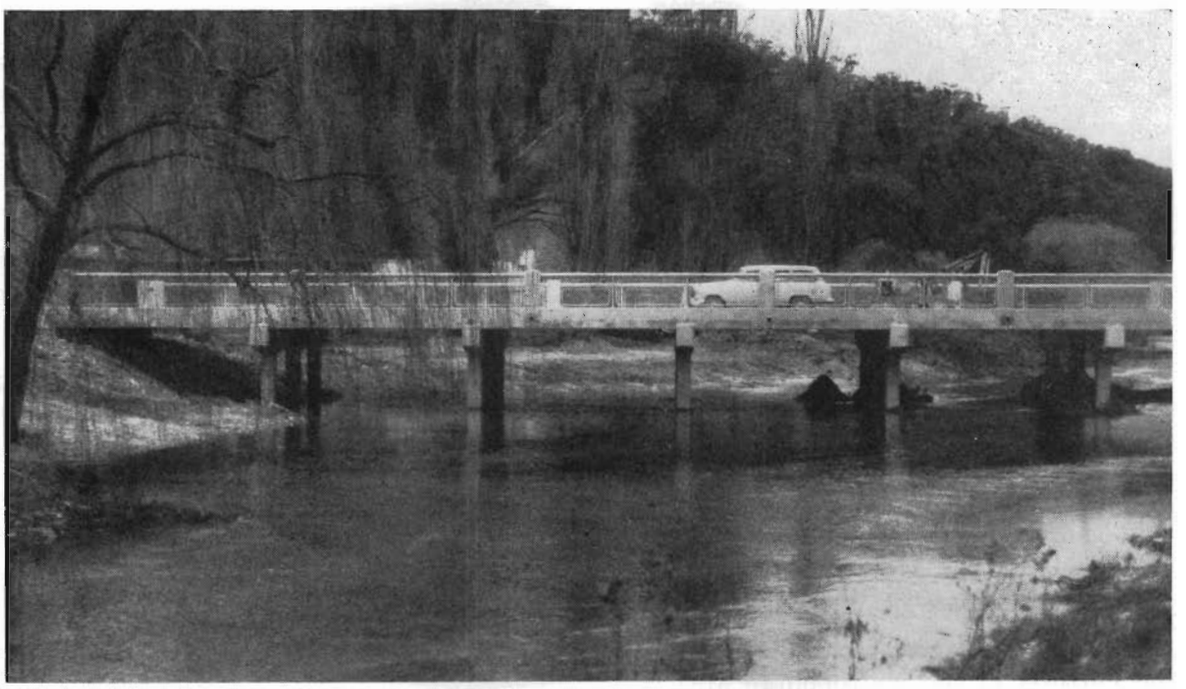


Plate 39.—Victoria Bridge over Happy Valley Creek—Buffalo River Road—Myrtleford.

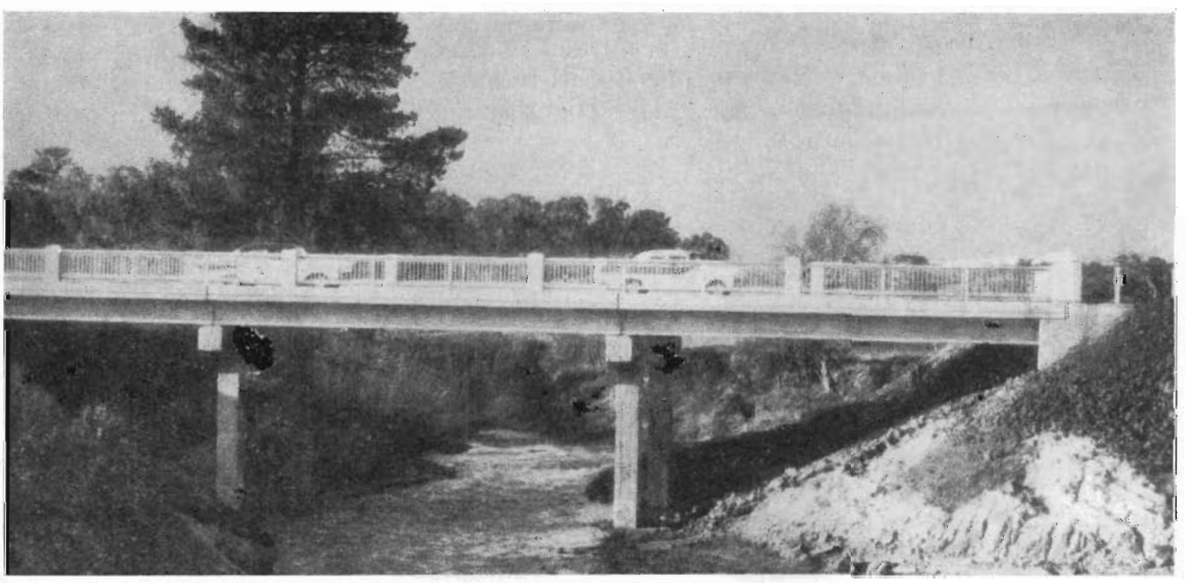


Plate 40.—Pre-stressed concrete beam and reinforced concrete bridge—McCrae Street—City of Dandenong.

Plate 41.—Pre-stressed concrete beam and reinforced concrete bridge over the Latrobe River—Shire of Narracan.

(*c*) a pre-stressed concrete beam and reinforced concrete bridge 260 feet long by 24 feet between kerbs over the Latrobe River on the Willowgrove Road in the Shire of Narracan (Plate 41);

(*d*) a pre-stressed slab and reinforced concrete bridge, 160 feet long by 28 feet between kerbs plus a 6-ft. footway, over Barongarook Creek on the Colac–Forrest Road in the City of Colac;

(*e*) a pre-stressed concrete beam and reinforced concrete bridge 321 feet long by 28 feet between kerbs plus a 6-ft. wide footway over Kororoit Creek and Millers Road in the Shire of Altona;

(*f*) a pre-stressed concrete beam and reinforced concrete bridge 120 feet long by 24 feet between kerbs over the Bass River on Ferriers Road in the Shire of Korumburra;

(*g*) a steel rail and concrete slab bridge 113 feet long by 24 feet between kerbs over Wallaloo Creek on the Marnoo Road in the Shire of Stawell.

Metropolitan Bridges and Over-passes.

Considerable work continued during the year on the design and construction of bridges and culverts in the metropolitan area.

Included amongst those on which work was started or completed during the year were:—

(*a*) A pre-stressed concrete beam and reinforced concrete bridge 239 feet by 28 feet between kerbs plus a 6-ft. footway over the Maribyrnong River on a realignment of the Calder Highway approaching Keilor—known as Curly Hill (Plate 42);

(*b*) Strathmore Pedestrian Over-pass, a reinforced concrete and pre-stressed concrete structure 340 feet long by 6 feet wide over Pascoe Vale Road, constructed as part of the level crossing elimination project (Plate 43);

(*c*) Beach Street Over-pass, a pre-stressed concrete beam and reinforced concrete structure, 154 feet long by 28 feet between kerbs on the Frankston By-pass Road, in the Shire of Frankston, together with a reinforced concrete retaining wall 227 feet long;

(*d*) a pre-stressed concrete box girder bridge, 288 feet long by 28 feet between kerbs, over the Calder Highway at the Lancefield Road Interchange, near the south-west corner of Essendon Aerodrome.

Historic Bridges.

Recent realignment of the Western Highway near Djerriwarrh Creek at the 28-mile post, isolated an attractive stone arch bridge constructed in 1858 from local sandstone.

The damaged stonework parapets of this bridge were restored during the year, using similar sandstone, in accordance with the Board's policy of preserving historic bridges wherever possible. The old bridge will be maintained by Bacchus Marsh Council (Plate 44).

Bridge Foundation Testing.

The Board's bridge boring gang investigated 42 bridge sites drilling a total of 155 bores amounting to 6,510 lineal feet. This represented an increase of 30 per cent. over the previous year.

Bridge and Culvert Materials.

Under various contracts 7,590 tons of pre-stressed concrete bridge components valued at £177,300, and reinforced concrete pipes and box culverts to the value of £301,000, were purchased during the year.

Plate 42.—Calder Highway—Bridge over the Maribyrnong River—City of Keilor.

Plate 43.—Strathmore Pedestrian Over-pass—Pascoe Vale Road—City of Broadmeadows.

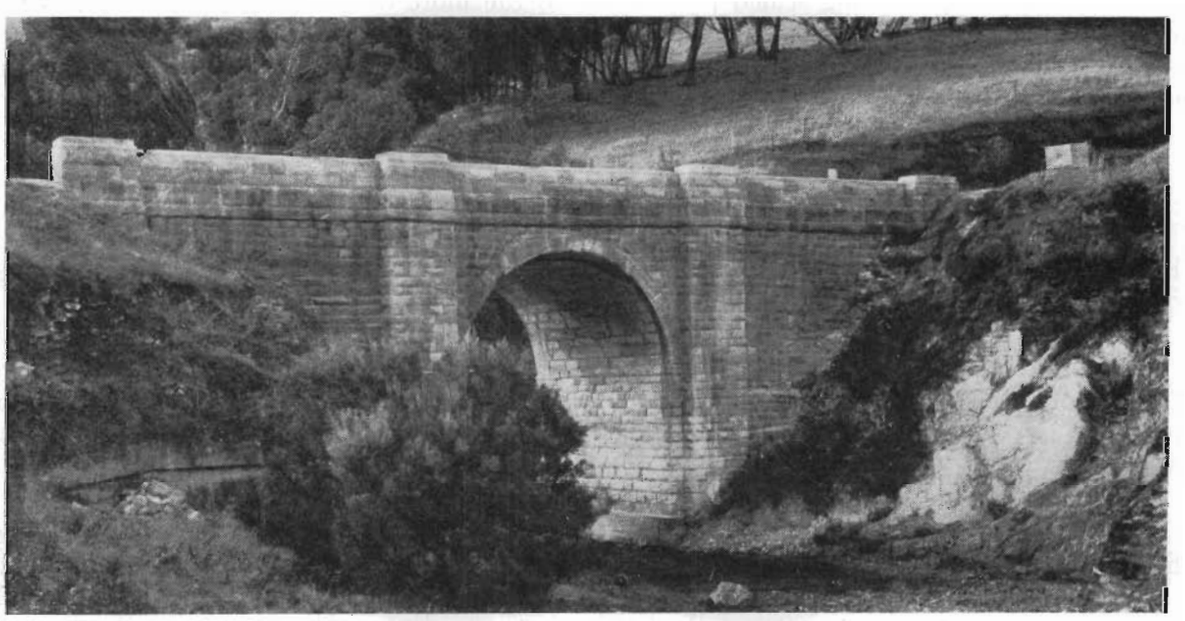


Plate 44.—Bacchus Marsh Shire—Restored sandstone bridge—Djerriwarrh Creek.

In addition, the Board's precasting yards produced 4,960 tons of the new high strength pre-cast reinforced concrete bridge units valued at £76,700.

A further feature was the use during the year of a considerable quantity of large inverted pre-cast concrete box culverts in sizes of 72-in. x 48-in., 72-in. x 66-in., 96-in. x 48-in. and 96-in. x 66-in.

Purchases of corrugated steel pipe and guard rail more than doubled during the year to a value of £66,000. In addition, approximately 8,200 tons of cement were used during the year on projects carried out with Board funds.

Rolled steel girders and steel reinforcing rounds were again in ample supply, and approximately 620 tons of steel girders and 2,200 tons of reinforcing rounds were used during 1963–64 in projects carried out with Board funds.

16. BITUMINOUS SURFACING.

Extent of Work.

This year a record length of 3,147 miles of bituminous surfacing work was carried out at a cost of approximately £4,500,000, and this work included the extension of the length of sealed roads in the State by a further 1,005 miles. This additional sealing was carried out on 41 miles of State highways, 27 miles of tourists', forest and by-pass roads, 266 miles of main roads and 671 miles of unclassified roads.

The length of sealed pavement on the Board's declared network of State highways, by-pass, tourists', forest and main roads now amounts to 12,151 miles or 83·7 per cent. of the total mileage of declared roads.

The total length of bituminous work carried out exceeded that undertaken in 1962–63 by 403 miles or 14·7 per cent., and, in addition to providing extensions to the sealed system, included 268 miles of widening of existing sealed pavements, 23 miles of duplication of existing carriageways, 479 miles of restoration of the seal coat on reconstructed sections and 1,260 miles of maintenance retreatment.

Again it was possible to assist Commonwealth and State authorities and municipalities which required bituminous surfacing work by making available the services of the Board's mobile bituminous surfacing units, and 112 miles of work was carried out in these cases. Plant mix machine spread work increased very substantially during the year and a length of 134 miles of road was treated in this way in providing surface courses on new construction and for resurfacing existing sealed pavements on the more densely trafficked roads. This work involved the manufacture, spreading, and compacting of 229,268 tons of binder and surface courses of bituminous concrete, and represents an increase of 83 per cent. on the quantity of this type of material used in the bituminous surfacing work in 1962–63.

Bituminous Plant and Personnel.

Twenty-five mobile bituminous surfacing units and one mobile asphalt plant manned by approximately 630 men were occupied during the major part of the year in carrying out the work of this large programme of bituminous work.

Suitably equipped municipalities and contractors are playing an increased part in the bituminous surfacing work, particularly in undertaking priming or light treatments on prepared pavements ahead of the Board's specially equipped mobile sealing units. In all, a length of some 700 miles of priming or light treatment work was carried out in this way.

The major part of the plant mix work was undertaken by contractors operating fixed asphalt plants near Melbourne and Geelong, but the Board's mobile asphalt plant undertook the laying of 19,844 tons of this type of material on the more heavily trafficked roads and streets in the vicinity of Wodonga, Seymour, Euroa, Traralgon and Bendigo.

Supply of Material.

The total quantity of bitumen purchased directly by the Board during the year amounted to 31,214 tons, and this was distributed throughout the State in bulk, approximately 69 per cent. by rail and approximately 31 per cent. by road tankers. The quantity of bitumen supplied and used by contractors in the plant mix work amounted to approximately 10,750 tons so that a total quantity of approximately 42,000 tons of bitumen was drawn from the two Victorian refineries for the Board's work during the year.

In addition to the supplies of bitumen above, approximately 9,000 tons of other bituminous materials such as cutback bitumen, tars and bitumen emulsion were purchased for the bituminous surfacing and allied maintenance work during the year.

The year's programme of bituminous surfacing required the use of approximately 523,000 cubic yards of mineral aggregate, an increase of approximately 40 per cent. on the usage in 1962–63. This quantity included approximately 303,000 cubic yards of covering aggregate in the sprayed work and approximately 220,000 cubic yards of crushed stone, sand and filler in the plant mix work.

17. RURAL FINANCE AND SETTLEMENT COMMISSION ESTATE ROADS.

Further work was carried out in conjunction with the Rural Finance and Settlement Commission in providing roads in the Commission's estates. In the Heytesbury Settlement area approximately 11 miles of roads were constructed, of which $6\frac{1}{2}$ miles were carried out by contract and $3\frac{1}{2}$ miles by direct labour. Much of the work was in heavy country in the Bryant's Creek area.

The above work completed the construction of all roads requested by the Rural Finance and Settlement Commission to 30th June, 1964, except for the completion of top course gravelling on about 7 miles of road. When this is completed in 1964–65 the Board will have constructed over 106 miles of road and seven bridges in the Heytesbury Settlement area.

The total expenditure for the year on bridge and road works in the Heytesbury Settlement area was £107,610. This expenditure is shared on the basis of Commission ($\frac{1}{2}$), the Board ($\frac{3}{8}$) and the Council ($\frac{1}{8}$).

The total expenditure on works in all the various estates established by the Commission since the inception of the scheme in 1947 is £2,451,188, of which the Commission has contributed £1,374,550, the Board £779,210 and the respective councils £297,428.

Plate 45.—Reconstruction and sealing of the road to Longerenong Agricultural College.

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 THE YEAR ENDED 30TH JUNE, 1964.

Departments.	Description of Works.	Expenditure.		
Victorian Departments.		£ s. d.	£ s. d.	
State Rivers and Water Supply Commission	Construction of various bridges over Commission channels, roadworks in connection with Lake Bellfield Deviation, &c.	43,927 4 11		
Rural Finance and Settlement Commission	Roadworks—Commission estates throughout the State	45,444 2 1		
State Electricity Commission ..	Roadworks—Morwell Shire Hernes Oak Deviation	3 5 10		
Housing Commission ..	Roadworks—Morwell Housing Estate ..	924 14 9 *Cr.*		
Department of Lands and Survey	Roadworks in Shires of Kaniva, Lowan, Portland and Upper Yarra	33,043 11 8		
Department of Public Works ..	Roadworks—Albert Park Lake Reserve Road, Longerenong Agricultural College (Plate 45). Construction of various fruit fly inspection points	14,021 19 2		
Melbourne and Metropolitan Board of Works	Roadworks—Healesville Shire	3,650 5 10		
Latrobe Valley Water and Sewerage Board	Roadworks—Gould deviation on Walhalla Road—Shire of Narracan	209 5 11		
Victorian Railways	Construction of Madden Grove Level Crossing for boom barriers	29,222 2 4		
			168,597 3 0	
Commonwealth Departments				
Department of Works ..	Roadworks—Various access roads to Commonwealth establishments. Tullamarine Freeway	116,306 9 9		
			116,306 9 9	
Special Projects.				
King's Bridge	Sundry expenditure less rentals received and proceeds to date of disposal of properties acquired in connexion with the construction of King's Bridge, &c. ..	71,180 4 0		
Coal Canal Bridge	Construction of bridge over Coal Canal at West Melbourne—City of Melbourne ..	22,659 18 11		
Lower Yarra Crossing ..	General and preliminary foundation investigations	234 6 0 *Cr.*		
Railway Level Crossings ..	Expenditure incurred on grade separations less amounts contributed from Board's funds	395,595 13 8		
Municipal Forest Roads Improvements	Improvement of various roads adjacent to State Forests to facilitate the extraction of forest produce	9,065 6 3		
			498,266 16 10	
			783,170 9 7	

Plate 46.—Road over rail over-pass at Strathmore—City of Broadmeadows.

Plate 47.—Road over rail over-pass—Princes Highway West—Brooklyn.

19. ELIMINATION OR IMPROVEMENT OF RAILWAY LEVEL CROSSINGS.

Expenditure on projects for the elimination or improvement of railway level crossings totalled £713,412.

This expenditure was shared as follows :—

	£
Country Roads Board	276,054
Level Crossings Fund	314,756
Victorian Railways	122,602
Total	713,412

Large projects completed during the year included—

Albion road over rail over-pass on the Western Highway ;

Strathmore road over rail over-pass on Pascoe Vale Road, City of Broadmeadows (Plate 46) ;

Buangor road over rail over-pass on the Western Highway.

Work on the Brooklyn road over rail over-pass on the Princes Highway West (Plate 47) was substantially completed, and work was commenced on projects at Burnley Street, Burnley, Wail on the Western Highway, and Beaufort on the Western Highway.

In addition, some expenditure was incurred on land acquisition for a road over rail over-pass at Warrigal Road, Oakleigh, and a road over rail over-pass at Somerville Road, Yarraville.

Flashing lights were installed at seventeen rural railway level crossings.

Investigations were continued into the needs and priorities of eliminating railway level crossings at other localities, and the programme for financial year 1964–65 will include provision for beginning six projects in rural areas and two major projects in the metropolitan area as well as equipping another twenty crossings with flashing lights.

20. FLOOD AND BUSH FIRE DAMAGE.

The bush fires which occurred in the summer of 1963–64, although not as severe as those in the summer of 1961–62, were of sufficient magnitude to cause considerable damage in forest areas throughout the State. However, apart from a bridge in the Kilmore Shire which was destroyed and is being replaced by a three-span concrete structure at an estimated cost of £14,000, no other damage to bridges was reported.

For the second successive year no major flood damage occurred to bridges or road surfaces. Where isolated instances of minor damage occurred through severe rainstorms, the damage was rectified and the expenditure charged to normal road allocations.

21. ROAD MAKING MATERIALS AND RESEARCH.

The Board is constantly searching for new deposits of good road making material and carrying out experiments on materials, which by the addition of certain other materials, can be used for pavements that ultimately will require to be sealed.

In certain areas there may be little surface evidence of the existence of deposits of sand or gravel at depth. One geophysical method of exploration for such deposits which can be rapidly employed is to use a siesmic sounding apparatus and where appropriate measure the electrical resistance of the soil. Such methods can produce evidence of the existence of materials other than soil but cannot reveal the quality of the material, which can then be investigated by boring or by test pits. In this way assistance has been given to a number of Shires whose known supplies of materials are nearing exhaustion but where further deposits may exist below the ground surface.

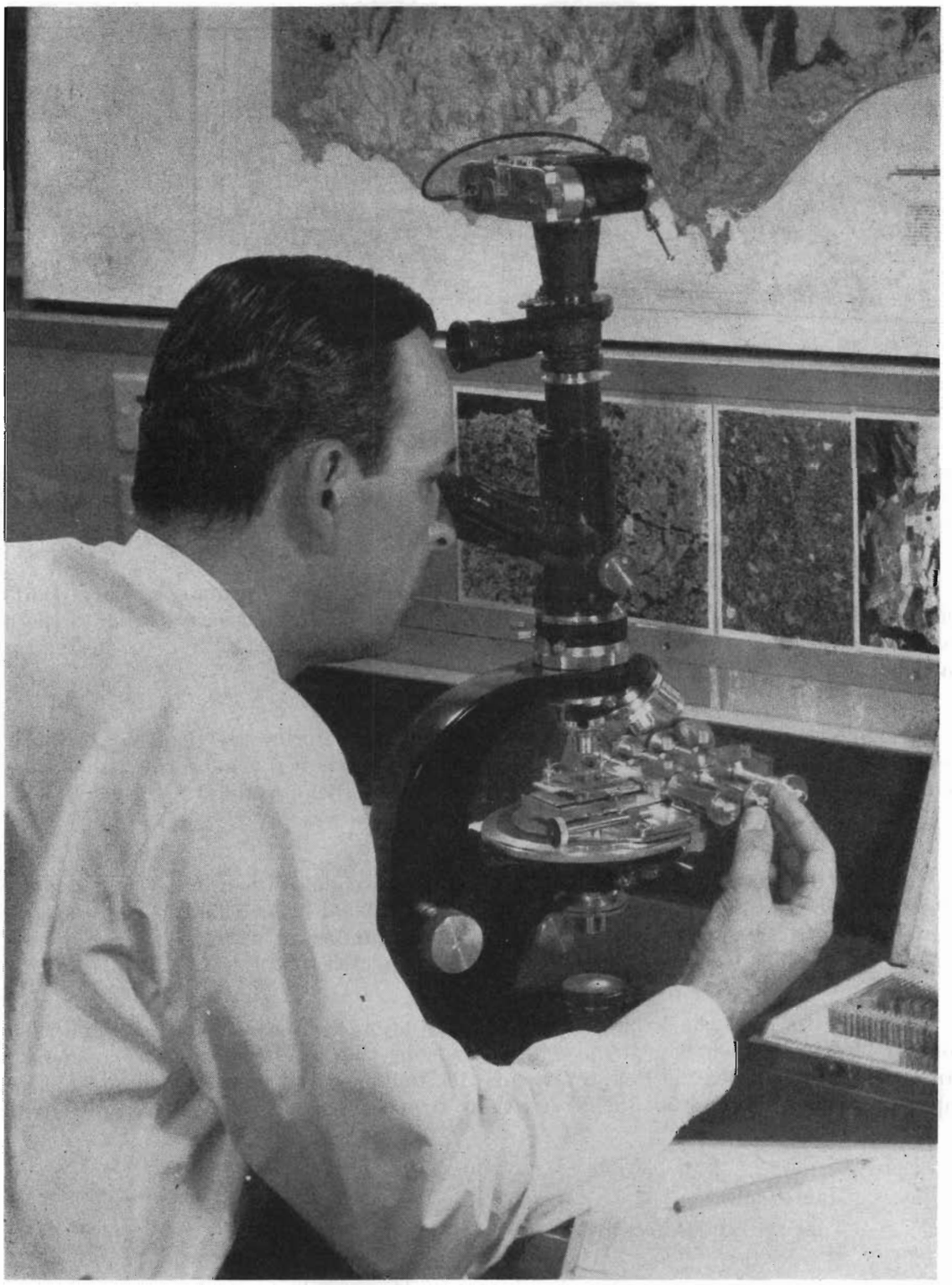


Plate 48.—Petrologist examining rock sample through a Leitz Petrological Microscope.

In areas where materials unsuitable for use in their natural or broken down state are available, it may at times be necessary to resort to stabilization with additives such as portland cement or hydrated lime and, in cases where this seems practicable, field and laboratory investigations are carried out. A trial is being made of test procedures developed recently in the State of Iowa in the U.S.A., which employ small test specimens and procedures less time consuming than conventional methods, and it is possible that these may enable results to be obtained more cheaply and expeditiously.

The extreme shortage of good road making materials in the north-western part of the State has always been a problem, and arrangements were made during the year for a survey to be made of all likely sites for sandstone extraction within 5 miles of the Western Highway between Horsham and the South Australian border.

The greater use of hotmix asphalt surfacing in special circumstances, such as on densely trafficked roads in some country areas, has required the investigation of local aggregate supplies in order that dense and stable mixtures may be designed and lasting surfaces constructed. Many local aggregates were examined and satisfactory mixtures designed.

22. CONTROL OF HEAVY TRAFFIC.

The number of offences reported during 1963–64 was 8,825, an increase of 696 over the last financial year. Of the total offences reported, 7,808 or 88·5 per cent. of cases, resulted in fines and costs amounting to £142,480, an increase of £19,299 over the financial year 1962–63.

The number of summonses unable to be served was 56. In financial years 1961–62 and 1962–63 the figures were 241 and 113 respectively. The reduction was due to the new procedure of posting summonses instead of personally serving them, and to the improved staff position.

While the total of unpaid fines since 1947 increased during the year, to £76,301 15s., the percentage outstanding was reduced from 10·2 to 9 per cent. The police officers seconded to the Board executed 2,750 warrants to the value of £41,873, which was an increase of 889 warrants and £13,435 over the previous year.

Cases of drivers of vehicles refusing to be weighed when requested numbered seventeen, which was a reduction of nine over financial year 1962–63 and represents approximately ·02 per cent. of total weighed. The number of motor vehicles impounded was twelve, mainly for refusing to off-load when directed.

During the year the 5-ton gross axle limitation was removed from the Phillip Island Tourists' Road between San Remo and Cowes, but the limit of 6 tons imposed on the San Remo bridge under the Country Roads Act remains. No additional limitations were imposed and total mileages of such restrictions at present in force on declared roads are :—

	Miles.
Main roads	25
Tourists' and forest roads	100
Total	125

The number of permits issued during the year for excess weights and over dimensional loads increased by approximately 18 per cent. The number of permits issued was 18,657 against 15,785 in financial year 1962–63. Of the permits issued, 11,536 were single trip permits, 1,600 were fourteen-day permits and 2,316 were annual permits, all issued from Head Office. The remaining 3,205 were single trip permits issued in Divisional Offices.

One hundred and eighty-seven permits were issued for loads in excess of 70 tons, and of these, 22 were for 100 tons or over. The heaviest single lifts were ten transformers carried on behalf of the State Electricity Commission. Each of these with the vehicle and prime mover weighed 160 tons gross.

The Board records its appreciation for the co-operation afforded by the Chief Commissioner of Police and the work of those members of the Mobile Traffic Section, Victoria Police, who have been seconded for duty with the Board.

23. TOURIST DEVELOPMENT.

Under the terms of the *Tourist Act* 1958, the Board is required 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 1963–64 the Board paid into the Tourist Fund the amount of £213,658.

During 1963–64, a further £100,000 was provided by the Government for expenditure on roads of tourist interest apart from the Board's declared tourists' roads.

Of the total Government allocation of £400,000 to 30th June, 1964, for works within this category, expenditure amounted to £352,913 which included an amount of £93,031 for the financial year 1963–64.

As in previous years, the practice of requiring a municipal contribution towards work of benefit to ratepayers was maintained.

The amount of £100,000 made available in 1963–64 was again utilized towards the provision of further access roads to various seaside resorts, picnic places, waterfalls and other places of scenic attraction to tourists. These included access roads to Mt. Baw Baw, the Balmoral–Rocklands reservoir, Dargo High Plains, " The Grotto ", " London Bridge " and " Twelve Apostles " near Port Campbell, Buchan Caves reserve and Lake Learmonth foreshore.

24. NATIONAL PARKS.

During 1963–64 the Treasurer made £50,000 available for expenditure on roads in or near National Parks. This was the first occasion on which a special Government allocation was made available for works of this nature.

After an initial selection of suggested work by the National Parks Authority and subsequent investigations by the Board of the detailed requirements, an amount of £39,803 was allocated from the fund. The works were situated in and near the National Parks at Wilson's Promontory, Mount Richmond near Portland, Wyperfeld and Hattah Lakes in north-western Victoria, and Kinglake, north-east of Melbourne. An allocation of £10,450 was also made for work at the Frazer National Park adjacent to Lake Eildon to extend the roads through the camping area towards Point Mead, from Devil's Cove to the boat harbour and easterly from the boat harbour.

25. MUNICIPALITIES FOREST ROADS IMPROVEMENT FUND.

Reference has been made in previous reports to the establishment in 1955 by the Government of a fund called the Municipalities Forest Roads Improvement Fund. Total allocations to the fund by the Government since its establishment amount to £115,000.

These funds have been fully allocated for the improvement of roads adjacent to State forest areas. Expenditure reimbursed to councils to 30th June, 1964 in respect of allocations made was £109,660. Councils benefitting from the allocations also make a small contribution towards the cost of the works.

Additional applications in excess of £66,000 have been received from councils in anticipation of a further allocation by the Government.

26. LINE MARKING.

During the year 1963-64 the Board added 1,109 route miles to the mileage of roads provided with a white-striped centre line.

The total route mileage now striped is 5,294 miles, consisting of 3,728 miles of State highways, 1,346 miles of other declared roads, and 220 miles of unclassified roads. The total mileage of equivalent standard 3-in. stripe, i.e., 10-ft. line, 30-ft. gap, painted in the year was 9,012 miles representing an increase of 21 per cent. over the previous year. Twc thousand four hundred and forty miles of this line was reflectorized with glass beads.

This substantial increase was due to the introduction in January of this year, of a new line marking machine designed and constructed at the Board's Syndal Depot. The new unit incorporates modern techniques in operation and control designed to improve output and quality of line, and, in addition, is equipped to reflectorize lines using " drop-on " glass beads.

The line marking fleet now consists of two large units engaged on longitudinal striping throughout the State, and a small unit suitably designed for such work as pavement markings at intersections, turn arrows and similar markings, together with the removal of redundant traffic lines using paint stripper.

The cost of line marking operations for the year was £63,833 and the average cost per mile of standard stripe painted by the two large units was £6 13s. 2d. The total quantity of paint used was 30,577 gallons.

27. PHOTOGRAPHY.

During the year the Board's film unit produced a film entitled " Road Transport Trends ". The film illustrates the planning that is necessary to enable the various types of road transport vehicles with their very heavy loads to travel safely on public roads. The transport of huge generators, transformers and fabricated industrial plant components, are featured in the film.

Work also proceeded on a film dealing with the construction of the road to the summit of Mt. William in the Grampians.

Many photographs were taken of Councils' and Board's road and bridge works both from the ground and from the air.

Air photographs were taken at various locations to assist in the establishment of traffic patterns and also at morning and afternoon peak periods when due to industrial stoppages all public transport facilities in the metropolitan area were not operating.

Increasing use has been made of colour photographs for display purposes.

Since 1947 the Board's mobile film unit has screened films at Board's camps in areas remote from towns. With the development of television transmitters in many of the larger cities in rural areas, the need for the service provided by the mobile film unit has largely disappeared. It was therefore discontinued at the end of 1963. The activities of the mobile film unit were greatly appreciated over the years by the Board's employees.

28. KEW LABORATORY BUILDING.

The new laboratory building at Kew was progressively occupied during the latter part of 1963 and early 1964. The building consists of a lower ground floor, ground floor and four upper floors.

The lower four floors are occupied by the Board's Materials Research Division. The two top floors are occupied by the Traffic Commission (3rd floor) and the Australian Road Research Board (4th Floor).

The internal area of the building is used for the following purposes :—

Laboratories	13,600	sq. ft. approx.
Offices	4,900	,, ,, ,,
Access and storage	4,900	,, ,, ,,
Services, lifts, &c.	4,800	,, ,, ,,
Tenanted floors	11,800	,, ,, ,,
	40,000	

LABORATORY FUNCTIONS.

Lower Ground Floor.

The functions performed on this floor include concrete mix design, concrete strength testing, concrete curing, metal testing, stone testing and structural testing. Stores for field and laboratory equipment and inflammable liquids are also located on this floor.

Ground Floor.

Activity on this floor is entirely devoted to soil testing. A large sample store and preparation laboratory serves four routine testing laboratories, a compaction and bearing strength laboratory, and a triaxial shear and consolidation laboratory.

First Floor.

Laboratories on this floor are devoted to physics and geology. The Materials Research Engineer's office and other offices are also located on this floor.

Second Floor.

The functions carried out on this floor include bitumen and paint testing, asphalt testing and bituminous analysis. These laboratories are served by sample stores, chemical store, apparatus workshop and cleaning facilities.

29. ENGINEERING COMPUTER INSTALLATION.

References have been made in previous Annual Reports to the increasing use by the Board of electronic computers in engineering work. In June, 1964, an I.B.M. 1620 computer with 40,000 digits of memory was purchased and installed on the sixth floor of the Head Office building.

The 1620 computer has punched card input and output. A rented card punch and verifier are used for the preparation of input data. The results are produced on a console typewriter or, if lengthy, are listed on a tabulator at an outside computer installation belonging to another Government instrumentality.

The use of the computer provides many advantages including the following :—

(*a*) Lengthy engineering computations can be performed faster and more economically by the computer than by manual methods ;

(*b*) More alternative solutions of engineering problems can be investigated with the aid of a computer than would be practicable by manual methods owing to the limitations of staff and time. Reductions in the overall costs of projects should be effected in a number of cases ;

(*c*) Engineering staff can be relieved of monotonous calculation and be more effectively employed ;

(*d*) The demand for additional staff in future years will be reduced.

The computer language used for programming is Fortran II., which is a problem orientated computer language. Prior to the computer being installed, 42 officers of the Chief Engineer's Branch attended training courses in programming in this language.

The Board has joined the Highway Engineers Exchange Program of U.S.A. (H.E.E.P.), enabling computer programmes to be exchanged between the members. It is expected that considerable savings in money and time will result.

30. PLANT AND VEHICLES.

Approximately 2,500 items of miscellaneous plant and transport vehicles were operated and maintained on the Board's works during the year. Amongst these were 134 power graders, 158 wheel and crawler tractors, 57 wheel and crawler front end loaders and 521 items of bituminous surface treatment plant and vehicles.

A total of £785,000 was spent on purchase of new plant, machinery and heavy transport vehicles.

The plant and vehicles were maintained and repaired at divisional workshops, the Syndal Depot and in the field. Approximately 15,400 repairs and overhauls were carried out in workshops and the field during the year.

The total expenditure on plant maintenance during the year was £1,329,000, while the total plant earnings amounted to £1,843,000.

The Board's Plant Instructor Drivers trained 204 new plant operators and divisional servicemen in the proper care and use of plant, in addition to following up the training of previously trained operators. Municipal personnel were also included in the training programmes.

Nine Plant Inspectors carried out a total of over 3,900 inspections of new plant, plant in the field, plant awaiting repairs, repaired plant and new and used vehicles.

31. DISPLAYS AND EXHIBITIONS.

During the year the Board exhibited material at the Annual Show of the Royal Agricultural Society of Victoria and at the Motor Show.

At the Royal Agricultural Show the Board's exhibit was based on the primary theme " Freeways (By-pass roads) " supported by the " Golden Jubilee ". Highlights of the exhibit were a 5 ft. x 4 ft. photograph of the Maltby By-pass Road and a scale model of the " Trumpet Interchange " at the junction of the Calder Highway and Lancefield Road. Supporting material which included film and coloured slides, illustrated the Board's works and the progress made since 1913.

At the Motor Show, the Board again co-operated with the National Safety Council and the Victoria Police in a tripartite exhibit on the theme " Engineering—Education—Enforcement " as the basis of road safety. A model of the proposed Tullamarine Freeway was shown in support of a photographic display.

In addition to these metropolitan shows, the Divisional Engineer, Bendigo Division exhibited a display of photographs and a model of the Craigieburn Over-pass on the Hume Highway at the Bendigo South Rotary Club exhibition in Bendigo.

32. NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES.

The twenty-sixth annual meeting of the National Association of Australian State Road Authorities was held at the Board's Head Office from 4th to 8th November, 1963.

Representatives of each State Road Authority and the Commonwealth Department of Works attended. The Secretary of the Commonwealth Department of Shipping and Transport, representing the Australian Transport Advisory Council, was present when road and vehicle standards and allied subjects and matters relating to the Permanent International Association of Road Congresses were under discussion.

The Chairman, Deputy Chairman and Member of the Board attended the meeting. Mr. I. J. O'Donnell, the Board's Chairman, was Chairman of the meeting.

There were 57 items on the agenda, including the need for additional finance for the improvement of roads to meet Australia's growing traffic requirements, and proposals to develop the Australian inter-regional road system comprising the inter-connexions of capital cities. A sub-committee of the Association was appointed to consider the planned development of these inter-regional routes.

It was also decided that the existing route markers on National routes would be supplemented by sign boards at the commencement of the routes and at State borders.

The Association also considered a variety of subjects including road and bridge design, construction and maintenance, methods and materials, pavement marking, dimensions of motor buses, regulation of weights and loads, road furnishings and roadside improvements.

It was also resolved that the Association meet twice a year. Accordingly, the twenty-seventh (Intermediate) meeting was held, with similar representation, on the 23rd March, 1964, at the Board's Head Office. Among the items discussed were State border signs, urban transportation, Commonwealth Aid Roads Legislation, the formulation of codes covering road openings by public utility authorities, and the International Road Federation meeting in Tokyo in April, 1964.

33. CONFERENCE OF MUNICIPAL ENGINEERS.

The 1964 (Twentieth) Conference of Municipal Engineers, convened by the Board was held from 8th–10th April, 1964, at the Board's Head Office, Kew. Approximately 250 persons attended, including engineers from most of the 209 municipalities throughout the State, the Chairman, Members and senior engineers of the Country Roads Board and representatives of various Commonwealth and State Government Departments. The conference was opened by the Minister for Public Works—The Hon. H. R. Petty, M.L.A.

Items on the agenda included run-off from catchments, design of wing-walls for culverts and bridges, roadmaking by heat treatment of the soil, and an address by Sir Louis Loder on the Metropolitan Transportation Survey. In addition, two excellent papers were submitted by municipal engineers, one dealing with soil stabilization in Echuca and the other giving full details of a trial study of the multi-wall paper sack system of garbage collection.

On the morning of Friday, 10th April, an inspection was made of the works in progress on and adjacent to the access roads to the proposed Tullamarine Jetport.

34. MUNICIPAL ASSOCIATION CONFERENCES.

Each year a representative of the Board attends Municipal Association Conferences throughout the State. The following conferences were attended :—

1. Municipal Association of Victoria	At Melbourne on 9th and 10th October, 1963. Attended by the Chairman and Board Members.
2. Western District Municipalities Association	At Heywood on 20th March, 1964. Attended by Mr. J. W. C. Pascoe, Divisional Engineer, Warrnambool.
3. Gippsland Municipalities Association	At Trafalgar on 10th April, 1964. Attended by Mr. I. J. O'Donnell, Chairman.
4. Northern District Municipal Association	At Avoca on 23rd April, 1964. Attended by Mr. F. West, Member.
5. North-Eastern and Goulburn Valley Councils Developmental Association	At Benalla on 21st May, 1964. Attended by Mr. R. E. V. Donaldson, Deputy Chairman.
6. North-Western Municipalities Association	At Birchip on 29th May, 1964. Attended by Mr. I. J. O'Donnell, Chairman.

These conferences further strengthen the Board's close ties with local government, and the opportunity to attend is appreciated.

35. BOARD'S INSPECTIONS.

During the year the Board continued the practice of visiting municipalities to inspect existing road conditions and to have the opportunity of discussing road problems and future requirements with Councillors and Council officers.

Visits were made to the Shires of Mornington, Melton, Orbost, Hampden, Minhamite, Kilmore, Walpeup, Mortlake, Winchelsea, Colac, Glenlyon, Metcalfe, Goulburn, Seymour, Newstead, Leigh, Upper Yarra and Healesville ; the Towns of Camperdown and Castlemaine, the Borough of Koroit, and the Cities of Geelong, Geelong West, Newtown and Chilwell, and Colac.

The Board is most appreciative of the Councils' co-operation in making detailed arrangements for these visits, and of the hospitality extended by the Councils.

36. LEGISLATION AFFECTING THE BOARD.

The main legislation enacted during the year which affected the Board was as follows :—

Motor Car Act 1963 (No. 7073).

Amongst other things, this Act makes provision for fines arising from prosecutions which are brought by an officer of the Transport Regulation Board to be paid into the Transport Regulation Fund. Prior to this amendment fines were paid into the Country Roads Board Fund.

Commonwealth Aid Roads Act 1964.

The various provision of this Act which became effective on 1st July, 1964, are discussed in an earlier section of this Report.

37. MISSIONS ABROAD.

During April, 1964, the second Pacific Regional Conference of the International Road Federation was held in Tokyo. The Board was represented by the Chairman, Mr. I. J. O'Donnell and the Chief Engineer, Mr. H. S. Gibbs and they were absent for a period of three weeks.

Items on the agenda included traffic engineering, design, materials and construction, soils, low cost roads, and highway maintenance. Several days were also spent making a study of road developments and transportation problems in densely populated areas in Japan.

Mr. O'Donnell and Mr. Gibbs returned to Australia via Kuala Lumpur, Malaysia, where recent road and aerodrome works were inspected.

The Board Member, Mr. F. West, accompanied by the Assistant Engineer for Plans and Survey, Mr. D. T. Hewson, left Melbourne at the end of May, 1964, on an official visit of about three months to the United States of America. Mr. West concentrated mainly on the organizational methods developed by the various authorities to improve efficiency in the use of manpower and the specialized techniques for the allocation of priorities in road works. In conjunction with Mr. Hewson, who is a specialist in plans and survey, Mr. West also studied the latest techniques in the fields of survey and geometric design of roads, particularly expressways and freeways.

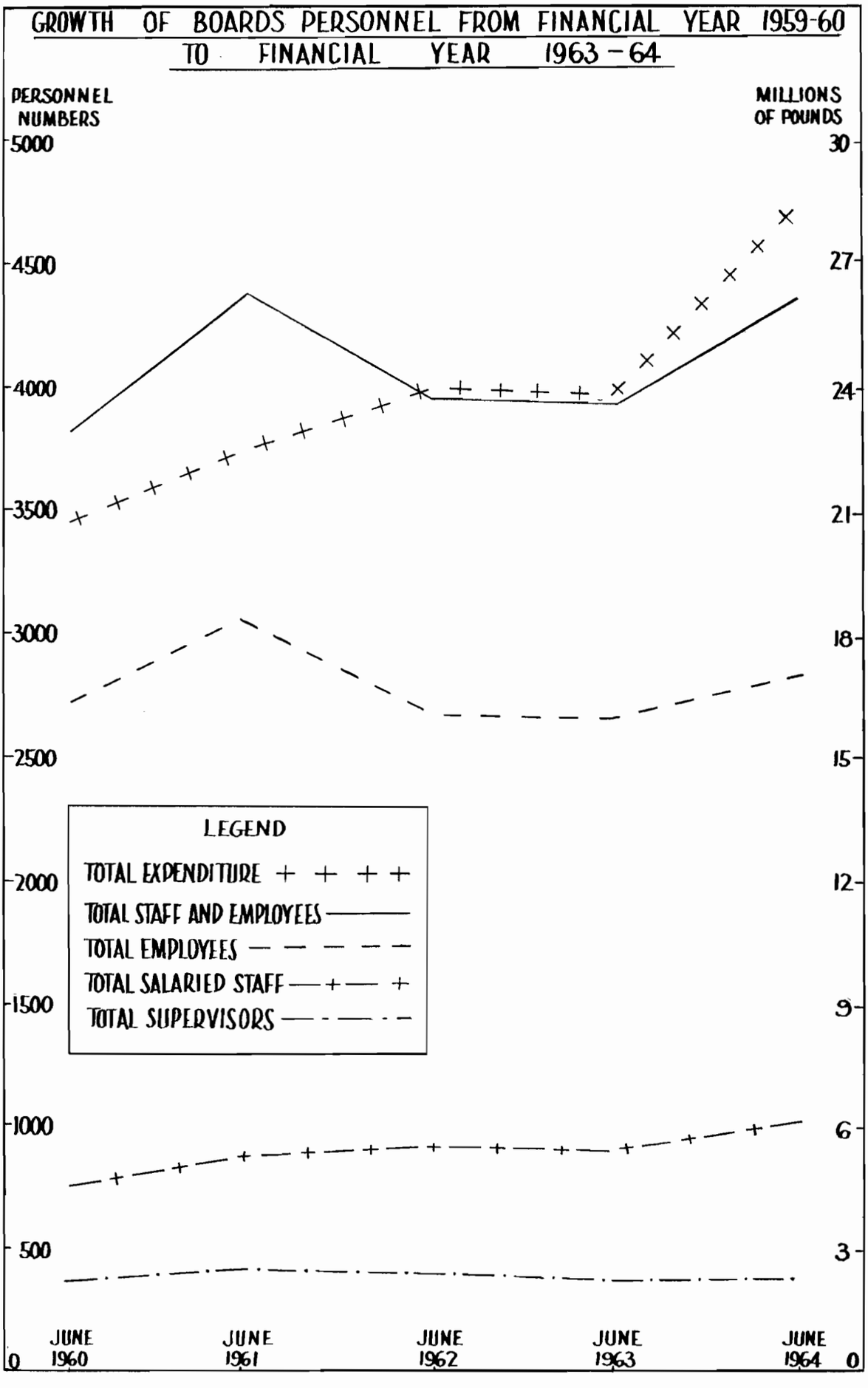
Their programme allowed for consultations with road authorities in nine States, and discussing their findings with officers of the Bureau of Public Roads in Washington.

38. PERSONNEL.

Personnel Employed.

The number of personnel employed by the Board as at the 30th June, 1964, were as follows :—

Salaried Staff	1,039
Supervisory Personnel	422
Employees	2,890
	4,351



The above graph illustrates the growth of Board's personnel compared with expenditure from 1959–60 to 1963–64.

These figures show an increase over the previous year and reflect an increased programme of works carried out by the Board. Among the salaried staff, increases were made in the planning and design groups and in the sections concerned with land acquisition. Supervisory personnel include direct works supervisory staff and clerks of works supervising contracts let to private firms.

Recruitment.

In the financial year 1962–63 the availability of qualified engineers exceeded the demand. In financial year 1963–64 however the buoyant economic conditions made the recruitment of experienced professional, technical and administrative staff very difficult. There was a particular shortage of professional engineers for design work and for country construction positions. The Board plans to extend its recruitment of experienced professional engineers to the United Kingdom.

Recruiting procedures during the year were accelerated in the form of increased activity in " Career Nights " and similar functions sponsored by Secondary Schools and Rotary Clubs.

The Municipal Officers Association and the Association of Architects, Surveyors, Engineers and Draftsmen were again active during the year. The Board's agreement with the Association of Professional Engineers was varied by adding to the salary rates the marginal and basic wage adjustments made by the Conciliation and Arbitration Commission.

During 1964 the Association of Professional Scientists obtained an Award similar to that of the Association of Professional Engineers. The Association advised the Board that it was representing professional scientists in the Board's Materials Research Division.

Staff Retirements.

The following officers with substantial service retired during 1963–64 :—

Mr. J. H. Jarvis, Traffic Officer, on 21st September, 1963, after 34 years of service with the Board.

Mr. H. V. Crameri, Engineering Assistant, on 14th May, 1964, after 34 years service with the Board.

The Board records its appreciation of the long and loyal service that these officers have rendered and wishes them every happiness in their retirement.

Industrial Activity.

After a considerable amount of negotiation between employers and the Australian Workers' Union, the new Construction and Maintenance Award 1964 became effective as from 1st January, 1964. The bulk of the Board's field employees are affected by this award and the total increased cost to the Board resulting from variations in the Award will amount to approximately £130,000 per annum.

The major decisions of the Conciliation and Arbitration Commission during the 1963–64 financial year, viz.—the granting of 3 weeks' annual leave, 13 weeks' long service leave after 15 years' service, and the basic wage increase of £1, will involve the Board in additional salary and wages costs of approximately £275,000 per annum.

The Board is proceeding with a plan to improve its camping standards and during the year a new code of camp standards was approved. The Board's camp at Carrum Downs has been built to these standards which are illustrated in the photographs at Plates 49, 50 and 51.

Plate 49.—Board's camp at Carrum Downs showing living huts.

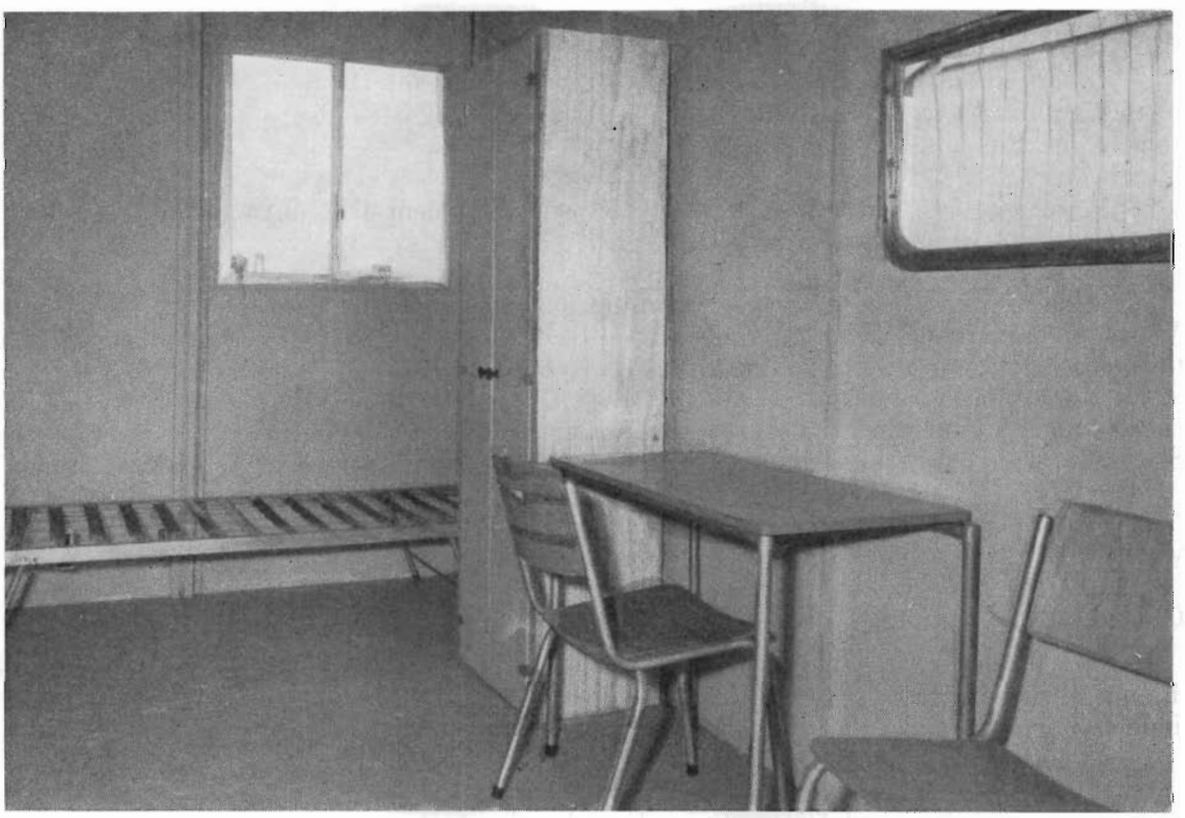


Plate 50.—Interior of Board's two-man hut used on construction jobs.

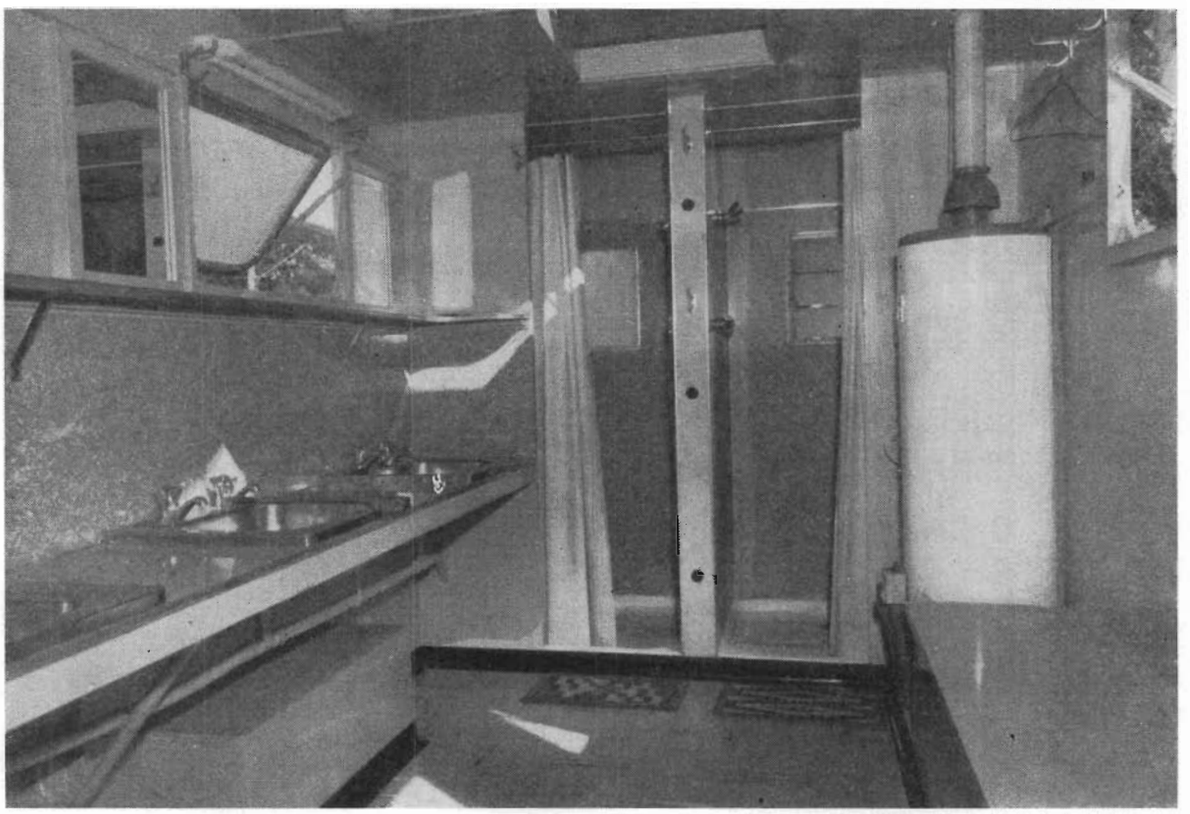


Plate 51.—Interior of a Mobile Ablution Unit for Bituminous Surface Treatment Camps.

Following an inspection of a new type army tent, arrangements were made for the introduction of a suitably modified tent into all the Board's mobile bituminous surface treatment camps. The tent, which is aluminium alloy framed has an aluminized nylon lining which acts as an insulation.

39. TRAINING.

The development of systematic training within the Board continued during the year.

During the year, programmes of induction for newly appointed salaried staff were commenced and a course of training for Senior Administrative Section Leaders was held.

Short intensive courses were held in all Divisions for Overseers and plans for their further training were advanced in detail. Arrangements were also put in hand for short courses for Roadmasters and Patrolmen.

Considerable attention was devoted to the development of a course held in July, 1964, on " Contract Administration for Engineers."

External institutions used for training purposes were the University of New South Wales and the Australian Administrative Staff College. Mr. B. A. Watson, Senior Construction Engineer, Bridge Sub-Branch, attended the Construction Management Course at the University of New South Wales and Mr. R. J. E. Bulman, Deputy Accountant, attended the Advanced Course at the Australian Administrative Staff College. Members of the Staff also attended certain courses conducted by the Australian Institute of Management.

Arrangements were also made for a quota of students to gain practical experience with the Board in the engineering field during the long school and university vacation.

Cadets.

Six cadetships in Civil Engineering, two in Commerce and one in Mechanical Engineering, were granted for university training in 1964. These cadets underwent a special induction programme at the beginning of 1964 before proceeding to academic studies.

Academic studies are supplemented by supervised vacation experience and by a transition course designed for newly graduated cadets.

The continuation of the cadetship scheme will assist in the provision of qualified professional officers to carry out the Board's future programmes of work.

The following table shows the number of cadets at universities in the 1964 academic year :—

Cadets under Training.	Civil Engineering.	Mechanical Engineering.	Commerce.	Economics.	Total.
First year..	4	1	2	..	7
Second year	8	..	..	..	8
Third year	7	..	..	..	7
Fourth year	4	..	..	1	5
Total	23	1	2	1	27

40. APPOINTMENT OF A HORTICULTURAL OFFICER.

The increase in the development of divided highways has led to the need for increased attention to the treatment of medians, outer separators and roadsides generally. The planting of shrubs and trees on medians and outer separators not only improves the aesthetic value of the road but also provides a measure of protection against dazzle and accident.

The Board has therefore appointed a Horticultural Officer who is generally concerned with ensuring that plantations either in medians or at the sides of the Board's road reserves are in keeping with the landscape and the best modern practice. His duties will relate to the maintenance of existing roadside trees and shrubs including control of insect infestation, roadside erosion and the establishment of new plantations. He will also be concerned with roadside facilities at certain parking areas and the development of viewing points and rest areas.

41. ACKNOWLEDGMENTS.

The Board extends its congratulations to Sir Horace Petty on his appointment as Knight Bachelor and offers its best wishes on his new post as Agent General for Victoria in London. The Board would also like to record its appreciation of Sir Horace's support and guidance during the years that he was Minister of Public Works.

The Board also desires to record its appreciation of 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.

The Board thanks all members of its staff for their continued loyal co-operation and work during the year.

We have the honour to be,

Sir,

Your obedient servants,

I. J. O'DONNELL, O.B.E., E.D., B.C.E., M.I.E. Aust., F.A.I.M., Chairman.

R. E. V. DONALDSON, A.A.S.A., A.C.A.A., J.P., Deputy Chairman.

F. WEST, B.C.E., M.I.E. Aust., C.E., Member.

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

APPENDIX 1.

MOTOR REGISTRATION

Registrations effected during the year under the Motor Car Act totalled 1,061,065, an increase of 7·5 per cent. on the registrations effected during the previous year as compared with an increase in 1962–63 of 5·4 per cent. over the total for 1961–62.

Vehicles.	Financial Year 1962–63.		Financial Year 1963–64.		Increase.	Decrease.
Private—						
New	78,722		91,222		..	..
Second-hand—						
Reregistered	22,039		23,065		..	..
Renewals	668,527		719,133		..	..
		769,288		833,420	64,132	..
Commercial and Hire—						
New	11,618		13,656		..	..
Second-hand—						
Reregistered	4,396		4,287		..	..
Renewals	98,159		102,301		..	..
		114,173		120,244	6,071	
Primary Producers—Trucks—						
New	4,188		4,895		..	..
Second-hand—						
Reregistered	4,932		4,659		..	..
Renewals	64,137		68,164		..	..
		73,257*		77,718†	4,461	..
Licences under Motor Omnibus Act		776		724	..	52
Trailers		14,760		15,328	568	..
Motor Cycles		15,145		13,631	..	1,514
Total		987,399		1,061,065	75,232	1,566

* Includes 35,116 No Fee tractors. † Includes 38,350 No Fee tractors.

APPENDIX 2.

COUNTRY ROADS BOARD.

STATEMENT OF RECEIPTS AND PAYMENTS FOR YEAR ENDED 30TH JUNE, 1964.

(Adjusted to nearest pound.)

—		Country Roads Board Fund.		*Commonwealth Aid Roads Act* 1959.		Loan Funds.	Sub-Total.	Total.
		Act 6229.	Act 6222 Road Maintenance Account.	Sec. 7 (1).	Sec. 7 (2).			
RECEIPTS	£	£	£	£	£	£	£	£
Balance as at 1st July, 1963		1,400,522	..	..	..	..	..	1,400,522
Motor Car Registration Fees	10,968,754							
Additional Registration Fees	848,912							
Drivers' Licence Fees ..	297,541							
Drivers' Licence Testing Fees	81,246							
Examiners' Licence Fees	7,765							
Fines	347,663							
	12,551,881							
Less Cost of Collection	838,505							
		11,713,376	..	..	..	..	..	11,713,376
Municipalities Repayments—								
Permanent Works—Main Roads	37,482							
Maintenance—Main Roads	752,232							
		789,714	..	..	..	..	..	789,714
Moneys provided by *Commonwealth Aid Roads Act* 1959		..	..	6,650,516	4,564,851	..	..	11,215,367
Proceeds from *Commercial Goods Vehicles Act* 6222		..	2,818,969	..	..	..	..	2,818,969
Receipts from State Loan Funds—Act 6229		..	..	..	..	333,000	..	333,000
Fees and Fines under Country Roads Act		740	..	..	..	..	..	740
General Receipts		110,966	..	..	..	..	..	110,966
		14,015,318	2,818,969	6,650,516	4,564,851	333,000	..	28,382,654
PAYMENTS.								
Main Roads—								
Construction and Reconstruction ..		3,907,623	..	1,673,296	..	128,378	5,709,297	7,444,648
Maintenance		854,030	877,399	3,922	..	..	1,735,351	
State Highways—								
Construction and Reconstruction ..		3,163,149	..	4,244,921	..	204,622	7,612,692	9,575,353
Maintenance		21,091	1,941,570	..	..	..	1,962,661	
By-pass Roads—								
Construction and Reconstruction ..		1,313,242	..	..	..	..	1,313,242	1,320,502
Maintenance		7,260	..	..	..	..	7,260	
Tourists' Roads—								
Construction and Reconstruction ..		510,401	..	..	..	..	510,401	712,339
Maintenance		201,938	..	..	..	..	201,938	
Forest Roads—								
Construction and Reconstruction ..		49,841	..	..	200,000	..	249,841	370,962
Maintenance		121,121	..	..	..	..	121,121	
Unclassified Roads—								
Construction and Reconstruction ..		..	..	671,845	3,553,420	..	4,225,265	5,053,390
Maintenance		..	..	16,694	811,431	..	828,125	
Murray River Bridges and Punts ..		43,511	..	..	..	..	..	43,511
Traffic Line Marking		61,584	..	..	..	..	..	61,584
Traffic Lights		13,637	..	..	..	..	..	13,637
Plant Purchases		596,273	..	..	..	..	..	596,273
Payment to Tourist Fund		213,658	..	..	..	..	..	213,658
Contribution—Australian Road Research Board		..	..	39,838	..	..	..	39,838
Contribution—Metropolitan Transportation Survey		15,746	..	..	..	..	..	15,746
Interest and Sinking Fund Payments ..		975,226	..	..	..	..	..	975,226
Kew Office and Laboratory		188,896	..	..	..	..	..	188,896
General and Administration Expenditure ..		1,753,494	..	..	..	..	..	1,753,494
		14,011,721	2,818,969	6,650,516	4,564,851	333,000	..	28,379,057
Balance at 30th June, 1964 ..		3,597	..	..	..	..	..	3,597

NOTE.—Relief to Municipalities granted under Act 6229 Section 32, amounted in 1963–64 to £25,100 9s. 7d.

R. G. COOPER,
Accountant.

11th December, 1964.

AUDITOR-GENERAL'S CERTIFICATE.

The accounts of the Country Roads Board for the year ended 30th June, 1964 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.

23rd December, 1964.

APPENDIX 3.

COUNTRY ROADS BOARD.

Loan Liability as at 30th June, 1964.

——	£ s. d.	Main Roads, &c. £ s. d.	Developmental Roads. £ s. d.	Total. £ s. d.
Permanent Works	..	..	..	
Main Roads	7,447,196 5 3			
State Highways	6,730,556 18 3			
Tourists' Roads	113,658 4 5			
Forest Roads	1,083 18 11			
		14,292,495 6 10	..	14,292,495 6 10
Developmental Roads	..	..	6,425,757 10 11	6,425,757 10 11
Discount and Expenses	..	278,464 12 0	270,499 11 10	548,964 3 10
Total amount Borrowed	..	14,570,959 18 10	6,696,257 2 9	21,267,217 1 7
Less Redemption of Loans—				
Redemption Funds	..	85,219 1 1	636,386 7 4	731,605 8 5
Main Roads Sinking Fund	..	285,688 7 7	..	285,688 7 7
Developmental Roads Sinking Fund	..	..	55,083 0 2	55,083 0 2
State Loans Repayment Fund	..	1,274,609 1 7	..	1,274,609 1 7
National Debt Sinking Fund	..	1,924,563 1 5	2,223,477 12 0	4,148,040 13 5
		3,570,079 11 8	2,924,946 19 6	6,495,026 11 2
Loan Liability at 30th June, 1964	..	11,000,880 7 2	3,771,310 3 3	14,772,190 10 5

APPENDIX 4.

CHIEF ENGINEER'S REPORT

Country Roads Board,
Melbourne,
9th October, 1964.

THE CHAIRMAN,

SIR,

I have the honour to report on matters of technical interest carried out during the year 1963-64. The report is divided into four major subdivisions corresponding to the four sub-branches of the Chief Engineer's Branch, followed by some matters of a general engineering nature.

WORKS SUB-BRANCH

1. ROAD CONSTRUCTION AND MAINTENANCE

Road construction and maintenance works and practices containing features of particular interest are set out below.

Motorized Two-man Posthole Auger

One thousand two hundred guide posts were installed, or relocated, on the Hamilton Highway during July by a team of four men using a motorized auger bought for this work.

This unit proved very satisfactory and more suitable than the tractor mounted units previously used. A further seven units have since been purchased for work of this nature and for materials investigation. (See Plate 1)

Mobile Rock Breaker

Following preliminary trials in 1962, hired mobile rock breakers have been successfully used on several jobs during the year.

These machines are essentially a powered hammer-mill which is towed straddling a windrow containing oversize material which is broken to acceptable size on site. The machine used had a 90 h.p. drive motor with eighteen hammers, operating at 1,000 r.p.m., breaking a width of 4 feet, and best results were obtained with a towing tractor able to progress continually at a crawl speed of approximately $\frac{1}{2}$ m.p.h. (See Plates 2 and 3.)

The rock breaker has been used particularly for reducing local pavement materials containing a proportion of oversize material which is too hard to break satisfactorily with grid or other rollers, including coarse alluvial gravel, hornfels, and limestone.

When operating in harder materials some stone is thrown out by the machine and it is necessary to stop traffic during breaking operations. With softer materials, however, traffic is able to continue without interruption provided the windrow is heavily watered before breaking to reduce dust problems.

Plate 1—Motorized Two-man Posthole Auger in Operation

Plates 2 and 3—Mobile Rock Breaker
(Dust somewhat obscures the clarity of Plate 3)

Critical Path Analysis

During 1963 the Board made trial applications of the recently developed technique known as the Critical Path Method (CPM) for job planning and control.

The technique, which provides the means to co-ordinate and analyse a project and isolate the activities which are most critical to the successful completion of the project within a planned period, was applied to complex works on a section of duplication of the Maroondah Highway through Ringwood, and to a new type prestressed box girder bridge overpass of the Calder Highway. The CPM analysis for the Maroondah Highway job was carried out by IBM Computer.

CPM was found to have definite application to the larger and more complex projects where extensive planning and co-ordination of many and diverse activities is necessary; in such cases the use of CPM and Computer analysis greatly facilitates planning and control.

2. Direct Labour Road Construction Costs

Detailed cost analysis available for 134 roadwork jobs completed during the year at a cost of £2·8 million indicate continuing stability in unit costs as shown in the following tables:—

Table 1—Distribution of Expenditure

Item.	Period 1963–64.	Five-year Weighted Average from 1959–60.
	%	%
Plant	30·0	35·9
Labour	31·2	32·9
Materials	29·3	21·5
Stores	9·5	9·6

Table 2—Works Overhead Expenditure

(Percentage of Productive Costs.)

Item.	1963–64.	Five-year Average.
	%	%
Construction expenses ..	7·6	7·7
On site expenses ..	19·1	20·9
Total	26·7	28·6

Table 3—Formation Costs (including Distributed Overhead Expenditure)

—	Rock.		Earth—Unclassified.		Total.	
	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Unit Cost.
	cub. yds.	£ s. d.	cub. yds.	£ s. d.	cub. yds.	£ s. d.
1963–64	20,474	0 18 8	1,171,970	0 11 9	1,192,444	0 11 11
5-year average	51,129	0 19 2	945,782	0 11 3	996,911	0 11 7

Table 4—Pavement Material Costs (Consolidated in Place including Distributed Overhead Expenditure)

—	Fine Crushed Rock.		Coarse Crushed Rock.		Gravel, &c.		Total.	
	Cubic Yards.	Unit Cost.	Cubic Yards.	Unit Cost.	Cubic Yards.	Unit Cost.	Cubic Yards.	Unit Cost.
		£ s. d.		£ s. d.		£ s. d.		£ s. d.
1963–64	159,362	2 2 2	56,529	1 11 11	1,037,788	1 1 11	1,253,679	1 3 3
5-year average	90,926	2 0 10	34,231	1 11 9	749,184	0 19 6	874,341	1 2 3

3. Roadside Development

In order to implement the Board's policy of roadside development the position of Horticultural Officer was created. The functions of the Horticultural Officer relate to the preservation, restoration, and development of as much of the attractive natural features of the roadside as is reasonably possible and include control of batter slopes, control of roadside erosion, care of existing timber, establishment of new plantations, median strip development on divided highways and development of roadside facilities at the various types of roadside parking areas.

During the year, preparations have been carried out for the planting of over 35,000 trees on State highways. The planting season extends from autumn till late spring, and the greater part of the actual planting will be carried out in September and October 1964.

A small special gang has been formed for the purpose of initiating special projects and during the year has been engaged on tree planting, median strip development and the development of roadside rest areas. Approximately 120,000 square yards of

median along divided highways have been completed and grassed, these being equivalent to 11·4 miles of median 18 feet wide.

4. Testing of Materials and Research

Lime Stabilization of Clay Subgrades

The highly expansive clay soils developed on basalt to the north and west of Melbourne are among the most troublesome of clay subgrades and require flexible pavements of the order of 24 inches to 30 inches thickness to withstand traffic loads. The addition of a small percentage of lime to the clay results in an increase of the CBR value from 2 per cent. to 4 per cent. in its natural state to a value of from 20 per cent. to 40 per cent., and volume changes associated with changes of moisture content are almost eliminated. A material having these characteristics is suitable for incorporating in the sub-base of a pavement below the pavement material itself. Equipment is now available to fragment the clay and add lime to give a depth of 6 inches to 8 inches of lime treated material, and this form of construction has been adopted in recent work on the Hume Highway and on the Tullamarine By-pass Road.

Laboratory investigations of the problems associated with lime stabilization of clays have been proceeding for several years, and typical results obtained with a clay from the Tullamarine area are summarized in Table 5.

Table 5—Results of Investigation of Lime Stabilization of Clays in Tullamarine Area

Property.	Percentage by Weight of Added Lime.				
	0.	1.	2.	4.	8.
Liquid Limit .. %	85½	66½	62½	52	47½
Plastic Limit .. %	15½	21½	20	26	31½
Plasticity Index	70	45	42½	26	16
Linear Shrinkage .. %	19	16½	16	9½	6½
Maximum Dry Density p.c.f.	85½	83½	85½	84½	85½
Optimum Moisture Content %	30½	28	28	25½	27½
CBR (Soaked) .. %	4	6	24	54	80

It will be noted that although as little as 1 per cent. of lime reduces the plasticity of the clay, there is no substantial change in CBR value until 2 per cent. or more is added.

In these laboratory investigations all materials were finely fragmented to all pass a $\frac{3}{16}$-in. B.S. sieve, and a great deal of care was taken to obtain a uniform distribution of moisture and lime through the material. In the field work on the Tullamarine By-pass Road, the ability of construction equipment to carry out these processes was investigated and comparative tests of field and laboratory processed materials are in progress.

A number of permanent test sites have been established and the long-term behaviour of the lime treated clay sub-base will be compared with the behaviour of laboratory mixed, compacted and stored samples up to an age of two years. Two types of material having the properties given in Table 6, have been stabilized by the addition of 5 per cent. to 6½ per cent. of lime. The contractors used single rotor pulverizers to fragment the clay and mix in the lime and to add moisture up to the optimum moisture content of approximately 30 per cent. Under adverse weather conditions the lime was added in two portions, with several days' delay between additions. The degree of fragmentation specified was 60 per cent. passing $\frac{3}{16}$-in. B.S. sieve. With the heavy clay designated A in Table 6, it was very difficult to achieve this standard with five to eleven passes of the pulverizer and periods of two to eight days were required between the first addition of lime and the final mixing, shaping, and rolling. It was found on examination that some of the larger lumps of clay, up to 3 inches to 4 inches across, contained lime, indicating that the breaking up had achieved its purpose, but reworking was kneading the particles into large lumps. When this became apparent and the moisture content was near optimum the section was considered as acceptable. With the lighter clay, designated B in Table 6, three passes of the pulverizer generally achieved an acceptable standard of fragmentation.

Table 6—Properties of Materials

Designation.	A.	B.
Soil Classification ..	A–7–6 (20) CH	A–7–6 (18) CL
Percentage Passing $\frac{3}{16}$"	100	100
No. 36 ..	90	83
No. 200 ..	84	66
Liquid Limit ..	77	47½
Plastic Limit ..	17	14½
Plasticity Index ..	60	33
Linear Shrinkage ..	19	12½

The rate and uniformity of addition of water was checked, by oven drying, by Speedie Moisture Meter, and by hand testing. It was found that the rate of application could be controlled to within 2 per cent. to 3 per cent. of the optimum moisture content, but non-uniformity occurred due to the use of unsatisfactory equipment, resulting in leakages and blocking of spray jets, and because of the inexperience of operators. Some attempts were made to check the rate and uniformity of application of lime, but the determination of lime content by chemical analysis was found to be too laborious to apply on a large scale. This matter will be investigated further.

The degree of compaction achieved on the lime stabilized material was 96 per cent. to 97½ per cent. British Standard. Compaction was carried out by 9-ton flat steel roller or by 4-ton vibrating roller.

Asphalt Paving Meter

An apparatus known as an Asphalt Paving Meter has been obtained for the purpose of assessing the degree of compaction of bituminous concrete. The apparatus (Plate 4) measures the rate of flow of air through the pavement surface into the atmosphere, under a constant air pressure. The correlation between air permeability and the percentage of air voids in the compacted mixture has been determined by obtaining cores at the same sites at which air permeability tests have been carried out. A typical relationship between air permeability and air voids is shown in Diagram 1.

The method appears to have promise as a means of controlling the operation of the rollers immediately behind the tamper spreader, and for investigating the effects of variables such as road temperature or mix temperature on compaction. The effect of traffic is to close the pores in the surface by kneading and by the introduction of dirt, &c., and hence it is unlikely that the technique will be useful as a means of studying the development of traffic compaction over a period of time.

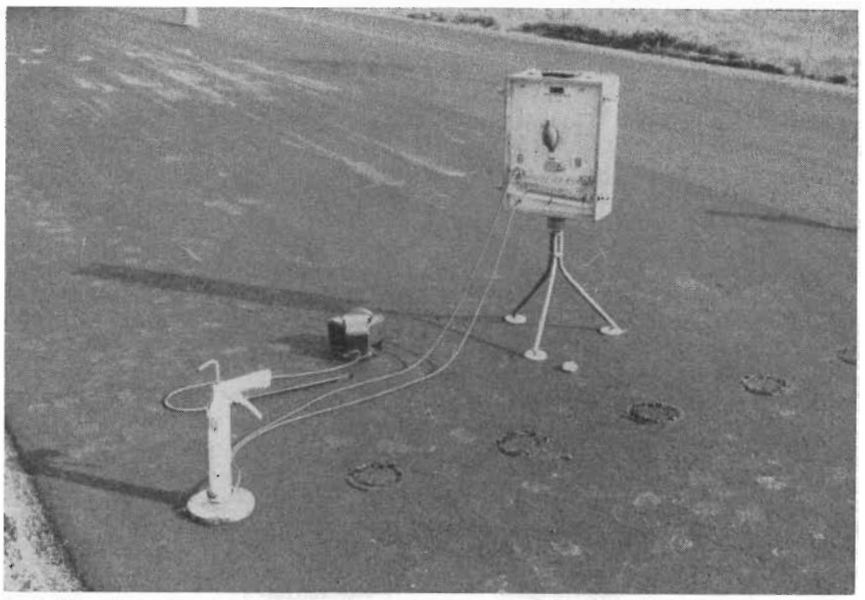


Plate 4—Asphalt Pavement Meter

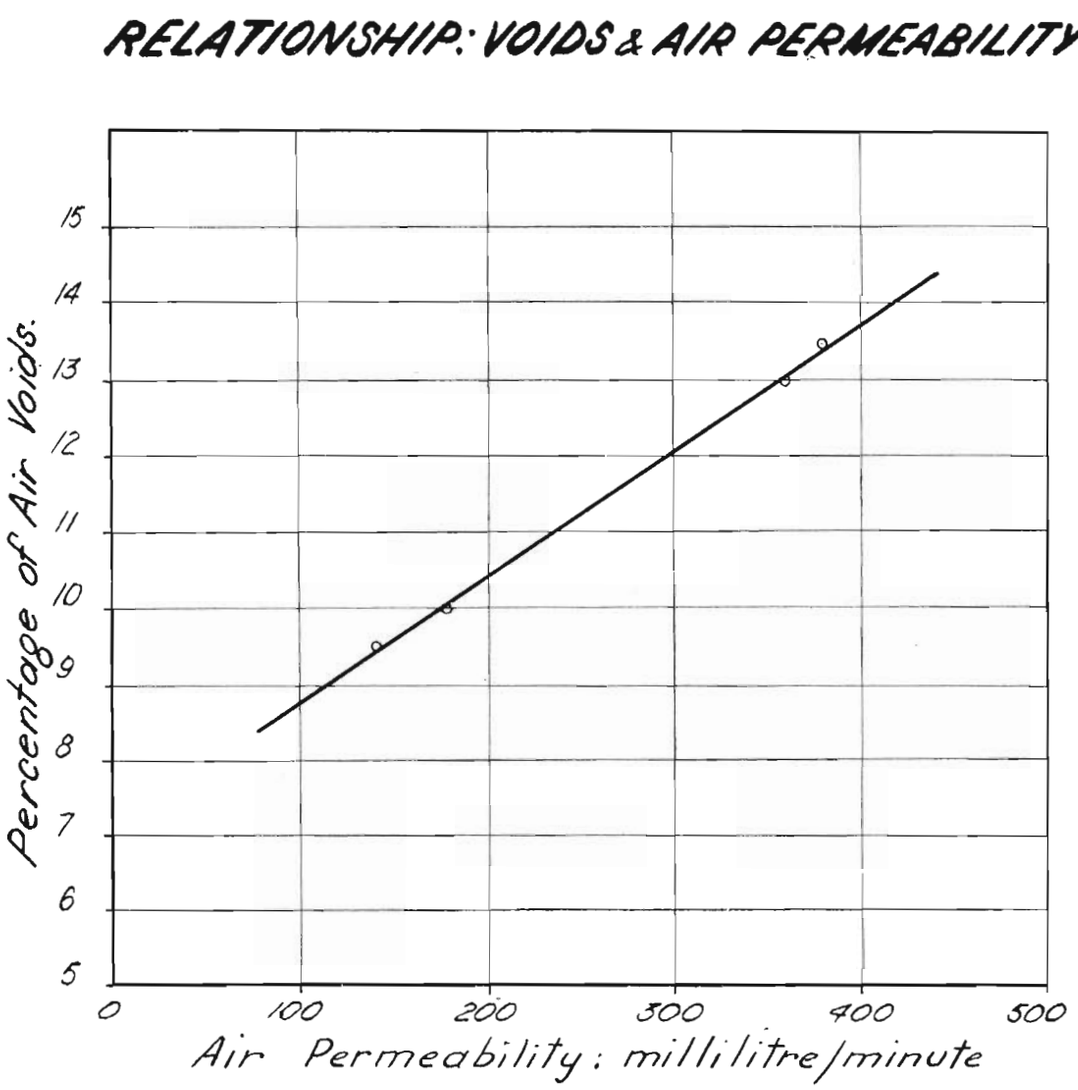


DIAGRAM 1.

This aspect of the problem may be investigated by coring samples from the road for laboratory testing, and field studies of compaction using both techniques are now in progress in connexion with resurfacing work on the Princes Highway West, Section 1.

5. Bituminous Work

Extent of Work

Table 7 sets out the mileage of all types of bituminous surfacing carried out during the past two years and indicates that the work done in 1963–64 exceeded that done in 1962–63 by 403 miles—an increase of 14·7 per cent. The work added a further 334 miles of sealed pavement to the declared system and provided new sealing on 671 miles of unclassified roads.

The rate of retreatment of the sealed length of the declared system rose in the 1963–64 year and amounted to 3·6 per cent. of reconstruction to a higher standard and restoration of the seal coat, and 8·8 per cent. of bituminous retreatment as compared with 2·8 per cent. and 7 per cent. respectively, in the previous year.

Table 8 summarizes the lengths of different categories of bituminous work carried out on all types of roads to which funds are contributed by the Board.

Types of Work

While sprayed work continues to predominate in the annual bituminous surfacing programme, representing 95·6 per cent. of the total length of work undertaken, the use of hot mixed, machine spread bituminous concrete is expanding.

On pavement reconstruction, duplication, and widening in urban areas and on major highway projects, the provision of 2 inches to 3 inches of bituminous concrete as a top course in the pavement structure is becoming the general practice.

This procedure not only adds some strength to the surface of the pavement but provides smoother and quieter riding qualities, requiring less maintenance retreatment than sprayed surface treatments. It is also a means of rapidly bringing a new pavement to its completed bituminous surfaced condition, with the least inconvenience to traffic.

Where existing sealed pavements, although otherwise sound, are in need of maintence retreatment, consideration is given to retreating them with bituminous concrete, machine spread to an average thickness of about 1 inch, when traffic volumes are in the order of 1,500 v.p.d. or more. This provides a higher class treatment of better surface roughness correction than the conventional sprayed reseals.

During the year, work of this nature utilized 83 per cent. more bituminous concrete than was used in the previous year and a total length of 134 miles of work was treated by this process.

Cost of Work

Table 9 sets out the average cost of sprayed work carried out by the Board's mobile spraying units during the year. The unit costs of work are higher than in the previous year, increases ranging from 2 per cent. to 9 per cent. for the different types of work. The weighted average unit costs for all types of work shows an over-all increase of 4·6 per cent. and this reflects the increases during the year in the average costs of aggregate (4·7 per cent.), labour (8 per cent.) and plant charges (11 per cent.).

Materials

(*a*) Aggregate.

The total quantity of covering aggregate used in the sprayed work amounted to approximately 303,000 cubic yards or an increase of 11·8 per cent. on the quantity used during the previous year, and Table 10 sets out the average costs of aggregate over the past five years.

It will be noted that the slight downward trend in the average costs of aggregate during the past few years was halted at the end of 1962–63 and the average cost of the material used in 1963–64 rose by 4·7 per cent. One factor which contributed to this year's rise was a substantial increase in price of crushed metal products introduced for a period by quarry interests in the Melbourne metropolitan and surrounding areas.

(*b*) Bitumen.

Thirty-one thousand two hundred and fourteen tons of 85/100 penetration bitumen was purchased directly by the Board during the year, and this was drawn from the two Victorian refineries, delivery being effected by rail and road by three marketing companies, assisted to some extent by the Board's own road tanker fleet.

The bitumen was produced from Middle East crude oils, and, although there have been changes in the actual source of the crudes during the year at one refinery, the Board's specification which conforms to that adopted by the N.A.A.S.R.A. has been consistently met by the suppliers.

(*c*) Priming Materials.

Reference was made in the 50th Annual Report to a special type of cutback bitumen primer, developed by one of the marketers of bitumen with which some work was undertaken. The satisfactory use of this material was extended considerably through the year and it is largely taking the place of the more expensive commercially or field-produced medium curing cutback bitumen primers.

For many years, considerable use has been made of crude horizontal retort tar as a primer, particularly in the north-west part of the State where the locally available pavement materials consist of relatively soft and highly absorptive limestones. These materials require a priming material containing a heavy pitch residue in order to close up the pores near the surface of the pavement and prevent subsequent absorption of the bitumen in the seal coat.

Crude horizontal retort tar has proved to be the best primer to perform this function but the availability of this material has diminished rapidly as liquid petroleum gas has supplanted the country coal gas making operations which produced the crude horizontal retort tar. In order to find a satisfactory substitute for this tar primer its use has been supplanted by some quantity of lightly distilled vertical retort tar as an interim measure with some success, while some limited trials have been undertaken with a petroleum tar imported from N.S.W. This tar has similar characteristics in some respects to the horizontal retort tar, and improved interstate rail facilities make it a promising and economical possibility.

Extensive trials are to be continued early next year with this material along with other possibilities in order to try and solve what has become an acute problem.

Plant Mix Work

(*a*) General.

While 91·4 per cent. of the plant mix work was undertaken by contractors operating fixed asphalt plants near Melbourne and Geelong, further valuable experience was gained with the use of the Board's mobile asphalt plant to which reference was made in in the 50th Annual Report.

This plant was set up at four different locations and produced 19,844 tons of ⅜-in. nominal size bituminous concrete which was used in resurfacing 26·6 miles of sealed pavement. The average rate of spread over the whole programme was 1 ton to 19 square yards which represents an average compacted thickness of slightly more than 1 inch.

(*b*) Costs.

The costing of the Board's work with this plant has been based on averaging the costs of any work carried out within a 10-mile radius of any plant set up, and for work outside that limit average costs were loaded to provide for additional transport charges and, where applicable, for any loss of production which may have been caused by any of the problems occasioned by transporting and laying the bituminous concrete in sites much further than the average distance from the mixing plant, e.g., temporary shortage of transport.

Unit costs per ton of bituminous concrete have been recorded in the following five major categories :—

Moving and setting up.

Includes the cost of transporting the plant from one site to another and site preparation. Setting up plant and calibrating it in readiness for commencement of work. This is influenced by distance required to move plant, site conditions and amount of work from each set up.

Overheads.

Includes all the cost of arrangements for camping or housing personnel, supervision, &c. This is influenced by availability or otherwise of existing camping facilities, &c.. and amount of work from each set up.

Materials.

Costs of bituminous materials and aggregates delivered to the mixing site.

Mixing.

Cost of operating the mixing plant, including labour, plant charges, fuel, &c.

Transporting.

Cost of transport of mixed material to the laying site.

Laying and Compacting.

Costs of placing the mixture, including tack coating, traffic control, &c.

The unit costs in these five categories may vary quite considerably according to the conditions and the amount of work to be done at each plant set up. For instance, the quantities of material produced in the four areas where the plant was set up ranged from 7,244 tons at Seymour to 2,754 tons at Bendigo, and this has a bearing on the unit costs of such items as moving, setting up, and overhead.

Table 11 sets out the ranges of unit costs for the five major categories at each of the four plant sites and the average unit costs of the whole year's programme. It will be noted that the average cost of the total quantity of ⅜-in. nominal size bituminous concrete surface course material produced and laid for the year amounted to £5 19s. 6d. per ton.

This compares favourably with the average unit cost of the total quantity of 209,424 tons of bituminous concrete produced and laid by contractors for binder and surface courses from the fixed plants near Melbourne and Geelong amounted to £6. 6s. 9d. per ton.

Table 7—Length of Bituminous Surfacing Work Carried Out in 1962–63 and 1963–64

Type of Road and Plant Used.	Miles.	
	1962-63.	1963-64.
(*a*) Work on C.R.B. declared roads—		
(i) Board's Plant ..	1,706	1,962
(ii) Municipal Plant ..	49	42
(iii) Contractors' Plant ..	46	84
	1,801	2,088
(*b*) Work on undeclared roads to which the Board contributes—		
(i) Board's Plant ..	773	869
(ii) Municipal Plant ..	48	54
(iii) Contractors' Plant ..	24	24
	845	947
(*c*) Work done for other Authorities by Board's plant—		
(i) Municipalities ..	90	109
(ii) State Instrumentalities	4	3
(iii) Commonwealth Works	4	..
	98	112
	2,744	3,147

Table 8—Summary of the Mileages of Different Categories of Bituminous Work Carried Out on All Roads to which the Board Contributed Funds During 1963–64

—	State Highways.	By-pass Roads.	Tourists' and Forest Roads.	Main Roads.	Unclassified Roads.	Totals.
Initial Treatments—						
Extensions to sealed system—						
(*a*) Sprayed work	40·72	5·23	21·82	265·98	669·70	1,003·45
(*b*) Plant mix work	..	0·30	..	..	1·26	1·56
Reconstruction of lengths of previously sealed pavements—						
(*a*) Sprayed work	198·44	..	8·78	203·28	37·03	447·53
(*b*) Plant mix work	7·87	..	..	10·80	12·31	30·98
Widening of existing sealed pavements—						
(*a*) Sprayed work	64·79	..	..	187·96	7·32	260·07
(*b*) Plant mix work	4·13	..	..	2·29	1·46	7·88
Duplication of existing sealed pavements—						
(*a*) Sprayed work	5·97	..	..	..	..	5·97
(*b*) Plant mix work	10·96	..	..	6·40	..	17·36
Retreatments—						
(*a*) Sprayed reseals	405·90	..	22·55	545·35	213·40	1,187·20
(*b*) Plant mix work	39·62	..	..	22·55	10·42	72·59
	778·40	5·53	53·15	1,244·61	952·90	3,034·59

TABLE 9—AVERAGE COST OF SPRAYED BITUMINOUS SURFACING CARRIED OUT BY C.R.B. PLANT ON ROADS TO WHICH THE BOARD CONTRIBUTED FUNDS DURING 1963–64

(COST IN PENCE PER SQUARE YARD)

Item.	Nature of Work.																			
	I.T.P. and S. $\frac{5}{8}$-in. and Over.		I.T.P. and S. $\frac{1}{2}$-in.		I.T.P. and S. $\frac{3}{8}$-in.		I.T.P. and S. $\frac{1}{4}$-in. and Sand.		I.T. Seal Only.		I.T. Two Application Seal Only.		Reseal $\frac{5}{8}$-in. and Over.		Reseal $\frac{1}{2}$-in.		Reseal $\frac{3}{8}$-in.		Reseal $\frac{1}{4}$-in. and Sand.	
Square Yards Costed ..	1,520,848		3,083,083		1,320,517		1,092,911		5,401,740		274,272		482,334		1,750,747		4,168,573		5,202,131	
	d.	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%
Material	21·5	54·3	18·6	53·3	20·6	64·4	16·5	67·1	17·6	59·7	24·2	64·2	19·1	60·3	16·3	63·9	12·2	58·9	10·0	62·9
Stores	1·3	3·3	1·1	3·1	0·8	2·5	0·7	2·8	0·8	2·7	1·0	2·7	0·8	2·5	0·6	2·4	0·5	2·4	0·5	3·1
Plant Hire	7·5	18·9	6·9	19·8	5·2	16·2	3·5	14·2	5·1	17·3	5·9	15·6	5·3	16·7	4·1	16·1	3·7	17·9	2·6	16·4
Labour	9·3	23·5	8·3	23·8	5·4	16·9	3·9	15·9	6·0	20·3	6·6	17·5	6·5	20·5	4·5	17·6	4·3	20·8	2·8	17·6
Totals ..	39·6	100·0	34·9	100·0	32·0	100·0	24·6	100·0	29·5	100·0	37·7	100·0	31·7	100·0	25·5	100·0	20·7	100·0	15·9	100·0

TABLE 10—AVERAGE PRICE OF AGGREGATE FOR BITUMINOUS SURFACING AT PER CUBIC YARD IN STACKS BY THE ROADSIDE FOR THE YEARS 1959–60, 60–61, 61–62, 62–63, 63–64

Material.	Prices per Cubic Yard.				
	1959–60.	1960–61.	1961–62.	1962–63.	1963–64.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Screenings	48 6	47 2	46 7	44 10	48 1
Gravel	42 2	43 0	44 1	42 7	39 6
Sand	27 4	21 1	19 3	21 7	23 1
Scoria	27 1	21 3	31 4	32 8	29 10
Average price all aggregates	46 5	45 8	44 11	42 9	44 9

TABLE 11—UNIT COSTS PER TON OF BITUMINOUS CONCRETE FOR BOARD'S MOBILE ASPHALT PLANT

Costing Categories.	Range of Unit Costs at Four Sites.	Average Unit Costs for All Work.
	£ *s. d.*	£ *s. d.*
Moving and setting up	0 2 10 to 0 11 2	0 5 6
Overhead	0 3 4 „ 1 5 11	0 10 9
Materials	2 16 10 „ 3 9 6	3 4 3
Mixing	0 13 7 „ 1 0 6	0 15 9
Transporting	0 7 10 „ 0 10 0	0 9 0
Laying and compacting	0 12 1 „ 0 19 7	0 14 3
Average unit cost for all work	.. ..	5 19 6

BRIDGE SUB-BRANCH

1. DESIGN

Field Splicing and Proof Loading of Welded Steel Girders

Prior to the finalization of the design of Princes Bridge over the Barwon River at Geelong, it was decided to fabricate a prototype fully butt-welded field splice under field conditions. A welding sequence to avoid distortion was developed from the information obtained.

Extensive non-destructive inspection of welding was maintained throughout the fabrication and field splicing of the girders for the Princes Bridge and the bridge over the Ovens River at Wangaratta. Radiographic inspection of butt welds to a specification slightly modified from that used by the Californian Highways Department was carried out to the extent shown in the Table 12.

TABLE 12—RADIOGRAPHIC INSPECTION STANDARDS ADOPTED

Location of Butt Weld.	Minimum Percentage of Total Weld Radiographed.
	%
Flange Plates (Field splice) ..	100
Web Plates (Field splice) ..	50
Flange Plates (Shop splice) ..	80
Web Plates (Shop splice) ..	25

The quality of fillet weld was assured by preliminary testing of welders, inspection of actual welding operation and final checking for surface cracks with magnetic particle or penetrant dye processes.

As an added precaution, it was decided to proof load the girders for Princes Bridge and Ovens River Bridge at the lightly stressed welded butt splices between Class D and ND2 steels.

In accordance with a theory advanced by the British Welding Research Association, it has been shown that brittle fracture in steel below the transition temperature at a particular stress, can be inhibited by heating the steel to above the transition temperature and applying a stress in excess of that anticipated in service. This type of proof loading appears to inhibit initiation of cracks at surface discontinuities or from internal defects in the parent or weld metal.

Proof loading of field splices of girders for Princes Bridge and for the Ovens River Bridge was carried out by loading the girders singly or in groups, by jacking, while maintaining the temperature of the steel at the splice points at 100° F. by means of electrically heated "hot boxes".

Sufficient load was applied to stress the steel at the splice to one and a half times the working stress.

Individual girders were loaded by jacking against restraining yokes. In some cases for the Ovens River bridge girders, loading was carried out by jacking one girder against another, with webs in the horizontal position. Groups of girders at both bridges were loaded by jacking at a pier against the weight of the girders.

2. Construction

Maribyrnong River Bridge—Calder Highway

The realignment of the Calder Highway at Curly Hill necessitated a new bridge over the Maribyrnong River at Keilor.

This bridge, 239 feet long in three spans, incorporates the longest pre-tensioned concrete beams so far used by the Board. Each beam is 78 ft. 6 in. long and weighs 19·1 tons. Because of this size and weight, and the precipitous bank of the river at the Melbourne abutment, a well organized complex system of cranes was necessary to place the beams in Span 1. This system, devised by the contractor, involved four mobile cranes, two of which acted as " feeder " cranes to the other two.

Spans 2 and 3 were more accessible and the difficulties of placing beams in these spans were not as great as for Span 1.

The 45 feet high, single column circular piers are an attractive aspect of this bridge.

Test Pile—Cardinia Creek, South Gippsland Highway

In carrying out tests on a test pile driven at Cardinia Creek on the South Gippsland Highway, an attempt was made to determine separately the toe bearing capacity and the capacity resulting from the friction of the surrounding strata on the pile shell.

The pile, which incorporates a special toe fitted to a steel shell by neoprene rings, was driven to a depth of 43 feet mainly in a greyish brown sandy clay.

Loading was carried out by jacks, jacking against a beam fastened to an anchor pile on each side of the test pile. Initially, by means of a mandrel placed inside the shell, load was applied to the test pile toe only. Load on the toe reached a maximum of 37 tons before the toe began to move away from the pile shell.

The toe was allowed to move away about 1½ inches before the load was removed from the toe and applied to the shell. Load to the shell was then increased to a maximum of about 179 tons when the shell moved sufficiently to become reunited with the toe. The load was further increased to obtain the ultimate capacity of the whole pile which was found to be approximately 217 tons.

The test pile was driven with a " Delmag " diesel hammer and the driving resistance of the pile was calculated at 237 tons using the Hiley formula. This value compares quite favourable with the 217 tons tested load.

" Vogt Wire Tension Meter "

During the year 1963–64, the Bridge Sub-branch supervised precast prestressed concrete contracts to the value of £177,000.

It is necessary to regularly check on the amount of prestress actually applied to the units in the factory and to help do this, a " Vogt Wire Tension Meter " was purchased. The instrument is a mechanical device which allows a simple measurement of the tension in a prestressing strand.

A reading from a micrometer scale gives a measure of the force required to produce a pre-determined lateral displacement of the strand between two supports. This force is also a function of the tension in the strand.

Readings can be taken at any accessible position along the tensioned strand. The instrument purchased can be used for tension measurements in ⅜-in., 7/16-in. and ½-in. diameter strand.

Calder Highway–Lancefield Road Interchange

Two curved concrete bridges of four spans each will be constructed side by side at this site. Construction of the first, a two lane structure 28 feet between kerbs for north-bound traffic in Lancefield Road, is well under way, and the second, providing 20 feet between kerbs for a single lane ramp for south-bound traffic turning west into Calder Highway, will follow.

Both structures are of continuous box girder conconstruction and will be cast *in situ*, then post-tensioned. They will be the first of this type of structure to be built in Victoria. Being curved in plan, the variable skew calls for spans of 55 feet, 94 feet, 94 feet, 41 feet, to cross the six through lanes, two acceleration lanes, and medians and shoulders of the highway.

The substructures consist of conventional buried abutments at each end, with three intermediate single column concrete piers (4 feet diameter) founded on spread footings. There are no crossheads on the piers but instead there is a heavy diaphragm built into the superstructure over each pier to transfer loads from the main longitudinal members to the single central support.

The superstructure of the main bridge consists of four longitudinal girders, cast integrally with an 8-in. deck and a 6-in. soffit slab to form a box of constant depth throughout (3 ft. 9 in.). Pier diaphragms and intermediate diaphragms between longitudinal girders assist to produce a structure of great torsional stiffness.

The superstructure will be post-tensioned by means of two 138-ton BBRV tendons (each 34 No. 0·276-in. diameter wires) and two 125-ton BBRV tendons (each 31 No. 0·276-in. diameter wires) in each girder. The 125-ton tendons extend the full length of the bridge with stressing heads at each end, but the 138-ton tendons are placed in pairs, one from each end of the bridge, and each terminating 18 feet past the middle pier. The resulting overlap produces a local increase in prestress in the vicinity of the middle pier which is the most heavily stressed section of the superstructure.

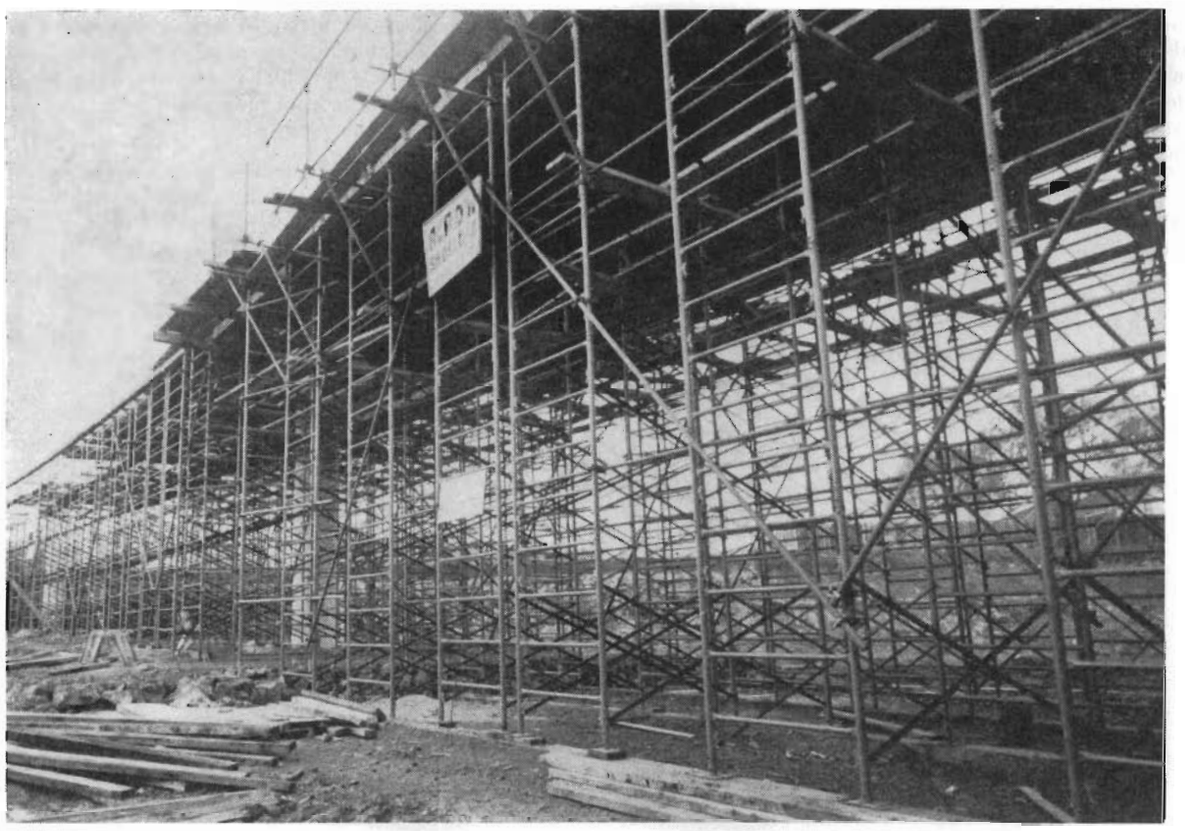
Post-tensioning will be done in two stages :

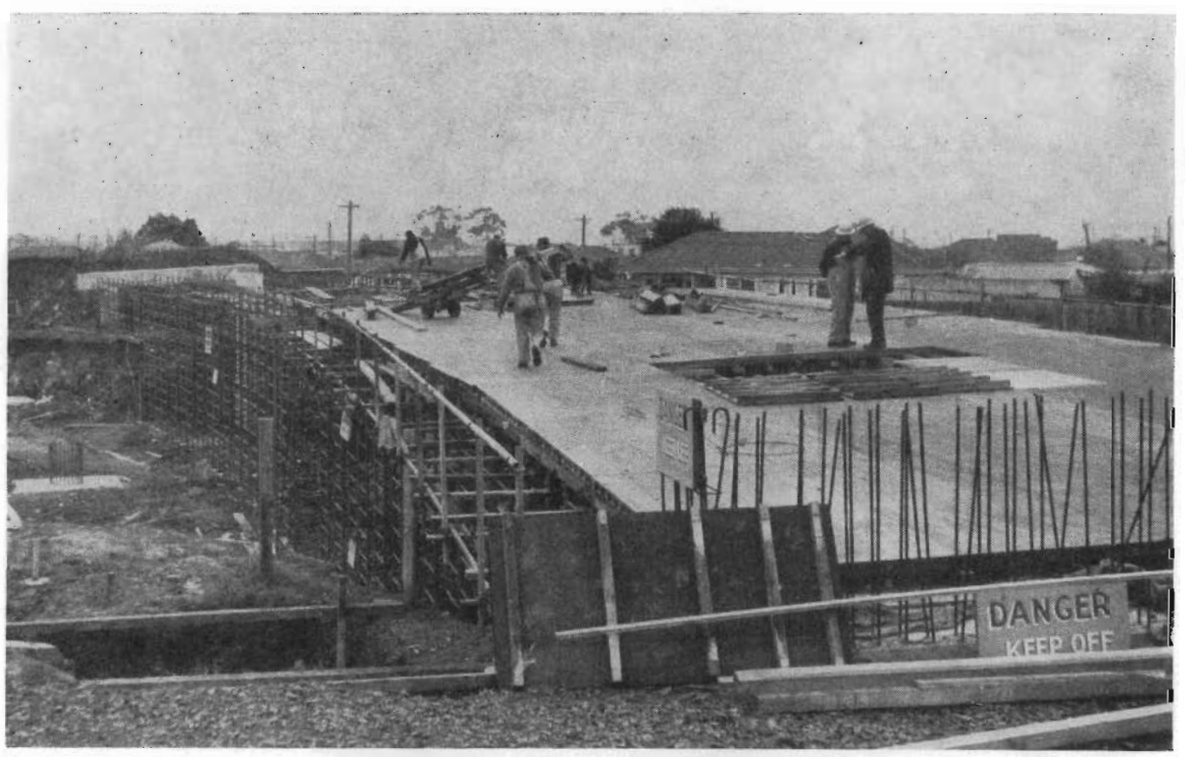
1. (*a*) Initially two 125-ton tendons will be stressed in steps up to the maximum stressing force, working from alternate ends to assess actual friction losses, in order that the final stressing forces may be adjusted if necessary.

   (*b*) When the concrete has reached the specified strength the tendons will be stressed in a suitable sequence to the maximum stressing force. This force will be approximately 20 per cent. greater than the final stressing force at the anchorages to partially offset the effects of friction in the ducts.

2. At 42 days the tendons will be re-stressed to the maximum stressing force to make up losses from relaxation and creep in this period, then after a short period the force will be reduced to the design force at release.

To support the superstructure until post-tensioning is carried out, a considerable quantity of falsework is required. A recently introduced system of tubular steel-framed, heavy duty falsework has been purchased by the Board. The frames and the connecting cross bracing members are capable of very speedy erection into towers. They will be suitable for re-use on other similar jobs, and also for the support during construction of conventional pier or abutment crossheads. (Plates 5 and 6.)





Plates 5 and 6—Calder Highway–Lancefield Road Interchange construction showing system of tubular steel-framed heavy duty falsework

The unusual layout and construction of these bridges have resulted in some special problems in the bearings and particular attention has been given to their design. The nature of the structures called for bearings at the piers which would satisfy the following requirements.

(*a*) Allow rotation in any vertical plane due to deflection or torsional rotation of the superstructure at all piers.

(*b*) Provide for horizontal movement in any direction due to stressing and thermal effects, at expansion piers.

(*c*) Maintain uniform distribution of vertical loads under the bearings at all piers when rotation of superstructure occurs.

(*d*) Reduce horizontal forces at expansion points to a minimum.

The bearing adopted to suit these conditions is the "pot" bearing which has been developed for similar structures in recent years in Germany. The main feature is the use of a large pad of neoprene rubber inside an inverted cast steel pot, 2 feet diameter by 2⅝ inches deep, and completely enclosed by resting on a cast steel base plate and two stainless steel sealing

rings. Under these conditions the neoprene behaves like an incompressible fluid enabling the pot to rotate relative to the base plate and follow movements of the superstructure in any vertical plane, and at the same time, transmit uniform pressure to the base of the bearing.

To provide for horizontal movements at the two expansion piers, a sliding surface is introduced between the pot and the bridge superstructure. This comprises a number of teflon (Polytetrafluoro-ethylene) discs set into a brass plate welded to the top of the pot and bearing on the polished chrome surface of the sole plate above. The teflon discs, which are reinforced with fibre glass for strength and impregnated with molybdenum disulphide as a lubricant, have a low coefficient of friction which decreases with pressure and will permit horizontal movement with very small lateral forces on the pier. (Plates 7, 8, 9, and 10.)

At the abutments, high tensile steel roller bearings will provide for longitudinal thermal movements. To allow for lateral movements of the ends of the curved superstructure during prestressing, a steel plate with a thin coating of teflon is placed between the sole plate and the top plate of the roller assembly. This temporary sliding plate will be fixed to both plates by welding after stressing has been completed.

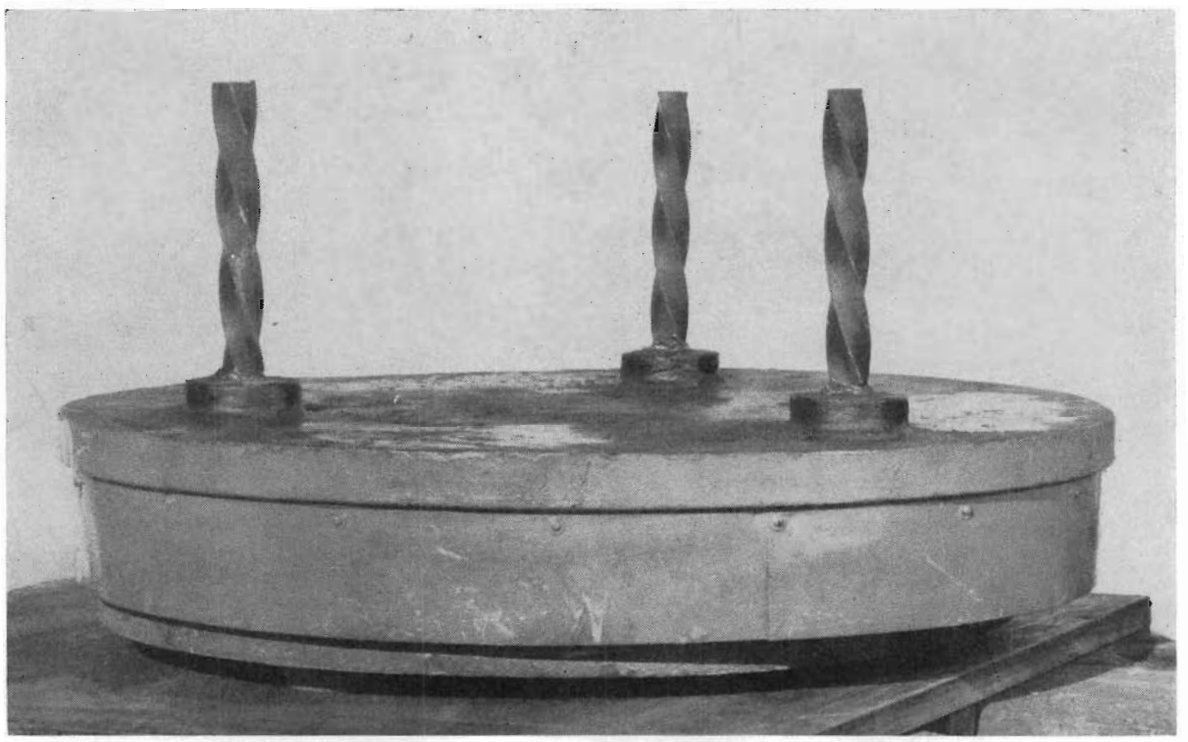


Plate 7—Assembled expansion bearing

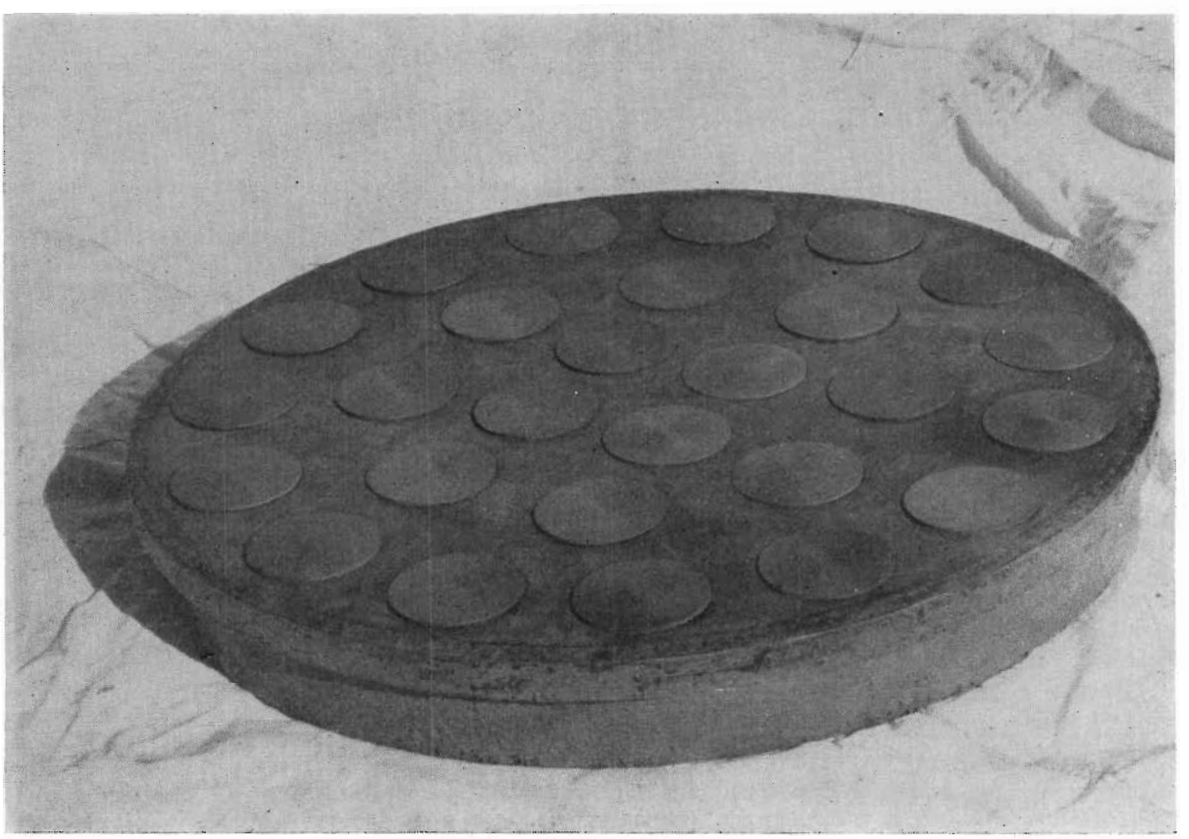


Plate 8—Teflon discs on top surface of pot

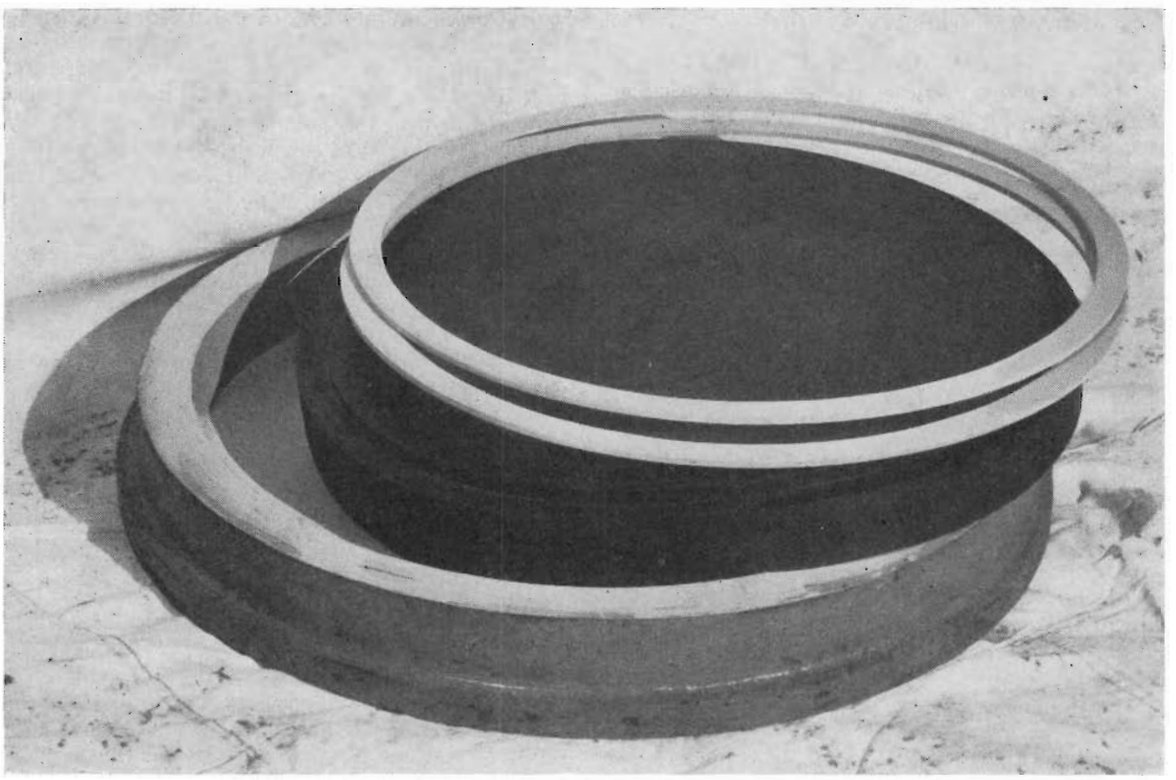


Plate 9—View of pot from below showing neoprene pad and stainless steel sealing rings

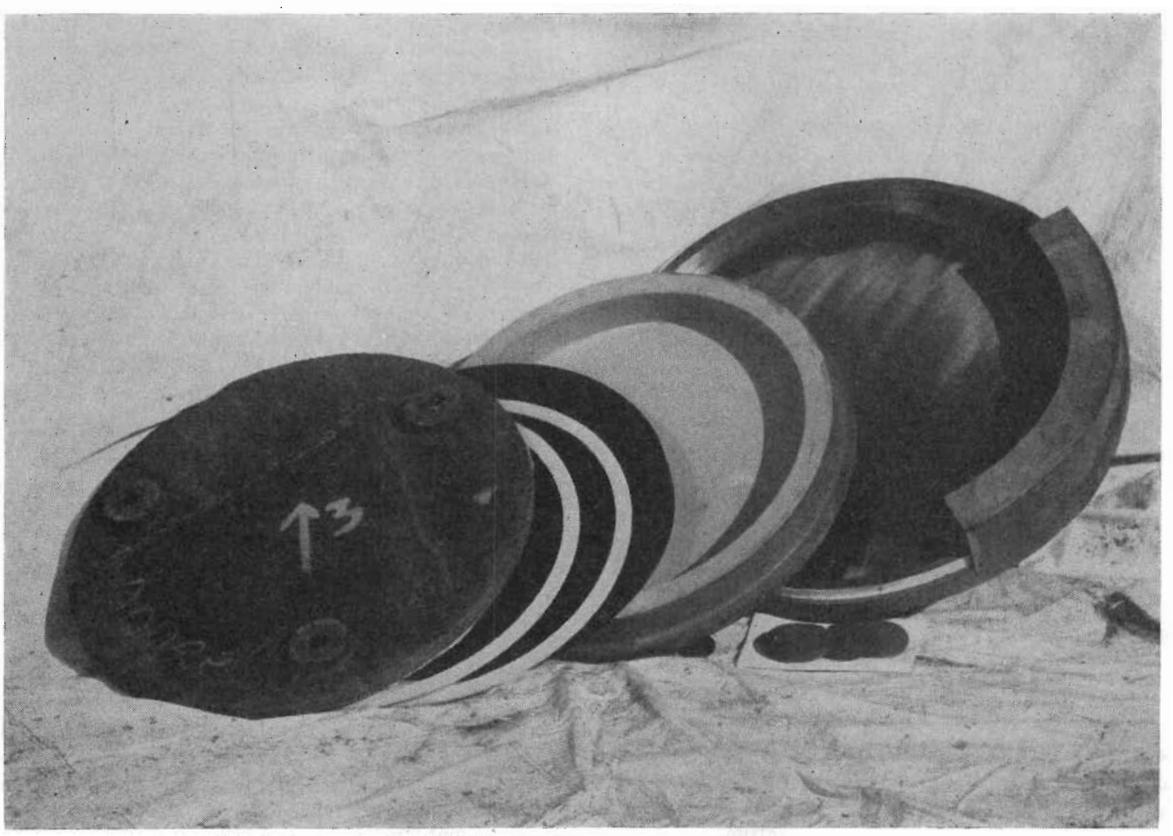


Plate 10—View of all parts of an expansion bearing—separated

River Murray–Barmah

A seven-span bridge, 550 feet long, is being built at this site to replace the present ferry crossing. The roadway will be 24 feet between kerbs and a footway 5 feet wide will be provided.

The main members of this bridge will be prestressed concrete beams 78 ft. 6 in. long, 4 ft. 6 in. deep and will weigh approximately 24 tons each. The specification provided for three alternative designs for these beams in both pre-tensioned and post-tensioned concrete and the contractor has elected to use segmental post-tensioned beams. The segments will be cast at a Melbourne casting yard then assembled and stressed together at the site prior to erection.

This indicates that for large prestressed concrete beams to be placed some distance from Melbourne, precast segmental construction assembled on site, has been preferred to transport of the completed beams from Melbourne, or to casting on site.

ROAD DESIGN SUB-BRANCH

1. Line Marking

During 1963–64, the Board added 1,109 route miles to the programme of roads maintained with a marked centre line. This now brings the total route mileage so maintained to 5,294 miles, consisting of 3,728 on State highways, 1,346 on other declared roads, and 220 miles on unclassified roads.

This substantial increase was due to the introduction into service in January, 1964, of a new line-marking machine (see photograph on front cover of 1962/63 Report) designed and constructed at the Board's Central Workshops. The new unit incorporates modern techniques in operation and control, designed to improve output and quality of line, and, in addition, is equipped to reflectorize lines using " drop-on " glass beads.

The total mileage of equivalent standard 3-in. stripes, i.e., 10 feet line, 30 feet gap, painted in the year was 9,012 miles representing an increase of 21 per cent. over the previous year; 2,440 miles of this line was reflectorized.

The fleet now consists of two large units engaged on longitudinal striping throughout the State, and a small unit previously engaged on similar work in the Metropolitan area, but whose activities have been diversified to include pavement markings at intersections, turn arrows, &c., and removal of traffic lines using paint stripper.

The cost of line-marking operations for the year was £63,833, the average cost per mile of standard stripe painted by the two large units was £6 13s. 2d., and total quantity of paint used, 30,577 gallons.

Success was achieved during the year with a technique for the removal of traffic lines and pavement markings from the road using a specially compounded paint stripper. Obliteration of unwanted lines and markings has been a problem for many years, various methods such as painting out with black paint or bitumen having been tried without success. Commercially available paint strippers were also tried but were not found to be economically feasible until a Melbourne chemical company specializing in this field was able to develop a stripper based on the widely used methylene chloride, but containing improved thickeners and activators. This material, known as G.S.B. Road Paint Stripper Type " D ", has been found to solve the special problem of removing a paint film several layers thick, the lower layers often being many years old, and doing so generally with a single application of stripper and a minimum amount of effort. Approximately eight miles of equivalent standard stripe have so far been successfully removed by this method

2. Traffic Studies and By-pass Road Location

The following traffic studies were completed during the year:

Annual Traffic Census

The annual traffic census was conducted on 18th March, 1964. Twelve hour counts were taken at a total of 1,340 stations, 666 of which were on State highways, and of the remainder 50 stations were on unclassified roads in the Metropolitan area.

The rural traffic index (100 in base year 1933) rose from 729 in 1963 to 768 in current year. The result remains close to the 1959 prediction (Technical Bulletin No. 17).

In addition to the annual census, a total of nine permanent stations have been established on the major State highway outlets from the Metropolitan area. Continuous hourly counts at these stations, each situated between 20 and 30 miles from the city centre, are now becoming available.

These counts are being obtained by means of automatic counters. The counters as used by the Board generally are operated by a rubber hose across the traffic lane connected to an air switch which electrically actuates the counting mechanism. Failure of the electrical contacts of the air switch has been responsible for inaccurate counting by this type of apparatus. Recently, the upper (adjustable) contact of silver has been modified to take a carbon insert. This carbon contact working against a silver contact on the diaphragm appears to have overcome the weakness. A road test was made with a unit which had previously failed at 6,000 counts with silver contacts. With the carbon contact fitted, examination after 150,000 counts showed no sign of failure and all counters are now being modified.

Human Factor Engineering

Useful additions to our knowledge of human factors in relation to traffic design were made by an engineer of the Traffic and Location Section in a report arising from his secondment to the Aeronautical Research Laboratories, Human Factors Group. The report was completed during the year. The main work was associated with the development of a laboratory experiment for the objective comparison of road features as they affect the driver. The experiment was used to assess the value of different types of median end treatment. This study resulted in a

recommendation for more positive directional information at median ends and a better system of prior warning involving the use of reflective road studs and line-marking. Redesign of conventional hazard markers is now in progress as a result.

Truck Performance on Grade

In last year's report, a study of the Texas Speed Curves for trucks on grades in relation to Australian conditions, was reported. This study showed that the Texas curves were applicable here for vehicles having comparable power to weight ratios.

A further study was conducted this year to determine whether the average truck in Victoria did, in fact, have comparable power to weight characteristics to those used in compiling the Texas curves. The performance of several hundred trucks was measured at five selected locations on five different highways, the average grade of the five locations being 6½ per cent. Diagram 2 shows the result of this study in graphical form, and indicates that the Victorian trucks studied have a higher power/weight ratio than the heavy trucks used in the Texas study. Accordingly, further work is in hand to modify the Texas curves.

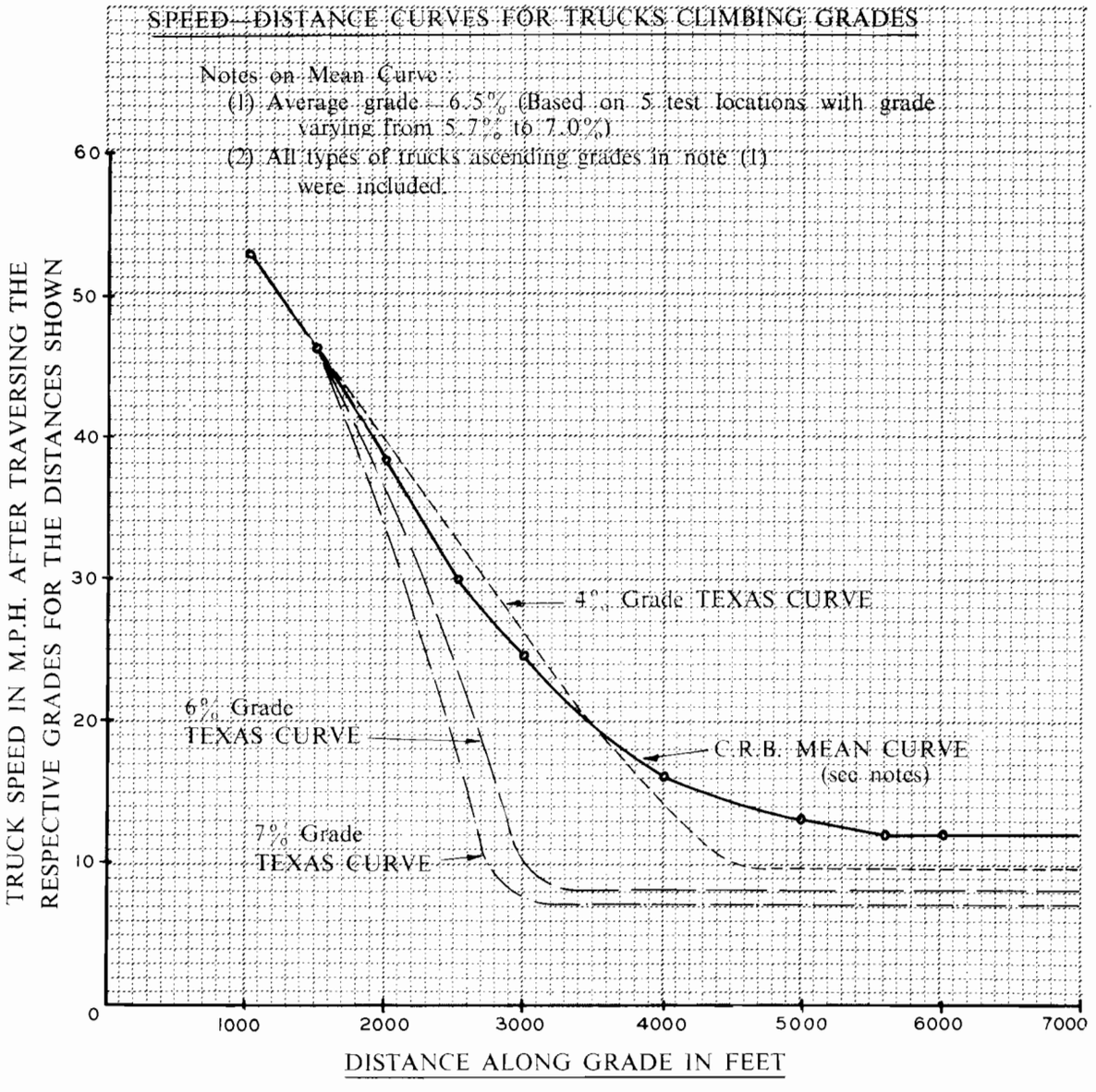


DIAGRAM No. 2

Occupants per Car

A study to determine the average number of occupants per car on rural roads was made for a number of different conditions and involving a sample of some 4,000 cars.

The figures obtained were as follows :—

Week-days	..	1·8 persons per car
Sundays ..	..	2·8 persons per car
Public Holidays	..	2·6 persons per car

These results will be useful in determining road user costs.

Road Signs

Further trials of the use of overlaid marine grade plywoods for large direction signs were made during the year. Three-quarter inch plywood panels have now been used to replace the internally illuminated plastic panels on the overhead sign at the eastern end of the Maltby By-pass Road. Special vinyl based sealers have been used to treat the edges of each panel to prevent the ingress of moisture and subsequent rotting of the timber.

Each of the three 12 feet panels has now been illuminated externally using a 48-in., 110 watt aperture type fluorescent lamp mounted in special housing containing a parabolic reflector, near the lower edge of the sign.

Advantages of this lamp and housing are better utilization of available light and greater light output per unit of electric power consumed, whilst advantages of the plywood are better appearance and resistance to vandalism at little or no increase in cost.

By-pass Roads

The year saw increased activity in the field of freeway location and design. Work continued on projects previously announced, and a number of new projects were initiated.

Projects in the former category included the Tullamarine By-pass Road, for which layout designs for the through road and its interchanges are complete. The Mulgrave By-pass Road to Dandenong has been nearly completely designed to the layout stage, and work has proceeded on several sections of the projected Hume By-pass Road to Seymour.

The following sections of freeway have been approved for detail design, and were added to the Board's list of projected freeway routes during the year.

(*a*) Extension of the Healesville Freeway By-pass Road to Hull Road near Lilydale.

(*b*) Conversion of the Calder Highway to By-pass Road from the south west corner of Essendon Airport to and around the town of Keilor to rejoin the Calder Highway west of Keilor.

(*c*) Two new sections of the proposed freeway route down the Mornington Peninsula have been adopted, one from Wells Road around the east of Frankston as far as Frankston–Cranbourne Road ; and the second from the Nepean Highway to Eastbourne Road around the back of Dromana.

Provisions for Overdimensional Vehicles

Special attention has recently been given to the problems associated with movements of over-dimensional loads, especially at intersections where turning movements must be made. Due to the progressive channelization or to other improvements to the general road system, difficulty is now being experienced in finding alternative routes to enable oversize vehicles to avoid these obstructions. For this reason improvements to existing overdimensional load routes must be designed to accommodate oversize vehicles. Special provisions needed include larger areas of pavement and paved median, removable road furniture, and mountable kerbs.

Permit Templates

An investigation was made into the extent of additional pavement area needed by overdimensional vehicles. Turning path templates (permit templates) were developed to facilitate accurate design to accommodate those overdimensional vehicles which travel without police escort. Many large unescorted vehicles travel under a "blanket" annual permit for an unlimited number of trips, and unobstructed safe paths are provided for these at all intersections with the aid of the templates.

Verification of the permit templates with actual vehicle tests confirmed the graphical and model investigation results obtained during the development of the templates. The templates have been made available to Metropolitan municipalities as a design aid for new construction on overdimensional load routes. It is pointed out that little research has previously been directed towards the development of templates for turning paths of such large vehicles. Published matter and correspondence with overseas authorities revealed no facilities for direct design for equivalent situations to those met with overdimensional vehicle travel in Victoria. The Board's work has resulted in a significant contribution to the field of traffic engineering.

3. Engineering Plans and Surveys

During 1963–64, the following engineering survey work and plans together with preparation of both construction and material supply specifications have been completed.

Engineering Surveys

Head Office engineering survey parties completed 336 miles of survey which included 110 miles of photo-control surveys, the remainder of 226 miles being centre line or feature surveys, principally on State highways or by-pass roads.

Divisional staff also completed engineering surveys for a considerable mileage of road and a number of intersections and bridges.

Specifications

During the year, slightly more than 300 specifications have been prepared and advertised for contract. The total value of supply and construction contracts was in excess of £4,000,000.

Thirty-nine major construction contract specifications were prepared and advertised for contract, and in addition, seven minor construction contract specifications were prepared in the divisions. The total number of 46 construction contracts were let for £2,300,000 as compared with 33 contracts let for £1,300,000 in 1963-63.

Plans for Road Construction

Final construction plans were completed for 90 separate road projects of varying magnitude and totalled 125 linear miles for a total construction cost of £3·6 million, 1,500 final plan sheets were produced and 15 miles of the 125 miles were designed with the aid of the 1620 IBM computer.

In addition, two miles of six lane divided road were designed by a consultant under the supervision of this office.

Final construction plans completed during the year included the following :—

Road	Description
Princes Highway East, Section 1	Springvale to Dandenong (Six lanes divided, let at £388,000 for 3·14 miles)
Princes Highway East, Section 1	East and west of Warragul (1·5 m)
Princes Highway East, Section 6	Reedy Creek to West Wingan Road—west of Scrubby Creek (12 m.)
Hume Highway, Section 1	Boundary Road to Camp Road (2 m.); Bylands to Kilmore (3 m.)
Hume Highway, Section 1	Prospect Hill–Dry Creek (3 m.); Duplication north of Tallarook (1·4 m.)
Princes Highway West,	Stony Rises (1·5 m.)
Western Highway ..	Duplication Jones Creek to Korroit Creek (1·0 m.)
Goulburn Valley Highway	Cottons Pinch (2.5 m.); West of Kerrisdale (2·0 m.); Hughes Creek Section (2·6 m.)
Maroondah Highway ..	Duplication Mitcham to Ringwood (1 m.); Reconstruction 58-60 m. posts, and north of Buxton (2 m.)
Warburton Highway ..	Through Wandin (1·7 m.)
Murray Valley Highway, Section 4	West of Boundary Bend (10 m.)
Bass Highway	Near Inverloch (3·3 m.)
Hamilton Highway ..	Near Derrinallum and Darlington (4·5 m.)
Glenelg Highway ..	West of Back Creek and near the South Australian Border (3 m.)
Omeo Highway ..	Gibsons Deviation to Bindi turn off and at Ensay (3 m.)
Midland Highway ..	Welshpool to Port Welshpool (2·7 m.)
Calder Highway ..	At Curly Hill, Keilor, and Dumosa to Nullawill (4 m.)
Fish Creek–Yanakie Road	South of Fish Creek (2·5 m.)
Grampians Road ..	Lake Bellfield deviation (4 m.)
Yarra Glen–Yea Road ..	At Highbrow Hill and the Yea River bridge approaches (3·5 m.)

Investigation, surveys and/or plan work has been commenced on the following jobs of special interest :—

Road	Description
Phillip Island Tourists' Road	San Remo Crossing. Completion final plans following extensive investigation including seismic surveys, hydrographic surveys, and location of a large bridge and major deviation. The computer was used to evaluate co-ordinates of the soundings and to reduce levels of the sea bed required for the longitudinal section
Western Highway ..	Pykes Creek Reservoir Deviation. A major realignment to V70 standard eliminating the 15 m.p.h. sub-standard curve on the present embankment. The design features a new embankment 106 feet high
Warburton Highway ..	Major road designs at Seville Hill and Killara Hill, Launching Place, and west of Hoddles Creek
Hume Highway, Section 1	Design of 4 miles of duplicated carriageway between Broadford and Tallarook together with investigation at Beveridge Hill, north of Kal Kallo, and at Seymour
Calder Highway, Section 1	"Porcupine Hill". 1·3 miles of major realignment including rail over-pass location on V70 alignment to replace the crossing on V20 reverse curves
Princes Highway East, Secion 6	Mount Drummer Section
Nepean Highway ..	Mordialloc Underpass

Design Developments

It is sometimes useful in the preliminary investigation of regrading involving vertical curves to use a transparent template on which are shown a series of summit vertical curves corresponding to various design speed values. The template is placed over the longitudinal section of the existing road and/or ground surface, and the fit of a vertical curve of the desired speed value is quickly seen by sliding the template about. Alternatively, if the approach grades are relatively long and naturally well defined, the relative depths of cut for vertical curves of different speed value are readily scaled.

Another use for such a template is to enable a quick check of a vertical curve, which has been plotted. To do this, the axis of the template is kept vertical and the design speed curve of the template fitted to the vertical curve so that it is tangential to the approach grades. The template should then fit the curve which has been plotted.

The vertical curves of the template are parabolic (Diagram 3 refers) and were computed as follows :—

(*a*) For each speed (v) from 30 to 80 m.p.h., stopping distances (S) for clean wet bituminous or concrete surfaces were computed from the formula

$$S = 1{\cdot}5v + \frac{v^2}{2gf}$$

where

S = Stopping sight distance in feet (4 ft. to 9 in.) (see para. (*b*) below);

v = vehicle speed in feet per second;

f = longitudinal friction coefficient between vehicle and roadway (linear variation from 0·50 at 30 m.p.h. to 0·33 at 80 m.p.h.

Corresponding values of S and v are shown on the template on the appropriate curve.

(*b*) Choosing appropriate equal approach (tangential) grades (A per cent.) for each curve :—

(i) The length L of the vertical curve was computed from the formula

$$L = \frac{S^2}{200(h_1 + h_2)^2}$$

where h_1 and h_2 are height of eye and an object above the road surface = 4 feet and 9 inches respectively (as above) under (*a*).

(ii) The middle ordinate from the intersection of the grade lines to the curve was computed from the formula

$$\text{Middle ordinate} = \frac{2A.L}{800}$$

(iii) Intermediate ordinates were computed from the formula

$$\text{Intermediate ordinate} = \text{middle ordinate} \times 4 \times \left(\frac{\text{horiz. distance from tangent point}}{\text{(Length } L \text{ of curve)}^2}\right)^2$$

The properties of parabolic curves are such that, once the curve is plotted, it may be used for that speed value by fitting tangentially to any pair of grade lines, provided the axis is kept vertical.

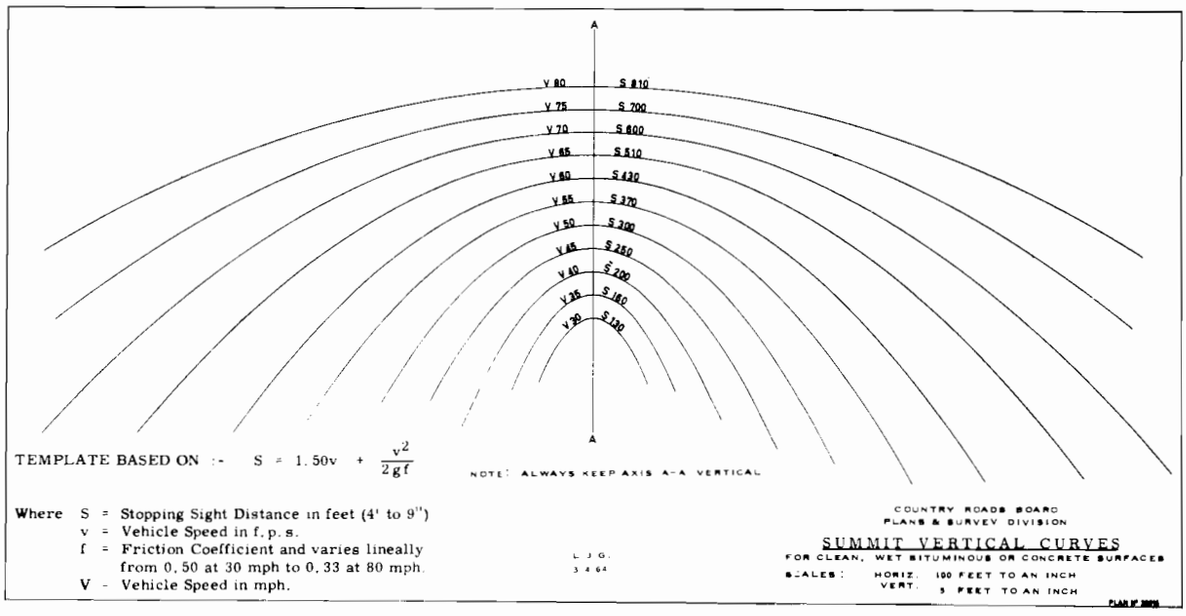


DIAGRAM 3

4. Title Surveys and Plans

Title Surveys

During the year, 487 surveys were completed including 25 for the acquisition of land for new by-pass roads.

Highway Records

As indicated in last year's report, increasing use is being made of aerial photography combined with accurate odometer measurements for survey purposes.

Record surveys were completed for the Kiewa Valley Highway, Goulburn Valley Highway Section 2, North Western Highway extension and the Midland Highway Section 2, a total distance of 210 miles.

Strip photos were also flown for the Omeo Highway, Midland Highway Section 8, and South Gippsland Highway, a total distance of 400 miles.

Odometer Surveys were carried out for all the main and forest roads, (totalling 622 miles) in the Geelong division, to fix position of mile posts and municipal boundaries.

Plan and Offset Printing

In addition to the preparation of master traces for plan reproduction and enlargement of aerial photographs, 25,000 half-plate statfile negatives were obtained, from various plans which will be afterwards destroyed.

This system of plan recording thus reduces the floor space required for plans to a minimum. A photo direct plate making equipment was purchased and installed in the Printing Section. This machine enables the production of speedy and economical service of offset printing matter.

5. Right-of-way

In order to co-ordinate the Board's control of land use adjoining Board's roads (both present and future) and Board's requirements for land acquisition, a Right-of-way Section was established during the latter half of 1963. An officer commenced duty as Right-of-way Engineer in November, 1963. Staff for the section, viz., an Assistant Right-of-way Engineer, four draftsmen, and one clerk will be appointed early in the financial year 1964–65.

Duties of the section include—

(*a*) Examination and approval of subdivisions ;

(*b*) Examination of deviations and road widening proposals ;

(*c*) Examination of planning schemes to ensure that the Board's interests are fully protected ;

(*d*) Engineering aspects of by-pass and freeway roads, including by-laws, access control, acquisition, disposal of surplus land, and enquiries from the public, to enable the right-of-way to be available at minimum cost when required for construction works.

MECHANICAL SUB-BRANCH

Apart from plant maintenance duties, the main activities of the sub-branch have been in the design and manufacture of equipment for the Board's needs.

The following summarizes the major acquisitions of plant and equipment and design of work during the year.

1. New types of plant and machinery not previously owned by the Board acquired during the year include the following :—

(*a*) Mobile ablution unit made by Don Caravan Co. Pty. Ltd. This trailer unit contains two showers and three hand wash basins and is complete with a liquified petroleum gas hot water system. The unit is on trial with the Board's construction and B.S.T. camps.

(*b*) Loadstar front end loader fitted to a Chamberlain Champion wheel tractor made by Cranes and Shovels Pty. Ltd. The unit, fitted with $\frac{7}{8}$ cubic yard capacity bucket and Funk torque converter transmission, is used for the loading of loose screenings and gravel.

(*c*) Seaman Gunnison Duo-pactor compacting device built under licence by A. E. Goodwin Ltd. and powered by a 66 h.p. Case wheel tractor. This machine combines in a single unit means of pneumatic tyred and steel roller compaction. The unit provides a maximum ballasted load of 2 tons per wheel on eight pneumatic tyred wheels fitted in a single line and a 16 ton load on a steel drum roller of 70-in. width.

(*d*) Goodwin Model 555 STD heavy duty tandem grader powered by 125 h.p. Cummins diesel engine. This machine is suitable for general construction and maintence work and is complete with scarifier and power side shift type mould board.

(*e*) International Model BTD8 crawler tractor fitted with hydraulic angle dozer. This tractor is for general clearing and light dozing operations and the towing of sheepsfoot compaction rollers.

(*f*) Rotomobile Model SBR soil stabilizing machine powered by a Chamberlain Champion tractor. The unit mixes soil by the use of fast rotating tynes attached to a horizontal axle. It is fitted with a special low speed transmission and a water supply which enables the addition of water to the mix.

(*g*) Case and John Deere pneumatic tyred two wheel drive front end loaders fitted with $\frac{7}{8}$ cubic yard buckets. Both these machines are suitable for the loading of loose screenings, gravel, and similar materials and due to some special design features are most manoeuvrable and capable of high output in difficult locations.

(*h*) Single drum towed vibrating sheepsfoot roller made by Coates and Co. Ltd. and powered by Deutz diesel engine.

2. The following new items of plant to the Board's design have been acquired or are in the course of construction :—

(*a*) Two electrically heated 8,000-gallon capacity bitumen storage heaters. These units are heavily insulated to reduce heat losses and are designed to keep bitumen at closely adjustable pre-set temperatures by the use of night tariff electric current only.

(*b*) A prototype 1,550-gallon capacity self-propelled water sprayer. The unit has been designed to suit diverse conditions of filling and usage, including both gravity and pressure spray over 8 feet and 12 feet widths and fire fighting.

3. The following new machine tools and equipment of the Board's design and manufacture have been put into operation in the Board's workshops or are in the course of construction :—

(*a*) A line marker for experimental purposes which will be capable of laying road marking paints in a wide variety of applications rates both with and without glass beads for testing the abrasion, reflection, and weather resistance qualities of various road marking materials.

(*b*) Broaching machine for the rapid and accurate making of keyways and internal splines.

(*c*) Horizontal hydraulic press for the assembly and dismantling of crawler tractor rollers and bushes and a number of other tasks including the bending of metal bars.

(*d*) A rig for testing water pumps. This rig allows the testing of centrifugal pumps both as regards their ability to prime and their output capacity under widely varying suction and pressure conditions.

4. The following new machine tools and equipment have been purchased and put into operation in the Board's workshops :—

(*a*) A welding flux collecting, circulating, and screening device which will provide better flux economy with the automatic welders now used in the reconditioning of some crawler tractor parts and some hard facing operations.

(*b*) A Heenan and Froude water brake dynamometer which has a maximum absorption capacity of 350 h.p. at 6,000 r.p.m. This unit was required as the demand on the existing dynamometers for engine testing exceeded capacity.

(*c*) A Harding high-precision lathe to be used for small work requiring very close tolerances.

(*d*) An electric welding set incorporating a carbon dioxide " atmosphere " which, with automatic fluxless wire feed, provides a fast weld metal deposit. The process does not

leave behind slag inclusions. The thin wire used, combined with the gas envelope, works at a lower temperature than conventional welding units and due to this there is less distortion. It is also convenient for use on overhead and vertical welds. The set, with small changes and the use of argon gas, can be used for the welding of aluminium.

ENGINEERING COMPUTER SECTION

Reference has been made earlier in this Annual Report to the purchase of an I.B.M. 1620 electronic computer for engineering work.

The operation of the computer has been placed under the control of the Engineering Computer Section. This is a Service Section, attached directly to the Chief Engineer's Branch. All Engineering Sub-branches have ready access to this section for the processing of data. At present, the section consists of an Acting Officer-in-Charge and one temporary machine operator. Additional staff will, no doubt, be necessary during the coming year as the volume of work increases.

In previous annual reports references have been made to the computer programmes used by the Bridge and Road design Sub-branches. The use of these programmes has increased during the year.

Use of 1620 *Electronic Computer for Bridge Pier Analysis*

Mention was made of the commencement of programming for analysing a two-legged rigid framed pier in the annual report for 1961–62. The complete analysis uses the following seven programmes :—

Part 1.

Computation of the moments, shears, and axial forces in the pier cross-head and columns due to the following vertical loadings :

(*a*) Dead load ;
(*b*) Footway live load ;
(*c*) A.A.S.H.O. lane live loading (up to eight separate cases.

Part 2.

Computation of the applied forces, moment, shears, and axial forces due to :

(*a*) Buoyancy ;
(*b*) A.A.S.H.O. truck live loading (up to eight separate cases) ;
(*c*) Centrifugal forces due to live loading.

Part 3.

Evaluation and analysis due to :

(*a*) Stream flow forces ;
(*b*) Wind forces on superstructure and substructure ;
(*c*) Traffic, braking, and acceleration forces ;
(*d*) Wind forces acting on vehicles.

Part 4.

This is the final step in the evaluation of individual forces and the analysis of resulting moments, shears, and axial loads. The loadings considered are :

(*a*) Stream pressure on accumulated debris ;
(*b*) Blows from floating logs ;
(*c*) Shrinkage and temperature effects.

Part 5.

The computer results for the pier crosshead for each of the individual loads are grouped together in accordance with the design code requirements. This programme produces the envelopes of maximum positive and negative moments and shears for the pier crosshead, together with a list of all major forces applied to the pier.

Part 6.

This programme produces a complete set of column loading cases from the computed results of the first four parts by grouping the individual loading cases as required by the design code.

Part 7.

The output from Part 6 is processed by either the circular or rectangular column analysis programme, and the critical column stresses are determined at each section.

Programming has been completed except for Part 6, which has not yet been commenced. Two test cases are being computed manually for checking the computer programmes.

It is hoped to have all these programmes de-bugged, checked, and documented by the middle of next financial year.

SAFETY

Further emphasis was placed on safety-on-the-job during the year. Some activities in this field were :—

Visits to Divisions

Regular visits normally of five days' duration, were paid by the Safety Officer to each division. During these visits, safety talks were given to groups of employees, and on at least one visit to each division safety films were screened. Where unsafe working practices or conditions were observed, they were brought to the notice of Divisional Engineers or Assistant Divisional Engineers. In addition, advice was given by the Safety Officer on specific safety matters referred to him.

Accident Investigation

Investigations were conducted into the causes of a number of accidents which occurred to employees on the job, with a view to devising ways of preventing a repetition of such accidents.

Pilot Study of Accident Costs

A pilot study will be conducted in the Geelong and Warrnambool divisions during the period July–October, 1964 ; the preparatory work was carried out by the Safety Officer during the year under review.

Accident Statistics

Two cases of fatal injury resulting from accidents on the job occurred during the year compared with three fatalities in the previous year. As statistics for other injuries have been completed only up to 31st March, 1964, it is not possible to give the complete figures for the year. The position at that date as compared with the same date of the previous year was :

	1963–64.	1962–63.
Fatalities	1	3
Lost Time Accidents	310	319
Minor Accidents ..	1,091	786
Man/hours worked ..	5,472,765	5,137,244
Working days lost ..	3,391	4,016

(*Note.*—The second fatal accident occurred in June, 1964, and therefore is not included in the above figures to the end of March.)

These figures show a decrease of eleven in lost time accidents including fatalities, equivalent to a reduction of six per 1,000,000 man/hours worked.

The number of working days lost decreased by 625, which represents a saving of approximately 2·5 man/years.

PUBLICATIONS

During the year the following papers were presented in connexion with the Board's engineering work :—

Paper.	Author.
Determination of Air Voids and Voids in Mineral Aggregate in Bituminous Mixtures Published in Australian Road Research No. 7, September, 1963	J. Morris, B.C.E.
Fibre-glass/Polyester Resin Laminate Surfacing of Timber Bridge Decks Published in Australian Road Research No. 8, December, 1963	T. H. Russell, M.Eng.Sc., B.C.E., A.M.I.E. Aust.
Highway Construction Practices Overseas Presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, 11th September, 1963	C. C. Perrin, C.E., A.M.I.E. Aust.
Examples of the Theory and Practice of Traffic Engineering Presented at a meeting of the Institution of Engineers, Australia, Geelong, 4th September, 1963	N. S. Guerin, B.C.E., C.E., E.W.S., A.M.I.E. Aust., C.H.T. (Yale), A.M.I.T.E.
Control of the Quality of Road Materials Presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, 13th November, 1963	A. H. Gawith, M.C.E., A.M.I.E. Aust.
Truck Performance on Hills Published in Australian Road Research No. 9, March, 1964	J. T. Smith, B.C.E.
Roads—Why, Where and How Retiring Chairman's Address presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, 11th March, 1964	N. S. Guerin, B.C.E., C.E., E.W.S., A.M.I.E. Aust., C.H.T. (Yale), A.M.I.T.E.
Road Design and Vehicle Design Presented at a meeting of the Institution of Automotive and Aeronautical Engineers, Melbourne, 21st May, 1964	N. S. Guerin, B.C.E., C.E., E.W.S., A.M.I.E. Aust., C.H.T. (Yale), A.M.I.T.E.
The Manufacture and Laying of Thin Bituminous Concrete Surfacing with a Mobile Asphalt Plant Presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, 13th May, 1964	J. Wolfe, Dip.C.E., A.M.I.E. Aust.
Fundamentals of Freeway Location and Design Published in Australian Road Research No. 10, June, 1964	J. L. Loder, C.E., A.M.I.E. Aust.
The Future of Victoria's Roads Presented at a meeting of the Society of Geography Students of Monash University, 16th June, 1964	N. S. Guerin, B.C.E., C.E., E.W.S., A.M.I.E. Aust., C.H.T. (Yale), A.M.I.T.E.

The following Technical Bulletin was issued during the year :—

No.	Title.	Date.
25	Construction Technique for Water-bound Macadam Pavements	15th May, 1964

STAFF

Total staff of the Chief Engineer's Branch rose from 699 at the commencement of the financial year to 785 at its end.

Total expenditure on Board's direct works and by municipalities with funds provided partly by the Board was £26,593,900 for this financial year.

The volume and complexity of the work continues to increase considerably. It is desired to thank all staff for the manner in which this challenging position has been met during the year under review.

H. S. GIBBS,
Chief Engineer.

By Authority: A. C. Brooks, Government Printer, Melbourne.